

Reclosers

Type WE, Three-Phase Maintenance Instructions

Service Information

S280-40-4

Page 1

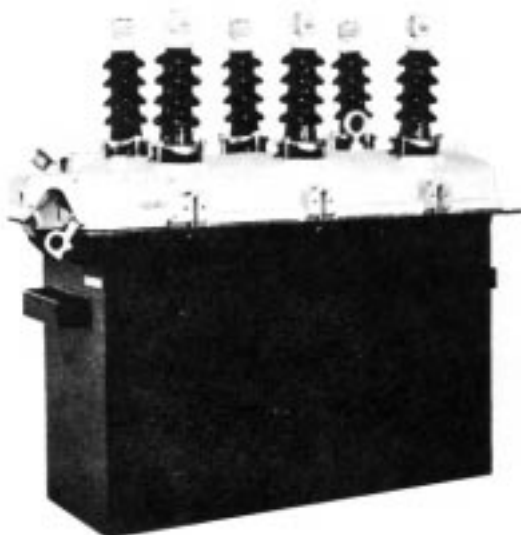
14.4 kv • 560 Amp

Replaces 281-355B-1 dated 9/65
No change in text

This manual, bulletin S280-40-1, for the Form 2 Type WE electronically controlled reclosers above serial No. 299 covers:

- maintenance of the interrupting mechanism
- operational checks for circuit components attached to the head casting and mechanism frame
- testing of the control cable and bushing current transformers
- replacement of mechanical and electrical components
- replacement parts for the interrupting unit

A separate manual, bulletin 281-27SB-1, is a service manual which covers the electronic control and provides information on general inspection, operational checks, and battery testing and charging. Procedures for testing the recloser and control together are found in the control installation manual, bulletin S280-65-1.



CAUTION: DO NOT ENERGIZE THIS EQUIPMENT OUT OF OIL

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These instructions do not claim to cover all details or variations in the equipment, procedure, or process described, nor to provide direction for meeting every possible contingency during installation, operation, or maintenance. When additional information is desired to satisfy a problem not covered sufficiently for the user's purpose, please contact your Cooper Power Systems sales engineer.



Cooper Power Systems

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January, 1970

**DESCRIPTION OF
TYPE WE RECLOSER**

The Type WE recloser, on cover, is a self-controlled device that protects distribution lines and equipment. This unit consists of a circuit interrupting device, hereafter referred to as the recloser, an electronic control, and a connecting cable. Fault current sensing is achieved by the control which actuates the recloser. Circuit interruption is provided by the recloser.

A Type WE recloser performs similarly to other reclosers in that it trips and automatically recloses. If a fault is temporary, reclosing of the Type WE restores normal service. If the fault is permanent, the recloser senses this by performing a preset number of operations and locking open. All three phases of a Type WE recloser open and lock out simultaneously.

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

Arcs are extinguished in the rugged arc-interrupter assemblies, figure 1, which utilize the proven selfblast principle of arc interruption. Moving contacts are driven by powerful opening springs that are loaded when the recloser is closed.

Closing is accomplished when a line-voltage solenoid is connected across two phases of the distribution line. This connection occurs when a rotary solenoid, located inside the recloser, allows the closing solenoid contactor to close.

A trip-free control lever, linked with the interruption mechanism, is provided to lock the recloser open manually. This lever, located under the sleet hood, cannot be used to close the recloser, but it must be in the CLOSED position before the electronic control can cause the recloser to close. A contact position indicator, linked to the interrupting mechanism but independent of the control lever, is provided under the sleet hood.

**GENERAL MAINTENANCE
INFORMATION**

Maintenance Ensures Reliable Performance

Reclosers are widely applied to increase service continuity, reduce system operating costs, and increase revenue. The Type WE recloser performs all the functions by combining the flexibility and reliability of electronic control with proven interrupting mechanisms to achieve superior distribution-circuit protection. However, the Type WE can perform at peak efficiency only if it is maintained in good condition. While maintenance is relatively easy and inexpensive it is important.

Oil plays an essential role in arc interruption, insulation, and reclosing. Arc interruption, however, contributes to oil decomposition. For this reason, the oil steadily diminishes in dielectric strength as the recloser continues to clear fault currents. Breathing action also can result in moisture absorption by the oil, thus lowering its insulation value. For effective recloser operation, oil must be replaced before it deteriorates beyond a safe level.

**Climate and Duty Determine
Maintenance Intervals**

Frequency of maintenance depends upon local climatic conditions and the interrupting duty imposed on the recloser. L-M recommends the unit be inspected completely, cleaned, and filled with new oil at least once each year. If the Type WE operates through a duty cycle in less than one year, periodic maintenance should be performed then.

The NEMA standard duty cycle for power class III reclosers is as follows:

Number of Recloser Operations	Fault Current, Percent of Interrupting Rating	Maximum Circuit X/R Value
28	15 to 20	3
20	45 to 55	7
10	90 to 100	14
Total 58		

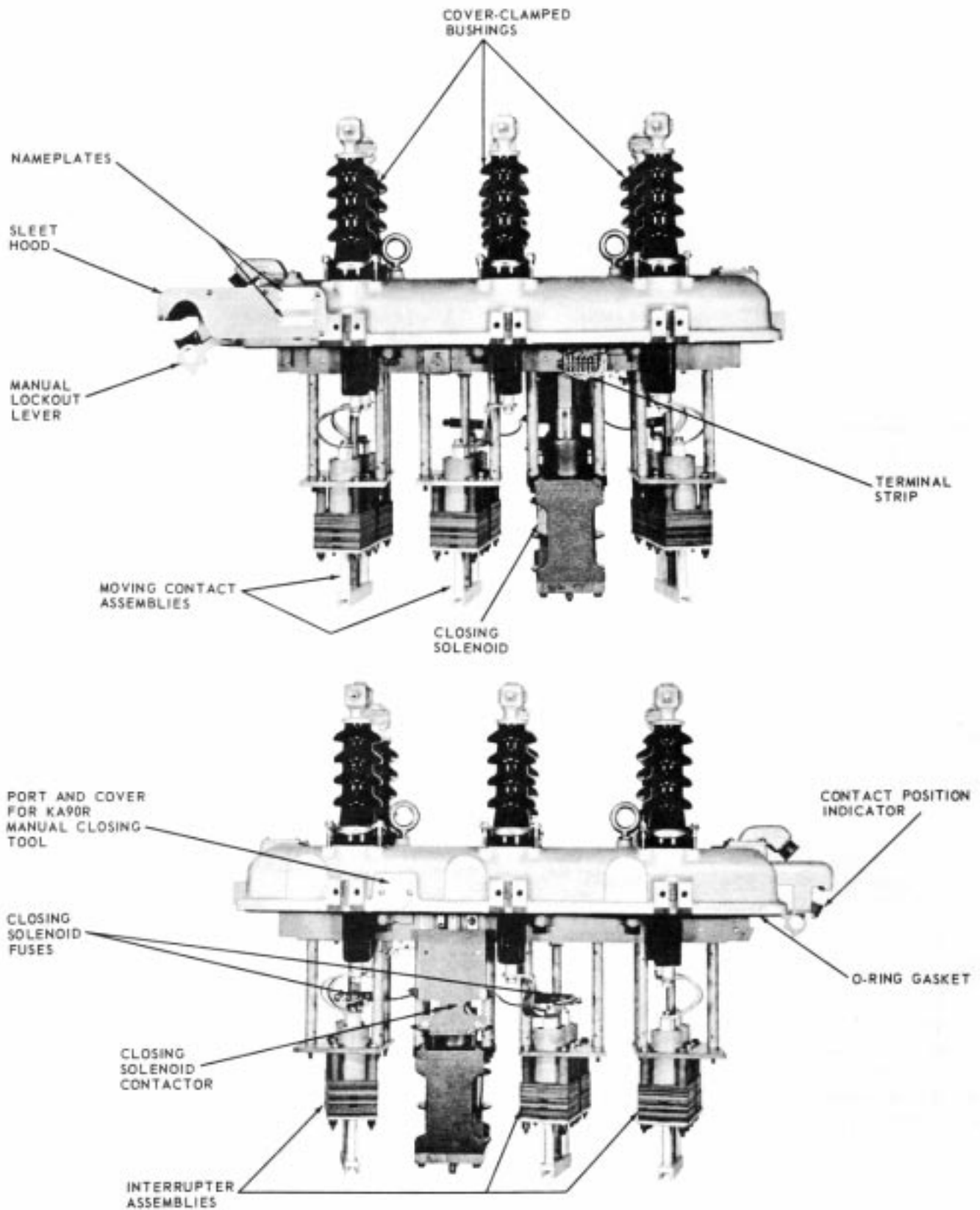


Figure 1
Untanked Type WE Recloser

GENERAL MAINTENANCE INFORMATION - CONT'D.**High Dielectric Strength Maintains Oil Effectiveness**

Although the Type WE can undergo a complete duty cycle without requiring an oil change, more frequent oil changes will be required if the majority of fault currents are near the maximum interrupting rating. Oil that has become contaminated with carbon and sludge, or has a dielectric strength of 18 kv or lower, should be replaced. Use only oil that meets the requirements tabulated below for L-M switchgear. Refer to "ASTM Methods of Testing Electrical Insulating oil," Publication D117. This publication is available from the American Society for Testing Materials, 1916 Race Street, Philadelphia, Pennsylvania.

CHARACTERISTICS OF OIL FOR L-M SWITCHGEAR

Color: nearly colorless	
ASTM colorimeter	1.0 max.
Union colorimeter	2.0 max.
Reaction	neutral
Neutralization number	0.03 mg KOH/g max.
Free sulphur	none
Corrosive compounds	3 max.
Steam emulsion number.....	25 seconds max.
Flash point.....	145°C min. (293° F)
Fire point	160°C min. (320° F)
Pour point.....	(-45.6°C max.) (-50° F)
Viscosity:	
at 37.8°C (100°F)	
Saybolt Universal	62 sec. max.
at 0°C (32°F)	
Saybolt Universal	320 sec. max.
Specific gravity:	
at 20.0°C (68.0°F) .	0.895/cc max.
Co-efficient of expansion:	
at 0°C (32°F).....	0.000725
at 100° C (212° F)	0.000755
Interfaciai tension.....	40 dynes/cm min.
Dielectric constant.....	2.2
Dielectric strength	26,000 volts min.
Weight per gallon.....	7.5 lb.
Water content	40 parts/million max. (Fischer test)

Servicing Locations Vary with Amount of Maintenance

Routine inspection, minor maintenance, most adjustments, and replacement of oil can be performed on a recloser without removing it from the mounting frame. Repairs or major maintenance work should be performed in the shop.

PERIODIC FIELD INSPECTION AND MAINTENANCE

Each periodic check should include at least the following steps:

1. BYPASS, TRIP, AND DE-ENERGIZE THE RECLOSER

Disconnect the control cable from the recloser.

2. INSPECT EXTERNAL COMPONENTS

Check for broken bushings, paint scratches, or other mechanical damage.

3. LOWER THE TANK TO EXPOSE INTERNAL COMPONENTS

Attach sheaves of the tank-hoisting mechanism to recloser tank, and take up slack. Then remove the ten bolts to release the tank from the head casting.

CAUTION: Be sure the recloser is tripped before lowering the tank, so the recloser will not be tripped accidentally while the mechanism is out of oil.

4. INSPECT MOVING CONTACTS

Arcing tips of the moving contacts can experience considerable erosion before replacement is necessary. The contacts should be replaced before their effectiveness is impaired by erosion of the load current contact surfaces.

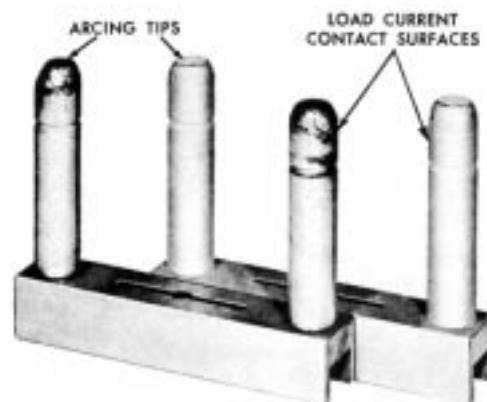


Figure 2

Left: moving contact assembly after one full duty cycle; right; contact assembly new.

Figure 2 shows a set of moving contacts after they have experienced severe interrupting duty, and a new set for comparison. The used contacts shown have reached the condition where they should be replaced.

If moving contacts appear to have further useful life, inspection of the arc interrupter chamber and stationary contacts can be omitted. These components are designed to last at least the life of the moving contacts.

5. INSPECT STATIONARY CONTACTS

If moving contacts of any phase or phases are in questionable condition, the corresponding stationary contacts should be inspected. Refer to page 7 or 9 for instructions on removal and reassembly of the fiber plates that form the arc interruption chambers. Removal of these plates is necessary for inspection of the stationary contacts.

Figure 3 shows a stationary contact assembly after one duty cycle and a new assembly for comparison. Note that erosion of the load current contact surfaces has started. The six contact segments or the entire assembly should be replaced.

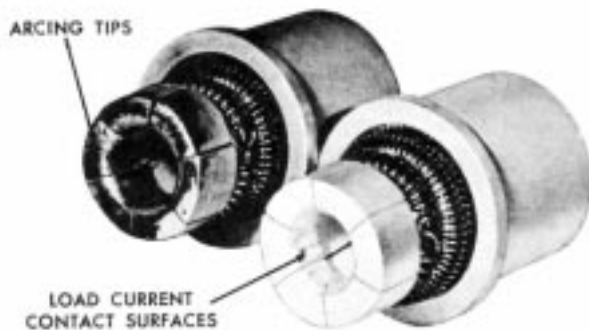


Figure 3

Left: Stationary contact assembly after one full duty cycle;
right: new contact assembly.
Reclosers below serial No.1001

6. INSPECT ARC INTERRUPTER CHAMBERS (Reclosers Below Serial No. 1001)

When stationary contacts are inspected, check fiber plates of the arc interrupter chambers. These plates are stacked as shown in figure 4.

The twelve 1/8-inch plates have a slot cut on one end to form exhaust ports. Each arc interruption causes some erosion of these slots. Plates should be replaced when the arc interrupter chamber wall is reduced to 3/4-inch, measured along the shortest side of the exhaust port slot, as illustrated in figure 5.

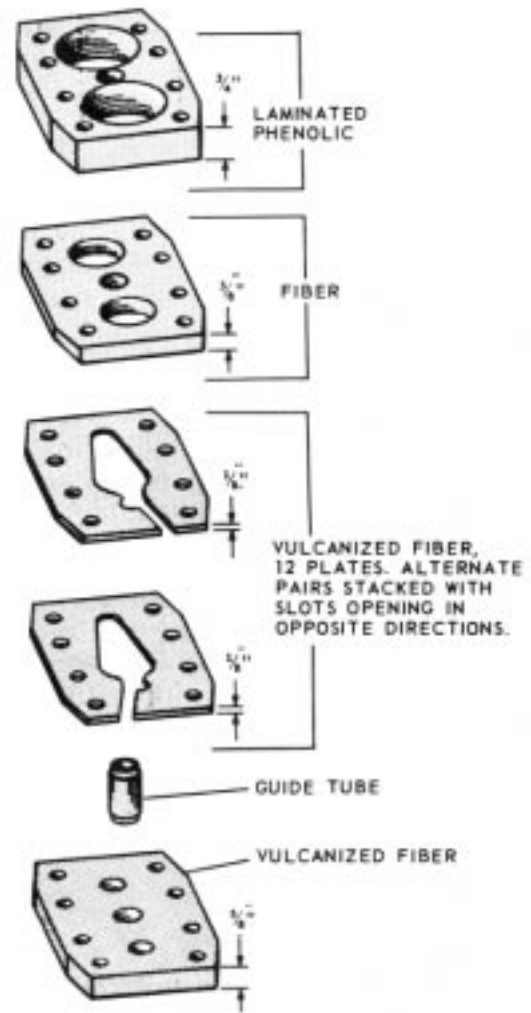


Figure 4

Fiber parts of arc interrupter assembly.
Reclosers below serial No. 1001

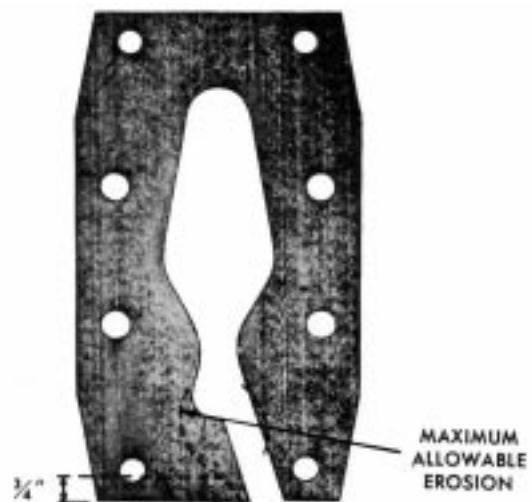


Figure 5

Vulcanized fiber plate from interrupter assembly.
Reclosers below serial No. 1001

GENERAL MAINTENANCE INFORMATION- CONT'D.

