

Type NR oil switch maintenance instructions

NR Switch Family Manufactured in Greenwood, SC

NR CP541000001 through CP541999999
NRV CP542000001 through CP542999999

Notice: This document is also applicable to product serial numbers beginning with the characters CP57.



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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.

G122.3

Product information

Introduction

Service Information MN230001EN covers the maintenance instructions for Eaton's Cooper Power™ series Type NR electrically-operated, single-phase, oil switches. This includes their general description, operating principles and instructions for periodic inspection and shop repairs. Service parts lists, keyed to exploded-view drawings of the switch, are included at the back of the manual.

Type NR oil switches are single-phase, electrically-operated with a quick-close, quick-open mechanism which also provides the switch with close-and-latch capability.

The switches are electrically operated. The standard actuator can be operated by any three-wire control device employing a set of SPDT contacts.

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 do not claim to cover all details or variations in the equipment, procedures, or process described, nor to provide directions for meeting every possible contingency during installation, operation, or maintenance. For additional information, contact your Eaton representative.

Acceptance and initial inspection

Each Type NR oil switch is completely assembled, tested, and inspected at the factory. It is carefully calibrated, adjusted and in good condition when accepted by the carrier for shipment.

Upon receipt, inspect the carton for signs of damage. Unpack the switch and inspect it thoroughly for damage incurred during shipment. If damage is discovered, file a claim with the carrier immediately.

Handling and storage

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

Standards

Type NR oil switches are designed and tested in accordance with IEEE Std C37.66™-2005 standard.

Quality standards

ISO 9001 certified quality management system

Description of operation

With the main switch contacts closed, energizing the opening circuit will operate the actuator motor to release a toggle which allows the preloaded opening springs to snap open the switch contacts and load the closing spring. It also drives the cam to position the selector switch for a closing operation and interrupts the opening circuit to stop the motor. The opening circuit must remain energized for at least 4.0 seconds for the actuator to perform these functions.

With the main switch contacts open, energizing the closing circuit will operate the actuator motor to allow the preloaded closing spring to snap closed the switch contacts and load the opening spring. It also drives the cam to position the selector switch for an opening operation and interrupts the closing circuit to stop the motor. The closing circuit must remain energized for at least 0.5 seconds for the actuator to perform these functions.

A holding switch accessory installation in the actuator reduces to one second the minimum time the control must be energized to effect an opening or closing operation.

Ratings and specifications

Table 1. Electrical Data (Control)

Description	Rating	
	Nominal operating voltage (Vac) (50/60 Hz only)	120
Operating voltage range (Vac)	95 – 130	190 – 260
Closing-motor current (amp)	1.9	.7
Switch response time, opening (sec)	4.0	4.0
Switch response time, closing (sec)	0.5	0.5

Table 2. Voltage and Current Ratings

Description	Standard	15 kV with 17" Creepage	15 kV with 125 kV BIL	22 kV
Maximum Design Voltage, kV	15.0	15.0	15.0	22.0
Nominal Operating Voltage, kV	2.4-14.4	2.4-14.4	2.4-14.4	20.0
Basic Insulation Level (BIL), kV	95	95	125	125
60 Hertz Withstand Voltage, kV				
Dry, One Minute	35	35	42	60
Wet, Ten seconds	30	30	36	50
Continuous Current Rating, Amps	200	200	200	60
Load Interrupting Ability (Inductive), Symmetric Amps				
75-100% power factor				
50-75% power factor	200	200	200	60
< 50% power factor	100	100	100	60
	50	50	50	60
Maximum Capacitive Current, Amps (parallel bank-max)	200	200	200*	60*
High Frequency Transient Current, Amps	12000	12000	12000	12000
Transient Frequency, Hz	6000	6000	6000	6000
High Frequency Damping Factor	.40-.55	.40-.55	.40-.55	.40-.55
Momentary Rating, Amps asym.	9000	9000	9000	9000
Short Time Current Amps				
1/2 second, sym.	6000	6000	6000	6000
1 second, sym.	4500	4500	4500	4500
Close and Latch Rating, Amps asym.	9000	9000	9000	9000

*The 125 kV BIL switch and the 22.0 kV switch are rated for single bank switching only.

Maintenance

Frequency of maintenance

These switches are applied under widely varying operating and climatic conditions, therefore, maintenance intervals are best determined by the user based on actual operating experience. To assure proper operation, switches must be maintained when they have performed the equivalent of a complete operating duty cycle and before the dielectric strength has deteriorated below prescribed levels. In the absence of specific operating experience, Eaton recommends the switch be inspected and serviced every 1200 operations or three years, whichever comes first. In no case should the service interval, between periodic maintenance and inspection, extend beyond 1200 operations.

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

Periodic maintenance inspection

Each periodic maintenance inspection should include at least the following:

1. By-pass and remove the switch from service.
2. Inspect external components.
 - A. Clean the bushings and inspect for chips, cracks and breaks. Replace as necessary, following procedure in "Shop Repair Procedures—Bushings" section.
 - B. Check for paint scratches and other mechanical damage. Paint to inhibit corrosion.
3. Perform a dielectric withstand test to determine the insulation level. Follow procedures in "Insulation Level Withstand Tests" section.
4. Loosen the head bolts and remove the mechanism from the tank. Be careful not to damage the gasket if the tank and head must be pried apart to break the seal.
5. Allow the oil to drain off the mechanism.

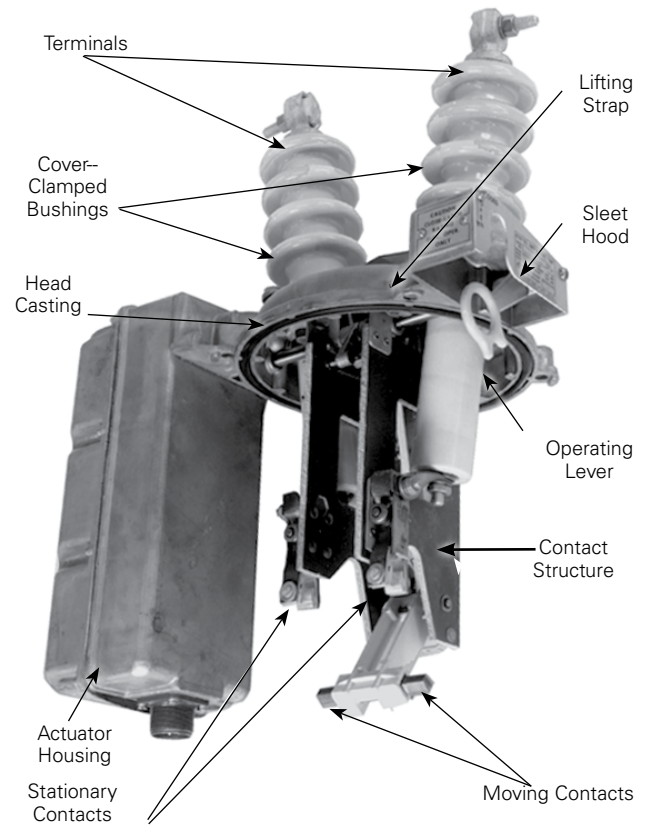


Figure 1. Untanked Type NR oil switch.

