Sectionalizers

COOPER Power Systems

Type GWC Maintenance Instructions

Service Information

S270-21-2

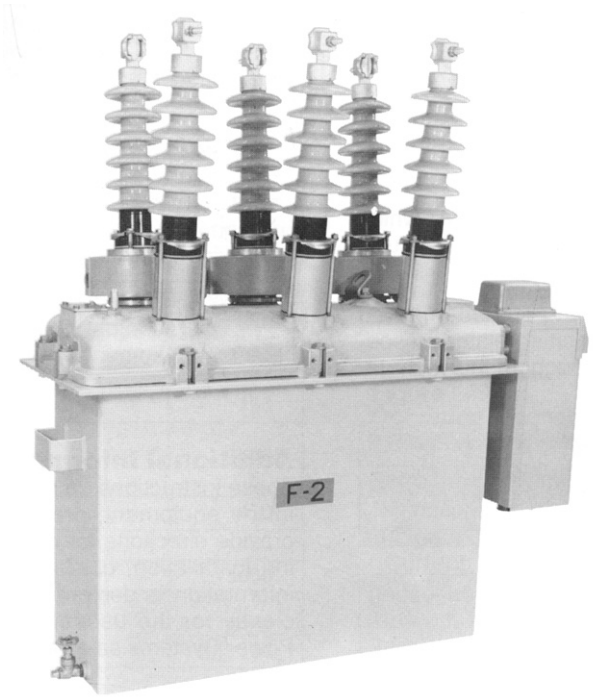

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Figure 1.
Type GWC sectionalizer.

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SAFETY FOR LIFE

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

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

SAFETY INFORMATION

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

A competent technician has these qualifications:

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

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

Hazard Statement Definitions

This manual may contain four types of hazard statements:

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

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

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

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

Safety Instructions

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

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

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

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

WARNING: Power distribution 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 equipment can result in death, severe personal injury, and equipment damage. G122.2

INTRODUCTION

Service Information S270-21-2 covers maintenance instructions for the Kyle Type GWC electronically controlled three-phase sectionalizer. It covers—in separate sections—a general description of the unit, a detailed description of operation (both electronic and mechanical), instructions for periodic inspection and maintenance, testing and troubleshooting, and shop repairs. In addition, service parts lists keyed to exploded-view drawings of the various sectionalizer parts groups are included in the back of this manual.

GENERAL

The sectionalizer is a self-contained, circuit-opening device used in conjunction with source-side protective devices, such as reclosers or reclosing circuit-breakers, to automatically isolate faulted sections of electrical distribution systems. The sectionalizer senses current flow above a preset level, and when the source-side protective device opens to de-energize the circuit, the sectionalizer counts the overcurrent interruption. Depending upon the coordination scheme, the sectionalizer will open during the first, second, or third open interval of the fault interrupting device to isolate permanent faults and confine outages to smaller sections of line.

The sectionalizer does not interrupt fault current but can be closed into a faulted line. It opens during the open interval of the backup device. For this reason, it must always be used in series with a fault-interrupting, backup protective reclosing device. Also, it will forget counts that do not reach the counts-to-open setting within the selected reset time due to clearing of temporary faults.

When properly applied, the sectionalizer will respond to downline fault currents that are interrupted by its backup device. However, as with any other protective device, system conditions may produce unexpected and unwanted sectionalizer operation. Overcurrents interrupted by a downline device is one cause for these occurrences, inrush current is another. Count restraint and inrush current restraint features are built into the sectionalizer control to block the sectionalizer's response to these system conditions.

A minimum of one-half amp of load current flowing through any phase of the sectionalizer will block the generation of a count pulse. This "count-restraint" feature prevents the sectionalizer from counting overcurrents interrupted by downline devices.

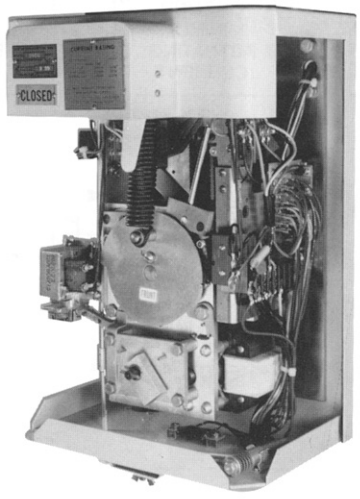

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Figure 2.
Operating mechanism assembly.

The sectionalizers are also equipped with an inrush-current restraint feature which distinguishes between inrush currents and fault currents. If it is determined that the overcurrent through the sectionalizer is inrush current, the phase actuating current level of the sectionalizer is raised by a multiple (X) for a time (Y) after circuit energization. At the same time, ground overcurrent protection is blocked entirely for a time (Z).

RATINGS

Operating Data

Phase-minimum-actuating current (amps)	16, 24, 40, 56, 80, 112, 160, 224, 256, 296, 320, 448, 640
Ground-minimum-actuating current (amps)	3.5, 7, 16, 20, 28, 40, 56, 80, 112, 160, 224, 320, BLOCK
Number of counts to open	1, 2, 3
Count reset (seconds)	15, 30, 60, 90, 120, 180
Phase actuating level multiplier (inrush restraint)	X1, X2, X4, X6, X8, BLOCK
Phase inrush reset (cycles)	5, 10, 15, 20
Ground inrush reset (seconds)	0.3, 0.7, 1.5, 3.0, 5.0

Basic Sectionalizer Ratings

Nominal voltage (kv)	34.5
Rated maximum voltage (kv)	38
Impulse withstand 1.2 x 50 microsecond wave (BIL) (kv)	150
60 hertz withstand Dry, 1 minute (kv) Wet, 10 seconds (kv)	 70 60
Continuous current rating (amps)	400
Rated symmetrical interrupting current (amps rms)	880
Rated making current, asymmetrical (amps rms)	15000
Short-time ratings (amps rms) 10-seconds symmetrical 1-second symmetrical	 3500 10000
Momentary maximum, asymmetrical (amps rms)	15000
Creepage distance, standard bushing (in)	26

DESCRIPTION OF OPERATION

The sectionalizer consists of three sets of oil-insulated contacts linked with bellcranks to a common shaft which is connected to the mechanism housed in the operator cabinet. Opening is initiated by a 24-Vdc trip mechanism operated by the electronic control. Actual opening energy is provided by springs which are charged when the sectionalizer is electrically or manually closed. Closed and open positions are indicated by a yellow pointer-like flag; contact opening operations are registered on a three-digit counter; both are located under the sleet hood of the operator cabinet.

The sectionalizer can be manually closed by cranking the hand-operated crankshaft (see Figure 2) until the mechanism stops (approximately 42 crank revolutions), and then pushing the closing solenoid plunger up into the solenoid. The sectionalizer can be manually opened by operating the yellow pullring.

Electronic Control Circuit

A functional block diagram of the electronic circuitry is shown in Figure 3.

Current flowing through the sectionalizer is sensed by the bushing-current transformers. Three transformers, connected in a wye (star) configuration, sense phase currents. Another three bushing current transformers, connected in parallel, sense the ground (earth) or zero-sequence current. These sig-

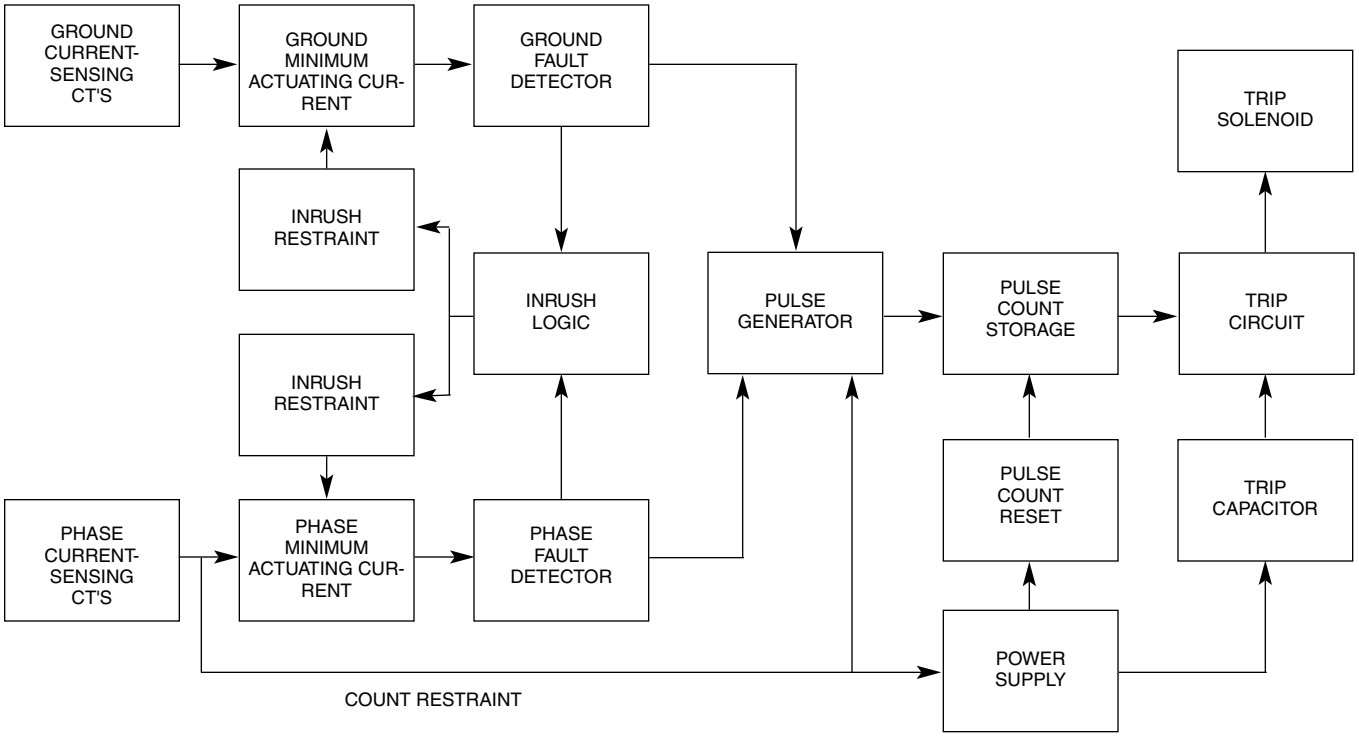

Figure 3.
Functional block diagram for sectionalizers.

nals are rectified and are adjusted to the desired minimum-actuating-current level by selection of appropriate plug-in resistors.

To generate and register a count pulse, a current above the preset-minimum-actuating level must be flowing through the sectionalizer (downline fault) and this overcurrent must drop to zero (fault interrupted by the backup protective device). The pulse counter provides storage for up to three pulses. Depending upon the counts-to-open setting, the tripping circuit will turn on after one, two, or three count pulses have been registered. When turned on, the tripping circuit connects the control battery to a 24-Vdc trip solenoid which, in turn, trips the sectionalizer mechanism to open the sectionalizer contacts. The opening operation closes a contact connecting the motor to its 120-Vac supply. Through a gear-and-lever mechanism, the motor extends both the trip and closing springs.

The pulse count reset will erase any stored pulse counts whenever load current through the sectionalizer flows, without interruption, for longer than the programmed reset time.

A count-restraint feature is built into the control of Type GWC sectionalizer to prevent the sectionalizer from counting fault currents interrupted by downline protective device. The current restraint will block the generation of a count pulse as long as at least 5 amps of load current is flowing through the sectionalizer, after the disappearance of fault current.

The control is also equipped with an inrush-current restraint feature which distinguishes between inrush current and fault current by a logic circuit, functionally diagrammed in Figure 4.

If an overcurrent is present through the sectionalizer when the backup protective device opens (current is interrupted), the overcurrent present upon reclosing is assumed to be fault current and the sectionalizer control operates in the normal manner as previously described. If, however, there is no overcurrent detected by the sectionalizer when the current is interrupted, the overcurrent present upon reclosing is assumed to be inrush current. To prevent the sectionalizer from counting this inrush current, the fault level detector circuit is modified to raise the phase actuating level by a multiple of 2X, 4X, 6X, or 8X the normal setting (or current detection, can be blocked entirely) for a time (Y) of 5, 10, 15, or 20 cycles (60-Hz base) after current flow through the sectionalizer is restored. Upon expiration of this time, the sectionalizer control returns to its normal operating settings. At the same time, ground overcurrent detection is blocked entirely for a period (Z) of 0.3, 0.7, 1.5, 3, or 5 seconds after current flow through the sectionalizer is restored.

On multiground wye systems, conditions can exist where the entire transient inrush of a particular phase could flow in the neutral. Typical settings for ground fault sensing on these systems is one-half or less of phase fault sensing. This could result in values at least double those necessary for phase magnitude and duration (X and Y). With the improved ground inrush logic, ground sensing is simply blocked for the duration of time (Z) selected.

Actuator Mechanism Operation

All three sets of moving contacts are linked to a common shaft. However; to describe the mechanical operation of the GWC sectionalizer, a single set of contacts connected to a simplified straight-line motion linkage is shown diagrammatically in Figures 5 through 7.

With the contacts closed, Figure 5, the opening spring is held extended by the latched toggle mechanism. The trip signal, from the electronic control, actuates the trip solenoid — which acts upon the trip lever to break the toggle latch. This action collapses the toggle, and allows the opening springs to open the contacts (Figure 6). At the same time, the closing motor is energized; the closing motor rotates the crank arm, extending the toggle, opening spring and closing springs, until the toggle latches. The closing mechanism is latched in the pre-loaded position by the closing solenoid (Figure 7). When the closing circuit is energized the closing solenoid releases the over toggle mechanism to close the sectionalizer and return the mechanism to the status shown in Figure 5.