Erosion of the slots in the fiber plates results in longer arcs being drawn. Greater arc energy must then be dissipated during each interruption. Test results indicate the Type WE can successfully interrupt rated current when the arc chamber wall is reduced to the above 3/4-inch dimension. Therefore, if fault currents are well below maximum rated currents, some further erosion can be tolerated. If any plates require replacement the entire stock should be replaced with a new style assembly, item number 12, page 22.

(Reclosers Above Serial No. 1000)

The insignificant cost of the fiber plates making up the arc interrupter chambers on all reclosers above serial no. 1000 permits complete replacement whenever the stationary contacts are replaced. A visual comparison of bottom and top plates will indicate necessity for replacement. The top plates closest to the stationary contacts and nearest to the most arcing will show enough erosion to provide a decision for replacement.

7. CLEAN ALL INTERNAL COMPONENTS

Remove all carbon traces by wiping with a clean, lint-free cloth. Pay particular attention to all insulating members. Flush the mechanism with clean, dry transformer oil.

CAUTION: Never use volatile solutions, detergents, or water-soluble cleaners.

8. DRAIN OLD OIL

Remove the 1/2-inch pipe plug at the bottom of the tank, or open the tank valve if one has been installed. Rinse the tank with clean oil, and wipe out all carbon traces with a clean lint-free cloth.

9. INSPECT TANK LINERS

Any soft or spongy areas in the liners indicate moisture has been absorbed. These areas are most likely to occur near the bottom of the tank. When replacing liners, be sure the new liner installed in each section is the same size as the original.

If interrupting duty is severe, the tank liners may be eroded near the exhaust ports of the arc interrupting structures. Replace any liners that show appreciable erosion.

NOTE: For reclosers below Serial No. 1001 the replacement liners come in a kit as part number KA829W. For reclosers above serial number 1000, replacement liners come in a kit, as part number KA867R.

10. CHECK CIRCUIT COMPONENTS ATTACHED TO THE RECLOSER COVER, FRAME, AND OPERATING MECHANISM

These components are identified in figures 23, 30 and 33. Be sure all wiring to the terminal strip is secure at each terminal. The rotary solenoid and trip solenoid should be firmly attached to the recloser frame.

Check mercury switches attached to the counter shaft and main shaft. They should be securely held in place by the nylon mounting straps. Check the microswitch mounted above the main shaft. It should be firmly held in place by the mounting bracket. Check bushing current transformers. See that wiring is in order.

11. FILL TANK WITH OIL

Use only new transformer oil with dielectric strength of at least 26 kv, as measured across a standard 0.1-inch gap in accordance with methods presented in ASTM Publication D117. The oil level should be 2-1/4 inches from the top of the tank with the mechanism removed. The level can be double checked with the oil level gauge after the mechanisms and head casting have been fastened in place. The capacity of the tank is approximately 38 gallons.

12. REPLACE TANK

Clean the O-ring head gasket and the tank gasket seat. Move the control lever to the closed position to avoid any possible binding while raising the tank. Raise the tank and secure it to the head casting with the ten head bolts.

13. CHECK LOCKOUT LEVER AND CONTACT POSITION INDICATOR

Correct operation of these components can be observed by manually operating the recloser.

14. MANUAL OPERATION

Remove the closing tool port cover and gasket and insert a KA90R closing tool. Manual operation can now be achieved by closing with the KA90R tool and tripping the recloser with the lockout lever. See figure 6.

CAUTION: Never use the KA90R tool on an energized recloser.

If a Type WE is to be tripped out of oil, use the closing tool to open the contacts. While one person turns the tool clockwise against the stop, another can move the trip lever, shown in figure 7, to the right. Now let the tool slowly rotate counterclockwise to open the contacts. Replace port cover and gasket when manual operation is completed.

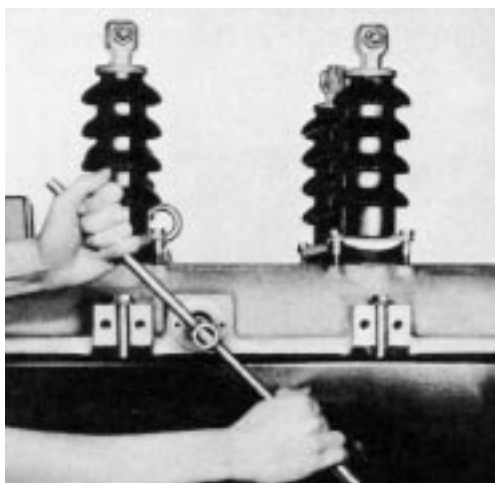


Figure 6

Rotating the KA90R tool clockwise to manually close the recloser.

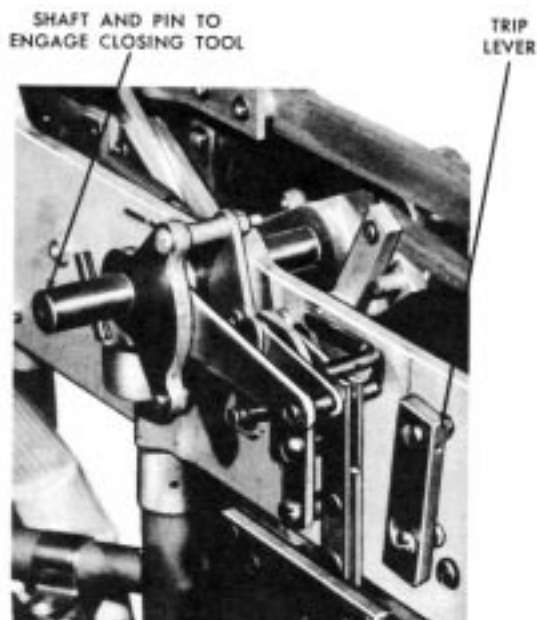


Figure 7

Move trip lever to the right to release recloser when opening with closing tool.

15. CONNECT CONTROL CABLE TO RECEPTACLE ON RECLOSER HEAD CASTING

Place recloser in service according to procedures outlined in the Type WE Installation Manual, bulletin 281-25SA-1.

NOTE: Electronic control can be checked out with or without recloser in service. Periodic operational checks can be made according to the control service manual.

SHOP MAINTENANCE

When shop maintenance or repairs are to be performed, remove the ten bolts that secure the head casting to the tank. With suitable hoist, raise the recloser mechanism out of the oil and allow it to drain. The recloser can be left suspended by the hoist, inverted and placed on a workbench, or the mechanism frame ends can be supported by a special rack.

ARC INTERRUPTING ASSEMBLY (Reclosers below Serial No. 1001)

After the Type WE recloser has operated through a complete duty cycle, the arc interrupter assembly should be completely dismantled and any worn parts replaced.

1. Using a 1/2-inch thin-wall socket, remove selflocking hexnut that secures the contact yoke to the lift rod, figure 8. Gently tap contact arm to remove contacts from the lift rod. Pin in the rod must be aligned with a slot in the contact yoke.
2. Disconnect the heavy braided lead from the top of each stationary contact assembly.
3. Remove hexnuts, flat washers, and lock washers from the bottom of interrupter assembly.

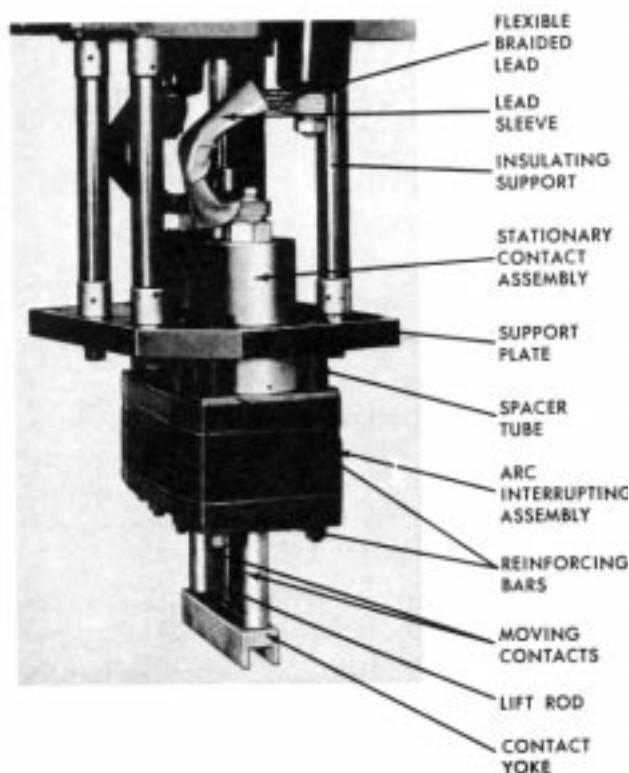


Figure 8

Exhaust side of interrupter housing. Note position of reinforcing plates. (Reclosers below serial no. 1001)

SHOP MAINTENANCE (CONT'D.)

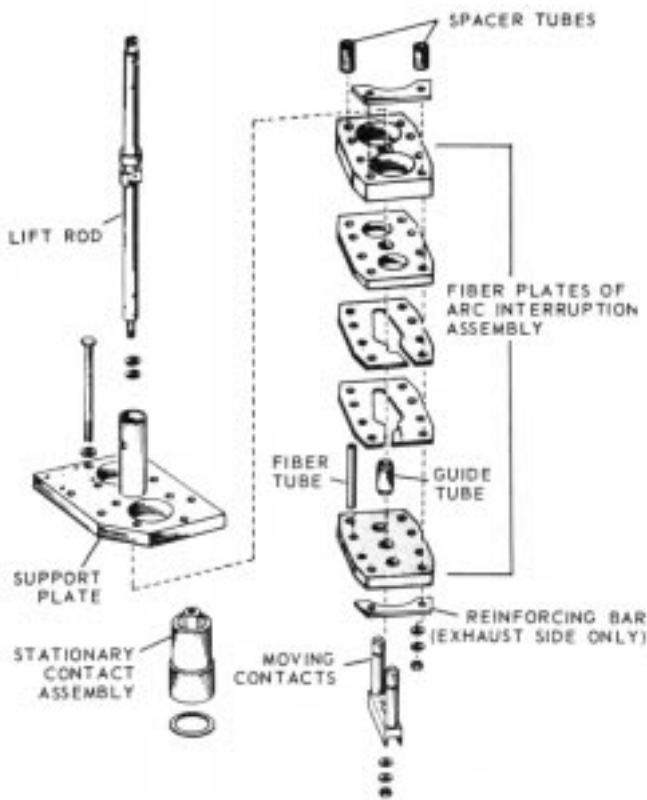


Figure 9
Components of arc interrupter assembly.
(Reclosers below serial no. 1001)

4. Slide the arc interrupter assembly downward. Figure 9 shows the individual parts in the order of removal.
5. Examine the stationary contact segments to determine if arc erosion has spread to the load contact surfaces. If so, replace the entire stationary contact assembly or, where erosion is less severe, the contact segments only.
6. Clamp the large end of the fiber tube in a smooth-jaw vise. Apply sufficient pressure to deform the tube slightly to create a hold on the contact receptacle. With an adjustable wrench, turn the large terminal nut counterclockwise to loosen it from the opposite end of the stationary contact assembly.

Engage a large screwdriver in the slotted contact stud located inside the contact assembly. The large terminal nut can now be removed completely.

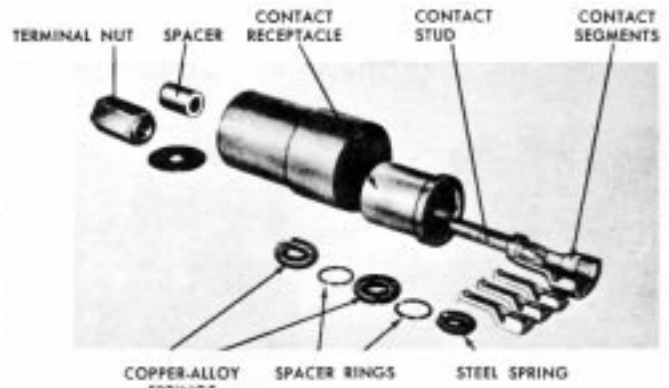


FIGURE 11

Figure 10
Components of stationary contact assembly.
(Reclosers below serial no. 1001)

Pull and turn the contact segments to remove them. Figure 10 shows the contact assembly completely dismantled.

7. To reassemble stationary contacts, arrange the six segments so they are hooked to the slotted head of the contact stud. Use a rubber band to hold them in place while installing springs. Slip the steel spring on followed, in order, by a spacer ring, copper-alloy spring, spacer ring, and the second copper-alloy spring.

Insert segments in the contact receptacle, figure 11, by twisting and pushing. Replace the contact receptacle in the fiber tube. Position the washer on the opposite end and secure the entire assembly with the terminal nut. Use the large screwdriver to hold the contact stud while tightening the large terminal nut.



Figure 11
Assembling stationary contact.
(Reclosers below serial no. 1001)

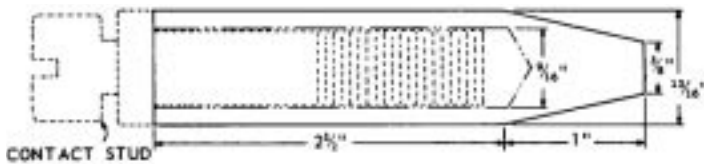


Figure 12

Dimensions of sleeve for installing steel spring on stationary contact assembly on reclosers below serial no. 1001

NOTE: Installation of the steel spring on each stationary contact assembly can be simplified by the use of a tapered wooden sleeve easily made in any woodworking shop. Turn and drill a piece dimensioned as shown in the sketch of figure 12. Slip the sleeve over the end of the heavy screw and roll the steel spring in place.

8. Refer to periodic maintenance, page 5, to determine if the twelve slotted 1/8-inch fiber plates and the laminated 3/8-inch phenolic plates should be replaced.

9. Examine the insulating supports for evidence of tracking or moisture absorption. Replace any defective members as follows:

Remove the hexnuts, lock washers, and flat washers that secure the phenolic contact support plate to the insulating supports. Loosen defective supports with pliers and remove. Install new members as required and reassemble.

10. If the fiber plates are not to be replaced, refer to figure 9, and reassemble the interrupter in the following order:

a. Position stationary contact assemblies on top plates. Be sure to include the gasket between these parts. Note that stationary contact tubes are identical. Slide them into position on the eight bolts.

b. Install slotted fiber plates in pairs to form six exhaust ports in each interrupter assembly. Exhaust ports open to the load side on the end phases and to the source side on the center phase.

c. Slip the fiber tubes over the four center bolts and push up through the slotted fiber plates.

d. Match the guide bushing with the center hole of the bottom plate and position the plate. Replace the flat washers, lock washers, and hexnuts on the mounting bolts.

Be sure reinforcing bars are placed on the exhaust end. Then install the moving contacts on the plunger shaft.

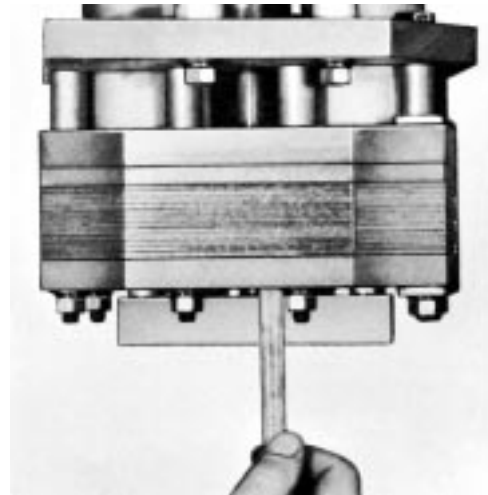


Figure 13

Checking for correct moving contact clearance between contact arm and fiber plate.
(Reclosers below serial No. 1001)

e. Check moving contact clearance as shown in figure 13, measuring from the top of the contact yoke to the bottom of the interrupter assembly. This space should be no less than 1/64, and no greater than 5/64" when the KA90R closing tool is turned clockwise against the stop.

If the space should be adjusted, add or subtract one or more washers above the roll pin in the plunger shaft to obtain the correct measurement. Any washers not placed above the roll pin should be retained between the contact yoke and the elastic stop nut.

If the fiber plates are to be replaced, the new style self-blast interrupter repair kit (item 12, page 22) should be used. The assembly procedure is the same as for the old style, except that the guide bushing and the insulating tubes for the four middle holes are not used.