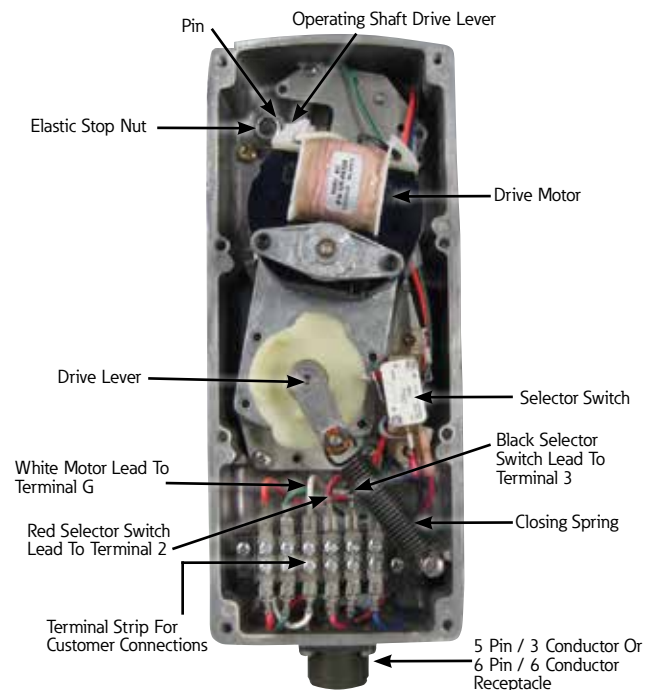


Figure 2. Standard actuator mechanism with auxiliary switch option.

CAUTION

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

T201.2

6. Clean the internal components:
 - A. Remove all traces of carbon by wiping with a clean lint free cloth. Flush the mechanism with clean, dry transformer oil.
 - B. If additional cleaning action is necessary, a dielectric cleaner (Biogenic® Electrosafe from Rochester Midland, Positron Dielectric Cleaner, or similar) may be used to clean internal parts. Check with your local regulating authorities to determine which dielectric cleaners are permitted in your area.

After the cleaner has evaporated, the mechanism must be thoroughly flushed or dipped in clean, dry transformer oil to remove all cleaner residue. Even dielectric cleaners with high dielectric strength leave a residue that will affect oil insulating properties if not removed.

7. Check the moving and stationary contacts.
 - A. Dress slight pitting and discoloration with crocus cloth.
 - B. Replace both the moving and stationary contacts if they are severely eroded. Follow procedures in "Shop Repair Procedures—Contacts" section.

Note: The contacts should be replaced before the erosion of the load current transfer surfaces impairs their effectiveness.

8. Manually close and trip the switch several times to check that all components perform properly.
9. Inspect tank lines. Note that two liners are employed. The inner liner is fibrous and readily absorbs any moisture present. Soft or spongy areas indicate water has been absorbed. Replace the liner if such areas are present. The outer liner need not be replaced unless it is cracked or punctured.
10. Check the dielectric strength of the insulating oil.
 - A. A sample taken near the bottom of the tank should have a dielectric strength of not less than 22 kV.
 - B. Low dielectric strength indicates the presence of water or carbon deposits; replace the oil. (See "Oil Condition" section.)
11. If oil must be replaced, drain the tank and discard the tank wall liners.
12. Thoroughly clean out all sludge and carbon deposits and rinse the tank with clean oil.

13. Install new tank wall liners and fill the tank with clean, new insulating oil to within one inch of the top of the tank flange. Oil capacity is approximately 1.5 gallons.

Note: Use only new, or like-new reconditioned transformer oil which conforms to the specifications in *Reference Data R280-90-1, Oil Specifications and Test*.

14. Replace all external seals and gaskets.
15. Clean the head gasket seat and retank the switch.
 - A. Replace the head bolts and torque to 15 ft-lbs. Apply clamping force gradually and equally, in rotation, to each bolt to achieve an evenly distributed gasket sealing pressure.
16. Electrically operate the switch to check for proper operation. See "Operating Instructions—Electrical Operation" section.
17. Repeat the high voltage dielectric withstand test (Step 3) to make sure the dielectric clearances within the tank have not been compromised.

Operating instructions

Electrical operation

The switch may be opened and closed electrically by applying rated control voltage to the proper terminals of the actuator terminal block. Figure 3 illustrates a connection diagram for a standard three-wire control.

Closing: Approx. 1.5 sec

Opening: Approx. 4 sec

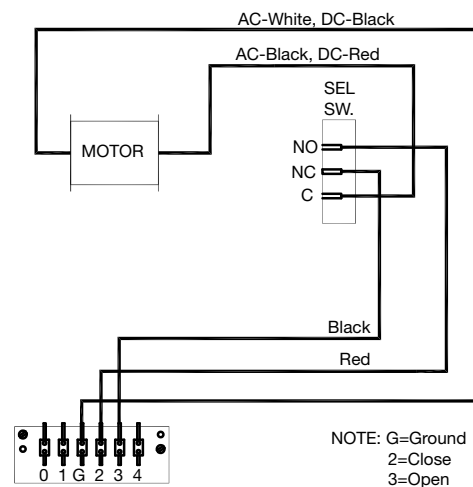


Figure 3. Typical connection diagram for three-wire control.

Manual operation

The switch may be manually opened and closed by operating the yellow handle under the sleet hood.

Note: Manual operation does not affect the status of the electrically operated actuator. To electrically close a switch which has been manually opened, the electrical open circuit must be first activated to change the status of the selector switch for a close operation.

Oil condition

Oil plays an important role in the proper functioning of the switch. It provides the internal insulating barrier from phase to ground, and acts as an arc quencher. Switching operations cause reductions of some of the oil into chemical compounds, free carbon and gases. Some of these compounds form water-absorbing particles which reduce the dielectric strength of the oil. For effective switch operation the oil must be replaced before it deteriorates below a safe level. Oil that has been contaminated with carbon sludge or has a dielectric strength of less than 22 kV should be replaced.

Used oil must be reconditioned before using. Filtering may remove absorbed and free water, and other contaminants to raise the dielectric strength to an acceptable level. However, it does not always remove water-absorbing contaminants. Thus, the dielectric strength of the oil may fall rapidly after the switch is returned to service. Therefore the switch should be filled with new oil or oil that has been restored to like-new condition. Oil used in these switches conforms to ASTM Standard D3487, Type 2; its property limits are listed in *Reference Data R280-90-1, Oil Specifications and Tests*.

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

Insulation level withstand tests

High-potential withstand tests provide information regarding the dielectric condition of the switch. Testing is performed at 75% of the rated low-frequency withstand voltage (Table 3).

Table 3. Test Voltages for Insulation Level Withstand Test

Switch Type	BIL (kV)	Test Voltage (kV)
NR	95	35.0
NR*	125	42.0

* Extra creepage bushings

Test 1: Proceed as follows:

1. Close the switch.
2. Ground switch tank and head.
3. Apply proper test voltage to one of the bushing terminals.
 - The switch should withstand the test voltage for 60 seconds.

