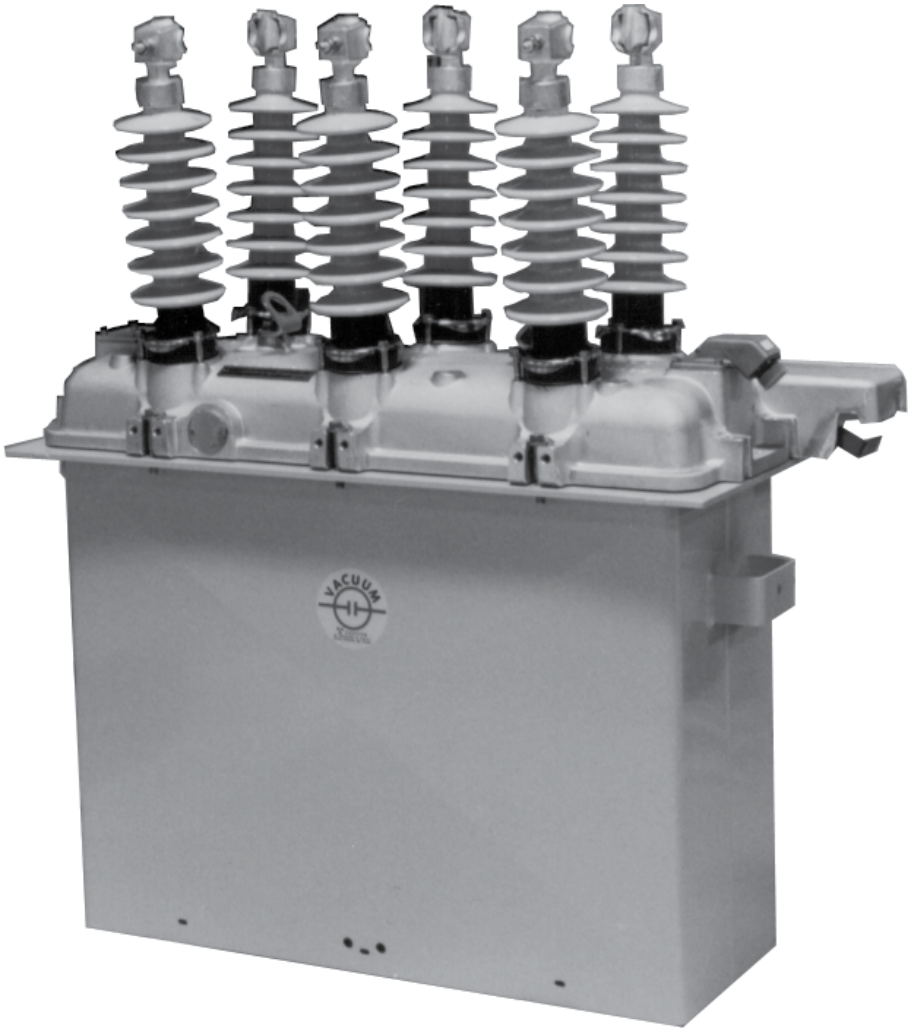
Effective May 2017
Supersedes October 2002 (S280-40-6)

Types VWE, VWVE27, and VWVE38X three-phase, electronically controlled vacuum reclosers maintenance instructions



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Safety for life

Eaton's Cooper Power series 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 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 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.

Hazard Statement Definitions

This manual may contain four types of hazard statements:

DANGER

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

WARNING

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

CAUTION

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

CAUTION

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

Safety instructions

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

DANGER

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

WARNING

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

WARNING

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

WARNING

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

Product information

Introduction

Service Information MN280061EN provides the maintenance instructions for Types VWE, VWVE27, and VWVE38X three-phase, electronically controlled, vacuum reclosers. Included is a general description of the recloser and its operation, instructions for periodic inspection and routine maintenance, testing procedures, and instructions for shop repairs. A service parts list, keyed to exploded-view drawings of the recloser is included at the back of the manual.

Refer to the specific electronic recloser control service information for control checking, testing, and troubleshooting procedures.

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 process described, nor to provide directions for meeting every possible contingency during installation, operation, or maintenance. For additional information, contact your Eaton representative.

ANSI Standards

Eaton's Cooper Power series reclosers are designed and tested in accordance with ANSI standards C37.60 and C37.85 and ANSI guideline C37.61.

Quality standards

ISO 9001-certified quality management system.

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.

Description

The Type VWE, VWVE27, and VWVE38X reclosers, are self-controlled devices that protect distribution lines and equipment. A complete unit consists of the recloser, an Eaton Cooper Power series control, and an interconnecting cable. Fault current sensing is provided by the control which actuates the recloser. Circuit interruption is provided by the recloser.

Operation

The Type VWE, VWVE27, and VWVE38X reclosers trip open on overcurrent (either phase or ground faults) and then reclose automatically. If the overcurrent is temporary, the automatic reclose restores normal service. If the fault is permanent a preset number of trip and reclose operations are performed to lockout. All three phases of the VWE, VWVE27, and VWVE38X reclosers open, reclose, and lockout simultaneously.

Opening sequences can all be fast, all delayed, or any combination of fast operations followed by delayed operations up to a total of four. Fast operations clear temporary faults before branch-line fuses can be damaged. Delayed operations allow time fuses or other downline protective devices to clear so that permanent faults can be confined to smaller sections of line.

Arc interruption takes place within the three sealed vacuum interrupters. Oil is used as an insulating medium but is not involved in arc interruption. The moving contacts of the vacuum interrupters are driven by the release of opening springs that are loaded when the recloser is closed.

Closing energy, as well as energy to charge the opening springs, is supplied by a high-voltage closing solenoid momentarily connected phase-to-phase through a high-voltage contactor. The contactor is mechanically closed by a rotary solenoid actuated by a signal from the electronic control.

A trip-free, yellow operating handle located under the sleet hood will manually lock open the recloser. It cannot manually close the recloser, but must be in the CLOSED position for the rotary close solenoid to operate. A red contact position indicator linked to the recloser mechanism, but independent of the operating handle, is also located under the sleet hood.

The location of the major operation components of the VWVE27 recloser is shown in Figure 2. They are the same for the VWE and VWVE38X reclosers, except for the configuration of the bushings and the rating of the vacuum interrupter.

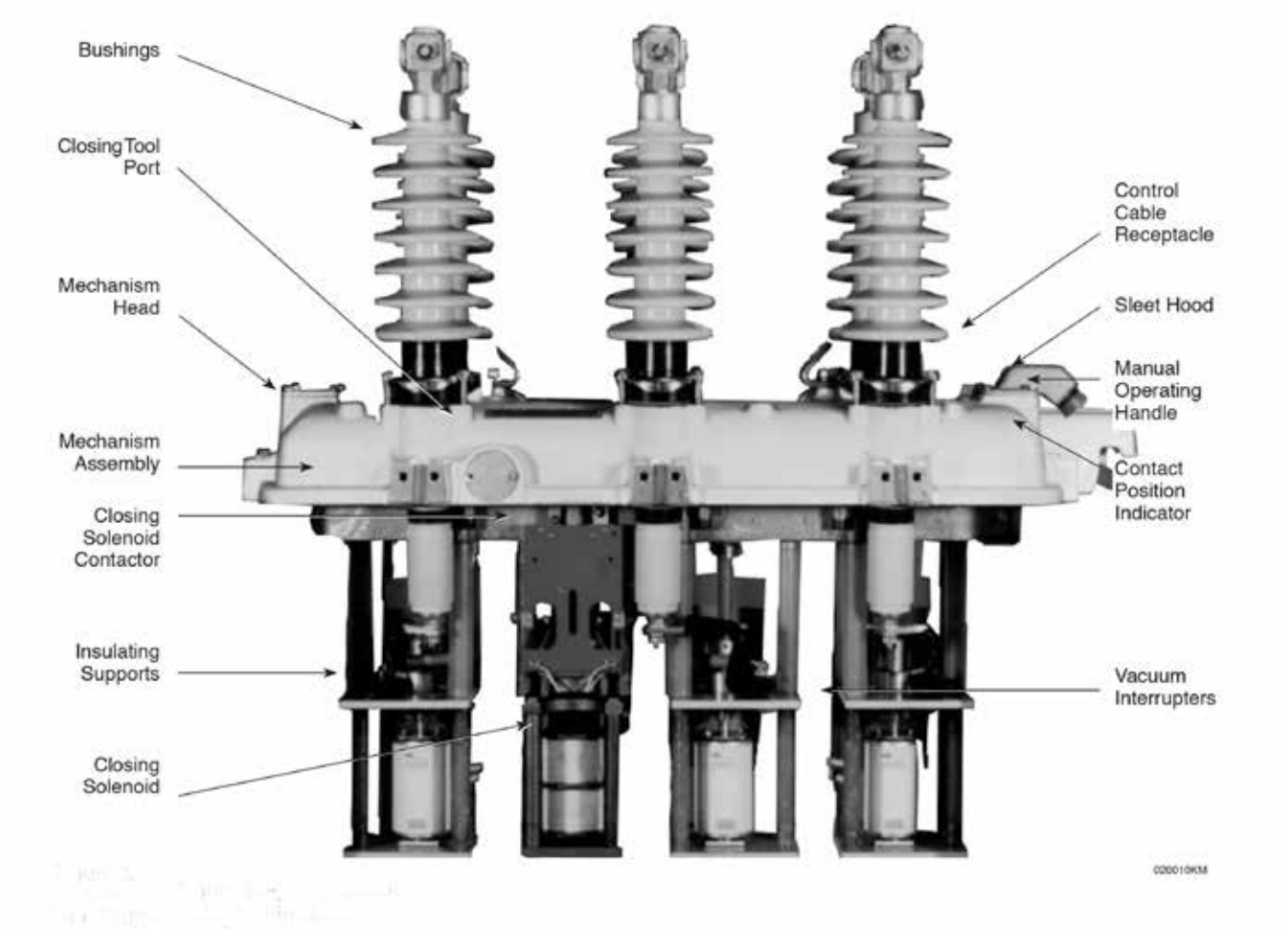

Figure 1. Untanked type VWVE27 vacuum recloser

Mechanism operation

The recloser mechanism performs the actual opening and closing of the vacuum interrupter contacts in response to signals from the electronic control. Contact opening is initiated by an electrical signal to a trip solenoid which acts upon the toggle latch to release charged opening springs. Contact closing is initiated by an electrical signal to a rotary solenoid which mechanically closes the closing coil contactor to energize the high voltage closing coil which closes the vacuum interrupters and charges the opening springs.

With the contacts closed (Figure 3), the opening springs are fully extended and the mechanism is in the rest (CLOSED) position.

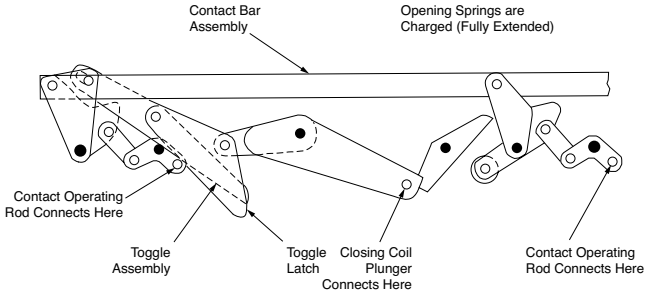

Figure 2. Contacts closed

When the trip solenoid is energized, its push rod acts upon the toggle latch to open the toggle and allow the opening springs to act upon the contact bar (Figure 4).

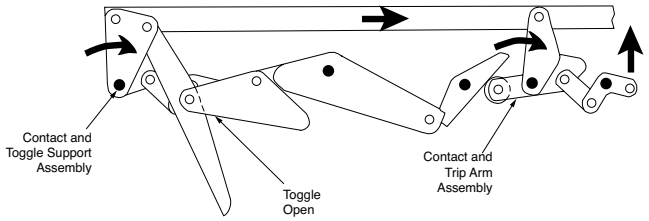

Figure 3. Opening springs are released

As soon as the toggle breaks, the contact arm assemblies are rotated on their fixed pivots to instantaneously open the interrupter contacts. In the same motion the trip lever is rotated to snap the toggle closed. This motion of the reset lever also pulls the plunger out of the closing coil. At this point the mechanism is in the tripped (OPEN) position (Figure 5).

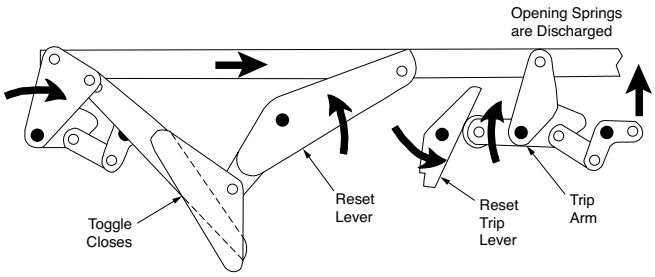

Figure 4. Contacts fully open

A signal to the rotary solenoid closes the contactor and energizes the high voltage closing coil solenoid. As the plunger is drawn down into the coil, the reset lever is pulled down and latched, the interrupter contacts are closed and the closing springs are extended (charged) (Figure 6). The mechanism is then ready for another opening operation.

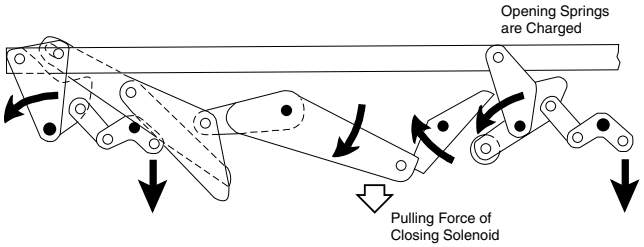

Figure 5. Contacts closed

Ratings

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

Table 1. Electrical ratings

Description	VWE	VWVE27	VWVE38X
Nominal system voltage (kV)	14.4	24.9	34.5
Maximum rated voltage (kV)	15.5	27	38
Rated impulse withstand voltage (BIL) (kV crest)	110	125**	150
60 Hz withstand voltage (kV rms)			
Dry, one minute	50	60	70
Wet, ten seconds	45	50	60
Rated maximum continuous current (amps)	560*	560*	560*
Bushing creepage distance mm (in)	295 (11.625)	673 (26.5)	673 (26.5)

*Extendable to 800 amps with accessory.

**Extendable to 150 kV BIL with accessory.

Table 2. Interrupting ratings

Type	Maximum continuous current (amps)	Interrupting ratings (rms symmetrical amps)	Voltage (kV)
VWE	560*	12000	14.4
VWVE27	560*	12000	24.9
VWVE38X	560*	12000	34.5

*Extendable to 800 amps with an accessory.

Table 3. Duty cycle

Type	% of interrupting rating	No. of unit operations	Maximum circuit X/R value
VWE	15-20	88	4
VWVE27	45-55	112	8
VWVE38X	90-100	32	15
		Total 232	

Maintenance

Frequency of recloser maintenance

Because reclosers are used under widely varying operating and climatic conditions, maintenance intervals are best determined by the user, based on actual operating experience. To assure proper and trouble-free operation, reclosers must be maintained when they have operated the equivalent of a rated duty cycle, refer to Table 3. In the absence of specific operating experience, the following procedures are recommended:

A. When VWE, VWVE27, or VWVE38X reclosers are operated under usual service conditions as defined in ANSI standard C37.60, "Standard Requirements for Overhead, Pad Mounted, Dry Vault and Submersible Automatic Reclosers and Fault Interrupters for AC Systems", it is recommended that the following maintenance procedures be performed at the completion of an equivalent duty cycle.

B. If the recloser has not completed an equivalent duty cycle within six years, it is recommended that an inspection be made at that time. See Periodic Recloser Inspection and Maintenance.

Periodic recloser inspection and maintenance

Each periodic inspection should include the following steps:

1. Bypass and remove recloser from service using all locally approved safety practices. Carefully transport the unit to a suitable service facility.

⚠ HAZARDOUS VOLTAGE

This equipment must be de-energized and grounded prior to conducting any maintenance, dielectric fluid sampling, or dielectric fluid filling procedures. Failure to comply can result in death or severe personal injury. T239.2

⚠ CAUTION

Equipment damage. Keep work areas clean to prevent debris from accumulating on or in the hydraulic mechanism during disassembly and reassembly of components. Failure to comply can result in hydraulic failure and recloser misoperation. T254.0

2. Inspect external components.

   A. Check for broken or cracked bushings and replace as necessary. Refer to Bushings section of this manual.

   B. Check for paint scratches and other mechanical damage. Paint to inhibit corrosion.

   C. Record counter reading from control in recloser record log.

⚠ 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

3. Perform a dielectric withstand test to check the insulation level of the recloser and the vacuum integrity of the interrupters. Refer to Insulation Level Withstand Tests section of this manual.