ARC INTERRUPTER ASSEMBLY (Units above Serial No. 1000)

After the W recloser has operated through a complete duty cycle; the arc interrupter assembly should be completely dismantled and any worn parts replaced.

1. Using a 1/2-inch thin wall socket, remove the vibration-proof hex nut that secures the contact yoke to the lift rod. Gently tap contact arm to remove contacts from the lift rod.

2. Remove the terminal bolt from the top of each stationary contact assembly.

3. Remove hex nuts, flat washers, and lock washers from bottom of interrupter assembly.

SHOP MAINTENANCE (CONT'D.)

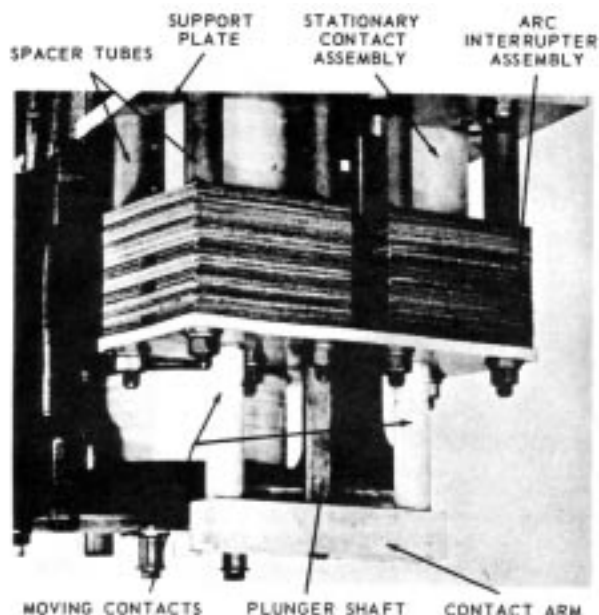


Figure 14
Arc interrupting assembly.
Reclosers above serial no. 1000

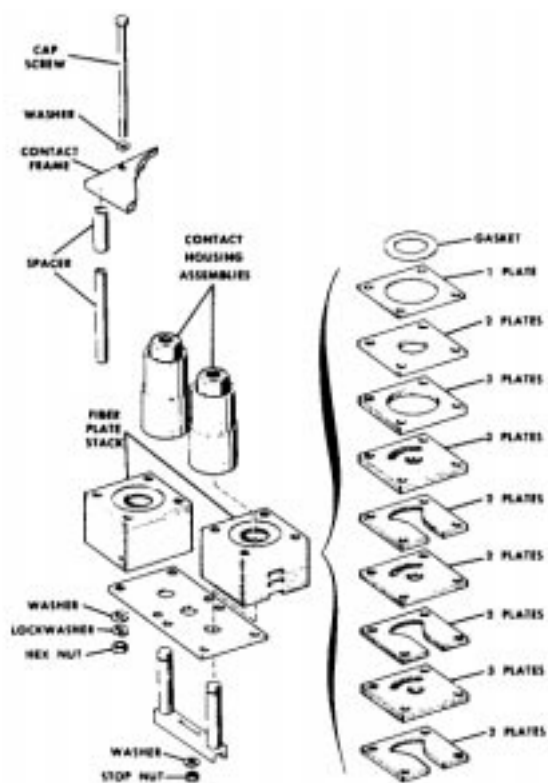


Figure 15
Components of arc interrupter assembly.
reclosers above serial no 1000

4. Slide the arc interrupter assembly downward. Figure 15 shows the individual parts in the order of removal.
5. Examine the stationary contact segments to determine if arc erosion has spread to the load contact surfaces. If so, the contact segments only, or the entire stationary contact assembly should be replaced.
6. Insert a large screwdriver through the stationary contacts to engage the fillister screw slot. With a box wrench, loosen and remove the contact nut while the special screwdriver is held securely in a vise. Remove contact arms, contact cup, and retaining washer, leaving the retaining ring which rests in a slot on the inside of the tube. Figure 16 shows a dismantled stationary contact assembly.
7. To reassemble the stationary contacts slip the contact retainer onto the fillister head cap screw and arrange the six contact segments around the screw and retainer. Each of the six teeth on the retainer should fit into a hole on a contact segment. Place the garter spring, contact springs, and spring spacers over the small end of the assembly in the following order: garter spring, spring spacer, contact spring, spring spacer, and contact spring. Insert this assembly into the contact cup by twisting in clockwise. Then push the cup and contacts into the large end of the tube. Insert the retaining washer and contact nut from the opposite end. Use the large screwdriver to hold the fillister head cap screw while the contact nut is tightened.

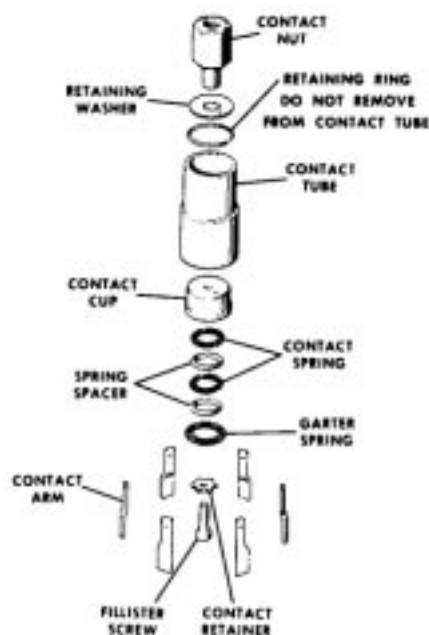


Figure 16
Stationary contact assembly components
Reclosers above serial no. 1000

8. Replace the fiber plates in the arc interruption assembly if necessary. Refer to periodic maintenance, page 6, for the method of determining when these plates should be replaced.

9. Examine the insulating support stringers for evidence of tracking or moisture absorption. Failure of these members is rare, but if any show tracking, replace as follows:

- a. Disconnect the lead attached to the series trip solenoid coil tube.
- b. Remove the hex nuts, lock washers, and flat washers that secure the phenolic contact support plate to the stringers.

NOTE: When this plate is lowered, the series trip solenoid plunger will slide out.

c. Loosen the stringers with pliers and remove.

d. Install new members as required and reassemble.

10. Refer to figure 15 and reassemble the interrupter in the following order:

- a. Place the fiber plates in two stacks on top of the bottom plate, in the order shown in figure 15. Make sure that the gasket is included. The exhaust ports open to the outside of the assembly.
- b. Drop the long spacer tubes into the corner holes of the two stacks. The lower end of each spacer tube should be flush with the lower surface of the bottom plate. Place the short spacer tubes over the portions of the long spacer tubes which protrude from the stacks.
- c. Position the stationary contact assemblies on top of the two stacks.
- d. Place the assembly in position on the contact frame and secure it with the eight mounting bolts. Reconnect the leads to the contact nuts.
- e. Install the moving contacts on the lift rod.

NOTE: No clearance adjustment between moving contact and interrupter necessary for new style interrupters furnished for service.

CLOSING SOLENOID

Little maintenance is required for the closing solenoid. However, if the recloser is to be operated at another voltage, replace the solenoid coil as follows:

1. Disconnect the two coil leads from the closing solenoid contactor, figure 17.
2. Remove four capscrews on the bottom of the solenoid frame and lower the coil and base plate. Lift the coil from the base plate.

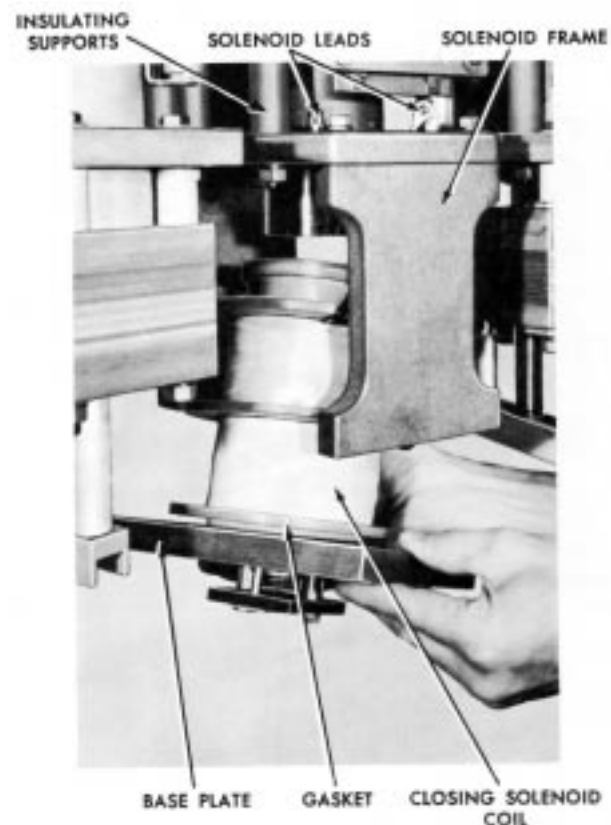


Figure 17
Removing closing solenoid coil.

3. Examine the insulating supports for evidence of tracking or moisture absorption. Replace any defective members as follows:

Remove the hexnuts, lock washers, and flat washers that secure the solenoid frame to the supports. Then lower the solenoid frame slowly to avoid damaging the closing plunger. Loosen defective supports with pliers and remove. Install new members as required and reassemble.

4. Install the closing solenoid. Be sure to use a new gasket between the coil and solenoid base plate. Also see that solenoid leads clear insulating supports and the solenoid frame by at least 1/2-inch.

CLOSING SOLENOID CONTACTOR

If the double-break contacts of the closing-solenoid contactor require replacement, install an entire new closing-solenoid contactor as follows:

1. Disconnect closing solenoid and fuse leads from contactor.

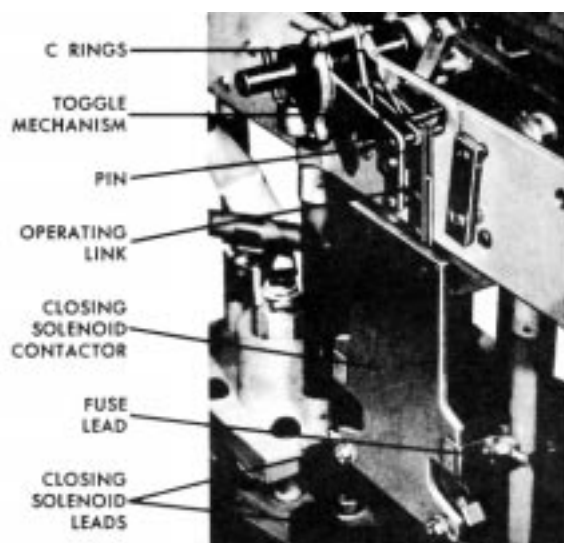
SHOP MAINTENANCE - CONT'D

Figure 18

Releasing contact operating rod of closing solenoid contactor from toggle mechanism.

2. Remove three C rings to release pin that connects the operating link to the toggle mechanism, figure 18. Two C rings are between the operating link and toggle mechanism. The third is located on the outer end of the pin.
3. With a long nose pliers, release the springs between the operating link and toggle from the pin. Then push pin through toggle mechanism and operating link.
4. Remove the three hexhead cap screws that secure the contactor to the underside of the recloser frame. Contactor is now free to be removed.
5. Replace the contactor by reversing the above procedure. Use new C rings on toggle-mechanism pin. Be sure closing-solenoid and fuse leads clear insulating supports and grounded parts by at least 1/2-inch.

CAUTION: Fuse leads must be connected to upper terminals of contactor.

CLOSING SOLENOID

To replace a blown closing solenoid fuse, simply disconnect the long lead at the closing-solenoid contactor, the short lead at the fuse end, and loosen the mounting strap. Slide out the fuse and install a new one.

A tag attached to each closing solenoid coil shows the color band coding and catalog number of the correct fuse to protect the coil. Table I also shows this information. Be sure fuse leads clear any grounded parts and insulating supports by 1/2 inch.

TABLE 1

Closing Solenoid Phase-to-Phase Voltage, kv	Fuse Catalog Number*	Color Band	TCC Number (See figure 19)
2.4 and 3.3	KA259R-4	Two Red	6
4.16 to 4.8 and 6.0	KA259R-1	Black	5
7.2 to 8.32 and 11.0	KA259R-2	Yellow	3
12.0 to 14.4	KA259R-3	Red	2

*Two fuses are required to protect the distribution system from closing coil failure.

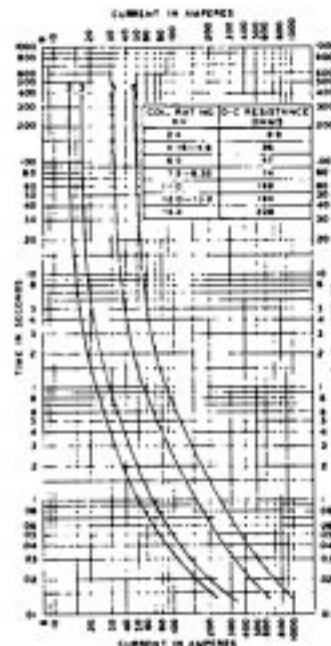


Figure 19

Fuse time-current characteristics for protection of closing solenoid.

BUSHINGS

Maintenance of bushings is generally limited to an occasional cleaning. However, if a bushing should become cracked or broken, replace it as follows:

1. Remove hexnut, lock washer, and flat washers on the lower end of the bushing to release the four flexible straps.
2. Remove the three hexhead cap screws that secure the bushing clamps to the head casting. Lift the bushing assembly up through the head casting.
3. An aluminum clamping ring cushions the pressure between the bushing and bushing clamps. If it is in good condition, the ring can be reused. Twist the ring and slip it from the bushing.
4. Now the bushing assembly can be replaced completely or new porcelain only may be installed. If

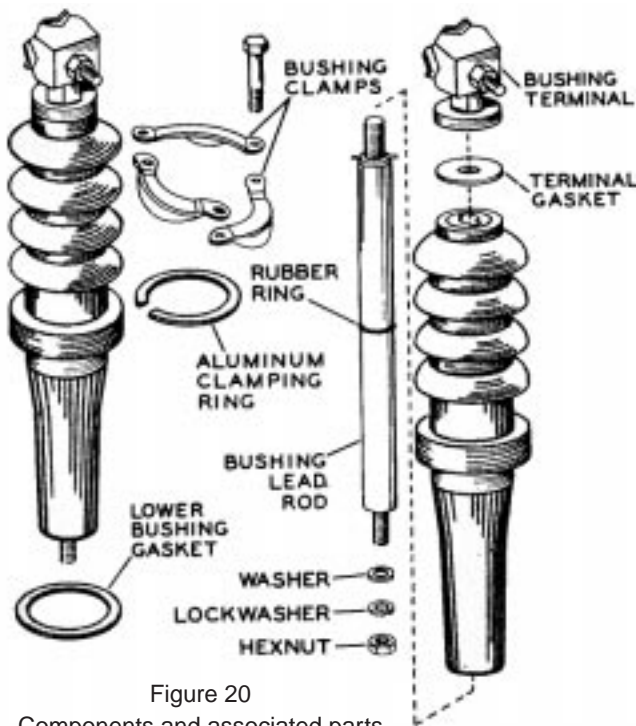


Figure 20
Components and associated parts
of bushing assemblies.

new porcelain is to be used, unscrew the bushing terminal and draw the bushing lead rod from the lower end of the porcelain. Insert the rod in the new porcelain and replace the bushing terminal. Be sure to use a new terminal gasket, figure 20.

5. Replace the bushing assembly, using a new gasket between the bushing and the head casting. When securing the bushing clamps, be sure to tighten the three bolts evenly a little at a time.

CAUTION: When reconnecting bushings position flexible leads at least 1/2 inch from any vertical insulating support, grounded part, or contact plunger rod.

REMOVAL OF HEAD CASTING

Access to components located in or on the main frame such as the operating mechanism, mercury switches, trip solenoid, rotary solenoid, and internal wiring, is achieved by removing the head casting. Proceed as follows:

1. Disconnect all bushing leads at the lower end of the bushings.
2. Disengage the lockout lever and the contact position indicator by pushing the spring-loaded couplers inward. Refer to figure 21. Turn the couplers to lock them in the disengaged position.



Figure 21
Spring-loaded sleeves of lockout lever and contact position indicator in engaged positions.

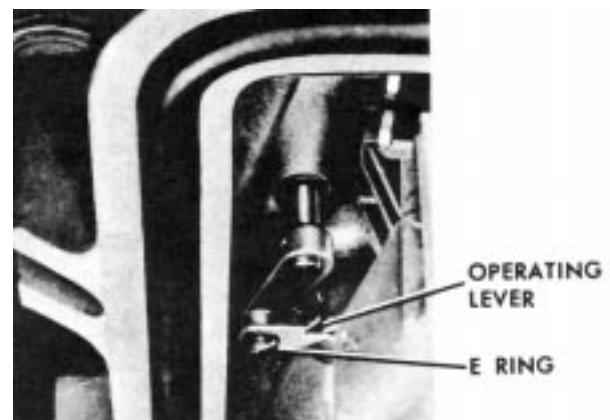


Figure 22
Auxiliary switch disconnection from operating lever
before removal of head casting from
operating mechanism.