Test 2: Proceed as follows:

1. Open the switch.
2. Ground switch tank and head.
3. Ground the bushing on one side of the switch.
4. Apply proper test voltage to the ungrounded bushing.
 - The switch should withstand the test voltage for 60 seconds.
5. Reverse the test and ground connections to the bushings.
6. Again apply proper test voltage to the ungrounded bushing.
 - The switch should withstand the test voltage for 60 seconds.

Test results:

These high potential withstand tests provide information on the dielectric condition of the switch.

1. If the switch passes the closed-contacts test (Test 1) but fails the open-contacts test (Test 2) the cause is likely to be in the main contact assembly.
2. If the switch fails the closed-contacts test (Test 1) the cause is likely to be a diminished electrical clearance or failed insulation.
3. After correcting the problem, retest to confirm the repair.

Shop repair procedures

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

Bushings

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

The Type NR oil switch bushings are oil-filled. The special fixtures and procedures required to assemble these bushings is beyond the scope of normal shop maintenance repair. Therefore if a bushing is in any way damaged, the complete bushing assembly must be replaced. Refer to Figure 8 and proceed as follows:

1. Disconnect the appropriate bushing lead from the bottom end of the bushing rod.
2. Remove the three hex head capscrews and bushing clamps that secure the bushing to the head casting and lift out the complete bushing assembly.
3. Remove and discard the lower bushing gasket.
4. Twist off the split aluminum ring from the old bushing and install on the new bushing assembly if ring is in good condition; replace ring if damaged.

Note: The clamping ring cushions and distributes the pressure between the porcelain and the clamps. DO NOT OMIT.

5. Install the new bushing assembly into the head using a new lower bushing gasket. Position the bushing with the stud-end of the terminal pointing outward.
6. Position the clamping ring with the split centered between two clamping bolts.
7. Reassemble the bushing to the head casting. Tighten the clamping bolts evenly, a little at a time, to a torque of 3-7 ft-lbs.

Note: Clamping forces must be applied gradually and equally, in rotation, to each bolt. This results in an evenly distributed gasket pressure.

8. Reconnect the lead to the bushing rod.

Contacts

The Type NR oil switch has an open-type, double-break contact arrangement as shown in Figure 6. Depending upon the extent of damage, the stationary and moving contacts only, the moving contact and arm assembly, or the complete contact box assembly may be replaced.

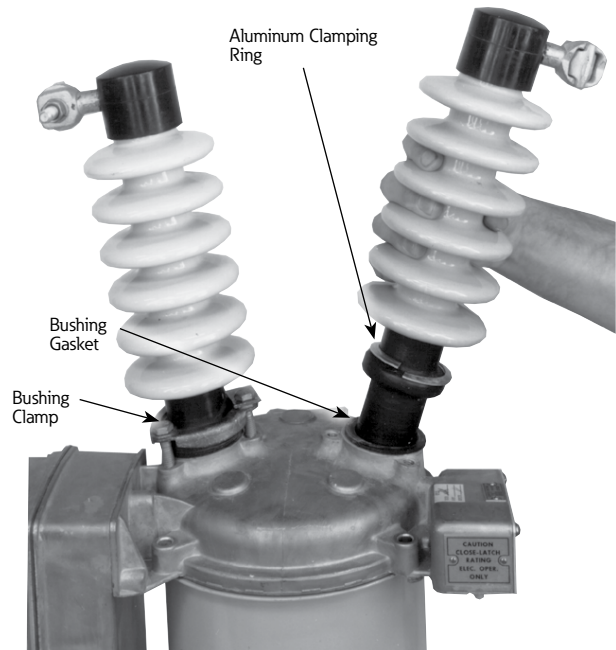


Figure 4. Bushing removal.

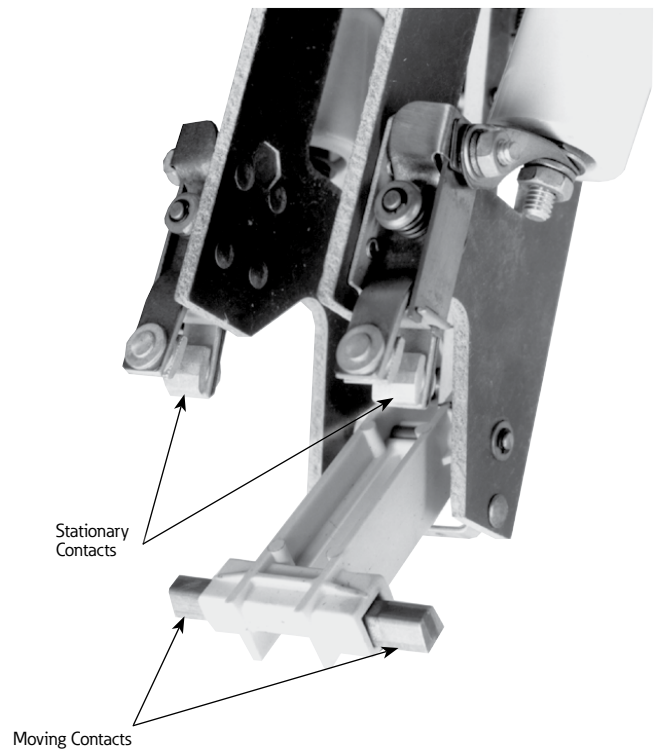


Figure 5. Open-type double-break contact arrangement of Type NR oil switch.

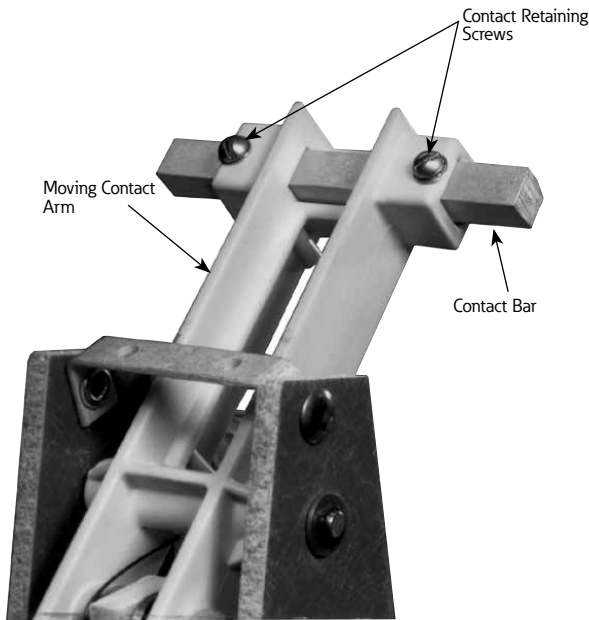


Figure 6. Removing moving contact.

