

Reclosers

Types VXE15 and VXE27 Electronically Controlled Single-Phase; Installation and Operation Instructions

Service Information

S280-16-1

VXE15 Serial Number 11009 and above
VXE27 Serial Number 1948 and above

VXE Control Serial Number 7401 and above



Figure 1.
Kyle® Type VXE electronically controlled, single-phase, vacuum-interrupting automatic circuit recloser.

020100KM

Contents

Safety Information	2	Non-Reclosing Operation	14
Safety Instructions	2	Automatic Operation	14
Hazard Statement Definitions	2	Lockout Indication	14
Product Information	3	Testing	15
Introduction	3	Safety Requirements	15
Acceptance and Initial Inspection	3	Test Equipment Required	15
Handling and Storage	3	Manual Closing Procedure	16
Description	3	High-Potential Insulation Withstand Tests	16
Manual Operating Levers and Indicators	5	Minimum-Trip Current Level Test	17
Recloser Data Plates	6	Sequence of Operation Test	17
Control Programming and Operation	7	Electrical Operation of Closing Solenoid Test	18
Type VXE Electronic Control	7	Accessories	19
Programming the Control Settings	8	Extra Creepage Bushings	19
Specifications and Ratings	10	Bushings-Type Multi-Ratio Current Transformer	19
Dimensions	11	Low-Voltage Closing	19
Installation Procedure	12	Cable-Locking Sleeve	19
Placing the Recloser In Service	13	SCADA Input/Output Board	19
Operation	14	Maintenance Information	20
Manual Operation of Energized Recloser	14		



SAFETY FOR LIFE



Cooper Power Systems products meet or exceed all applicable industry standards relating to product safety. 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 Cooper Power Systems 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 flash clothing, safety glasses, face shield, hard hat, rubber gloves, 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.

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.

G103.2



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 may result in death, severe personal injury and equipment damage.

G102.1



WARNING: Power distribution 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 equipment can result in death, severe personal injury, and equipment damage.

G122.2

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.



PRODUCT INFORMATION

Introduction

Service Information S280-16-1 provides installation instructions, operation information, and testing procedures for Kyle® single-phase, electronically controlled VXE15 and VXE27 reclosers.

The information contained in this manual is organized into the following major categories: *Safety Information, Product Information, Control Programming and Operation, Specifications and Ratings, Dimensions and Weights, Installation Procedure, Recloser Operation, Testing, Accessories, and Maintenance Information.*

Serial Number Updates

VXE15: Serial Number 11009 and above
Include updated oil dipstick.

VXE27: Serial Number 1948 and above
Include updated oil dipstick.

VXE Control: Serial Number 7401 and above
Include ball target lockout indicator and larger cabinet.

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.

Additional Information

These instructions cannot 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 Cooper Power Systems sales representative.

Acceptance and Initial Inspection

Each recloser is completely assembled, tested, and inspected at the factory. It is carefully calibrated, adjusted, and filled to the correct level with insulating oil. Always verify the proper oil level by using the dipstick (refer to Figure 8).

It is in good condition when accepted by the carrier for shipment. Upon receipt, inspect the recloser and the control thoroughly for damage and loss of parts or oil incurred during shipment. If damage or loss is discovered, file a claim with the carrier immediately.

Check for oil leakage and tighten all bolts that may have loosened during shipment, especially the tank mounting bolts. Tank mounting bolts should be tightened to 34–54 N•m (25–40 ft•lb) torque, using an alternating tightening pattern.

Handling and Storage

Recloser and Control

If the unit is to be stored for any appreciable time before installation, provide a clean, dry storage area. Be careful during handling and storage to minimize the possibility of damage; in particular, protect the bushings, control, and control cable.

Control and Lockout Indicator Batteries

During storage, the control and lockout indicator batteries must be disconnected from the control and lockout indicator circuit boards. If the storage area temperature exceeds 100° F, remove the control batteries and store in a cool, dry area.

Standards

The Kyle® Type VXE recloser is designed and tested in accordance with:

ANSI/IEEE C37.60 - 1981

ANSI C37.61 - 1973

ANSI C37.85 - 1989

Quality Standards

ISO 9001:2000 Certified Quality Management System

Description

The Type VXE recloser is a self-contained, single-phase, current-interrupting device. VXE reclosers protect distribution systems with phase-to-phase voltage ratings of 15.5 through 27.0 kV and are rated at 400 A maximum continuous current and 8000 A symmetrical interrupting current.

A complete Type VXE recloser assembly consists of a VXE recloser and a separate VXE control, which is connected to the recloser with a control cable. The control cable is available in lengths from 2–30 m (7–100 ft) and is specified at time of order. The control cabinet is designed to be mounted to the recloser tank, or it can be mounted to the pole or other mounting structure, such as crossarms, at a distance equal to the cable length. The control cable is attached to the control and recloser with threaded, separable weatherproof connectors.

Recloser Operation

The VXE recloser senses line current and automatically interrupts the phase of the distribution circuit to which it is connected when line current exceeds the minimum-trip level. Next, it automatically recloses to restore service and monitor the line to determine if the fault has been cleared. If the fault is permanent, the recloser locks out after one, two, three, or four preset trip operations. Once locked out, the recloser must be manually reset to restore service.

Note: The recloser can be reset remotely if equipped with the SCADA Input/Output accessory board, via the remote close feature.

Should the fault clear before lockout, the recloser will reset automatically for another sequence of operations. The recloser can also be set for non-reclosing operation (lockout after the first trip operation) with a manually operated external non-reclosing lever. The recloser can be remotely set for non-reclosing operation, if equipped with the SCADA Input/Output accessory board, via the remote non-reclosing feature. The trip operations of the recloser can be all fast, all delayed, or any combination of fast operations and delayed operations up to a maximum total of four. Fast operations clear temporary faults before branch line fuses are weakened. Delayed operations allow time for fuses or other downline protective devices to clear to limit permanent faults to the smallest section of line.

The VXE recloser control uses solid-state electronics to provide accuracy, reliability, and flexibility for overcurrent sensing and trip timing. The electronic circuits are housed in a separate weatherproof cabinet attached to the recloser tank and connected to the recloser with a control cable.

Vacuum Interrupter

Arc interruption takes place within the sealed vacuum interrupter. Oil is used for electrical insulation but is not involved in arc interruption of load or fault current.

Tripping and Closing

The moving contact in the vacuum interrupter is driven open by the release of an opening spring. A low-energy actuator, operated by the electronic circuitry, releases the opening spring when line current is sensed above the preset minimum-trip level. Closing energy, as well as energy to charge the opening spring, is supplied by a high- or low-voltage closing solenoid momentarily connected phase-to-ground through a high-voltage contactor.

Closing Solenoid

Selection of the closing solenoid voltage rating is based on the phase-to-ground voltage of the system on which the recloser is to be used. Low-voltage ac and dc closing coils are also available for the closing solenoid (refer to Table 6). Electrical power for low-voltage closing is supplied through a 2-pin connector mounted on the recloser head.

Closing Solenoid Operation

The closing operation is illustrated by considering the recloser to be connected to the line, but locked out (orange control lockout indicator target is displayed). To close from lockout, the manual operating handle must be pulled downward to the Open position and then raised to the Closed position. This allows the closing solenoid contactor to close the phase-to-ground connection, thereby energizing the closing solenoid and imparting an upward acceleration to the solenoid plunger.

Upward movement of the plunger causes the recloser operating mechanism to effect the following actions:

1. Opening spring is charged.
2. Closing solenoid contactor opens.
3. Closing spring is released, driving contact operating rod downward to close the vacuum interrupter.
4. Undervoltage lockout timer is reset.