3. If an auxiliary switch accessory is mounted on the recloser head casting, remove the E ring and washer, figure 22, to allow disconnection of the operating lever.
4. Remove the two screws that secure the 0.2-MFD capacitor to the load side of the recloser frame.

SHOP MAINTENANCE - CONT'D

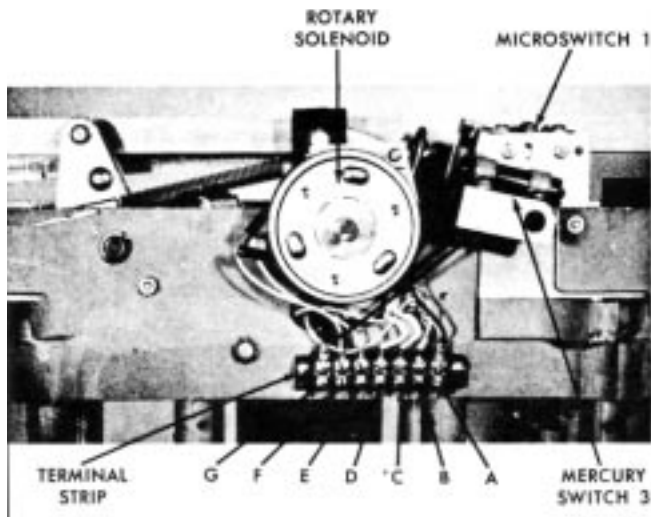


Figure 23

Terminal strip attached to recloser frame.

5. Disconnect the seven leads connected to the lower terminal strip of the terminal block attached to the recloser frame, figure 23. Be sure to label these seven leads corresponding to the terminals from which they are disconnected. Terminals are lettered A through G. *right to left*.

Remove the screw that secures the nylon leadstrap to the frame above the terminal block.

6. Remove the six 1/2" x 4-1/2" hexsocket head bolts that secure the frame to the head casting. Be sure the recloser mechanism is supported from below before these bolts are removed. Six tubular spacers and lock washers will be released when the bolts are removed and the head is lifted from the recloser-mechanism frame. Figure 24 shows head casting and associated components removed from the mechanism frame.

7. To reassemble, carefully lower head casting in place with the six tubular spacers placed on the lugs. Start the six 1/2" bolts and tighten evenly to avoid any binding of the mechanism.

8. Engage the contact indicator and lockout lever. Reconnect the operating lever of the auxiliary switch if used.

9. Attach 0.2-MFD capacitor to the recloser frame. Reconnect bushing leads. Be sure bushing leads are positioned as described in the cautionary note under step 5 page 13.

10. Connect wiring from bushing CT's and cable receptacle to respective terminals on the terminal block. Attach nylon lead-strap to recloser frame.

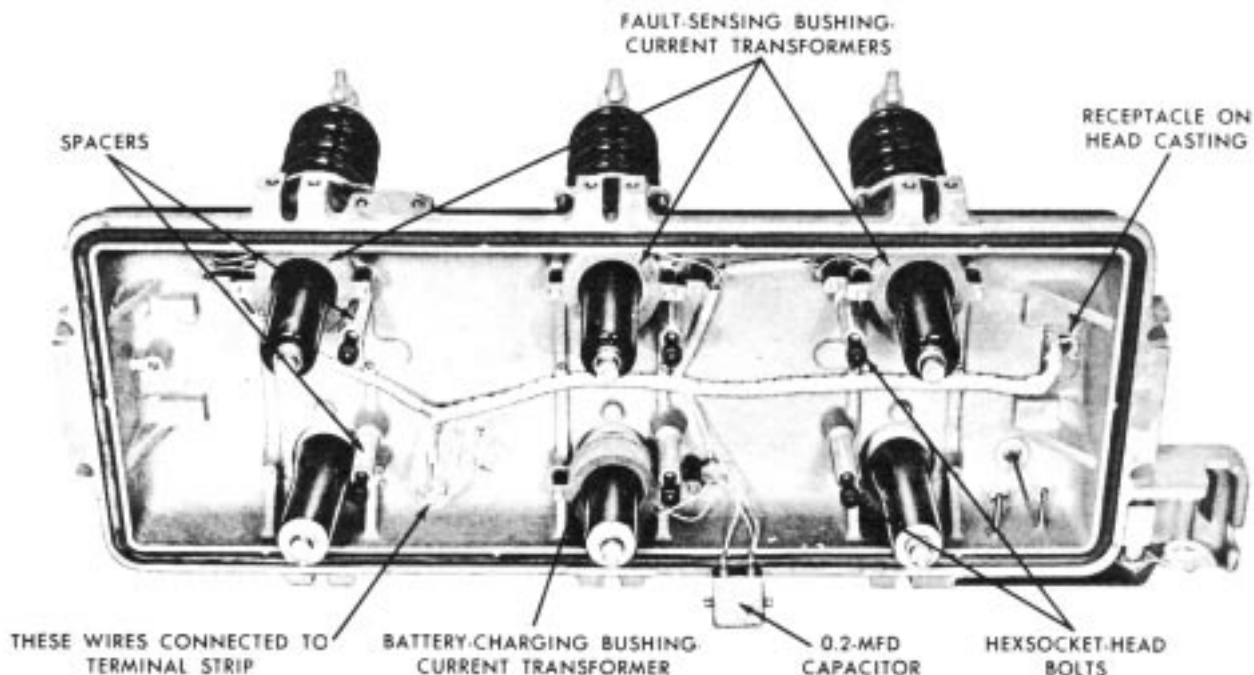


Figure 24

Head casting detached from operating mechanism. Hexsocket-head bolts have been attached to head casting for illustrative purposes.

MECHANISM

The head mechanism performs the actual opening and closing operations in response to signals from the electronic control. Contact opening is initiated by a trip coil. Contact closing is performed by the closing coil, mounted below the mechanism. The basic lever arrangement in the mechanism is shown here.

With the contacts closed, figure 25, the opening springs are fully extended. The trip coil push rod rests up against the toggle latch and when the trip coil is energized, the toggle opens, figure 26. The contact-and-toggle-support assembly and the contact-and-trip-arm assembly rotate on their shafts and begin to push the contacts open. As the opening springs rotate the contact-and-trip-arm assembly past this point, figure 27, the trip arm moves the reset trip lever, which releases the reset lever. The reset lever is rotated by a spring and snaps the toggle closed. This motion of the reset lever also pulls the plunger out of the closing coil. At this point the contacts are completely open.

The closing coil is energized by a signal to the rotary solenoid on the side of the mechanism. The solenoid closes the closing solenoid contactor, which energizes the coil. The plunger is drawn into the coil and the reset lever is pulled back, figure 28, to its original position, at the same time closing the contacts. The mechanism is then ready for another cycle.

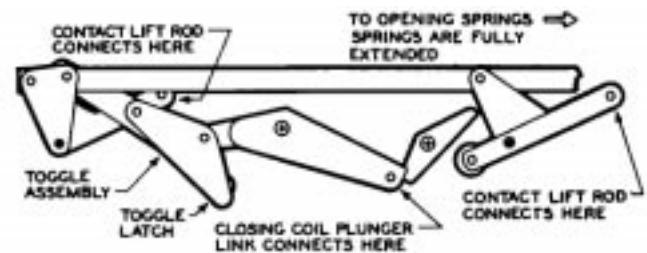


Figure 25
Contacts closed.

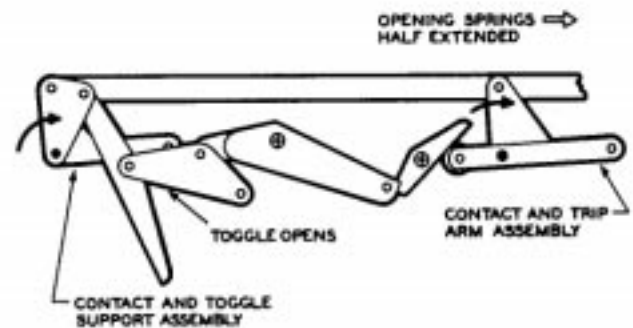


Figure 26
Contacts open halfway.

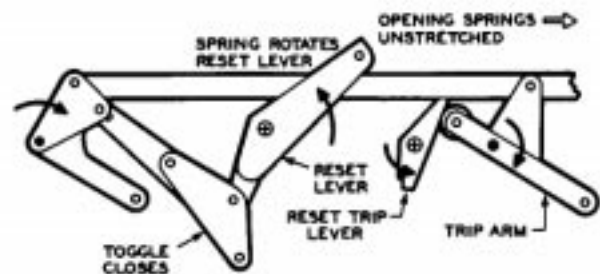


Figure 27
Contacts fully open.

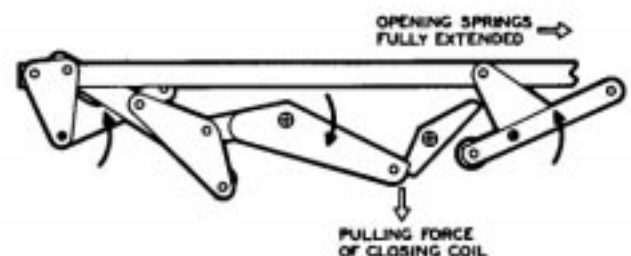


Figure 28
Contacts reclosed.

RATING CHANGES

Type WE reclosers' continuous current rating and minimum-trip values can be changed in the field as described in the control installation manual. Closing solenoid coils are available for eight voltage ranges from 2.4 to 14.4 kv.

Two d-c coils rated at 125- and 250-volts dc also are available for use on the Type WE. When the closing solenoid coil is changed, as described on page 11, the protective fuses may also require replacement. Two fuses are shipped with each replacement coil. Fuse and coil data are given on page 12.

ADJUSTMENTS

Refer to the control installation manual bulletin 281-27SA-1, for information about operations to lockout, reclosing time, phase-trip sequence, minimum-trip values, resetting time, ground-trip sequence, phase-trip timing and ground-trip timing.

ADJUSTMENTS - CONT'D

CONTROL LEVER OVERTRAVEL ADJUSTMENT

Check for proper adjustment of the control lever by first removing the sleet hood cover to expose the control lever. From the OPEN position, slowly push the control lever toward the CLOSED position. As the lever is pushed up, latching of the recloser will be felt. At this point dimension a of figure 29 should be 1/4 inch.

If the control lever is not adjusted properly, open the C ring and remove it with diagonal cutters. Then slide the control lever from the shaft. Rotate the control lever clockwise to reduce dimension a or counter-clockwise to increase dimension a. Reassemble by reversing the procedure when the correct clearance has been set.

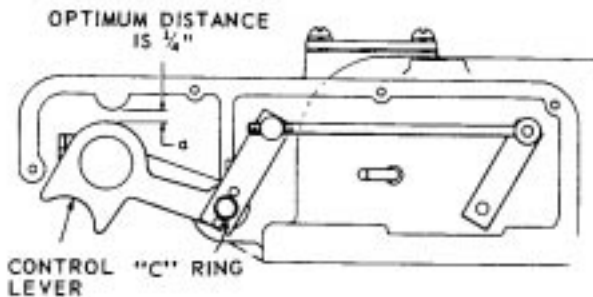


Figure 29
Overtravel adjustment of manual lockout lever.

OPERATIONAL CHECKS

Circuit components attached to the recloser cover, frame and operating mechanism require no maintenance and should provide trouble-free operation. However, if the Type WE recloser fails to operate properly, perform these steps:

1. check out the control cable for continuity between ends,
2. test the circuit components associated with the recloser mechanism as described below, and
3. check the electronic control as described in the electronic control Service Manual, Bulletin No. 281-27SB-1.

The Type WE should be checked out in this order. An ohmmeter-voltmeter such as the Triplet Model M30, which was used as a reference for the following tests, is the only equipment necessary for steps 1 and 2.

CONTROL CABLE

Remove the recloser from service as described on page 4 if not already disconnected. Then detach the control cable from the receptacles on the recloser cover and underside of the electronic control housing. With the ohmmeter, check for continuity between cable pins and pin sockets. Pins and pin sockets are identified on each cable end.

A zero reading indicates continuity; an infinite reading indicates an open circuit. If an open circuit is discovered, the cable can be reinstalled after the open-circuited lead is repaired or replaced. Continuity between unlike pins or sockets indicates a short circuit. Pins and sockets of the control cable designated N and P are not used.

CIRCUIT COMPONENTS

Refer to figures 23, 30, 31, 32, 33 and 36 for identification of microswitch 1, mercury switches 2 and 3, rotary solenoid, trip solenoid, bushing current transformers, terminal strip, and the configuration of pinsockets of the control-cable receptacle on the head casting. The components are checked out under the three following conditions:

1. Recloser *contacts open* and manual control lever *down*
 - a. All measurements are made from the pin-sockets of the control-cable receptacle.
 - b. Connect ohmmeter probes to sockets A and B. The ohmmeter should read approximately 9.5 ohms. If not, difficulty may be present in the trip solenoid.

NOTE: Readings within ± 15 percent of suggested readings are sufficient to indicate components are trouble free.

- c. Transfer ohmmeter probes to sockets E and F. Reading of 19 ohms indicates rotary solenoid should be trouble free.
 - d. Insert ohmmeter common probe into socket K. Insert the positive probe into sockets G. H. then J. All three readings should be 7 ohms. If not, corresponding sensing current transformer may be faulty. Check bushing CT's for ratio and polarity as described in the test procedure on page 19.
 - e. With ohmmeter common probe still inserted in socket K, insert positive probe into socket L. ohmmeter should read 1000 ohms. If a reading of zero ohms is obtained, the 0.2-MFD capacitor may be short circuited. Readings deviating from 1000 ohms outside a 20 percent tolerance indicate damaged resistor or transformer winding.

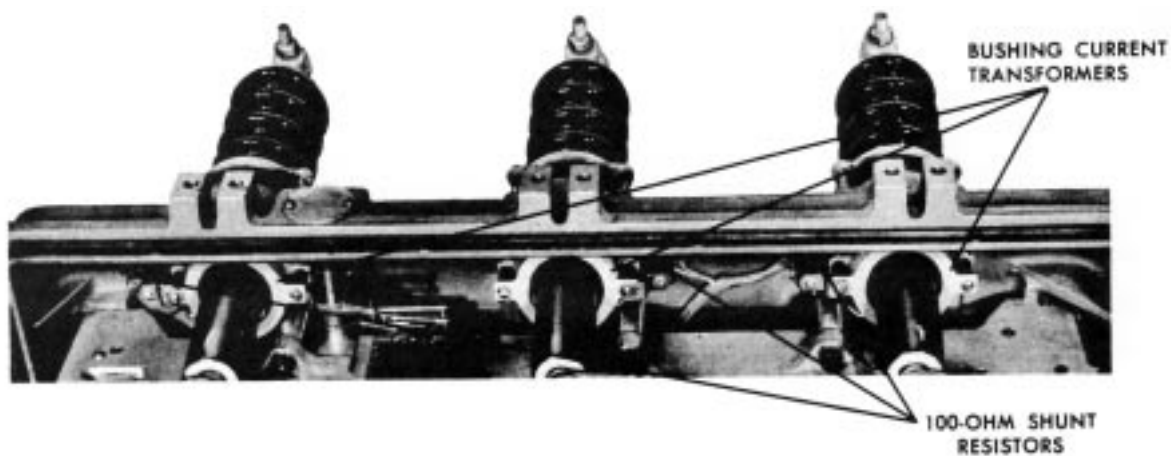


Figure 30

View of fault-sensing bushing-current transformers located on source side of recloser. Battery-charging current transformer is located on center-phase load side, except for these combinations:

1. 100 ampere phase-trip resistors, 2.4 kv or 4.16 kv to 4.8 kv closing solenoids

2. 140 ampere phase-trip resistors, 2.4 kv closing solenoid.

For these combinations the sensing transformers are located on the load side of the recloser while the battery-charging transformer is located on the center-phase source-side bushing.