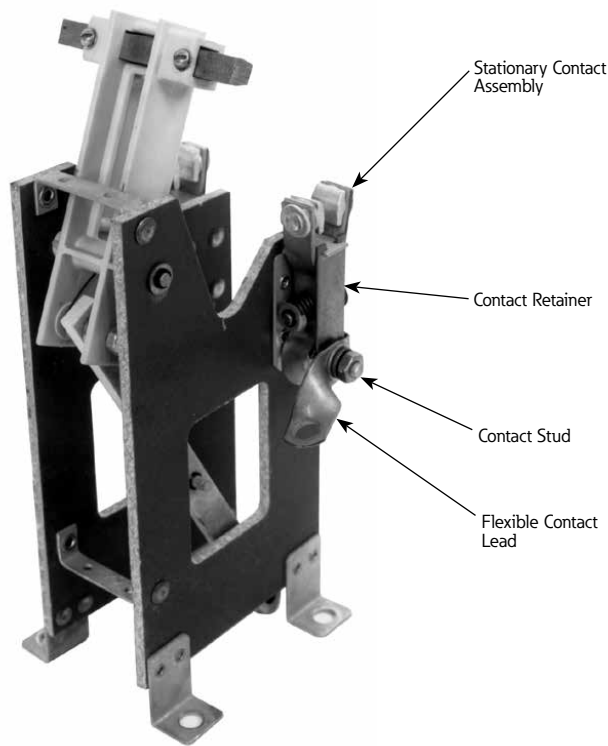


Figure 7. Removing stationary contact.

Contact resistance*

Standard: 750-875 mΩ
 Extra Creepage (17 inch): 875-1000 mΩ
 20 kV (125 kV BIL): 845-945 mΩ

Moving contacts

Minor pitting can be smoothed with crocus cloth. If contacts show appreciable wear due to arc erosion, replace as follows:

1. Remove the round head screws and lockwashers that secure the moving contact bar to the contact arm. Remove the bar from the contact arm.
2. Reassemble the new moving contact bar to the contact arm and secure with round head screws and lockwashers. Apply one drop of Loctite® Threadlocker 242® to each threaded hole of the contact bar prior to assembly.

Stationary contacts

Smooth minor pitting with crocus cloth. If contacts are excessively eroded, replace as follows:

1. Remove hex nut, lockwasher and flatwasher from contact stud. Loosen nut on bushing rod slightly and slip terminal lead from contact stud.
2. Open flexible contact leads and remove contact retainer. Pull the stationary contact assembly and contact roller from contact stud.
3. Install contact roller within new contact assembly and mount on the contact stud. Install following parts in order: contact retainer, flexible contact leads, terminal leads, flatwasher, lockwasher and hex nut. Tighten hex nut on bushing rod.
4. With the moving contacts in the open position, the space between the stationary contacts should measure 0.281 ± 0.010 inch.

Note: The stationary contact assembly is normally pre-adjusted during manufacture to obtain this clearance. Bend the contact fingers as required if this spacing is not within specified tolerances.

⚠ CAUTION

Be sure not to pull contacts or contact structure out of alignment when tightening the jumper lead to the bushing terminal rod. To test alignment, wet the contacts with oil. Then, with the actuator mechanism prepared for a closing operation, push the contacts closed by hand and hold for a few seconds. When the moving contacts are released, they should be pulled open by the spring in the head mechanism. If not, adjust stationary contacts as described in Step 4 until they do so.

Moving contact arm assembly

To replace the moving contact arm assembly proceed as follows:

1. Detach both opening springs from toggle link (Figure 8).
2. Pull back latch lever assembly and remove C-ring which secures the toggle link to the bell crank lever.

Note: The latch assembly can be held back with a screwdriver as shown in Figure 9.

3. Remove the pivot pin attaching the contact arm assembly to the side plates of the contact box.
4. Remove the contact arm assembly.

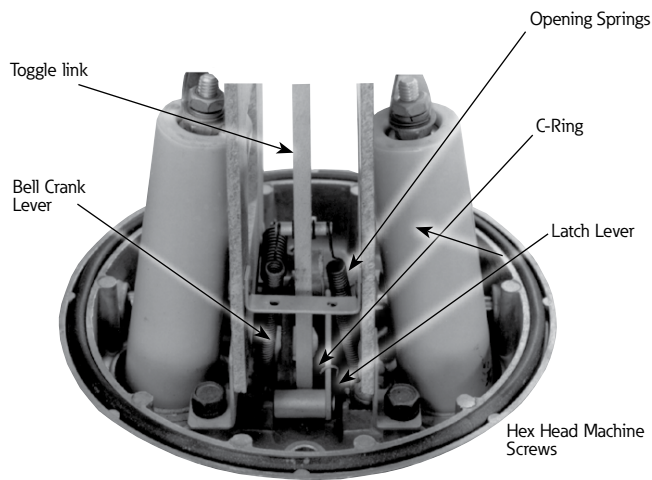


Figure 8. Components of toggle mechanism assembly.

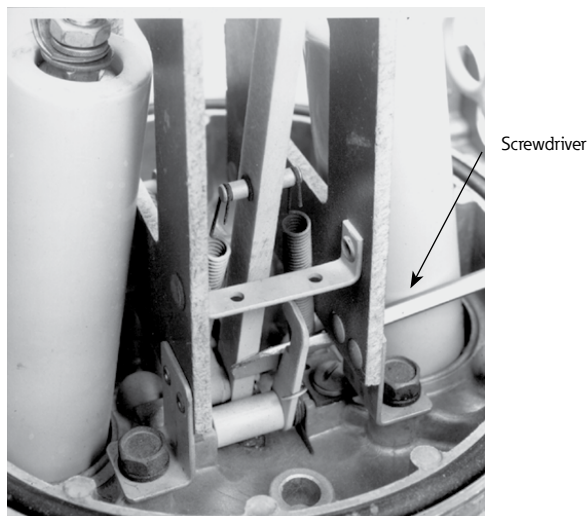


Figure 9. Holding back latch lever with screwdriver.

5. Reassemble the new contact arm assembly, which includes the moving contact bar, to the contact box.

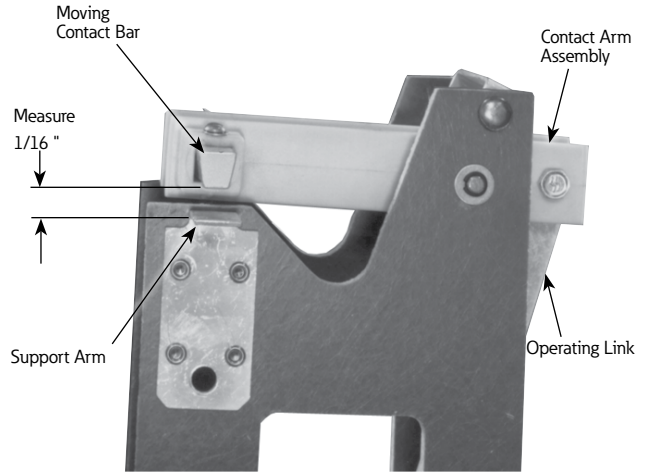


Figure 10. Contact engagement adjustment (stationary contact removed to show measuring point).