Undervoltage Lockout

An undervoltage lockout feature is provided to protect the high-voltage closing solenoid from thermal damage, which could be caused by repeated closing attempts during severe undervoltage conditions.

The undervoltage lockout system protects the closing solenoid with a spring-biased hydraulic time-delay lockout linkage charged with the closing stroke of the closing solenoid or by operating the yellow handle.

Each closing signal initiates a time-delayed lockout operation with the down stroke of the solenoid plunger. The time-delay is 20 seconds. If sufficient voltage is present and the oil is filled to the proper level, a closing operation occurs and the undervoltage lockout linkage is reset. If system voltage is too low to permit a closing operation or if the oil level is low, the linkage will provide lockout following its time delay.

The undervoltage lockout feature also prevents unexpected recloser closing upon the return of line voltage, in the event that a reclose operation is attempted without sufficient line voltage.

If a closing operation is attempted by closing the manual operating handle with a hotstick (or via remote close on units equipped with the SCADA I/O board) and line voltage is below 85% of rated voltage, the recloser will lock out and the manual operating handle will drop to the Open position. The recloser can only be closed when line voltage is within $\pm 15\%$ of the rated voltage of the closing solenoid.

Low-Energy Opening and Closing Actuators

Low-energy actuators, which receive signals from the electronic control, are utilized for both opening and closing functions. Each actuator consists of a permanent magnet, a spring-biased armature, and a coil assembly. Pre-charged reset springs are used to charge the armature of each actuator upon completion of mechanism operation.

Manual Operating Levers and Indicators

The operating levers and indicators (Figure 2) for the Type VXE recloser are located under the sleet hood.

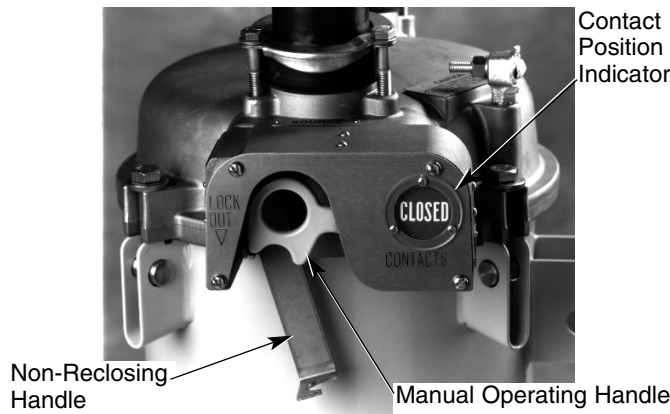


Figure 2.
Recloser operating levers and indicators.

921125KM

Manual Operating Handle

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 handle permits manual opening and closing of an energized recloser. Pulling down the handle trips and locks open the main contacts of the recloser. It is never to be used as a substitute for establishing a visible disconnect during line work.

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

Lifting up the handle closes the closing-coil contactor, and, if high-voltage power is supplied to the recloser source-side bushing, the closing solenoid will close the main contacts. The manual operating handle is designed to be operated with a hotstick.

IMPORTANT: When closing, always place the hotstick underneath the handle. Do not use the eye in the yellow handle for a closing operation: the hotstick will encounter the sleet hood before the closing procedure can be completed.

The handle is trip free, meaning that it will not prevent the recloser from tripping on a fault while the handle is being held closed. If the yellow operating handle is held in the closed position, the recloser will only operate its programmed number of operations and the control will lock out.

When the recloser operates to lockout, the yellow operating handle will not drop down from under the sleet hood. The yellow handle only drops during a manual opening or with the undervoltage lockout feature operation. Control lockout is indicated by an orange lockout indicator target located on the bottom of the control cabinet.

When source voltage is present, the recloser can be closed from lockout by pulling down the operating handle to the Open position and raising it to the Closed position. If the recloser is equipped with the SCADA accessory, the recloser can be remotely closed from lockout, without using the manual operating handle, as long as the manual operating handle is in the Up position.

Non-Reclosing Lever

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 non-reclosing lever provides the recloser with the capability of locking out on the first trip operation, regardless of the operations-to-lockout setting inside the control. The non-reclosing lever is designed for operation with a hotstick.

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

For non-reclosing operation, the lever is pulled from under the sleet hood to its down position, as shown in Figure 2. The lever must be manually returned to the up position in order to return the recloser to its pre-programmed number of operations to lockout. The recloser can be opened or closed manually regardless of the position of the non-reclosing lever.

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.

Operations Counter

A four-digit mechanical counter, located under the sleet hood, cumulatively records each time the recloser trips open.

Electronic Control

The electronic circuits for programming the operating sequence, minimum-trip levels, time-current characteristics, and other parameters are located in a separate pad-lockable cabinet that can be mounted at any convenient accessible location, near or remote from the recloser.

CAUTION: Fire. Explosion. Leakage. Severe burn hazard. Do not recharge or disassemble battery. Battery should not be exposed to temperatures above 175°F. Do not incinerate or expose the battery contents to water. Failure to comply can result in equipment damage and serious personal injury. T251.1

No external power source is required to operate the electronics. Power is obtained from the line by means of a 1000:1 bushing current transformer mounted in the head of the recloser. A minimum of 3 A of primary current flow is sufficient to power the sensing circuits and charge the trip capacitors which actuate the low-energy actuator. A 9 V, 1.4 Ah lithium battery is provided to supply energy to actuate the closing contactor. And, in the event that current drops below 3 A, the battery will ensure proper control operation.

Electronic control circuitry is centralized on a single printed circuit board which is easily replaceable. DIP switch programmable control parameters, along with easily replaceable TCC cards, increase application flexibility. Refer to the *Control Programming and Operation* section of this manual for further information.

The VXE control can be equipped with an optional SCADA input/output board to provide remote operation and status functions for SCADA applications. Refer to the *Accessories* section of this manual for additional information.

Recloser Data Plates

Check the recloser data plates (Figure 3), which are located on the sleet hood, to make sure the closing coil voltage, the voltage, and the current ratings are compatible with the system on which the recloser is to be installed.

WARNING: Hazardous voltage. Closing coil voltage and current ratings must be compatible with the system application. Refer to the data plates, located on the sleethood of the recloser, for specific rating information. Failure to comply can result in death, severe personal injury, and equipment damage. G129.0

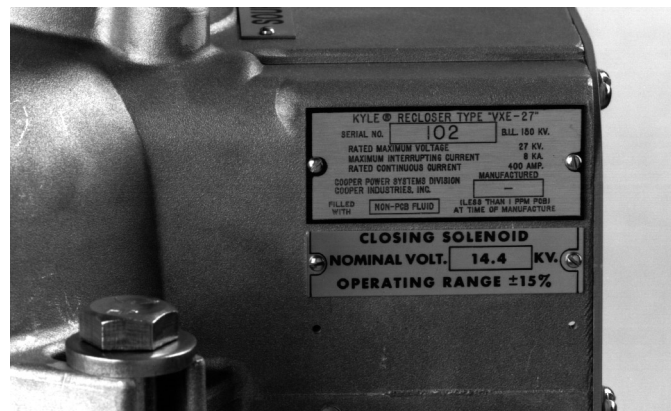


Figure 3. Recloser data plates are located on sleet hood. 921122KM

CONTROL PROGRAMMING AND OPERATION

Type VXE Electronic Control

The VXE electronic control utilizes solid-state circuitry and provides the intelligence for current sensing, trip timing, and all other control functions. The control has an external weatherproof cabinet connected to the recloser with a control cable.