⚠ CAUTION

Equipment damage. Recloser must be open (yellow operating handle, under sleethood, down) before untanking. Tripping the mechanism out of oil will cause excessive mechanical shock to the operating mechanism, which will cause accelerated wear and/or damage to the mechanism. T202.0

⚠ CAUTION

Dielectric failure, equipment damage. Never use volatile solutions, detergents, or water-soluble cleaners when cleaning the interior of this equipment. These cleaners will contaminate the insulating oil, reducing its dielectric strength. Operation with contaminated insulating oil can result in internal flashovers that will cause equipment damage and possible personal injury. T201.2

4. Untank the recloser to expose the internal components.

5. Clean all internal components.

   A. Remove all traces of carbon by wiping with a clean, lint-free cloth.

Note: Although current interruption takes place in a sealed vacuum chamber, the closing solenoid contactor operates in oil and will produce some carbon deposits.

   B. Flush the mechanism with clean, dry insulating oil.

6. Check the contact erosion of the vacuum interrupters.

   A. Manually CLOSE the recloser.

Note: Refer to Manual Operation of the Recloser section of this manual for Manual Operation of the Mechanism Out of Oil procedure.

   B. Locate the scribe mark or the step on the moving contact rod at the top of the interrupter (Figure 7).

Note: The step is used the same as a scribe mark. The movable rod changes from a .562 inch diameter to a .812 inch diameter.

   C. If the scribe mark falls below the top of the phenolic guide when the interrupter is closed or if the end

of the .812 inch diameter movable rod is flush with the guide, the interrupter has reached the end of its useful life and must be replaced. Refer to Vacuum Interrupters section of this manual.

D. Manually OPEN the recloser.

Note: Refer to Manual Operation of the Recloser section of this manual for Manual Operation of the Mechanism Out of Oil procedure.

7. Check circuit components attached to the recloser head, frame, and operating mechanism.

   A. Check condition of the wiring to the terminal strip and make sure all connections are tight.

   B. Make sure that the rotary solenoid and the trip solenoid are firmly attached to the recloser frame.

   C. Check SW1, SW2, and SW3 switches as applicable:

⚠ WARNING

Hazardous material. Do not open mercury switches or come in direct contact with switches exhibiting any sign of mercury leakage. Exposure to mercury can cause serious health problems. T281.0

- For units with two mercury switches and one microswitch:

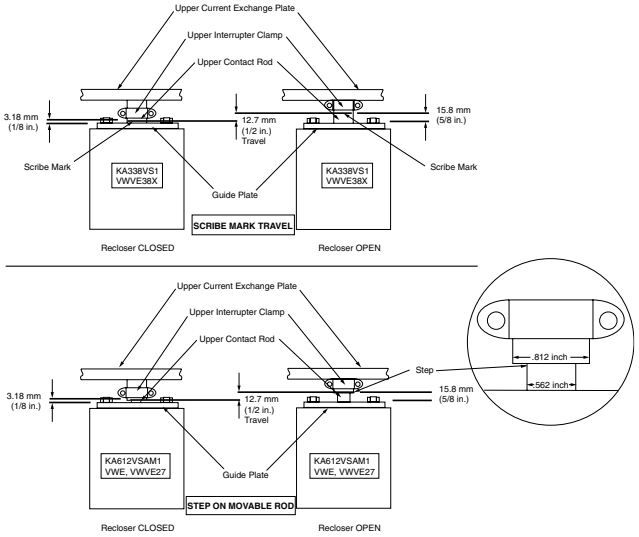

Figure 6. Location of scribe mark or step on movable contact rod of vacuum interrupter

1. Check that the two mercury switches (SW2 and SW3) are securely held in place by the nylon mounting straps.

Note: Mercury Switch-to-Microswitch Retrofit Kit KA349WE is available to replace existing mercury switches with microswitches. Contact your Eaton representative for additional information.

2. Check condition of microswitch (SW1) mounted above main shaft.

   - For units with three microswitches: Check condition of all three microswitches.

D. Check condition of the bushing current transformers and the associated wiring.

E. Check the control cable receptacle. If circuit component malfunction is suspected, refer to Operational Checks section of this manual.

⚠ CAUTION

This equipment relies on dielectric fluid to provide electrical insulation between components. The dielectric strength of the fluid 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 dielectric fluid that does not meet minimum requirements can result in internal flashovers that will damage the equipment and can cause personal injury. G107.3

8. Check the dielectric strength of the insulating oil.

An oil sample taken near the bottom of the tank should have a dielectric strength of not less than 22 kV rms.

Note: Low dielectric strength indicates the presence of water or carbon deposits.

9. If dielectric strength of oil is less than 22 kV rms, it must be replaced:

   A. Drain the tank, and clean out all sludge and carbon deposits.

   B. Fill with new, clean insulating oil up to 2-1/4 inches below the top of the tank flange.

Note: Tank capacity is approximately 53 U.S. gallons.

Refer to Oil Condition section of this manual.

10. Clean and examine the head gasket. If it is cracked, cut, or otherwise damaged, or if it has been permanently deformed, it must be replaced.

11. Clean the head gasket seat and retank the recloser.

    A. Move the yellow operating handle under the sleet hood to the up position to avoid any possible binding while retanking.

⚠ CAUTION

Dielectric failure, bushing damage. To prevent gasket leaks or bushing damage, clamping force must be applied gradually and equally in rotation to each bolt. If the clamping force is not evenly applied, seal leakage can result, compromising the dielectric capabilities of the recloser and can cause possible personal injury. Unequal clamping force can cause bushing breakage. T235.2

B. Replace the head bolts and torque to 35-55 ft-lbs.

Note: Type VWE reclosers below serial 1340 and VWVE reclosers below serial 1060 require the following special thread-sealing procedure to keep moisture from entering the tank along the threads of the head bolts:

1. Before reinstalling the head bolts, apply a liberal amount of a non-hardening pliable sealant, Permatex Form-A-Gasket No. 2, to the end of each bolt. The four leading threads should be completely coated.
2. When the bolt is installed, a slight bead of material (resembling an O-ring) should remain on the top of the tank flange. Apply the sealant each time the head bolts are removed and reinstalled.

12. Check the oil level with the dipstick in the head and adjust the level to the upper line on the dipstick.

Note: If the recloser is equipped with an oil-sight gage, the oil level should be above the sight gage. If the oil surface line is visible in the window, add oil to raise the level to the upper line on the dipstick.

13. Repeat the high voltage dielectric withstand test to make sure the dielectric clearances within the tank have not been compromised.

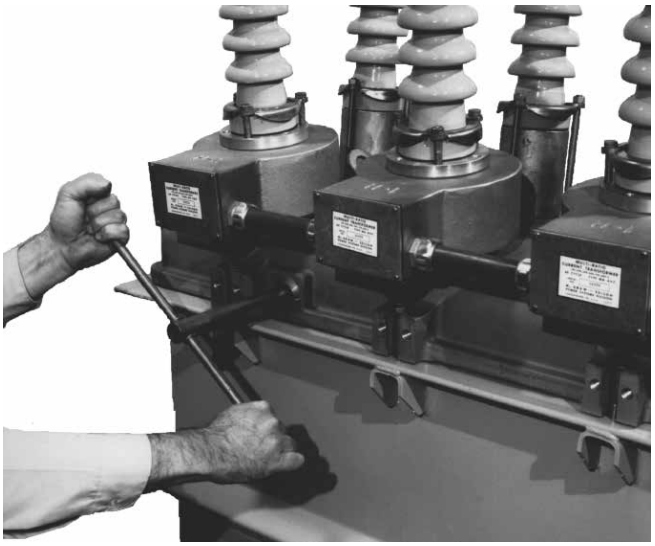

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Figure 7. Using a KA90R2 manual reclosing tool to operate the recloser

Manual operation of the recloser

The recloser may be closed and opened manually while the mechanism is either in or out of oil. Refer to the applicable procedure as follows:

Manual operation of the mechanism in oil (tanked)

⚠ WARNING

Explosion Hazard. Excessive Contact Arcing. Do not use the manual closing tool to close an energized recloser. Closing an energized oil-insulated recloser with a manual closing tool can cause excessive contact arcing, rapid build-up of gas within the equipment, and possible explosion that can cause death, severe personal injury, and equipment damage. T203.2

For a tanked recloser (mechanism immersed in oil) use the following manual operating procedures:

Close the recloser as follows:

1. Remove the closing tool port cover and gasket from the side of the head casting. Refer to Figure 2 for location.
2. Insert the KA90R2 T-handle closing tool accessory into the closing tool port (Figure 8) and engage the pin on the closing shaft.

⚠ CAUTION

Equipment damage. Do not turn the manual closing tool more than one-quarter turn clockwise. Forcing the tool beyond the mechanism stop may shear the pin on the closing shaft of the recloser. T222.0

3. Lift up the yellow operating handle under the sleet hood to reset the mechanism.
4. Turn the closing tool one-quarter turn clockwise to close the main contacts.

Open the recloser as follows:

Pull down the yellow operating handle to trip open the recloser.

Manual operation of the mechanism out of oil (Untanked)

⚠ CAUTION

Equipment damage. Do not trip open the recloser when the mechanism is out of oil. Tripping the mechanism out of oil will cause excessive mechanical shock to the operating mechanism, which can cause damage to the mechanism. T282.0

To operate the mechanism out of oil, proceed as follows:

Close the recloser as follows:

- If the mechanism is still mounted in the head, follow the Mechanism in Oil Close procedure.
- If the mechanism is removed from the head, proceed as follows:
  1. Turn the trip-reset shaft clockwise (Figure 9) with a pair of pliers to reset the mechanism.
  2. Turn the closing shaft clockwise with the closing tool to close the main contacts.

Open the recloser as follows:

To open the contacts while the mechanism is out of oil, proceed as follows:

IMPORTANT

This procedure requires two people; one to operate the closing tool, the other to operate the trip lever.

1. Using the T-handle closing tool, the first person turns the closing shaft clockwise and holds against the stop.

⚠ CAUTION

Personal injury. Failure to maintain enough pressure to hold the closing shaft against the stop will cause the opening springs to release and aggressively snap the manual closing tool counterclockwise resulting in personal injury. T283.0

2. While the first person continues to maintain enough pressure to hold against the stop, the second person releases the trip lever (Figure 10) by moving it to the right.
3. The first person maintains enough pressure to slowly allow the closing tool to rotate counterclockwise; releasing the opening spring pressure and opening the main contacts.

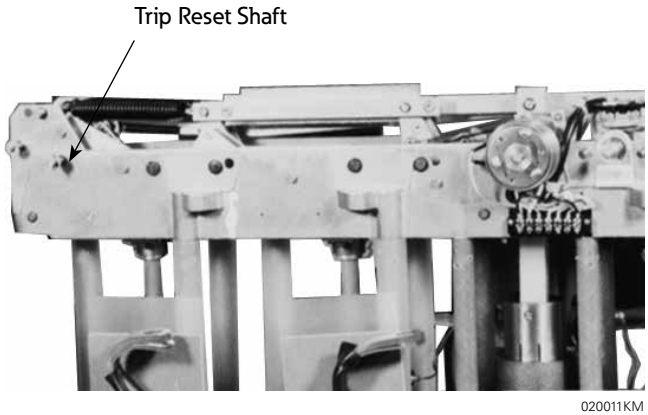

Figure 8. Location of trip reset shaft

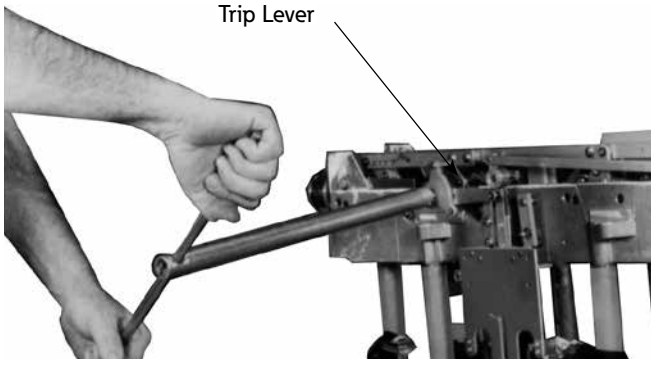

Figure 9. Trip lever releases mechanism when opening recloser out of oil

Insulation level withstand tests

⚠ 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 4 for test voltages and Figure 11 for test connection diagrams.

Table 4. Types VWE and VWVE recloser withstand test voltage ratings information

	75% of rated low-frequency withstand voltage (1 minute dry) (kV rms)	
Description	**ac**	**dc**
VWE	37.5	53.0
VWVE27	45.0	63.5
VWVE38X	52.5	74.2

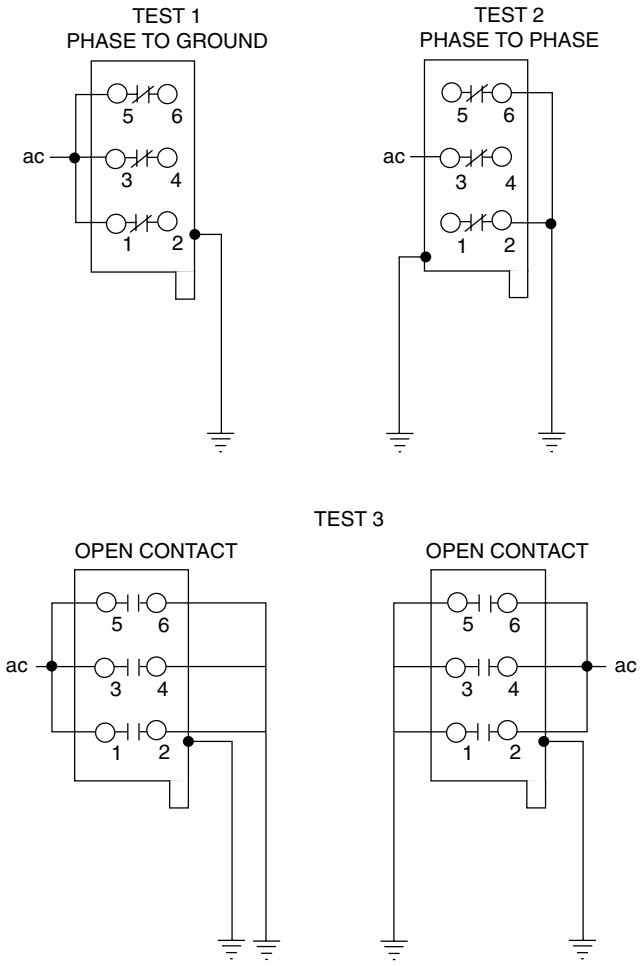

Figure 10. High potential withstand testing connection diagrams

Refer to Figure 11 and test as follows:

Test 1

1. Manually close the recloser contacts. Refer to Manual Operation of the Recloser section of this manual.
2. Ground recloser tank and head.
3. Connect all three source-side bushings (1, 3, 5) together.
4. Apply proper test voltage to source-side bushings.
5. The recloser should withstand the test voltage for 60 seconds.

Test 2

1. Manually close the recloser contacts. Refer to Manual Operation of the Recloser section of this manual.
2. Ground recloser tank and head.
3. Ground Phase A (bushing 2) and Phase C (bushing 6).
4. Apply proper test voltage to Phase B (bushing 3).
5. The recloser should withstand the test voltage for 60 seconds.

Test 3

IMPORTANT

The recloser must pass the closed-contacts tests (Tests 1 and 2) prior to attempting the open-contacts test (Test 3).

1. Open recloser contacts. Refer to Manual Operation of the Recloser section of this manual.
2. Ground recloser tank and head.
3. Connect and ground all three load-side bushings (2, 4, 6).
4. Connect all three source-side bushings (1, 3, 5).
5. Apply proper test voltage to source-side bushings.
6. The recloser should withstand the test voltage for 60 seconds.
7. Reverse the connections.
8. Ground source-side bushings (1, 3, 5).
9. Apply test voltage to load-side bushings (2, 4, 6) for 60 seconds.
10. The recloser should withstand the test voltage for 60 seconds.

Withstand test results

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

If the recloser fails the closed-contacts tests (Tests 1 and 2), the cause is likely to be a diminished electrical clearance or a failed insulation. Retest each phase individually to determine the failed phase or phases. After correcting the problem, retest to confirm the repair.

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

If the recloser does not pass Tests 1, 2, or 3, contact an authorized service center or your Eaton representative.

Oil condition

⚠ CAUTION

This equipment relies on dielectric fluid to provide electrical insulation between components. The dielectric strength of the fluid 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 dielectric fluid that does not meet minimum requirements can result in internal flashovers that will damage the equipment and can cause personal injury.

G107.3

Oil provides the internal insulation barrier between phases and from phase to ground, and must be replaced before it deteriorates below a safe dielectric level. Replace the oil if its dielectric strength falls below 22 kv.

New oil should always be filtered before using even though it is obtained from an approved source. Passing the oil through a blotter press will remove free water and solid contaminants such as rust, dirt, and lint. Keep aeration to a minimum during filtering to prevent moisture in the air from condensing in the oil and lowering its dielectric strength.

Used oil must be treated before reusing. Filtering may remove absorbed and free water and other contaminants to raise the dielectric strength to acceptable levels. However, filtering does not always remove water-absorbing contaminants and the dielectric strength may fall rapidly after being returned to service. Therefore the recloser should be filled with new oil, or oil that has been restored to like-new condition. Oil used in these reclosers conforms to ASTM Standard D3487, Type I; its property limits are shown in Table 5.