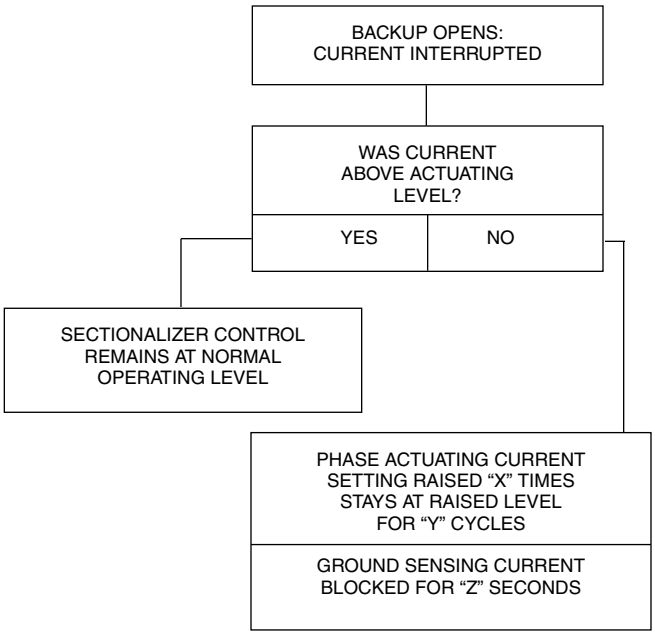

Figure 4.
Logic diagram for inrush-current restraint feature (both phase and ground currents).

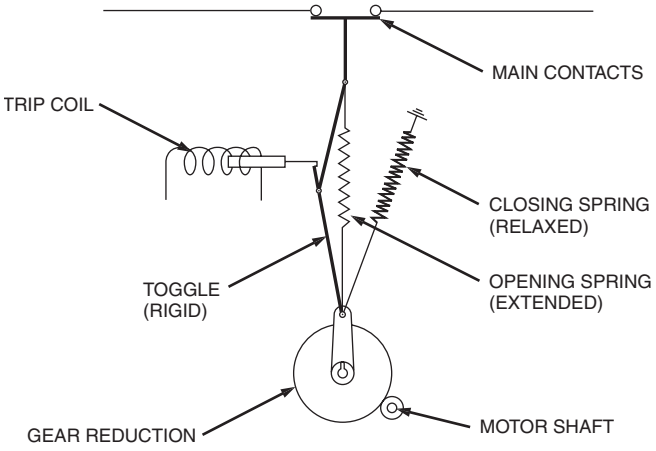

Figure 5.
Schematic diagram of mechanism with contacts closed.

The contacts can be tripped open manually by pulling the pullring, located underneath the operator mechanism housing. The manual trip pullring acts on the trip lever to break the latch and collapse the toggle.

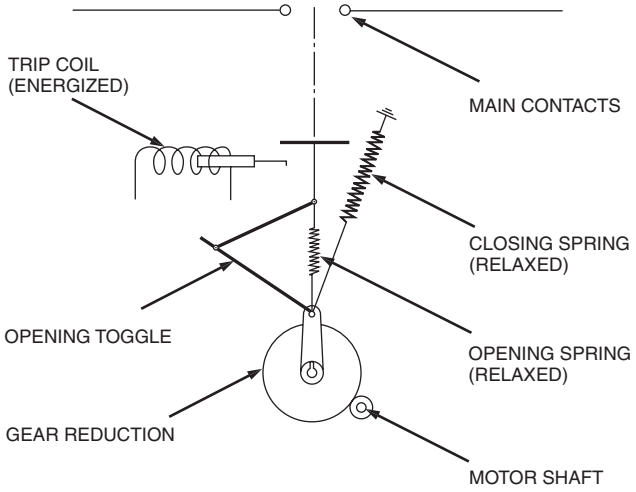

Figure 6.
Schematic diagram of trip operation.

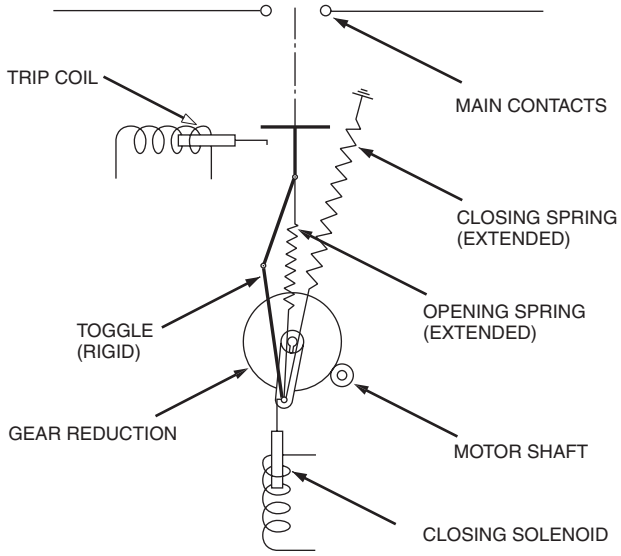

Figure 7.
Schematic diagram of closing operation.

MAINTENANCE

Frequency of Maintenance

Because sectionalizers are applied under widely varying operating and climactic conditions, maintenance intervals are best determined by the user based on actual operating experience. However, to assure proper operation sectionalizers must be routinely maintained; sectionalizers should be externally inspected, the oil level should be checked and the dielectric strength of the oil should be measured on a yearly basis. (See steps 1, 2, 8 and 10 of "Periodic Inspection and Maintenance" below.) Each periodic check should include at least the following steps:

WARNING: Continuous use of a sectionalizer, without regular routine inspection and repair, can effect reliability. This could lead to equipment failure and possible personal injury.

1. Bypass and remove the sectionalizer from service.
2. Inspect external components.
   A. Check for broken or cracked bushings, paint scratches, and other mechanical damage.
   B. Note the counter reading and enter the reading in the record log.
   C. Close and trip the sectionalizer manually several times to check the manual operators. Leave the sectionalizer in the tripped position.
3. Loosen the bolts that secure the head casting and remove the mechanism from the tank. (If tank and head do not separate readily, break the gasket seal by prying them apart.). Allow oil to drain off mechanism.
4. Inspect contacts for erosion. Refer to Contact Inspection procedure, within this manual, for inspection instructions.
   A. Slight pitting and discoloration can be dressed with crocus cloth.
   B. Replace moving and stationary contacts if they are severely eroded.
5. Clean all internal components.
   A. Remove all carbon traces by wiping with a clean, lint-free cloth.
   B. Flush the internal mechanism with clean, dry transformer oil.

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

6. Replace head gasket. Use Pliobond to retain new gasket.
7. Inspect tank liners. Soft or spongy areas indicate that water has been absorbed. Replace liners if this condition exists.
8. Check the dielectric strength of the insulating oil.
   A. The dielectric strength should not be less than 22 kv.
   B. Low dielectric strength usually indicates the presence of water. There are gasket seals between each bushing and the head. Check the seals carefully for deterioration or entrance of moisture.
   NOTE: The unit employs a vented oil-level gage and filler plug Make sure vent is free and clear to allow unit to breathe with changes in atmospheric conditions Normal breathing will prevent a seal from breaking which can instigate a path for moisture to enter the tank.
9. Inspect circuit components attached to the sectionalizer head and operating mechanism.
   A. Check condition of wiring to terminal strips, make sure all connections are tight.
   B. Check condition of bushing current transformers and associated wiring.
   C. Check condition of microswitches and wiring.
10. If oil must be replaced.
   A. Drain tank and clean out all sludge and carbon deposits.
   B. Fill tank with clean insulating oil to 7/8 in. from top of tank, with mechanism removed. Capacity is approximately 42 gallons. See Oil Condition following.
11. Replace mechanism into tank. Install head bolts and tighten evenly to 35-55 ft-lbs torque.
12. Manually close and trip the unit several times to check for proper operation of the mechanism.
13. Perform an insulation withstand test (see page *** for procedure).

Battery Maintenance

BATTERY SPECIFICATIONS

- Nickel-cadmium.
- 24-volts (20 cells in series).
- 1.3 Ampere hour capacity (10 hour rate).
- Charging rate: 50-mA maximum.
- Weight: 41.5 oz.
- Length: 10”.
- Width: 2”.
- Height: 2”.

MAINTAINING BATTERY CHARGE

For storage at temperatures under 70-degrees, the battery will maintain adequate charge for operation up to 1 month without trickle charging. However, extremely high ambient storage temperatures can result in a battery shelf-life of as little as one month. Thus we recommend that a control battery in storage not be left off charge for a period of more than 1 month.
Two convenient methods exist for applying a trickle charge to the control battery.

1. Connect the battery to the sectionalizer control and energize the potential charger.

WARNING: High voltage. The COMMON AC GND terminal is connected to the control cabinet; if the incoming 120 Vac supply is inadvertently connected to the common terminal the control cabinet will be at 120 Vac potential. Contact with high voltage will cause severe personal injury or death.

2. A battery charger accessory (KA1142ME3 120 Vac) is available for maintaining one ME control battery.

   The KA1142ME3 battery charger provides two charging rates, 15 mA and 50 mA. The 15 mA charging rate is used to maintain a battery at full charge. The 50 mA rate is used to charge a discharged battery. A battery must be charged at the 50-mA rate for 48 hours.
   NOTE: A fully discharged battery can be brought to full charge in about 7-days with the control’s potential charger, if the battery is good. The KA1142ME3 battery charger, at the 50-mA charge level, will recharge a battery in about 48 hours.

FIELD TESTING BATTERY

To check the condition of a battery, a field test can easily be made. To positively insure proper control operation, this test is conservative; failure to pass does not necessarily mean the battery needs replacement. But a more thorough test can then be performed—normally in a repair or maintenance shop.
To field test:

1. From the battery test terminals on the control front panel measure the battery voltage (see Figure 8) . If battery voltage is below 24-volts, the battery is either low on charge or is faulty. The battery should be removed for recharging and retested before returning to service.
2. If battery voltage is above 24-volts, a power delivery check should be made. To load the battery, a 10 ohm resistor is built into the sectionalizer control. To test the battery—while

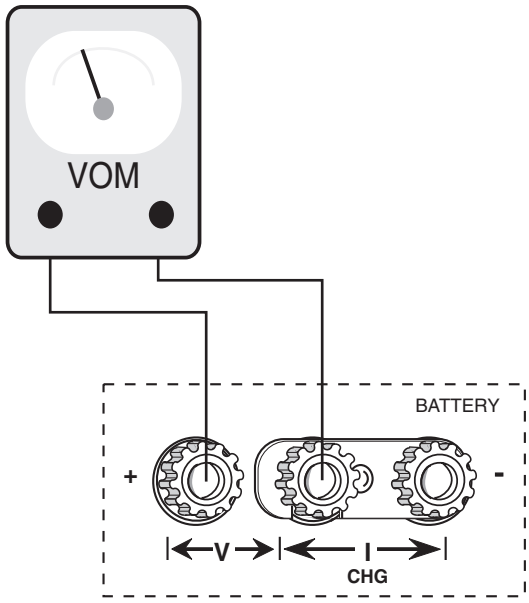

Figure 8.
Battery test terminals.

measuring battery voltage press the BATTERY LOAD TEST button, for approximately 2-3 seconds. The battery voltage should drop by no more than 3-volts from the unloaded voltage, for ambient temperatures above 20 degrees F.

3. If the temperature is below 20-degrees F, the voltage should be approximately that shown by the lower curve in Figure 9. If the voltage is lower than this, the battery should be removed for shop testing.

SHOP TESTING BATTERY

Before testing, the top and bottom covers of the battery should be removed. Then the following tests can be made.

1. Check for leaking cells. These are detectable by the presence of a white powdery deposit of electrolyte.
2. Measure voltage across each cell. Any cell measuring 0.0 volts is cause for immediate rejection of the entire battery.
3. If all cells have at least 0.1 volts or more, charge the battery using the KA1142ME battery charger. All cells should have at least 1.0 Vdc within 5 minutes. Any battery failing this test should be rejected.
4. Charge the battery for 48 hours with the KA1142ME battery charger.
5. Place a 10-ohm load (a KA638ME1S voltmeter has this built in) across the battery for approximately 2-3 seconds. The voltage must not drop more than 3-volts below the open circuit voltage for temperatures above 20 degrees F.
6. Make a capacity check. Discharge the battery through a 100 ohm, 12-watt resistor for 3-hours. At the end of this period and while under load, check the individual cell voltages. No cell should read less than 1.1-volts.
7. Remove the 100 ohm resistor. Recheck the open-circuit voltage on each cell after 7-days. All cells should measure very close to the same voltage level. Do not recharge the battery prior to this test.

If the battery passes the above test, it is in satisfactory condition; replace the battery covers, recharge (48-hours using the KA1142ME battery charger) and return to service.

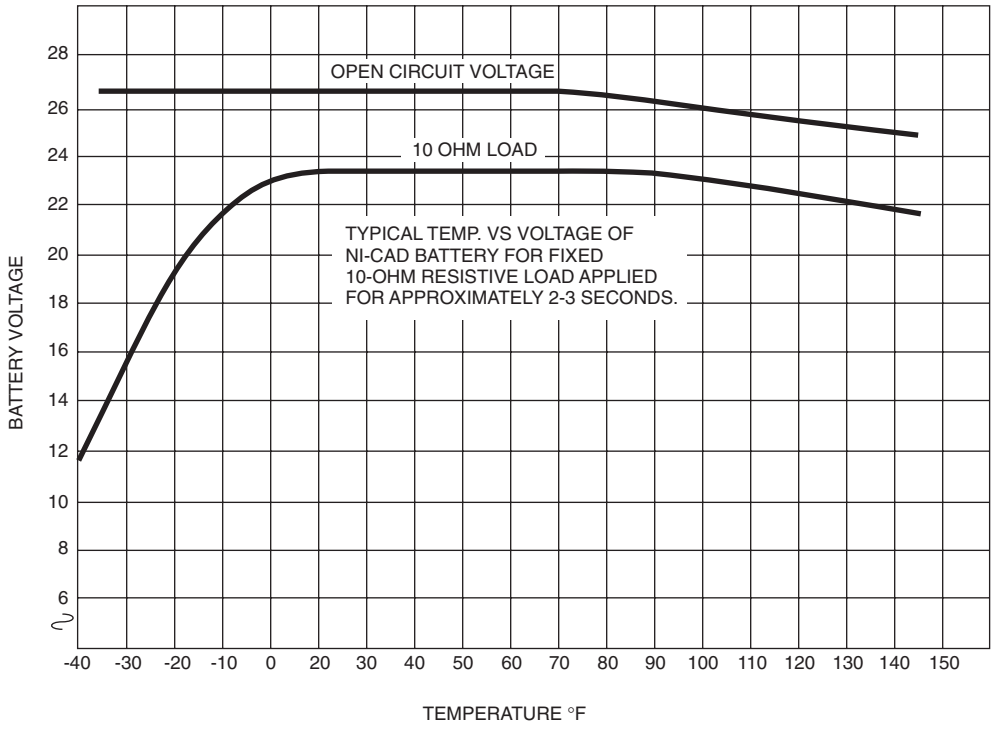

Figure 9.
Typical voltage versus temperature characteristics of nickel-cadmium battery.

