Reclosers

COOPER POWER SYSTEMS

Service Information

Type VSA12, VSA16 and VSA20/800 Maintenance Instructions

S280-45-5

901035KMA

Figure 1.
KYLE® Type VSA Recloser.

CONTENTS

SAFETY INFORMATION

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

Hazard Statements

This manual contains two types of hazard statements:

WARNING: Refers to hazards or unsafe practices which could result in severe personal injury, or death, and equipment damage.

CAUTION: Refers to hazards or unsafe practices which could result in damage to equipment or in personal injury.

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.

WARNING: High voltage. Contact with high voltage will cause severe personal injury or death. Follow all locally approved safety procedures when working around high voltage lines and equipment.

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.

CAUTION: At voltages up to 37.5 kv rms and 50 kv dc, the radiation emitted by the vacuum interrupter is negligible. However, above 37.5 kV rms or 50 kV dc radiation injurious to personnel may be emitted. See Radiation Warning in Service Information S280-90-1 for further details.

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

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

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. 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.

INTRODUCTION

Service Information S280-45-5 covers the maintenance instructions for the type VSA electronically controlled, three-phase, vacuum recloser. The manual includes a general description of the recloser and its operation and instructions for periodic inspection, testing and shop repairs. Keyed service parts exploded-view drawings of the unit, along with ordering information are included at the back of the manual.

DESCRIPTION AND OPERATION

The VSA12, VSA16 and VSA20/800 three-phase reclosers feature vacuum interruption and air insulation. Current interruption takes place in the rugged vacuum interrupter assemblies which are suspended from the recloser cover by insulating supports, as shown in Figure 2. The moving contacts, located in each interrupter assembly, driven by the recloser operating mechanism, close or open the circuit. Interruption takes place within two and one-half cycles, while utilizing a contact stroke of one-half inch.

Recloser tripping and closing are initiated by signals from the recloser control unit. When current in excess of the programmed minimum trip level is detected, on any phase or phases, the recloser control initiates a trip signal which energizes a solenoid in the operating mechanism of the recloser. When actuated, this solenoid trips the opening springs, which opens the interrupter contacts.

Closing springs provide the force required to close the vacuum interrupters, as well as the force required to charge the opening springs. A 240 Vac motor charges the closing springs through a multi-stage gear drive. When 240 Vac is present, the motor is automatically operated to keep the closing springs in a charged state. To close the recloser the control initiates a signal which energizes a solenoid in the recloser operating mechanism. Once actuated the solenoid releases the closing springs, which close the vacuum interrupters and charge the opening springs. Therefore a sequence of Open-Close-Open is available after loss of 240 Vdc power.

An external 240 Vac source is required to operate the drive motor. A battery, in the electronic control, supplies the 24 Vdc tripping and closing power.

Recloser tripping employs stored spring energy. The stored spring energy is released, to open the recloser, when the trip solenoid is actuated by the 24 Vdc trip signal. The 24 Vdc trip signal is originated at the recloser control. The 240 Vac supply is not required to trip the recloser.

A totally manual closing operation can be accomplished even during loss of motor power and with the closing springs discharged. A hand crank can be applied to the motor to charge the closing springs. Once charged, the closing springs can be released either from inside or from below the operator mechanism cabinet. As with electrical operations, the opening springs are charged by release of the closing springs, so even a manually closed unit has energy stored for a trip operation.

Major parts and assemblies of the VSA recloser are shown in Figures 2 and 3. Being aware of the location of these components and their part in the operation of the recloser will give a quicker and clearer understanding of the recloser maintenance and repair procedures that follow.

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Figure 2.
Type VSA Recloser with side panels removed.

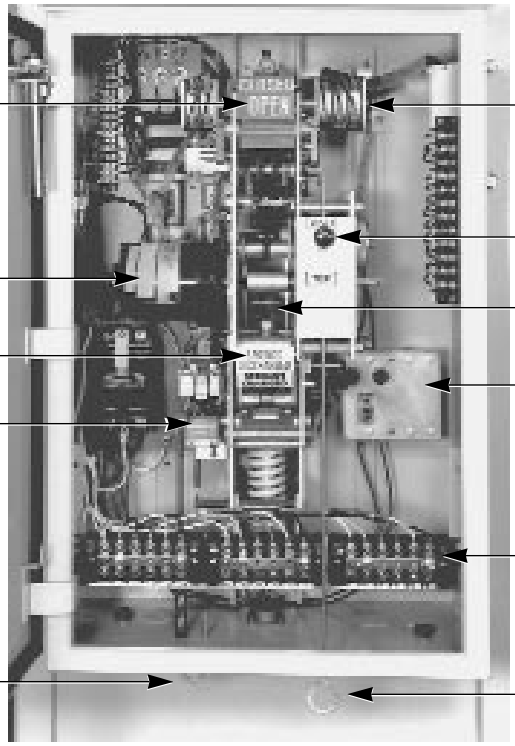

Figure 3.
Operating mechanism.

SPECIFICATIONS AND RATINGS

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

Table 1
Voltage Ratings

	VSA-12	VSA-16	VSA20
Maximum Design Voltage (kV)	15.5	15.5	15.5
Nominal Operating Voltage (kV)	2.4-14.4	2.4-14.4	2.4-14.4
Basic Insulation Level (BIL) (kV)	110	110	110
60 Hertz Withstand Voltage (kV)			
Dry, one minute	50	50	50
Wet, ten seconds	45	45	45
Max RIV at 1.0 MHz/9.41 kV (μV)	100	100	100

Table 2
Duty Cycle

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

Table 3
Mechanical Life

Open-Close, no load, operations	2500

Table 4
Electrical Specifications

Trip Solenoid:		
Operating voltage (Vdc)	24	
Peak current (A)	12.2	
Actuation time (cycles (ms))	1.25 (21)	
Close Solenoid:		
Operating voltage (Vdc)	24	
Peak current (A)	15.5	
Actuation time (cycles (ms))	1.5 (25)	
Spring Charging Motor:		
	STANDARD	ACCESSORY
Operating Voltage (Vac)	240	120
Voltage Range (Vac)	190-257	90-127
Maximum Current, RMS (A)	14	18
Steady State Current (A)	4.1	9
Running Time (cycles (s))	40 (0.67)	40 (0.67)
DC Resistance, Nominal:		
Bushings, terminal-to-terminal (μΩ)	120	
Interrupter, terminal-to-terminal (μΩ)	29	

Table 5
Current Ratings

	VSA-12	VSA-16	VSA20
Continuous Current Rating (A)	800	800	800
Symmetric Interrupting Current (A)	12,000	16,000	20,000
Cable Charging Current (A)	2	2	2
Magnetizing Current (A)	28	28	28
3 Second Current, Symmetric (A)	12,000	16,000	20,000
Momentary Current, Asymmetric (A)	20,000	25,600	32,000

Table 6
Mechanical Specifications

Operating Temperature (°C)	
Minimum	-30
Maximum	+50
Closing Mechanism	Spring Operated
Opening Mechanism	Spring Operated
Contact Gap (inches (mm))	0.5 (13,7)
Close Contact Travel Time (cycles (ms))	0.5 (8)
Open Contact Travel Time (cycles (ms))	0.5 (8)
Maximum Arcing Time (cycles (ms))	1.0 (17)
Interrupting Time (cycles (ms))	2.5 (42)
Allowable Contact Erosion (inches (mm))	0.125 (3,2)
Opening Time (24 Vdc solenoid, signal to Contact Part) (ms)	19-25
Closing Time (24 Vdc solenoid, signal to Contact Make) (ms)	32

MAINTENANCE

Frequency of Maintenance

Because reclosers are applied under widely varying operating and climactic conditions, maintenance intervals are best determined by the user, based on actual operating experience. To assure proper and trouble-free operation, reclosers must be maintained when they have operated the equivalent of a rated duty cycle (see Table 2). In the absence of specific operating experience the following procedures are recommended:

- When the type VSA recloser is operated under usual service conditions as defined in ANSI (American National Standards Institute) C37.60, "Standard Requirements for Overhead, Pad Mounted, Dry Vault and Submersible Automatic Circuit Reclosers and Fault Interrupters for AC Systems", it is recommended that the following maintenance procedures be performed at the completion of an equivalent duty cycle.

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

- However, if the recloser has not completed an equivalent duty cycle within THREE YEARS, it is recommended that an inspection be made at that time. (See Steps one through ten of "Periodic Maintenance Inspection.")

Periodic Maintenance Inspection

Each maintenance inspection at the completion of an equivalent duty cycle should include at least the following:

1. Bypass and remove the recloser from service:

a. Disconnect the control cable from the recloser.

b. Remove the fused pullout switch to de-energize the 240 Vac power source to the operator mechanism.

2. Visually inspect external components:

a. Check for broken or cracked bushings; replace as necessary. (See "Shop Maintenance Instructions—Bushings" for procedure.)

b. Check for paint scratches and other mechanical damage; touch up to inhibit corrosion.

3. Visually inspect the operator mechanism:

a. Check interior of the operator mechanism cabinet for accumulation of dust and dirt; clean as necessary.

b. Check door gasket for effectiveness of seal, repair or replace as required.

c. Visually inspect all components for worn or broken parts and corrosion; replace as necessary.

d. Check for broken or loose wiring terminals at the various components and terminal boards.

CAUTION: Do not use excessive force when replacing brush holder caps; excessive tightening may crack the caps.

e. Check the motor brushes for excessive wear and burning; replace as needed.

f. Record counter reading in the record log.

4. Close and trip the recloser manually several times to check mechanical operation. (See“Manual Operation—To Close the Recloser” for manual operating instructions.)

5. Perform a dielectric withstand test to check the insulation level of the recloser and the vacuum integrity of the interrupters. (See “Insulation Level Withstand Tests” for procedure.)

6. Remove cabinet side panels to expose the internal components.

7. Check the contact erosion of the vacuum interrupters:

a. Locate the scribe mark on the moving contact rod at the top of the interrupter. (See Figure 4.)

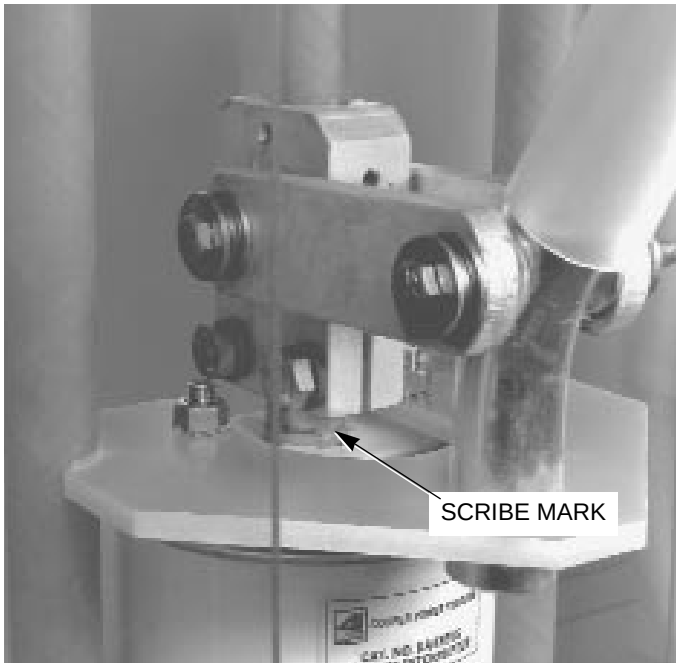

Figure 4.
Interrupter contact wear inspection.
911063KMA

b. If the scribe mark falls below the top of the upper support plate, when the interrupter is closed, the interrupter has reached the end of its useful life and must be replaced. (See “Vacuum Interrupters” for replacement procedure.)

8. Check the electrical operation of the recloser:

a. Reinstall the fused pullout switch to energize the motor circuit.

- If this recloser has been manually tripped while the motor circuit was de-energized (SPRINGS DISCHARGED), the motor will run to charge the closing springs (SPRINGS CHARGED) .

b. Momentarily apply 24 Vdc to terminals A (+) and E (-) of the control terminal board, mounted vertically along the left edge of the panel board.

- The recloser will close, and the motor will run to recharge the closing springs for the next closing operation.

c. Momentarily apply 24-Vdc to terminals A (+) and C (-) of the control terminal board.

- The recloser will trip open.

d. Electrically open and close the recloser several times to check its operation; leave in the open position.

9. Check operation of recloser with its control. Checkout procedures for a recloser with a F3A control, and for the control only, are described in the applicable control installation manual: Form 3A electronic recloser controls refer to S280-75-1, Form 4C microprocessor-based controls refer to S280-77-1.

IMPORTANT: Form 3A electronic control must be equipped with the KA1175ME fuse accessory. This accessory supplies a MDQ-2.5 closing coil control fuse which is required to operate the closing solenoid.

Controls must not be programmed with reclose delay intervals that are shorter than 0.5 second. The instantaneous reclose delay plug must not be used. The KA1177ME-1 reclose delay plug provides a fixed 0.5 second delay. A maximum of one 0.5 second delay can be used, successive reclosing operations must be a minimum of two (2) seconds.

10. Refer to the applicable sections of the “Type VSA12, VSA16 and VSA20/800 Installation Instructions”, S280-45-1, for procedures to return the recloser to service.

MANUAL OPERATION

The recloser can be manually closed and tripped with a set of operating levers on the operator mechanism inside the cabinet (Figure 5) or a set of pullrings located externally on the underside of the cabinet (Figure 6).

To Close Recloser

Proceed as follows:

1. Apply rated voltage to the input terminal block on the side of the operator cabinet.

   NOTE: If closing springs are discharged, the motor will operate immediately to charge the springs.

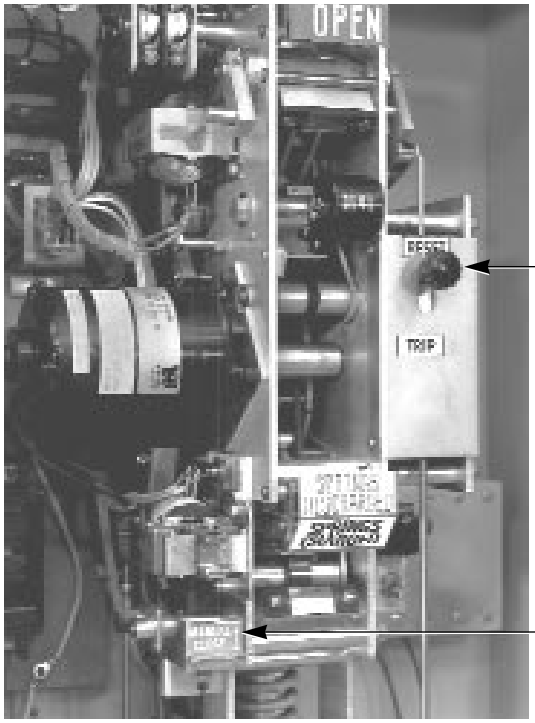

Figure 5. 911062KMA
Manual operation control levers.

