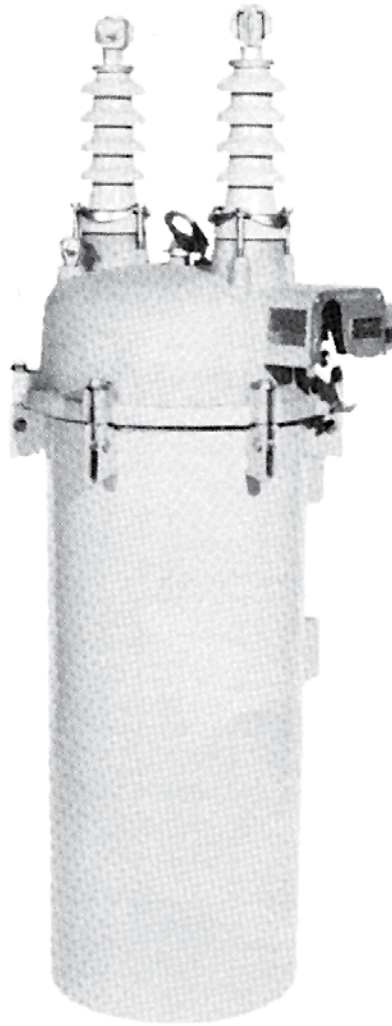


Type D, DV single-phase recloser maintenance instructions



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Contents

SAFETY INFORMATION

Safety instructions iv

PRODUCT INFORMATION

Introduction 1
Handling and storage 1
ANSI standards 1
Quality standards 1
Description 1

COMPONENT FUNCTIONS

Arc interrupting assembly 2
Closing solenoid 2
Closing solenoid contactor 2
Fuse assembly 2
Hydraulic integrator assembly 2
Series trip solenoid 2
Time-delay unit 2
Head mechanism 2

GENERAL MAINTENANCE INFORMATION

Oil condition 3
Maintenance intervals 3
Oil specifications 3

PERIODIC INSPECTION AND MAINTENANCE

. 4

SHOP MAINTENANCE

Interrupter assembly 6
Closing solenoid 6
Series trip solenoid 7
Closing solenoid contactor 8
Hydraulic integrator mechanism 8
Time-delay unit 9
Bushings 10

RATING CHANGES

Rated current 11
Rated phase-to-ground voltage 11
Closing solenoid fuse 11

HIGH-POTENTIAL WITHSTAND TESTING

Closed-contacts test 11
Open-contacts test 11
Withstand test results 11

SERVICE PARTS LISTING

. 12



Safety for life



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

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

Safety information

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

A competent technician has these qualifications:

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

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

Hazard Statement Definitions

This manual may contain four types of hazard statements:

DANGER

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

WARNING

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

CAUTION

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

CAUTION

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

Safety instructions

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

DANGER

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

G103.3

WARNING

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

G101.0

WARNING

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

G102.1

WARNING

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

G122.2

Product information

Introduction

Service Information MN280027EN provides maintenance instructions for Eaton's Cooper Power™ series Type D and DV single-phase reclosers. A service parts list is included.

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, please contact your Eaton representative.

Handling and storage

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

ANSI standards

Eaton's 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

Description

The Type D and DV reclosers sense and interrupt fault currents on single-phase distribution lines. These reclosers automatically reclose and, if the fault is temporary, restore service. If the fault is permanent, they lock open after one, two, three, or four operations, depending upon the settings.

Automatic reclosing makes it possible to distinguish between permanent and temporary faults. If a fault is temporary, the recloser resets and is then ready for a complete sequence should another fault occur.

The operating sequences of a recloser can be all fast, all delayed, or a combination of fast followed by delayed operations. Furthermore, any one of four delay curves can be used to insure coordination with other reclosers or protective devices. On coordinated systems, fast recloser operations are used to clear temporary fault currents before branch-line fuses are damaged. Subsequent delayed openings allow time for fault currents to be cleared by branch-line fuses. Outages caused by permanent faults are thereby confined to shorter sections of line.

Refer to *Service Information S280-20-1 Types D, DV Reclosers Installation Instructions* for additional information.

Component functions

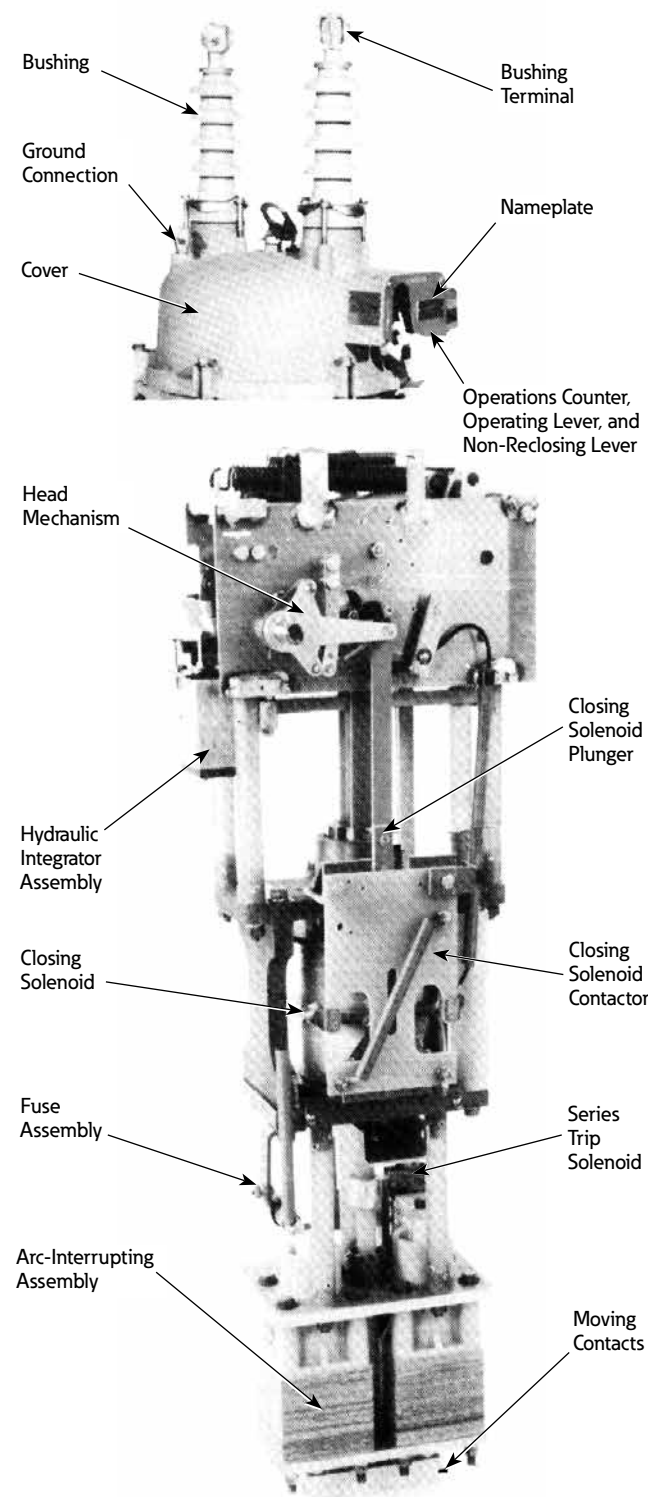


Figure 1. Untanked recloser (DV).

Arc interrupting assembly

The heart of these reclosers is a rugged arc-interrupting assembly. Circuit opening is achieved by a double-break moving contact assembly.

Closing solenoid

The moving contacts are closed by the closing solenoid, which also extends the opening spring located in the head assembly. The solenoid is only energized a few cycles during a closing operation; it is momentarily connected between phase and grounded neutral.

Closing solenoid contactor

Snap-action contacts complete the closing solenoid circuit during the closing operation.

Fuse assembly

A fuse assembly protects the distribution line from any possible fault in the closing solenoid.

Hydraulic integrator assembly

Each time the recloser trips, a hydraulic pump makes one stroke, forcing a measured amount of fluid under the lockout piston. The lockout piston advances a definite amount after each recloser trip operation. The lockout piston in turn advances a lockout lever. After the selected number of fast operations, the series trip solenoid linkage engages the time-delay unit. When the selected number of repeated trip operations have occurred, the lockout lever prevents reclosing and the control lever unlatches to signal the recloser has locked open.

Series trip solenoid

This device carries full line current. When current greater than the minimum trip value flows, the solenoid plunger moves downward, causing a recloser trip operation. When delayed openings are called for, the plunger is restrained by a time-delay unit and requires more time to trip the recloser.

Time-delay unit

A sealed time-delay unit provides consistent delay action by forcing hydraulic fluid through orifices. In order to ensure reliable timing characteristics, the fluid used in the time-delay units is HFA (Hydraulic Fluid, Aircraft).

Head mechanism

This incorporates transfer linkage from the integrator, closing solenoid and time-delay assemblies to the moving contact rod.

General maintenance information

The Type D and DV reclosers are usually applied to increase service continuity, reduce operating costs, and increase revenue. The high load and interrupting ratings make them suitable for use in important substations.



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

The Type D and DV can perform at peak efficiency and provide reliable circuit protection if adequate maintenance is performed. Maintenance is relatively easy and inexpensive when compared with the savings achieved by use of reclosers.

Oil condition

Oil plays an important role in several recloser functions. It is essential in arc interruption and insulation. However, because arc interruption contributes to oil decomposition, the oil steadily diminishes in dielectric strength as the recloser continues to clear fault currents. Breathing action may result in moisture absorption by the oil, lowering its insulation value. For effective recloser operation, oil must be replaced before it deteriorates beyond a safe level.