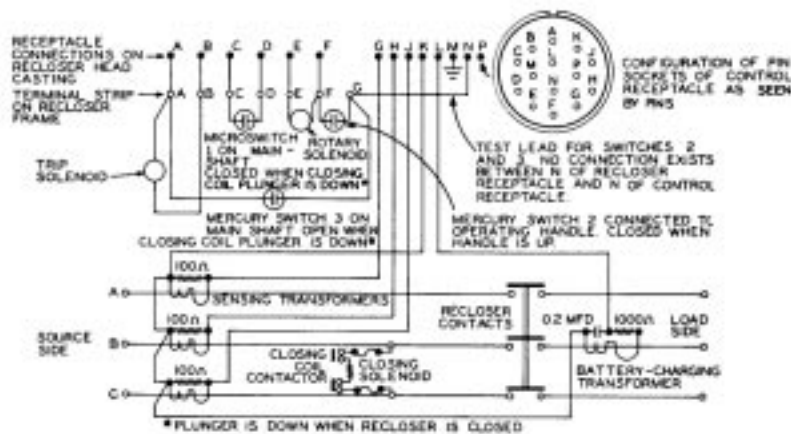


Figure 31

Internal wiring of Type WE recloser. Terminals on recloser terminal strip are lettered right to left, A through G. Terminals on terminal strip in this diagram are lettered left to right, A through G, for explanatory purposes. Pin N of the control-cable receptacle is connected to terminal G of the terminal strip on the recloser frame to facilitate testing of mercury switches 2 and 3.

- f. Transfer ohmmeter probes to sockets C and D. Infinite ohms should be read indicating microswitch 1 is open-circuited. If not, the mercury switch is faulty, but should be rechecked before replacing.

NOTE: Mercury switch and microswitch positions for combinations of control-lever and recloser-contact positions are tabulated on page 18.

- g. Transfer ohmmeter probes to sockets F and A. The ohmmeter should read infinite ohms. If not, mercury switch 2 may be faulty. Individual checks on mercury switches 2 and 3 can be made by means of pin-sockets N, F, and A.

2. Recloser contacts open and manual control lever up

- a. Repeat step f under condition 1. Microswitch 1 should still be open.

OPERATIONAL CHECKS- CONT'D

- b. Transfer ohmmeter leads to sockets F and A. ohmmeter should indicate closed circuit showing that mercury switch 3 has remained closed. Mercury switch 2 should be closed.
- c. Remove ohmmeter probes from terminals F and A. Connect positive lead of the battery (or 25-volt station d-c source) to socket F. Momentarily connect the negative lead to socket E. Rotary solenoid should operate producing an easily distinguished sound. Repeat two or three times. Connect ohm meter across source-side B and C phases; see figure 32 for identification of phases. The ohmmeter should show closing coil continuity (effective d-c resistance of coil when rotary solenoid is energized.) Disconnect d-c source.

NOTE: To check for d-c closing-coil continuity, read value across d-c terminals in junction box.

CAUTION: If the control battery is used as the 25-volt d-c test source, the battery should be connected only as long as is necessary for testing purposes. Lengthy connection across the rotary solenoid will create an excessive drain of energy from the battery, although it has no effect on the solenoid itself. If a station d-c source is used, it can remain connected to sockets E and F from step 2c through completion of testing.

3. Recloser *contacts* closed and manual *control* lever up
- a. With 25-volt d-c source connected across sockets E and F. close the main recloser contacts with the KA90R closing tool, as described on page 6. ohmmeter connected across B and C phases should show loss of continuity indicating that closing-solenoid contactor is open.
 - b. Transfer ohmmeter probes to terminals C and D. Zero ohms indicates that microswitch 1 is operative and closed. Remove KA90R closing tool and ohmmeter leads from receptacle sockets.
 - c. Trip recloser by applying 25 volts d-c across socket A (positive) and socket B (negative). If recloser contacts do not trip open, trip solenoid may be inoperative.

CAUTION: Recloser should be tripped in oil to avoid damage to the dashpot in the arc-interrupting mechanisms.

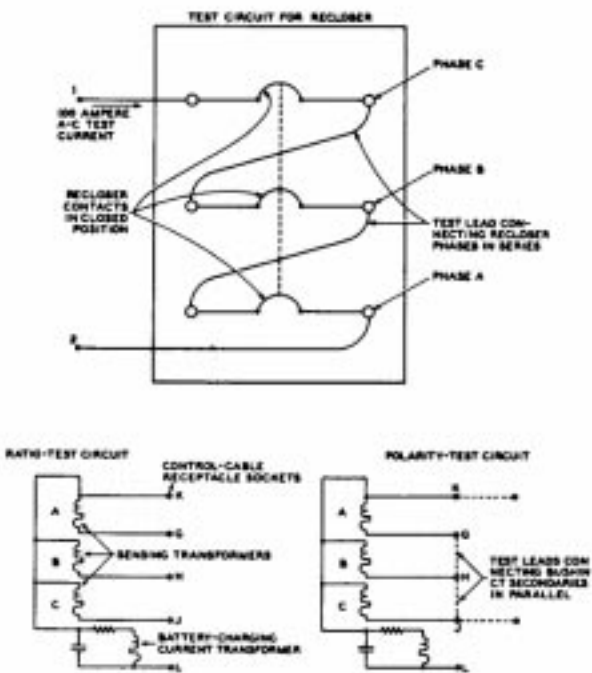


Figure 32
Test circuit for checking bushing current transformers. Ratio and polarity test-circuits shown are the effective circuits that contribute to the testing. Components not having an effect on the current flow are not shown. Dotted lines in the polarity-test circuit are test leads.

TABLE 2

Recloser Contacts	Manual Control Lever	Micro-switch 1	Mercury Switch 2	Mercury Switch 3
OPEN	DOWN	OPEN	OPEN	CLOSED
OPEN	UP	OPEN	CLOSED	CLOSED
CLOSED	UP	CLOSED	CLOSED	OPEN

BUSHING-CURRENT TRANSFORMER TESTS

The sensing transformers and battery-charging transformer can be tested using the circuits shown in figure 32. An a-c ammeter possessing a 0 to 500 milliampere range is required.

Assemble the test circuit as shown in the top drawing of figure 32. Connect the phases in series and close the recloser contacts with the KA90R closing tool as described on page 6. Connect a 1000-ampere a-c test-current supply to points 1 and 2.

CAUTION: Never use the KA90R manual closing tool on an energized recloser.

Ratio Test for Sensing Current Transformers

1. Energize 100-ampere test source.
2. Check current through control-cable receptacle sockets K-G, K-H, and K-J as identified in figure 31. For each sensing bushing CT checked, the milliammeter should indicate 100 milliamperes, + 10 percent. BE SURE TO ALLOW FOR TOLERANCES OF METERING EQUIPMENT. The resistance of certain types of meters is not negligible. It may be necessary to use the 0-100 milliamperes scale, with its lower resistance, rather than the 0-100 milliamperes scale.
3. A 100-ma reading verifies the 1000:1 ratio of the current transformer. If 100-ma is not achieved, bushing CT can be suspected as faulty; but polarity test should be performed. De-energize test source.

Polarity Test for Sensing Current Transformers

1. Connect sockets G, H, and J of the control-cable receptacle in series with jumper leads as indicated in figure 32. The jumper leads connect the secondaries of the current transformers in parallel so that total output current, measured at points K and J, should be 300 ma.
2. Energize a-c test current. Check for 300-ma reading at sockets K and J. Results can indicate either (a) all three bushing current transformers have the same polarity - 300-ma reading, or (b) one bushing current transformer has polarity opposite remaining two—100-ma reading. Should one transformer possess opposite polarity, be sure to refer to the circuit of figure 31 as a guide during further trouble shooting.
3. De-energize a-c test current and remove jumper wires from receptacle sockets.

Output Test for Battery-charging Current Transformer

1. Energize 100-ampere a-c test current.
2. Measure current at sockets K and L of receptacle. Value should fall between 40 and 60 milliamperes.
3. Readings within this range indicate sufficient current to maintain the control battery at the optimum voltage level.

REPLACEMENT INSTRUCTIONS FOR CIRCUIT COMPONENTS

All circuit components associated with the recloser frame, head casting and operating mechanism except the trip solenoid, rotary solenoid, microswitch 1 and mercury switch 2 can be replaced without detaching the recloser mechanism from the head casting. Instructions for replacing bushing CT's, mercury switch 3, and the 0.2-MFD capacitor are given first.

A 100-watt soldering iron will meet all requirements for repair work. When resoldering lead connections, use only resin core solder. M-E will assume no responsibility for components having leads connected by means of acid core solder.

0.2-MFD Capacitor

Label lead connections to the capacitor and proceed as follows:

1. Heat solder joints to disconnect leads.
2. Remove two screws that secure capacitor to recloser frame.
3. Replace by reversing above procedure. Be sure to reconnect leads to proper capacitor terminals.

Battery-Charging Current Transformer

Label lead connections to the current transformer and shunting resistor. Then proceed as follows:

1. With diagonal cutters, clip the leads close to the current transformer.
2. Disconnect the flexible bushing lead.
3. Remove the two screws that secure the current transformer to the head casting. Bushing CT is now free to be removed.
4. Replace current transformer by reversing the above procedure. Be sure to use spacers between the transformer mounting supports. Replacement transformers are equipped with six-inch leads which can be trimmed as required. When splicing connections, be sure the proper leads are connected before soldering. Be sure to wrap all splices with electrical tape and observe soldering precautions recommended above.

Sensing Bushing-Current Transformers

Replacement of phase A, phase B, and phase C current transformers is identical. These transformers are installed as described above under battery-charging transformer instructions.

Mercury Switch 3

Refer to figure 23. Disconnect leads from terminals A and G and proceed as follows:

1. Loosen two screws that secure nylon mounting straps to lever pinned to main reclosing shaft.
2. Slip mercury switch from mounting straps when screws are loosened sufficiently.
3. Be sure to replace mercury switch so that lead wires are furthest from the rotary solenoid. If the end without lead wires is not nearest the rotary solenoid, improper operation of the recloser mechanism will result.

OPERATIONAL CHECKS- CONT'D

Remove Head Casting for Remaining Components

To replace the following components - trip solenoid, microswitch 1, mercury switch 2 and rotary solenoid - the recloser mechanism must be removed from the head casting, as described on page 13.

Mercury Switch 2

Refer to figure 33 and install new switch as follows:

1. Disconnect the leads of the mercury switch from the terminal strip terminals F and G.
2. Remove the four nylon mounting straps that secure the sleeving to the recloser frame.
3. Remove the faulty switch from its mounting straps. With an offset screwdriver, loosen the screws that secure the nylon straps to manual-lockout shaft lever to allow removal of switch 2.
4. Pull the leads through the protective sleeving. Thread the leads of the new mercury switch through the sleeving. Thread both leads at the same time. Leads can be secured to a long wire which can draw the mercury switch leads through the sleeving.

NOTE Switch leads need only be connected between the proper terminals for correct operation. Reversing leads between switch terminals has no effect on recloser operation.

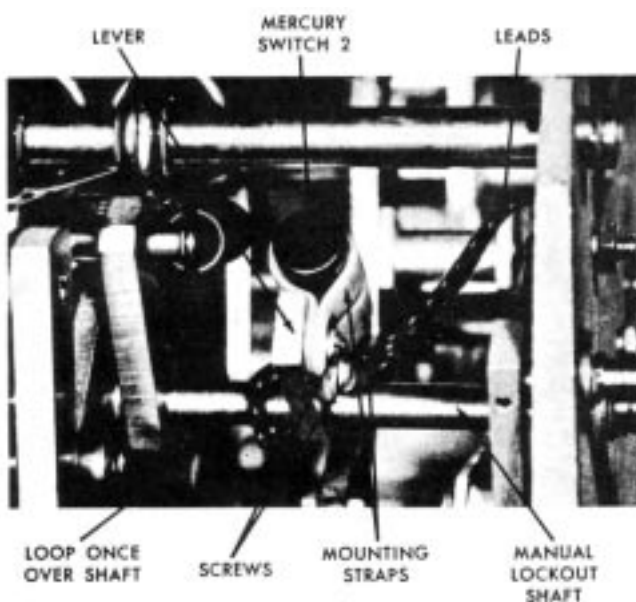


Figure 33
Location of mercury switch 2.

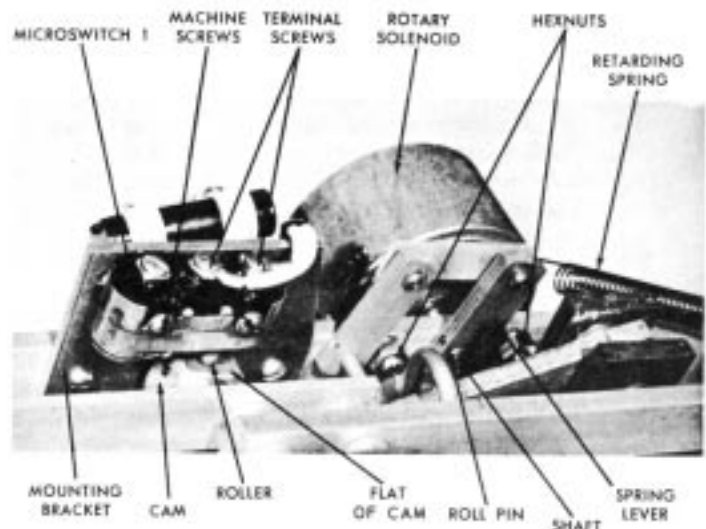


Figure 34
Properly installed microswitch 1.

5. Pass sleeving through mounting straps and tighten to secure sleeving. Connect switch leads to proper terminals. Position switch as shown in figure 33 and secure mounting straps to lever. If switch is positioned opposite to that illustrated in figure 33, the recloser will operate improperly.

Microswitch 1

Refer to figure 34 and proceed as follows:

1. Disconnect the two white leads from the top of the microswitch.
2. Remove two round-head machine screws to release microswitch from mounting bracket. A hexnut and washer will be released from the threaded end of the screw.
3. Attach new microswitch to mounting bracket. Adjust microswitch so that roller lever stop just touches base of switch when roller rides on cam. When roller is off cam, it should just clear flat of cam as shown in figure 34. Tighten machine screws.
4. Reconnect leads to two terminals nearest rotary solenoid as shown.

Rotary Solenoid

Refer to figures 23, 34, and 35 and proceed as follows to replace the rotary solenoid:

1. Drive out the roll pin that secures the spring lever to the rotary-solenoid shaft. Detach retarding spring from cotter pin.

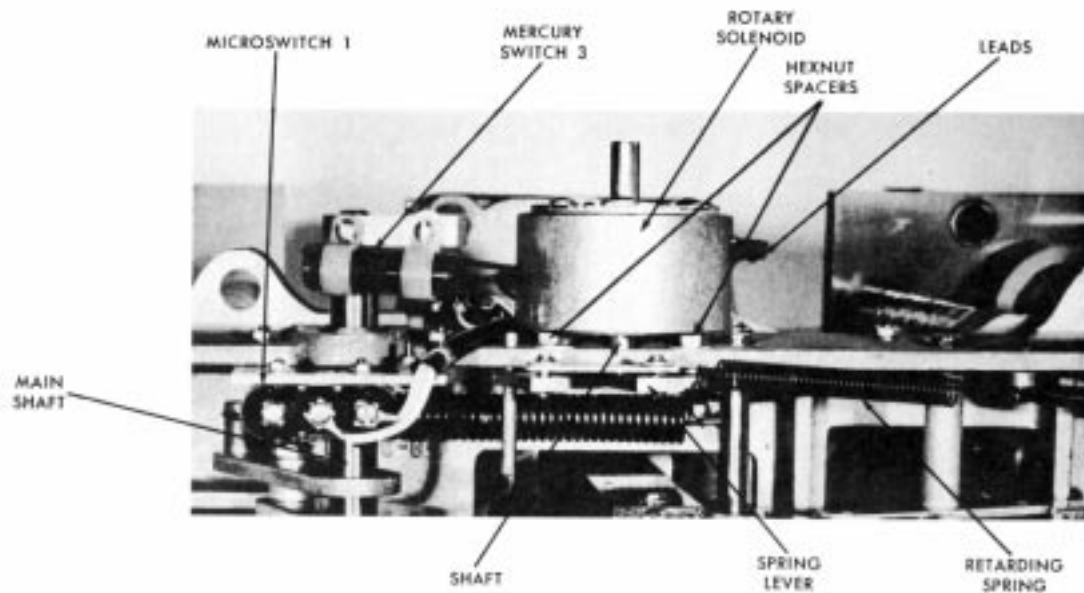


Figure 35
Top view of rotary solenoid and associated components.

2. Remove hexnuts and lock washers that secure the rotary solenoid to the recloser frame. Disconnect solenoid leads from the terminal block and remove rotary solenoid.
3. Remove hexnut spacers and washers from rotary solenoid mounting studs and attach to new solenoid. Install new rotary solenoid by reversing the foregoing procedure. Be sure solenoid leads are connected to correct terminals. Refer to figures 23 and 31.