2. When closing spring status indicator reads SPRINGS CHARGED, lift up the MANUAL CLOSE lever on the operating mechanism, or pull the external MANUAL CLOSE pullring to release the charged springs and close the recloser.

   NOTE: Immediately upon closing, the motor will operate to again charge the closing springs.

If motor operating power is not available the closing springs may be charged by manually cranking the mechanism until the closing springs status indicator reads SPRINGS CHARGED:

1. Remove bolt and seal assembly from hole in right side of cabinet.
2. Insert manual crank shaft through the cabinet wall and onto the shaft protruding from the mechanism (Figure 7).

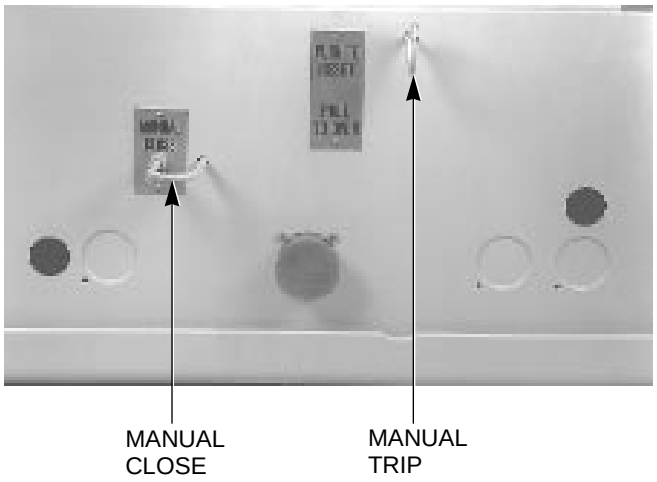

Figure 6. 911060KMA
Manual operation pullrings.

3. Crank the motor in a COUNTERCLOCKWISE direction until the spring status indicator reads SPRINGS CHARGED. Approximately 150 revolutions are required.

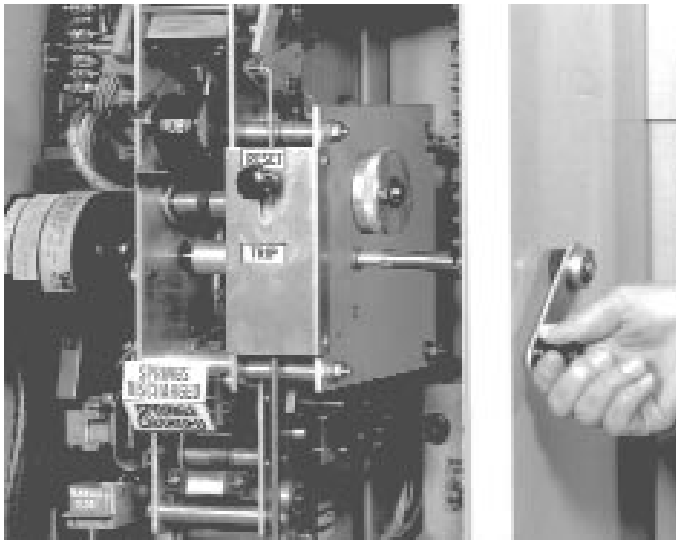

Figure 7. 901040KMA
Manually charging closing springs.

To Open Recloser

To release the opening spring either pull down the TRIP RESET knob on the front of the operator mechanism or the PULL TO OPEN pullring under the cabinet. Return knob or pullring to the RESET position after the unit has tripped, to enable the electronic closing circuit.

INSULATION LEVEL WITHSTAND TESTS

High potential withstand tests provide information on the dielectric condition of the recloser and the vacuum integrity of the interrupters. Testing is performed at 37.5 kV rms (75% of the rated low frequency withstand voltage of the VSA recloser).

TEST 1: Proceed as follows:

1. Manually close main contacts of recloser.
2. Ground recloser housing.
3. Connect all three bushings on one side of the recloser together.
4. Apply proper test voltage to the connected bushings.
5. The recloser should withstand the test voltage for 60 seconds.

TEST 2: Proceed as follows:

1. Manually close main contacts of the recloser.
2. Ground housing.
3. Ground outer two phase bushings (1-2 and 5-6).
4. Apply proper test voltage to center phase bushings (3-4).
5. The recloser should withstand the test voltage for 60 seconds.

TEST 3: Proceed as follows:

1. Open main contacts of recloser.
2. Ground recloser housing.
3. Connect and ground all three bushings on one side of the recloser.
4. Connect the other three bushings together.
5. Apply proper test voltage to the ungrounded bushings.
6. The recloser should withstand the test voltage for 60 seconds.
7. Reverse the ground and test connections and apply test voltage to the ungrounded bushings for 60 seconds.
8. The recloser should withstand the test voltage for 60 seconds.

TEST RESULTS:

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

1. If the recloser passes the closed contacts tests (Tests 1 and 2) but fails the open-contacts test (Test 3) a deteriorated vacuum in one or more of the interrupters is most likely the cause. Retest each vacuum interrupter individually to determine the failed phase or phases, and replace the interrupter(s). Retest to confirm the repair.
2. If the recloser fails the closed-contacts tests (Tests 1 and 2) the cause is likely to be a diminished electrical clearance or a failed insulation. After correcting the problem, retest to confirm the repair.

SHOP MAINTENANCE INSTRUCTIONS

The operations described in this section should be performed under the cleanest conditions possible. 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 physical damage during the periodic maintenance inspection. Bushing porcelain must be replaced whenever damage is discovered. The porcelain can be replaced without removing the bushing assembly from the recloser.

To replace bushing porcelain proceed as follows, refer to Figure 8:

1. Unscrew the bushing terminal, discard the terminal gasket.

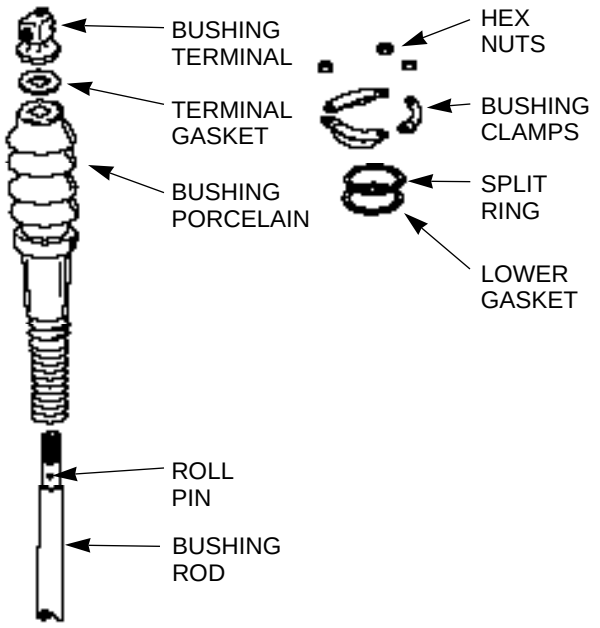

Figure 8.
Bushing porcelain replacement.

2. Remove the three hexnuts and bushing clamps that secure the bushing to the recloser housing.
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 porcelain, if it is still in good condition; replace if damaged.

CAUTION: Bushing damage. Do not reuse the split aluminum ring if damaged. The clamping ring cushions and distributes the pressure between the bushing flange and the bushing clamps, DO NOT OMIT. If bushing clamps are assembled without the clamping ring the bushing may be damaged when clamp hardware is tightened.

5. Install a new lower bushing gasket and slide the new bushing porcelain, into the recloser housing, over the bushing rod. Make sure that the roll pin is seated in the locking groove in the top of the bushing.
6. Position the clamping ring with the split centered between two clamp bolts.
7. Install bushing clamp hardware and tighten nuts evenly, a little at a time, to 6-10 ft-lbs. torque.

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 may result, compromising the dielectric capabilities of the recloser. Unequal clamping force may cause bushing breakage.

8. Apply a very small amount of petroleum jelly to the knurled inside surface of the bushing terminal.
9. Install a new terminal gasket and the bushing terminal, tighten to 35 ft-lbs. torque.

Vacuum Interrupters

Vacuum interrupters must be replaced when:

- They lose their vacuum as evidenced by a failure during the low-frequency dielectric withstand test across the open contacts; or
- The interrupter contacts have eroded beyond their useful life as evidenced by the position of the scribe mark on the moving contact rod.

To replace an interrupter refer to Figure 9, and proceed as follows:

1. Remove fused pullout switch to de-energize AC power source to operator mechanism.
2. Make sure recloser contacts are open; manually operate mechanism until contact position indicator reads OPEN and closing spring status indicator reads SPRINGS DISCHARGED.
3. Remove nylon hardware, or wire tie, securing insulating barrier to stringers, remove insulating barrier.
4. Remove hardware and clamp that secure long bushing rod to lower interrupter support bracket.
5. Loosen bolts that secure upper interrupter clamp. As clamp is loosened atmospheric pressure, acting on the bellows, will cause the contact rod to move down into interrupter. This action can be verified by observing the scribe mark on the contact rod. It should move down, toward contact rod support plate, when clamp is loosened.

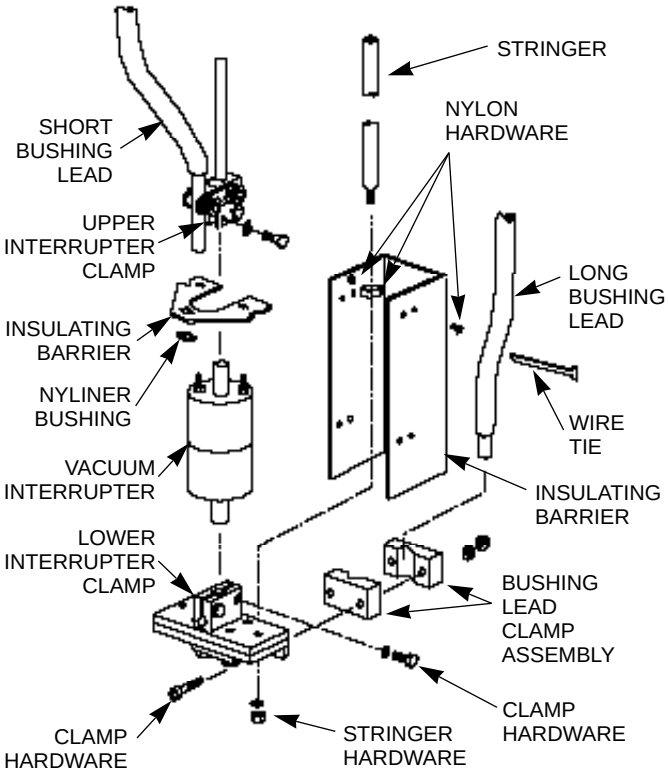

Figure 9.
Vacuum interrupter replacement.

NOTE: If contact rod does not move, interrupter may have lost vacuum, or the contact rod may be sticking within the clamp. Use a screwdriver to gently spread clamp to free rod.

6. Remove hardware attaching lower current exchange plate to stringers. Carefully lower plate and vacuum interrupter assembly from between stringers.

7. Loosen lower current exchange clamp and remove interrupter. If stationary contact rod sticks within clamp use a screwdriver to gently spread clamp to free rod.

8. Remove insulating barrier from top of old interrupter and install on new interrupter.

9. Install stationary contact rod into lower current exchange plate, do not tighten clamp hardware.

CAUTION: Interrupter damage. When installing the moving contact rod into the upper clamp avoid twisting or cocking the rod. Excessive force can damage the bellows, causing loss of vacuum and irreparable damage to the interrupter and/or premature interrupter failure.

10. Carefully place interrupter and lower current exchange assembly into position; situate moving contact rod within upper clamp as assembly is installed. Install washers and locknuts to secure lower current exchange plate to stringers.

11. Loosen tension bolt to relieve opening spring tension, Figure 10.

12. Manually close recloser.

13. Tighten top and bottom contact rod clamp hardware to 20-22 ft-lbs torque.

14. Tighten tension bolt to re-apply tension to opening spring, Figure 10.

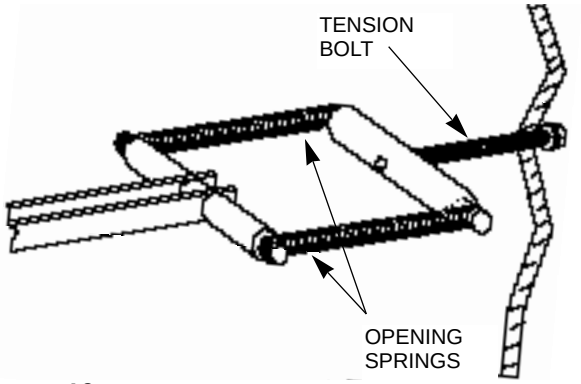

Figure 10.
Opening spring tension bolt.

15. Install clamp and hardware to secure long bushing lead to lower current exchange assembly and tighten.

16. Manually trip and close recloser several times to check operation.

17. Install insulating barrier and secure with nylon hardware, or wire ties, as applicable

18. Perform Insulation Level Withstand Test (see page 8).

19. Install fused pullout switch to energize AC power source to operator mechanism.

Operating Mechanism

The spring operated mechanism uses solenoids to release charged opening and closing springs. The closing springs are charged by a motor-gear reduction drive. The closing operation charges the opening springs.

The upper portion of the operating mechanism in the operator cabinet incorporates the tripping mechanism which includes the trip solenoid, mechanical linkages and associated switches. The lower portion of the mechanism incorporates the closing mechanism which includes the close solenoid, motor, gear reduction drive, clutch, closing springs, mechanical linkages and associated switches. The opening springs and the linkages to operate the interrupters are located under the head of the recloser.

The major components of the operating mechanism are easily accessible without need to remove the mechanism. However, if necessary, the complete operating mechanism can be removed from the operating cabinet as a unit.

Mechanism Removal

1. Remove fused pullout switch to de-energize AC power source to operator mechanism.
2. Make sure recloser contacts are open; manually operate mechanism, if necessary, until contact position indicator reads OPEN and closing spring status indicator reads SPRINGS DISCHARGED.
3. Remove screws attaching auxiliary switch to mechanism frame. Remove auxiliary switch.
4. Loosen operating bar turnbuckle assembly, inside interrupter housing, see Figure 11.