Table 5. Eaton oil specifications

Characteristic	Acceptable value	ASTM test standard*
Color	0.5 max (ASTM calorimeter)	D1500
Reaction	Neutral	
Neutralization No.	0.03 mg KOH/g max	D974
Corrosive Sulfur	Non-Corrosive	D1275
Steam Emulsion No.	25 seconds max	D1935
Flash Point	145 C min	D92
Fire Point	160 C min	D92
Pour Point	-40 C max	D97
Viscosity, ST (SUS) at 100 C 40 C 0 C	 3.0 (36) Maximum 12.0 (66) Maximum 76.0 (350) Maximum	D445, D88
Specific Gravity at 15 C	0.91 g/cc max	D1298
Coefficient of Expansion (from 25 to 100 C)	0.0007 to 0.0008	D1903
Interfacial Tension	40 dynes per cm min	D971
Dielectric Constant	2.2 – 2.3	D924
Dielectric Strength	30 kV min	D877, D1816
Water Content (Karl Fischer Test)	35 ppm	D1533
PCB Content	No detectable amount	D3304
Weight	0.9 kg/liter 7.5 lb/gal	

*Tests are described in latest revision of ASTM standards.

Shop maintenance procedures

⚠ CAUTION

Equipment damage. Keep work areas clean to prevent debris from accumulating on or in the hydraulic mechanism during disassembly and reassembly of components. Failure to comply can result in hydraulic failure and recloser misoperation. T254.0

The operations described in this section should be performed under the cleanest conditions possible. The repair work (except for bushing replacement), will be simplified if the workbench is arranged so the mechanism/head assembly can be inverted (bushings down). No special tools are required for any of the repair procedures.

⚠ WARNING

Hazardous voltage. This equipment must be de-energized and grounded prior to conducting any maintenance, dielectric fluid sampling, or dielectric fluid filling procedures. Failure to comply can result in death or severe personal injury. T239.2

1. Bypass and remove recloser from service using all locally approved safety practices.
2. Carefully transport the unit to a suitable service facility.

Bushings

Bushing maintenance generally consists of a thorough cleaning and a careful examination for chips, cracks, or other mechanical damage during the periodic maintenance inspection. Bushings must be replaced whenever damage is discovered.

Type VWE bushings

A damaged bushing can be replaced with the recloser either tanked or untanked, depending upon the circumstance or the damage:

- If the bushing porcelain is chipped during installation of the recloser and no other damage has occurred, the bushing porcelain can only be replaced without untanking the recloser. Refer to Replacing the Bushing Porcelain with the Recloser Tanked procedure in this section.
- If the bushings have been damaged while in service or storage, the recloser must be removed from service and untanked because water or other contaminants may have entered the tank, the bushing lead may be damaged (either mechanically or electrical flashover), or pieces of porcelain may have fallen into the tank. Refer to Replacing the Bushing with the Recloser Untanked procedure in this section.

Replacing VWE bushing porcelain with the recloser tanked

⚠ WARNING

Hazardous voltage. This equipment must be de-energized and grounded prior to conducting any maintenance, dielectric fluid sampling, or dielectric fluid filling procedures. Failure to comply can result in death or severe personal injury. T239.2

To replace Type VWE bushing porcelain with the recloser tanked, refer to Figure 12 and proceed as follows:

1. Bypass and remove recloser from service using all locally approved safety practices.
2. Carefully transport the unit to a suitable service facility.
3. Unscrew the bushing terminal and discard the terminal gasket.
4. Remove the three hex head capscrews and clamps that secure the bushing to the head and lift out the porcelain.
5. Remove and discard the lower bushing gasket.
6. Twist off the split aluminum clamping ring from the old porcelain and proceed as applicable:

⚠ CAUTION

Bushing damage. The split aluminum ring must be replaced if damaged. The clamping ring cushions and distributes the pressure between the bushing flange and the bushing. If bushing clamps are assembled without a new clamping ring, the bushing may be damaged when clamp hardware is tightened. T234.1

- If the ring is in good condition, install it on the new porcelain.
- If the ring is damaged, replace it with a new ring.

7. Using a new gasket, install the new porcelain over the bushing rod and into the head.

Note: Make sure the roll pin on the end of the rod is seated into the keyway at the top of the porcelain.

⚠ CAUTION

Dielectric failure, bushing damage. To prevent gasket leaks or bushing damage, clamping force must be applied gradually and equally in rotation to each bolt. If the clamping force is not evenly applied, seal leakage can result, compromising the dielectric capabilities of the recloser and can cause possible personal injury. Unequal clamping force can cause bushing breakage. T235.2

8. Position the clamping ring with the split centered between two clamping bolts.
9. Reassemble the bushing to the head casting with the bushing clamps. Tighten the clamping bolts evenly, a little at a time, to a torque of 10-15 ft-lbs.
10. Install a new terminal gasket and reassemble the terminal to the bushing rod with 35 ft-lbs of torque.

Note: Apply a very small amount of petroleum jelly to the knurled surface of the inside face of the terminal before assembling the terminal to the bushing rod.

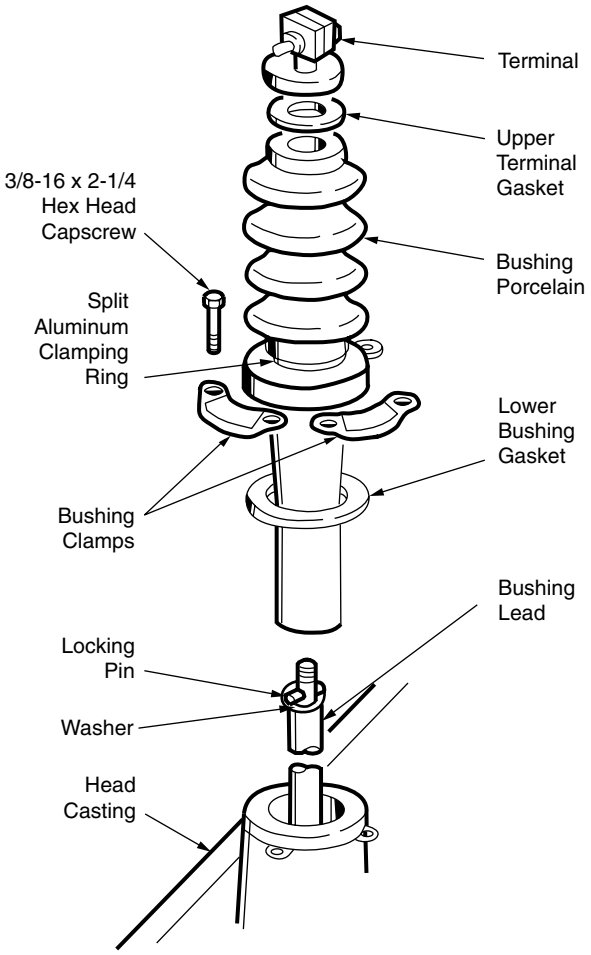

Figure 11. Replacing VWE bushing porcelain with recloser tanked

Replacing a VWE bushing with the recloser untanked.

⚠ WARNING

Hazardous voltage. This equipment must be de-energized and grounded prior to conducting any maintenance, dielectric fluid sampling, or dielectric fluid filling procedures. Failure to comply can result in death or severe personal injury. T239.2

To replace a VWE bushing with the recloser untanked, refer to Figure 13 and proceed as follows:

1. Bypass and remove recloser from service using all locally approved safety practices.
2. Carefully transport the unit to a suitable service facility.
3. Disconnect the appropriate bushing lead from the bottom end of the bushing rod.
4. Remove the three hex head capscrews and clamps that secure the bushing to the head and lift out the complete bushing assembly.
5. Remove and discard the lower bushing gasket.
6. The complete bushing assembly can be replaced or new porcelain only can be installed depending upon the extent of damage. If new porcelain only is to be installed, proceed as follows:
   A. Unscrew the bushing terminal and withdraw the rod from the bottom of the porcelain; discard the terminal gasket.
   B. Insert the rod assembly all the way into the new porcelain, making sure the roll pin is seated in the keyway in the top of the bushing.
   C. Assemble the terminal to the bushing rod using a new terminal gasket; tighten to a torque of 35 ft lbs.

      Note: Apply a very small amount of petroleum jelly to the knurled surface of the inside face of the terminal before assembling the terminal to the bushing rod.
7. Twist off the split aluminum clamping ring from the old bushing and proceed as applicable:

⚠ CAUTION

Bushing damage. The split aluminum ring must be replaced if damaged. The clamping ring cushions and distributes the pressure between the bushing flange and the bushing. If bushing clamps are assembled without a new clamping ring, the bushing may be damaged when clamp hardware is tightened. T234.1

- If the ring is in good condition, install it on the new bushing.
- If the ring is damaged, replace it with a new ring.

8. Install the bushing assembly (new or reworked) into the head using a new lower bushing gasket. Position the bushing with the stud-end of the terminal pointing outward.
9. Position the clamping ring with the split centered between two clamping bolts.

⚠ CAUTION

Dielectric failure, bushing damage. To prevent gasket leaks or bushing damage, clamping force must be applied gradually and equally in rotation to each bolt. If the clamping force is not evenly applied, seal leakage can result, compromising the dielectric capabilities of the recloser and can cause possible personal injury. Unequal clamping force can cause bushing breakage. T235.2

10. Reassemble the bushing to the head casting. Tighten the clamping bolts evenly, a little at a time, to a torque of 10-15 ft-lbs.
11. Reconnect the lead to the bushing rod.

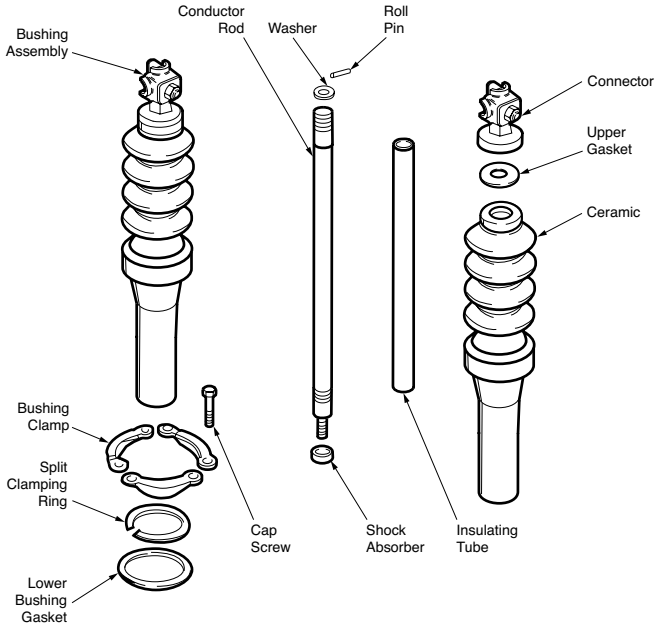

Figure 12. VWE recloser bushing parts

Type VWVE bushings

The Type VWVE recloser bushings are oil-filled. The special fixtures and procedures required to assemble these bushings is beyond the scope of normal shop maintenance repair. Therefore, if a Type VWVE bushing is damaged in any way, the complete bushing assembly must be replaced.

⚠ WARNING

Hazardous voltage. This equipment must be de-energized and grounded prior to conducting any maintenance, dielectric fluid sampling, or dielectric fluid filling procedures. Failure to comply can result in death or severe personal injury. T239.2

To replace a VWVE bushing, refer to Figure 14 and proceed as follows:

1. Bypass and remove recloser from service using all locally approved safety practices.
2. Carefully transport the unit to a suitable service facility.
3. Untank the recloser. Refer to Periodic Recloser Inspection and Maintenance section of this manual for untanking procedure.
4. Disconnect the appropriate bushing lead from the bottom end of the bushing rod.
5. Remove the three hex head capscrews and bushing clamps that secure the bushing to the head casting and lift out the complete bushing assembly.
6. Remove and discard the lower bushing gasket.
7. Twist off the split aluminum clamping ring from the old bushing and proceed as applicable:

⚠ CAUTION

Bushing damage. The split aluminum ring must be replaced if damaged. The clamping ring cushions and distributes the pressure between the bushing flange and the bushing. If bushing clamps are assembled without a new clamping ring, the bushing may be damaged when clamp hardware is tightened. T234.1

- If the ring is in good condition, install it on the new bushing assembly.
- If the ring is damaged, replace it with a new ring.

8. Install the new bushing assembly into the head using a new conductive lower bushing gasket.

   Position the bushing with the stud-end of the terminal pointing outward.

9. Position the clamping ring with the split centered between two clamping bolts.

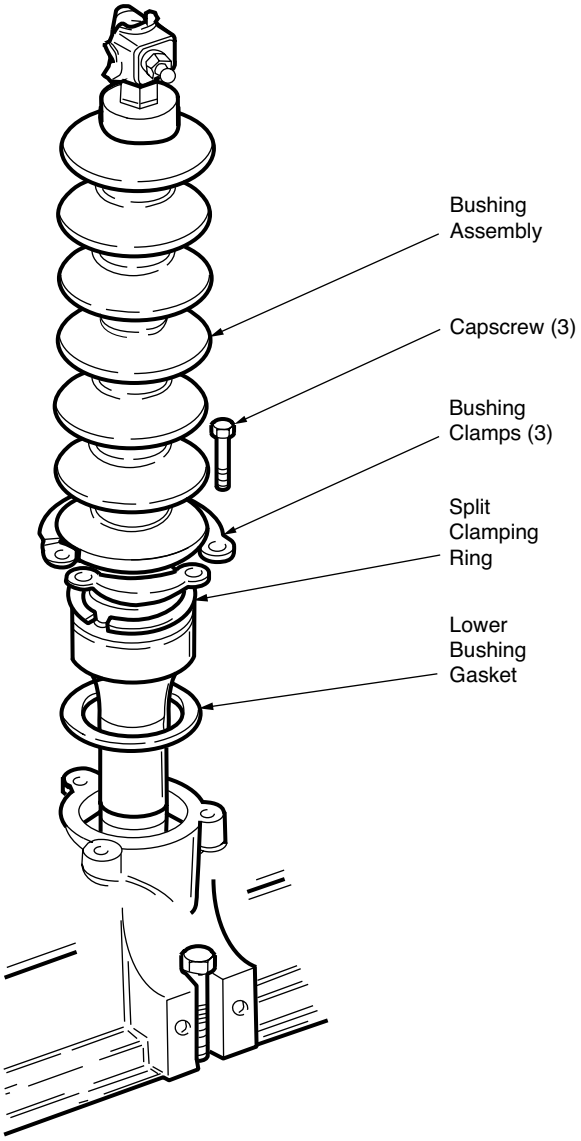

Figure 13. Removing type VWVE bushing

10. Reassemble the bushing to the head casting.

⚠ CAUTION

Dielectric failure, bushing damage. To prevent gasket leaks or bushing damage, clamping force must be applied gradually and equally in rotation to each bolt. If the clamping force is not evenly applied, seal leakage can result, compromising the dielectric capabilities of the recloser and can cause possible personal injury. Unequal clamping force can cause bushing breakage. T235.2

   Tighten the clamping bolts evenly, a little at a time, to a torque of 10-15 ft-lbs.

11. Reconnect the lead to the bushing rod.

Vacuum interrupters

Vacuum interrupters must be replaced when any of the following situations occur:

- The interrupters lose their vacuum as evidenced by a failure during the low frequency dielectric withstand test across the open contacts.
- The interrupter contacts have eroded beyond their useful life as evidenced by the position of the scribe mark or step on the moving contact rod.
- The recloser has reached the mechanical life of 2500 operations.

⚠ WARNING

Hazardous voltage. This equipment must be de-energized and grounded prior to conducting any maintenance, dielectric fluid sampling, or dielectric fluid filling procedures. Failure to comply can result in death or severe personal injury. T239.2

To replace a vacuum interrupter, refer to Figure 15 and proceed as follows:

1. Bypass and remove recloser from service using all locally approved safety practices.
2. Carefully transport the unit to a suitable service facility.
3. Pull down the yellow manual operating handle (located under the sleethood) to the OPEN position.

IMPORTANT: Before untanking the recloser, check the contact position indicator to verify that the recloser contacts are OPEN.

⚠ CAUTION

Equipment damage. Recloser must be open (yellow operating handle, under sleet hood, down) before untanking. Tripping the mechanism out of oil will cause excessive mechanical shock to the operating mechanism, which will cause accelerated wear and/or damage to the mechanism. T202.0

4. Untank the recloser. Refer to Periodic Recloser Inspection and Maintenance section of this manual for untanking procedure.
5. Cut the three nylon tie straps (or cotton lacing) which secure the vertical insulating barrier and remove the barrier.
6. Loosen and remove the upper interrupter clamp.

   As the clamp is loosened, atmospheric pressure on the bellows will cause the contact rod to move down into the interrupter. This action can be verified by observing the scribe mark or step on the contact rod. It will move downward to just above or just below the fiber disk at the top of the interrupter.