Oil Condition

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

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

Used oil must be treated before reusing. Filtering may remove absorbed and free water and other contaminants to raise the dielectric strength to acceptable levels. However, filtering does not always remove water-absorbing contaminants and the dielectric strength may fall rapidly after being returned to service. Therefore the sectionalizer should be filled with new oil, or oil that has been restored to like-new condition. Oil supplied in sectionalizers conforms to ASTM Standard D3487, Type I; its property limits are shown in Reference Data R280-90-1, "Oil Specifications and Tests."

Insulation Level Withstand Tests

High-potential withstand tests provide information on the dielectric condition of the sectionalizer. Testing is performed at 52.5 kv (75% of the rated low-frequency withstand voltage).

TEST 1: Proceed as follows:

1. Manually close main contacts.
2. Ground sectionalizer tank and head.
3. Connect all three source-side bushings (1, 3,5) together.
4. Apply proper test voltage to source-side bushings.
5. The sectionalizer should withstand the test voltage for 60 seconds.

TEST 2: Proceed as follows:

1. Manually close main contacts.
2. Ground sectionalizer tank and head.
3. Ground Phase A (bushing 2) and Phase C (bushing 6).
4. Apply proper test voltage to Phase B (bushing 3).

TEST 3. Proceed as follows:

1. Open main contacts of sectionalizer.
2. Ground sectionalizer tank and head.
3. Connect and ground all three load-side bushings (2,4,6).
4. Connect all three source-side bushings (1, 3,5).
5. Apply proper test voltage to source-side bushings.
6. The sectionalizer should withstand the test voltage for 60 seconds.
7. Reverse the connections: ground source-side bushings (1,3, 5); apply test voltage to load-side bushings (2,4,6) for 60 seconds.
8. The sectionalizer should withstand the test voltage for 60 seconds.

TEST RESULTS: These high potential withstand tests provide information on the dielectric condition of the sectionalizer and the integrity of the contacts.

1. If the sectionalizer passes the closed-contacts tests (Tests 1 and 2) but fails the open-contacts test (Test 3) a deterioration of one or more of the contact assemblies is likely to be the cause. Check each contact assembly individually to determine the failed phase or phases, and replace. Retest to confirm repair.
2. If the sectionalizer fails the closed-contacts tests (Test 1 and 2) the cause is likely to be a diminished electrical clearance, low oil dielectric strength or failed insulation. After correcting the problem, retest to confirm repair.

OPERATING INSTRUCTIONS

Electrical Operation

The sectionalizer may be opened and closed electrically by applying rated ac operating voltage to the sectionalizer control. See nameplate for rated operating voltage.

TO CLOSE sectionalizer —Move the manual control switch to the OPEN position.

TO OPEN sectionalizer —Move the manual control switch to the CLOSE position.

Manual Operation

TO CLOSE sectionalizer —A crank is provided in the bottom of the actuator cabinet for closing the sectionalizer manually. Apply crank to shaft on the front of the mechanism (Figure 10) and turn crank clockwise until the closing spring drive crank hits its mechanical stop (approximately 42 turns). Then mechanically operate the close solenoid to release the spring and close the sectionalizer .

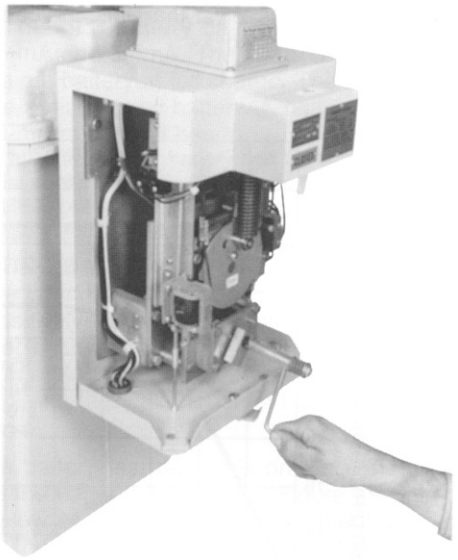

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Figure 10.
Manually closing sectionalizer.

TO OPEN sectionalizer —Pull down on the pullring, located underneath the actuator cabinet, to mechanically operate the trip solenoid.

TEST PROCEDURES AND TROUBLESHOOTING

The following test procedures are recommended to check the operating condition and to determine possible trouble areas in a malfunctioning unit:

Test Circuit and Equipment

A suggested test circuit is shown in Figure 11. In this test setup, the test current is obtained by back-feeding a 600:5 amp current transformer (located in the primary loop of one phase of the sectionalizer) from an adjustable 120 Vac source. The ammeter scales should be selected to accommodate the appropriate range of test currents. Energize the sectionalizer charging motor and closing coil with 120 Vac at terminals 2 and 3 on the sectionalizer terminal strip (TB2). Install a fully charged battery into the sectionalizer control, and connect the control/sectionalizer interconnection cable.

IMPORTANT: Before performing any of the test procedures that follow, make sure the 120 Vac power to the control is disconnected to disable the voltage restraint feature. The sectionalizer will not count as long as the voltage restraint feature (part of the voltage charging board) is energized.

Test Procedures

MINIMUM ACTUATING CURRENT

The minimum actuating current can be verified by testing at the ± ten percent values of the phase and ground actuating current ratings. For example, the minimum actuating resistor rated at 80 amps is tested at 72 amps (no-count) and 88 amps (count registered) .

Phase Minimum Actuating Current

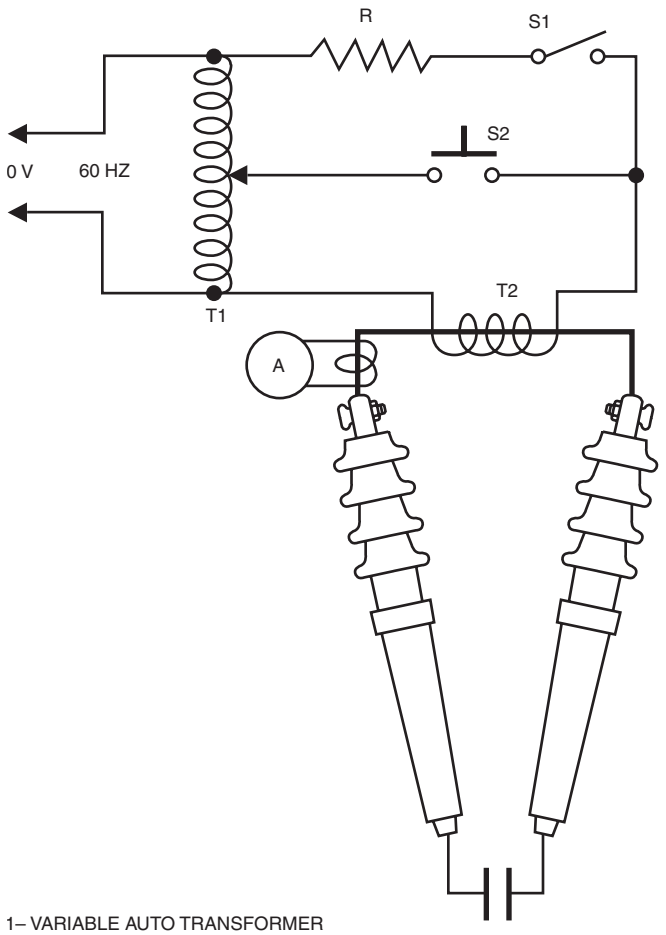
When checking the phase minimum actuating current, the ground fault sensing portion of the sectionalizer must be disabled. Testing an individual phase without disabling the ground sensing circuits will cause a false count. The following procedure can be used:

1. Jumper the ground actuating current resistor with a short lead to disable the ground sensing circuit.
2. Program sectionalizer for one count-to-open by setting the COUNTS TO OPEN SELECTOR switch to “1”.
3. Close sectionalizer by moving the manual control switch, on the sectionalizer control panel, to “CLOSE.”
4. With the test circuit connected to phase A of the sectionalizer and S1 open, hold S2 closed and slowly raise the test current from zero to the appropriate value shown in Column A of Table 1.
5. Release S2 to simulate a backup opening. The sectionalizer should not open.
6. Close S2 and adjust the test current to the appropriate value shown in Column B of Table 1.
7. Release S2 to simulate a backup opening. The sectionalizer should count the overcurrent interruption and open.
8. Repeat steps 3 through 7 for phases B and C.
9. Remove the jumper from across the ground actuating current resistor upon completion of this portion of the test.

Ground Minimum Actuating Current

To prevent the possibility of a false count, the phase sensing portion of the sectionalizer control circuit should be disabled when the ground minimum actuating current is being checked. The following procedure can be used:

1. Jumper the phase actuating current resistor with a short lead to disable the phase sensing circuit.
2. Check that sectionalizer control is set for one count-to-open.



1– VARIABLE AUTO TRANSFORMER
2– 600:5 CURRENT TRANSFORMER
1– SPST TOGGLE SWITCH
2– SPST PUSHBUTTON SWITCH
1– DROPPING RESISTOR, 2K-10 WATT
– AMMETER

Figure 11.
Test circuit schematic.

3. Close sectionalizer by moving the manual control switch, on the sectionalizer control panel, to “CLOSE.”
4. With the test circuit connected to phase A of the sectionalizer and S1 open, hold S2 closed and slowly raise the test current from zero to the appropriate value shown in Column A of Table 1.
5. Release S2 to simulate a backup opening The sectionalizer should not open.
6. Close S2 and adjust the test current to the appropriate value shown in Column B of Table 1.
7. Release S2 to simulate a backup opening. The sectionalizer should count the overcurrent interruption and open.
8. Repeat steps 3 through 7 for B and C phases.
9. Remove the jumper from across the phase actuating current resistor.

COUNT RESTRAINT

The count restraint feature prevents invalid counts of over-currents, interrupted by downline protective devices, by blocking the counting operation, as long as a minimum of one-half amp of uninterrupted line current flows through the sectionalizer.

The operation of the count restraint can be verified by superimposing an interruptible overcurrent on a constant minimum line current. The sectionalizer will not count or open on the interruption of the overcurrent as long as the minimum line current is not interrupted. To check the count restraint feature, proceed as follows:

1. Jumper the ground actuating current resistor with a short lead to disable the ground sensing circuit.
2. Check that sectionalizer is set for one count-to-open.
3. Close sectionalizer by moving the manual control switch, on the sectionalizer control panel, to "CLOSE."
4. With the test circuit connected to phase A of the sectionalizer and S1 closed (to simulate a constant load current of approximately six amps), hold S2 closed and raise the test current to slightly above the appropriate value shown in Column B of Table 1.
5. Release S2 to simulate a downline device clearing the overcurrent. The sectionalizer should not open verifying the operation of the count restraint feature.
6. Open S1 and again close and release S2 to simulate a backup device clearing the fault. This time the sectionalizer should count the overcurrent interruption and open.

TABLE 1
Test Circuit Operating Limits for Actuating Current Settings

Actuating Current Setting (amps)	Column A Sectionalizer Must Not Count Below (amps)	Column B Sectionalizer Must Count At (amps)
3.5	3	4
7	6.3	7.7
16	14.4	17.6
20	18	22
24	21.6	26.4
28	25.2	30.8
40	36	44
56	50.4	61.6
80	72	88
112	101	124
160	144	176
224	201	247
256	230	282
296	266	326
320	288	352
384	345	422
448	403	493
640	576	704
768	691	845
896	806	986

VOLTAGE RESTRAINT

When energized at 120 Vac, the voltage charging board provides fast charging times for the trip energy storage capacitors. It also acts as a voltage restraint; the sectionalizer will not count an overcurrent interruption of the backup protective device unless the voltage at the control is also interrupted. To check the voltage restraint feature, proceed as follows:

1. Jumper the ground actuating resistor with a short lead to disable the ground sensing circuit.
2. Program sectionalizer for one count-to-open.
3. Close sectionalizer by moving the manual control switch, on the sectionalizer control panel, to "CLOSE."
4. Connect 120 Vac to terminals 5 and 6 (control cabinet TB2).
5. With the test circuit connected to phase A of the sectionalizer and S1 open, close S2 and raise the current to slightly above the appropriate value shown in Column B of Table 1.
6. Release S2 to simulate a downline device clearing the overcurrent. The sectionalizer should not open.
7. Disconnect 120 Vac from terminals 5 and 6 (control cabinet TB2).
8. Again close and release S2. The sectionalizer should open.

NUMBER OF COUNTS-TO-OPEN

The number of counts-to-open can be verified by interrupting an overcurrent through the sectionalizer for a preset number of times. For example, with the control set for three counts, the sectionalizer will open upon the third overcurrent interruption. Proceed as follows:

1. Jumper the ground actuating current resistor with a short lead .
2. Program sectionalizer for three counts-to-open by setting the COUNTS-TO-OPEN SELECTOR switch to "3".
3. Close sectionalizer by moving the manual control switch, on the sectionalizer control panel, to "CLOSE."
4. With the test circuit connected to phase A of the sectionalizer and S1 open-close S2 and raise the test current to slightly above the appropriate value shown in Column B of Table 1.
5. Open and close S2 a number of times. The sectionalizer should open upon the third opening of S2.
6. To verify the two-counts-to-open setting, set the COUNTS TO-OPEN SELECTOR switch to "2" and repeat steps 3 through 5. The sectionalizer should open upon the second opening of S2.

COUNT RESET

The count reset feature resets the sectionalizer count to zero whenever current below the actuating level flows through the sectionalizer for longer than the programmed reset time without interruption. The reset time settings have a tolerance of ± 10 percent.

It can be verified by interrupting an overcurrent flow through the sectionalizer one time less than the counts-to-open setting, then allowing load current to flow for periods just under and just over the reset setting. The sectionalizer should open if the overcurrent for the final count is interrupted within the reset time period (reset has not activated). The sectionalizer should not open if the overcurrent for the final count is interrupted after the reset time period (count has reset to zero) . The following procedure may be used to verify the count reset.