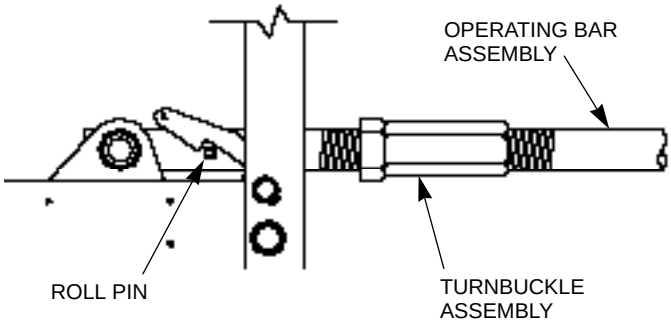

Figure 11.
Turnbuckle assembly.

5. Remove link pin that attaches operating mechanism to operating bar assembly, Figure 12.

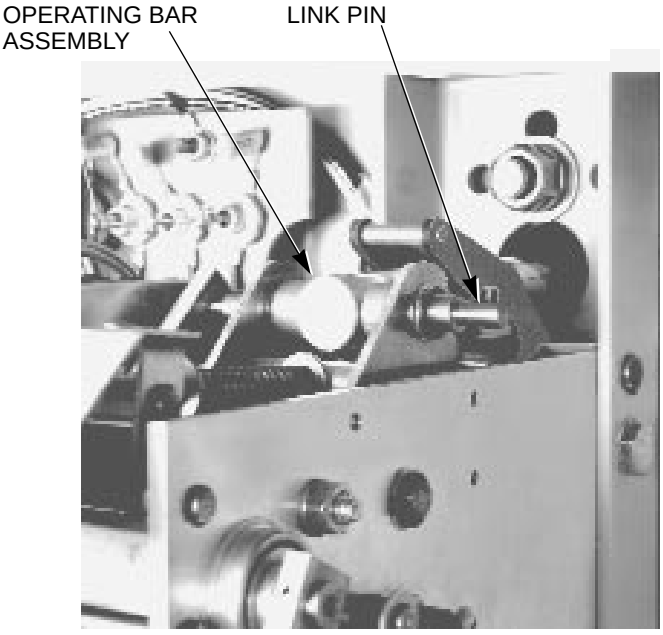

Figure 12.
Location of link pin.
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6. Turn operating bar clockwise 90 degrees to disengage roll pin from anti-bounce latch.
7. Unplug wiring harness from panel board on the back of the cabinet.
8. Remove trip reset knob and front plate, remove cotter-pin to disconnect external trip pullring from threaded pin on trip link, Figure 13.

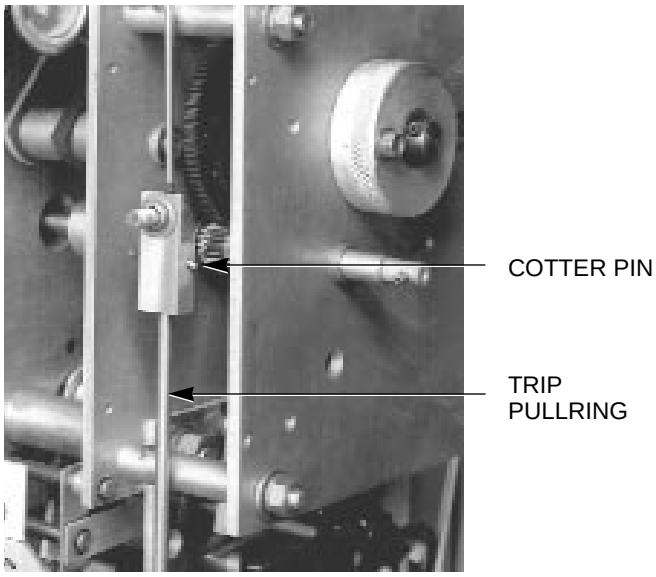

Figure 13.
Removal of external trip pullring.
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9. Disconnect external quick-close pull hook by removing attaching stop nut, Figure 14.

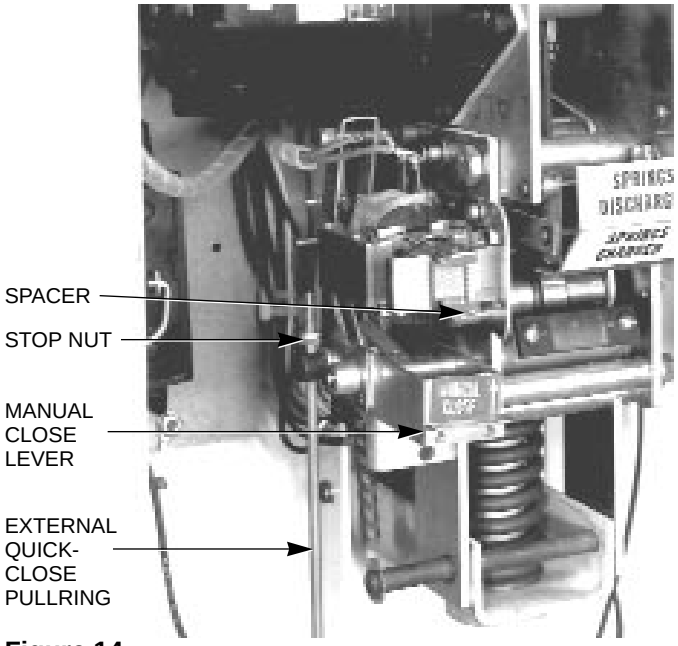


Figure 14.
Attachment of external quick-close pullring.

10. Remove two ⅜ inch hex nuts and lockwashers from top of mechanism channel.

11. Remove ½ inch hex nut lockwasher attaching bottom of channel to cabinet.

12. Remove ½ inch hex head bolt and lockwasher attaching top of mechanism channel.

13. Maneuver complete mechanism assembly out of operator cabinet.

Mechanism Installation

Installation of the operating mechanism is essentially the reverse of disassembly; however, two adjustments must be made after the mechanism is installed.

External Quick-Close pullring adjustment. The stop nut that secures the external quick-close pullring must be adjusted to prevent over travel of the manual close lever assembly, refer to Figure 14.

1. From under the mechanism housing, pull quick-close lever down until linkage comes to its mechanical stop.

2. Adjust stop nut until the top edge of the manual close lever just contacts the spacer.

Anti-bounce latch adjustment. The anti-bounce latch assembly must be properly adjusted to operate properly, refer to Figure 15.

1. Loosen operating bar turn-buckle.

2. Adjust turnbuckle to provide a 1/32 inch gap between operating bar roll pin and the anti-bounce latch.

3. Secure turnbuckle.

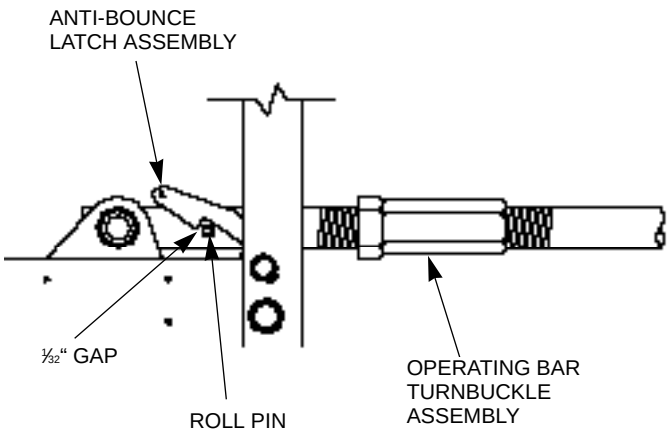


Figure 15.
Anti-bounce latch adjustment.

Motor

CAUTION: This type of motor should NEVER be energized while disconnected from gear reduction unit. Uncontrolled motor speed will result when operated without load, excessive speed will damage motor.

A universal series-type motor is used to charge the closing springs. The motor is energized from either a 240- or 120-Vac auxiliary power source, through a fused pullout switch. The motor has permanently lubricated, sealed ball-bearings that require no service. Periodically check motor brushes for wear or burning, replace as required.

NOTE: Brush replacement kits are available for both the 240-Vac and 120-Vac motors. The kit consists of two brushes and two brush caps.

Motor Replacement

The universal drive motor must be replaced, as an assembly, if it become damaged or worn. To replace the motor proceed as follows, refer to Figure 16:

CAUTION: Do not attempt to replace the drive motor while recloser contacts are closed, or while operator springs are charged. If the operator assembly were to trip while hands are within operating linkage personal injury could result.

1. Remove fused pullout switch to de-energize AC power source to operator mechanism.
2. Make sure recloser contacts are open; manually operate mechanism until contact position indicator reads OPEN and closing spring status indicator reads SPRINGS DISCHARGED.
3. Cut motor leads, close to old motor.
4. Remove hardware securing motor and carefully remove from operator assembly.
5. Position replacement motor into operator assembly, engage motor shaft into coupling, secure with hardware removed. Apply Loctite #242 (blue) to screw threads prior to assembly.
6. Trim motor leads, leave sufficient length to splice new motor leads to old motor leads.
7. Slide shrink tube over motor leads, splice and solder leads. Shrink tubes over joints.
8. Install fused pullout switch to energize AC power source.

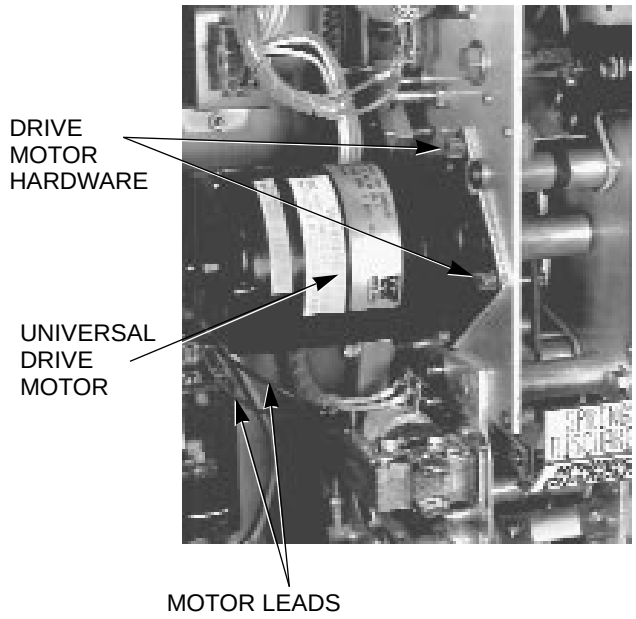


Figure 16.
Motor replacement.

911059KMA

Brush Replacement

1. Remove brush caps and carefully pull old brushes from motor.
2. Install new brushes, with cove positioned to cup over the commutator.

CAUTION: Do not use excessive force when replacing brush holder caps; excessive tightening may crack the caps.

3. Install brush caps to secure.

Gear Reduction Unit

The pinion gear at the opposite end of the motor shaft coupling engages a gear reduction train consisting of a first and second intermediate gear and the main gear. All gears are permanently lubricated to provide maintenance-free operation and prevent corrosion. Oil impregnated bronze bearings provide long wear life. Inspect all gear teeth and bearings carefully; disassemble the unit only when part replacement is necessary.

ELECTRICAL COMPONENTS

Electrical circuit components of the operating mechanism require no maintenance and should provide trouble-free operation. If control circuit malfunction is indicated, check out the circuitry in the following order:

1. Substitute another electronic control - known to be in working order. Follow the procedures in the electronic control service manual to test and repair the control.
2. Check the control cable for breaks or shorts.
3. Check the circuit components in the operating mechanism.

Sensing Current Transformer Tests

The sensing transformers can be tested using the circuits shown in Figure 17. Connect all three phases of the recloser in series across a 100 ampere ac test supply and close the recloser with the manual closing crank.

WARNING: High voltage. Contact with high voltage will cause serious personal injury or death. When checking the CT output of one phase, be sure that the CT's on the other two phases are shorted—or use three milliammeters to load all three phases at one time. Energizing the primary without shorting the CT secondary may cause dangerous voltages to be generate in the CT Secondary.

Ratio Test for Sensing-Current Transformers

Refer to Figure 17, "Ratio Test Circuit (A)."

1. Energize 100 ampere test source.
2. Check current through control cable receptacle sockets K-G (Phase A), K-H (Phase B) and K-J (Phase C). For each sensing bushing CT checked, the milliammeter should indicate 100 milliamperes (mA) (50 mA when testing 2000:1 ratio CTs) plus or minus ten percent.
3. A 100 mA reading verifies the 1000:1 ratio (a 50 mA reading verifies the 2000:1 ratio) of each current transformer. Be sure to allow for tolerances of metering equipment. De-energize test source and proceed with polarity test.

Polarity Test

Refer to Figure 17, Polarity Test Circuit (B) .

1. Connect sockets G, H and J of the control cable receptacle in series with jumper leads as indicated in Figure 18. 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, 150mA when testing 2000:1 ratio CTs.
2. Energize the 100 ampere test source. A 300 mA reading (150mA when testing 2000:1 ratio CTs) indicates correct polarity for all three sensing transformers. If the meter across K and J reads only 100 mA (50 mA when testing 2000:1 ratio CTs), the polarity of one of the transformers is reversed. Check for uniform location of the polarity marks on all three transformers; reposition as necessary.
3. De-energize ac test current and remove jumper wires from receptacle sockets.