Maintenance intervals

Frequency of maintenance depends upon local climatic conditions and the interrupting duty imposed on the recloser. It is recommended that the unit be completely inspected, cleaned, and filled with new oil at least once each year. If a unit operates through a duty cycle in less than one year, periodic maintenance should be performed at that time. Refer to Table 1 for the NEMA® standard duty cycle for Power Class III reclosers.

Oil specifications

Refer to Table 2. The recommended minimum dielectric strength for oil sampled from new equipment is 26 kV rms as specified in *ANSI® C37.61, Guide for the Application, Operation, and Maintenance of Automatic Circuit Reclosers*.

Table 1. NEMA® Standard Duty Cycle for Power Class III Reclosers

Percent of Interrupting Rating	Number of Unit Operations
15 – 20	28
45 – 55	20
90 – 100	10
	total 58

Table 2. Specifications for Oil used in Distribution Switchgear

Characteristic	Acceptable Value	ASTM Test Standard*
Color	0.5 max (ASTM colormeter)	D1500
Reaction	Neutral	
Neutralization no.	0.03 mg KOH/g max	D974
Corrosive sulfur	Noncorrosive	D1275
Steam emulsion no.	25 seconds max	D1935
Flash point	145°C min	D92
Fire point	160°C min	D92
Pour point	-46°C max	D97
Viscosity, max cST (SUS) at		
100°C	3.0 (36)	D445, D88
40°C	12.0 (66)	
0°C	76.0 (350)	
Specific gravity at 15°C	0.91 g/cc max	C1298
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 (by Karl Fischer test)	30 ppm	D1533
PCB content	No detectable amount	D4059
Weight	0.9 kg/liter 7.5 lb/gal	

Periodic inspection and maintenance

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

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

WARNING

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

G114.1

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

CAUTION

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

T254.0

WARNING

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

G106.3

1. **Bypass, trip, and de-energize recloser.**
2. **Inspect external components.** Check for broken bushings, paint scratches, or other mechanical damage. The counter reading should be noted and entered in the recloser record. Close and trip the recloser manually to see if the counter is functioning properly.

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

3. **Remove mechanism from tank.** Loosen six bolts that secure the tank to the head casting, and loosen the gasket seal between tank and head casting. Trip the recloser, and hoist the mechanism out of the tank; allow oil to drain.
4. **Inspect moving contacts.** Limited erosion of the contact arcing tips is acceptable. However, the movable contact assembly must be replaced if the load current surfaces show any erosion or if the arcing tips are excessively eroded.

Figure 2 shows a set of contacts after severe interrupting duty and a new set for comparison. The used set should be replaced.

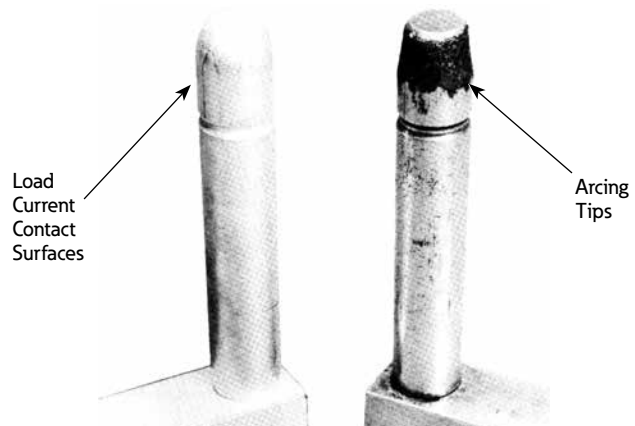


Figure 2. Moving contact set: Left, new; right, after one full duty cycle.

CAUTION

Dielectric failure, equipment damage. Never use volatile solutions, detergents, or watersoluble 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

5. **Inspect stationary contacts.** If the moving contacts require replacement the stationary contacts must also be replaced.
6. **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

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

7. **Remove old oil.** Pour out old oil from tank. If the maintenance inspection period selected is before one standard duty cycle or less than a year of operation, the old oil should be tested before re-use is considered.
8. **Inspect tank liner.** One tank liner is employed. The liner is fibrous and readily absorbs any moisture present. Soft or spongy areas indicate water has been absorbed. Replace the liner if these areas are present. Rinse the tank with clean oil, and wipe out all carbon traces with a clean lint-free cloth.
9. **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 illustrated in ASTM Publication D117. Fill to within four inches of the top of the tank with the mechanism out of oil. Tank capacity is 76 L (20 gal).
10. **Replace cover and mechanism in tank.** Wipe clean the o-ring type gasket, the gasket recess in the recloser cover, and the tank gasket seat. Position the six head bolts and tighten alternately; tighten type D recloser head bolts to 34–47 Nm (25–35 ft-lbs) torque, tighten type DV to 47–75 Nm (35–55 ft-lbs) torque. The cover can be rotated in steps of 60 degrees with respect to the tank and its mountings.

⚠ WARNING

Hazardous voltage. Never use a manual closing tool to close an energized recloser. Manually closing an energized recloser can result in contact with high voltage that will cause death or severe personal injury.

T231.1

⚠ CAUTION

Equipment damage. Refer to the specific switchgear unit maintenance manual for tanking/untanking procedures and related instructions. Failure to follow these instructions could result in equipment damage or personal injury.

T238.0

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

11. **Test closing operation.** A manual closing tool permits manual closing of the main contacts for testing when the closing solenoid is not connected to a high-voltage source. Prior to use, remove pipe plug located in the cover. Insert manual closing tool to engage the roll pin on the main lever and shaft assembly in the head mechanism. Turn clockwise to close contacts. Be certain to replace plug before restoring to service.

Note: When the recloser is energized, the open and close operations can be freely tested with a hot stick inserted in the manual control lever under the sleet hood. This control lever, under the sleet hood, is tripfree. If the recloser is closed against a fault, the recloser will continue to trip and reclose until the manual control lever drops to the open position.

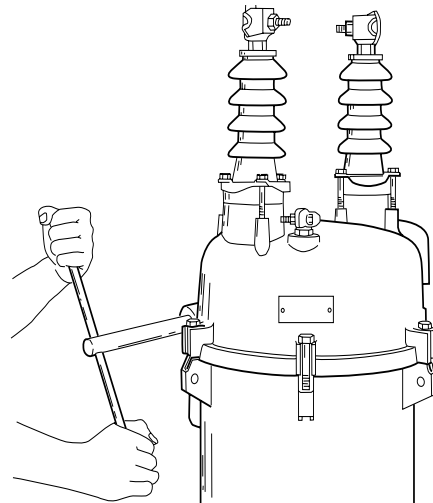


Figure 3. Manual closing operation.

Shop maintenance

When shop maintenance or repairs are to be performed, remove the six bolts that secure the tank and head casting. Trip the recloser, and lift the mechanism out of the oil and allow it to drain. Operations described in this section should be performed in the cleanest conditions possible.

Interrupter assembly

1. Using a 1/2-inch thin wall socket, remove the vibrationproof hex nut that secures the movable contact assembly to the lift rod. Gently tap contact arm to remove contacts from the lift rod. See Figure 4.
2. Remove the terminal bolt from the top of each stationary contact assembly.
3. Remove hex nuts, flat washers, and lock washers that secure the interrupter assembly to the stringers.
4. Slide the arc interrupter assembly off.

Note: The arc interrupter assembly and movable contact assembly should both be replaced at the same time. The arc interrupter assembly is only available as a unit.

5. Place the replacement interrupter assembly into position and secure it with the original hardware.
6. Install the terminal bolt into each stationary contact assembly.
7. Place the movable contact assembly onto the lift rod and install the vibration-proof hex nut.

Note: It is recommended to replace vibration-proof nuts after they have been removed.

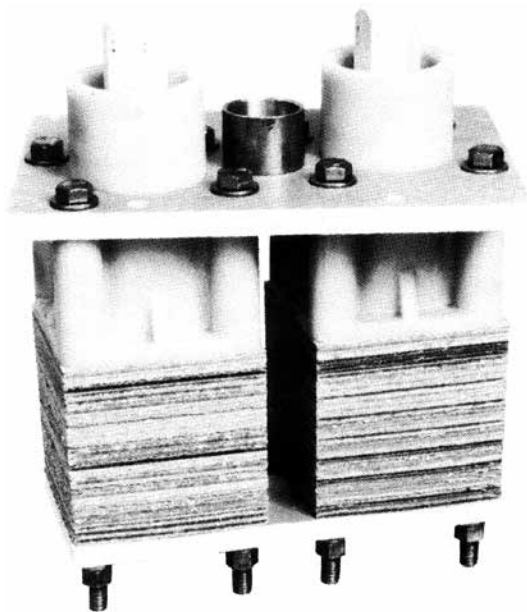


Figure 4. Assembled interrupter and stationary contacts.

Closing solenoid

Very little maintenance should be required for the closing solenoid. It may be necessary to replace the potential coil if the recloser is to be operated at another voltage. To replace potential solenoid, untank the recloser, remove cover and bushing rods, and place horizontally on a clean bench.

1. Disconnect the coil and fuse leads from the contactor assembly.

Note: When changing closing coil to operate at another voltage, the accompanying fuse must also be replaced.