No external power source is required to operate the VXE control. Power is obtained from the line by means of a bushing current transformer. The separate control cabinet is intended to be mounted to the recloser tank, although it can be mounted to the pole or other mounting structure at a distance approximately equal to the cable length. The maximum control cable length is 30 m (100 ft).

Current Sensing

VXE reclosers have a 1000:1-ratio-sensing current transformer, mounted on the load-side bushing under the head, which provides phase current sensing. The CT is connected to the electronic control cabinet through the control cable. A solid-state CT protector is connected to the current transformer inside the recloser, ahead of the cable disconnect, to allow for removing the control while the recloser is in service.

Control Power

Control power for the electronic circuitry is supplied by the sensing CT located in the recloser when a minimum of 3 A of line current is flowing through the recloser. A green LED on the circuit board will light when the control is powered by line current (20-second delay for LED to light).

A minimum of 3 A of primary current is sufficient to power the electronics and charge the trip capacitors, which

actuate the low-energy opening actuator. In addition, a control battery is required to supply power to the control during the reclose intervals. If line current drops below 3 A or the recloser is in the open position, power is then supplied by the control battery.

Control Batteries

CAUTION: Fire. Explosion. Leakage. Severe burn hazard. Do not recharge or disassemble battery. Battery should not be exposed to temperatures above 175°F. Do not incinerate or expose the battery contents to water. Failure to comply can result in equipment damage and serious personal injury. T251.0

The VXE control requires a 9 V, 1.4 Ah lithium battery to supply power when line current is not present. The battery is required to close the recloser after a trip operation, during a normal trip sequence, and to eliminate arming time. Arm time is the time self-powered controls require to charge the power supply, before the control can issue a trip signal. This is noted for instances of a dead battery. In spite of a dead battery, the fault current will arm the control and trip the recloser open.

The VXE control requires a second 9 V, 1.4 Ah lithium battery to operate the lockout indicator. The battery is required to supply the current needed by the trip and close coil of the lockout indicator.

IMPORTANT: The control and lockout indicator batteries should be disconnected from the control and lockout indicator circuit boards whenever the control is not in service.

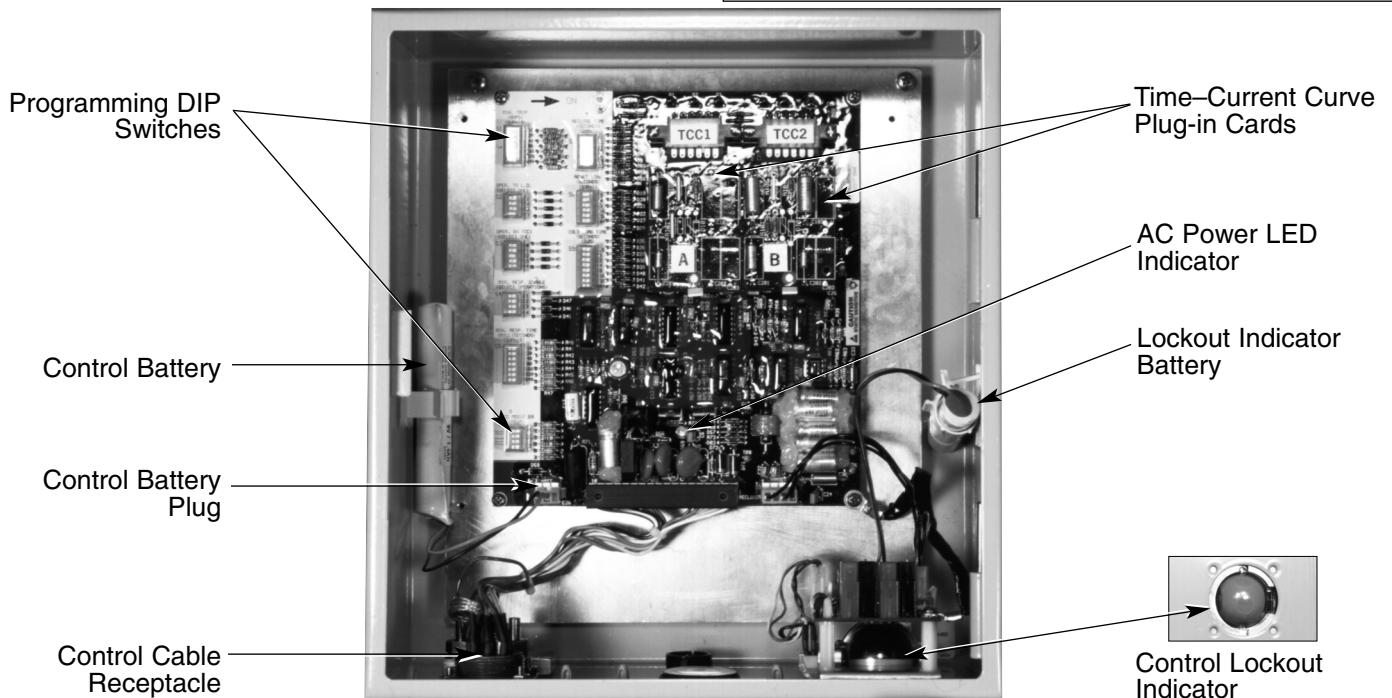


Figure 4.
Type VXE electronic recloser control.

Battery Replacement

Although both the control and lockout target batteries are designed to last for ten years under normal duty, it is recommended that they be replaced every six years. This corresponds to the maximum recommended interval for vacuum recloser maintenance. The control battery should also be replaced if the total accumulated time without CT power reaches 100 days; however, the control battery life is reduced to half (50 days) with SCADA. The control battery life is independent of the number of trip or close operations of the recloser.

CAUTION: Equipment misoperation. Do not energize this equipment until all control settings have been properly programmed and verified. Refer to the Control Programming and Operation section of this manual for programming procedures. Failure to comply can result in misoperation (unintended operation), equipment damage, and personal injury. G118.1

Programming the Control Settings

The control must be programmed with all necessary operating settings prior to operation with an energized recloser. Changes in the control operating parameters should only be made by a qualified technician or engineer.

The DIP switches for programming the control are located on the lefthand side of the control cabinet as shown in Figure 4.

Sequence Coordination

Sequence Coordination prevents unnecessary operation of the backup recloser for a fault beyond a downline recloser by advancing the control sequence one step when line current exceeds the programmed minimum trip value for a time duration shorter than the programmed control response time. This maintains trip coordination with a downline recloser while protecting fuses from temporary faults.

Sequence Coordination is always active for the number of TCC1 operations selected for the VXE control. For example, for two trip operations on TCC1 and two trip operations on TCC2, Sequence Coordination will advance to TCC2 for the third trip operation of the downline recloser, maintaining trip coordination.

Minimum-Trip Value

The minimum-trip current rating for phase overcurrent is established by positioning DIP switches (labeled S1) in the control (Figure 5). The minimum-trip setting of the recloser can be changed by merely changing the DIP switch setting.

Minimum-trip level can be programmed from 10 through 1280 A, in 10 A increments. The programmed value equals the sum of the values of the switches in the On position plus 10 A.

To avoid inadvertent tripping of the recloser when changing minimum-trip settings on an energized recloser, *all the S1 switches must be set to the ON position first*. Turn off the necessary switches to obtain the desired minimum trip value.