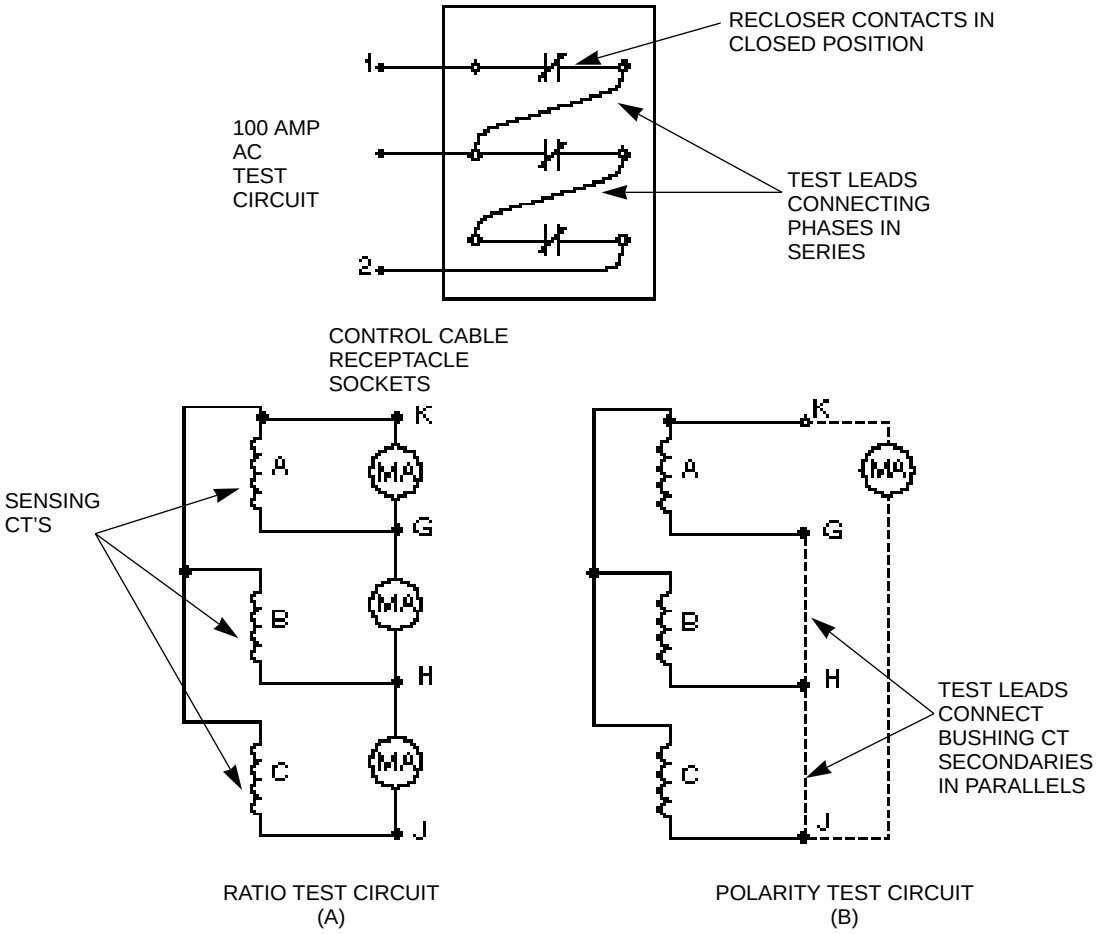


Figure 17.
Test circuit for checking bushing current transformers.

Sensing-Current Transformer Replacement

To replace a damaged current sensing transformer proceed as follows, refer to Figure 18.

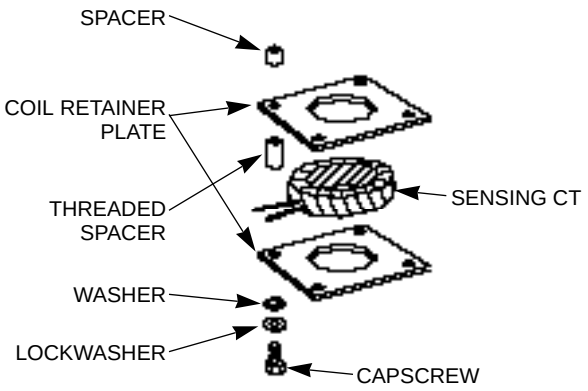


Figure 18.
Current sensing transformer replacement.

1. Remove bushing that passes through the current transformer that is to be replaced.
2. Label sensing current transformer leads. Use labeling in accordance with connection diagram. The X1 leads are white and the X2 leads are black.
3. Cut leads, on transformer side of the original splice, to disconnect current transformer.
4. Remove capscrews that secure current transformers. Remove and discard damaged sensing CT; retain coil retainer plate.

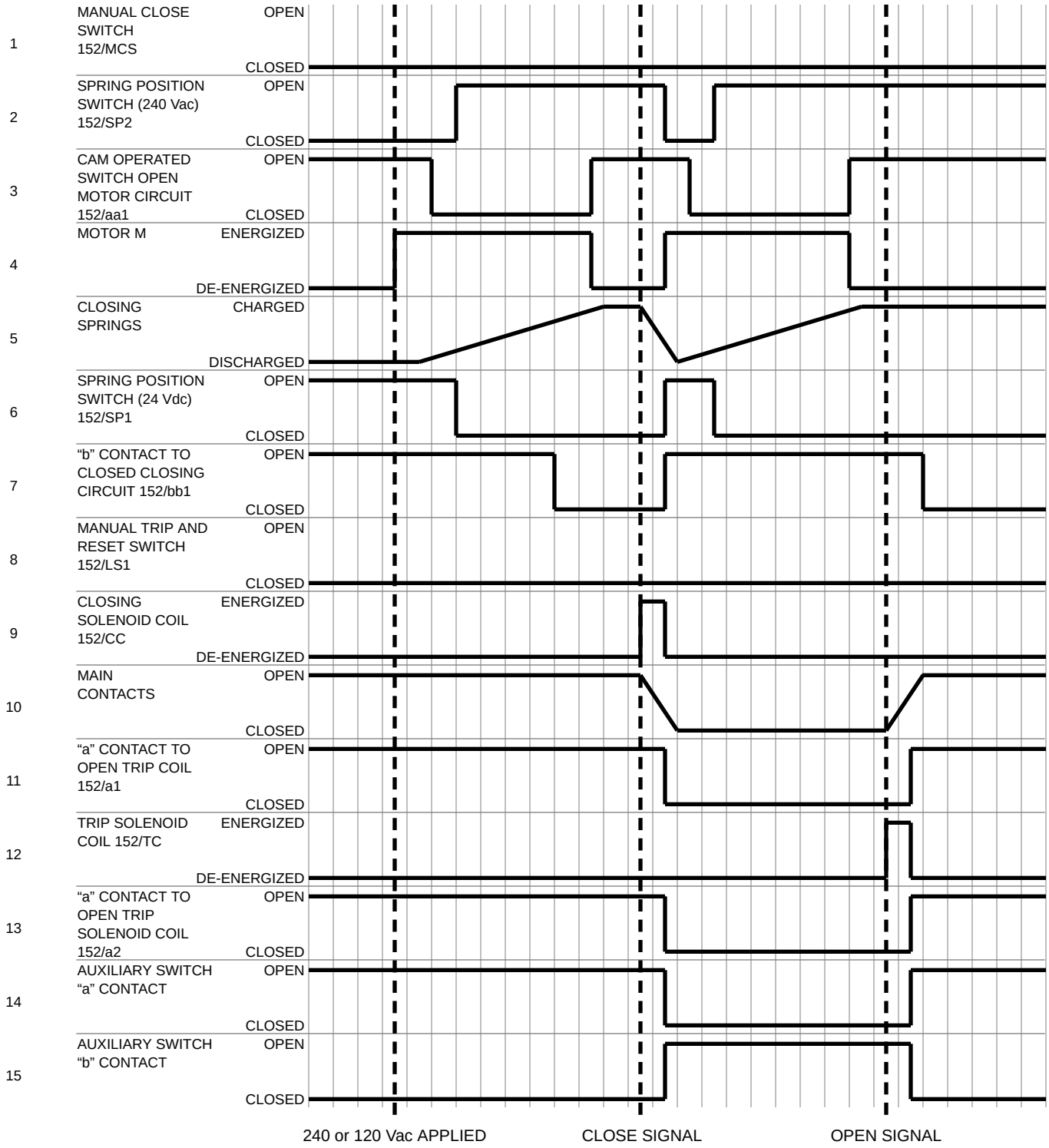
   Note: Sensing CTs are marked with a black spot to indicate polarity, when installing the replacement CT orient the black dot to match the dot on the other CTs that are already installed.
5. Install replacement CT, secure with hardware removed.
6. Trim CT leads as required. Slide shrink tube over each lead, splice connection and solder. Slide shrink tube over splice and apply heat to shrink. When splicing connections, refer to previous labeling to assure proper leads are connected before soldering.
7. Install bushing assembly.
8. Perform the ratio and polarity tests after replacement of any sensing CT to make sure they are properly installed.

Control Cable Check

With the cable removed at the control, use an ohm meter to check the continuity of each circuit through the connection at the operator cabinet up to the control terminal block. The connector pin sockets and the control terminal block are lettered correspondingly. Remove and replace each conductor at the control terminal block while checking. A zero reading will indicate continuity, an infinite reading indicates an open circuit. Continuity between terminals and unlike pin socket indicates a shorted circuit. Replace if cable is damaged.

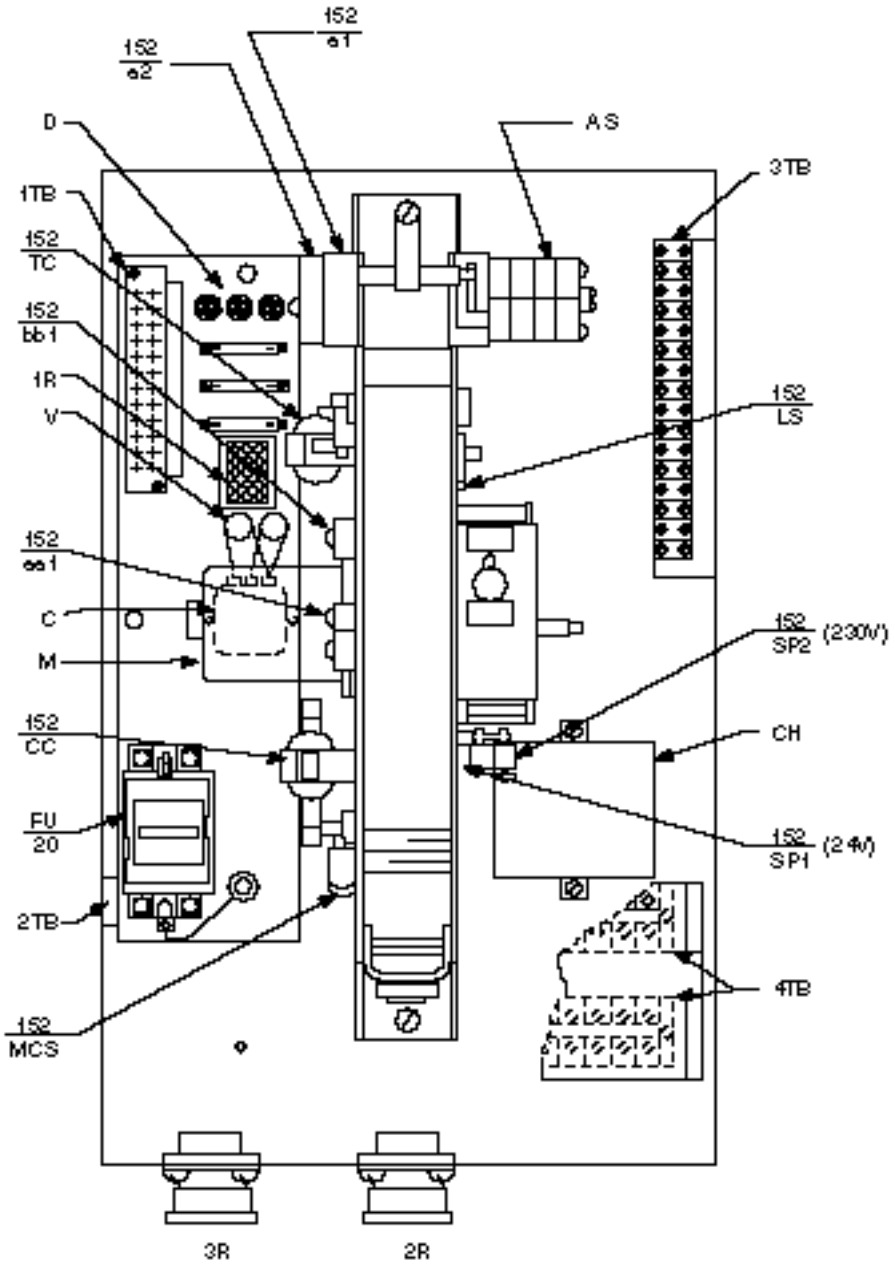
Control Circuit Components

The operating sequence of the various circuit components is diagrammed in Figure 19. See Figures 20 and 21 for connection diagrams and wiring tables. A schematic diagram of recloser circuits is shown in Figure 22.



NOTE: Unit in "OPEN" position with closing springs discharged when auxiliary power is initially applied. (MANUAL CLOSE or TRIP pullrings are not operated.) *Drawing shows operational sequence only; it does not have a scaled time base.*

Figure 19.
Sequential operation of control circuit components in recloser.



AS	AUXILIARY SWITCH	152/a1	"a" CONTACT TO OPEN TRIP COIL	152/TC	TRIP COIL (SOLENOID)
D	DIODES 1N3209	152/a2	"a" CONTACT TO OPEN TRIP CIRCUIT	152/CC	CLOSE COIL (SOLENOID)
C	SURGE CAPACITOR	152/SP1	SPRING POSITION SWITCH (24Vdc)	152/MCS	MANUAL CLOSE SWITCH
CH	MECHANISM CABINET HEATER	152/SP2	SPRING POSITION SWITCH (240 Vac) CLOSE MOTOR CIRCUIT	152/LS	CONTACT FOR MANUAL LIMIT SWITCH - TRIP & RESET
FU/20	FUSE BOX	152/aa1	CAM OPERATED SWITCH OPEN MOTOR CIRCUIT	V	VARISTOR
M	MOTOR	152/bb1	"b" CONTACT TO CLOSE CLOSING CIRCUIT		
1R	CONTROL RECEPTACLE				
2R	RECLOSER RECEPTACLE				
3R	AUXILIARY SWITCH RECEPTACLE				

Figure 20.
Location and connection table of control components on operating mechanism.