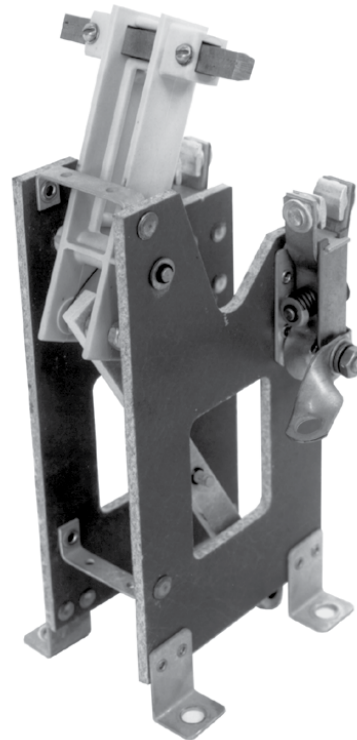


Figure 11. Contact structure removed from head mechanism.

6. With the mechanism closed, the moving contacts should be within 1/16-inch of full engagement, as measured between the top edge of the moving contact insulator and the bottom edge of the contact box side plate as shown in Figure 10. To obtain this dimension, adjust the effective length of the insulated operating link by adjusting the attaching point for the contact arm assembly in the slotted hole of the link. Be sure to retighten the elastic stop nut when adjustment is completed.

Complete contact box assembly

To replace the complete contact box assembly proceed as follows:

1. Detach the opening springs and disconnect the toggle link from the bell crank as described in "Moving Contact Arm Assembly" section, Steps 1 and 2.
2. Remove the hex nuts, lockwashers and flatwashers that retain terminal leads to bushing rods.
3. Remove four hex head machine screws with pre-assembled lockwashers that secure the contact structure to the head casting. Contact structure removed from switch is shown in Figure 11.
4. To replace contact structure:
 - A. Slip toggle link over bell crank lever and secure with C-ring.
 - B. Attach contact structure to head casting with four hex head machine screws with lockwashers.
 - C. Attach opening springs to toggle link.
 - D. Install moving and stationary contact assemblies, if necessary, as described previously.
 - E. Attach terminal leads to bushing rods with flat-washers, lockwashers and hex nuts.

Actuator mechanism

The actuator mechanism requires little attention. When the switch is removed from service for its periodic maintenance inspection, check the condition of the selector switch contacts, and holding switch contacts if so equipped. Also check the condition of the wiring, motor and cams. Components of a standard actuator mechanism are shown in Figure 12. Figure 13 shows the wiring diagram of the switch actuator with the various accessory connections shown in dotted lines.

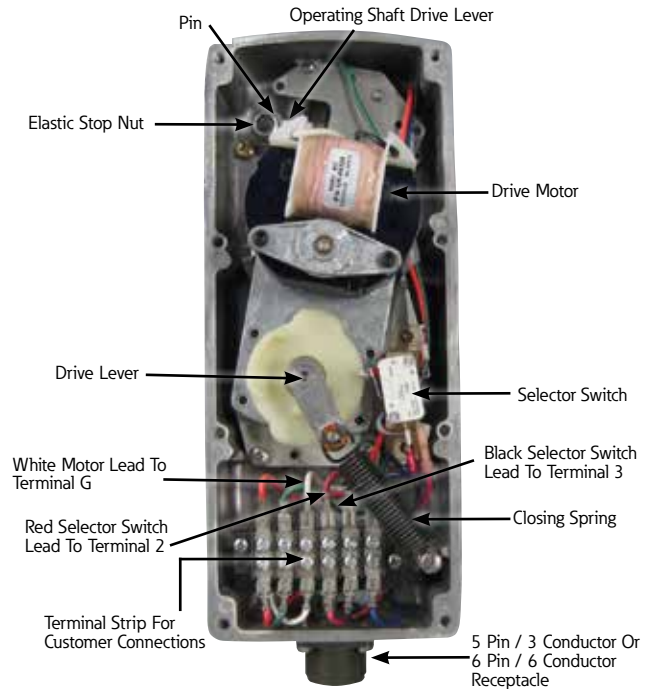


Figure 12. Standard actuator mechanism with auxiliary switch option.

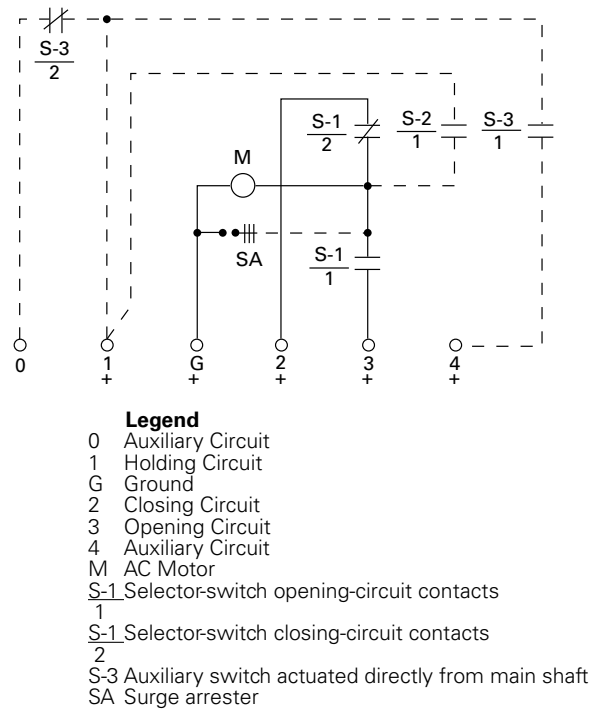


Figure 13. Wiring diagram with accessory connections indicated by broken lines.

Selector and holding switches

To replace the selector switch, or holding switch if so equipped, proceed as follows:

1. Heat the solder joint at the common terminal of the selector switch to disconnect black lead (Figure 12). Use a gun rated no higher than 100 watts and use only 50-50 or 40-60 rosin core solder for repair work.
2. Disconnect leads from terminal strip: red and black from terminals 2 and 3 for selector switch, green from terminal 1 for holding switch.
3. Remove two round head screws with lockwashers that secure the switch to the support bracket. Mounting spacers and a nut bracket (on underside of support) will also be released.
4. Attach new switch to support bracket, securing it loosely with two round head screws so that it is free to move for adjustment.
5. Connect wire lead(s) to terminal strip. Solder black lead(s) to common terminal of selector switch.
6. Operate cam electrically and adjust selector switch so contact actuation takes place relatively early on cam lobe, and that an over-travel (movement of operator arm after contact actuates) of approximately 3/64-inch is achieved.
7. Check that main contacts open before the selector switch actuates. Main contact and selector switch are properly coordinated when an audible click is heard, from within the tank, before selector switch contact actuates.
8. Adjust holding switch (if so equipped) so actuation takes place after selector switch actuation and operator arm over-travel is observed. A definite time lag between the actuation of the selector switch and holding switch must be observed.

Note: It may be necessary to readjust selector switch to obtain proper sequence and over-travel.

9. When selector switch and holding switch (if so equipped) are properly adjusted, tighten screws to secure switch(es) to support bracket. Run actuator through 25 opening and closing operations to be sure switch adjustments hold.