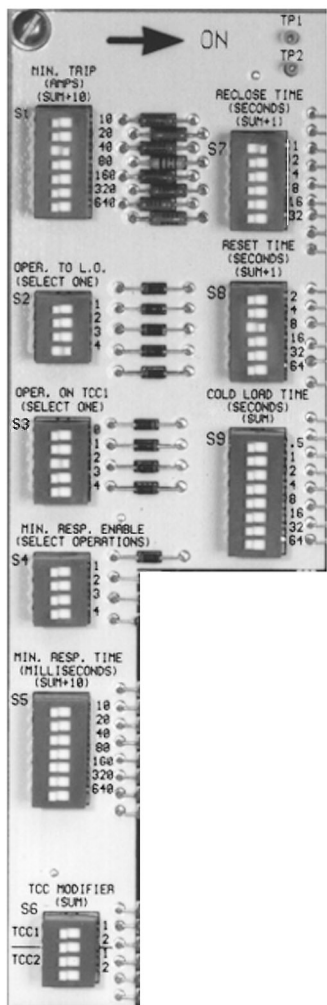


Figure 5. Programming DIP switches.

921119KM-2

Operations to Lockout

The control can be set to provide 1, 2, 3, or 4 operations to lockout, by positioning one of the DIP switches labeled S2 to the ON position (Figure 5). If more than one switch is selected, only the lowest switch value will be enabled. If none are selected, the control defaults to 4 operations.

Operations on TCC Number 1

The control can be set to provide 0, 1, 2, 3, or 4 operations on TCC 1, by positioning one of the DIP switches labeled S3 to the ON position (Figure 5). If none are selected, the control defaults to zero operations. If more than one switch is selected, all operations will be on TCC 1.

Minimum Response Time Enable

To achieve coordination of in-line fault-interrupting devices, where fault levels would cause simultaneous tripping, the minimum response time function will inhibit tripping until a programmed time has elapsed. The minimum response time function can be enabled on operation 1, 2, 3, and/or 4, by selecting any of the desired DIP switches labeled S4 (Figure 5).

Minimum Response Time Setting

The minimum response time setting is established by positioning the DIP switches labeled S5 (see Figure 5). Minimum response time can be programmed from 10 through 1280 milliseconds, in 10 millisecond increments. The programmed time setting equals the sum of the values of the switches in the On position plus 10 milliseconds.

Time–Current Curve Characteristics

The VXE time–current characteristic (TCC) curves are established by individual circuit cards that plug into the circuit board of the control (Figure 4). Two TCC plug-in cards are required for proper operation.

The available plug-in time current characteristic curves, and the TCC modifiers available for the electronic control, enable the VXE to meet a wide variety of application requirements and simplify coordination with other protective devices in the distribution system.

All timing starts at initiation of a fault or when closing into a fault. TCC circuit cards are interchangeable between sockets TCC1 and TCC2. However, fast curves are normally used in TCC1, and delayed response curves are normally used in TCC2.

Time–Current Curve Modifiers

The DIP switches labeled S6 (Figure 5) are used to modify the shape of the time–current curve produced by the TCC plug-in card for TCC1 and/or TCC2. Each TCC plug-in card can produce 4 curves (Unmodified, Mod 1, Mod 2, or Mod 3).

The TCC modifier is the sum of the values of the DIP switches. For example, TCC1 is unmodified when both DIP switches are in the Off position. To modify TCC1 to obtain the Mod 3 modification, move TCC1 DIP switches 1 and 2 to the On position.

Reclose Time

The reclose time setting is established by positioning the DIP switches labeled S7 (Figure 5). Reclose time, the open interval between fault timings, can be programmed from 1 through 64 seconds, in 1-second increments. Programmed reclose time is the sum of the value of all DIP switches in the On position plus 1 second.

Reset Time

The reset-after-successful-reclose time setting is established by positioning the DIP switches labeled S8 (Figure 5). Reset time can be programmed from 1 through 124 seconds, in 1-second increments. Programmed reset time is the sum of the value of all DIP switches in the On position plus 1 second.

Cold-Load Pickup

After the recloser has been closed from lockout, either manually or remotely, cold-load pickup will be active for the programmed time interval. During this interval, the control will be in the one-operation-to-lockout mode, and overcurrent timing will be on time–current curve number 2. If no overcurrent is present during the programmed time interval, the control will reset and the lockout indicator will flip from orange to black.

The cold-load pickup time setting is established by positioning the DIP switches labeled S9 (Figure 5). The cold-load pickup time can be programmed from 0 to 127.5 seconds in 0.5-second increments. Programmed cold-load pickup time is the sum of the value of all DIP switches in the On position.

Control Lockout Indicator

Control lockout is indicated by a lockout indicator located at the bottom of the control cabinet. A round orange target (shown in Figure 4) is displayed when the control is in lockout. When the control is not in lockout, the display is black.

The control lockout indicator will not change status if cold-load pickup is active until the cold-load pickup time interval elapses.

SPECIFICATIONS AND RATINGS

Check Recloser Ratings Prior To Installation

The recloser will operate effectively only when applied within its specified ratings. Consult the following ratings tables and compare to system characteristics at the point of application prior to installation.

**TABLE 1
Voltage Ratings**

VXE15	
Maximum Design Voltage (kV)	15.5
Nominal Operating Voltage (kV)	2.4-14.4
Basic Insulation Level (BIL) (kV)	110
60 Hertz Withstand Voltage (kV)	
Dry, one minute	50
Wet, ten seconds	45
Max RIV at 1.0 MHz/9.41 kV (µV)	100
VXE27	
Maximum Design Voltage (kV)	27.0
Nominal Operating Voltage (kV)	24.9
Basic Insulation Level (BIL) (kV)	150
60 Hertz Withstand Voltage (kV)	
Dry, one minute	60
Wet, ten seconds	50
Max RIV at 1.0 MHz/23 kV (µV)	100

**TABLE 2
Current Ratings**

Continuous Current Rating (A)	
VXE15, VXE27	400
Symmetric Interrupting Current (A)	
VXE15, VXE27	8,000
Overload Capability VXE15, VXE27	
125% - 4 Hours (A)	500
150% - 2 Hours (A)	600
Cable Charging Current	
VXE15 (A)	5
VXE27 (A)	25
Magnetizing Current (A)	
VXE15, VXE27	14
Three-Second Current, Symmetric (A)	
VXE15, VXE27	8,000
Surge Current (A) VXE15, VXE27	65,000

**TABLE 3
Duty Cycle**

Percent of Maximum Circuit Interrupting Rating	Maximum X/R Ratio	Number of Unit Operations
15-20	4	88
45-55	8	112
90-100	15	32
		Total 232

**TABLE 4
Mechanical Specifications**

Operating Temperature (°C)	
Minimum	-30
Maximum	+40
Closing Mechanism	Spring/Solenoid Operated
Opening Mechanism	Spring Operated
Contact Gap (approximate) (inches)	0.4 - 0.5
Contact Close Time	
Close Signal To Contact Make (seconds)	0.19 - 0.24
Open Contact Travel Time	
Open Signal To Contact Part (seconds)	0.014 - 0.022
Interrupting Time	
Open Signal to Arc Extinction (seconds)	0.016 - 0.036
Allowable Contact Erosion (inches)	0.0625
Mechanical Life (minimum operations)	2500

**TABLE 5
Weights and Oil Capacity of VXE15 and VXE27 Reclosers**

Weight, without oil, kg (lb)	67 (149)
Weight, with oil, kg (lb)	89 (198)
Oil Capacity, L (gal)	36 (9.5)
Weight of the Control, kg (lb)	7.2 (16)

DIMENSIONS

Recloser Dimensions

Figure 6 shows the dimensional information for VXE reclosers. Figure 7 provides the mounting dimensions for the control cabinet.