1. Jumper the ground actuating current resistor with a short lead to disable ground sensing circuit.
2. Program sectionalizer control for 2 COUNTS-TO-OPEN and set the COUNT RESET SELECTOR to 15 seconds.
3. Close sectionalizer by moving the manual control switch, on the sectionalizer control panel, to "CLOSE."
4. With test circuit connected to phase A of the sectionalizer and S1 open, close S2 and raise the test current to slightly above the appropriate value shown in Column B of Table 1.
5. Release S2 to simulate a backup protective device clearing the overcurrent. The sectionalizer will register a count.
6. Close S1 for 13.5 seconds.

7. Momentarily close and then release switch S2. The sectionalizer should open, verifying that the count reset has not been activated.
8. Reclose sectionalizer and then close and release S2 once to register one overcurrent interruption count.
9. Close S1 for slightly more than 22 seconds.
10. Momentarily close and release switch S2. The sectionalizer should not open verifying that the count reset has been activated and the first count has been erased.
11. Again close and release S2. The sectionalizer should open.

INRUSH-CURRENT RESTRAINT

The inrush-current restraint feature distinguishes between fault currents and inrush currents. For fault current interruptions, the sectionalizer counts and opens normally. For an inrush-current condition, the phase minimum actuating current is raised by a preset multiple for a preset time and ground fault detection is blocked for a preset time to prevent counting the inrush current.

The operation of the inrush-current restraint can be verified by simulating a fault condition (the overcurrent is preceded by an overcurrent interruption) and an inrush condition (the overcurrent is preceded by a load current interruption).

The following procedure may be used to verify the inrush current restraint feature.

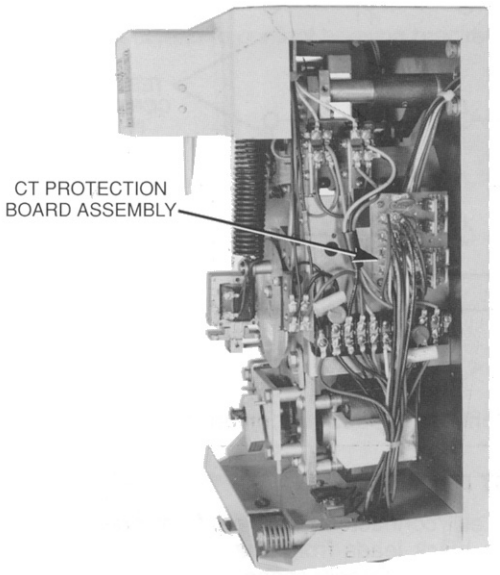
1. Jumper the ground actuating current resistor with a short lead to disable the ground sensing circuit.
2. Set the COUNTS-TO-OPEN SELECTOR switch to “1” and the PHASE ACTUATING LEVEL MULTIPLIER switch to X2.
3. Set the GND INRUSH RESET and the PHASE INRUSH RESET switches to TEST.
   NOTE: In the TEST position inrush restraint, once activated, is blocked from resetting.
4. Close sectionalizer by moving the manual control switch, on the sectionalizer control panel, to “CLOSE.”
5. With test circuit connected to phase A of the sectionalizer and S1 open, hold S2 closed and raise the test current to slightly below the appropriate value shown in Column A of Table 1.
6. Release S2 to simulate a backup opening with only load current flowing through the sectionalizer when current was interrupted. The sectionalizer should not open.
7. Close S2 and adjust the test current to just below twice the appropriate value shown in Column A of Table 1 to simulate an inrush condition.
8. Release S2. The sectionalizer should not open, verifying that the inrush restraint feature has been activated.
9. Reset inrush restraint as follows:
   A. Return the GND INRUSH RESET and the PHASE INRUSH RESET switches to some finite values.
   B. Hold S2 closed longer than the greater of the two settings to reset the inrush restraint feature.
   C. Return both GND INRUSH RESET and PHASE INRUSH RESET switches to TEST.
10. Again hold S2 closed and raise the test current to slightly below the appropriate value shown in Column A of Table 1.
11. Release S2 to simulate a backup opening with only load current flowing through the sectionalizer when current was interrupted .
12. Close S2 and adjust test current to slightly less than twice the value shown in Column B of Table 1.
13. Release S2. The sectionalizer should trip verifying the 2X phase actuating level multiplier setting.
14. Manually close the sectionalizer and repeat step 9 to reset the inrush restraint feature.
15. Close S2 and raise the test current to just above the appropriate value shown in Column B of Table 1.
16. Release S2 to simulate a backup opening with fault current flowing through the sectionalizer when current was interrupted. The sectionalizer should open.
17. Close the sectionalizer.
18. Repeat step 15 to simulate a fault condition.
19. Release S2. The sectionalizer should open verifying that the inrush restraint feature has not been activated.

POST-TEST PROCEDURES

After testing has been completed: disconnect test circuits and verify that the control is returned to its originally settings.

CURRENT TRANSFORMERS

Type GWC sectionalizers are equipped with six 1000:1 current sensing transformers. Two are installed over the shank of each source side bushing, underneath the head casting. The leads from the current transformers are routed to a through connector and then into the mechanism housing to the CT protection board, see Figure 12. To test the current transformers proceed as follows:



891005KMA

Figure 12.
CT protection board.

CONTINUITY CHECK

1. Disconnect white CT lead from phase A connector on CT protection board. Measure resistance between white lead and phase A, B, and C leads (connected to CT protection board). Approximately 11.4 ohms should be measured. Replace white lead.
2. Disconnect yellow and red CT leads, from ground connectors on CT protection board. Measure resistance between leads. Approximately 3.8 ohms should be measured. Replace leads.

RATIO TEST FOR SENSING CT's

1. Connect all three phases of the sectionalizer in series, as shown in Figure 13, and close sectionalizer.
2. Connect a 100 ampere ac test circuit to test points 1 and 2, do not energize.
3. Remove the black CT lead from phase A on the CT protection board. Insert a 0-500 milliammeter between black lead and white CT lead.
4. Energize 100 ampere source and observe the milliammeter. The meter should record 100 ma ± 10%. De-energize source and reconnect lead.
   NOTE: Be sure to allow for the tolerances of meter being used. The resistance of certain type of meters is not negligible. Use as high a scale (lower resistance) as is accurately readable.
5. Repeat test on phases B and C.
6. Remove red and yellow ground CT leads from CT protection board. Insert a 0-500 milliammeter between red and yellow leads.
7. Energize 100 ampere source and observe milliammeter. The meter should record 300 ma ± 10%. De-energize source and reconnect leads.

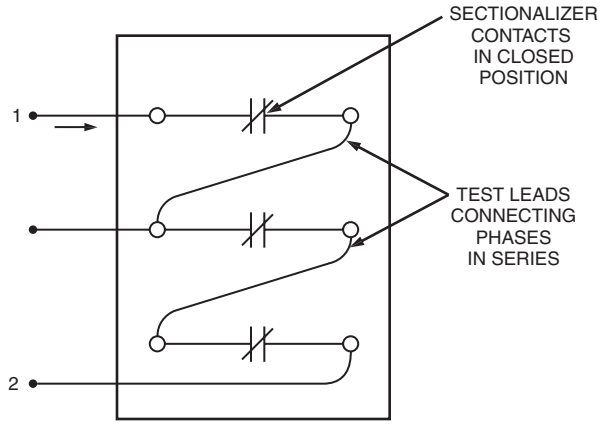


Figure 13.
Test circuit for checking bushing current transformers.

POLARITY TEST FOR SENSING CT's

1. With phases still connected in series, from previous test, remove three black leads from phase connectors on CT protection board. Temporarily connect black leads together. Insert a 0-500 milliammeter between black leads and white phase CT lead.
2. Energize 100 ampere source and observe milliammeter. The meter should record 300 ma ± 10%. De-energize 100 ampere source and reconnect leads.
   A. All three transformers should have the same polarity; the output should measure 300 ma.
   B. If one transformer has its polarity opposite of the remaining two the output will measure 100 ma.

CT PROTECTION BOARD

The CT protection board provides automatic protection for the bushing mounted CTs. The protection board is located on the right side of the mechanism frame, within the mechanism housing. The following test can be used to determine if the protection board is working properly. Assemble and connect the equipment as shown in Figure 14, which shows the test voltage being applied to phase A.

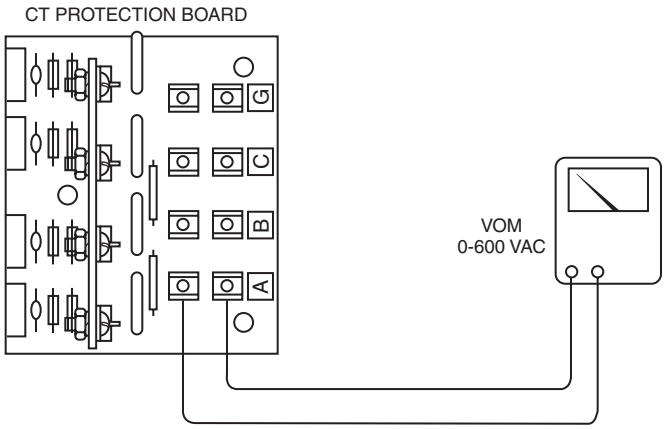


Figure 14.
Testing CT protection board.

1. Unplug wire harness from control printed circuit board assembly.
2. Slowly increase the voltage on the variable transformer while observing the voltage between the 1000:1 CT leads.
3. At approximately 115 volts, the voltage should drop off even though the voltage from the variable transformer is increased. If the voltage does not drop off, the CT protection board is damaged and must be replaced.
4. Disconnect input power and reconnect to test phase B, phase C and ground.
5. Reconnect wire harness onto control printed circuit board assembly.

TROUBLESHOOTING

Sectionalizer troubleshooting is the process of evaluating problems that are encountered and determining the cause. The following procedure is recommended.

1. Check for loose or broken connections and wiring. Figure 34 shows the interconnection between the various electrical components within the sectionalizer, Figure 35 shows component interconnection within the sectionalizer control and Figure 36 is a complete schematic diagram of the sectionalizer and the control.
2. Check the toggle and associated linkage and springs for mechanical binding by closing the sectionalizer and tripping it manually several times.
3. Perform the applicable electrical test described in the Test Procedures section of these instructions. If the sectionalizer does not trip under test either the control or the sectionalizer may be malfunctioning.

4. Observe the trip coil to see if it actuates properly. If the coil actuates the toggle assembly should release. If it did not release check for mechanical binding of the toggle and associated linkages, check the engagement surface of the toggle to make sure there are no rough spots or burrs. Repair or replace as required.

   A. If the trip coil did not actuate:

      (1) Check the dc resistance of the coil, resistance should measure approximately 1.0 ohms. If the trip coil is damaged or inoperative replace.

      (2) Check that the trip signal is being received by the trip coil. When the sectionalizer is closed, moving the manual control switch, on the sectionalizer control panel, to "OPEN" will generate a 24 Vdc trip signal at terminal TB2-4. If the signal is received check interconnection wiring, and operation of micro-switch LS1. Repair or replace as required.

   B. No trip signal:

      (1) Measure dc voltage at TB1-16 with the manual control switch held in the "Open" position. 24 Vdc should be observed. If no voltage is observed replace relay board and retest.

      (2) Check the Zener diodes mounted on the back side of the control swing-out panel. If the Zener diodes are damaged replace.
      NOTE: The dc voltage across the zener diode will be approximately 18 Vdc, with load current greater than 10 amps flowing through the sectionalizer.

      (3) If all components check out satisfactorily, the problem is in the control printed circuit board assembly, replace the board and retest.

5. Observe the closing coil to see if it actuates properly. If the coil actuates it should release the overtoggled mechanism to close the sectionalizer. If the closing coil did not actuate:

   A. Check the dc resistance of the coil, resistance should measure approximately 0.8 ohms. If the coil is damaged or inoperative replace.

   B. Check that the closing signal is being received by the closing coil. When the sectionalizer is open, and the closing springs are extended, moving the the manual control switch, on the sectionalizer control panel, to "Close" will generate a 115 Vac potential at terminal TB1-14. If proper voltage is present at the terminal check interconnection wiring and the operation of micro-switches LS-2, LS-3 and LS-4. Repair or replace as required.

   C. If no voltage is observed at terminal TB1-14 check for a 24 Vdc potential at terminal TB1-2, when manual control switch, on the sectionalizer control panel, is moved to "Close." If proper voltage is observed replace the relay board and retest.

SHOP MAINTENANCE 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. Refer to Figure 15 and proceed as follows:

1. Remove head-clamp bolts and untank sectionalizer.
2. Remove nut, lockwasher, and flat washer holding the lower end of bushing rod to contact housing bracket.
3. Remove the three hex head capscrews and clamps that secure the bushing to the head and lift out.
4. Remove and discard the lower bushing gasket.
5. Twist off the split aluminum clamping ring from the old bushing and install on the new bushing, if it is in good condition—replace if damaged.
   NOTE: The clamping ring cushions and distributes the pressure between the ceramic and the clamps. DO NOT OMIT.
6. Install new bushing into head, use a new lower bushing gasket.
7. Position bushing with the stud end of the terminal pointing outward .
8. Position the clamping ring with the split centered between two clamping bolts.
9. Reassemble bushing to head casting. Tighten bolts evenly, a little at a time, to a torque of 10-15 ft-lbs.
   NOTE: Clamping forces must be applied gradually and equally in rotation to each bolt. This results in an evenly distributed gasket sealing pressure.
10. Reconnect lead to contact housing bracket.

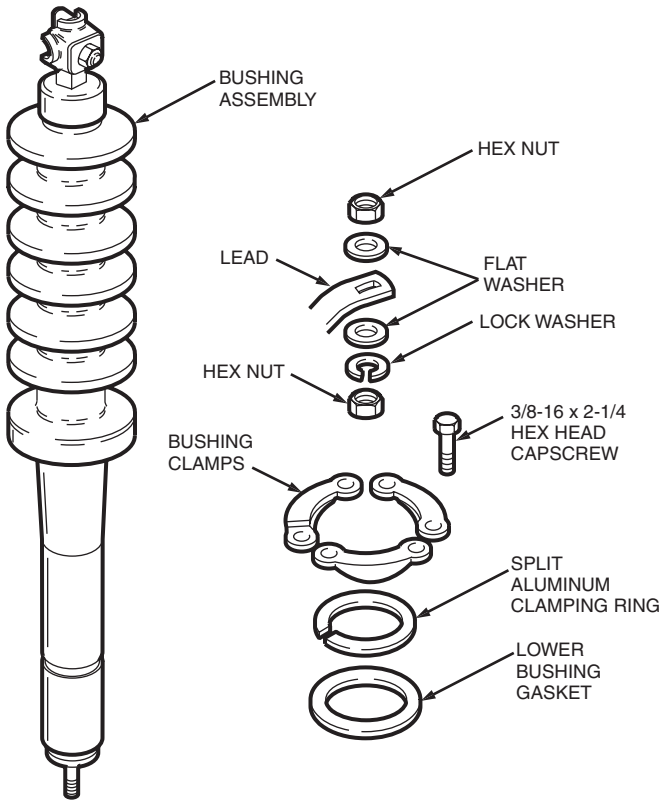


Figure 15.
Bushing removal.