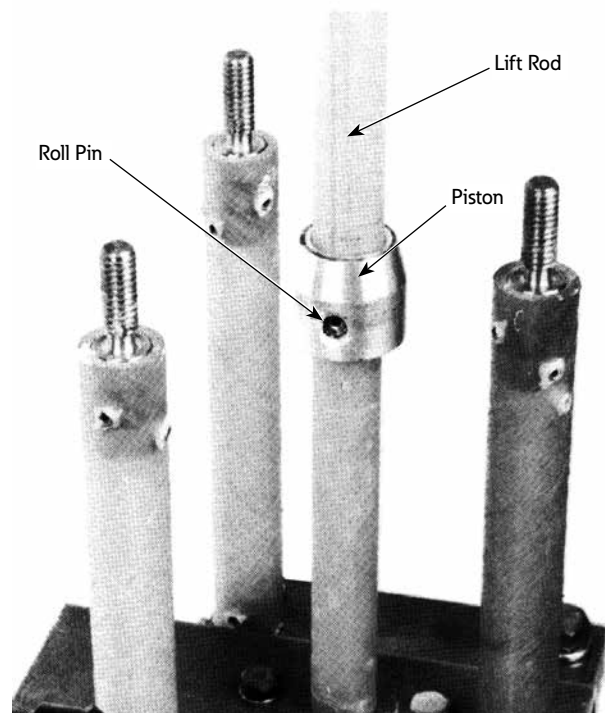


Figure 5. Removing lift rod piston.

2. Remove the vibration-proof hex nut that secures the movable contact yoke to the lift rod. Gently tap contact yoke off lift rod.
3. Remove the terminal bolts from stationary contact assemblies.
4. Disengage the series trip link from the series trip plunger by removing cotter pin, spacer, and pin.
5. Remove the three nuts, lockwashers, and flat washers that secure the interrupter assembly to the support stringers.
6. Remove the interrupter assembly.
7. Drive out roll pin that secures piston to lift rod, see Figure 5. Remove piston.
8. Remove four capscrews securing bridge plate to closing solenoid frame, and remove bridge plate assembly.

9. Remove the closing coil and gasket. See Figure 6.
10. Reassemble in reverse order of disassembly.



Figure 6. Removing closing coil.

Series trip solenoid

Coil kits are furnished for replacements to change recloser minimum trip ratings. Series-trip solenoids can be equipped with either standard coils or an alternate coil. Standard coils are used to achieve tripping at approximately 200 percent of full-load rating. Alternate 100X, 140X, 400X and 560X coils are used to achieve tripping at approximately 140 percent of full-load rating. The same basic procedure is used to dismantle either solenoid.

Solenoid disassembly

1. Remove cotter pin and slide out the grooved pin that connects the insulated operating links to the solenoid plunger. See Figure 7.
2. Remove the terminal bolt that fastens the bushing lead to the outer coil terminal.
3. Remove the capscrew that fastens the terminal strap to the stationary contact nut.
4. Remove the two frame mounting bolts that secure the solenoid frame to the mounting board, and lift the entire solenoid assembly off the mounting board. See Figure 8.
5. Lift out the solenoid plunger, guide clips, and guide channels. Slide the upper insulation washer as far as it will go in the direction of the terminal strap. Lift the coil slightly and pull it out of the solenoid frame. See Figure 9. Wipe off any carbon deposits on these parts with a clean lint-free cloth. Replace any damaged parts at this time.

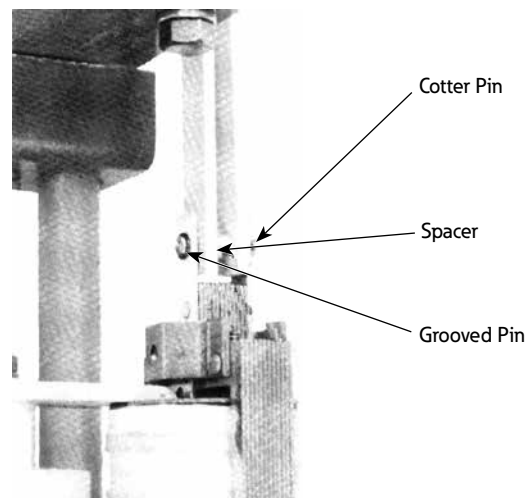


Figure 7. Series trip coil plunger.

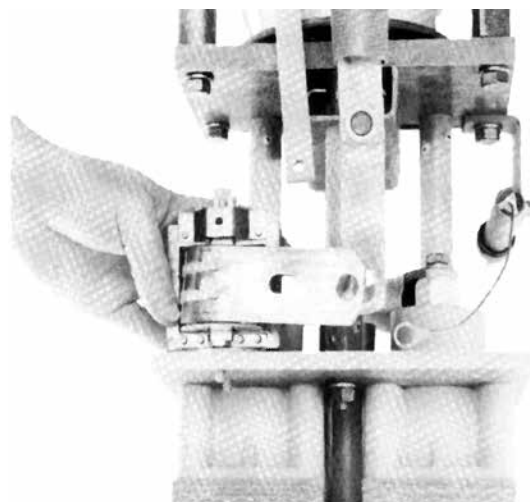


Figure 8. Removing series trip solenoid.

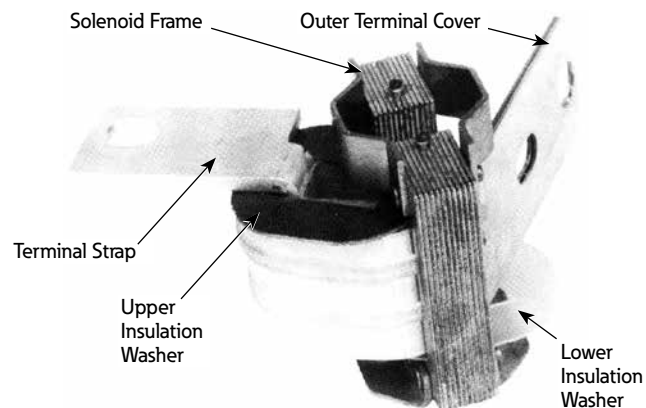
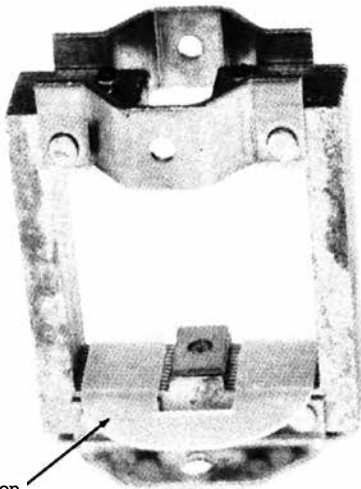


Figure 9. Solenoid disassembly.

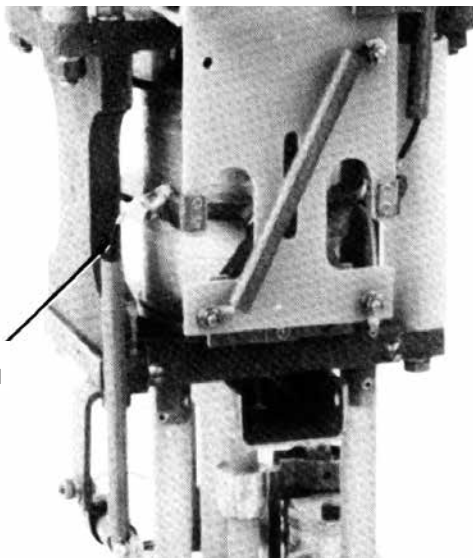
Solenoid replacement

1. Place the lower insulation washer in position. See Figure 10. Pass the upper insulation washer over the terminal strap and position it on top of the coil; see Figure 9. Push the coil into the solenoid frame and slide the upper washer into position. Replace, in order, the guide channels, guide clips, and plunger.
2. Place the solenoid assembly back on the mounting board and secure it with two new nuts.
3. Connect the operating links to the plunger with the grooved pin; secure with cotter pin.
4. Connect coil terminals to the stationary contact nut and the bushing lead to complete reassembly.



Lower Insulation Washer

Figure 10. Placement of lower insulation washer.



Fuse Lead

Figure 11. Closing solenoid contactor.

Closing solenoid contactor

The closing solenoid contactor assembly is replaced as an assembly.

1. Disconnect closing solenoid, fuse, and ground leads. See Figure 11.
2. Remove two C-rings to release pin that connects the operating link to the switch toggle assembly.
3. Remove the three capscrews that secure the contactor to the frame.
4. Replace contactor in above reverse order. Be sure closing solenoid and fuse leads clear insulating supports or grounded parts by at least 19 mm (3/4").

Hydraulic integrator mechanism

The hydraulic pump and lockout piston are enclosed in the integrator assembly. The integrator assembly is attached to the head mechanism with two, 1/4-inch hex-head machine screws and need not be removed; except to inspect fluid level, about every two or three years.

1. Disconnect the pump and lockout piston rods before removing integrator and integrator cover to check fluid level. Fluid level should be 5 mm (3/16") from the top of the cover gasket seat or a capacity of three ounces. The fluid used in the integrator is the same as that used in the time-delay unit (HFA—Hydraulic Fluid Aircraft conforming to military specification MIL-O-5606). Fluid can be added through the machine screw hole in the top cover.
2. If the integrator mechanism is not working properly, it must be replaced as a complete assembly.