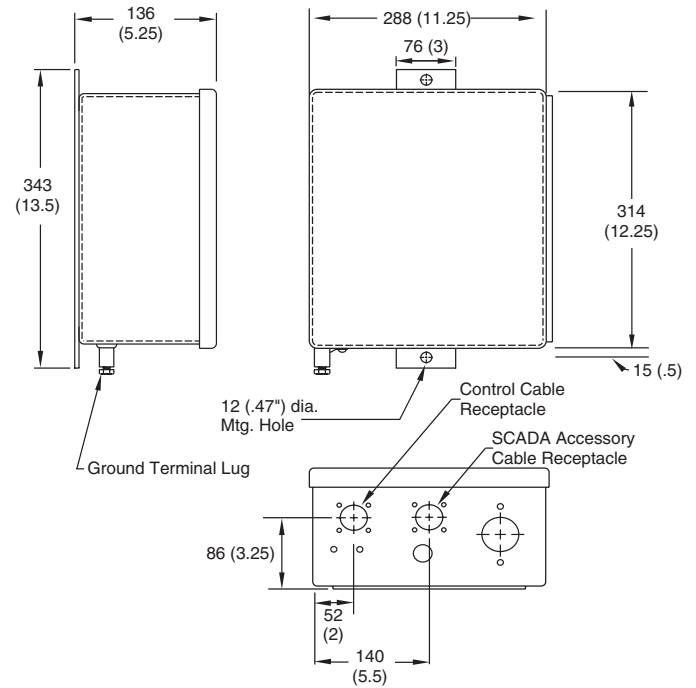
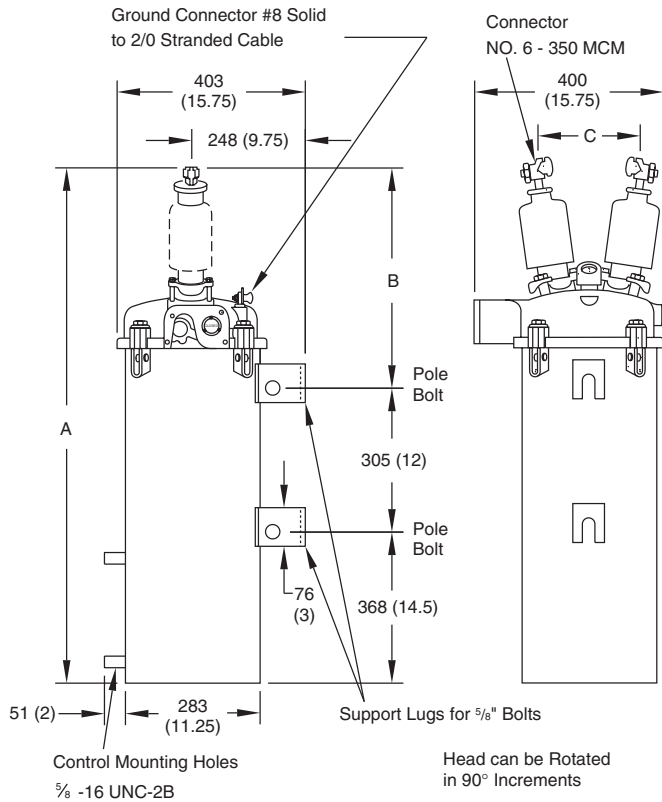


Figure 7.
Control cabinet mounting dimensions.

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

Dimensions of Recloser

Type	Bushing Type	A	B	C
VXE15	standard	1156 (45.5)	483 (19)	270 (10.5)
VXE15	extra creepage	1237 (48.75)	564 (22.25)	283 (11)
VXE27	standard	1237 (48.75)	564 (22.25)	283 (11)
VXE27	extra creepage	1237 (48.75)	564 (22.25)	283 (11)

Figure 6.
Dimensions of Types VXE15 and VXE27 reclosers.

INSTALLATION PROCEDURE

Installing the Recloser and Control

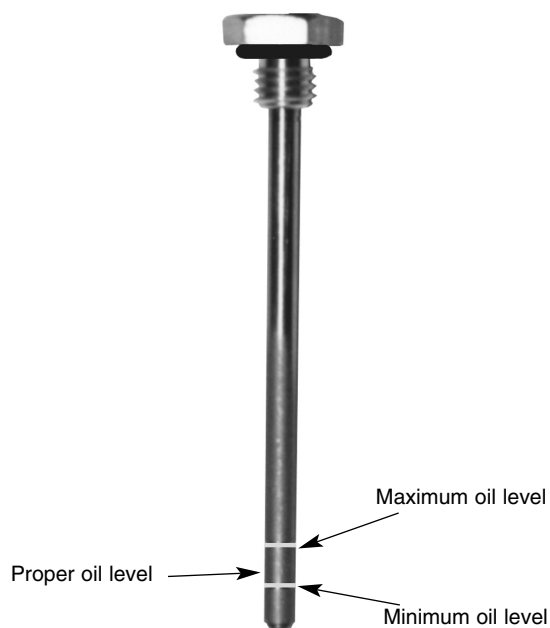
All reclosers are carefully tested and adjusted at the factory to operate according to published data. Well equipped test facilities, detailed testing procedures, and thoroughly trained personnel assure accurately calibrated equipment. Each recloser leaves the factory ready for installation. Pre-installation testing is not necessary.

Use the following procedure when installing the recloser.

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

1. Check the oil level. Using the dipstick provided on the recloser head, make sure the oil in the recloser tank is at the proper level (Figure 8). Measure the oil level with the dipstick completely screwed in at 25°C. If the oil is below the minimum level, fill the recloser with oil to the proper level, using the dipstick opening. Do not exceed the maximum oil level, as indicated by Figure 8.

WARNING: Do not operate this equipment out of oil. Oil is the electrical insulating medium within this equipment; operation out of oil will result in internal flashovers that will damage the equipment and can cause death or severe personal injury. G104.2



010064KM

Figure 8.
Type VXE oil dipstick.

CAUTION: This equipment relies on oil to provide electrical insulation between components. The dielectric strength of the oil must be checked on a regular basis, as part of the routine maintenance inspection, to ensure that it is at or above minimum dielectric requirements. Use of this equipment with insulating oil that does not meet minimum requirements can result in internal flashovers that will damage the equipment and can cause personal injury. G107.2

2. Test the oil dielectric strength. If the recloser has been stored for some time or is being relocated, perform a dielectric test on the oil in accordance with ASTM-approved testing procedures.

A. On new equipment, the oil must have minimum dielectric strength of 26 kV.

B. If the dielectric strength of the oil is less than 26 kV, filter the oil to restore its dielectric strength to acceptable minimum level.

3. Check the data plate ratings. Be sure the ratings on the recloser data plates are correct for the installation.

WARNING: Hazardous voltage. Closing coil voltage and current ratings must be compatible with the system application. Refer to the data plates, located on the sleethood of the recloser, for specific rating information. Failure to comply can result in death, severe personal injury, and equipment damage. G129.0

4. Perform high-potential withstand tests. Prior to installing the recloser, perform high-potential withstand tests. Refer to the *Testing* section of this manual for high-potential withstand test procedures.

5. Program and Install the control. All VXE electronic controls are carefully tested at the factory and shipped with plug-in TCC cards connected and ready for operation. Before installation, inspect the control and make sure that all TCC components are correct for the planned installation. Connect the control battery to the battery plug as shown in Figure 4. Make sure that all DIP switch settings are set correctly and that the control cable is connected between the recloser and control.

CAUTION: Follow all locally approved safety practices when lifting and mounting the equipment. Use the lifting lugs provided. Lift the unit smoothly and do not allow the unit to shift. Improper lifting can result in equipment damage. G106.2

6. Mount the recloser. Use the lifting lug located on the head casting and follow approved procedures.

Note: It is important that the recloser be mounted on the level to accurately check the oil.