Trip Solenoid

The trip solenoid, figure 36, is replaced as follows:

1. Disconnect leads from terminals A and B of the terminal block.
2. Loosen the hexnut that secures the nylon mounting strap to allow lead sleeving to slip through freely.
3. Remove two socket-head set screws that secure the trip solenoid to the mounting bracket. Detach trip solenoid from bracket. Two lock washers will be released.
4. Install new solenoid by reversing above procedure. Pass leads through nylon mounting strap and grommet in mechanism frame. Connect leads in any order. The trip solenoid is not polarity sensitive.

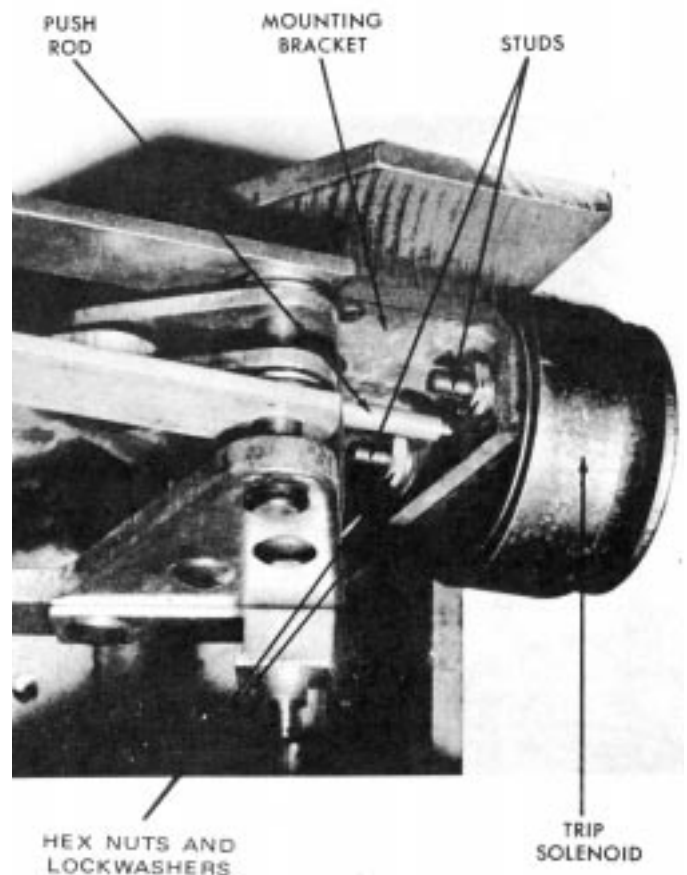
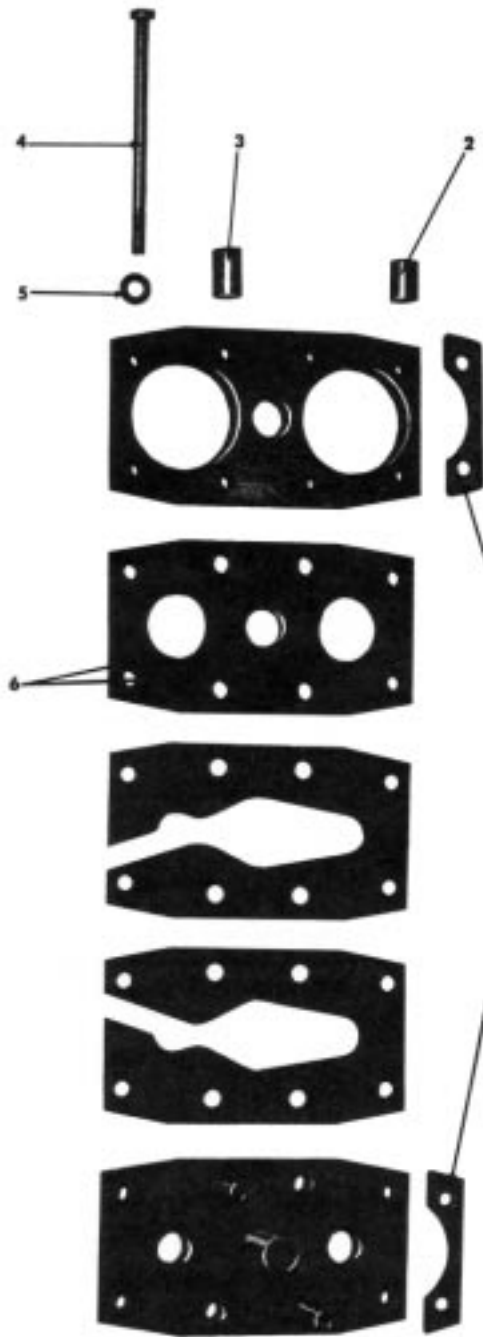


Figure 36
Properly installed trip solenoid.

PARTS LIST FOR TYPE WE RECLOSER
INTERRUPTING MECHANISM
(Units Below Serial No. 1001)

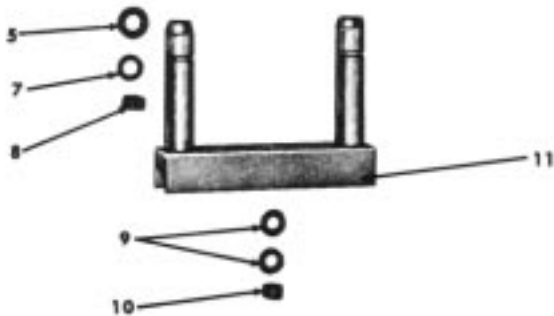


Item No.	Description	Catalog Number
1	Support Plate	KP137W
2	Spacer, short	KP134W
3	Spacer, long	KP135W
4	Cap screw, 3/8"—24 UNF2 x 6"	
	SAE steel hex hd	KP726
5	Flat washer, 3/8", SAE steel	KP807
6	Gasket	KP136W
7	Lock washer, 3/8" med, steel	KP556
8	Hexnut, 3/8"—24 UNF2, steel	KP589
9	Flat washer, 5/16", SAE	KP350
10	Elastic stop nut, 5/16"—24NF3	KP286
11	Moving contacts and yoke assembly	KA11W
12	Interrupter repair kit	KA834W

OLD STYLE
PLATES TO
BE REPLACED
WITH
KA834W,
ITEM # 12



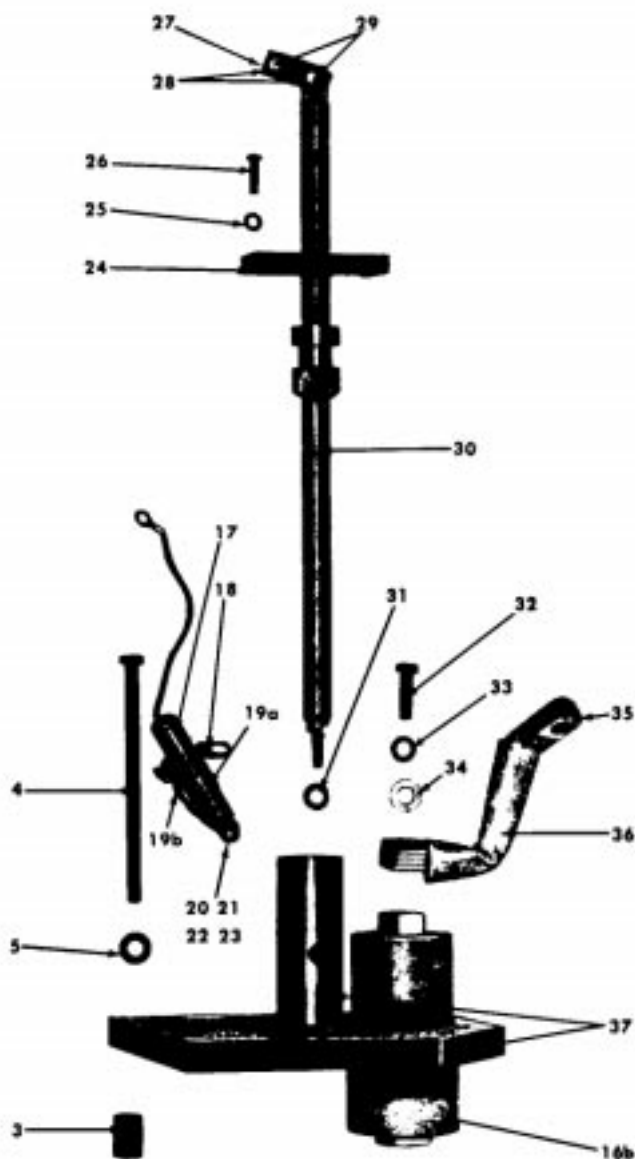
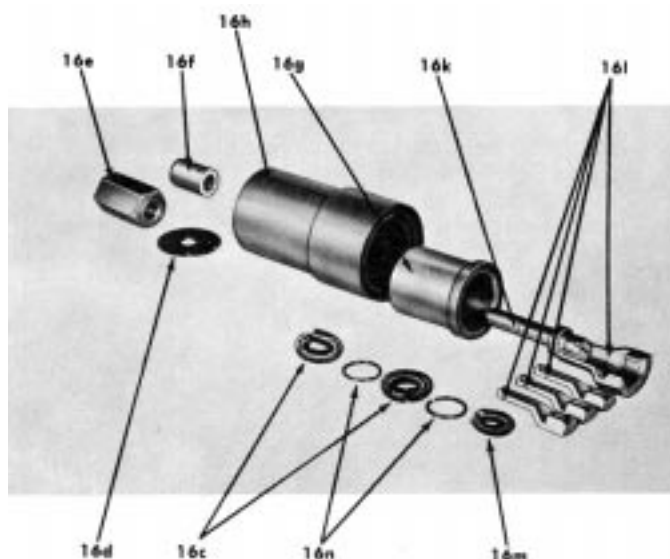
Plate arrangement.



Both stacks plus the base plate are shipped as a complete assembly.

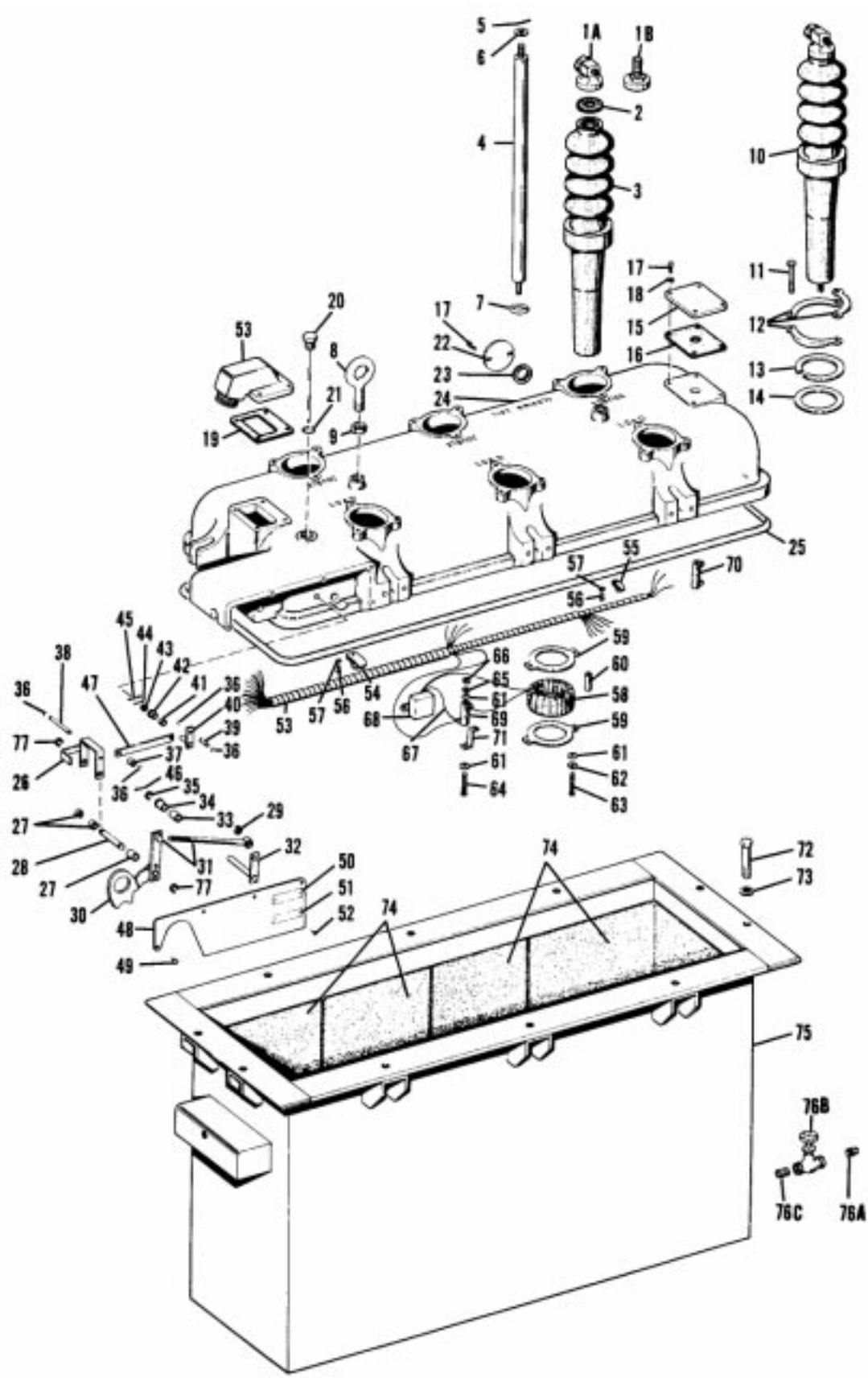
PARTS LIST FOR TYPE WE RECLOSER INTERRUPTING MECHANISM (Units Below Serial No. 1001)

Item No.	Description	Catalog Number
16b	Contact tube assembly	KA14W
16c	Contact current exchange spring	KA12W
16d	Washer	KP114W
16e	Contact terminal nut	KP112W
16f	Spacer, silver pl	KP115W
16g	Contact hauling, silver pl	KP120W
16h	Fiber tube	KP113W
16k	Contact terminal stud, silver pl	KP116W
16l	Contact fingers	KA13W
16m	Spring, contact pressure	KP119W
16n	Spring spacer	KP121W



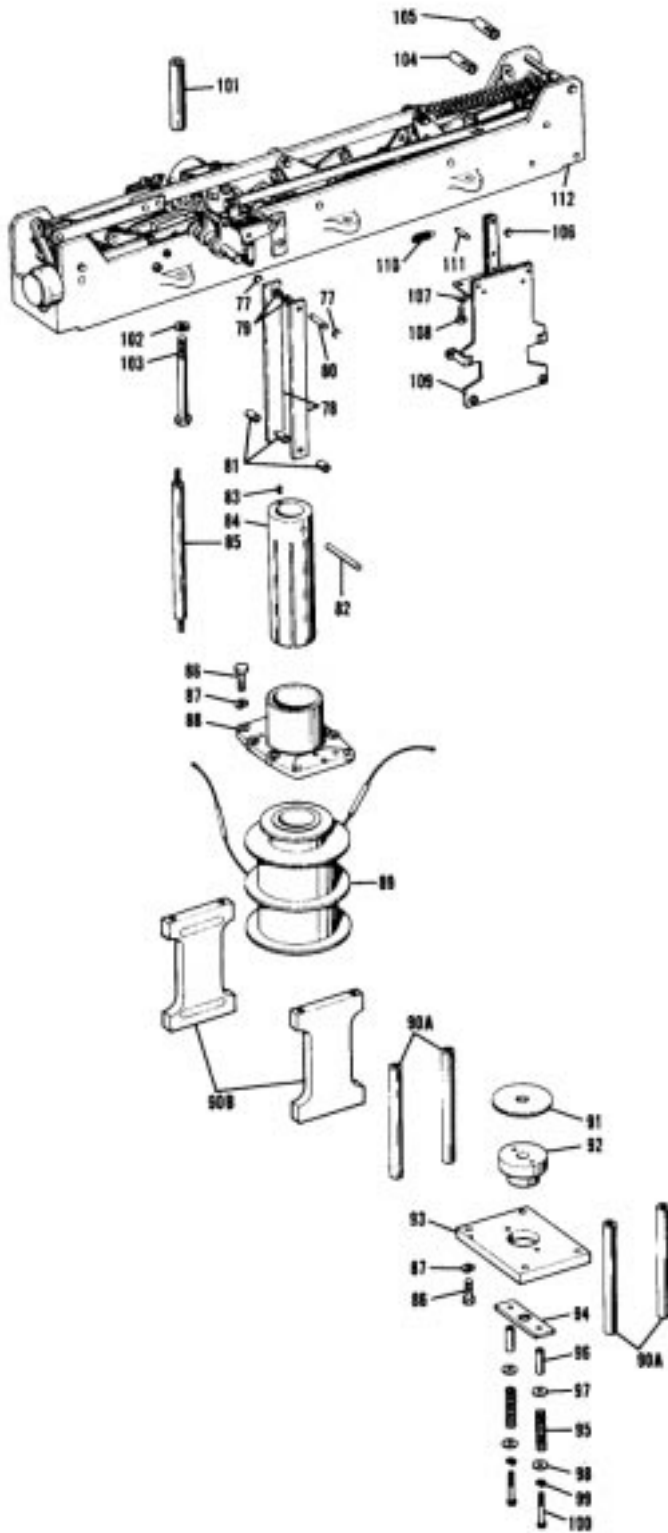
Item No.	Description	Catalog Number
17	Closing coil fuse assembly Add number to indicate voltage rating: 1 - 4.16 to 4.8 kv and 6.0 kv (color band black) 2 - 7.2 to 8.32 kv and 11.0 kv (color band yellow) 3 - 12.0 to 14.4 kv (color band one red) 4- 2.4 kv (color band two red)	KA259R—
18	Fuse terminal bracket	KP257L
19a	Fuse bracket (also included with item 17)	KP714R
19h	Fuse wire jumper assembly	KA28W
20	Mach screw, 1/4"-20 UNC2 x 1/2" brass rd hd	KP473
21	Washer, No. 14L, plain brass	KP818
22	Lock washer, 1/4". med, phos brz	KP347
23	Mach screw nut 1/4"-20 UNC2 x 1/2", brass hex	KP274
24	Lift rod guide, for phases A and B	KP138W
	Lift rod guide, for phase C	KP139W
25	Lock washer, 1/4" x .109" x .062", stl	KP337
26	Mach screw, 1/4"—20 UNC2 x 7/8", stl rd hd	KP452
27	Lift rod link	KP167R
28	Retaining ring, WA516	KP76
29	Contact link pin	KP285R
30	Contact lift rod assem, for phases A and B	KA16W
	Contact lift rod assem, for phase C	KA15W
31	Washer, .687" x .343" x .062"	KP350
32	Mach bolt, 3/8"—24 UNF2 x 1-1/4", sil hrz hex hd	KP727
33	Lock washer, 3/8" med, phos brz	KP326
34	Washer No. 24S, silver pl brass	KP986
35	Jumper load assembly (4 per bushing)	KA20W
36	Insulating sleeve	KP141W
37	Interrupter frame assem, for phases A and B	KA8W
	Interrupter frame assem, for phase C	KA9W