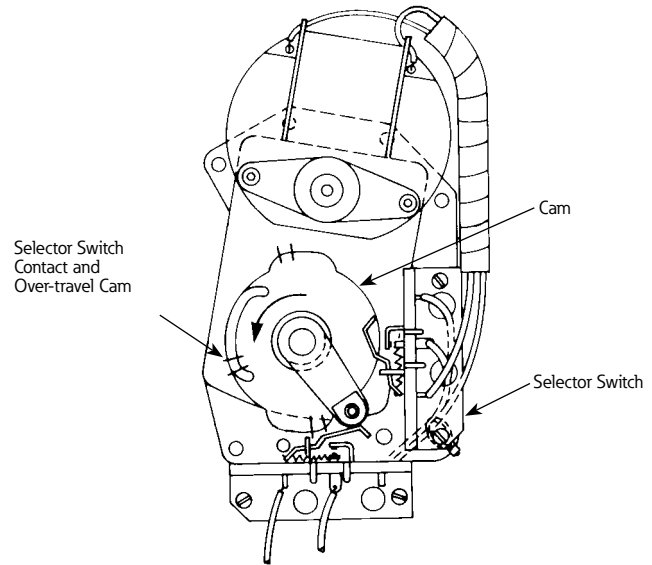


Figure 14. Adjustment procedure for selector (main contacts and spring relaxed).

Actuator assembly replacement

To replace the actuator assembly proceed as follows:

1. Pull yellow handle down to open switch contacts.
2. Remove elastic stop nut, lockwasher and flatwasher from operating shaft.
3. With a right angle punch or allen wrench force out straight pin as shown in Figure 15.
4. Disconnect wire leads from terminal strip.
5. Remove four screws that secure actuator base plate to housing. Carefully lift actuator assembly from housing, pulling the drive lever straight from the operating shaft.
6. Place actuator assembly in mounting position and slip drive lever over operating shaft. Loosely install the four mounting screws that secure the base plate to the housing.
7. Insert straight pin through drive lever and operating shaft. Install flatwasher, lockwasher and elastic stop nut. Tighten stop nut firmly to prevent straight pin from backing out. Moderate force is sufficient to tighten stop nut. Extreme force on nut can break straight pin.
8. Tighten four actuator assembly mounting screws.
9. Attach wire leads to terminal strip, as shown in Figure 12.
10. Operate the switch electrically and check for binding. Check adjustment of selector switch (and holding switch if equipped) as described in "Shop Repair Procedures—Selector and Holding Switches" section.

Greasing recommendations

When a Type NR oil switch is removed from service, check these points in the actuator for sufficient lubrication:

- Spring anchor boss
- Actuator drive lever spring anchor
- Mechanism shaft through cam center
- Pinion gear on motor shaft and mechanism gears

Apply "MOBILGREASE 28" or a similar low-temperature grease to these areas. Well-lubricated mechanisms will reduce subsequent wear and preserve smooth actuator operation.

Note: Grease need only be applied to these points when the switch is removed from service. Do not remove switch from service for sole purpose of applying lubrication to the actuator mechanism.

Head mechanism

The head mechanism requires no periodic maintenance. Observe the following procedure when disassembling the head mechanism:

1. Remove the contact structure as described in "Shop Repair Procedures—Complete Contact Box Assembly" section.
2. Remove the bushings as described in "Shop Repair Procedures—Bushings" section.

Note: This step is not mandatory, but is suggested to simplify working on the head mechanism if a service rack is not available.

3. Perform Steps 1 and 2 in "Actuator Assembly" section to free the actuator mechanism from the operating shaft.
4. With a hammer and punch, drive out the roll pin that secures the reset lever to the operating shaft (Figure 16).

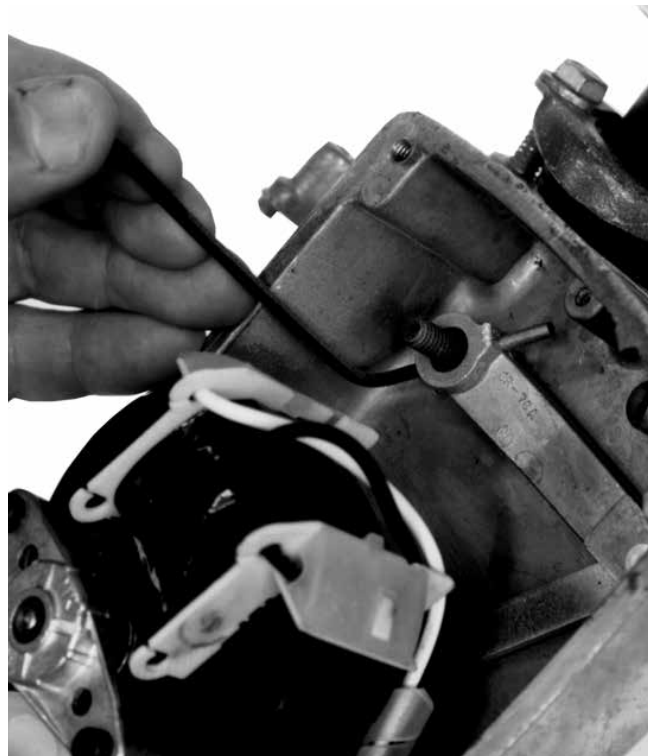


Figure 15. Removing straight pin with allen wrench.

5. Remove the sleet hood cover and slip the operating handle spring from the reset lever. Slide out the operating shaft.
6. Install new parts as required. Be sure roll pin that fixes reset lever to operating shaft is driven in until 3/16-inch of pin projects as shown in Figure 16.

7. To replace the latch lever assembly:
 - A. Remove screws that secure the shaft retainers to the head casting.
 - B. Lift out the latch lever assembly.
 - C. When reassembling, slip the latch lever torsion spring and latch lever onto the latch lever shaft.
 - D. Screw the two shaft retainers to the head casting to secure the latch lever shaft.
 - E. Hook the torsion spring on the latch lever assembly. Be sure the two shaft retainers are positioned as in Figure 17, and that the latch lever is retarded when moved away from the head casting.
8. Install the contact structure and bushings to complete assembly.

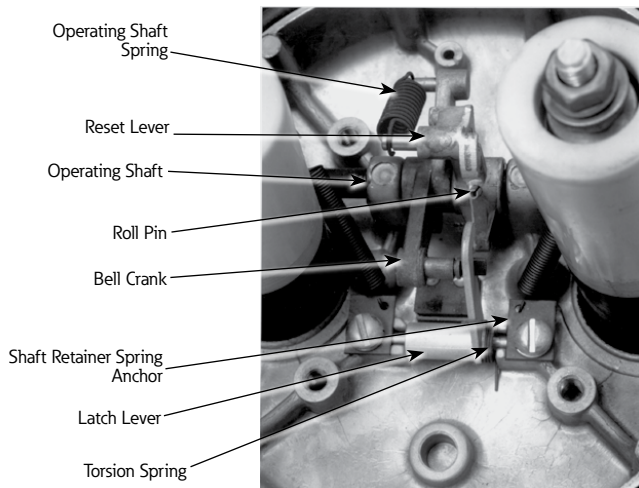


Figure 16. Components of head mechanism assembly.