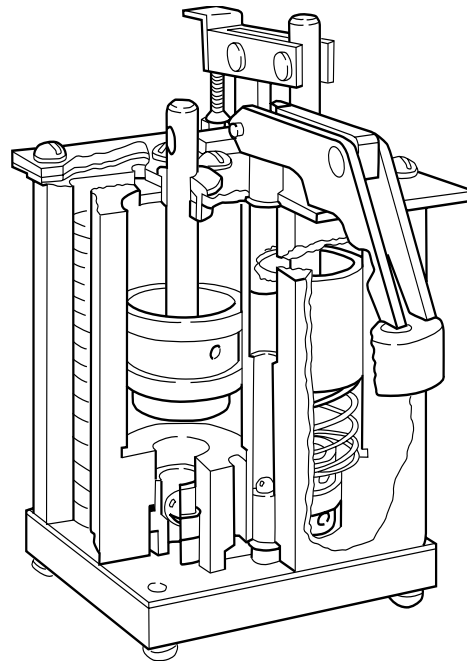


Figure 12. Cross section of integrator assembly.

Time-delay unit

Maintenance to the time-delay unit is limited to the inspection of fluid level, about every two or three years.

CAUTION

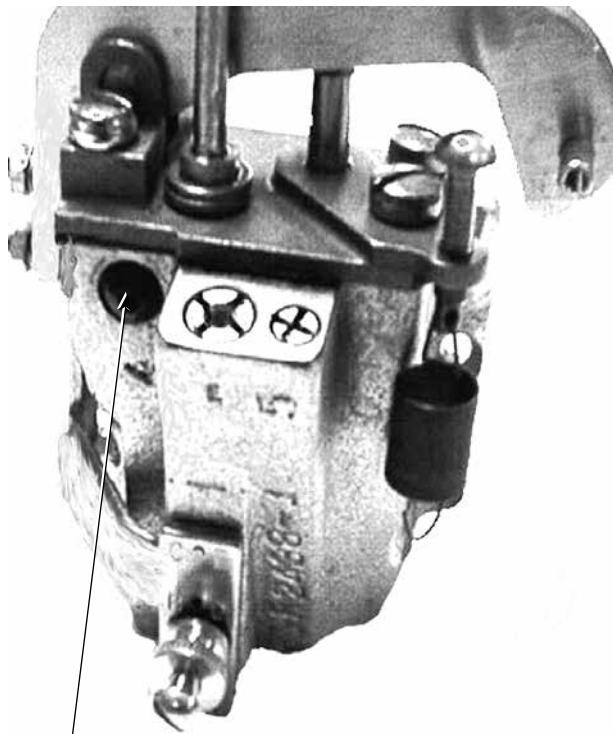
Equipment damage. Keep work areas clean to prevent debris from accumulating on or in the hydraulic mechanism during disassembly and re-assembly procedures. Failure to comply can result in hydraulic failure and recloser misoperation.

T254.0

To check the fluid level, remove the filler plug located on the side of the unit.

A special kit, catalog number KA806R2, is available for filling the time-delay unit. This kit includes two ounces of the special time-delay unit fluid and an eyedropper. Add enough fluid to bring the level up to the filler plug hole. Replace the plug.

If the time-delay unit is not working properly, it must be replaced as a complete unit.



Hydraulic fluid plug and filler hole.

Figure 13a. Time-delay unit.

Note: Earlier designs with alternate filler holes are shown in Figures 13b and c.

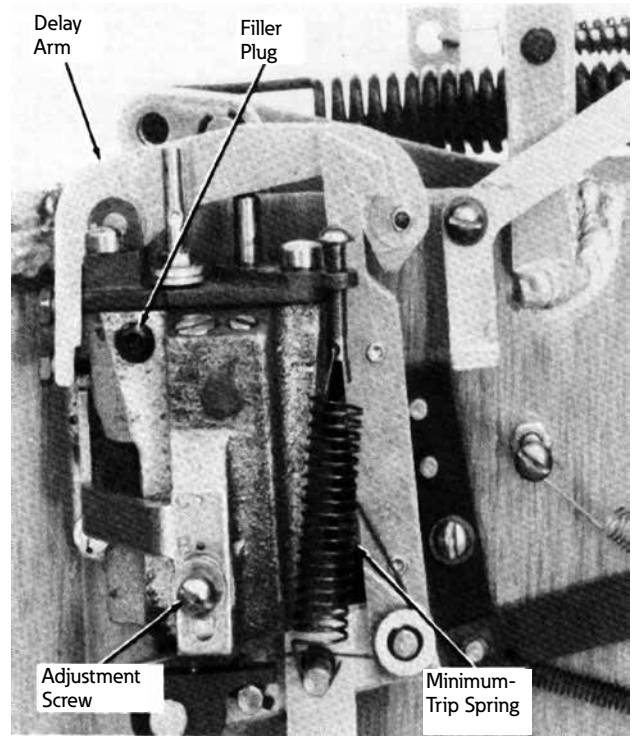


Figure 13b.

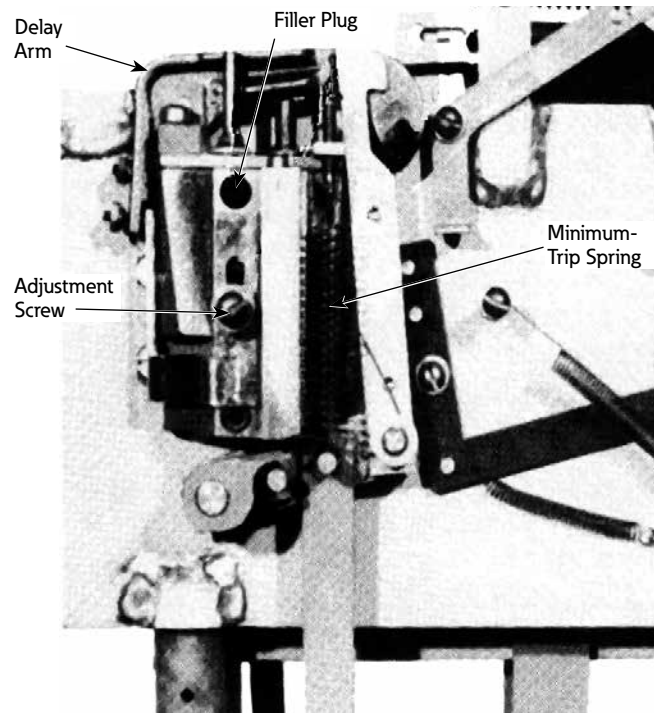


Figure 13c.

Bushings

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

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

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

1. Disconnect bushing terminal leads and untank the recloser.
2. Type D only (refer to Figure 14).
 - A. Remove bottom capscrew of the silver-plated rod connected to the bushing lead rod. The silver-plated rod has a tapped hole and may be turned out and off of the bottom of the bushing lead rod.
 - B. Remove the three hex-head capscrews that secure the bushing clamps. Lift the bushing assembly up through the head casting.
 - C. An aluminum clamping ring cushions the pressure between the bushing and bushing clamps. The ring can be reused if it is in good condition. Twist the ring to slip it off the bushing.

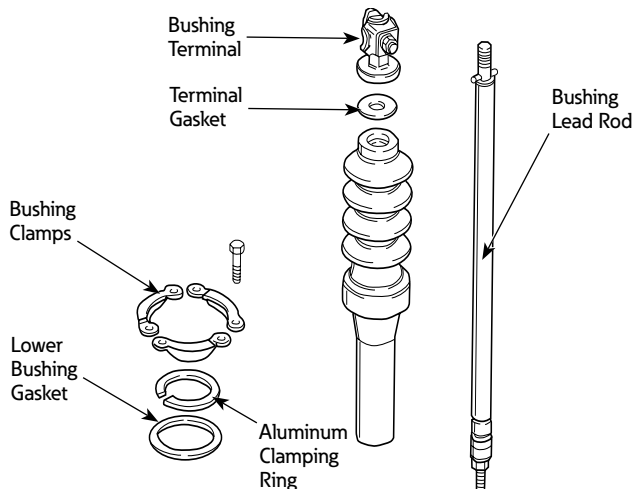


Figure 14. Bushing replacement (D).

- D. The bushing assembly can be completely replaced, or new porcelain only can be installed. If new porcelain is to be installed, unscrew the bushing terminal and draw the bushing lead rod out the lower end of the porcelain. Insert the rod in the new porcelain, and replace the bushing terminal. Use a new terminal gasket.
 - E. Replace the bushing assembly, using a new gasket between the bushing and the head casting. Tighten the three capscrews that secure the bushing clamps to 14–20 Nm (10–15 ft-lbs) torque.
 - F. Screw the silver-plated rod onto the stud portion of the bushing lead rod.
3. Type DV only (refer to Figure 15).
 - A. Remove the hex nuts connecting the bushing terminals to the interrupter leads.
 - B. Loosen the clamps that secure the corona shield, and remove the corona shield.
 - C. Remove the three hex head capscrews that secure the bushing clamps. Lift the bushing assembly up through the head casting.
 - D. An aluminum clamping ring cushions the pressure between the bushing and bushing clamps. The ring can be reused if it is in good condition. Twist the ring to slip it off the bushing.
 - E. The bushing assembly must be replaced as an assembly.
 - F. When replacing the bushing assembly, use a new gasket between the bushing and the head casting. Tighten the three hex-head capscrews, that secure the bushing clamps to 14–20 Nm (10–15 ft-lbs) torque.