PARTS LIST FOR TYPE WE RECLOSER



PARTS LIST FOR TYPE WE RECLOSER

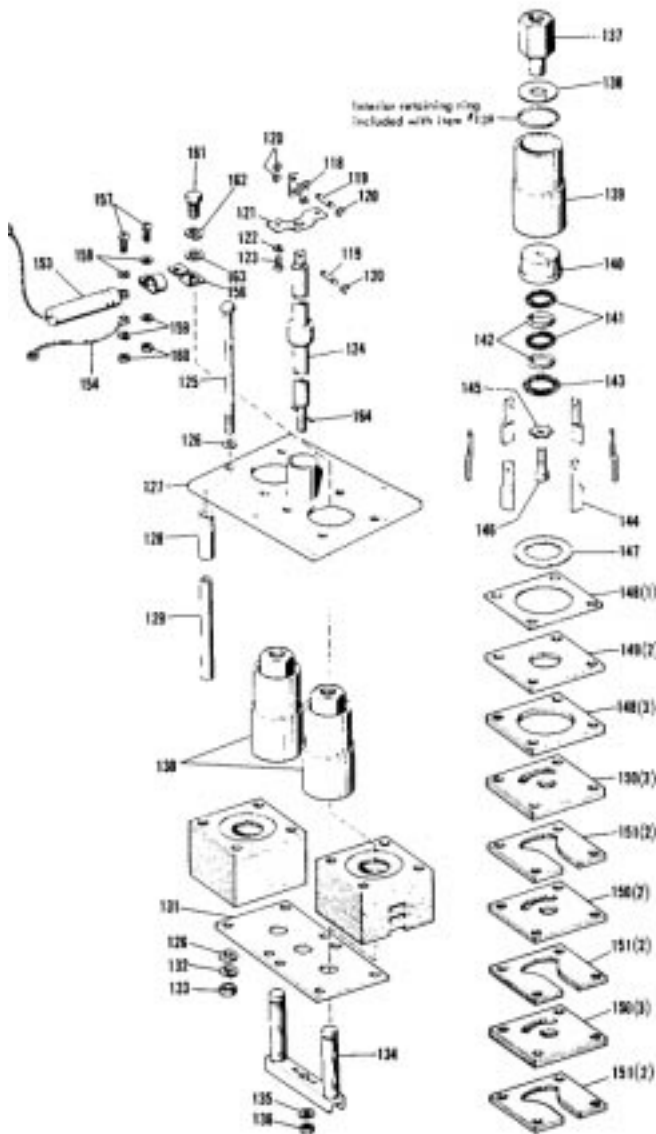
Item No.	Description	Catalog Number	Quantity Per Recloser	Item No.	Description	Catalog Number	Quantity Per Recloser
1A	Terminal assembly, No. 1/0 solid through 500 MCM	KA17W	6	39	Groove pin	KP3123A3	1
1B	Threaded terminal stud, 1-1/8", 12 x 2-1/8" tin plated	KP158W	6	40	Shaft and lever assembly	KA319R	1
2	Bushing terminal gasket	KP120L	6	41	Spacer	KP3007A8	1
3	Porcelain bushing, standard	KP1110R	6	42	Shaft bearing (included with item 24)	KP1055R	1
	Porcelain bushing, standard for use with BCT	KP171W	6	43	Washer, 9/16" X .260" x .040," brass	KP399	1
	Porcelain bushing, 17" creepage distance	KP1578R	6	44	Cotter pin, 3/32" X 1/2", brass	KP302	1
	Porcelain bushing, 17" creepage distance, for use with BCT	KP186W	6	45	Roll pin, 3/32" X 1/2"	KP504	1
4	Conductor rod	KP131W1	6	46	Roll pin, 1/8" X 3/4"	KP502	1
	Conductor rod, for use with BCT	KP131W2	6	47	Link	KP137RE	1
5	Roll pin, 1/8" X 15/16", lg.			48	Sleet hood cover plate	KP283R	1
6	Washer	KP130W	6	49	Self-tapping screw, No. 12 x 1/2", sstl	KP50	5
7	"O" ring	KP2000A8	6	50	Serial number nameplate	KP190RE	1
8	Lifting eyebolt	KP1104R	2	51	Voltage rating nameplate, add correct number:	KP567R	1
9	Palnut 5/8"—11UNC2, galv.	KP2064A7	2		1 - 2.4 kv; 2 - 4.16 to 4.8 kv; 3 - 7.2 to 8.32 kv; 4 - 12.0 to 13.8 kv. 5 - 14.4 kv (Item 51 is also included with item 89)		
10	Bushing assembly, standard	KA18W	6	52	Self-tapping screw, No. 4 x 3/16", sstl	KP21	8
	Bushing assembly, standard for use with BCT	KA41W	6	53	Receptacle wiring duct assembly	KA33RE1	1
	Bushing assembly, 17" creepage distance	KA79W	6	54	Cable clamp	KP2006A2	4
	Bushing assembly, 17" creepage distance, for use with BCT	KA58W	6	55	Cable clamp	KP2006A1	2
11	Mach. bolt 3/8"—16UNC2 x 2" sstl hex hd	KP763	18	56	Machine screw, #8-32UNC x 5/16", lg rd hd stl cad pl	KP678	6
12	Bushing clamp	KP1109R	18	57	Lockwasher, #10 med sstl	KP994	6
13	Bushing clamping ring aluminum	KP1111R	6	58	Current transformers	KP144RE	4
14	Lower Bushing gasket	KP1112R	6	59	Support, current transformers	KP145RE	8
15	Cover plate	KP609R	2	60	Spacer	KP3009A38	8
16	Mounting gasket for auxiliary switch	KP610R	1	61	Washer, #14S, plain, brass	KP339	16
17	Mach. screw, 1/4"—20UNC2 x 5/8" sstl rd hd	KP613	10	62	Lockwasher, 18-8, 1/4" X 0.109" x 0.062", sstl	KP563	8
18	Lock washer, 14"—20UNC2 x 5/8", sstl rd hd	KP563	8	63	Cap screw 1/4"-20NC2 x 2-1/4" lg hex hd stl cad pl	KP798	8
19	Terminal box gasket	KP611R	1	64	Machine screw, #10-24NC2 x 2-1/2" lg rd hd stl cad pl	KP668	4
20	Oil level dipstick	KA363R	1	65	Lockwasher, #10 med.	KP564	4
21	O-ring gasket	KP2000A9	1	66	Mach screw nut, #10-24NC2	KP272	4
22	Closing-tool port cover	KP246R	1	67	Lead wire	KPS339A1050	2
23	Port-cover plate gasket	KP247R	1	68	Capacitor, #23355, 0.2 MFD Potter Co. 2500 VDCW		1
24	Head casting, (includes control shaft bushings, items 34 and 42)	KA840R	1	69	Resistor, 1K, 25W	KP4022A36	1
25	Head gasket	KP120R	1	70	Resistor, 100 ohm, 25W	KP4022A31	3
26	Indicator and support assembly	KA19RE	1	71	Terminal bracket	KP96GS	4
27	Spacer	KP3013A11	3	72	Cap screw, 1/2"-13NC2 x 3-1/4" electro zn and iridite pl hex hd stl	KP752	10
28	Groove pin	KP3126A4	1				
29	#WA514 retaining ring	KP75	1	73	Washer, wrought galv.	KP2028A23	10
30	Lockout handle assembly	KA621R	1	74	Tank liner kit, see Note pg.6	KA867R	1
31	Link rod and pin assembly	KA314R	1	75	Tank assembly	KA88W	1
32	Handle lever assembly	KA320R	1	76A	Pipe plug, 1/2", solid sq. hd. brass	KP2007A3	1
33	Spacer	KP3010A6	1	76B	Gate valve, 100 lb. -1/2" brass, optional	KA809R	1
34	Handle shaft gearing (included with item 24)	KP259R	1	76C	Close nipple (included with item 76B)	KP2039A1	1
35	#WA516, retaining ring	KP76	1	77	Retaining ring, WA518, stl	KP79	4
36	#WA510, retaining ring	KP72	4				
37	Spacer	KP3006A9	1				
38	Groove pin	KP3123A12	1				



Item No.	Description	Catalog Number	Quantity Per Recloser
78	Insulating link for closing plunger	KP103R	2
79	SAE washer 13/16" x 13/32" .062", zinc pl	KP1102	2
80	Plunger link pin	KP3126A2	1
81	Spacer for plunger link	KP3010A1	3
82	Plunger link pin	KP113R	1
83	Set screw, No. 10-32 x 1/4", pin lock	KP394	1
84	Closing plunger	KP104R	1
85	Insulating spacer	KA62R	13
86	Cap screw, 3/8" -16UNC2 x 1-1/2", stl hex hd	KP419	8
87	Lockwasher, 3/8" med. steel	KP556	4
88	Upper solenoid frame	KP100R2	1
89	Closing coil and fuses kit (includes items 51, 91, and 153)		1
	60 cycle	KA834R	
	50 cycle	KA861R	
	40 cycle	KA860R	
	Add correct number: 1 - 2.4 kv, 2 - 4.16 to 4.8 kv; 3 - 7.2 to 8.32 kv. 4 - 12.0 to 13.8 kv, 5 - 14.4 kv; 6 - 6.0 kv; 7 - 125 vdc; 8 - 250 vdc, 9 - 11.0 kv; 10 - 3.3 kv		
90A	Rod, solenoid frame	KP1669R	4
90B	Solenoid frame shoe (Alternate for 90A)	KP102R	2
91	Fiber stop (also included with item 89)	KP106R	1
92	Closing plunger stop	KP1667R	1
93	Bridge plate	KP1668R	1
94	Plate	KP1587R1	1
95	Spring valve lift	KP563R	2
96	Spacer	KP3009A6	2
97	Washer, 1/2" AN light, stl.	KP1103	1
98	Washer, #14L, brass	KP818	2
99	Lockwasher, 1/4", med.	KP337	2
100	Cap screw 1/4"-20UNC2 x 2-1/4" stl hex hd	KP751	2
101	Head-to-frame spacer	KP227R1	6
102	Lockwasher, 1/2". med. stl. zn pl	KP1107	6
103	Socket cap screw, 1/2"-13UNC2 x 4-1/2", stl, hex (black oxide finish or equivalent)	KP2036A3	6
104	Quick-release control lever coupler	KP1177R	1
105	Quick-release counter shaft coupler	KP1056R	1
106	Retaining ring, WA514, stl.	KP75	7
107	Lockwasher, 1/4" x .109" x .0628t, stl.	KP337	3
108	Cap screw, 1/4"-20UNC2 x 3/4", stl hex hd	KP735	3
109	Closing solenoid contactor kit	KA852R	1
110	Contact toggle spring	KP141R	2
111	Contact link pin	KP1306R	1
112	Mechanism frame assembly (see parts list page 28)	KA68RE	1
113	Hex nut, 3/8"-16UNC2	KP869	13

NOTE: Reclosers below serial number 480 included one lower solenoid gasket KP389R, one closing plunger stop KA824R, one base plate KP107R, one valve dish KP108R, one valve spring KP128R, and one valve seat assembly KA51R. Replace these parts with items 91 through 100

PARTS LIST FOR TYPE WE RECLOSER

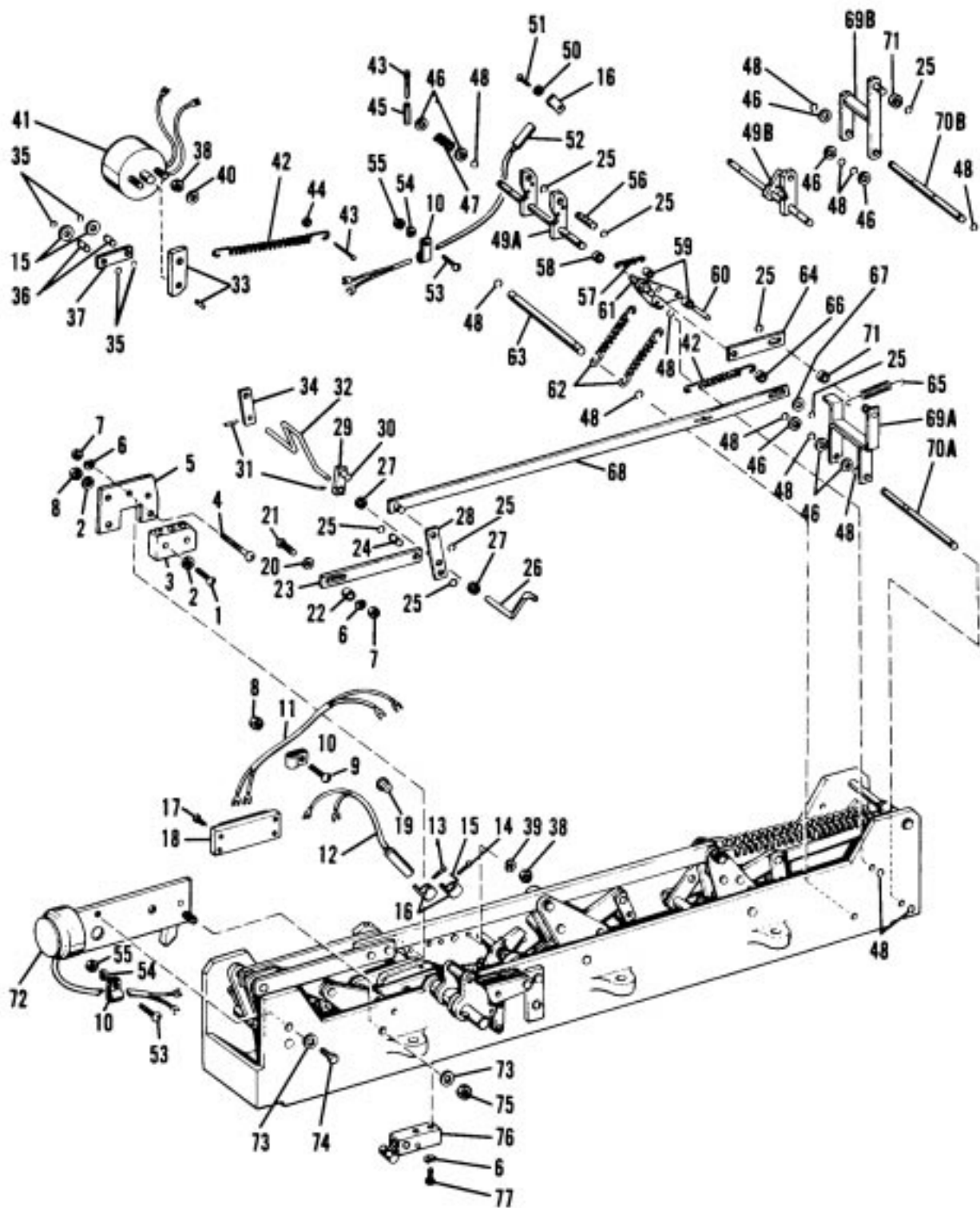


**Interrupting Assembly
Units above serial no. 1000**

Item No.	Description	Catalog Number	Quantity Per Recloser
118	Lift rod link	KP167R	6
119	Groove Pin	KP3125A2	6
120	Retaining ring, WA-516	KP76	12
121	Guide, contact rod	KP518RV2	3
122	Lock washer, 1/4" med.	KP1040	6
123	Screw, rd-hd, stl., 1/4"-20UNC 2A x 1/2"	KP837	6