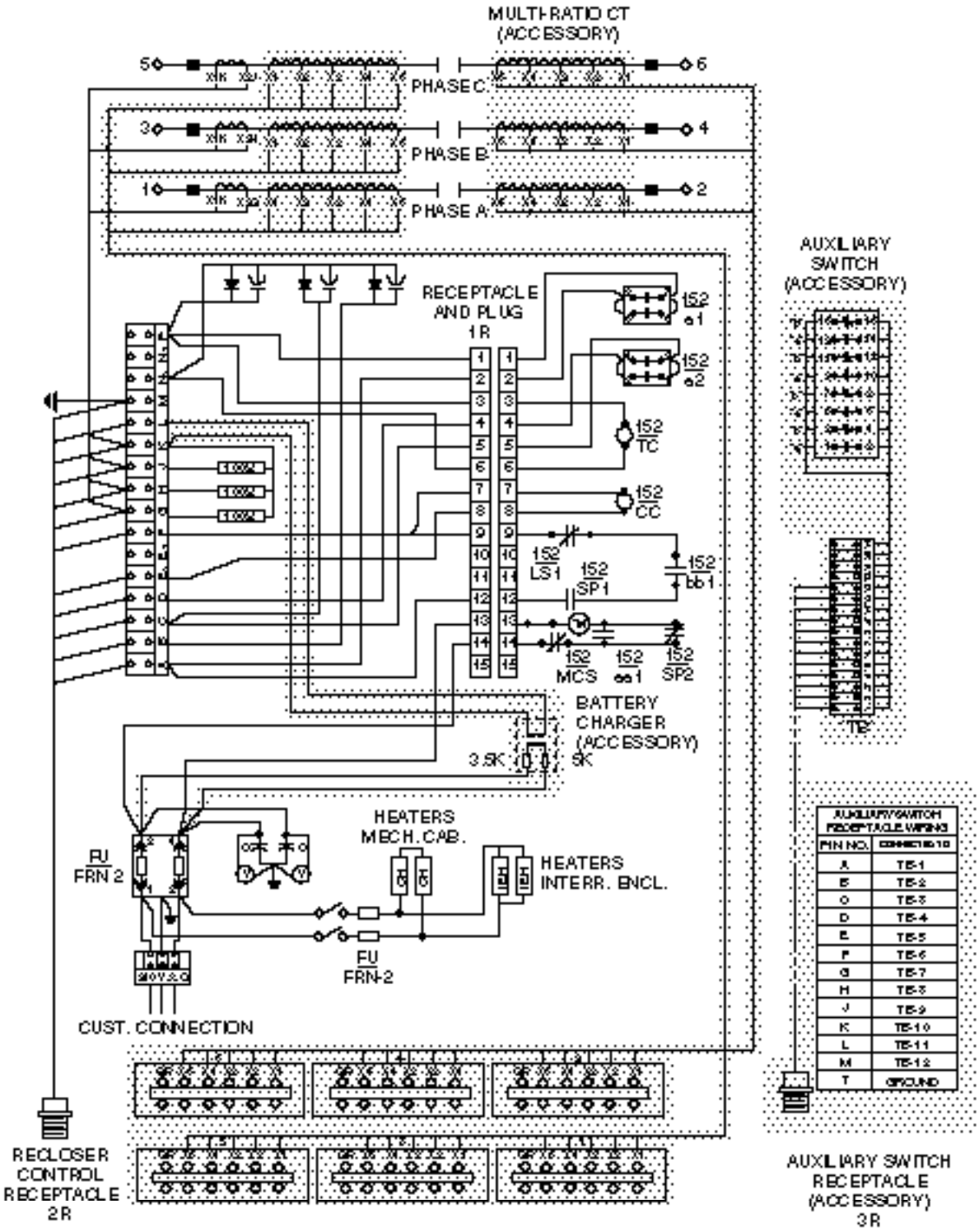


Figure 21.
Connection diagram for other control components.

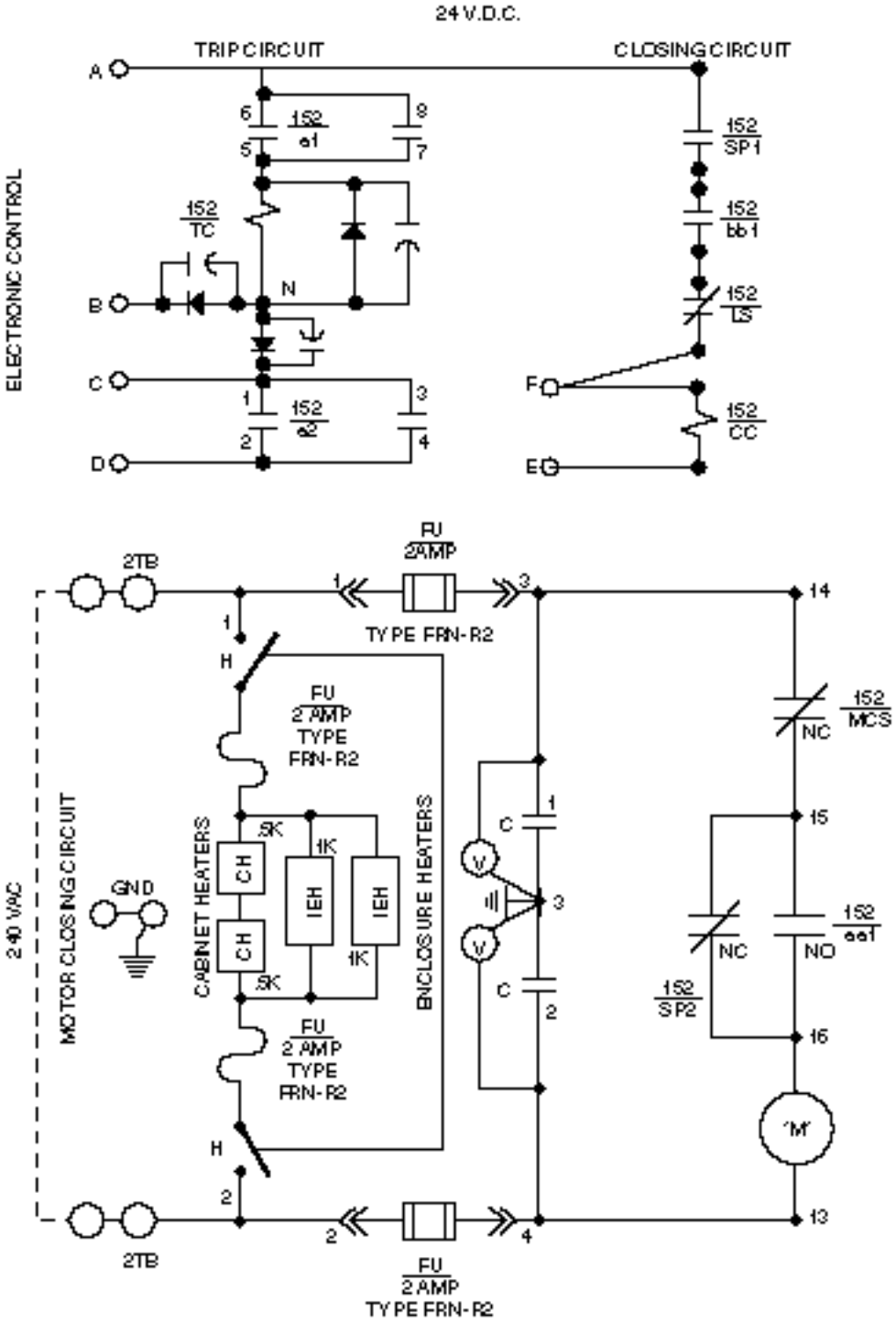


Figure 22.
Schematic diagram of recloser circuits.

SERVICE PARTS LIST

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

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

A - No plating; raw material

H - Silver

M - Black oxide

Q - Cadmium + zinc + chromate

Y - Zinc + chromate

Z - Electro zinc + bronze irridite

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

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

Prices of Replacement Parts, Section S280-01 Part No. 45, lists recommended spare parts and prices for most parts. Parts not listed in price list may still be available, consult your Cooper Power Systems sales engineer for price and availability.

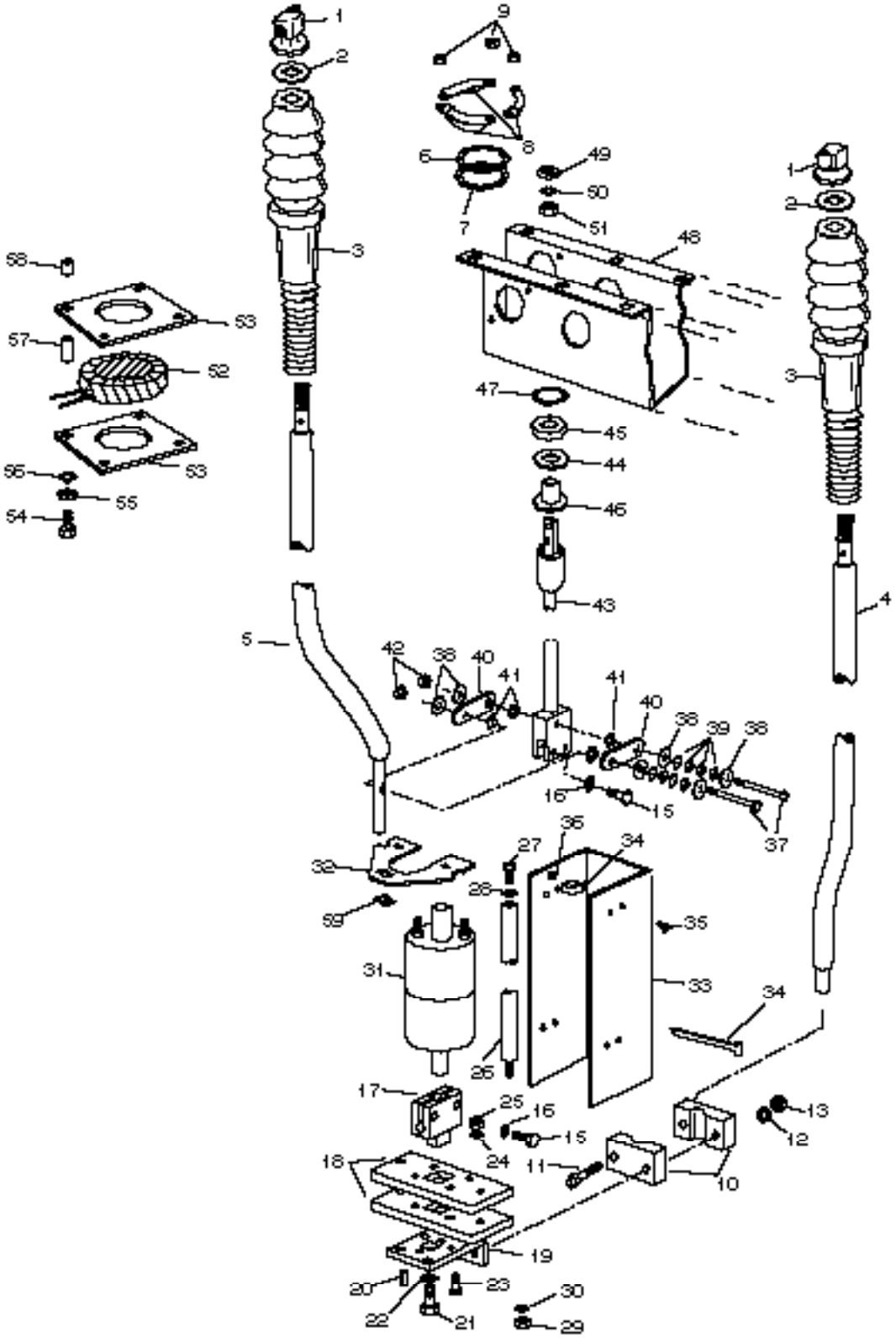


Figure 23.
Bushings and Interrupters.

Bushings and Interrupter (Figure 23)

Item No.	Description	Catalog Number	Qty. per Assy.
-	Bushing assembly, long lead (items 1 thru 4)		3
-	Bushing assembly, short lead (items 1, 2, 3, 5)		3
1	Bushing terminal assembly	KA112VSML	6
2	Upper bushing gasket	KP2090A57	6
3	Ceramic bushing	KP1039VS	6
4	Bushing rod, long	KA111VSML2	3
5	Bushing rod, short	KA111VSML5	3
6	Bushing clamping ring	KP1066VS1	6
7	Lower bushing gasket	KP2090A9	6
8	Bushing clamp	KP1252VS	18
9	Hex nut, 3/8-16, stl	K880215116087A	18
10	Bushing rod clamp	KP1136VS3	6
11	Cap screw, 3/8-16 x 2, bronze	K730133137200A	12
12	Lockwasher, med, 3/8, bronze	K900833037000A	12
13	Hex nut, 3/8-16 bronze	K880233116037A	12
14	Connector current exchange and bracket assembly (Includes items 15 thru 25)	KA186VS	3
15	Machine screw, hex hd, 3/8-16 x 1-1/4, bronze	K730133137125A	2
16	Lockwasher, 3/8, med, stl	K900801037000Z	2
17	Stationary clamping block	KA177VS	1
18	Bottom plate	KA1005VS	2
19	Stationary bracket	KA1178VS	1
20	Roll pin, 3/16 x 1/2, stl	K970815187050A	2
21	Machine screw, hex hd, 1/2-13 x 1, bronze	K730133150100A	1
22	Lockwasher, 1/2 med, bronze	K900830050000A	1
23	Machine screw, hex hd, 1/4-20 x 1-1/2, stl	K730101125150Q	4
24	Washer, 1/4 med, stl	K900201025000Z	4
25	Elastic stop nut, 1/4-20, stl	KP2020A3	4
26	Stringer assembly	KA254VS	6
27	Machine screw, hex hd, 3/8-16 x 3/4, stl	K730101137075Z	6
28	Lockwasher, 3/8, stl	K900801037000Z	6
29	Elastic stop nut	KP2020A21	6
30	Washer, 3/8, stl	K900201037000Z	7
31	Vacuum interrupter		
	VSA12	KA717VS1	3
	VSA16	KA717VS4	3
	VSA20/800	KA717VS5	3
32	Insulating barrier	KP1180VS	3
33	Barrier panel	KP1300VS	3
34	Cable clip	KP2006A10	12
	Wire tie (used in place of cable clip above)	K994904170001A	12
35	Machine screw, rd hd, #10-32 x 5/8, nylon	K721584310062A	12
36	Hex nut, #10-32, nylon	K821054132010A	12
37	Machine screw, hex hd, 1/4-20 x 3, stl	K730101125300Q	6
38	Washer	KP1197VS	6
39	Belleville washer	KP2183A3	24
40	Transfer bar	KP1196VS	6
41	Spherical disc	KP1195VS	12
42	Elastic stop nut	KP2020A3	6
43	Transfer rod and stop assembly	KA170VS	3
44	Stop	KP1396VS	3
45	Washer	KP2090A109	3
46	Bushing	KP1288VS	3
47	Retaining ring	KP2013A22	3
48	Bracket	KP1395VS	1
49	Spacer	KP3013A27	12
50	Lockwasher, 1/4 med,	K900801025000Z	12
51	Nut, hex, 1/4-20"	K880201120025Q	12
52	Sensing current transformer		
	VSA12, VSA16 1000:1 ratio	KA930M-1	3
	VSA20/800 2000:1 ratio	KA930M-2	3
53	Plate	KP1163M	9
54	Cap screw, hex hd, 1/4-20 x 3/4, stl	K730101125100Q	12
55	Lockwasher, med, 1/4, stl	K900801025000Z	12
56	Flat washer, 1/4, stl	K900201025000Z	12
57	Threaded Spacer	KP3008A62	12
58	Spacer	KP3013A27	12
59	Nyliner	KP2332A	3