   Note: If the contact rod does not move, the interrupter may have lost its vacuum or the contact rod may be sticking in the clamping fingers of the contact operating rod assembly. Use a screwdriver to gently spread the clamping fingers to free the rod.
7. Disconnect the bushing lead from the lower contact plate assembly.
8. Loosen and remove the lower interrupter clamp.

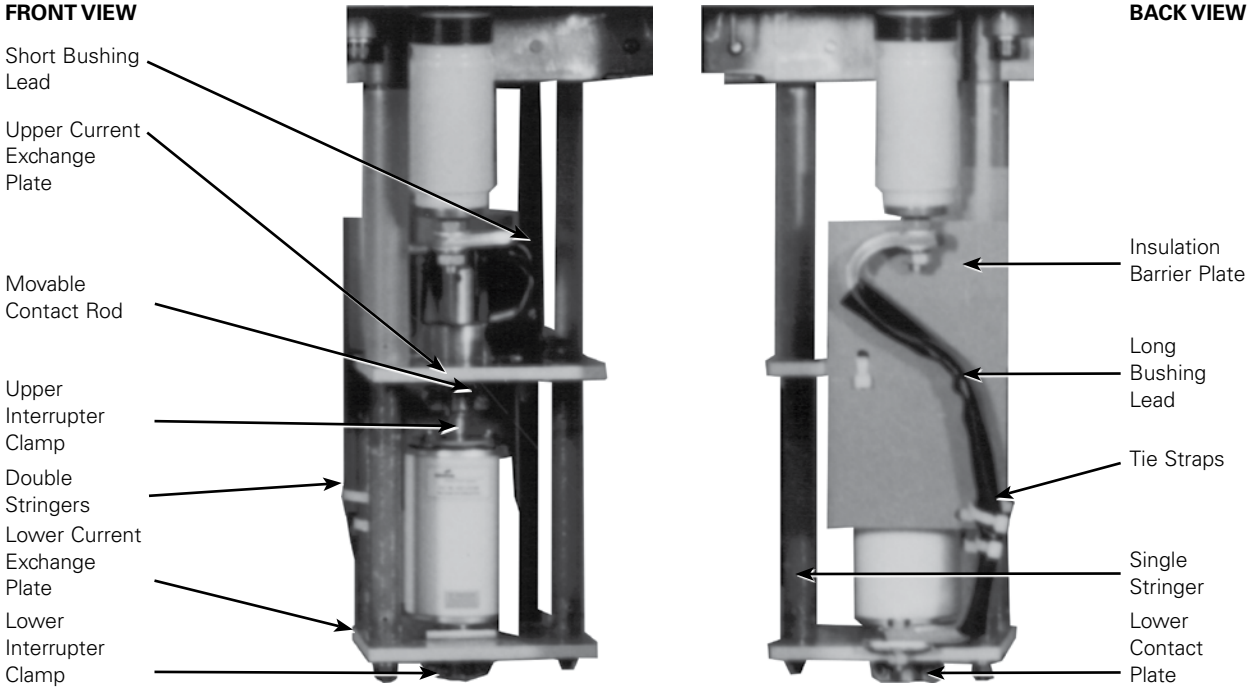

Figure 14. Vacuum interrupter parts (front and back views)

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9. Remove the hardware attaching the lower contact plate to the three vertical stringers and remove the contact plate and the vacuum interrupter.
10. Install a new vacuum interrupter into the clamping fingers of the contact operating rod and the lower contact plate.

    Note: Verify the moving contact rod is in the UP position.
11. Attach the lower contact plate to the stringers.

    Note: On the side with the single stringer, a spacer on the stringer stud provides an intentional 1/16 inch gap between the contact plate and the attaching flat washer and locknut when the interrupter contacts are open.

⚠ CAUTION

Equipment damage. Do not turn the manual closing tool more than one-quarter turn clockwise. Forcing the tool beyond the mechanism stop may shear the pin on the closing shaft of the recloser. T222.0

12. Manually close the recloser.
    A. Insert the KA90R2 T-handle closing tool accessory into the closing tool port and engage the pin on the closing shaft.
    B. Lift up the yellow operating handle under the sleet hood to reset the mechanism.
    C. Turn the closing tool approximately one-quarter turn clockwise to close the main contacts.
13. Coat the threads of the interrupter clamps and attaching screws with a film of insulating oil.

    Loosely position, but do not tighten, the upper and lower interrupter clamps in place.
14. Position the upper and lower interrupter clamps just below the shoulder on the finger-type current exchange connectors, so that the clamping force will be applied to the center of each. Refer to Figure 16.

⚠ CAUTION

Equipment damage. Do not twist or apply radial pressure to the vacuum interrupter movable contact rod. Excessive twisting or pressure on the contact rod will damage the interrupter bellows, which can cause equipment failure. T211.0

15. Position the interrupter so that one of the hex nuts at the top of the interrupter is centered directly beneath the gap on one side of the upper clamp. Refer to Figure 16.
16. Tighten the screws of each interrupter clamp evenly to a torque of 75 in-lbs.

IMPORTANT

Clamps must be tight to prevent slippage of the interrupter contact rods in their current-exchange connectors.

17. Reconnect the bushing lead to the lower contact plate.

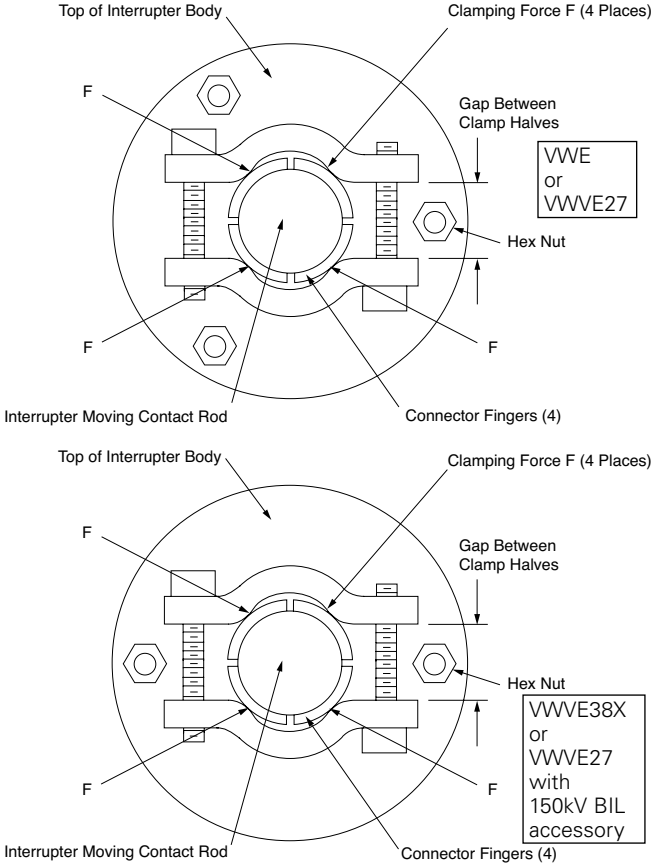

Figure 15. Vacuum interrupter and clamp orientation

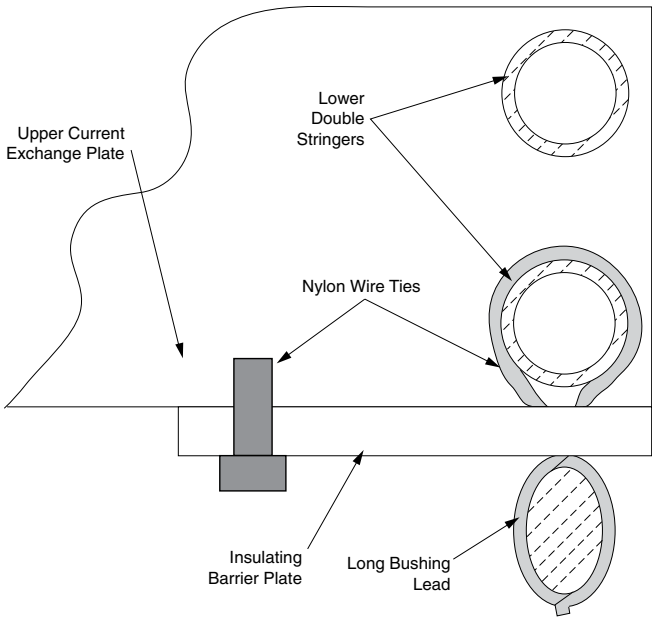

Figure 16. Typical representation of nylon wire tie "Figure 8" configuration

⚠ CAUTION

Equipment damage. Do not turn the manual closing tool more than one-quarter turn clockwise. Forcing the tool beyond the mechanism stop may shear the pin on the closing shaft of the recloser. T222.0

18. Re-install the vertical insulation barrier plate between the long bushing lead and the mechanism:

IMPORTANT

The manual OPEN procedure requires two people; one to operate the closing tool, the other to operate the trip lever.

A. Position the plate and secure it with the nylon tie strap.

B. The ties securing the barrier to the vertical stringer should also encircle and secure the bushing lead using a "Figure 8" configuration (Figure 17).

⚠ CAUTION

Personal injury. Failure to maintain enough pressure to hold the closing shaft against the stop will cause the opening springs to release and aggressively snap the manual closing tool counterclockwise resulting in personal injury. T283.0

19. Manually OPEN and CLOSE the recloser several times to verify interrupter operation.

A. Insert the KA90R2 T-handle closing tool accessory into the closing tool port and engage the pin on the closing shaft.

B. Using the T-handle closing tool, the first person turns the closing shaft clockwise and holds against the stop.

C. While the first person continues to maintain enough pressure to hold against the stop, the second person releases the trip lever by moving it to the right.

D. The first person maintains enough pressure to slowly allow the closing tool to rotate counterclockwise; releasing the opening spring pressure and opening the main contacts.

Note: Contact movement can be verified by observing the movement of the scribe mark or the step on the upper contact rod of the interrupter, whichever is applicable:

- When the recloser is OPEN, the scribe mark will be about 5/8-inch above the fiber disk.
- When the recloser is OPEN, the step where the rod changes from .562 diameter to .812 diameter will be approximately 5/8-inch above the molded rod guide.

E. Turn the closing tool one-quarter turn clockwise to CLOSE the main contacts.

Note: Contact movement can be verified by observing the movement of the scribe mark or the step on the upper contact rod of the interrupter, whichever is applicable:

- When the recloser is closing, the scribe mark will travel approximately 1/2-inch downward.
- When the recloser is closed, the end of the .812 diameter movable rod will travel approximately 1/2-inch downward.

Repeat several times to verify interrupter operation.

Closing solenoid contactor

Type VWE, VWVE27, and VWVE38X reclosers with potential coils rated below 30 kV are equipped with a double pole contactor, KA4304R3, which provides a single break in each line (Figure 18).

Type VWVE38X reclosers with potential coils rated above 30 kV are equipped with a double pole contactor, KA1143R, which provides two breaks in series in each line (Figure 19).

Maintenance procedures are the same for both contactors.

If the contacts are badly burned or eroded, the entire contactor must be replaced. See Figure 20 and proceed as follows:

1. Unhook the two toggle springs from the pin that connects the operating shaft of the contactor to the toggle arm.
2. Remove the three C-type retaining rings and two toggle springs indicated in Figure 20. Withdraw the pin.
3. Disconnect the two coil leads from the contactor.

Note: On the KA430R3 (Figure 18) contactor configuration, reattach the lockwasher and hex nut to the contactor terminal immediately after disconnecting the coil lead to prevent loss of moving contact parts which are attached to the support plate with the same hardware.

4. Disconnect the two fuse leads from the contactor.
5. Remove three hex head capscrews and lockwasher that attach the contactor to the underside of the recloser mechanism frame and remove the contactor.
6. Install the new contactor by reversing the disassembly procedure.

   Note: Use new C-rings to secure the toggle-link pin.

7. Connect the solenoid coil leads as applicable:
   - Reclosers with potential coils rated below 30 kV – Connect the solenoid coil leads to the lower terminals of the KA430R3 single-break contactor.
   - Reclosers with potential coils rated above 30 kV – Connect the solenoid coil leads to the inside terminals of the KA1143R double-break contactor.
8. Connect the fuse leads as applicable:
   - Reclosers with potential coils rated below 30 kV – Connect the fuse leads to the upper terminals of the KA430R3 contactor.
   - Reclosers with potential coils rated above 30 kV – Connect the fuse leads to the outside terminals of the KA1143R contactor.

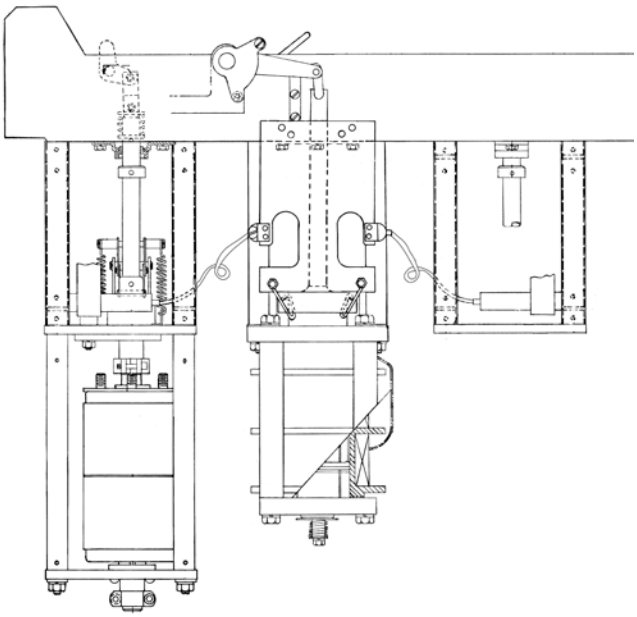

Figure 17. KA430R3 single break contactor – applicable to reclosers with a potential coils rated below 30 kV

9. Refer to Figure 18 or 19 (whichever is applicable) for proper lead connections:

IMPORTANT

Coil and fuse leads must be positioned for maximum clearance to other grounded parts

- Type VWE, VWVE27, and VWVE38X reclosers with potential coils rated below 30 kV are equipped with a double pole contactor, KA4304R3, which provides a single break in each line (Figure 18).
- Type VWVE38X reclosers with potential coils rated above 30 kV are equipped with a double pole contactor, KA1143R, which provides two breaks in series in each line (Figure 19).

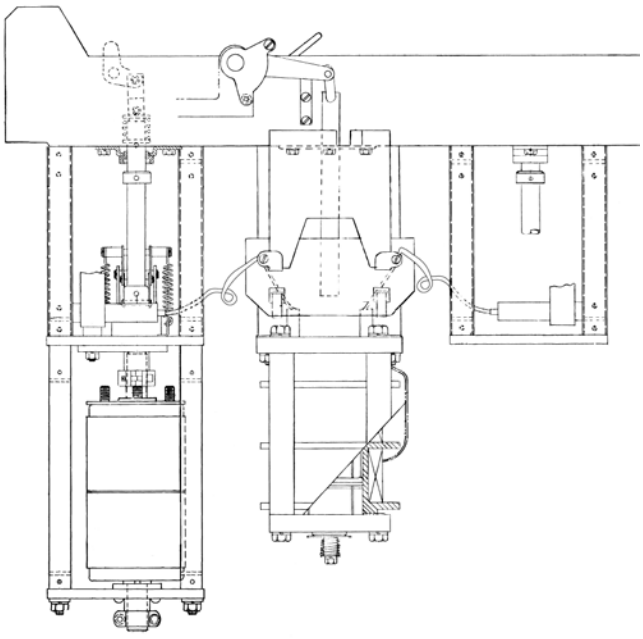

Figure 18. KA1143R double break contactor – applicable to reclosers with potential coils rated above 30 kV

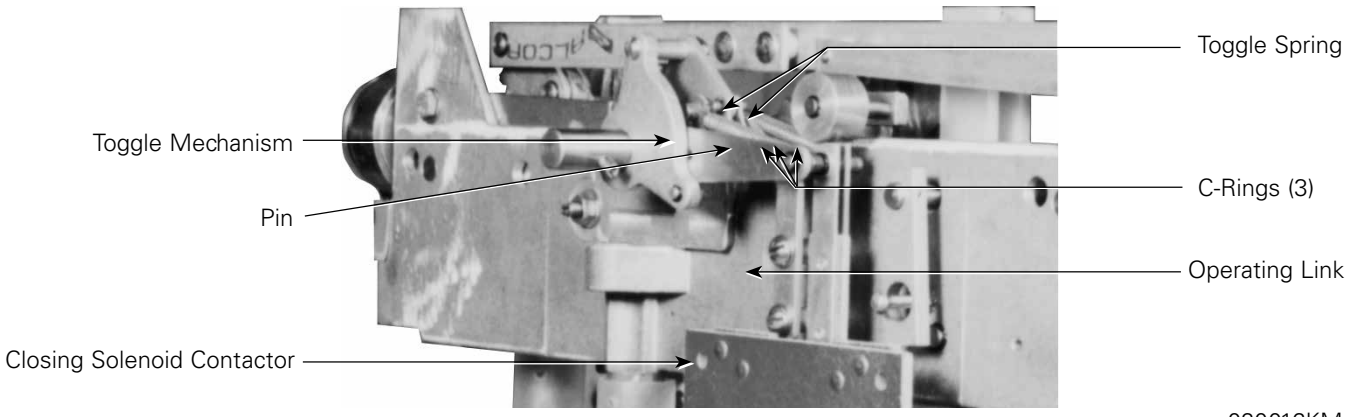

Figure 19. Closing coil contactor

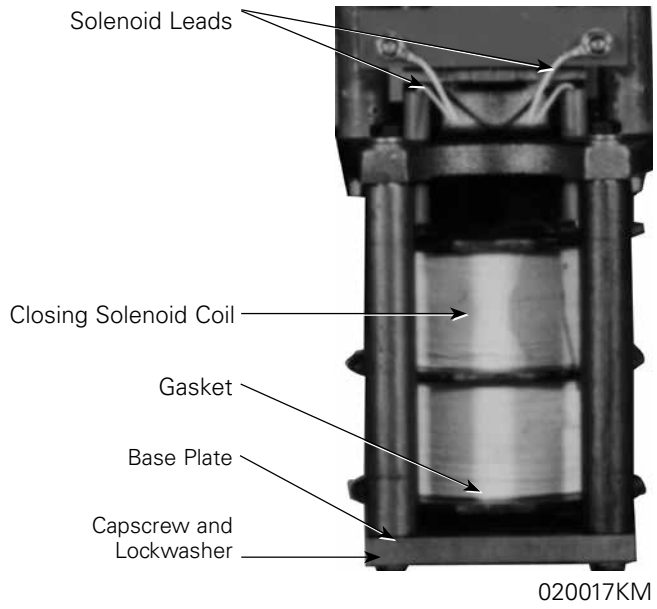

Figure 20. Parts associated with solenoid coil replacement

Closing solenoid

The closing solenoid coil of all Type VWE, VWVE27, and VWVE38 reclosers is connected phase-to-phase and is rated to operate a full system voltage. It is protected with two fuses, one on either side. A data plate attached to the recloser head between source side bushings 3 and 5 provides the coil connection information.