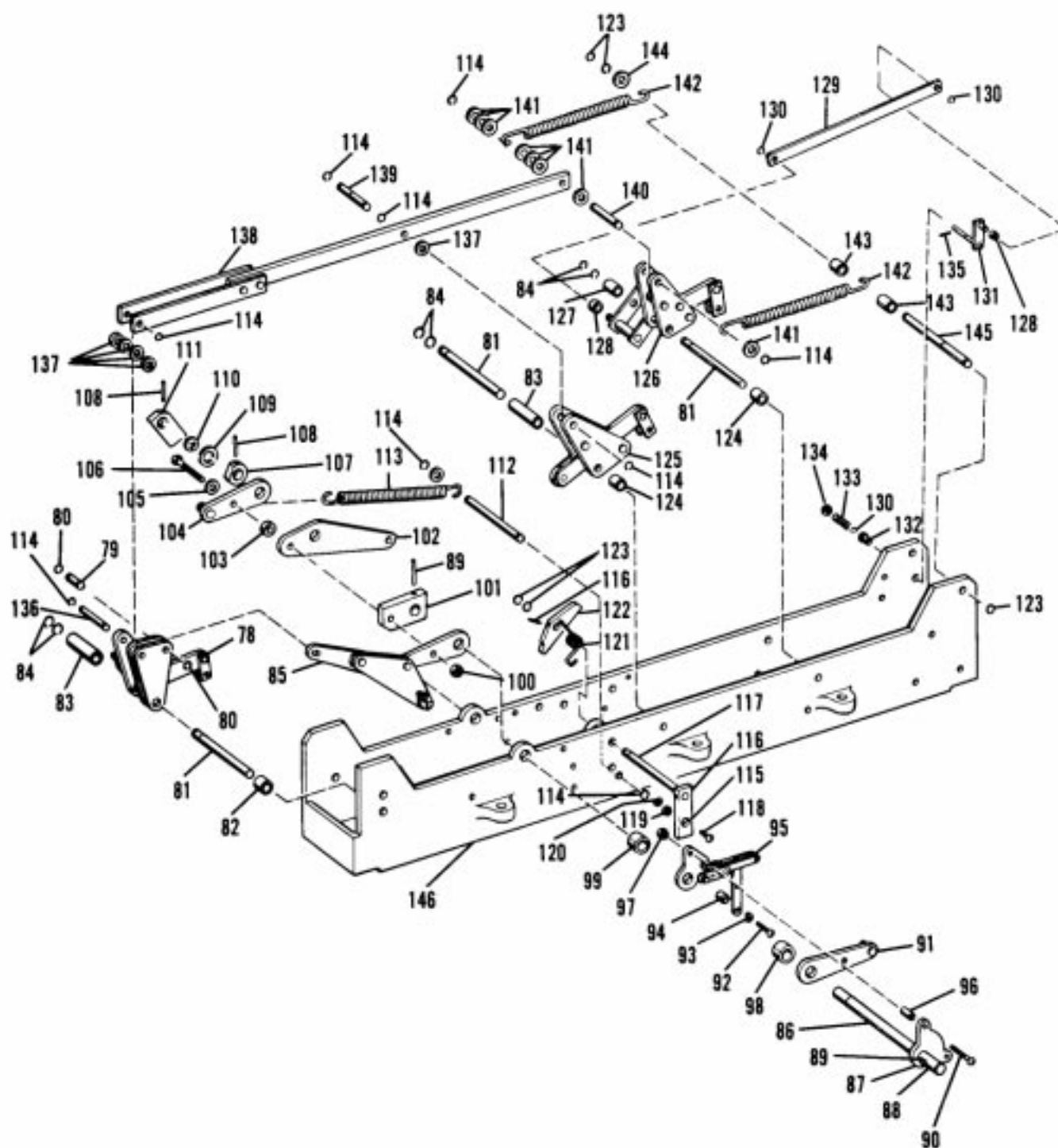
Item No.	Description	Catalog Number	Quantity per Recloser
124	Contact rod assembly, phases A and B	KA95W1	2
	Contact rod assembly, phase C	KA95W2	1
125	Cap screw, stl, 3/8"-16 UNC-2A x 6"	KP1068	24
126	Washer, 3/8", SAE, stl	KP1112	48
127	Contact frame assembly phases A and B	KA127W	2
	Contact frame assembly phase C	KA128W	1
128	Spacer	KP3013A40	24
129	Spacer	KP3008A23	24
130	Contact housing assembly	K4125W	6
131	Bottom plate	KP214W	3
132	Lockwasher, 3/8", med.	KP1108	24
133	Hex nut, stl, 3/8"-16UNC-2B	KP276	24
134	Contact yoke assembly	KA11W	3
135	Washer, 5/16", SAE, stl.	KP350	3
136	Stop nut, elastic	KP2020A2	3
137	Contact nut	KP207W	6
138	Washer, retaining	KP515RV2	6
139	Fiber tube (includes retaining ring)	KP512RV	6
140	Contact cup	KP206W	6
141	Contact spring	KP117W	12
142	Spring spacer	KP210W	12
143	Garter spring	KP209W	6
144	Contact arm assembly	KA124W	36
145	Contact retainer	KP211W	6
146	Cap screw, fil-hds 3/8"-24UNF 2 x 1-14"	KP1069	6
147	Gasket	KP136W	6
148	Plate	KP1293M	24
149	Plate	KP213W	12
150	Plate	KP1294M	48
151	Plate	KP523RV	36
152	Interrupter Kit (Includes two stacks of plates, items 148-151; and one bottom plate, item 131)	KA836W	3
153	Closing coil fuse assembly (also included with item 89) Add number to indicate voltage rating: 1 - 4.16 to 4.8 kv and 6.0 kv (color band black) 2 - 7.2 to 8.32 kv and 11.0 kv (color band yellow) 3 - 12.0 to 14.4 kv (color band one red) 4 - 2.4 kv (color band two red)	KA259R _____	1
154	Fuse wire jumper assembly	KA28W1	1
155	Fuse bracket (included with Item #153)	KP714R	1
156	Fuse terminal bracket	KP257L	1
157	Machine screw 1/4" - 20UNC2 x 1/2" brass, rd. hd.	KP473	4
158	Washer, #14L, plain, brass	KP818	4
159	Lockwasher, 1/4" med., phos. brz.	KP347	4
160	Machine screw nut, 1/4"-20UNC2, brass hex	KP274	4
161	Machine bolt, 3/8"-24UNF2 x 7/8" silver bronze hex hd.	KP729	6
162	Lock washer, 3/8" x 0.141" x 0.094", phos. brz.	KP326	6
163	Washer, 7/8" x 25/64" x 0.064", brass	KP986	6
164	Roll pin 1/8" x 13/16"	KP506	3

PARTS LIST FOR MECHANISM FRAME ASSEMBLY



PARTS LIST FOR TYPE RE RECLOSER

Item No.	Description	Catalog Number	Quantity Per Recloser	Item No.	Description	Catalog Number	Quantity Per Recloser
1	Machine screw, #6-32NC2 x1"			42	Spring, counterbalance	KP98L	2
	lg rd hd brass	KP681	2	43	Cotter pin, 3/32" X 1", lg,brass	KP433	2
2	Lockwasher, #6, internal tooth, bronze	KP826	5	44	Spacer	KP3007A30	1
3	Switch, hermetically sealed type 1HS3 with roller lever actuator (Minneapolis Honeywell)		1	45	Roll pin, 1/8"X 3/4"	KP502	1
4	Machine screw, #10-24NC2 x 3/4", lg rd hd, stl, cad	KP497	2	46	Washer, flat, 5/16", SAE, stl,cad	KP350	13
5	Bracket	KP186RE	1	47	Spring	KP1176R	1
6	Lockwasher, #10 med, stl, cad	KP353	6	48	Retaining ring, WA516	KP77	19
7	Hex nut, #10-24NC2, stl, cad	KP272	4	49A	Handle shaft assembly (used with items 69A and 70A)	KA15RE	1
8	Hex nut, #6-32NC2, brass, cad	KP852	3	49B	Handle shaft assembly (used with items 69B and 70B)	KA15RE	1
9	Machine screw, #6-32NC2 x 1/2" lg rd hd, brass, cad	KP641	1	50	Self-tapping screw, #6-32NC2 x 1/2", lg, Type F	KP30	2
10	Cable clip	KP2006A8	8	51	Washer, #6L, plain, brass		2
11	Lead wire assembly	KA62RE	1	52	Mercury switch subassembly	KA63RE	1
12	Mercury switch	KP134RE	1	53	Machine screw, #8-32NC2 x 5/8", lg, rd hd, brass, cad	KP669	6
13	Machine screw, #8-32NC2 x 1/4", lg rd hd, stl, cad	KP500	1	54	Lockwasher, #8 med, phos. bronze, cad	KP813	6
14	Machine screw, #8-32NC2 x 5/8" lg rd hd, stl, cad	KP669	1	55	Hex nut, #8-32NC2,steel, cad	KP573	6
15	Washer, #10L, plain brass	KP560	4	56	Pin, reset lever	KP280R	1
16	Nylaclip, HP-8N, Burndy	KP2006A4	4	57	Spring	KP16GS	1
17	Machine screw, #6-32NC2 x 5/8", lg fil hd, stl, cad	KP1043	2	58	Spacer	KP330R	1
18	7-terminal board	KP882	1	59	Spacer	KP3006A6	2
19	Grommet, rubber	KP2017A4	1	60	Pin, spring anchor	KP282R	1
20	Washer, #10S, plain, brass, cad	KP840	1	61	Trip lever assembly	KA17RE	1
21	Machine screw, #10-24NC2 x 1/4", lg rd hd, stl, cad	KP670	2	62	Spring, bell crank	KP12GS	2
22	Spacer	KP133RE	1	63	Shaft, spring anchor	KP1488R	1
23	Link	KP128RE	1	64	Link	KP1147R	1
24	Groove pin	KP3124A3	1	65	Spring	KP731R	1
25	Retaining ring, WA514	KP75	10	66	Spacer	KP3007A1	1
26	Arm	KP1295R	1	67	Washer, #14S, plain,brass, cad	KP811	1
27	Spacer	KP3009A9	2	68	Auxiliary switch bar assembly	KA253R	1
28	Lever	KP130RE	1	69A	Trip latch lever (used with items 49A and 70A)	KA647R	1
29	Lever, order with item #30	KP118RE	1	69B	Trip latch lever (alternate used with items 49B and 70B)	KA13RE	1
30	Pin, order with item #29	KP119RE	1	70A	Shaft (used with items 49A and 69A)	KP1678R	1
31	Roll pin, 3/32" X 1/2"	KP504	3	70B	Shaft (alternate-used with items 49B and 69B)	KP125RE	1
32	Transfer shaft	KP152RE	1	71	Spacer	KP3007A8	1
33	Roll pin and lever (included in item 41)			72	Solenoid trip assembly (The solenoid may be ordered separately as part na. KP182RE)	KA55RE	1
34	Lever	KP117RE	1	73	Flat washer, 1/4" SAE, stl cad	KP827	2
35	Retaining ring, #WA510	KP72	4	74	Cap screw, 1/4"-20NC2 x 1/2" lg hex hd stl cad	KP701	1
36	Groove pin	KP3123A4	2	75	Hex nut, 1/4"-20NC2, stl, cad	KP279	1
37	Link	KP126RE	1	76	Cam roller assembly	KA67R	1
38	Hex nut, 1/4"-28NF2, stl, cad	KP290	4	77	Machine screw, #10-24NC2 x 7/16",lg, rd hd,stl cad	KP489	2
39	Lockwasher, 1/4", med	KP337	4				
40	Washer, #14S, plain, brass, cod	KP811	3				
41	Rotary solenoid assembly	KA12RE	1				



PARTS LIST FOR MECHANISM FRAME ASSEMBLY

Item No.	Description	Catalog Number	Quantity Per Recloser
78	Contact and toggle support assembly	KA361R	1
79	Toggle pin	KP273R	1
80	Retaining ring #5133-37 Type E	KP86	2
81	Shaft	KP1198R	3
82	Spacer	KP3009A18	1
83	Spacer	KP3009A22	2
84	Retaining ring #WA520	KP100	6
85	Toggle assembly	KP450R	1
86	Reclosing shaft (order only with items 87, 88 and 89)	KP295R	1
87	Roll pin 1/8" X 1-1/4", lg. (order only with items 86, 88, and 89)	KP520	1
88	Toggle driver (order only with items 86, 87, and 89)	KP1329R	1
89	Roll pin, 7/32" X 1-1/4", lg. (order only with items 86, 87, and 88)	KP512	2
90	Machine screw, #10-32NF2 x 1-1/2", lg rd hd, stl, cad	KP630	1
91	Switch driver	KP148R	1
92	Machine screw, 1/4"-20NC2 x 1-1/4", lg rd hd, stl, cad	KP479	2
93	Lockwasher, 1/4" med	KP337	4
94	Spacer	KP3007A15	2
95	Switch toggle assembly	KA428R	1
96	Spacer	KP3006A4	1
97	Stop nut, elastic, #10-32NF-2	KP2020A1	1
98	Spacer	KP3015A2	1
99	Spacer	KP3015A3	1
100	Stop nut, 5/16"-24NF-3, elastic	KP2020A2	1
101	Reset lever	KP166R	1
102	Reset lever	KP164R	1
103	Spacer	KP3011A4	1
104	Reset arm and pin assembly	KA17R	1
105	Washer, 3/4" X 0.375". x 0.031" thk, brass, cad (optional)		1
106	Bolt	KP346R	1
107	Cam	KP187RE	1
108	Roll pin, 1/8" X 1", lg	KP518	1
109	Washer	KP2028A4	1
110	Retaining ring, #5133-62, Type E	KP87	1

Item No.	Description	Catalog Number	Quantity Per Recloser
111	Mounting bracket	KP163RE	1
112	Shaft, spring anchor	KP292R	1
113	Spring, reclosing	KP191R	1
114	Retaining ring, WA516, Type C	KP77	19
115	Lever, reset trip (order only with items 116 and 117)	KP194R	1
116	Roll pin, 3/32" X 3/4", lg. (order only with items 115 and 117)	KP523	2
117	Shaft (order only with items 115 and 116)	KP153RE	1
118	Machine screw, #10-24NC2 x 1", lg rd hd, stl, cad	KP670	1
119	Hex nut, #10-24NC2, stl, cad	KP272	1
120	Lockwasher, #10 med, stl, cad	KP353	1
121	Spring, reset lever	KP172R	1
122	Lever, reset trip	KP171R	1
123	Retaining ring, #WA518 Type C	KP79	5
124	Spacer	KP3009A17	2
125	Contact and trip arm assembly	KA360R	1
126	Contact and counter arm assembly	KA359R	1
127	Spacer	KP3009A16	1
128	Spacer	KP3007A8	3
129	Counter link	KP183R	1
130	Retaining ring, WA514, Type C	KP75	10
131	Contact lever and shaft assembly	KA318R	1
132	Bearing, shaft	KP1055R	1
133	Spring	KP1180R	1
134	Washer, #14S, plain, brass, cad	KP811	4
135	Roll pin, 3/32" X 1/2"	KP504	3
136	Groove pin	KP3125A5	1
137	Washer, flat, 5/16", SAE, brz irr	KP1120	13
138	Contact bar assembly	KA13R	1
139	Contact bar pin	KP290R	1
140	Pin	KP3125A9	1
141	Washer, flat, 5/16" AN, stl, zn pi	KP833	8
142	Contact opening spring	KP173R	2
143	Spacer	KP3011A34	2
144	Washer, flat, 3/8" SAE, stl, cad	KP547	1
145	Spring anchor shaft	KP284R	1
146	Frame, operating mechanism	KP189RE	1



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