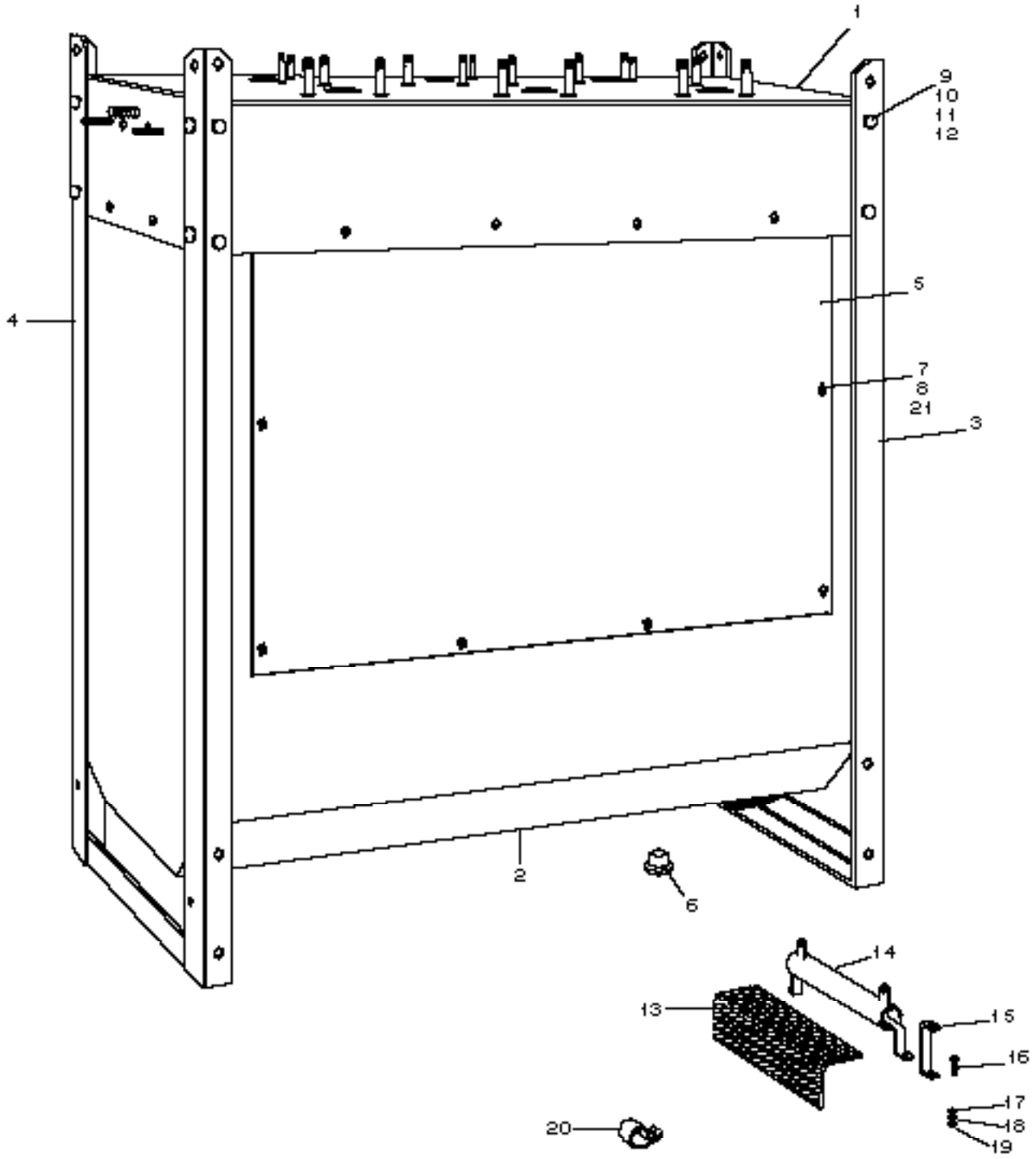


Figure 24.
Interrupter Cabinet.

Interrupter Cabinet (Figure 24)

Item No.	Description	Catalog Number	Qty. per Assy.
1	Interrupter cabinet cover	KA281VS	1
2	Enclosure	KA177VS	1
3	Rear cover support	KA178VS	1
4	Cover and operating cabinet support	KA179VS	1
5	Side panel	KA180VS900	2
6	Ventilating screen plug	KP2204A1	2
7	Speed nut	KP2005A4	24
8	Screw, self tapping, #14 x 3/4, st stl	K801715014075A	24
9	Machine screw, hex hd, 3/8-16 X1, st stl	K730115137100A	16
10	Hex nut, 3/8-16	K880201116037Q	16
11	Washer, 3/8, st stl	K900215037000A	16
12	Lock washer, 3/8 external tooth	K901101037000Z	16
13	Heater guard	KP1173CE	2
14	Resistor, 1000 ohms	KP287VR	2
15	Bracket	KP255NR	4
16	Machine screw, rd hd, #8-32 x 7/16, st stl	K721515108043A	12
17	Lockwasher, #8 med, st stl	K900815008000A	12
18	Washer, #10, brass	K900525020043A	8
19	Nut, hex, #8-32, st stl	K880215132008A	12
20	Nylo Clip	KP2006A1	4
21	Washer, 1/4, st stl	K900215026050A	24

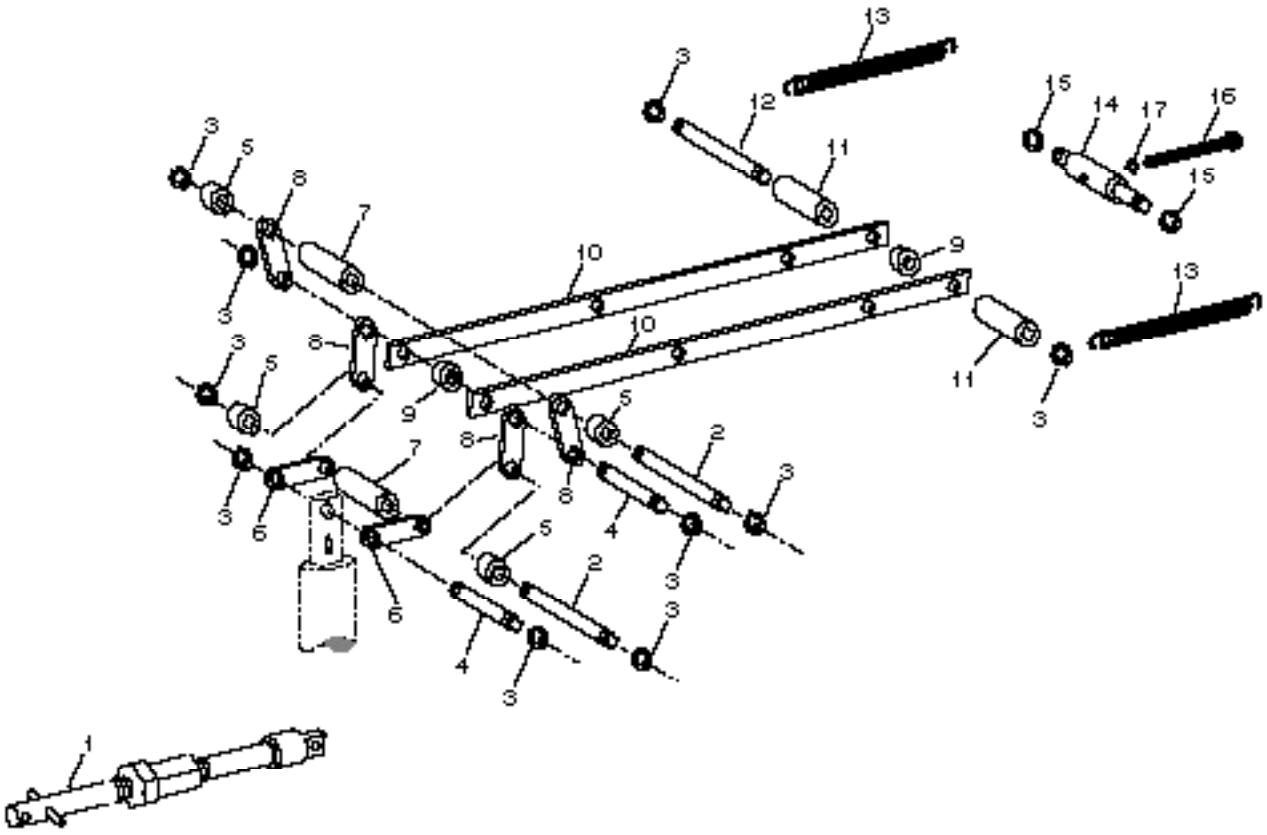


Figure 25.
Operating Linkage Assembly.

Operating Linkage Assembly (Figure 25)

Item No.	Description	Catalog Number	Qty. per Assy.
1	Connector and rod assembly	KA223VS3	1
2	Groove pin	KP3126A14	6
3	Retaining ring, Type C, stl	K970901375000M	26
4	Groove pin	KP3126A11	6
5	Spacer	KP3011A49	12
6	Link assembly	KA236VS	2
7	Spacer	KP3011A50	6
8	Link assembly	KA122VS	12

Item No.	Description	Catalog Number	Qty. per Assy.
9	Spacer	KP3011A133	3
10	Link	KP1400VS	2
11	Spacer	KP3009A92	2
12	Groove pin	KP3126A17	1
13	Main operating spring	KP1094VS	2
14	Spring retainer	KP1078VS	1
15	Retaining ring, Type WA-518	K970901375000M	4
16	Bolt, spring retainer	KP1015VS2	1
17	Washer, 3/8, stl	K900201037000Z	1

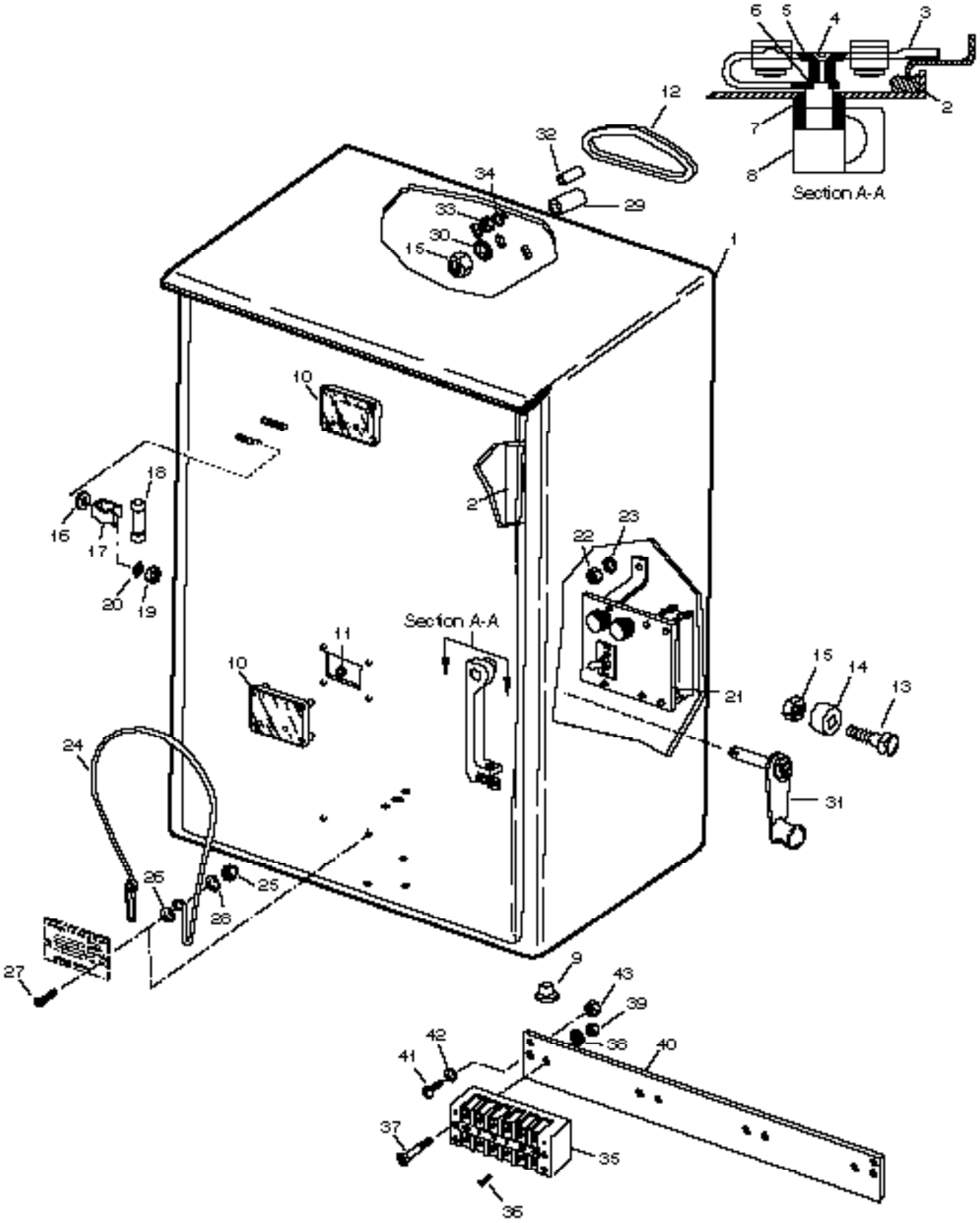


Figure 26.
Operator Cabinet.