If the solenoid coil must be replaced, due to damage or change in operating voltage, refer to Figure 21 and proceed as follows:

1. Disconnect the two coil leads from the closing solenoid contactor.
2. Remove the four capscrews and lockwashers which attach the base plate to the bottom of the solenoid frame posts.

   Lower the coil and base plate.
3. Remove the coil from the base plate.

   Discard the coil gasket.
4. Using a new coil gasket, install the new closing coil on the base plate.

Note: A new coil gasket and fuses are included in the closing coil replacement kit.

5. Reassemble the base plate to the solenoid frame posts and connect the coil leads to the contactor terminals.

IMPORTANT

On the KA430R3 (Figure 18) contactor configuration, reattach the lockwashers and nut to the contactor terminal immediately after disconnecting the coil lead to prevent loss of parts of the moving contact arm assembly which is attached to the support plate with the same hardware.

IMPORTANT

The coil leads must clear the solenoid frame by at least 1/2-inch.

6. Install the two new coil fuses (included with the closing coil replacement kit) with the new coil. Refer to Closing Solenoid Fuses section in this manual for fuse replacement procedure.
7. Replace the data plate on the sleet hood of the recloser head if the operating voltage of the recloser is being changed.

Note: The closing coil replacement kit includes a new voltage data plate.

Closing solenoid fuses

Two fuses are used with closing coils connected phase-to-phase.

New fuses are provided with the closing solenoid coil replacement kit and should be installed with the replacement coil. Fuses can also be ordered separately for individual replacement.

A label, attached to the closing coil, specifies the catalog number, and color band coding of the proper fuse required to protect the coil. This information is also listed in Table 6.

Note: The voltage rating is either phase-to-phase, or phase-to-neutral, depending upon type of closing solenoid coil connection.

Table 6. Closing solenoid fuse data

Closing solenoid voltage*	Fuse catalog number	Color band
2.4 – 3.3 kv	KA259R14	Two Red
4.16 – 6.0 kv	KA259R11	Black
7.2 – 11.0 kv	KA259R12	Yellow
12 – 24.9 kv	KA259R13	Red

*Either phase-to-phase or phase-to-ground neutral depending upon coil connection.

Replace a closing solenoid fuse as follows:

1. Disconnect the long fuse lead at the closing solenoid contactor.
2. Disconnect the lead wire from the terminal at the other end of the fuse.
3. Loosen the mounting strap and slide out the fuse.

IMPORTANT

The long fuse lead must clear the grounded parts and insulating supports by at least 1/2-inch.

4. Install the new fuse and reconnect the fuse leads.
5. Slightly tilt the fuse so that the open end of the fuse is higher than the closed end. This will allow any air to escape.

Removing mechanism from head

To gain access to components located in or on the main frame, use the following procedure to remove the mechanism from the head.

Note: These procedures are simplified if the untanked head and mechanism assembly is inverted (bushings down).

1. Disconnect all six bushing leads from the rods at the ends of the bushings.
2. Remove oil level dip stick.
3. Disconnect the lockout lever and contact position indicator shafts by disengaging the spring loaded couplers and locking them in the disengaged position (Figure 22).

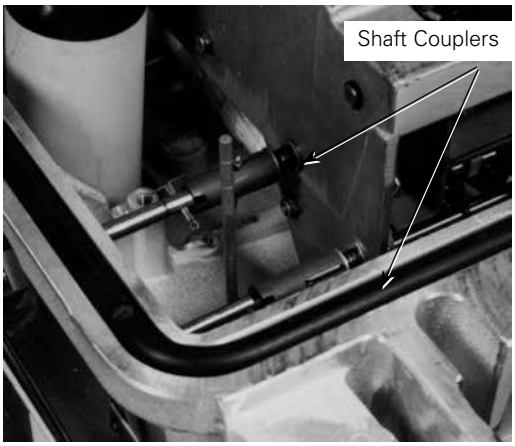

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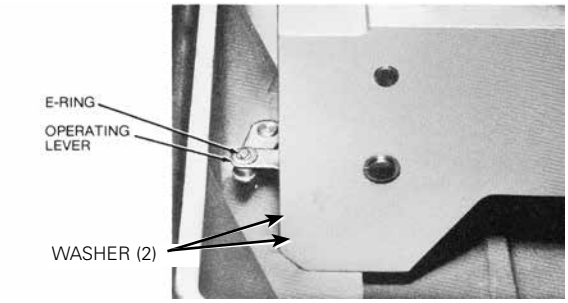
Figure 21. Couplers locked in disengaged position

4. If the recloser is equipped with the auxiliary switch accessory, remove the C or E-ring and washer (Figure 23), and disconnect the operating lever of the switch from the recloser mechanism.

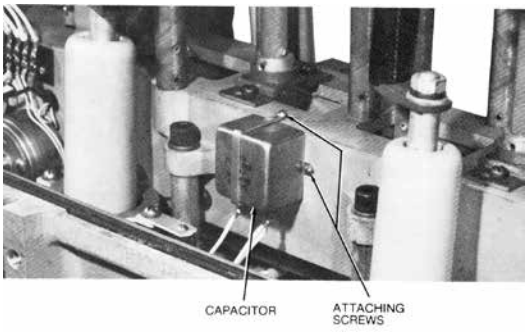


020019KM

Figure 22. Remove E-ring to disconnect auxiliary switch operation power

5. If the recloser is equipped with the CT type battery charger power source, remove the screws that secure the 0.2 mfd capacitor to the recloser frame (Figure 24).

Note: The CT-type battery charger power source is standard on Type VWE reclosers below serial 2100 and Type VWVE reclosers below serial 1500. It may be provided as an accessory on later units.



020020KM

Figure 23. Capacitor for CT-type battery charger

6. Disconnect the seven leads connected to the bottom of the terminal block attached to the recloser frame (Figure 25).

Note: Be sure all leads are labeled before removing. With the unit inverted as shown in Figure 25, the leads are labeled A, B, C, D, E, F and N from left to right.

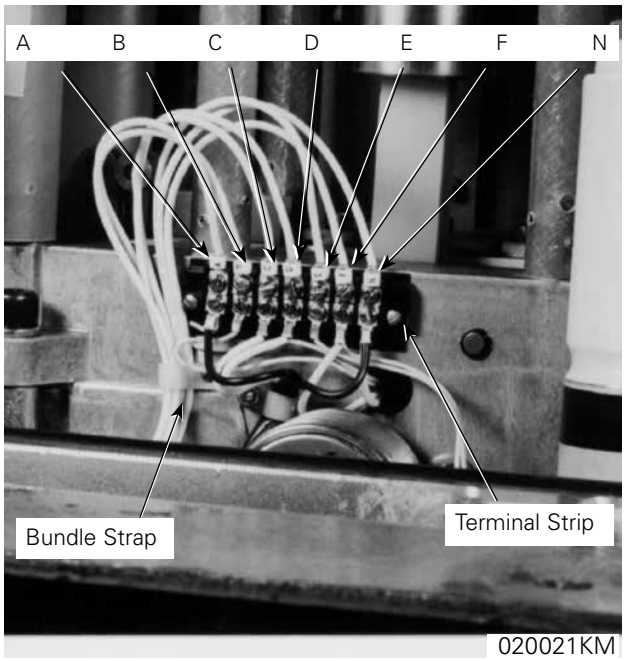


Figure 24. Connections to terminal strip attached to recloser mechanism frame. (Unit is inverted.)

7. The lead bundle is secured with a nylon strap attached to the mechanism frame (Figure 25). Remove the attaching screw to free the strap from the mechanism.

8. Temporarily substitute eye-bolts for two of the hex head bolts in the bottom of the closing solenoid frame so the mechanism can be easily lifted and handled with a hoist (Figure 26).

9. Remove the six socket head bolts and lockwashers that secure the frame to the head casting and carefully lift the mechanism from the head.

   Six long pipe spacers will be released when the mechanism is lifted.

Figure 25. Lifting mechanism in and out of recloser head

10. Remove the two previously disengaged spring-loaded couplers and set aside for later use.

The components remaining in the head are shown in Figure 27.

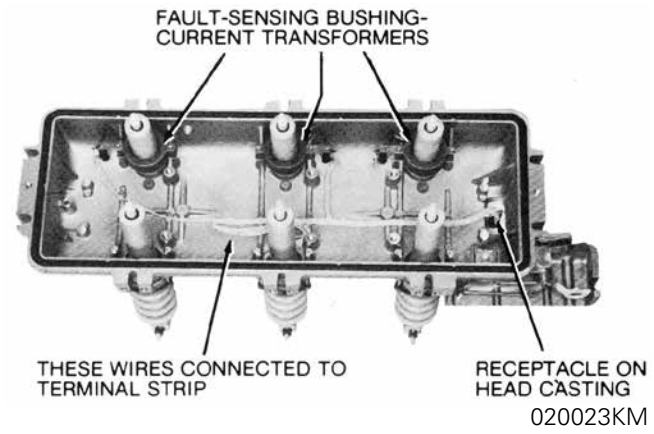


Figure 26. Head casting detached from operating mechanism

Re-Installing mechanism into head

Follow this procedure to re-install the recloser mechanism assembly into the head:

1. Install the couplers on the lockout lever and contact position indicator shafts of the mechanism and lock them in the disengaged position.

2. Carefully lower the mechanism assembly onto the six pipe spacers which have been positioned over the attaching holes in the casting (Figure 27).

3. Install the six attaching socket head bolts and tighten evenly to avoid any binding of the mechanism.

Note: Remove the two eyebolts and replace with the hex head bolts in the bottom of the closing solenoid frame.

4. Re-engage the lockout lever and contact position indicator shaft by releasing the shaft couplers.

5. Reconnect the operating lever of the auxiliary switch (if used) to the mechanism and secure with the washer and E-ring (Figure 23).

6. Attach the 0.2 mfd capacitor (if present) to the mechanism frame (Figure 24).

7. Reconnect the leads to the respective terminals on the terminal block, and reattach the nylon strap to the frame to secure the lead bundle (Figure 25).

8. Reconnect the bushing leads to their respective bushings.

⚠ CAUTION

Equipment damage. When reconnecting the VWVE bushing leads to the oil-filled bushings, always secure and hold the jamb nut between bushing and lead in place when tightening the bottom nut. Failure to do so can cause the bushings to freely rotate resulting in damage to the bushings. T289.0

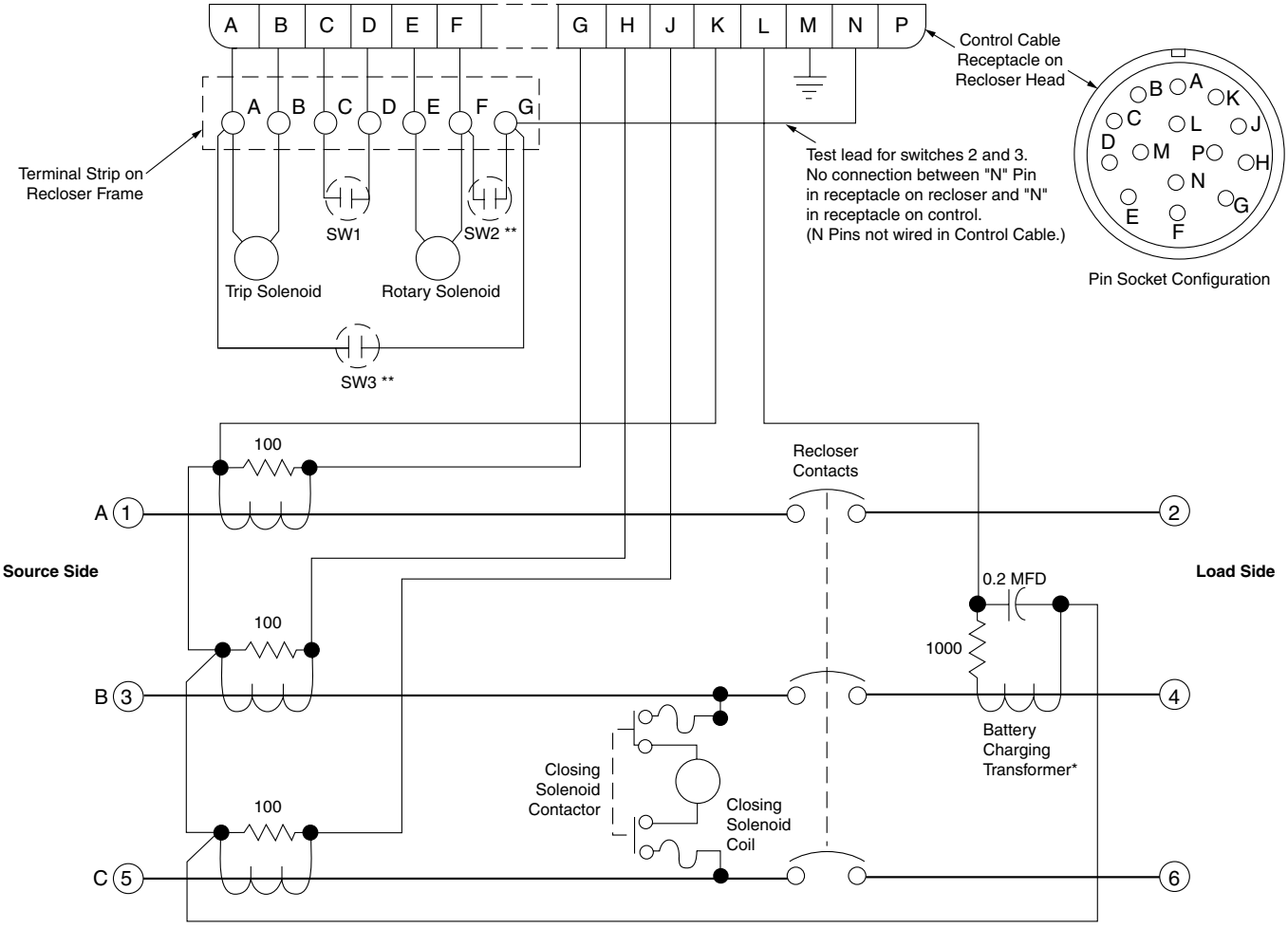
Operational checks

An internal connection diagram of the recloser circuits is shown in Figure 28.

The operating sequence for the various circuit components is diagrammed in Figure 29. These components should provide trouble-free operation with little or no maintenance. However, if the recloser does not operate properly, the following checks can be made to troubleshoot the recloser circuits.

Note: Refer to the specific electronic recloser control service information for control checking, testing, and troubleshooting procedures.

It is not necessary to untank the recloser to perform these checks.