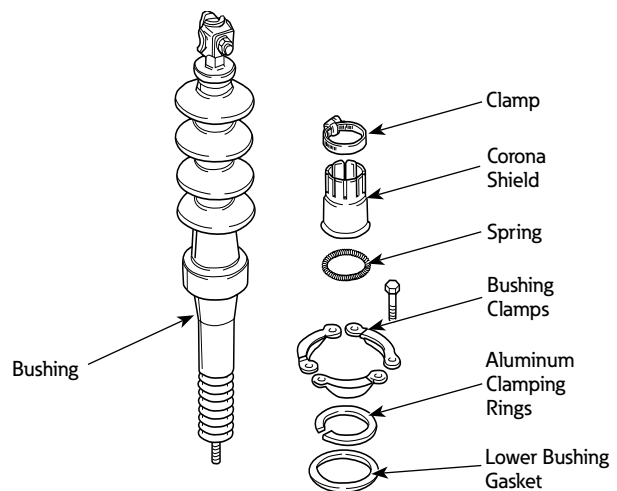


Figure 15. Bushing replacement (DV).

Rating changes

WARNING

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

G129.0

Rated current

A recloser's continuous current rating can be easily changed by installing a new coil in the series trip solenoid. Coil ratings of 100, 140, 160, 185, 225, 280, 400, or 560 A are available.

Tripping occurs at 200% of full load rating when the recloser is equipped with standard trip coils. Coils 100X, 140X, 400X and 560X will initiate tripping at 140% of load rating.

Rated phase-to-ground voltage

Closing solenoid coils are available for different voltages. When the closing solenoid is changed, the protective fuse also may have to be changed. A fuse is shipped with each replacement coil. Table 3 shows the correct size fuse to use with different ratings of coils.

When changing current or voltage ratings, be sure to change coil data and/or voltage data nameplates on the sleet hood.

Closing solenoid fuse

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 bolt. Slide the fuse out 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 3 also shows this information. Be sure the fuse leads clear any grounded parts or the insulating supports by 19 mm (3/4").

Table 3. Closing Solenoid Protective Fuses

Closing Solenoid Phase-to-Ground Voltage	Fuse Catalog Number	Color Band
2.4	KA259R901	Black
4.16-6.0	KA259R902	Yellow
7.2-20.0	KA259R903	Red

High-potential withstand testing

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

WARNING

Do not operate this equipment if energized parts are not immersed in dielectric fluid. Operation when parts are not properly immersed in dielectric fluid may result in internal flashovers that will damage the equipment and can cause death or severe personal injury.

G104.4

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 one minute. See Table 4.

Table 4. Test Voltages for High-Potential Testing

Recloser Type	75% of Rated Low-Frequency Recloser Type Withstand Voltage (kV rms)	
	AC	DC
D	37.5	53.0
DV	52.5	74.2

Closed-contacts test

1. Manually close the recloser contacts.
2. Ground the recloser.
3. Apply proper test voltage to one of the bushing terminals. The recloser should withstand the test voltage for 60 seconds.

Open-contacts test

1. Pull down the yellow manual operating handle to open the recloser contacts.
2. Ground the recloser.
3. Ground the bushing on one side of the recloser.
4. Apply proper test voltage to the ungrounded bushing. The recloser should withstand the test voltage for 60 seconds.
5. Reverse the test and ground connections to the bushings.
6. Apply proper test voltage to the ungrounded bushing. The recloser should withstand the voltage for 60 seconds.

Withstand test results

The high-potential withstand tests provide information on the dielectric condition of the recloser.

If the recloser passes the closed-contacts test and fails the open-contacts test, the cause is likely to be in the interrupter assembly.

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

Service parts listing

To help you find a service part by a general location, this parts listing has been divided into various parts groups that are cross-referenced to exploded parts views.

Service parts listed and illustrated include only those parts

that are usually furnished with a standard unit. Major parts that have been specially ordered for specific applications are available upon request. Please include a full description of the part, the recloser type number, and the serial number. With Eaton's continuous improvement policy, there will be some cases where replacement parts will not be exactly the same as the original parts furnished.

Because of the ease, faster receipt, and greater economy of local acquisition, the wiring, wire-end terminals, and connectors have not been included in this parts listing. All hardware parts dimensions have been carefully checked so that they may likewise be obtained locally.

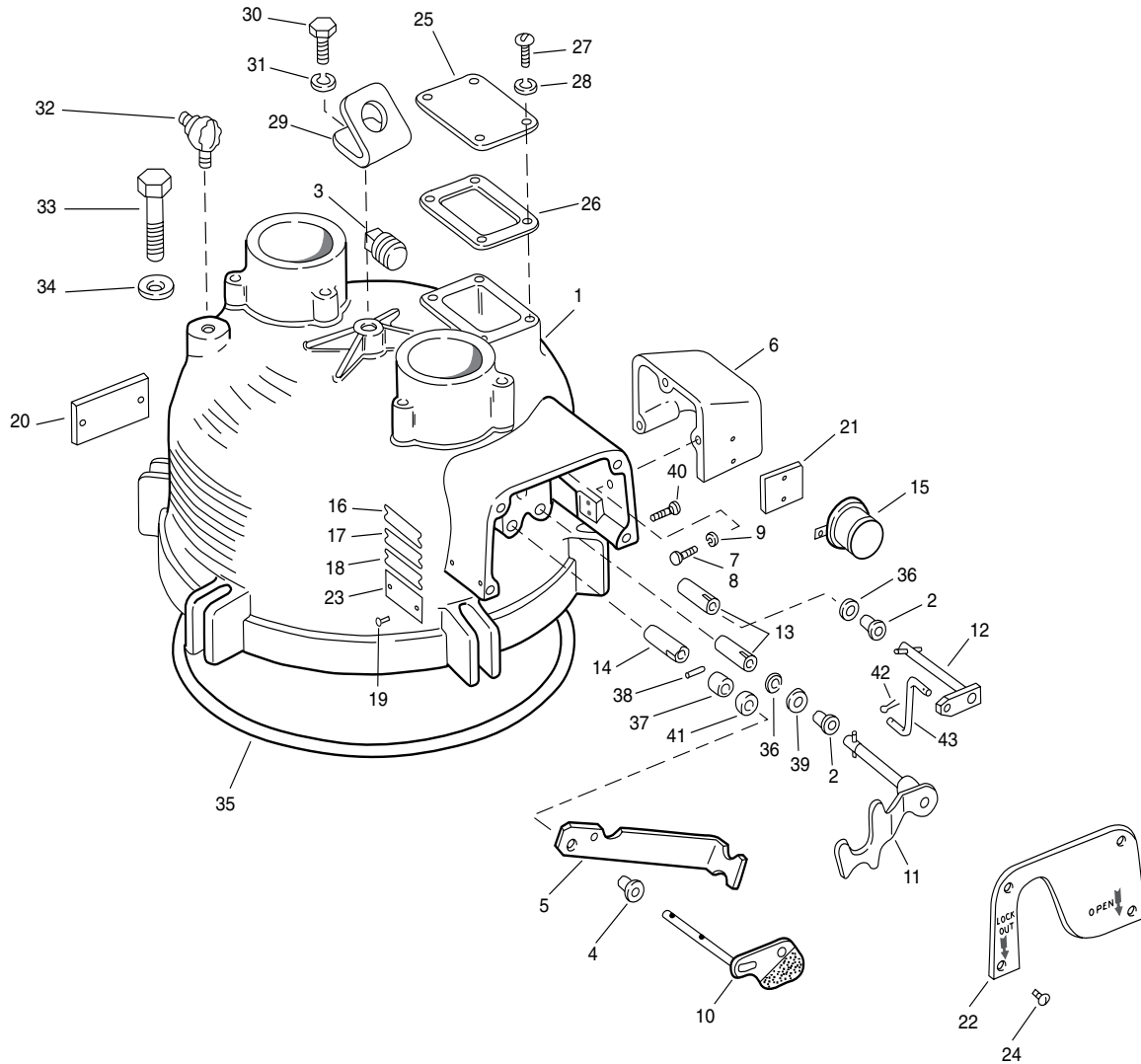


Figure 16. Type D, cover parts group.

Type D Cover Parts Group (Figure 16)

Item No.	Description	Catalog Number	Quan. Req'd.
1-9	Cover assembly	KA67D	1
1	Cover casting	KP501D	1
2	Bushing, operating handle of counter shaft	KP3107A1	2
3	Plug, manual closing	KP2007A4	1
4	Bushing, non-reclosing lever	KP691D	1
5	Lever, non-reclosing	KP692D	1
6	Sleethood	KP693D	1
7	Capscrew hex hd, 1/4"-20UNC-3 x 3/4", st stl	K730115125075A	1
8	Capscrew hex hd, 1/4"-20UNC-2 x 1", st stl	K730115125100A	2
9	Lockwasher, 1/4", med, st stl	K90081502500A	3
10	Shaft and position indicator	KA118D	1
11	Operating handle and shaft	KA147D	1
12	Lever and shaft, non-reclosing	KA90D	1
13	Coupling, operating handle and non-reclosing lever	KP1177R	2
14	Coupling, shaft and indicator	KP1056R	1
15	Operations counter	KA28C05	1
16	Voltage data plate, for 2.4 kv Voltage data plate, 4.16-4.8 kv Voltage data plate, 7.2-7.62 kv Voltage data plate, 8.0-8.32 kv	KP567R-1 KP567R-2 KP567R14 KP567R15	1
17	Coil data plate, specify series trip value	KP2119A11	1
18	Operating data plate	KP1371R	1
19	Screw, #2 x 3/16", self-tapping, st stl, rd hd	K801515002018A	10
20	Ground instruction plate	KP611 D	1
21	Plate, non-reclosing handle designation	KP390R	1
22	Cover plate, side	KP588D	1
23	Nameplate	KP589D	1
24	Screw #12 x 1/2", self-tapping, st stl, rd hd	K781515112050A	4
25	Cover plate, top	KP609R	1
26	Gasket, top cover plate	KP611R	1
27	Machine screw, 1/4"-20UNC-2 x 3/8, rd hd, st stl	K730115125075A	4
28	Lockwasher, 1/4", med, st stl	K900815025000A	4
29	Lifting lug	KP1010DV2	1
30	Capscrew, 5/8"-11UNC-2A x 1" st w/ brz irid	K730115162150A	1
31	Lockwasher, 5/8", med, st zn pit brz irid	K900815062000A	1
32	Ground connector	KA392R	1