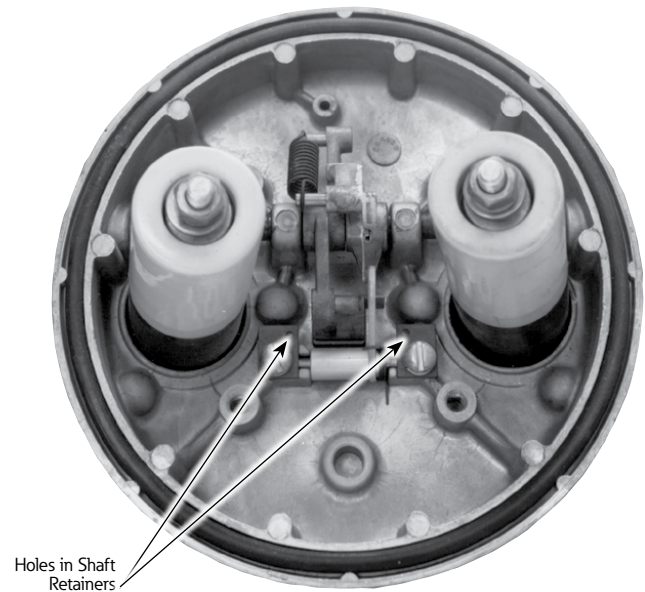


Figure 17. Correct position of shaft retainers.

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Service parts list

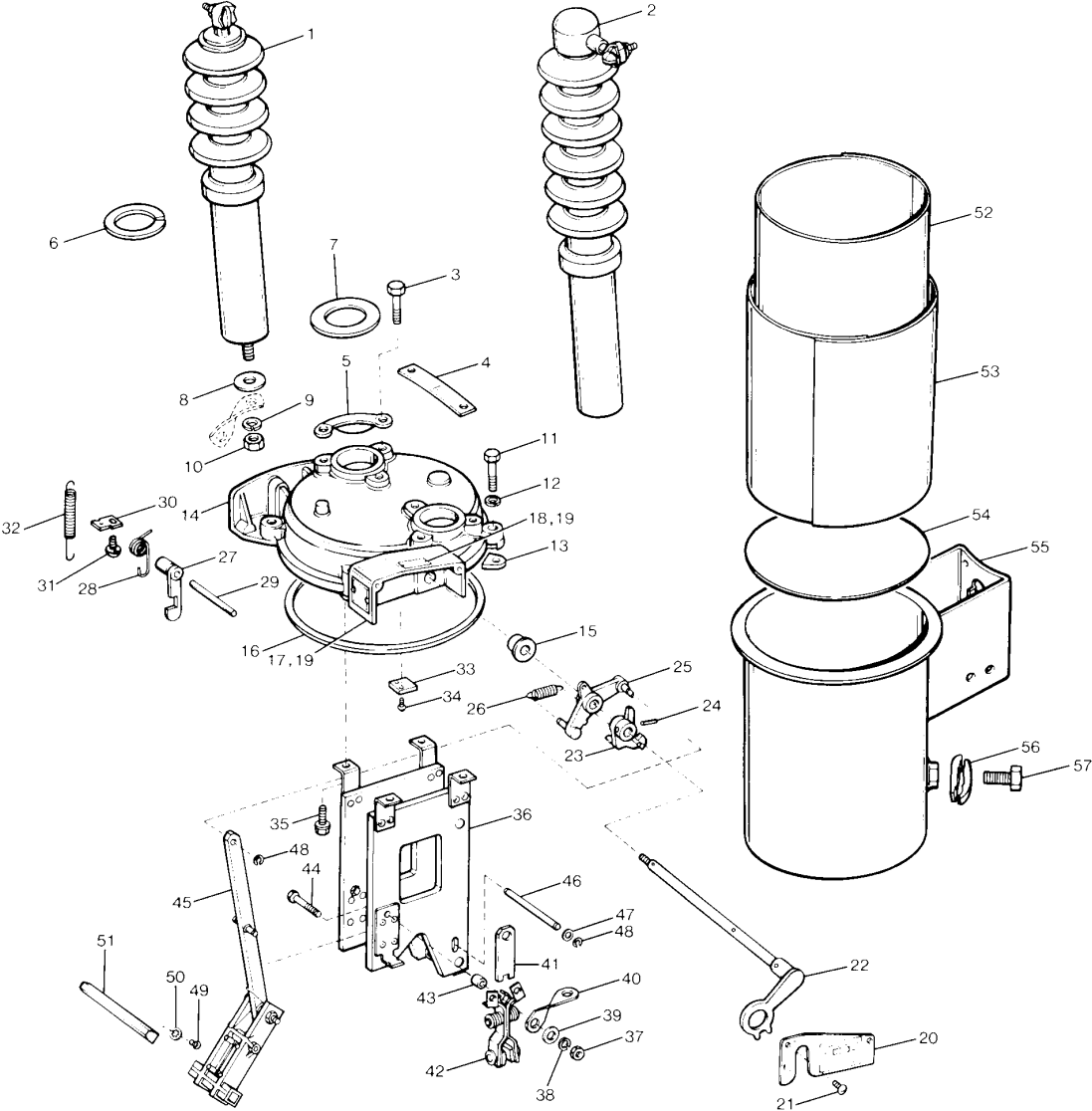


Figure 18. Type NR oil switch service parts.

Type NR oil switch service parts

Item No	Description	Catalog Number	Qty
1	Bushing assembly, Type NR Standard Bushing	GRA0346003	2
2	Bushing assembly, Type NR 17" Creepage Bushing	GRA0346005	2
3	Capscrew hex hd, 5/16-18 x 1-3/8, stl	730115131150A	6
4	Lifting strap	H000472	1
5	Bushing clamp	GR00233	6
6	Clamping ring, Aluminum	GR00110	2
7	Bushing gasket	KA20900040	2
8	Plain washer #20S, brass	900525033075A	2
9	Split lockwasher, med, 5/16, bronze	900830031000A	2
10	Nut, Hex, 5/16-18, brass	881025118031A	2
11	Capscrew, hex hd, 5/16-18 x 1-3/8 stl	730115131137A	4
12	Lockwasher, 5/16 stl	900815031000AGW	4
13	Clamp	6A00326401	4
14	Head casting	GR00330	1
15	Shaft insert	KA30360019	1
16	Head gasket	KA21030012	1
17	Caution plate	SI01057	1
18	Control rating plate, Decal	6A00471702	1
19	Screw, sheet metal, Type Z, #2 x 3/16	Not required for Decal	4
20	Nameplate	GR00122	1
21	Self-tapping screw, rd hd, Type Z #10 x 3/8	802815010037A	2
22	Operating handle assembly	GRA0033001	1
23	Reset lever	GSA0009	1
24	Roll pin	KA20010030	1
25	Bell crank assembly	GRA0040001	1
26	Operating handle spring	GR00296	1
27	Latch lever	GSA0078	1
28	Latch lever spring	GS00011001	1
29	Latch lever pin	KA30540002	1
30	Pin retainer and spring anchor	GR00120	2
31	Machine screw, rd hd, with pre-assembled split lockwasher 1/4-20 x 3/8, stl	831501125037A	2