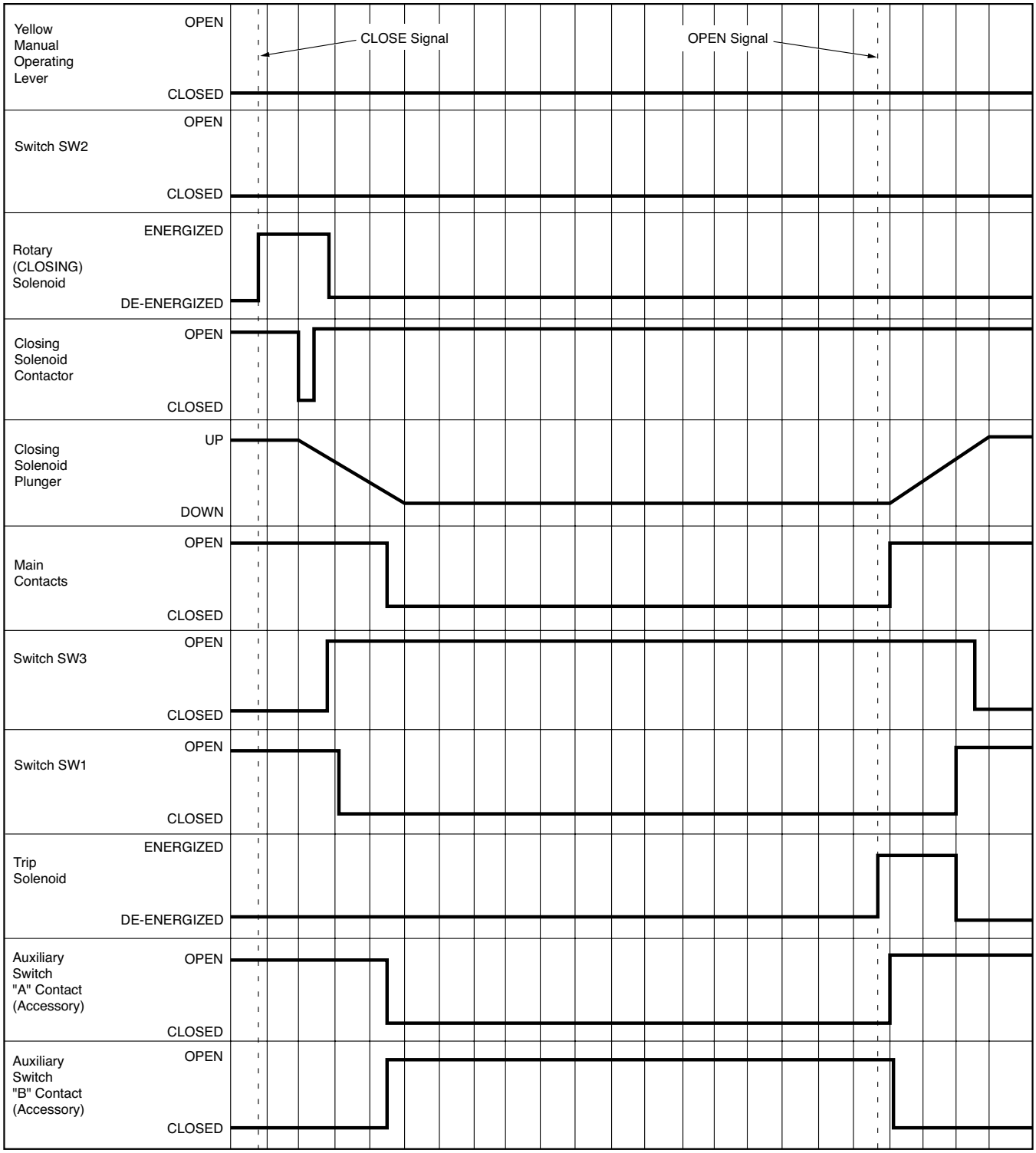


SW1 – Microswitch on mainshaft - Closed when closing solenoid plunger is down. (Plunger is down when recloser is closed.)
SW2 – Mercury Switch or Microswitch on Manual Operating Handle - Closed when handle is up in CLOSED position.**
SW3 – Mercury Switch or Microswitch on Main Shaft - Open when closing solenoid plunger is down. (Plunger is down when recloser is closed.)**

*For VWE reclosers below Serial Number 2000 and VWVE reclosers below Serial Number 1500, battery charging transformer is standard. It is supplied as an accessory on later units.

**For VWE reclosers below Serial Number 16082, VWVE27 reclosers below Serial Number 17751, and VWVE38X reclosers below Serial Number 2683, SW2 and SW3 are mercury switches. Reclosers above these serial numbers have only microswitches. Mercury Switch to Microswitch Retrofit Kit KA394WE is available to replace existing mercury switches. Contact your Eaton representative for additional information.

Figure 27. Type VWE, VWVE27, and VWVE38X recloser internal connection diagram



Note: Diagram shows operational sequence only. It does not have a scaled time base.

Figure 28. Sequential operation of contacts in VWE and VWVE reclosers

Control cable

Use an ohmmeter to determine the condition of the control cable as follows:

1. Check the continuity between like pins and pin sockets of the connector plugs on either end of the electronic control cable.
2. Check for discontinuity between unlike pins and pin sockets.

Note: Pins or pin sockets N and P are not connected on either plug.

Repair or replace the control cable if defective.

Circuit components

All measurements are made at the pin sockets of the control cable receptacle on the recloser head. A reading within ±15 percent of the specified value indicates components are operational.

Any component failing to meet the specified checks should be replaced.

Figure 30 identifies the various circuit components.

Note: For VWE reclosers above serial number 16081, VWVE27 reclosers above serial number 17750, and VWVE38X reclosers above serial number 2682, switches SW1, SW2, and SW3 are microswitches.

For reclosers below these serial numbers, SW2 and SW3 are mercury switches.

Mercury Switch-to-Microswitch Retrofit Kit KA349WE is available to replace existing mercury switches with microswitches. Contact your Eaton representative for additional information.

IMPORTANT

To prevent excessive battery drain (if the electronic control battery is used to supply the 25 Vdc power), connect as directed for only as long as necessary to perform the specified action.

Trip-solenoid

1. Connect an ohmmeter between pin sockets A and B. The meter should read approximately 9.5 ohms.
2. Lift up the yellow manual operating handle under the sleet hood and manually close the recloser with the closing tool. Refer to Manual Operation of the Recloser section of this manual.
3. Momentarily apply 25 Vdc to pin sockets A (+) and B (–).

   The recloser should trip.

Rotary solenoid and closing solenoid contactor

1. Connect an ohmmeter between pin sockets E and F.

   The meter should read approximately 19 ohms.
2. Connect the ohmmeter across bushings 3 and 5. (Refer to Figure 31 for bushing identification.)

   A. With the yellow manual operating handle in the UP position and the recloser contacts OPEN, momentarily apply 25 vdc to pin sockets A (+) and E (–)

   Repeat two or three times.

   The meter should indicate closing coil continuity (read the effective dc resistance of the closing coil) confirming that the closing solenoid contactor is closed.

   B. With the rotary solenoid still energized, manually CLOSE the recloser with the closing tool.

   The ohmmeter should indicate loss of continuity indicating that the closing solenoid contactor has opened.

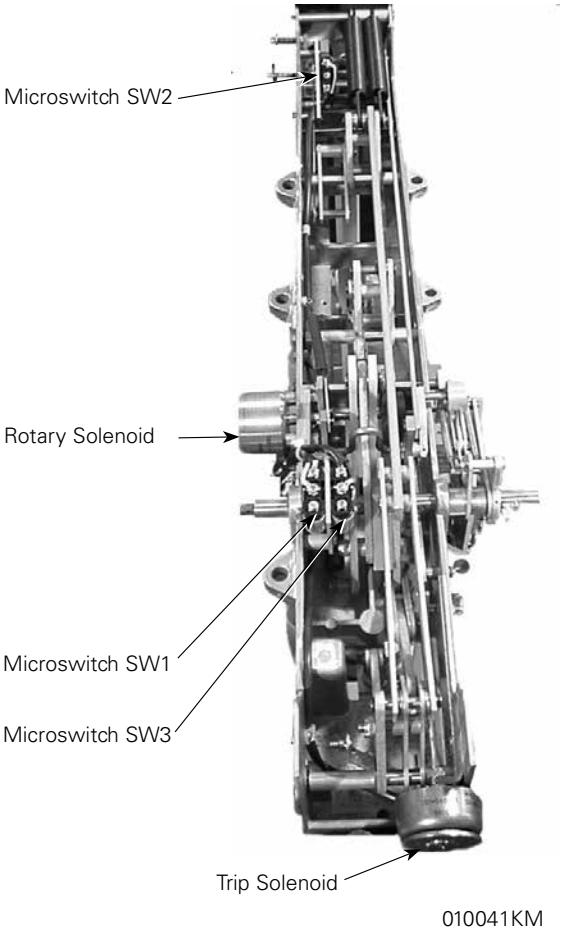


Figure 29. Location of circuit components on mechanism frame

Switches (SW1, SW2, SW3)

Note: For VWE reclosers above serial number 16081, VWVE27 reclosers above serial number 17750, and VWVE38X reclosers above serial number 2682, switches SW1, SW2, and SW3 are microswitches.

For reclosers below these serial numbers, SW2 and SW3 are mercury switches.

Mercury Switch-to-Microswitch Retrofit Kit KA349WE is available to replace existing mercury switches with microswitches. Contact your Eaton representative for additional information.

⚠ WARNING

Hazardous material. Do not open mercury switches or come in direct contact with switches exhibiting any sign of mercury leakage. Exposure to mercury can cause serious health problems. T281.0

Table 7 shows switch for manual operating lever/recloser contact combinations.

Use an ohmmeter or multimeter to perform the following tests:

1. Testing one switch at a time, attach ohmmeter leads to switch terminal screws.
2. Check the switch for an OPEN or CLOSED condition as specified in Table 7.

Note: An ohmmeter connected across the designated pin sockets of the control cable receptacle will indicate as follows:

- CLOSED contact – Ohmmeter will indicate Zero.
- OPEN contact – Ohmmeter will indicate Infinity.

Table 7. Switch status

Recloser contacts	Manual operating lever	SW1 terminals C & D	SW2 terminals F & N	SW3 terminals A & N
OPEN	DOWN	OPEN	OPEN	CLOSED
OPEN	UP	OPEN	CLOSED	CLOSED
CLOSED	UP	CLOSED	CLOSED	OPEN

3. If a switch fails the test, complete the following checks:
   A. Review switch positioning.
   B. If switch is positioned correctly, review switch terminal and terminal block connections.
   C. If all switch and terminal block connections are correct, check switch to make sure it actually opens and closes as its arm changes position.
   D. Review switch cam for correct position.
   E. Check cable wires to ensure continuity exists within each wire.

Current transformers

The current sensing transformers are mounted on the source side bushings underneath the head casting. The battery charger CT power source (if applicable) is mounted on the load side center bushing.

Continuity check

1. Connect an ohmmeter, in turn, to pin sockets K and G, and pin sockets K and H to check the continuity of the three current sensing transformers.

   The meter should read as follows:

   - Approximately 7 ohms for A-Type sensing CTs
   - Approximately 3.5 ohms for B-Type sensing CTs.

   This value is the dc resistance of each winding.
2. Connect the ohmmeter to pin sockets K and L to check the continuity of the battery charger CT winding (if used).

   The meter should read approximately 1000 ohms.

   - A zero ohms reading indicates the 0.2 mfd capacitor may be short-circuited.
   - Readings deviating more than ±20% from 1000 ohms indicate a damaged resistor or transformer winding.

Ratio test for sensing CTs

1. Connect all three phases of the recloser in series as shown in Figure 31.

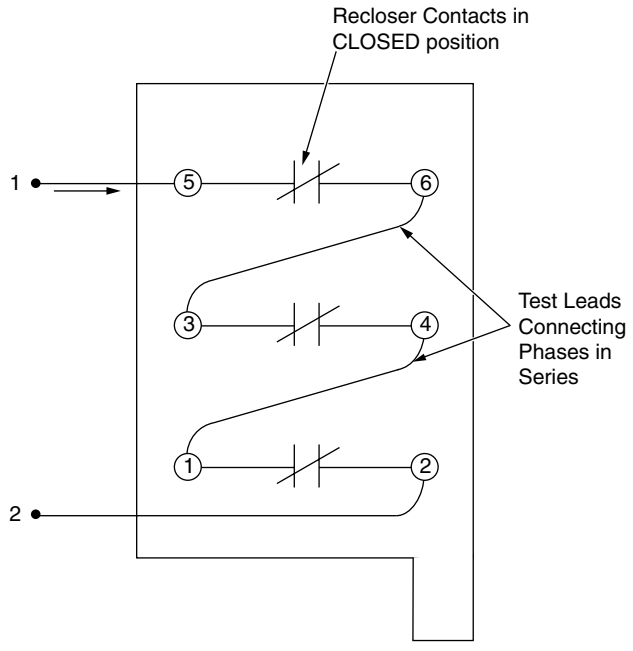


Figure 30. Test circuit for checking bushing current transformers

2. Close the recloser contacts with the manual closing tool.
3. Connect a 100 ampere ac test current to test points 1 and 2.
4. Energize the 100 ampere test source.
5. Using a multimeter on the 0-500 milliamp range, check the current output across socket pins K–G, K–H, and K–J as shown in Figure 32.

Note: Ratio test-circuit shown is the effective circuit that contributes to the testing. Components not having an effect on the current flow are not shown.

The output of each CT should measure 100 ma ±10%.

Note: Be sure to allow for the tolerances of meter being used. The resistance of certain type of meters is not negligible. Use as high a scale (lower resistance) as is accurately readable.

A 100 ma reading verifies the 1000:1 ratio of the sensing CTs. If the 100 ma is not attained, the CT winding may be faulty.

6. De-energize the test source.

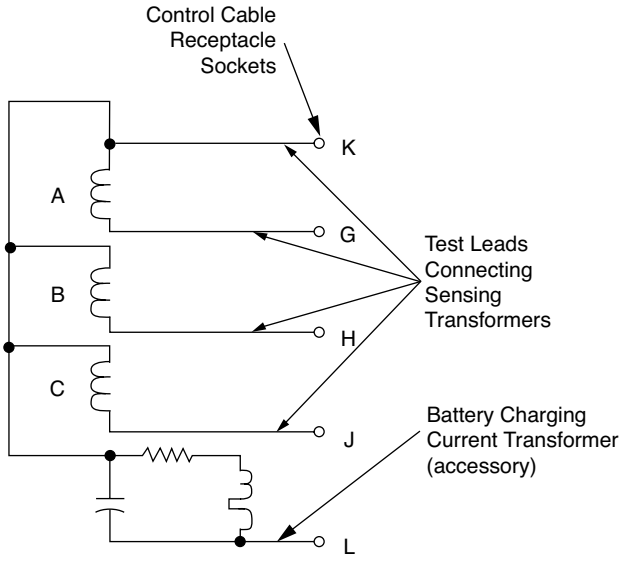


Figure 31. Ratio test circuit for sensing CTs

Polarity test for sensing CTs

1. With the phases still connected in series from the previous test, connect the secondaries of the CTs in parallel by connecting pin socket G to H to J.
2. Measure the output between pin sockets K and J as shown in Figure 33.

Note: Polarity test-circuit shown is the effective circuit that contributes to the testing. Components not having an effect on the current flow are not shown. Dotted lines are test leads.

3. Energize the 100 ampere ac test source.

   All three transformers should have the same polarity and the output should measure 300 ma.

Note: If one transformer has its polarity opposite of the remaining two, the output will measure 100 ma.

4. De-energize the test source and remove the jumper wire from the receptacle.

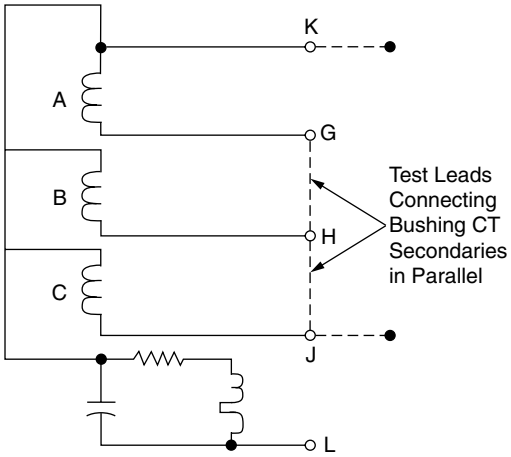


Figure 32. Polarity test circuit for sensing CTs

Output test of battery charging CT

1. With the phases still connected in series, energize the 100 ampere ac source.
2. Measure the output between pin socket K and L of the control cable receptacle.

   The output should measure 40–60 ma.

   Readings within this range indicate sufficient output to maintain control battery charge.

Service parts lists

The service parts and hardware listed and illustrated include only those parts and assemblies usually furnished for repair or involved in the maintenance procedures described in this manual. Further breakdown of listed assemblies is not recommended.

Dimensions of all common hardware parts have been carefully checked so that they may be locally acquired. The suffix letter of the 14 character catalog number for common hardware parts codes the plating of the part.