Contacts

Open sectionalizer contacts and remove head mechanism from tank. Operate sectionalizer manually several times, while observing the contacts, to make sure contacts mate properly; leave in open position.

The contacts used in the Type GWC sectionalizer are self cleaning through the wiping action of the contacts. When erosion has spread to the load-current transfer surfaces of the moving contacts the entire contact assembly must be replaced. Use the following procedure for contact inspection and replacement, as required.

CONTACT INSPECTION

The movable contact yoke assembly must be removed for contact inspection, refer to Figure 16.

1. Remove stop nut and washer.
2. Carefully drive out roll pin.
3. Note arrangement of flat washers above and below the movable contact yoke, they must be replaced in the exact same order.
4. Remove contact yoke assembly and inspect (Figure 17).
   - Arcing tips of the moving contacts can experience considerable erosion before replacement is necessary. Slight pitting and discoloration can be dressed with crocus cloth.
   - If one-half or more of the contact load surface is worn away the complete contact assembly (movable and stationary contacts) must be replaced. Refer to Stationary Contact Assembly section of these instructions for stationary contact replacement instructions.
5. Install washers, as removed, and movable contact yoke assembly.
6. Carefully drive roll pin into position, install elastic stop nut and carefully tighten, do not over tighten.

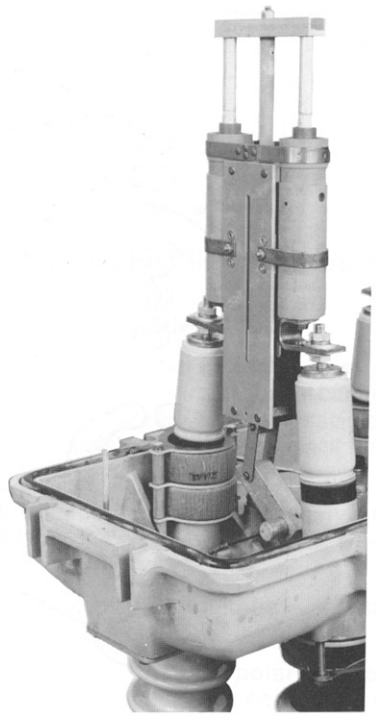


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Figure 16.
Contact arrangement.

STATIONARY CONTACT ASSEMBLY

To replace the stationary contact assembly (refer to Figure 18):

1. Remove movable contact yoke assembly, refer to Contact Inspection section of these instructions for removal procedure.
2. Remove the lower bushing nuts securing stationary contact assembly to bushing assemblies.
3. Lift contact assembly off bushings.
4. Operate actuator mechanism until it is in the switch-closed position.

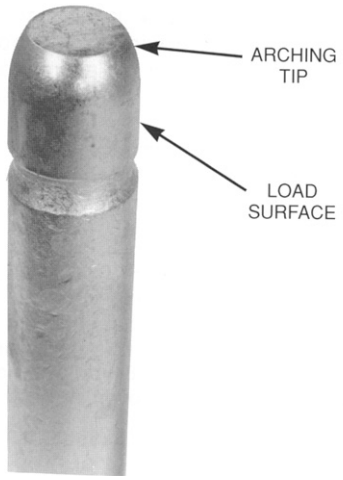

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Figure 17.
Movable contact.

5. Place the new stationary contact assembly on the upper bushing washers. Loosely install lower flat washer, lockwasher and lower bushing nuts.
6. Install the new movable contact yoke assembly, refer to Contact Inspection section for installation procedure.
7. Adjust upper bushing nuts to provide 1/32” (.8 mm) clearance between moving contact assembly and contact tubes.
8. Square contact housing with head casting bottom as shown in Figure 19.
9. Recheck moving contact assembly for proper clearance (refer to Figure 18).
10. Tighten lower bushing nuts to secure stationary contact assembly.
11. Refer to Contact Alignment section of these instructions for proper adjustment of contacts.

CONTACT ROD

To replace the contact rod:

1. With the switch mechanism removed from the tank, remove moving contact assembly, refer to Contact Inspection section for removal instructions.
2. Remove lower bushing nuts, lockwasher and flat washer securing stationary contact assembly, Figure 18.
3. Lift contact assembly off bushings.
4. Remove C-ring and pin securing contact rod to shaft lever (Figure 20).

5. Attach new contact rod to shaft lever with pin and C-ring removed (Figure 20).
6. Place contact assembly over contact rod and onto upper bushing washers. Loosely install lower flat washer, lockwasher and jam nut.

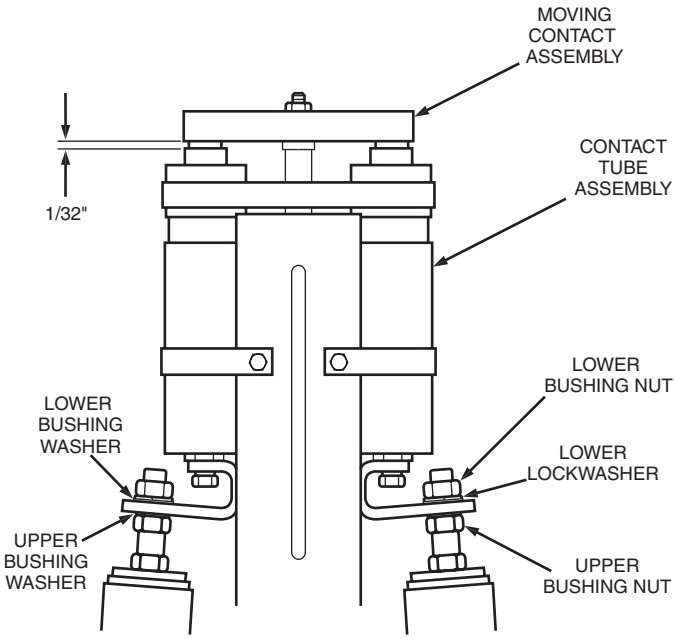

Figure 18.
Moving contact clearance.

7. Install movable contact yoke assembly, refer to Contact Inspection section for installation instructions.
8. Adjust upper bushing nuts to provide 1/32” (.8 mm) clearance between moving contact assembly and contact tubes, refer to Figure 18.
9. Square contact housing with head casting bottom as shown in Figure 19.
10. Recheck contact assembly for proper clearance (refer to Figure 18).
11. Tighten lower bushing nuts to secure stationary contact assembly.
12. Refer to Contact Alignment section of these instructions for proper adjustment of contacts.

CONTACT ALIGNMENT

1. Make sure the clearance between the moving contact assembly and the stationary contact tubes is 1/32 in. with the contacts full closed (Figure 18). To obtain the 1/32 in. clearance, adjust the stationary contact assembly at the upper bushing nuts.
2. With the contacts fully open, check to make sure that the contact rod piston does not bottom in the stationary contact assembly dashpot.
   A. To prevent bottoming, set the stop bolt, inside the operating housing, so that the slotted side plates of the latch assembly at the upper pivot bear snugly against the pivot pin when the latch is in the toggle position as shown in Figure 21.

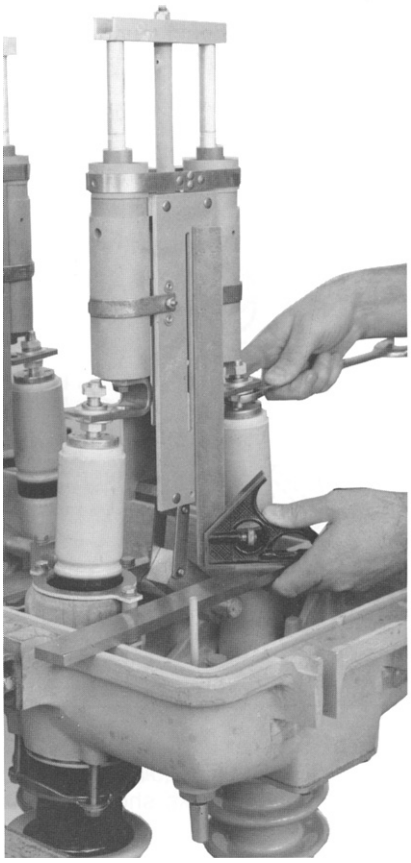

Figure 19.
Squaring contact housing.
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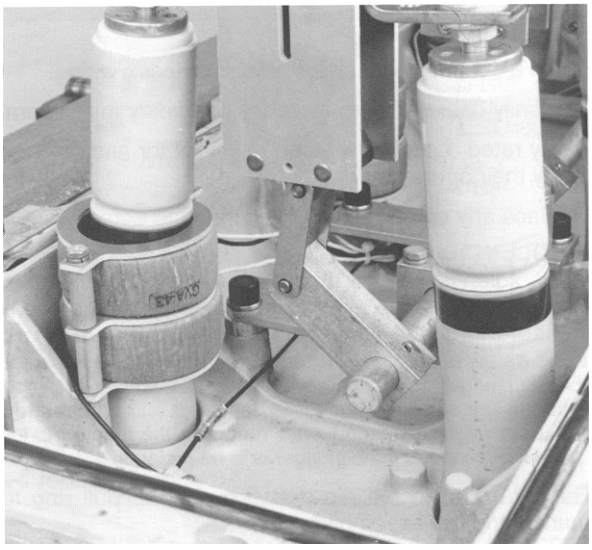

Figure 20.
Contact rod linkage.
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B. Check this by manually winding the actuator mechanism. The pivot pin should touch the end of the slot just as the latch assembly reaches the toggle position.

3. Retank the sectionalizer.

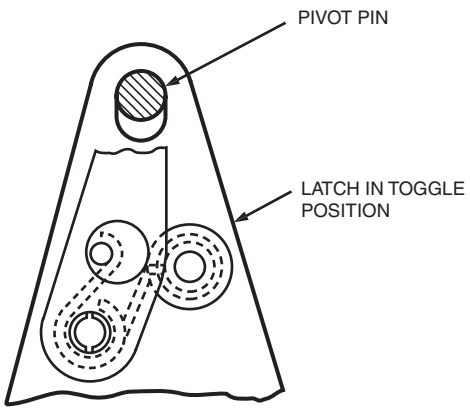

Figure 21.
Proper stop bolt adjustment.

Actuator Mechanism

Normally, little maintenance is required on the actuator mechanism. However, periodic checks should be made to assure trouble-free operation.

ELECTRICAL COMPONENTS

If the sectionalizer does not operate electrically but can be manually opened and closed, check the electrical components.

WARNING: High voltage. Contact with high voltage will cause serious personal injury or death. Prior to performing any maintenance the sectionalizer must be removed from service and all control power must be disconnected.

1. Make a continuity check for broken or loose wiring.
2. Manually operate micro-switches and verify their operation.
3. Apply rated operating voltage to the motor and solenoids to verify their operation.

   Replace any components or wiring found defective.

TRIP SOLENOID

If the trip solenoid plunger becomes rusted, it can be cleaned with crocus cloth. If the plunger or frame are severely eroded, or the solenoid coil is damaged, the solenoid must be replaced as an assembly. Proceed as follows, see Figure 22:

NOTE: The plunger pin that secures the toggle trip lever to the plunger is rivetted, if the solenoid plunger is damaged and requires replacement this pin will be damaged while removing the toggle trip lever, a new pin will be required if the plunger is to be replaced.

1. Remove the top roll pin that secures the pull ring to the manual trip rod assembly.
2. Remove the screws and lockwashers attaching the mounting plate to the speed reducer frame, remove the assembly.
3. Remove retaining ring that attaches the plunger link to the toggle lever.
4. Remove leads from solenoid coil.
5. Remove the attaching hardware to free the solenoid frame from the mounting plate.
6. If the solenoid plunger is to be reused install it in the replacement coil and continue with Step 7. Or, if a new plunger is to be used:

WARNING: Wear goggles or other eye protection equipment. Filing or grinding operations create metal particles which may enter the eye, these metal particles may cause permanent eye injury.

A. File or grind the rivetted end from the plunger pin, until pin is loose.

B. Remove spacer and toggle lever, install, as removed, into new plunger and secure with the new plunger pin.

C. Carefully rivet the plunger pin to secure assembly.

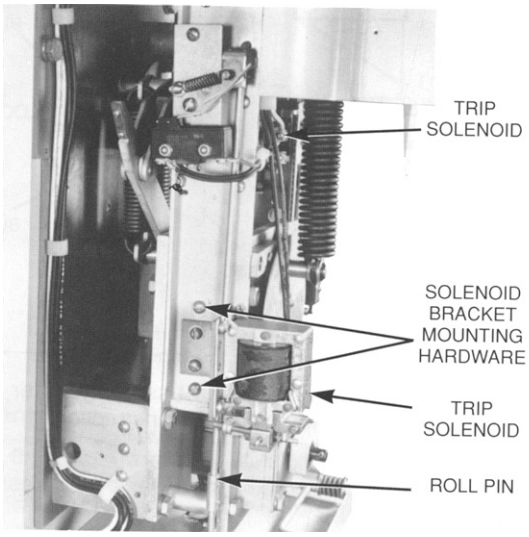

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Figure 22.
Trip solenoid bracket removal.

7. Install new solenoid assembly, reconnect the plunger link to the toggle trip lever, secure with C-ring removed.
8. Attach leads to solenoid coil.
9. Attach mounting plate to the speed reducer frame.
10. Install top roll pin that secures the pull ring to the manual trip rod assembly.

CLOSING SOLENOID

If the closing solenoid plunger becomes rusted, it can be cleaned with crocus cloth. If the plunger or frame are severely eroded, or the solenoid coil is damaged, the solenoid must be replaced as an assembly. Proceed as follows, see Figure 23:

1. Remove the four screws and lockwashers that secure the closing solenoid to the solenoid bracket, lift the solenoid from the bracket.
2. Remove leads from solenoid coil.
3. Remove the cotter pin, spacers and bracket from the old plunger and install on the new plunger.
4. Attach leads to solenoid coil.