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

7. Ground the recloser and the control. (Refer to Figure 9) Make ground connections to the recloser head ground connector. It will accommodate two no. 10 through no. 2 stranded conductors. Ground the control using the ground connector provided at the bottom of the electronic control cabinet for connecting a no. 14 through no. 4 stranded grounding cable to a suitable ground. Make ground connections in accordance with approved utility standards.

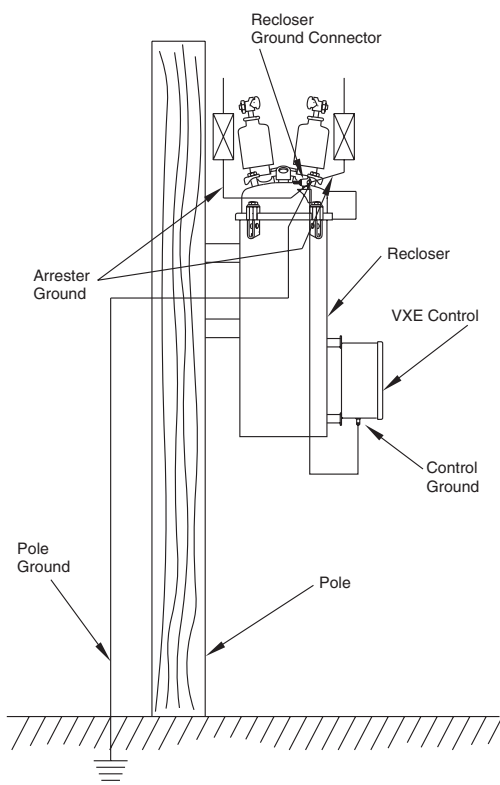


Figure 9. Recommended grounding method for VXE recloser and control.

8. Make the high-voltage line connections. Connect high-voltage lines to the recloser bushing terminals as shown in Figure 10. The source lead must be connected to the source-side bushing, which is located adjacent to the sleet hood. To facilitate connection, the cover of the recloser can be rotated in 90-degree increments with respect to the tank and its mounting bolts. The universal clamp-type terminals accept no. 6 through 350 mcm conductors.

9. Provide bypass and disconnect switches. The two disconnect switches and the bypass switch shown in Figure 10 are not required, but they do facilitate maintenance.

Note: The two disconnect switches and one bypass switch are not required, but they are highly recommended.

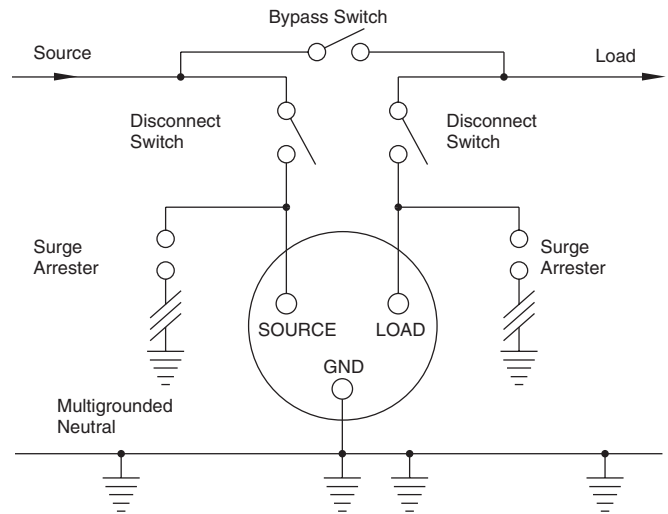


Figure 10. Connection diagram shows complete surge protection and illustrates switches to facilitate maintenance.

10. Provide surge protection. Surge protection on both sides of the recloser is advisable (Figure 10). However, if protection is provided on only one side, it should be located on the source side for line installations and the load side for substation installations.

Placing the Recloser in Service

Always follow locally approved procedures and safety practices when placing the recloser in service. Be sure that the control battery is properly connected. When the recloser is connected and source-side high-voltage lines are energized (by closing the source-side disconnect switch), the recloser can be placed in service. Refer to the connection diagram in Figure 10.


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


To place the recloser in service:


1. Move the yellow manual operating handle under the sleet hood to the CLOSE position. This resets the control and synchronizes the control to the recloser. The recloser should immediately close.
2. Close the load-side disconnect switch and open the bypass switch. The recloser is now in service.

Note: To remove from service, close the bypass switch, open the recloser, and open the source and load disconnect switches.

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

 **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

Manual Operation of Energized Recloser

To manually operate an energized Type VXE recloser, use a hotstick to engage of the yellow operating handle located under the sleet hood. When the handle is pulled down, the mechanism is tripped to open the main contacts. Contact position is indicated by the OPEN flag of the contact position indicator. When the handle is pushed up, the closing solenoid is energized to latch the main contacts in the closed position.

Non-Reclosing Operation

When the non-reclosing lever has been manually pulled down into the non-reclosing position, any current over minimum-trip rating will cause the control to automatically lock open the recloser on the first trip operation, instead of cycling through the normal operating sequence. The recloser will trip on the programmed TCC for the first trip operation. The non-reclosing lever does not interfere with manual recloser operation. The recloser can be opened or closed manually regardless of the position of the non-reclosing lever.

Automatic Operation

When the VXE recloser is closed and in service, it operates automatically, per the settings programmed in the control, as overcurrent conditions demand. However, once locked out, it must be manually closed by pulling the yellow manual operating handle down and returning the yellow handle to its up (Closed) position. If the VXE control is equipped with the optional SCADA input/output accessory board, the recloser can be remotely closed from lockout.

Lockout Indication

When the recloser is locked-out, the yellow manual operating handle will not drop down from under the sleet hood. Lockout is indicated by the Lockout Indicator located at the bottom of the control cabinet. A round orange target is displayed when the control is in lockout. When the control is not in lockout, the display is black.

TESTING

Type VXE reclosers are carefully tested and adjusted at the factory to operate according to the published data. Well-equipped test facilities, a detailed testing procedure, and trained personnel assure accurate calibration. Permanent records are kept of each recloser's test performance. As a result, each recloser leaves the factory ready for installation, and pre-installation testing is not necessary. However, should verification of recloser operation be desired prior to installation, the following characteristics can be checked:

1. Dielectric integrity of the recloser.
2. Minimum-trip current.
3. Operations sequence of the recloser.
4. Operation of the closing solenoid.

The test findings should agree with the settings programmed in the control. The recloser can be test-tripped with a low-voltage ac source. However, to test operation of the high-voltage closing solenoid, a high-voltage ac source is required.

Safety Requirements

For personnel safety, the recloser, the electronic control, and the high-voltage transformer must be enclosed in suitable test cage to prevent accidental contact with hazardous voltage and all grounding precautions must be observed.

WARNING: Hazardous voltage. The switchgear and high voltage transformer must be in a test cage or similar protective device 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. T221.3

Test Equipment Required

The following equipment is required for these tests:

1. *Variable autotransformer* — 120 V, 10 A.
2. *600:5 BCT* — Slip-on type bushing current transformer, set on the 600:5 tap.
3. *Ammeter* — Must have a rating based on the level of test current. Since the control is responsive to peak current, it is recommended that metering responsive to peak current be used when wave distortion is a problem.