A - No plating; raw material

H - Silver

M - Black oxide

Q - Cadmium + zinc + chromate

Y - Zinc + chromate

Z - Electro zinc + bronze irridite

A hardware kit, Catalog No. KA849R1, contains an assortment of roll pins, cotter pins, retaining rings, stop nuts, etc. – common hardware parts used in Eaton's Cooper Power series reclosers that may not be readily available locally.

To assure correct receipt of any part order, always include recloser type and serial number. Because of Eaton's continuous improvement policy, there may be instances where the parts furnished may not look exactly the same as the parts ordered. However, they will be completely interchangeable without any rework of the recloser.

Prices of Replacement Parts, Section S280-01, lists recommended spare parts and prices for most parts. Parts not listed in price list may still be available. Consult your Eaton representative for price and availability.

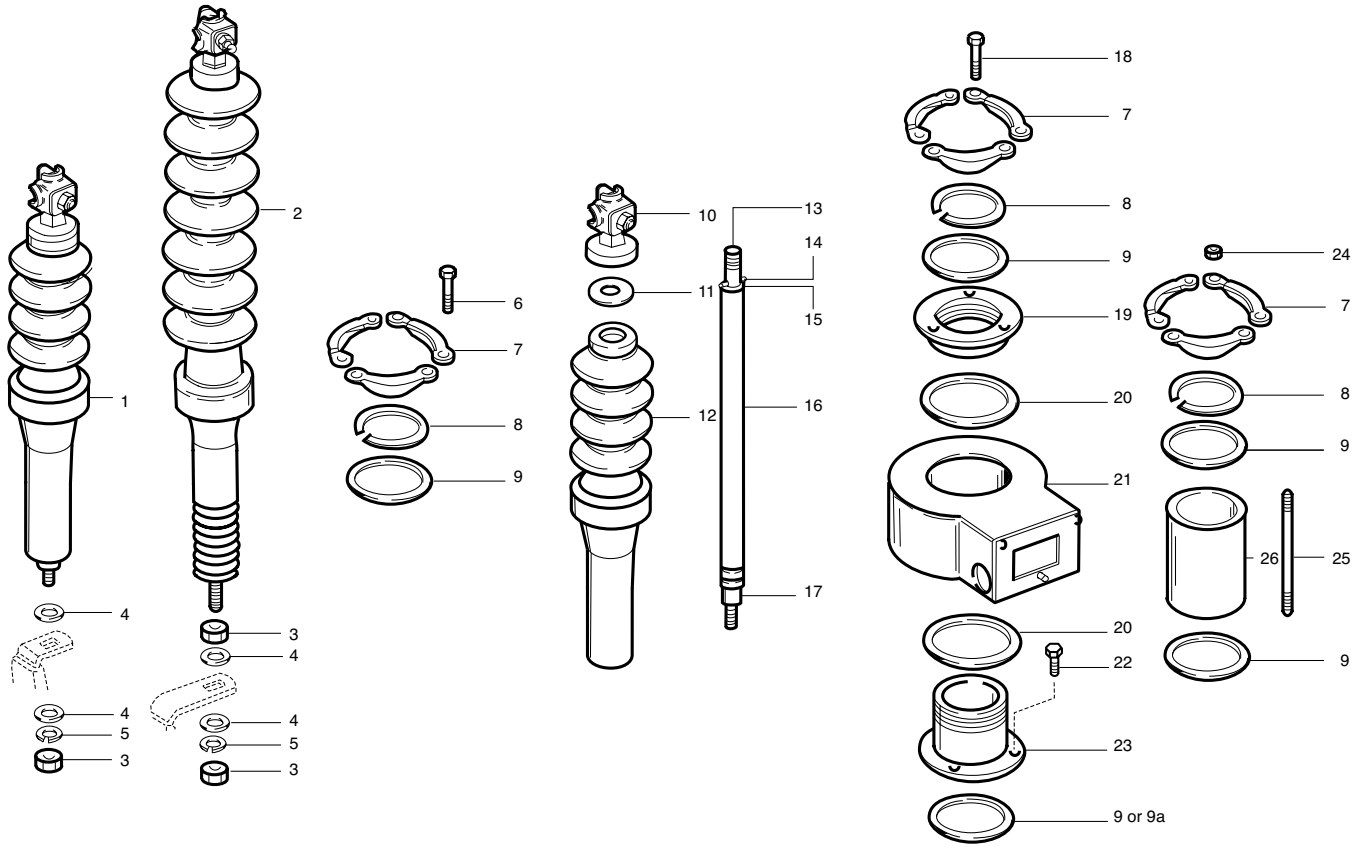


Figure 33. Bushing parts – exploded view

Bushing Parts (Figure 34)

Item number	Description	Catalog number	Quantity per accessory
1	Bushing assembly – Type VWE		
	Standard creepage	KA221W1	6
	Standard creepage with BCT accy	KA221W2	6
	17-inch extra-creepage	KA221W11	6
	17-inch extra-creepage with BCT accy	KA221W12	6
2	Bushing assembly – Type VWVE27 above S/N 4249	KA56RV3	6
	26-1/2-inch extra-creepage with BCT accy above S/N 4249	KA56RV4	6
3	Hex jam nut, 1/2–20, brass		
	Type VWE	K880725320050H	6
	Type VWVE	K880725320050H	12
4	Flat washer	KP2028A3	12
5	Split lockwasher, med, 1/2, bronze	K900830050000A	6
6	Capscrew, hex hd, 3/8–16x2-1/4, s stl	K730115137225A	3
7	Bushing clamp, s stl	KP1574R	3
8	Clamping ring	KP1111R	1
9	Lower bushing gasket		
	Used with old-style clamping sleeve without groove VWE	KP2090A66	1
	VWVE27, VWVE38X	KA1193R	1
9a	O-ring gasket		
	Used with transformer clamping sleeve with machined groove		
	VWE, VWVE27, VWVE38X	KP2000A64	1
10	Terminal	KA17W901	1
11	Upper bushing gasket	KP2090A57	1
12	Bushing ceramic – Type VWE		
	Standard creepage	KP1110R	1
	Standard creepage with BCT accy	KP171W	1
	17-inch extra-creepage	KP1578R	1
	17-inch extra-creepage with BCT accy	KP186W	1
13	Bushing rod assembly – Type VWE		
	Standard & 17-inch creepage	KA716R20	1
	Standard & 17-inch creepage with BCT accy	KA716R21	1
14	Roll pin, 1/8x15/16 (included in Item 13)	K970815125093A	1
15	Flat washer (included in Item 13)	KP2028A39	1
16	Insulating tube (included in Item 13)		
	Standard & 17-inch creepage	KP3230A49	1
	Standard & 17-inch creepage with BCT accy	KP3230A46	1
17	Shock absorber (included in Item 13)	KP2090A2	1
The following parts are applicable to the bushing current transformer accessory only.			
18	Capscrew, hex hd, 3/8—16x2, s stl	K730115137200A	3
19	Transformer clamping flange	KP170W1	1
20	Flange gasket	KP2090A73	2
21	Replacement current transformer		
	600:5, multi-ratio	KA159W1S	1
	1200:5, multi-ratio	KA132WS	1
22	Capscrew, hex hd, 3/8–16x1-1/4, s stl	K730115137125A	3
23	Transformer clamping sleeve	KP169W1	1
24	SS Hex nut, 3/8–16, stl	K880215116037A	3
25	Stud	KP3149A40	3
26	Bushing spacer	KP275W1	1

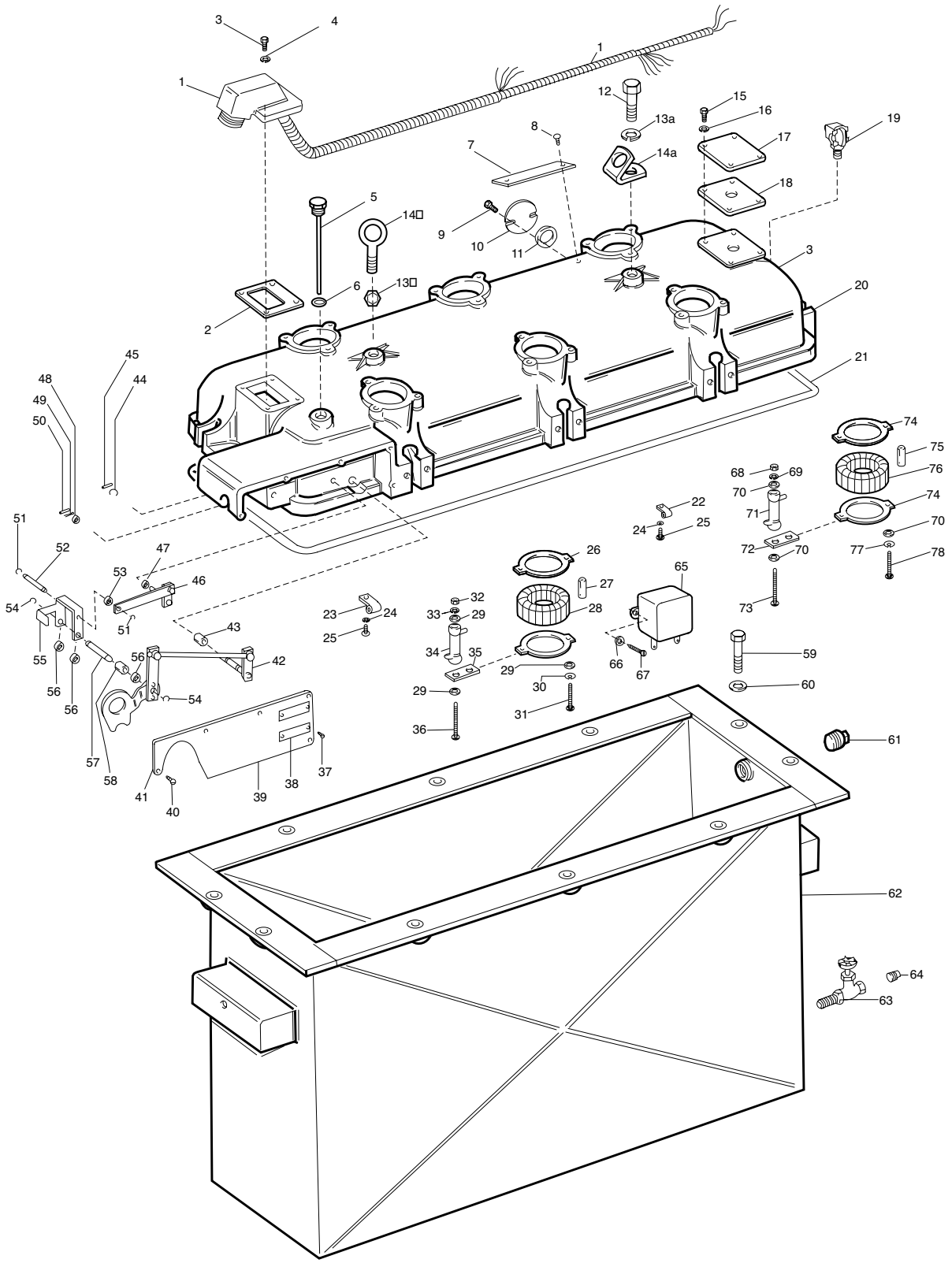


Figure 34. Head and tank assemblies – exploded view

Head and tank assemblies (Figure 35)

Item number	Description	Catalog number	Quantity per accessory
1	Receptacle and wiring bundle assembly	KA33RE1	1
2	Gasket	KP611R	1
3	Capscrew, hex hd, 1/4–20x3/4, s stl	K730115125075A	4
4	Split lockwasher, med., 1/4, s stl	K900815025000A	4
5	Oil level dipstick	KA363R	1
6	O-ring gasket	KP2000A9	1
7	Closing coil instruction plate		
	All Type VWE and Type VWVE		
	serial 1304 and above	KP2312R	1
8	Self-tapping screw,		
	Type Z, #2x3/16, sst	K751515102018A	2
9	Capscrew, hex hd, 1/4–20x5/8 s stl	K730115125075A	2
10	Manual closing tool access cover plate	KP246R	1
11	Cover plate gasket	KP2000A12	1
12	Capscrew, hex hd, 5/8–11x1-1/2, s stl, VWE, VWVE27	K730115162150A	2
13a	Split lockwasher, med, 5/8, s stl, VWE, VWVE27	K900815062000A	2
13b	Pal Nut, VWVE38X	K881101111062A	2
14a	Lifting lug, VWE, VWVE27, s stl	KP473H2	2
14b	Lifting lug, VWVE38X	KP1104R	2
15	Capscrew, hex hd, 1/4–20x5/8, s stl	K730115125075A	4
16	Split lockwasher, med, 1/4, s stl	K900815025000A	4
17	Auxiliary switch cover plate	KP609R	1
18	Cover plate gasket	KP611R	1
19	Ground connector	KA392R	1
20	Head casting, includes control shaft bushings, VWE, VWVE27	KA840R	1
	VWVE38X	KP2565R2	1
21	Head gasket, VWE, VWVE27	KP2103A8	1
	VWVE38X	KP2103A20	1
22	Cable clamp	KP2006A1	2
23	Cable clamp	KP2006A2	4
24	SS Machine screw, rd hd, 8–32x5/16, stl	K721515108031A	6
25	Split lockwasher, med No. 8, s stl	K900815008000A	6
26	Current transformer support	KP145RE	6
27	Spacer	KP3009A38	6
28	Sensing current transformer	KA86RE3	3
29	Flat washer, 14S, brass	K900525025056A	12
30	Split lockwasher, med, 1/4, s stl	K900815025000A	9
31	Machine screw, rd hd, 1/4–30x2, stl	K721501125200Z	6
32	Hex nut, 10–24, s stl	K881015124010A	3
33	Split lockwasher, med, No. 10, s stl	K900815010000A	3
34	Resistor, wirewound, 100 ohm, 25 watta	KP4022A31	3
35	Bracket	KP2383R	3
36	Machine Screw, rd hd, 10–24x2-1/4, s stl	K721515110225A	3
37	Self-tapping screw, Type Z, #4x3/16, sst	K753315004018A	4
38	Voltage data plate	KP567RX	1
39	Nameplate		
	Type VWE	KRW271V1	1
	Type VWVE	KRW307V1	1
40	Self-tapping screw, rd hd. No. 12x1/2, sst	K801515012050A	5
41	Cover plate	KP283R900	1
42	Manual operating handle assembly	KA672R	1
43	Spacer	KP3009A39	1
44	Retaining ring, Type C, 5/16 in, sst (WA516)	K970915312000A	1
45	Roll pin, 1/8x3/4, stl	K970801125075C	1
46	Shaft and lever assembly	KA18RE	1
47	Spacer	KP3007A8	1
48	Flat washer, 14S, brass	K900525026056A	1
49	Cotter pin, 3/32x1/2, brass	K970525093050A	1
50	Roll pin, 3/32x1/2, stl	K970801093050C	1
51	Retaining ring, Type C, 3/16 in, sst (WA510)	K970915188000A	2
52	Groove pin	KP3123A12	1
53	SS spacer	KP3006A30	1
54	Retaining ring, Type C, 3/8 in, sst (WA518)	K970915375000A	2

Item number	Description	Catalog number	Quantity per accessory
55	Indicator and support assembly	KA19RE	1
56	SS spacer	KP3013A46	3
57	Groove pin	KP3126A4	1
58	Spacer	KP301 3A11	1
59	Capscrew, hex hd, 1/2–13x1/4, s stl	K730115150325A	10
60	Flat washer, s stl	KP2028A19	10
61	Pipe plug, 1 in, sq hd, s stl	KP2007A8	1
62	Tank (based on tank depth)	Consult Factory	
	VWE, VWVE27	KRW116FX	1
	VWVE38X	KA52WV1	1
63	Oil sampling and drain valve	KA809R	1
64	Pipe plug, 1/2 in sq hd, s stl	KP2007A11	1
The following parts are applicable to the CT-type battery charger power source which is standard on the Type VWE below serial 2100 and VWVE below serial 1500. The CT-type battery charger power source is an optional accessory on later units.			
65	Capacitor, 0.2 mfd, 2500 wvdc	KP4004A8	1
66	Split lockwasher, med, No. 6, s stl	K900815006000A	2
67	Machine screw, rd hd, 6–32x5/16, s stl	K721515106031A	2
68	Hex nut, 10–24, s stl	K881015124010A	1
69	Split lockwasher, med, No. 10, s stl	K900815010000A	3
70	Flat washer, 14S, brass	K900525026056A	2
71	Resistor, wirewound, 1000 ohms, 25 w	KP4022A36	1
72	Bracket	KP238E	1
73	Machine screw, rd hd 10–24x2-1 /4, s stl	K721515110225A	1
74	Current transformer support	KP145RE	2
75	Spacer	KP3009A38	2
76	CT charging current transformer	KA86RE1	1
77	Split lockwasher, med, 1/4, s stl	K900815025000A	2
78	Machine screw, rd hd, 1/4–20x2, stl	K721501125200Z	2