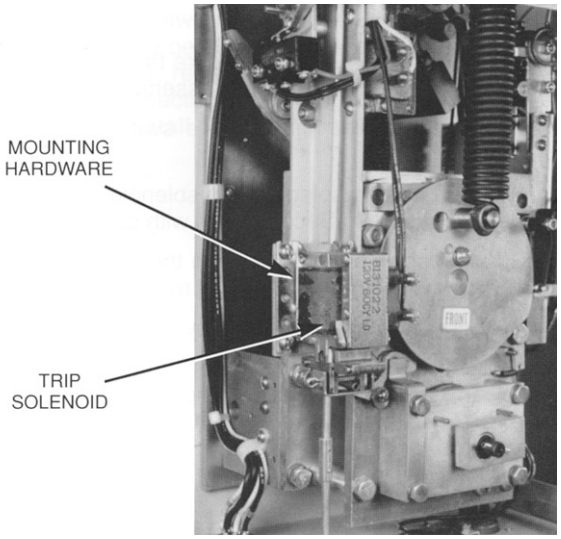

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Figure 23.
Closing solenoid replacement.

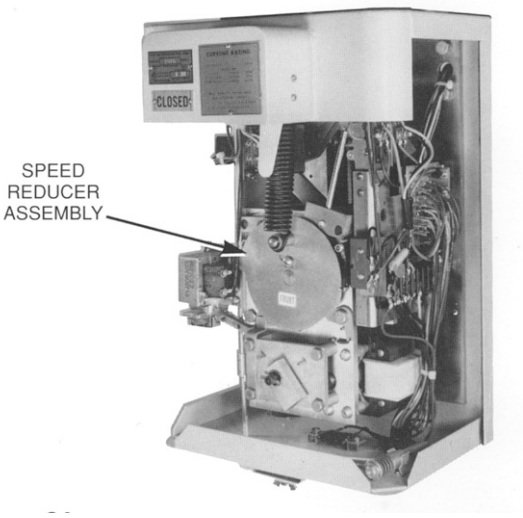
5. Position the solenoid and plunger assembly on the mounting bracket, position the closing linkage pin between cotter pin and bracket, loosely install mounting hardware.
6. Adjust the solenoid assembly so the latch trips 1/16" before the plunger bottoms within the solenoid frame. Tighten mounting hardware.

MOTOR REPLACEMENT

To replace a motor simply disconnect the motor leads and remove the attaching hardware. Make sure the drive gear on the motor shaft meshes correctly with its mating reduction gear when installing the new motor.

SPEED REDUCER

Speed reducer maintenance is limited to periodically greasing the gears, with an all weather, non-freezing grease. If speed reducer must be replaced, refer to Figure 24 and proceed as follows:



891004KMA

Figure 24.
Speed reducer.

Removal:

1. With sectionalizer contacts open, remove the closing spring from the crank-shaft lever drive pin.
2. Disconnect motor leads.
3. Remove lower roll pin that secures the pull ring to the manual trip rod assembly.
4. Remove C-ring and washer to free toggle assembly (see Figure 25) and lower spring bracket from crank-shaft assembly.

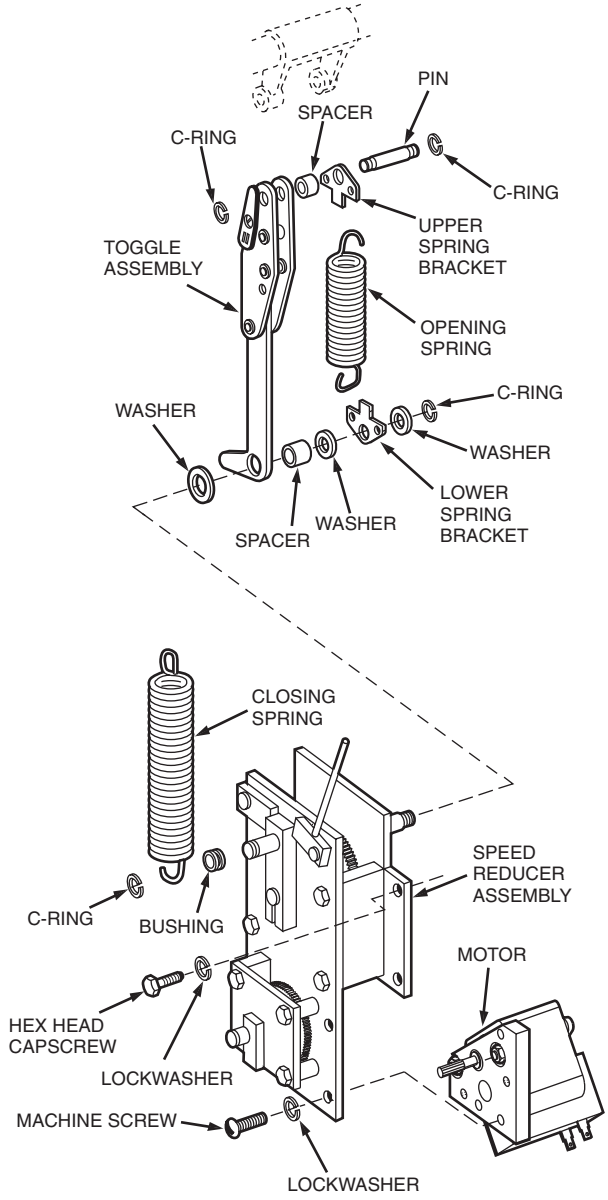


Figure 25.
Speed reducer removal.

5. Loosen the three screws that secure the switch mounting panel to actuator housing, see Figure 26, this provides clearance that is need to access two of the speed reducer mounting bolts.
   NOTE: Do not remove screws. Spacers are installed between the switch mounting panel and the actuator housing, if screws are removed the spacers will fall out of position.

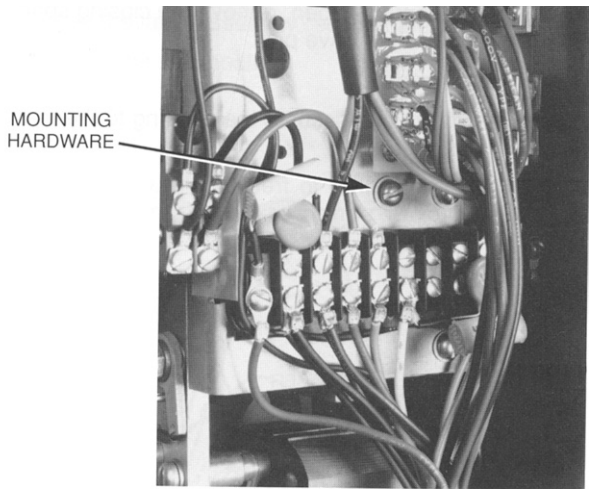


Figure 26.
Switch mounting panel.

891008KMA

6. Disconnect and tag all wiring to the trip solenoid, the closing solenoid and the manual trip position limit switch. Remove cable clip.
7. Remove hex head screws that secure the speed reducer to the actuator housing .
8. Carefully lift speed reducer assembly from actuator housing. Slide the lower spring bracket, spacer and toggle assembly from the crank-shaft, as the speed reducer is being removed.

Installation:

1. Carefully place the speed reducer assembly into position within the actuator housing. Slide the toggle assembly, spacer and lower spring bracket onto the crank-shaft assembly, see Figure 27.
   NOTE: The speed reducer assembly must be in the open state, crank-shaft positioned with operator pins at Twelve-O-Clock, for assembly. The toggle latch must be open for reducer assembly.
2. Install the four hex head capscrews and lockwashers to secure reducer assembly.
3. Install washer and a new C-ring to secure the spring bracket and toggle assembly to crank-shaft assembly.
4. Tighten the three screws that secure switch mounting panel.
5. Connect wiring to closing solenoid, trip solenoid and manual trip position limit switch. Secure wires with cable clip.
6. Slide the manual open pull ring through the actuator housing cabinet and into the coupling. Install roll pin to secure.
7. Install closing spring from crank-shaft lever drive pin.
8. Operate actuator mechanism manually with crank to close contacts. Open contacts with manual trip rod. Repeat operation of actuator mechanism electrically and check for proper operation.

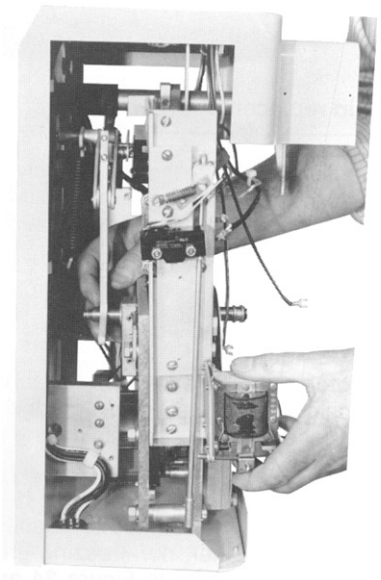


Figure 27.
Speed reducer installation.

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Control

All electrical hardware components (toggle switches, manual switch, etc.) can be visually or electrically checked. If replacement is needed, remove wires, noting their exact placement, remove all connecting hardware and then remove the existing component. Install the new component by reversing procedure.

SERVICE PARTS LIST

When ordering service parts, always include the sectionalizer type and serial number. Because of Cooper Power System's continuous-improvement policy, there will be cases in which parts ordered may not be the same as the parts furnished; however, they will be interchangeable. All parts have the same warranty as any whole item of switchgear; i.e., against defects in material or workmanship within one year from the date of shipment.

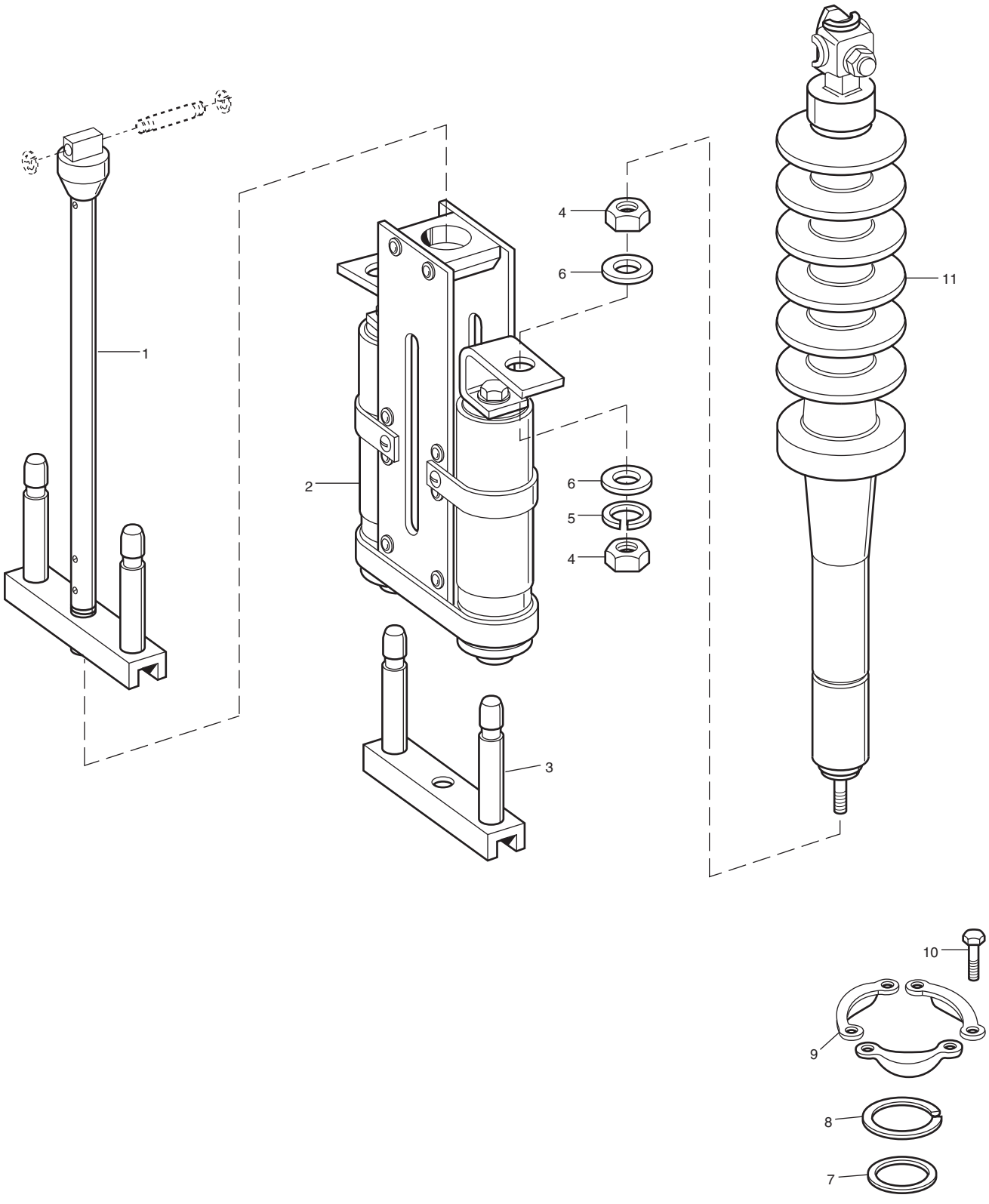


Figure 28.
Bushings and Contacts.