Type D Cover Parts Group (Figure 16)

Item No.	Description	Catalog Number	Quan. Req'd.
33	Capscrew, 1/2" -13UNC-2 x 3-1/2 st zn pit, brz irid	K730115150325A	6
34	Washer, flat, steel	KP2028A19	6
35	Gasket, cover to tank	KP2103A9	1
36	Retaining ring	K970901312000M	1
37	Spacer	KP3004A3	1
38	Roll pin, 3/32" x 1/2	K970801093050M	1
39	Washer, 5/16", brass	K900225032056Z	2
40	Machine screw, #6-32UNC-2 x 1", st stl	K751515106100A	2
41	Spacer	KP791D	1
42	Cotter pin	K970525062050A	2
43	Link	KP688D	1

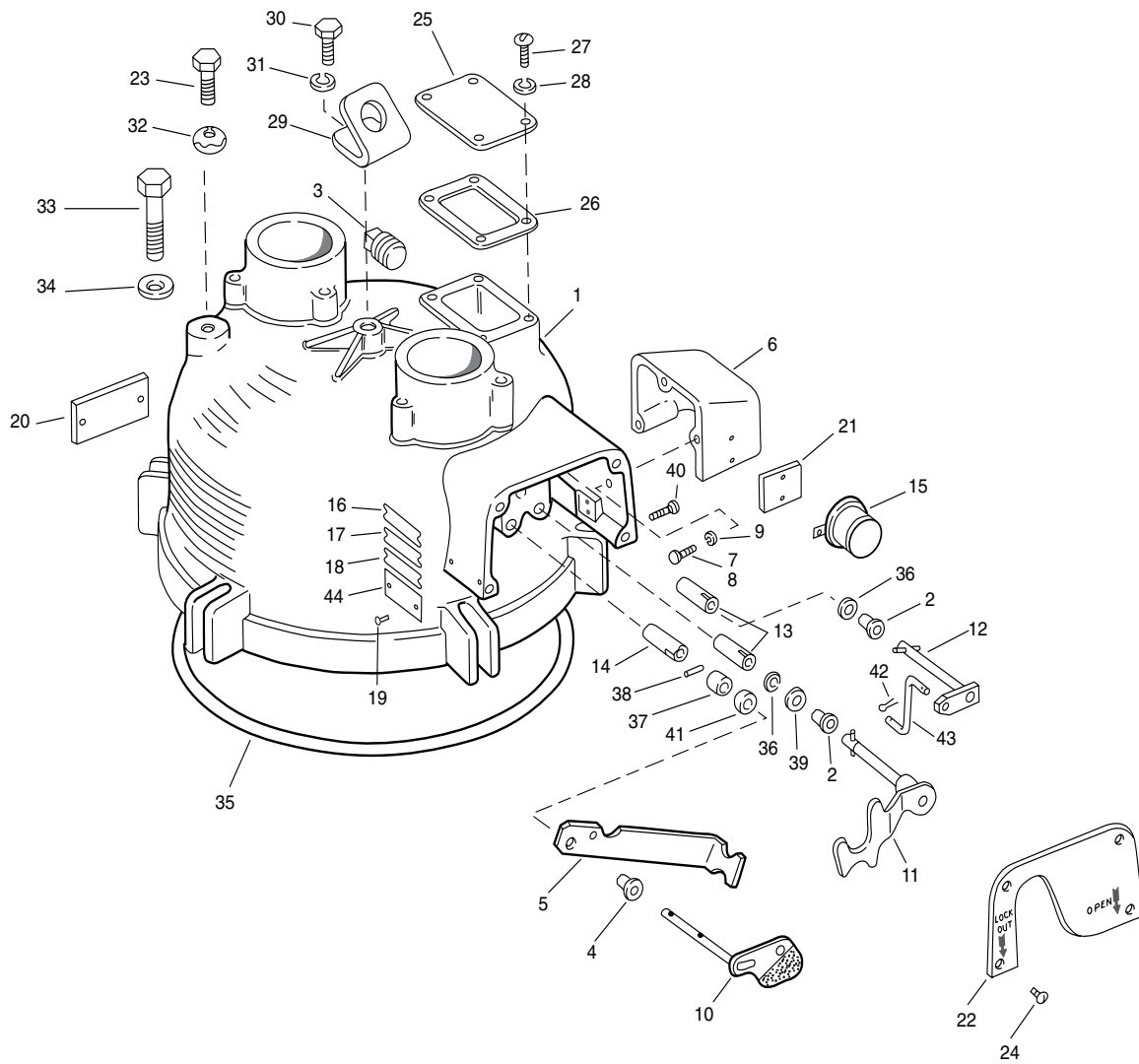


Figure 17. Type DV, cover parts group.

Type DV Cover Parts Group (Figure 17)

Item No.	Description	Catalog Number	Quan. Req'd.
1-9	Cover assembly	KA11 7DV	1
1	Cover casting	KP1001DV	1
2	Bushing, operating handle of counter shaft	KP3107A1	2
3	Plug, manual closing	KP2007A4	1
4	Bushing, non-reclosing lever	KP691D	1
5	Lever, non-reclosing	KP692D	1
6	Sleethood	KP693D	1
7	Capscrew hex hd, 1/4"-20UNC-3 x 3/4", st stl	K730115125075A	1
8	Capscrew hex hd, 1/4"-20UNC-2 x 1", st stl	K730115125100A	2
9	Lockwasher, 1/4", med, st stl	K90081502500A	3
10	Shaft and position indicator	KA114DV	1
11	Operating handle and shaft	KA115DV	1
12	Lever and shaft, non-reclosing	KA118DV	1
13	Coupling, operating handle and non-reclosing lever	KP1177R	2
14	Coupling, shaft and indicator	KP1056R	1
15	Operations counter	KA28C05	1
16	Voltage data plate, for 20.0 kv	KP567R-9	1
17	Coil data plate, specify series trip value	KP2119A11	1
18	Operating data plate	KP1371R	1
19	Screw, #2 x 3/16", self-tapping, st stl, rd hd	K801515002018A	12
20	Ground instruction plate	KP611D	1
21	Plate, non-reclosing handle designation	KP390R	1
22	Cover plate, side	KP588D	1
23	Screw, 1/2-13UNC-2A x 1 1/4" hex head	K730115150125A	1
24	Screw #12 x 1/2", self-tapping, st stl, rd hd	K781515112050A	4
25	Cover plate, top	KP609R	1
26	Gasket, top cover plate	KP611R	1
27	Machine screw, 1/4"-20UNC-2 x 5/8, rd hd, st stl	K730115125075A	4
28	Lockwasher, 1/4", med, st stl	K900815025000A	4
29	Lifting lug	KP1010DV2	1
30	Capscrew, 5/8"-11UNC-2A x 1-1/2" st	K730115162150A	1
31	Lockwasher, 5/8", med, st	K900815062000A	1
32	Ground connector	KA227H	1
33	Capscrew, 1/2"-13UNC-2 x 3-3/4" st zn pit, brz irid	K730115162375A	6
34	Washer, flat, steel	KP2028A31	6
35	Gasket, cover to tank	KP2103A14	1
36	Retaining ring	K970901312000M	1
37	Spacer	KP3004A3	1

Type DV Cover Parts Group (Figure 17)

Item No.	Description	Catalog Number	Quan. Req'd.
38	Roll pin, 3/32 x 1/2	K970801093050M	1
39	Washer, 5/16", brass	K900225032056Z	2
40	Machine screw, #6-32UNC-2 x 1", st stl	K751515106100A	2
41	Spacer	KP791D	1
42	Cotter pin	K970525062050A	2
43	Link	KP688D	1
44	Name plate	KP1029DV	1