Item No	Description	Catalog Number	Qty
32	Toggle spring	GS00040	2
33	Shock absorber	GR00107	1
34	Self-tapping screw, rd hd, Type F, 4-40 x 5/16 stl	753315106062A	2
35	Screw, hex hd, with pre assembled split lockwasher, 5/16-18 x 1/2, Parkerized	830101131050A	4
36	Contact box assembly	GRA0385	1
37	Hex nut 1/4-20, brass	881025120025A	2
38	Split lockwasher, med, 1/4 bronze	900830025000A	2
39	Plain washer, #14S, brass	900525026056A	2
40	Terminal lead	GR00257	4
41	Contact retainer	GR00214	2
42	Contact assembly	GN3A0000640002	2
43	Contact roller	GR00256	2
44	Capscrew, hex hd, 1/4-20 x 1-1/4 brass	730125125125A	2
45	Moving contact arm assembly (includes items 49, 50, and 51)	GR00326	1
46	Pin	KA31230011	1
47	Plain washer, #10S, brass	900525020043A	2
48	Retaining ring	970901188000M	2
49	Machine screw, rd hd, #6-32 x 1/2, sst	721515106050A	2
50	Lockwasher, Internal tooth #6 bronze	901032006000A	2
51	Contact bar	GRA0384	1
52	Tank liner	GR00115	1
53	Tank liner NRV	GR00289	1
54	Bottom liner	GR00114	1
55	Tank Assembly	GRA0021003	1
56	Parallel ground clamp Ground clamp assembly	HA00227	1
57	Capscrew, hex hd 1/2-13 x 1, stl	730115150100A	1

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

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

- A - No plating; raw material
- H - Silver
- M - Black oxide
- Q - Cadmium + zinc + chromate
- Y - Zinc + chromate
- Z - Electro zinc + bronze irridite

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

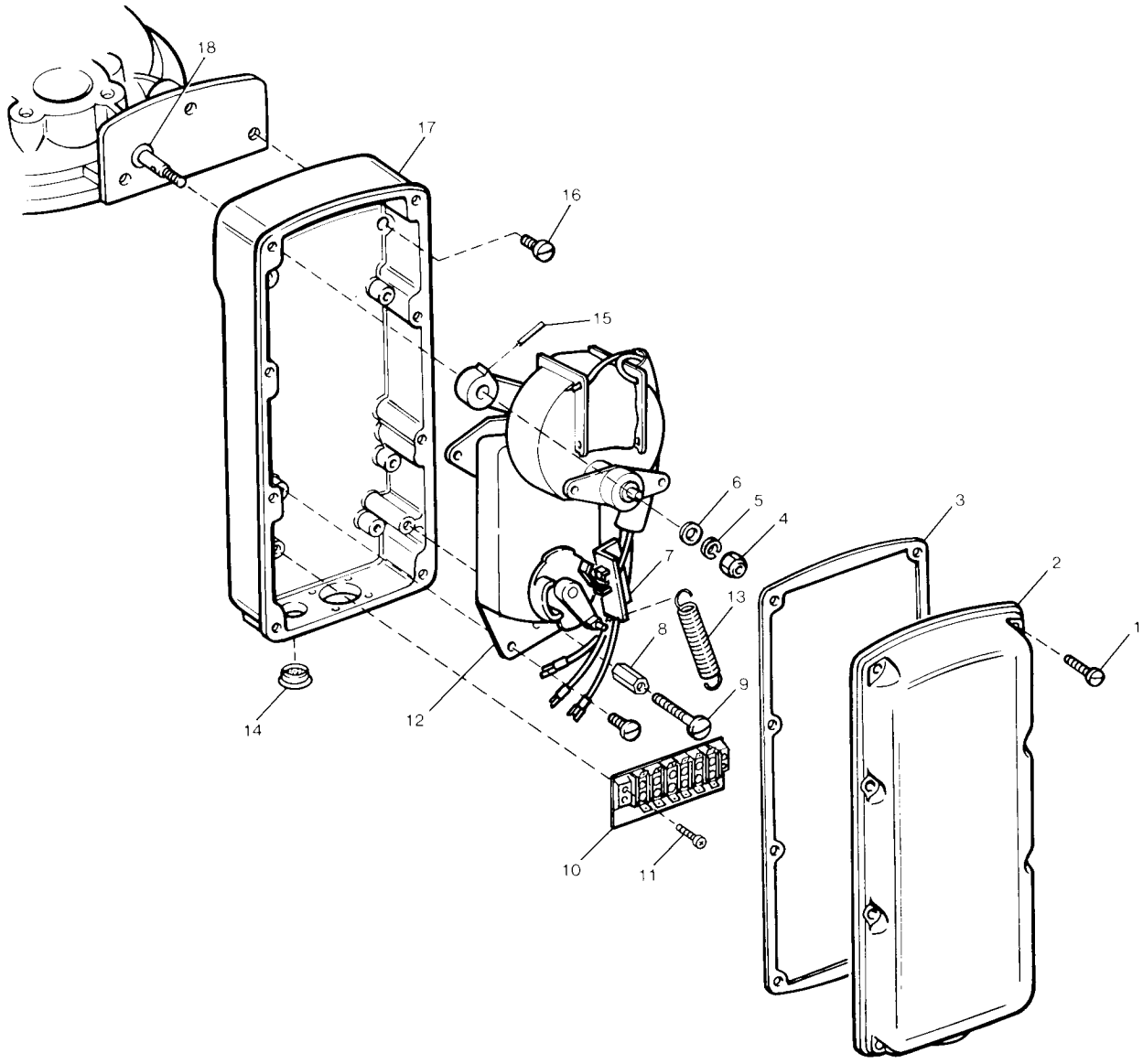


Figure 19. Actuator and housing service parts.

Actuator and housing service parts

Item No	Description	Catalog Number	Qty
1	Machine screws, Fil hd. #10-24 x 7/8 sst	999904250369A	8
2	Cover	GR00323	1
3	Gasket	GR00121	1
4	Nut	KA20200003	1
5	Split lockwasher, med, 1/4 bronze	900830025000A	1
6	Plain washer, #14S, brass	900525026056A	1
7	Switch Assembly	*	1
	Limit Switch	KA23980002	
	Holding	KA23980001	
	Auxiliary (SPDT)	GRA0364	
8	Spacer	GR00324	1
9	Screw, pan hd mach #10-24 x 1-1/2 sst	721715110150A	1
10	Terminal strip	GR00266	2
11	Screw, self-tapping, phillips, pan hd, Type F, #6-32 x 5/8, sst	753315106062A	1
12	Actuator (includes item 13 and standard selector switch)	GRA0381	1
	Actuator repair kit, 240 Vac (includes item 13 and standard selector switch)	GRA0321	
13	Spring	GR00302	1
14	Vent screen plug	GR00038001	1
15	Pin	KA30540002	1
16	Machine screw, Fil hd #1/4-20 x 3/8 stl	723101125037Z	3
17	Housing	GR00319001	1
18	Oil seal	GR00275	1
19	Motor, 110V	GR00320	1
	Motor, 240V	GR00321	
20	Receptacles	**	1
	5 Pin/3 Conductor	GRA0121005	
	6 Pin/6 Conductor	GRA0108002	

* Sold separately

**Not shown in the illustration shown on page 16

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