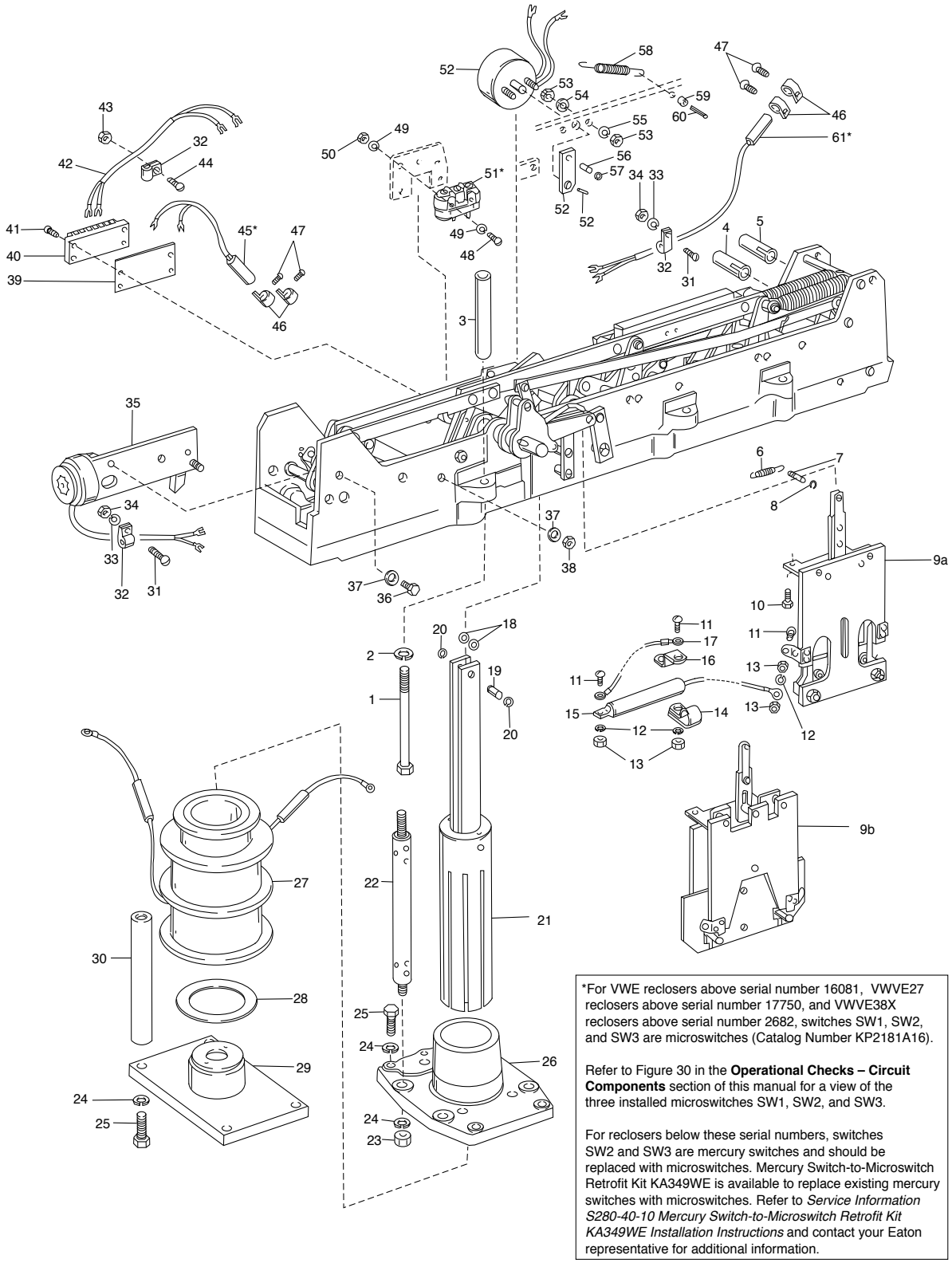


Figure 35. Closing coil mechanism – exploded view

Closing coil mechanism (Figure 36)

Item number	Description	Catalog number	Quantity per accessory
1	Capscrew, skt hd, 1/2–13x4-1/2, stl	KP2036A3	6
2	Split lockwasher, med, 1/2, stl	K900801050000Z	6
3	Spacer	KP3182A1	6
4	Operating lever coupler	KP1177R	1
5	Indicator shaft coupler	KP1056R1	1
6	Contactor toggle spring	KP141R	2
7	Groove pin	KP1306R	1
8	Retaining ring WA514, Type C, 1/4, stl	KP970901250000M	4
9a	Closing solenoid contactor, below 30 kV	KA430R3	1
9b	Closing solenoid contactor, above 30 kV	KA1143R	1
10	Capscrew with preassembled split lockwasher, 1/4–20x1/2, stl	K830101125050A	3
11	Machine screw, rd hd,		
	1/4–30x1/2, brass	K721525125050A	6
12	Split lockwasher, med, 1/4, bronze	K900830025000A	6
13	Hex nut, 1/4–20, brass	K881025120025A	8
14	Fuse retainer clip	KP2006A16	2
15	Closing coil fuse assembly (Also, included in closing coil replacement kit, Item 27.)		2
	2.4-3.3 kV (2 red color bands)	KA259R14	
	4.15-6 kV (black color band)	KA259R11	
	7.2 to 11 kV (yellow color band)	KA259R12	
	12 to 24.9 kV (red color band)	KA259R13	
	(Only one fuse assembly is required on reclosers with closing coils connected phase-to-ground – Type VWVE below Serial Number 1304.)		
16	Fuse mounting bracket	KP257L	2
17	Lead assembly	KA28W1	2
18	Flat washer, 3/8 SAE, stl	K900201037000A	2
19	Groove pin	KP3126A2	1
20	Retaining ring WA518, Type C, 3/8, stl	K970901375000M	2
21	Plunger and link assembly	KA50R	1
22	Upper stringer assembly	KA62R	4
23	Hex nut, 3/8–16, stl	K880201116037A	4
24	Split lockwasher, med, 3/8, stl	K900801037000Z	12
25	Capscrew, hex hd, 3/8–16x1-1/4, stl	K730101137125A	12
26	Solenoid frame	KP100R2	1
27	Closing coil replacement kit (Includes closing coil, lower coil gasket, voltage data plate, and two fuse assemblies.)	60 Hertz	50 Hertz
	2.4 kV	KA834R1	KA861R1
	3.3 kV	KA834R10	KA861R10
	4.16 – 4.8 kV	KA834R2	KA861R2
	6.0 kV	KA834R6	KA861R6
	7.2 – 8.32 kV	KA834R3	KA861R3
	11.0 kV	KA834R9	KA861R9
	12.0 – 13.2 kV	KA834R4	KA861R4
	14.0 kV	KA834R5	KA861R5
	17.0 kV	KA834R12	
	20.0 kV	KA834R11	KA861R11
	23.0 – 24.9 kV	KA834R13	KA861R13
	33 kV		KA861R14
	34.5 kV	KA834R14	
	125 Vdc•	KA834R7	
	250 Vdc•	KA834R8	
	•No fuses required with low-voltage dc coils.		
28	Lower solenoid gasket	KP389R	1
29	Solenoid bridge plate assembly	KA644R1	1
30	Solenoid frame post	KP1669R	4
31	Machine screw, rd hd, 8–32x3/4, s stl	K721515108075A	5
32	Cable clip	KP2006A8	7
33	Split lockwasher, med, No. 8, s stl	K900815008000A	4
34	Hex nut, 8–32, s stl	K881015132008A	5
35	Trip solenoid assembly	KA11RVE	1
36	Capscrew, hex hd, 1/4–30x1/2, s stl	K730115125050A	1
37	Flat washer, 1/4 SAE, stl	K900201025000Z	2

Item number	Description	Catalog number	Quantity per accessory
38	Hex nut, 1/4–20, stl	K880201120025Y	1
39	Insulator	KP2101A209	1
40	Terminal block	KP2101A9	1
41	Machine screw, fil hd, 6–32x5/8, s stl	K721815106062A	2
42	Lead wire assembly	KA62RE	1
43	Hex nut, 6–32, brass	K881025132006A	1
44	Machine screw, rd hd, 6–32x1/2, brass	K721525106050A	1
45	Mercury switch (SW3)**	Replaced by KA349WE*	
46	Mounting clip	KP2006A19	4
47	Machine screw, rd hd, 8–32x7/16, s stl	K721515108043A	4
48	Machine screw, rd hd, 6–32x1, brass	K721525106100A	2
49	Internal tooth lockwasher, No. 6, brz	K901032006000A	4
50	Hex nut, 6–32, brass	K881025132006A	2
51	Microswitch (SW1)	KP2181A16**	1
52	Rotary solenoid assembly Type VWE below Serial No. 3900 and Type VWVE below Serial No. 2850	KA12RE1	1
	Type VWE above Serial No. 3900 and Type VWVE above Serial No. 2850	KA61WE	1
53	Hex nut, 1/4–28, stl	K881001328025Z	4
54	Flat washer, No. 14S, brass	K900525026056Z	2
55	Split lockwasher, med, 1/4, stl	K900801025000Z	2
56	Groove pin	KP3123A3	1
57	Retaining ring WA510, Type C, 3/16, stl	K970901188000M	2
58	Spring	KP98L	1
59	Spacer	KP3007A30	1
60	Cotter pin, 3/32x1, brass	K970525093100A	1
61	Mercury switch assembly (SW2)**	Replaced by KA349WE*	

*Replace mercury switches with KA349WE mercury switch-to-microswitch retrofit kit.

**For reclosers with three microswitches (no mercury switches), KP2181A16 is applicable to SW1, SW2, and SW3.

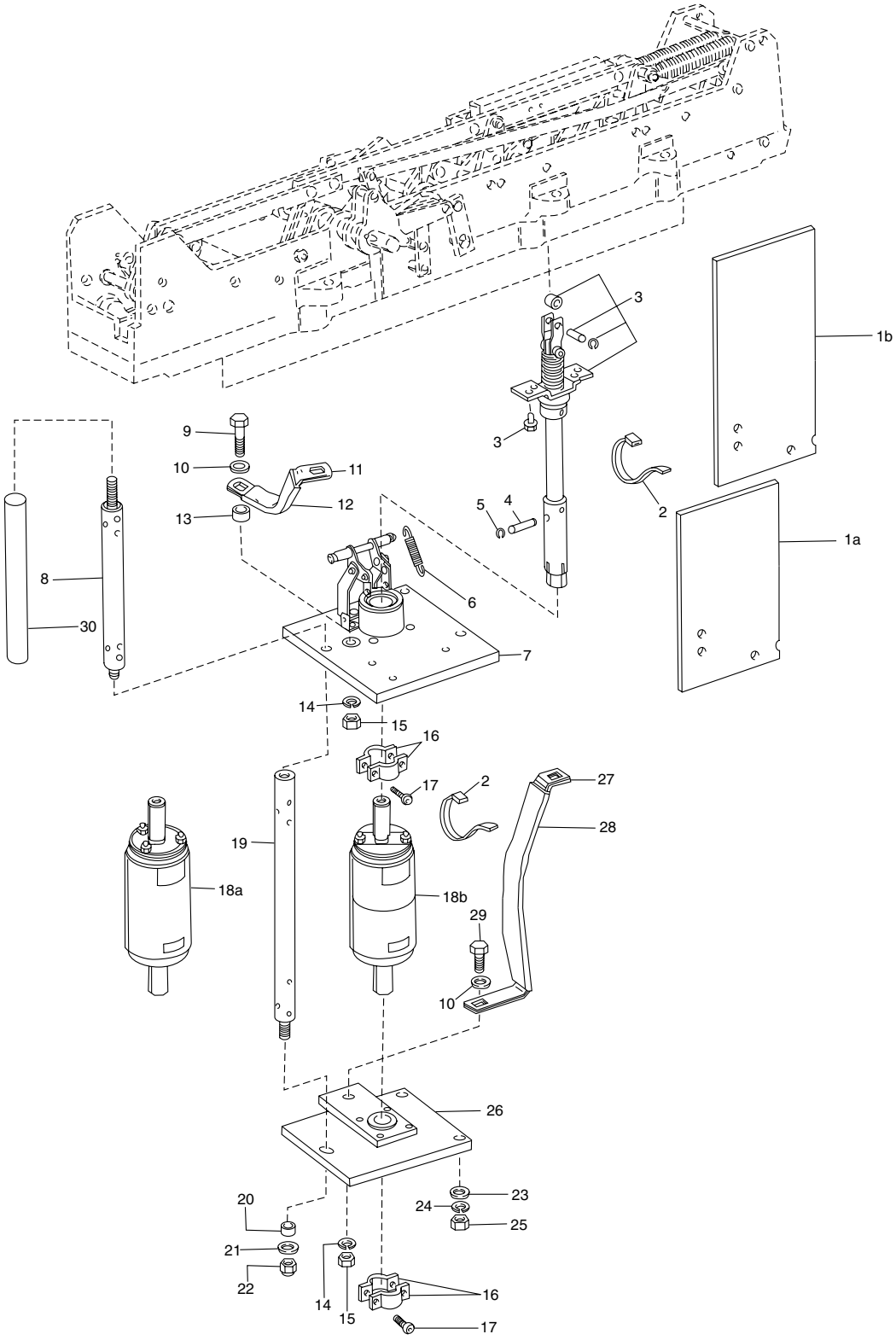


Figure 36. Interrupter mechanism – exploded view

Interrupter mechanism (Figure 37)

Item number	Description	Catalog number	Quantity per accessory
1a	Insulating barrier, fiberglass	KRW125N1	3
1b	Insulating barrier, Polypropylene	KRW129N	3
2	Wire tie	KP2358A6	12
3	Contact rod assembly replacement kit	KRW706VA	3
4	Groove pin	KP3124A50	3
5	Retaining ring, Type C, 1/4" stl	K970901250000M	6
6	Spring	KP1066VWS	6
7	Upper current exchange assembly		
	Phases A and B	KRW115FB	2
	Phase C	KRW115FA	1
8	Upper stringer assembly	KA62R	9
9	Capscrew, hex hd, 3/8 16x1-3/4, brass	K730125137175A	3
10	Flat washer, No. 24S, brass	K900525039087H	6
11	Short bushing lead (6 per phase)		
	Phases A and B	KP3250A13	12
	Phase C	KP3250A14	6
12	Short lead insulation		
	Phases A and B	KP2106A72	2
	Phase C	KP2106A71	1
13	Spacer	KP3013A63	3
14	Split lockwasher, mea, 3/8 si brz	K900833037000A	6
15	Hex nut, 3/8 16, brass	K880233116037K	6
16	Interrupter clamp	KP1036VS	12
17	Capscrew, skt hd, 1/4–20x1, stl	KP2036A10	12
18	Vacuum interrupter		
	VWE below S/N 7305 (not shown)		
	Phases A and B	KRW710V1	2
	Phase C	KRW710V2	1
	VWE S/N 7305 thru 9573 (not shown)		
	Phases A and B	KRW710V3	2
	Phase C	KRW710V4	1
18a	VWE above S/N 9573, VWVE27 above S/N 9993	KA612VSAM1	3
18b	VWVE38	KA338VS1	3
19	Lower stringer assembly		
	VWE, VWVE27	KA306VS	9
	VWVE38X	KA222VS	9
20	Spacer	KP3009A121	3
21	Flat washer, 3/8 AN, s stl	K900215039062A	3
22	Elastic stop nut, 3/8–16	KP2020A21	3
23	Flat washer, 3/8 SAE, stl	K900201037000A	9
24	Split lockwasher, med, 3/8, stl	K900801037000Z	9
25	Hex nut, 3/8–16, stl	K880201116037A	9
26	Lower current exchange assembly		
	Phases A and B	KRW468VB	2
	Phase C	KRW468VA	1
27	Long bushing lead (6 per phase)		
	VWE, VWVE27, 16.94"	KP3250A33	18
	VWVE38X, 19.69"	KP3250A27	18
28	Long lead insulation (1 per phase)		
	VWE, VWVE27, 11.25" long	KP2106A81	3
	VWVE38X, 14" long	KP2106A77	3
29	Capscrew, hex hd, 3/8–16x1, brass	K730125137100A	3
30	Insulating tube, 7.62" long	KP3230A14	9

Additional 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

Replacement kits

Replacement kits for Eaton's Cooper Power series reclosers are available through the factory service department. To order these kits, refer to the Replacement Parts price list for catalog numbers and pricing. Contact your Eaton representative for additional information and order procedures.

Factory-authorized service centers

Factory-authorized service centers are located throughout the continental United States to provide maintenance, repair and testing services for Eaton's Cooper Power series controls and reclosers. For further information, contact your Eaton representative.

Factory maintenance classes

The factory service department offers a basic testing and troubleshooting course for electronically controlled reclosers. This course, taught by experienced service technicians, is held at the factory's in-house training facility. For additional information, contact your Eaton representative.

Type MET recloser control tester

A 30-minute DVD video program KSPV7 Kyle® Type MET Electronic Recloser Control Tester Operation and Testing Procedures is available as a supplemental training aid for service personnel.

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Printed in USA
Publication No. MN280061EN
May 2017

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