Operator Cabinet (Figure 26)

Item No.	Description	Catalog Number	Qty. per Assy.
	Cabinet assembly, complete (includes items 1 thru 11)	KA154VS4	1
1	Cabinet only	KA133VSM	1
2	Gasket	KP2084A7	1
3	Latch assembly	KA152VS	1
4	Machine screw, flat hd, #10-24 x 3/4, stl	K721601110075Z	1
5	Spacer	KP3006A32	1
6	Flat washer	K90020101000Z	1
7	Bushing	KP3041A5	1
8	Handle assembly	KP153VS	1
9	Vent plug	KP2204A1	2
10	Window	KP1240M	2
11	Speed nut	KP2005A1	8
12	Gasket	KP2084A19	1
13	Machine screw, hex hd, 1/2-13 x 1, st stl	K730115150100A	1
14	Washer	KP2090A102	1
15	Nut, hex, 1/2-13, st stl	K880215113050A	2
16	Spacer	KP3011A132	2
17	Fuse clip	KP1091ME1	2
18	Fuse	KP2075A22	2
19	Nut, hex, #8-32, st stl	K880215132008A	2
20	Lockwasher, #8, st stl	K900815008000A	2
21	Heater assembly for Operator cabinet.	KVSO125VA	1
	Resistor, 500 ohm, 50 watt, IRC	K999904310084A	2
	Toggle switch, DPST	K999904250091A	1
	Decal	KP207VR	1
	Fuse holder	KP2074A1	2
	Fuse, Type AGC, 1A-250V	KP2075A2	2
22	Nut, hex, #8-32, st stl	K880215132008A	2
23	Lockwasher, #8, med, st stl	K900815008000A	2
24	Spring	KP1215VSM	1
25	Elastic stop nut	KP2020A6	2
26	Washer	KP2090A39	2
27	Machine screw, rd hd, #6-32 x 3/8, brass	K721525106037A	2
28	Flat washer, #6, st stl	K900215006000A	2
29	Spacer	KP3017A2	1
30	Lockwasher, 1/2, med, st stl	K900815050000A	1
31	Crank assembly	KA134VSM2	1
32	Spacer	KP3013A61	2
33	Hex nut, 1/4-20, stl	K880201120025Q	2
34	Lockwasher, 1/4, med, stl	K900801025000Z	2
	THE FOLLOWING PARTS ARE APPLICABLE TO THE BCT ACCESSORY ONLY		
35	Terminal block	KP2101A53	3
36	Machine screw, rd hd, #8-32 x 1/2, brass	K721525108050A	3
37	Machine screw, rd hd, #10-24 x 1-1/8, stl	K721501110106A	6
38	Lockwasher, ext tooth, #10, stl	K901101010000Z	6
39	Hex nut, #10-24, stl	K881001124010Z	6
40	Panel	KP1098VSM	1
41	Machine screw, rd hd, 1/4-20 x 1/2, stl	K721501125050Z	2
42	Lockwasher, 1/4, split, med, stl	K900801025000Z	2
43	Hex nut, 1/4-20, stl	K881001120025Z	2

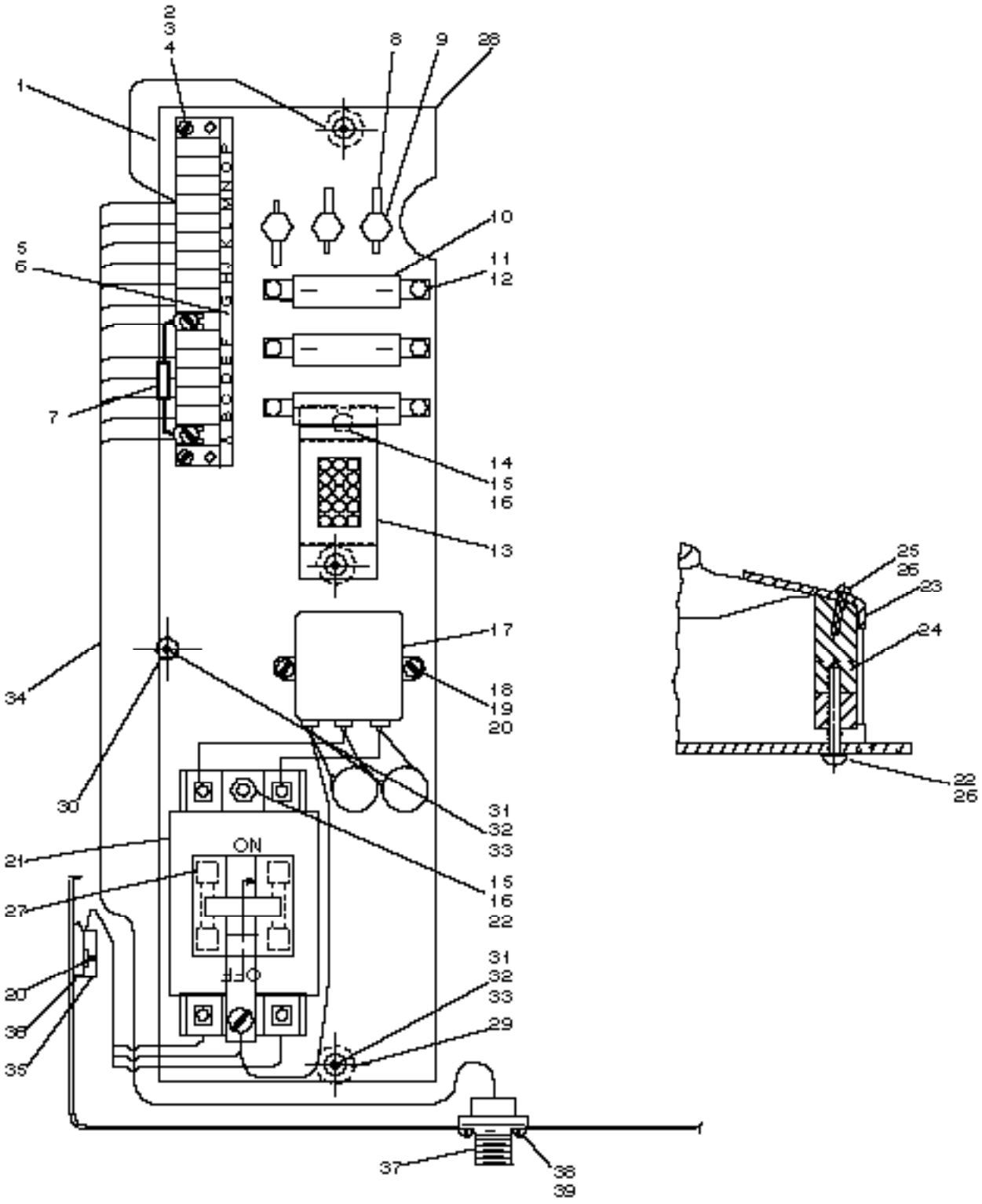


Figure 27.
Terminal Panel .

Terminal Panel (Figure 27)

Item No.	Description	Catalog Number	Qty. per Assy.
1	Terminal strip	KP2101A56	1
2	Machine screw, rd hd, #6-32 x 5/8, stl	K721515106062A	2
3	Lockwasher, #6, external tooth, stl	K901115006000A	2
4	Hex nut, #6-32, stl	K881015132006A	4
5	Marker strip	KP2076A51	1
6	Marker strip	KP2101A256	1
7	Capacitor assembly	KA256VS	1
8	Capacitor	KA158CE	3
9	Silicon diode	KP4011A9	3
10	Resistor	KP4022A31	3
11	Rivet, 0.146 x 9/32, stl	K930801014028Z	6
12	Flat washer, #6, brass	K900525014031A	6
13	Bracket and socket assembly	KA189VSM2	1
14	Machine screw, rd hd #10-24 x 3/8, stl	K721515110037A	1
15	Lockwasher, #10 external tooth, stl	K901115010000A	2
16	Hex nut, #10-24, stl	K881015124010A	2
17	Capacitor assembly	KA964M11	1
18	Machine screw, rd hd, #8-32 x 3/8, stl	K721515108037A	2
19	Lockwasher, #8, external tooth, stl	K901115008000A	2
20	Hex nut, #8-32, stl	K881015132008A	4
21	Fuse box	KP2261A1	1
22	Machine screw, rd hd, #10-24 x 1-3/8	K721515110137Q	2
23	Tapping block	KP1287VS	1
24	Strap	KP1286VS	1
25	Machine screw, rd hd, #10-24 x 5/8	K721515110063A	1
26	Lockwasher, #10, stl	K900815010000A	2
27	Fuse, Bussmann Type FRN-R2	KP2075A22	2
28	Panel Board	KP1077VSM	1
29	Spacer	KP3013A23	3
30	Spacer	KP3010A4	1
31	Hex nut, #10-24, brass	K881025124010A	4
32	Lockwasher, #10, med, brass	K900830010000A	4
33	Flat washer, #10, brass	K900525020043A	4
34	Control cable assembly	KA106VS	1
35	Terminal block	KP2101A27	1
36	Label	KP1144VSM	1
37	Cable receptacle	KP2056A5	1
38	Screw, self tapping, #6-32 x 3/8	K751515106037A	4
39	Lock washer, #6, medium, stl	K900815006000A	4

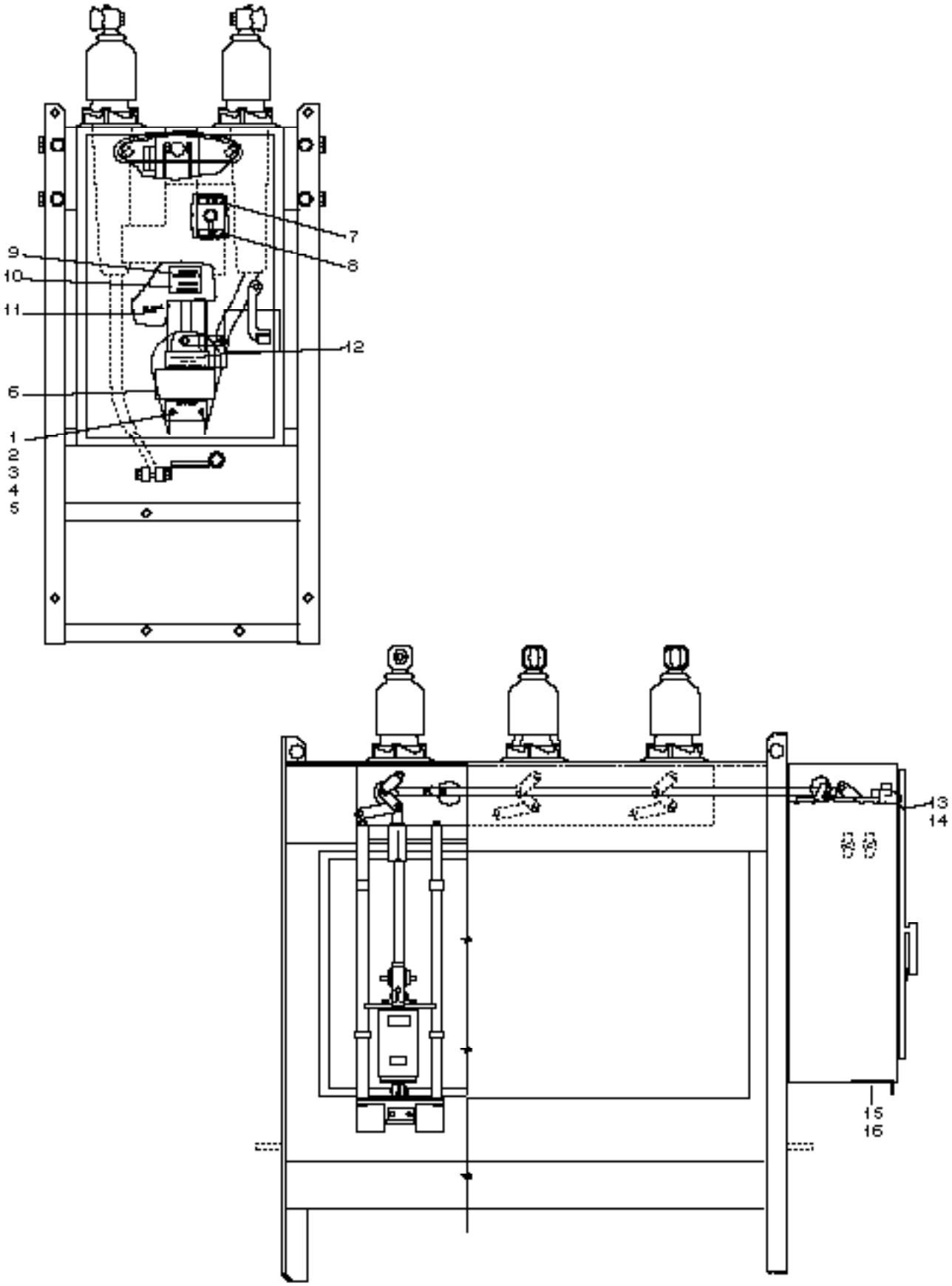


Figure 28.
Decals and Labels.

Decals and Labels (Figure 28)

Item No.	Description	Catalog Number	Qty. per Assy.
1	Nameplate, 12KA	KP1428VS	1
	Nameplate, 16KA	KP1289VS	1
	Nameplate, 20KA	KP1430VS	1
2	Machine screw, rd hd, #6-32 x 3/8, brass	K721325106037A	2
3	Washer	KP2090A39	2
4	Flatwasher, #6, st stl	K900215006000A	2
5	Stop nut, elastic	KP2020A6	2
6	Decal	KP1373ME	1
7	Decal	KP1071VS-2	1

Item No.	Description	Catalog Number	Qty. per Assy.
8	Decal	KP1071VS-1	1
9	Decal	KP1209VSM	1
10	Decal	KP1208VSM	1
11	Decal	KP1210VSM	1
12	Label	KRW441V1	1
13	Decal	KP1164M	1
14	Decal	KP1165M	1
15	Manual trip plate	KP1242VSM	1
16	Self tapping screw, rd hd 1/4 x 3/16, st stl	K801715004018A	2