Bushings and Contacts (Figure 28)

Item No.	Description	Catalog Number	Qty. per Assy.
1	Contact rod assembly (includes item 3)	KA104GW	3
2	Stationary contact assembly	KA107GW	3
3	Movable contact assembly	KA102GW1	3
4	Jam nut, hex, 1/2-20, brass	K880625120050H	12
5	Split lockwasher, 1/2, med, bronze	K900830050000A	6
6	Washer, 9/16, brass	K900225056125H	12
7	Gasket	KA1193R	6
8	Clamping ring	KP1111R	6
9	Bushing clamp	KP1574R	18
10	Capscrew, hex hd, 3/8-16 x 2-1/4, stl	K730115137225A	18
11	Bushing assembly Standard bushing	KA56RV1	6
	Standard bushing with BCT	KA56RV2	6

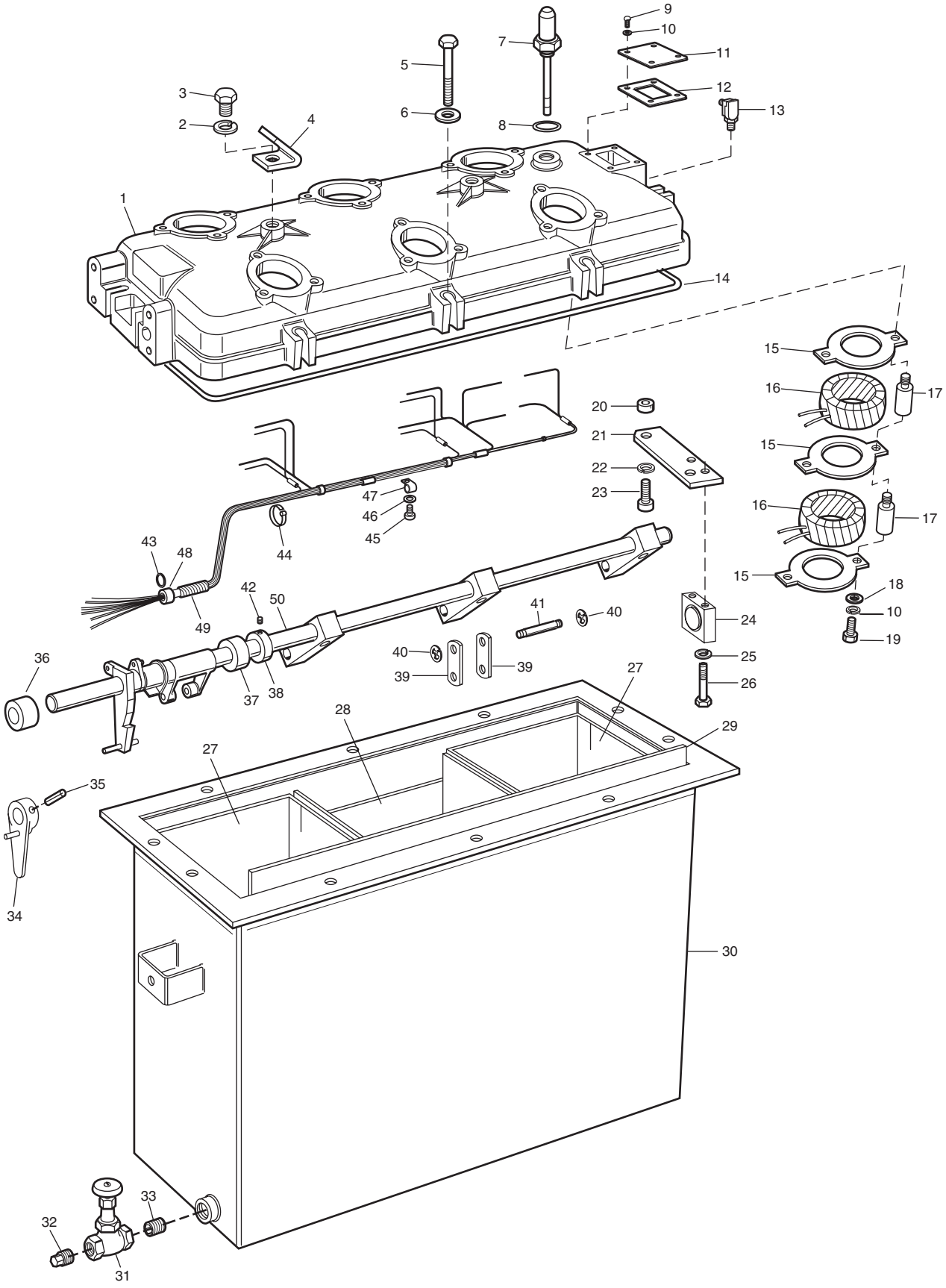


Figure 29.
Head and Tank Assemblies.

Head and Tank Assemblies (Figure 29)

Item No.	Description	Catalog Number	Qty. per Assy.
1	Head assembly	KP504GW2	1
2	Lockwasher, med, 5/8, stl	K900801062000Z	2
3	Capscrew, hex head, 5/8-11 x 1-1/2, stl	K730101162150Q	2
4	Lifting lug	KP456H2	2
5	Capscrew, hex head, 1/2-13 x 3-1/4,stl	K730115150325A	10
6	Washer	KP2028A19	10
7	Plug and gauge assembly	KA118GW	1
8	O-ring	KP2000A9	1
9	Capscrew, hex head, 1/4-20 x 5/8, stl	K730101125062Z	4
10	Lockwasher, 1/4, med, stl	K900801025000Z	10
11	Cover plate	KP609R	1
12	Gasket	KP611R	1
13	Ground connector	KP392RA	1
14	Gasket	KP2103A8	1
15	Support	KP145RE	9
16	Current transformer assembly	KA43GV	6
17	Spacer	KP3009A88	12
18	Washer, #14, brass	K900525026056A	6
19	Capscrew, hex head, 1/4-20 x 4, stl	K730101125400Y	6
20	Spacer	KP3017A18	6
21	Bearing plate	KP502GW	1
22	Lockwasher, 1/2, med, stl	K900801050000Z	6
23	Capscrew, socket head, 1/2-13 x 1-1/2, stl	KP2036A11	6
24	Bearing	KP88VR	3
25	Lockwasher, 5/16, med, stl	K900801031000Z	6
26	Capscrew, hex head, 5/16-13 x 2, stl	K730101131200Y	6
27	Tank liner	KP525GW	2
28	Tank liner	KP524GW	1
29	Tank liner support	KP225W	2
30	Tank assembly	KA18GW	1
31	Valve	KP2038A1	1
32	Pipe plug	KP2007A3	1
33	Pipe nipple	KP2039A1	1
34	Position indicator assembly	KA19VR	1
35	Roll pin, 3/16 x 1-1/8	K970801188113Z	1
36	Gasket	KP2090A44	1
37	Bushing	KP3106A9	1
38	Collar	KP138VLM	1
39	Link	KP510GW	6
40	Retaining ring, WA514, 1/4, stl	K97091250000A	12
41	Pin	KP3124A69	6
42	Screw, hex set 1/4-20 x 3/8	K762315125037A	1
43	O-ring	KP2000A6	1
44	Wire retainer	K994904170003A	3
45	Machine screw, rd hd, #8-32 x 3/8, stl	K721501108037Z	3
46	Lockwasher, #8, med, stl	K900801008000Z	3
47	Cable clamp	KP2006A1	2
	Cable clamp	KP2006A8	1
48	Connector assembly	KA201GV	1
49	Spirap, 1-1/2”	KP2072A1	1
50	Lever and shaft assembly (includes items 34 and 35)	KA103GW	1

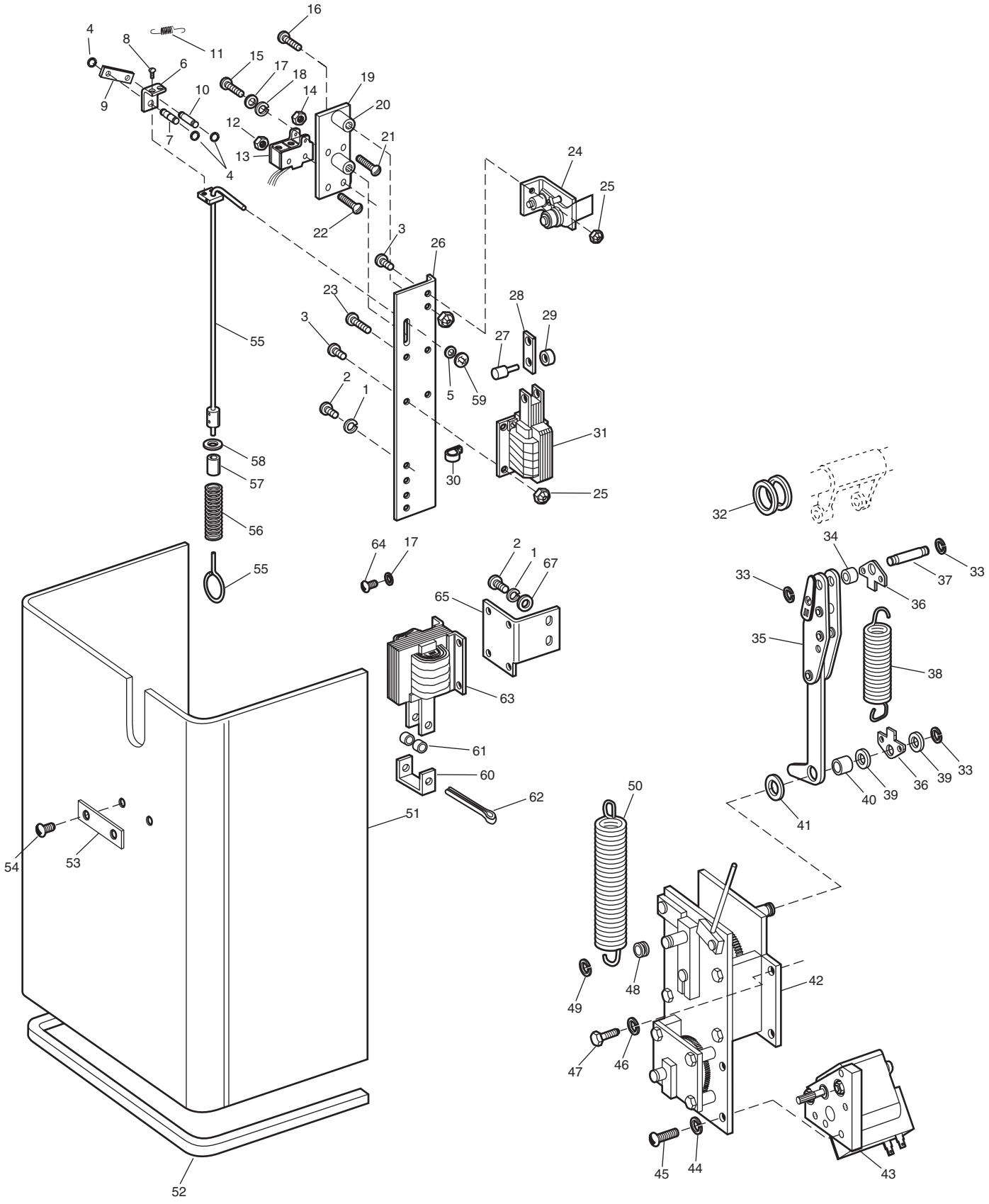


Figure 30.
Operating Mechanism, Part 1.

Operating Mechanism, Part 1 (Figure 30)

Item No.	Description	Catalog Number	Qty. per Assy.
1	Lockwasher, med, #10, stl	K900801010000Z	4
2	Machine screw, rd head, #10-32 x 3/4, st stl	K721515310075A	4
3	Machine screw, rd head, #10-32 x 1/2, st stl	K721515310050A	3
4	Retaining ring, #WA510, 3/16	K970915188000A	4
5	Washer, #10, brass	K900525020043A	2
6	Bracket	KP592GV	1
7	Pin	KP594GV	1
8	Machine screw, rd head, #6-32 x 3/8, st stl	K721515106037A	2
9	Lever	KP3308A38	1
10	Pin	KP3123A30	1
11	Spring	KP1192CE	1
12	Elastic stop nut	KP2020A6	2
13	Micro-switch	KP2181A8	1
14	Hex nut, #10-24, st stl	K881015124010A	1
15	Machine screw, rd head, #10-32 x 1-1/8, st stl	K721515310112A	1
16	Machine screw, rd head, #10-32 x 1-3/8, st stl	K721515310137A	1
17	Lockwasher, med, #10, st stl	K900815010000A	5
18	Spacer	KP3006A47	1
19	Mounting plate	KP590GV	1
20	Spacer	KP3009A129	2
21	Machine screw, rd head, #10-24 x 3/4, st stl	K721515110075A	1
22	Machine screw, rd head, #6-32 x 1, st stl	K721515106100A	2
23	Machine screw, flat head, #10-32 x 1/2, st stl	K721615310050A	1
24	Support and lever assembly (Includes item 28)	KA41VR2	1
25	Elastic stop nut	KP2020A1	6
26	Mounting plate	KP590GV	1
27	Pin	KP373VR	1
28	Lever	KP382VR	1
29	Spacer	KP3007A152	1
30	Cable clip	KP2006A1	1
31	Solenoid assembly 24 Vdc	KP1259M7S	1
32	Spacer	KP2028A46	2
33	Retaining ring, #WA516, 5/16, stl	K970901312000M	3
34	Spacer	KP3010A7	1
35	Toggle assembly	KA11VR1	1
36	Link	KP31VR	2
37	Pin	KP3125A7	1
38	Opening spring	KP35VR	2
39	Washer, #20, brass	K900225020000A	2
40	Spacer	KP3011A6	1
41	Washer, 1/2, brass	K900225050000A	1
42	Speed reducer assembly (includes item 43)	KA32VR	1
43	Motor Assembly	KA253VR	1
	Motor only	KA252VR	1
44	Lockwasher, med, 1/4, stl	K900801025000Z	3
45	Machine screw, rd head, 1/4-28 x 3/4, stl	K721501325075A	3
46	Lockwasher, med, 5/16, stl	K900801031000Z	4
47	Cap screw, hex head, 5/16-18 x 3/4, stl	K730101131075Q	4
48	Sleeve	KP280VR	1
49	Retaining ring, #WA518, 3/8	K970901375000M	10
50	Closing spring	KP533GW	1
51	Cover	KP129VR	1
52	Gasket	KP2084A1	1
53	Name plate	KP730R	1
54	Self tapping screw, #2 x 3/16 st stl	K801515002018A	2
55	Manual trip rod assembly	KA65VR	1
56	Spring	KP157VR	1
57	Spacer	KP3007A18	1
58	Washer, flat, 1/4, stl	K900201025000Z	1
59	Speed nut	KP2005A1	1
60	Bracket	KP376VR	1
61	Spacer	KP3004A20	2
62	Cotter pin, brass	K970525125150A	1
63	Solenoid assembly	KP2262A2	1
64	Machine screw, rd head, #10-32 x 5/16, stl	K721501310031A	4
65	Bracket	KP375VR	1
66	Washer, plain, #10, stl	K900201010000Z	2