TABLE 6
Closing Solenoid Codes and Minimum Voltage

Closing Solenoid Rating (kV)	Closing Solenoid Code Number	Minimum Allowable Voltage at Recloser When Solenoid is Energized (V)
VXE15		
2.4	21	2040
4.16–4.8	22	3540
6.0	31	5100
7.2–7.62	23	6120
8.0–8.32	24	6800
VXE27		
11.5	32	9775
12.0–13.2	30	10200
14.4	27	12240
Low-Voltage Closing Coils		
120 Vac/125 Vdc	26	95
240 Vac/250 Vdc	28	190

4. *High-voltage transformer T1* — Used to operate high-voltage closing solenoid (refer to Figure 13). Be sure minimum allowable voltage, shown in Table 6, is maintained at recloser terminals during the 4–5 cycle interval the closing solenoid is energized.
5. *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. Refer to *Service Information S280-16-4, Type VXE Electronic Recloser Control Tester Operation Instructions*.



921124KM

Figure 11.
The manual closing tool is used to close a de-energized Type VXE recloser.

Manual Closing Procedure

The manual closing tool (shown in Figure 11) permits manual closing of the main contacts of the VXE recloser for test purposes, when a high-voltage source for closing is not available. Minimum-trip current and operating sequence can be tested in this manner. Refer to instructions covering *Manual Operation Of De-energized Recloser* for closing procedure when using the manual closing tool. The best procedure is to have one person operate the closing tool while another regulates the tripping circuit and observes test results.

Manual Operation of a De-energized Recloser

The manual closing tool is only to be used for closing a de-energized recloser.

WARNING: Hazardous voltage. Never use a manual closing tool to close an energized recloser. Manually closing an energized recloser will result in failure of the vacuum interrupter and can result in contact with high voltage, which can cause death or severe personal injury.

T236.0

The de-energized recloser is manually closed by raising the yellow manual operating handle to the Closed position and using the manual closing tool to rotate the main operating shaft of the recloser mechanism 90 degrees. Rotation of the main operating shaft must be completed before the undervoltage lockout feature operates. Refer to the *Undervoltage Lockout* section of this manual.

Use the following procedure for manual closing of a de-energized recloser:

1. Remove the pipe plug from the side of the recloser head casting and insert the manual closing tool to engage the main operating shaft.
2. Raise the yellow operating handle to the CLOSED position.
3. Rotate the closing tool about 1/4 turn clockwise, to close the recloser contacts. Avoid forcing the closing tool beyond the mechanism stop: doing so may shear the pin on the main operating shaft.
4. A de-energized recloser can be tripped open by pulling the yellow manual operating handle down to the LOCKOUT position.

IMPORTANT: After each recloser trip, while the closing solenoid plunger is moving downward, two metallic clicks will be heard. The first click is the main toggle latch resetting. The second click is the closing solenoid contactor closing. As soon as these clicks are heard, the closing tool can be turned to close the recloser.

5. Be sure to replace the pipe plug in the head casting before placing the recloser in service.

High-Potential Insulation Level Withstand Tests

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

High-potential withstand tests provide information on the dielectric condition of the recloser. Testing is performed at 75% of the rated low-frequency withstand voltage.

Always use a suitable test cage and follow procedures outlined in the *Testing: Safety Requirements* section of this manual.

- For a VXE15 recloser, test at 37.5 kV rms.
- For a VXE27 recloser, test at 45.0 kV rms.

Closed-Contacts High-Potential Test

1. Manually close the recloser contacts.
2. Ground the recloser head casting and control.
3. Apply the proper test voltage to the source-side bushing.
4. The recloser should withstand the test voltage for 60 seconds.

Open-Contacts High-Potential Test

1. Pull down the Manual Operating Handle to open the recloser contacts.
2. Ground the recloser head casting, control, and load-side bushing.
3. Apply the proper test voltage to the source-side bushing.
4. The recloser should withstand the test voltage for 60 seconds.
5. Ground the source-side bushing.
6. Apply the proper test voltage to the load-side bushing.
7. The recloser should withstand the test voltage for 60 seconds.

Test Results

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

If the recloser passes the closed-contacts test but fails the open-contacts test, the cause is likely to be a deterioration of the vacuum interrupter. Replace the interrupter and retest to confirm the repair.

If the recloser fails the closed-contacts test, the cause is likely to be a diminished electrical clearance, low oil dielectric strength, or failed insulation. After correcting the problem, retest to confirm the repair.

Minimum-Trip Current Level Test

The minimum-trip current can be checked by using the manual closing tool to close the recloser while it is de-energized and then tripping the recloser with the low-voltage ac source. Assemble and connect the low-voltage test portion of the set-up shown in Figure 12 and proceed as follows:

1. With the yellow manual operating handle in the CLOSED position, use the manual closing tool to close the recloser.

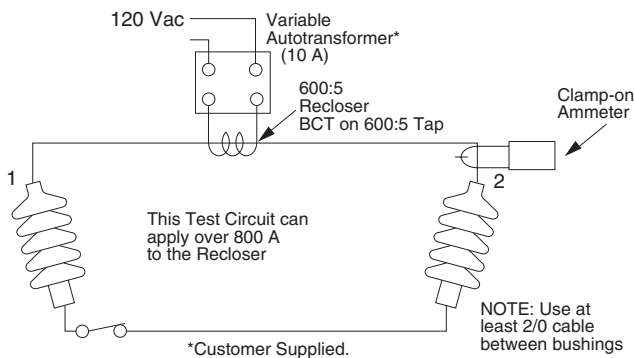


Figure 12.
Suggested test diagram for minimum-trip testing.

WARNING: Hazardous voltage. Never connect a high voltage source for testing closing coil operation and a low voltage source for fault current trip operation, simultaneously. The high- and low-voltage circuits are not compatible. Failure to comply can result in death, severe personal injury, and equipment damage.

T233.2

2. Connect the low-voltage test leads to the recloser bushings as shown in Figure 12.
3. Slowly increase the variable autotransformer voltage from zero, note the ammeter reading when the recloser trips, and compare to the VXE control's programmed minimum-trip value.

Sequence of Operation Test

The operating sequence can be checked by using the manual closing tool to close the recloser while it is de-energized and then tripping the recloser with the low-voltage ac source.

1. Check the number of programmed fast and delayed operations by observing the VXE control DIP switch setting for Operations To Lockout (labeled S2) and the number of TCC 1 fast operations programmed on DIP switches labeled S3.
2. Assemble and connect the low-voltage test portion of the set-up shown in Figure 12 and proceed as follows:
3. With the yellow manual operating handle in the CLOSED position, use the manual closing tool to close the recloser.
4. Connect the low-voltage test leads to the recloser bushings as shown in Figure 12.
5. Using the customer supplied variable autotransformer, apply a test current above the minimum-trip level to trip the recloser.
6. Repeat step 5 until the recloser locks out, which is indicated by the orange control lockout indicator target on the bottom of the control cabinet.

Test Results

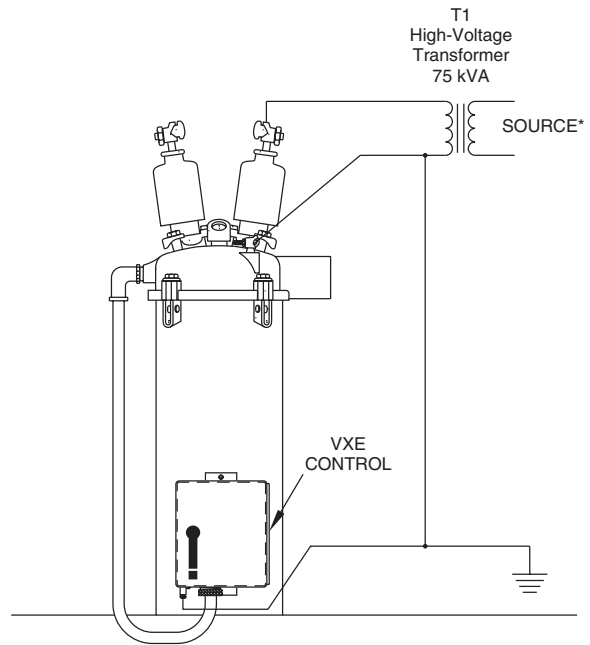
Note the number of fast and delayed operations to lockout and compare these numbers to the programmed values.