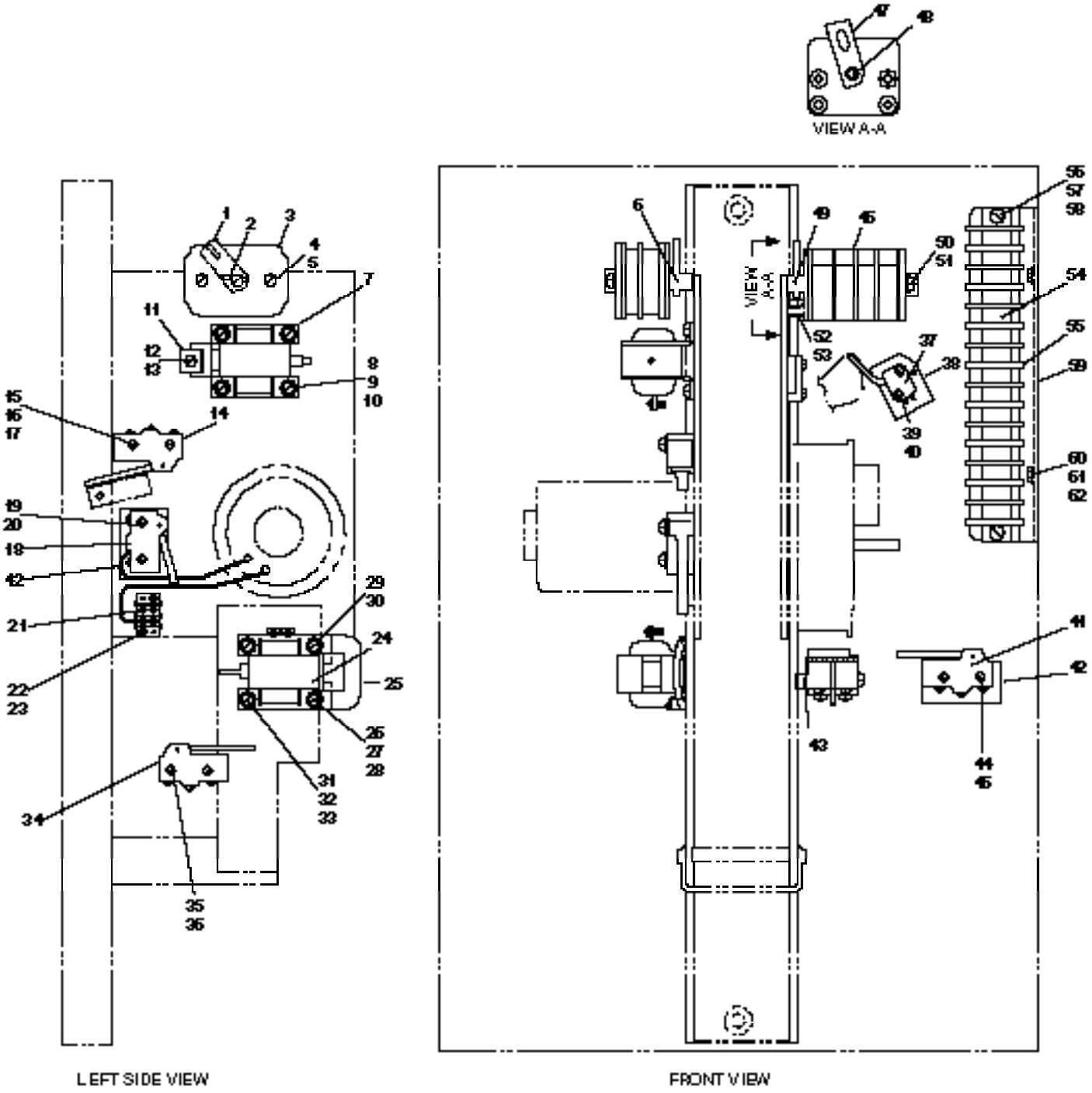


Figure 29.
Operating Mechanism Electrical Parts.

Operating Mechanism Electrical Parts (Figure 29)

Item No.	Description	Catalog Number	Qty. per Assy.
1	Lever	KP1029VS	1
2	Roll pin, 3/32 x 3/4, stl	K970801043075M	1
3	Switch, 2 DPST 152/a1 152/a2	KA612R24	1
4	Machine screw, rd hd, #10-24 x 2-3/4, stl	K721501110275Z	2
5	Split lockwasher, med, #10, stl	K900801010000Z	2
6	Spacer	KP3009A167	2
7	Trip solenoid 152/TC	KA1055M1	1
8	Machine screw, rd hd, #10-24 x 5/16, stl	K721501110031Z	4
9	Split lockwasher, med, #10, stl	K900801010000Z	4
10	Plain washer, #10, brass	K900525020043A	4
11	Solenoid stop	KP1092CE	1
12	Machine screw, rd hd, #10-24 x 5/16, stl	K721501110031Z	1
13	Split lockwasher, med, #10, stl	K900801010000Z	1
14	Closing circuit switch 152/bb1	KP2181A8	1
15	Spacer	KP3006A56	2
16	Machine screw, rd hd, #6-32 x 1, stl	K721501106100Z	2
17	Split lockwasher, med, #6, stl	K900801006000Z	2
18	Motor circuit switch 152/aa1	KA1230VS	1
19	Machine screw, rd hd, #6-32 x 7/8, stl	K721501106087Z	2
20	Split lockwasher, med, #6, stl	K900801006000Z	2
21	Terminal strip	KP2101A1	1
22	Machine screw, rd hd, #6-32 x 1/2, stl	K721501106050Z	2
23	Split lockwasher, med, #6, stl	K900801006000Z	2
24	Closing solenoid 152/CC	KA169VSM1	1
25	Solenoid stop	KP1163VSM	1
26	Machine screw, rd hd, #10-24 x 3/4, stl	K721501110075Z	1
27	Split lockwasher, med, #10, stl	K900801010000Z	1
28	Spacer	KP3006A1	1
29	Machine screw, rd hd, #10-24 x 3/8, stl	K721501110037Z	2
30	Split lockwasher, med, #10, stl	K900801010000Z	2
31	Machine screw rd hd, #10-24 x 5/16, stl	K721501110031Z	2
32	Split lockwasher, med, #10, stl	K900810010000Z	2
33	Plain washer, #10, brass	K900525020043Z	2
34	Manual close switch 152/MCS	KA2181A8	1
35	Machine screw, rd hd, #6-32 x 7/8, stl	K721501106087Z	2
36	Split lockwasher, med, #6, stl	K900801006000Z	2
37	Manual limit switch 152/LS1	KA201CE	1
38	Insulating barrier	KP1244VSM	1
39	Machine screw, rd hd, #4-40 x 1/2, stl	K721501104050Z	2
40	Split lockwasher, med, #4, stl	K900801004000Z	2
41	Spring position switch 152/SP1 152/SP2	KP2181A8	2
42	Insulating barrier	KNC1070S	1
43	Spacer	KP3007A32	2
44	Machine screw, rd hd, #6-32 x 2, stl	K721201106200Z	2
45	Split lockwasher, med, #6, stl	K900801006000Z	2
46	Auxiliary switch, 4 NO - 4 NC	KA612R44	1
47	Lever	KVS01036V1	1
48	Roll pin, 3/32 x 3/4, stl	K970801093075M	1
49	Spacer	KP3009A90	2
50	Machine screw, rd hd, #10-24 x 3-3/4, stl	K721501110375Z	2
51	Split lockwasher, med, #10, stl	K900801010000Z	2
52	Spacer	KP1020VS	2
53	Machine screw, flt hd, #10-24 x 7/8, stl	K721601110082Z	2
54	Terminal strip	KP2101A18	1
55	Marker strip	KP2101A218	1
56	Machine screw, rd hd, #10-24 x 5/8, stl	K721501110062Z	2
57	Split lockwasher, med, #10, stl	K900801010000Z	2
58	Hex nut, #10-24, stl	K881001124010Z	2
59	Bracket	KP1099VSM	1
60	Hex nut, #8-32, stl	K881001132008Z	2
61	Split lockwasher, med, #8, stl	K900801008000Z	2
62	Plain washer, #8, stl	K900201008000Z	2

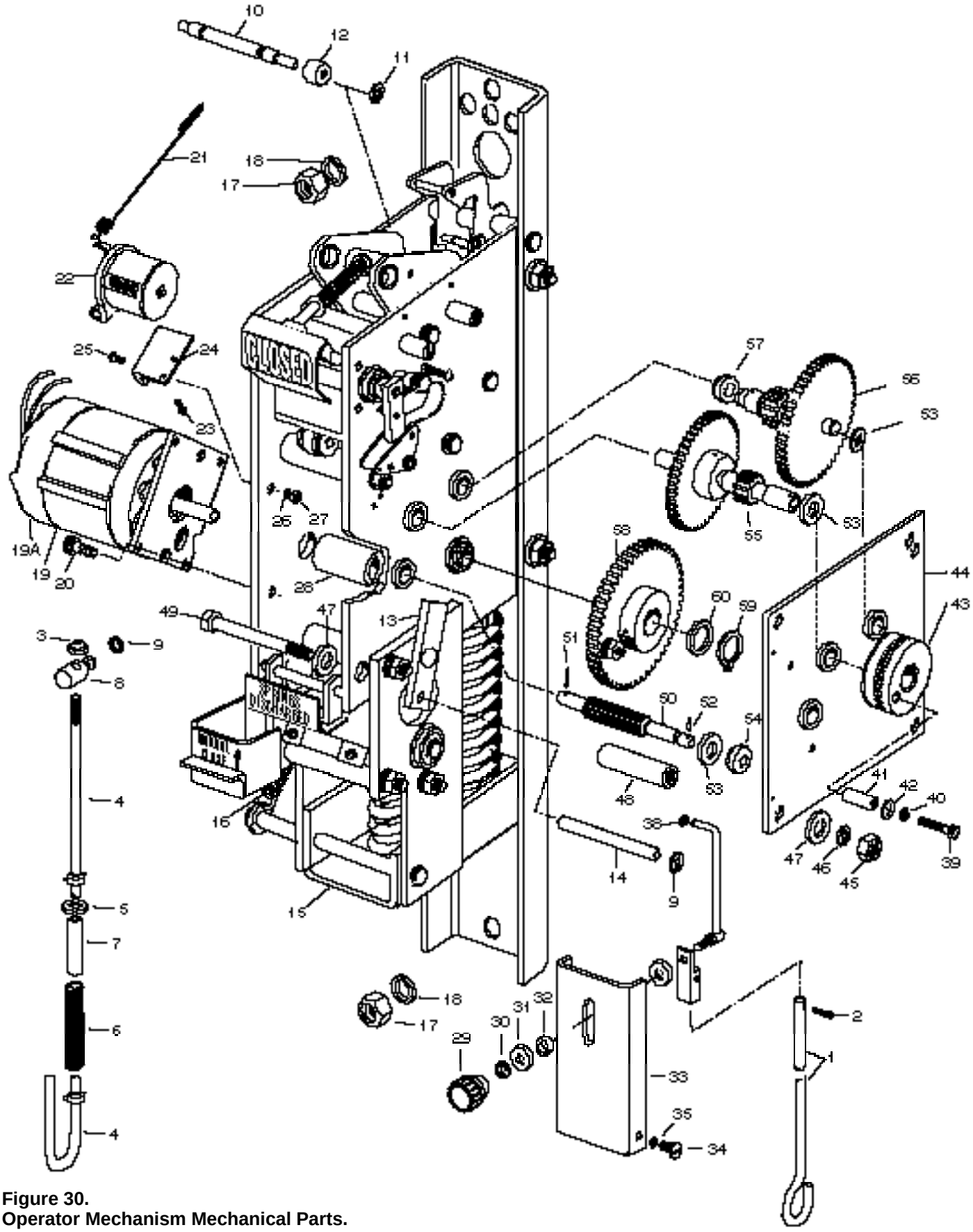


Figure 30.
Operator Mechanism Mechanical Parts.

Operator Mechanism Mechanical Parts (Figure 30)

Item No.	Description	Catalog Number	Qty. per Assy.
1	External trip pullring	KP1240VSM2	1
2	Cotter pin, 1/16 x 1, brass	K970525062100A	1
3	Elastic stop nut, #10-24	KP2020A13	1
4	External quick-close pull hook	KA186VSM3	1
5	Plain washer, special	KP2028A53	1
6	Spring	KP157VR	1
7	Spacer	KP3007A18	1
8	Operating link	KP724D	1
9	Retaining ring, Type C, 1/4, stl, (WA514)	K970901250000M	3
10	Pin	KP1205VSM	1
11	Retaining ring, Type C, 3/8, stl, (WA518)	K970901375000M	1
12	Spacer	KP3011A54	2
13	Lever	KP1187VSM	1
14	Pin	KP1188VSM	1
15	Closing spring assembly	KA107VSM2	1
16	Toggle Spring	KP40GS	1
17	Hex nut, 1/2-13, stl	K881001113050Q	1
18	Split lockwasher, med, 1/2, st stl	K900815050000A	1
19	Motor and adapter plate assy, 240-Vac	KA248VSM	1
l9A	Brush replacement kit (consists of 2 brushes and 2 brush caps)		
	For 240-Vac motor	KA1294VSM900S	1
	For 120-Vac motor	KA210VSM900S	1
20	Machine screw. skt hd, 1/4-20 x 3/8 stl	KP2036A29	4
21	Counter spring	KP1191VSM	1
22	Counter assembly	KA28CO9	1
23	Self-tapping screw Type F, #6-32 x 3/8, st stl	K751515106037A	1
24	Counter bracket	KPll90VSM	1
25	Machine screw, rd hd, #6-32 x 2-1/2, stl	K721501106050Z	2
26	Split lockwasher, med, #6, stl	K900801006000Z	2
27	Hex nut, #6-32, stl	K881001132006Z	2
28	Coupling	KP1278VSM	1
29	Reset knob	KP2069A6	1
30	Split lockwasher, 1/4, stl	K900801025000Z	1
31	Plain washer, #14, brass	K900525026056A	2
32	Spacer	KP3007A75	1
33	Front plate	KP1165VSM	1
34	Machine screw, rd hd, #6-32 x 5/16, stl	K721501106031Z	4
35	Split lockwasher, med, #6, stl	K900801006000Z	4
36	Pull link	KP1241VSM	1
37	Rod and pin assembly	KA143VSM	1
38	Retaining ring, Type E, 1/4, stl	K971001125000Z	1
39	Machine screw, hex hd, #10-24 x 1, stl	K722401110100Z	1
40	Split lockwasher, med, #10, stl	K900801010000Z	1
41	Spacer	KP3005A9	1
42	Plain washer, #10, brass	K900525020043A	1
43	Clutch assembly	KA185VSM	1
44	Plate assembly	KA119VS1	1
45	Hex nut, 1/4-20, stl	K880201120025Q	4
46	Split lockwasher, med, 1/4, stl	K900801025000Z	4
47	Plain washer, 1/4, stl	K900201025000Z	8
48	Spacer	KP3105A29	4
49	Cap screw, hex hd, 1/4-20 x 3, stl	K730101125300Q	4
50	Pinion	KP1059VS	1
51	Roll pin, 0.156 x 3/4, stl	K970801156075C	1
52	Roll pin, 0.125 x 1/2, stl	K970801125050C	1
53	Plain washer	KP2028A67	3
54	Spacer	KP3010A14	1
55	Gear assembly, 1st intermediate	KA165VSM	1
56	Gear assembly, 2nd intermediate	KA166VSM	1
57	Spacer	KP3011A112	1
58	Gear assembly, main	KA164VSM	1
59	Retaining ring	KP2013A32	1
60	Washer	KP2028A17	1

COOPER POWER SYSTEMS

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