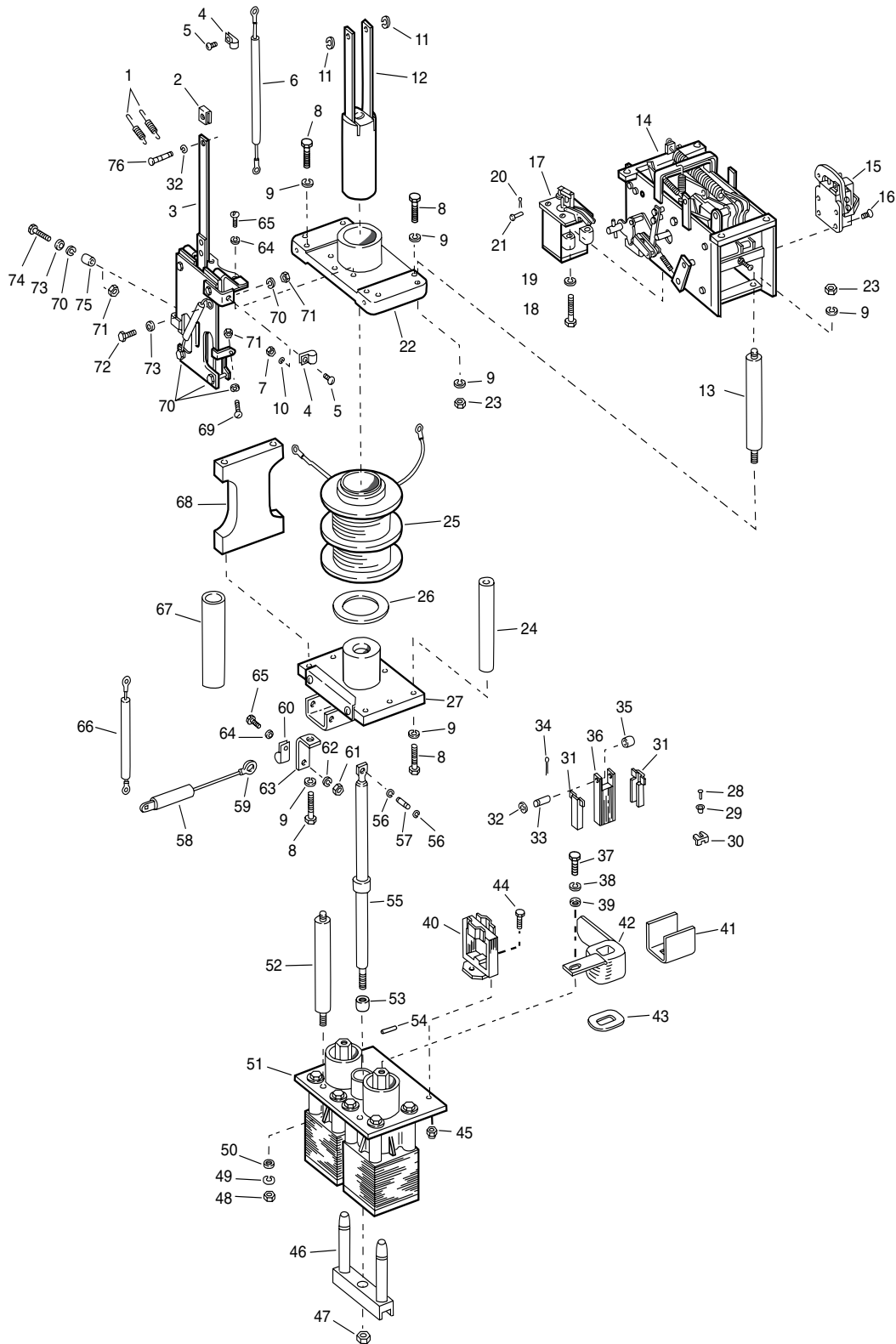


Figure 18. Head mechanism and frame assembly.

Head Mechanism and Frame Assembly (Figure 18)

Item No.	Description	Catalog Number	Quan. Req'd.
1	Spring	KP141R	2
2	Shield	KP599D	1
3	Solenoid contactor	KA97D1	1
4	Cable clip	KP2006A19	2
5	Screw, #8-32UNC x 1/2, round head, st stl	K721515108050A	2
6	Tube assembly	KA43D	1
7	Nut, #8-32UNC-2B, hex, st stl	K881015132008A	1
8	Screw, 7/16"-14UNC-2 x 1-1/2, hex head	K730101143150A	8
9	Lockwasher, 7/16, med	K900801043000E	12
10	Lockwasher, #8, med, st stl	K900815008000	1
11	Retaining ring	K970901375000M	2
12	Plunger assembly	KA45D	1
13	Spacer	KA106D	4
14	Mechanism assembly	KA103DVA1	1
15	Time-delay assembly: B and C curve D and E curve	KA864R1 KA864R2	1
16	Machine screw, #10-24UNC-2A X 1/2", flat head, st stl	K721515110050A	4
17	Integrator assembly	KA79D	1
18	Machine screw, 1/4-20UNC-2A x 13/4, hex head, st stl	K722415125175	2
19	Lockwasher 1/4" med, st stl	K900815025000	2
20	Cotter pin, 1/16 X 1/2, brass	K970525062050A	1
21	Pin	KP729D	1
22	Solenoid frame	KP725D	1
23	Hex nut, 7/16"-14UNC, stl	K880201114043A	4
24	Stringer	KP712D	2
25	Closing coil and fuse kit 2.4 kv 4.16-4.8 kv 7.2-7.62 kv 8.0-8.32 kv 125 VDC 250 VDC 14.4 kv 20 kv	KA700D1 KA700D2 KA700D3 KA700D4 KA700D5 KA700D6 KA700D7 KA700D9	1
26	Gasket	KP579D	1
27	Bridge plate assembly	KA103D1	1
28	Screw, #2 x 5/16", self tapping, round head, st stl	K751501102031A	2
29	Eyelet	KP2160A4	2
30	Guide	KP622R	2
31	Guide	KP312R	2
32	Retaining pin	K970901250000M	2
33	Groove pin	KP3114A1	1
34	Cotter pin, 1/16 x 1/2	K970501062050A	1
35	Spacer	KP3007A12	1
36	Plunger assembly	KA604R	1
37	Screw, 3/8"-24UNC x 7/8", hex cap, brz	K700133337087A	1
38	Washer, #24S, brass	K900525039087A	1
39	Lockwasher, 3/8", med brz	K900830037000A	1
40	Series solenoid frame 2-1/16" coil opening Series solenoid frame, 2-7/16" coil opening	KA603R KA150D	1

Head Mechanism and Frame Assembly (Figure 18)

Item No.	Description	Catalog Number	Quan. Req'd.
41	Barrier, for use with 2-1/16" coil opening frame Barrier, for use with 2-7/16" coil opening frame	KP1684R1 KP1684R2	1
42	Series coil trip coil replacement kit. Add coil rating to this number. Includes coil and nameplate up to 280 A. and coil washer (item 43) for 400 A and above. 400X and 560X coils also includes a 2-7/16 opening coil frame (item 40).	KA835W2_____	1
43	Washer	KP1075R	2
44	Screw, 1/4"-20UNC-2A x 3/4", hex head, st stl	K722415125075A	2
45	Nut, elastic	KP2020A3	2
46	Contact yoke assembly Prior to serial number 4947D After serial number 4946D	KA11W1	1
47	Nut, elastic	KP2020A4	1
48	Nut 3/8"-24UNC, hex head, stl	K880201324037A	3
49	Lockwasher, 3/8", med, st	K900801037000Z	3
50	Washer, 3/8", st	K90020103700Z	3
51	Interrupter and contact assy. Prior to serial number 4947D After serial number 4946D	KA85D KA102DV	1
52	Spacer	KA18H4-1	3
53	Spacer	K3011A74	1
54	Roll pin, 1/8. x 5/8	K970801125062C	1
55	Contact rod assembly	KA104DV	1
56	Retaining ring	K970901312000M	2
57	Groove pin	KP3125A2	1
58	Fuse assembly, enter number to indicate color band on fuse e.g. 901-black, 902-yellow and 903-red.	KA259R_____	1
59	Terminal	KP2010A23	1
60	Cable clip	KP2006A14	1
61	Nut, 1/4"-20UNC, hex, st stl	K880215120025A	1
62	Washer, 1/4", st stl	K900115026050A	1
63	Bracket, fuse	KP769D	1
64	Lockwasher 1/4", med, st stl	K900815025000A	4
65	Screw, 1/4"-20UNC x 3/4", machine, round head	K721515125075A	4
66	Tube assembly	KA148D	2
67	Insulating tube	KP3230A29	1
68	Solenoid shoe	KP789D	1
69	Screw, 1/4"-20UNC x 3/4", round head, brass	K721525125075A	1
70	Lockwasher, 1/4", med, brz	K900830025000A	5
71	Nut, 1/4"-20UNC, hex, brass	K881025120025A	3
72	Screw, 1/4"-20UNC-2A x 3/4" hex head, brass	K730125125075A	1
73	Washer, #14S, brass	K900525026056A	2
74	Screw, 1/4"-20UNC-2A x 1-1/4" hex head, brass	K730125125125A	1
75	Spacer	KP3009A137	1
76	Pin	KP775D	1

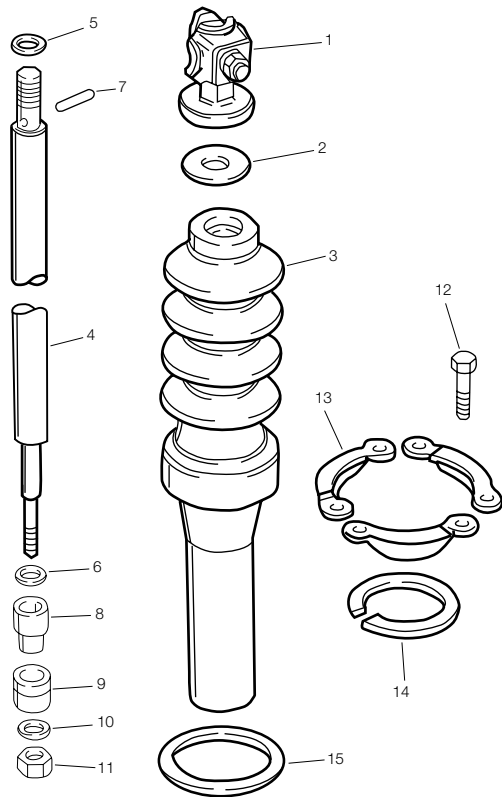


Figure 19. Type D, bushing parts group.