Electrical Operation of Closing Solenoid Test

Refer to Figure 13 to assemble and connect the equipment. The recloser head casting and the control must be solidly grounded and in a test cage.

WARNING: Hazardous voltage. The switchgear and high voltage transformer must be in a test cage or similar protective device 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. T221.3

1. With the yellow manual operating handle down to LOCKOUT position, energize the high-voltage transformer.
2. Using a hotstick, raise the yellow operating handle to the CLOSED position. The recloser should close immediately, indicating correct operation of the closing solenoid.



* Source shall not limit the kVA output of the transformer.

Figure 13.
Suggested test diagram for high-voltage closing.

ACCESSORIES

The Type VXE recloser can be equipped with a variety of factory-installed accessories to meet specific application requirements.

Extra-Creepage Bushings

When VXE reclosers are to be installed where extensive salt spray, smog, smoke, or other atmospheric contaminants reduce the effectiveness of porcelain insulation, Extra-Creepage Bushings can be supplied. Standard Type VXE15 recloser bushings provide 295 mm (11-5/8 in.) of creepage; extra-creepage accessory bushings provide 432 mm (17 in.). Type VXE27 recloser bushings provide 432 mm (17 in.) of creepage; extra-creepage accessory bushings provide 673 mm (26-1/2 in.).

Bushing-Type Multi-Ratio Current Transformer

A 450:5 multi-ratio current transformer for load metering can be factory installed externally on the source- or load-side bushing. This transformer has only one primary turn: the bushing rod. Taps on the secondary winding provide the different ratios. The available ratios and their corresponding terminal connections (labeled A, B, C, and D) are shown in Table 7. The terminal arrangement for the tapped secondary is accessible when the cover plate on the transformer housing is removed.

TABLE 7
450:5 Multi-Ratio Current Transformer Ratios and Terminal Connections

Ratio	Terminal
450:5	A-D
300:5	A-C
250:5	B-D
200:5	A-B
150:5	C-D
100:5	B-C

Low-Voltage Closing

The VXE recloser can employ 120 Vac or 240 Vac low-voltage closing. The low-voltage ac closing accessory provides a bridge rectifier, surge varistors, and the factory-installed wiring to accommodate the low-voltage closing power. Customer low-voltage power is connected at the 2-pin connector (polarity independent) in the recloser head. This accessory requires a low-voltage closing coil.

Cable-Locking Sleeve

To prevent detachment of the control cable from the VXE control cabinet by unauthorized personnel, a cable-locking sleeve is available to enclose the cable plug. The plug is passed through the sleeve and the sleeve is then fastened from inside the control cabinet. There is no access to the cable receptacle without opening the locked cabinet door and detaching the sleeve.

SCADA Input/Output Board

An optional factory-installed SCADA input/output circuit board is available for the VXE control to provide remote operation capabilities. The SCADA I/O board also includes dry contacts to provide remote status information.

All remote features are accessed through a 19-pin receptacle (Type MS 22-14 female) mounted on the bottom of the control cabinet.

Remote Lockout

Remote lockout provides the ability to trip and lock out the recloser from a remote signal. Operation requires a momentary contact closure of 0.1 second between pins D and B.

Remote Close With Cold-Load Pickup

The remote close with cold-load pickup feature provides the control with the capability of being remotely closed from lockout by momentary contact closure (0.1 second) between pins E and B.

Cold-load pickup is active for a programmable time, during which the control will be in the one-operation-to-lockout mode and overcurrent timing will be on TCC2. If no overcurrent is present during this interval, the control will reset to the programmed operating sequence.

Remote Non-Reclose

Remote non-reclose provides the ability to remotely place the control in the non-reclose mode by momentary contact closure (0.1 second) between pins F and B.

Recloser Open/Close Status Indicator

The recloser status indicator provides a dry contact (SPDT rated 1 A at 28 Vdc) to indicate open or closed status of the recloser contacts. Contact closure occurs between pins H and K when the recloser is closed.

Remote Lockout Status

The remote lockout status feature provides an open contact between pins L and K when the control is not locked out and a closed contact between pins M and K when the control is locked out. Contacts are rated 1 A at 30 Vdc.

Remote Non-Reclose Status

The remote non-reclose status indicator provides a closed contact (rated 1 A at 28 Vdc) to indicate when the recloser is in the normal reclosing mode. Contact closure occurs between pins J and K when the recloser is in the reclose mode.

Remote Analog Current Monitor

The remote analog current monitor provides a 0 to 0.5 mA dc signal corresponding to 0 to 500 A of line current, between pins C (+) and B (-). The factory calibration point is set at 35 A with a 2.5 kΩ resistor across the output with accuracy of ±10% from 15 to 400 A.

MAINTENANCE INFORMATION

CAUTION: This equipment requires routine inspection and maintenance to ensure proper operation. If it is not maintained, it can fail to operate properly. Improper operation can cause equipment damage and possible personal injury. G105.1

CAUTION: This equipment relies on oil to provide electrical insulation between components. The dielectric strength of the oil must be checked on a regular basis, as part of the routine maintenance inspection, to ensure that it is at or above minimum dielectric requirements. Use of this equipment with insulating oil that does not meet minimum requirements can result in internal flashovers that will damage the equipment and can cause personal injury. G107.2

For detailed maintenance instructions, refer to *Service Information S280-16-2, Type VXE15 and VXE27 Electronically Controlled, Single-Phase Recloser Maintenance Instructions*.

Frequency of Maintenance

To assure proper and trouble-free operation, reclosers must be maintained when they have operated the equivalent of a rated duty cycle (see Table 3).

Note: ANSI C37.61, "Guide for the Application, Operation and Maintenance of Automatic Circuit Reclosers", gives a procedure for converting the rated standard duty cycle into an equivalent duty cycle based on the actual operating duty of the recloser.

Maximum Recloser Maintenance Intervals

In the absence of specific operating experience, use the following guideline to establish maintenance intervals:

- Vacuum interrupting reclosers should be maintained at least every six years.

Replacement Parts

Replacement parts for Kyle® reclosers are available through the factory Service Department. Only factory-authorized replacement parts are to be used. To order replacement parts, refer to the current Replacement Parts price list for catalog numbers and pricing. Contact your Cooper Power Systems sales representative for additional information and ordering procedures.

Factory-Authorized Service Centers

Factory-authorized service centers are located throughout the continental United States to provide maintenance, repair, and testing services for Kyle reclosers. For further information, contact your Cooper Power Systems sales representative.

Factory Maintenance Classes

The factory Service Department offers recloser maintenance training classes. These classes, taught by experienced service technicians, are held at the factory's in-house training facility. For additional information, contact your Cooper Power Systems sales representative.

Instructional Video Cassette Program

A video cassette maintenance training program; *KSPV1 General Maintenance and Inspection Procedures for Kyle Reclosers* is available as a supplemental training aid for maintenance personnel. This video program, developed for use in the factory training classes, is to be used in conjunction with existing service literature. For additional information, contact your Cooper Power Systems sales representative.