Type D Bushing Parts Group (Figure 19)

Item No.	Description	Catalog Number	Quan. Req'd.
1-11	Bushing assembly	KA717R26	2
1	Bushing terminal	KP17W901	1
2	Upper bushing gasket	KP2090A57	1
3	Ceramic bushing	KP171W	1
4	Lead rod	KP105WV4	1
5	Washer	KP2028A39	1
6	O-ring	KP2196A1	1
7	Roll pin 1/8X 7/8	K970801125875A	1
8	Sleeve	KP537RV	1
9	Sealing ring	KP507RV	1
10	Lockwasher, 1/2", brz, med	K900830062000A	1
11	Nut, 1/2"-20UNF-2B, hex, brass	K88012532050A	1
12	Screw, 3/8"-16UNC-2 x 3", hex hd, st stl	K730115137300A	3
13	Bushing clamp	KP1574R	3
14	Gasket bushing clamp	KP1111R	3
15	Gasket lower bushing	KP2090A66	1

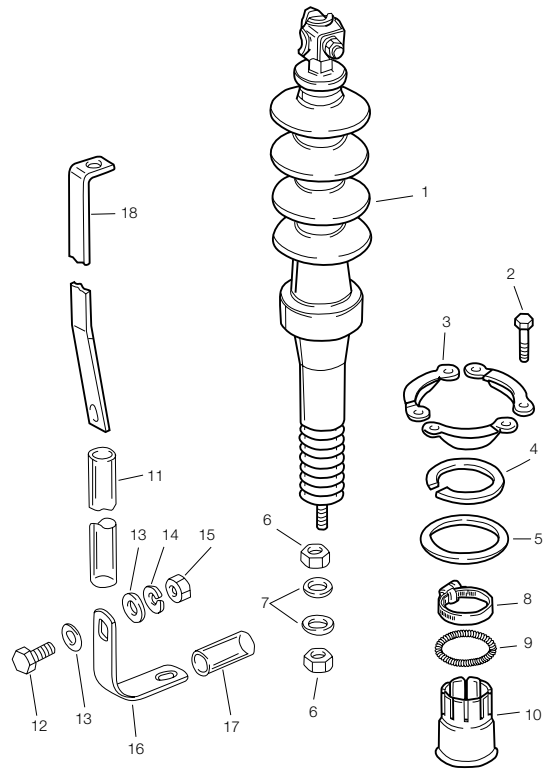


Figure 20. Type DV, bushing parts and leads.

Type DV Bushing Parts and Leads (Figure 20)

Item No.	Description	Catalog Number	Quan. Req'd.
1	Bushing assembly	KA56RV-4	2
2	Capscrew, 3/8"-16UNC-2 x 3", hex hd st stl	K730115137250A	6
3	Clamp, bushing	KP1574R	6
4	Gasket, bushing clamp	KP1111R	2
5	Gasket lower bushing	KA1193R	2
6	Nut, 1/2"-20	K880725320050H	2
7	Lockwasher, 1/2", med	K9008300500000H	2
8	Clamp	KP109WV	2
9	O-ring	KP2000A19	2
10	Corona shield	KP582RV	2
11	Glass sleeving	KP2104A17	2
12	Bolt, 1/2"-13UNC-2A x 1", hex head, brz	K700133150100	2
13	Washer, 1/2"	K901025050000H	4
14	Lockwasher, 1/2" med, brz	K900830050000H	2
15	Nut, 1/2" UNC-2A, brass	K880725320050H	2
16	Lead	KP3250A1	6
17	Glass sleeving	KP2104A9	1
18	Lead, bushing rod extension	KP1034DV	2

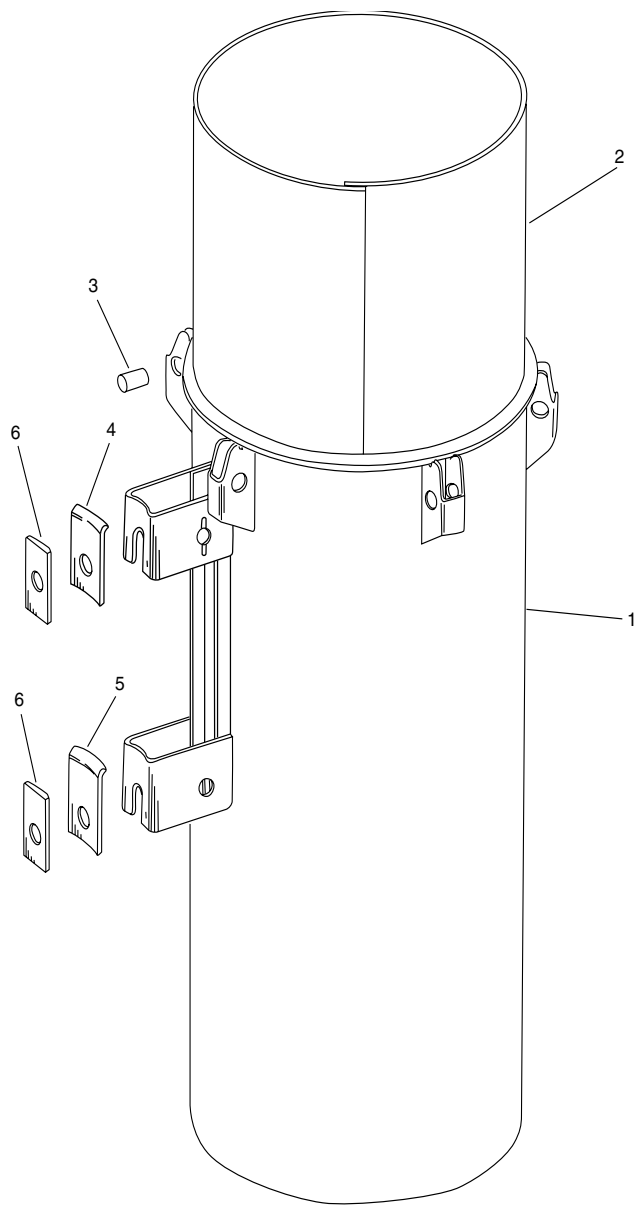


Figure 21. Type D, tank parts group.

Type D Tank Parts Group (Figure 21)

Item No.	Description	Catalog Number	Quan. Req'd.
1	Tank assembly	KA4D	1
2	Tank wall liner	KP511D	1
3	Combination nut and pin	KP307L	6
4	Mounting plate, curved, plate mtg, top	KP632D-1	1
5	Mounting plate, curved, pole, mtg, lower	KP632D-2	1
6	Mounting plate, flat adapting	KP631D-3	2

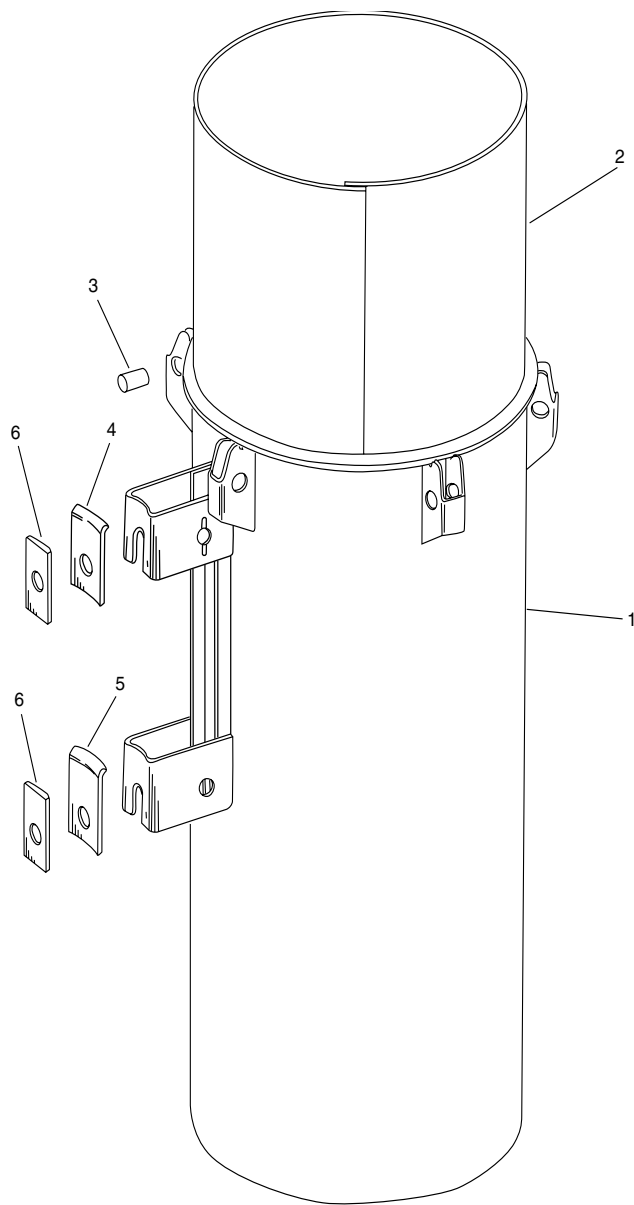


Figure 22. Type DV, tank parts group.

Type DV Tank Parts Group (Figure 22)

Item No.	Description	Catalog Number	Quan. Req'd.
1	Tank assembly	KA107DV-1	1
2	Tank wall liner	KP1021DV	1
3	Combination nut and pin	KP1010DV2	6
4	Mounting plate, curved, plate mtg, top	KP632D-1	1
5	Mounting plate, curved, pole, mtg, lower	KP632D-2	1
6	Mounting plate, flat adapting	KP631D-3	2



Eaton
1000 Eaton Boulevard
Cleveland, OH 44122
United States
Eaton.com

**Eaton's Cooper Power Systems
Division**
2300 Badger Drive
Waukesha, WI 53188
United States
Eaton.com/cooperpowerseries

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