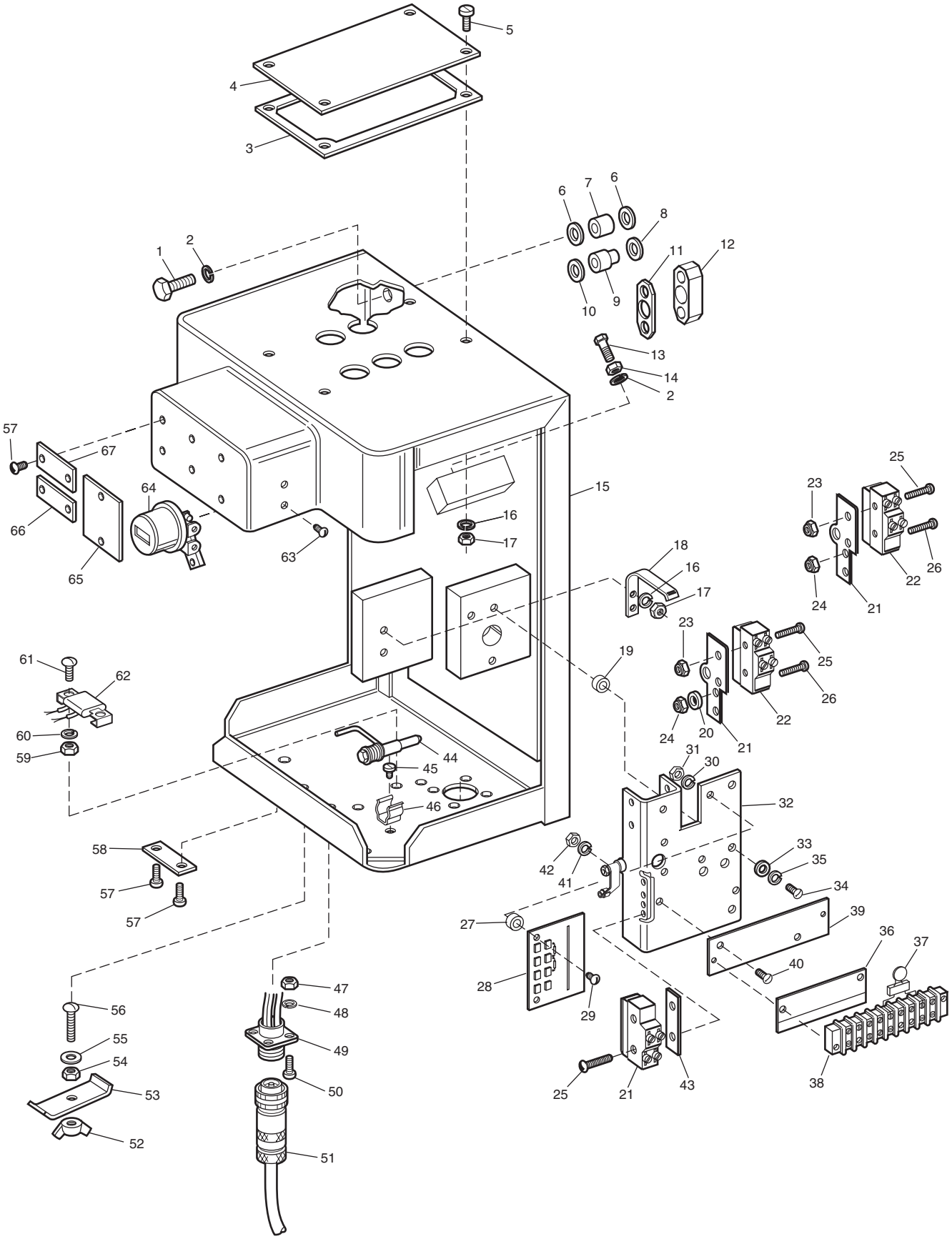


Figure 31.
Operating Mechanism, Part 2.

Operating Mechanism, Part 2 (Figure 31)

Item No.	Description	Catalog Number	Qty. per Assy.
1	Capscrew, hex head, 3/8-16 x 1, stl	K732401137100Q	4
2	Lockwasher, 3/8, med, stl	K900801037000Z	5
3	Gasket	KP649R	1
4	Cover	KP158VR	1
5	Machine screw, rd head, #10-32 x 3/4, st stl	K721515310075A	4
6	Gasket	KP2090A54	4
7	Spacer	KP3015A25	2
8	Gasket	KP2090A52	1
9	Bushing	KP3046A6	1
10	Gasket	KP2090A53	1
11	Gasket	KP521GW	2
12	Spacer	KP520GW1	1
13	Capscrew, hex head, 3/8-16 x 1-1/2, stl	K732401138150Q	1
14	Jam nut, hex, 3/8-16, stl	K880601116038Q	1
15	Mechanism housing	KA230VR3	1
16	Lockwasher, #10, med, stl	K900701010000Z	5
17	Hex nut, #10-32, stl	K880101332010Z	5
18	Spring	KP72VR	1
19	Spacer	KP3007A37	3
20	Spacer	KP3007A35	2
21	Latch assembly	KA204VR	2
22	Micro-switch	KP2181A13	3
23	Elastic stop nut	KP2020A6	6
24	Elastic stop nut	KP2020A5	4
25	Machine screw, rd head, #6-32 x 1, st stl	K721515106100A	6
26	Machine screw, rd head, #8-32 x 1/2, st stl	K721515108050A	4
27	Spacer	KP3006A28	2
28	CT protector, circuit board	KA197GV1	1
29	Machine screw, rd head, #6-32 x 5/8, st stl	K721515106062A	2
30	Lockwasher, med, #6, st stl	K900815006000A	2
31	Hex nut, #6-32, stl	K861001132006Z	2
32	Mounting panel assembly	KA203VR	1
33	Washer, plain, #10, stl	K900201010000Z	3
34	Lockwasher, med, #10, stl	K900801010000Z	3
35	Machine screw, rd head, #10-32 x 3/4, stl	K721501310075Z	3

Item No.	Description	Catalog Number	Qty. per Assy.
36	Marker strip	KP2101A224	1
37	Capacitor and varistor	KA155GW	2
38	Terminal strip	KP2101A24	1
39	Mounting plate	KP593GV	1
40	Machine screw, flat head, #8-32 x 3/8, st stl	K721615108037A	2
41	Lockwasher, med, #8, st stl	K900815008000A	2
42	Hex nut, #8-32, st stl	K881015132008A	2
43	Insulation	KNC1070S1	1
44	Crank assembly	KA141VR	1
45	Screw, pan head, self tapping #10 x 3/8, st stl	K751715110037A	1
46	Cable clip	KP1091ME	1
47	Hex nut, #6-32, st stl	K881015132006A	1
48	Lockwasher, med, #6, st stl	K900815006000A	1
49	Receptacle assembly	KA152GW	1
50	Self tapping screw, type F, #6 x 1/2, st stl	K751515106050A	1
51	Control cable assemble, add length to end of part number (maximum 35 feet)	KA92GV___	1
52	Wing nut, 5/16-18, stl	K881201118031Z	1
53	Latch	KP268VR	1
54	Hex nut, 5/16-18, stl	K880101118031Z	1
55	Washer, flat, 5/16, stl	K900201031000Z	1
56	Machine screw, rd head, 5/16-18 x 1-1/4, stl	K721501131125Z	1
57	Self tapping screw, #2 x 3/16, st stl	K741515106019Z	8
58	Nameplate (manual trip)	KP377VR	1
59	Hex nut, #8-32, brass	K881025132008A	2
60	Lockwasher, med, #8, brass	K900825008000A	2
61	Machine screw, rd head, #8-32 x 1/2, st stl	K721515108050A	2
62	Heater assembly	KP4023A14	1
63	Self tapping screw, #6 x 3/8, st stl	K751515106037A	2
64	Counter assembly	KA28CO3S	1
65	Nameplate (current ratings)	KP549GW	1
66	Nameplate (closed)	KP729R	1
67	Nameplate (serial number)	KP730R	1

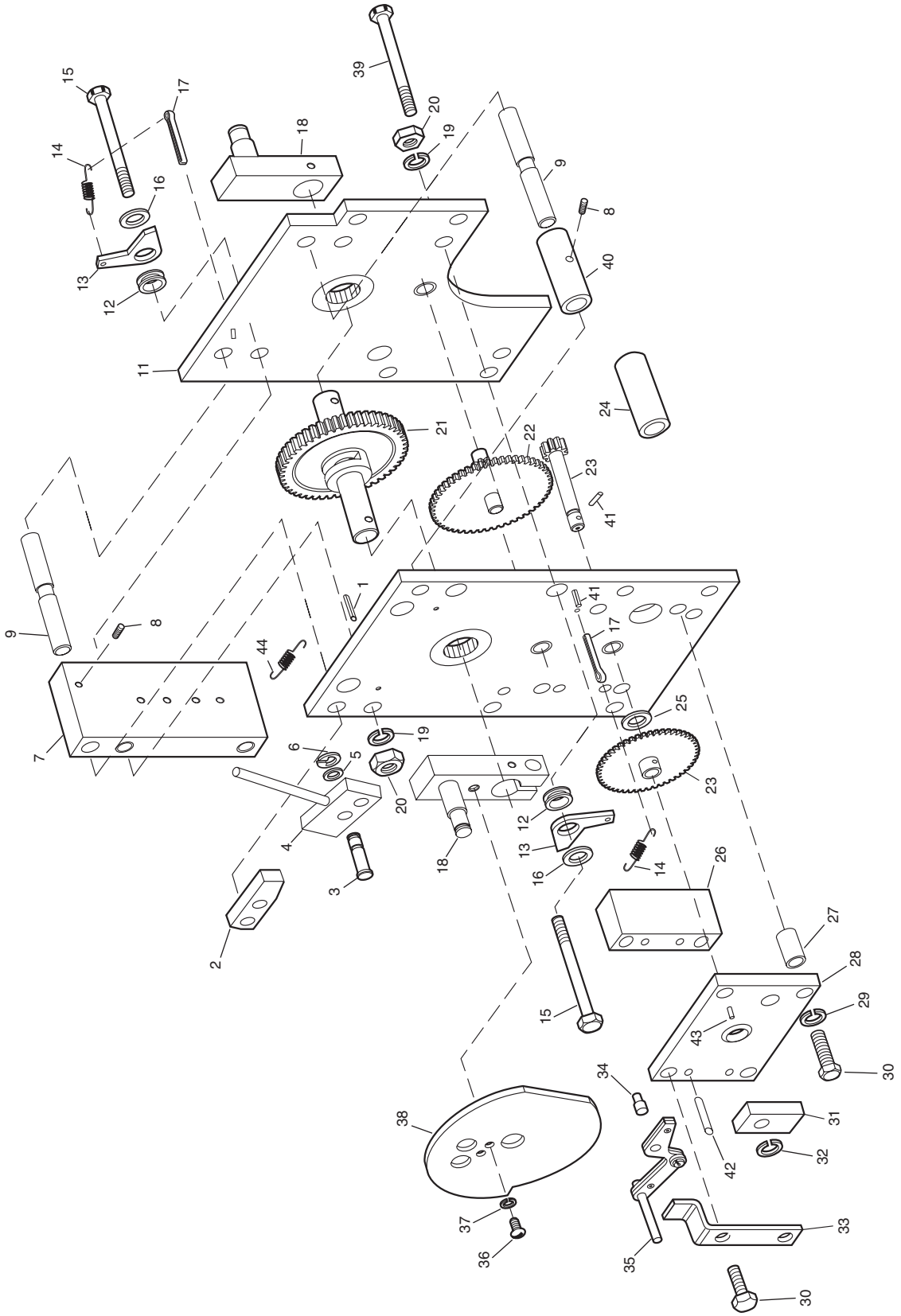


Figure 32.
Speed Reducer Assembly.

Speed Reducer Assembly (Figure 32)

Item No.	Description	Catalog Number	Qty. per Assy.
1	Roll pin, 1/8 x 7/8	K970801125087C	3
2	Latch lever	KP388VR	1
3	Pin	KP365VR	2
4	Latch lever assembly	KA158VR	1
5	Washer, plain, brass	K900525026068A	2
6	Retaining ring, WA415	K970901250000L	2
7	Side plate	KP36VR	1
8	Set screw, #8-32 x 1/8	K762301108012A	2
9	Pin	KP370VR	2
10	Front plate assembly	KA15VR	1
	Bearing	KP2026A1	1
11	Plate assembly	KA62VR	1
	Bearing	KP2026A1	1
12	Spacer	KP3036A14	2
13	Anti-reverse pawl	KP306VR	2
14	Spring	KP340VR	2
15	Cap screw, hex head, 5/16-18 x 2-3/4, stl	K732401131275Q	2
16	Washer, plain, 5/16, stl	K900201031000Z	2
17	Cotter pin, 3/32 x 3/4 st stl	K970515094075A	2
18	Crank shaft assembly	KA17VR	1
19	Lockwasher, med, 5/16, stl	K900801031000Z	5
20	Hex nut, 5/16-18	K880101118031Q	5
21	Spur gear	KP313VR	1
22	Gear and pinion assembly	KA20VR	1

Item No.	Description	Catalog Number	Qty. per Assy.
23	Third reduction gear assembly	KA21VR	1
24	Spacer	KP3011A9	3
25	Washer	KP2028A2	1
26	Side plate	KP38VR	1
27	Spacer	KP3009A19	2
28	Plate assembly	KA60VR	1
29	Lockwasher, med, 1/4, stl	K900801025000Z	4
30	Cap screw, hex head, 1/4-20 x 1-1/2, stl	K732401125150Q	4
31	Clutch lever assembly	KA224VR	1
32	Retaining ring, WA518	K970901375000M	1
33	Bracket	KP375VR	1
34	Pin	KP185VR	1
35	Latch assembly	KA72VR1	1
36	Machine screw, rd head, 1/4-20 x 1/2, stl	K721501125050Z	1
37	Lockwasher, med, 1/4, stl	K900801025000Z	1
38	Cam	KP312VR	1
39	Cap screw, hex head, 5/16-18 x 2-1/2, stl	K732401131250Q	3
40	Spacer	KP369VR	1
41	Roll pin, 1/8 x 5/8	K970801125062C	3
42	Pin, 1/4 x 1-1/4, stl	K010400025125A	2
43	Roll pin, 71/8 x 3/4	K970801125075C	2
44	Latch spring	KP61VR	2

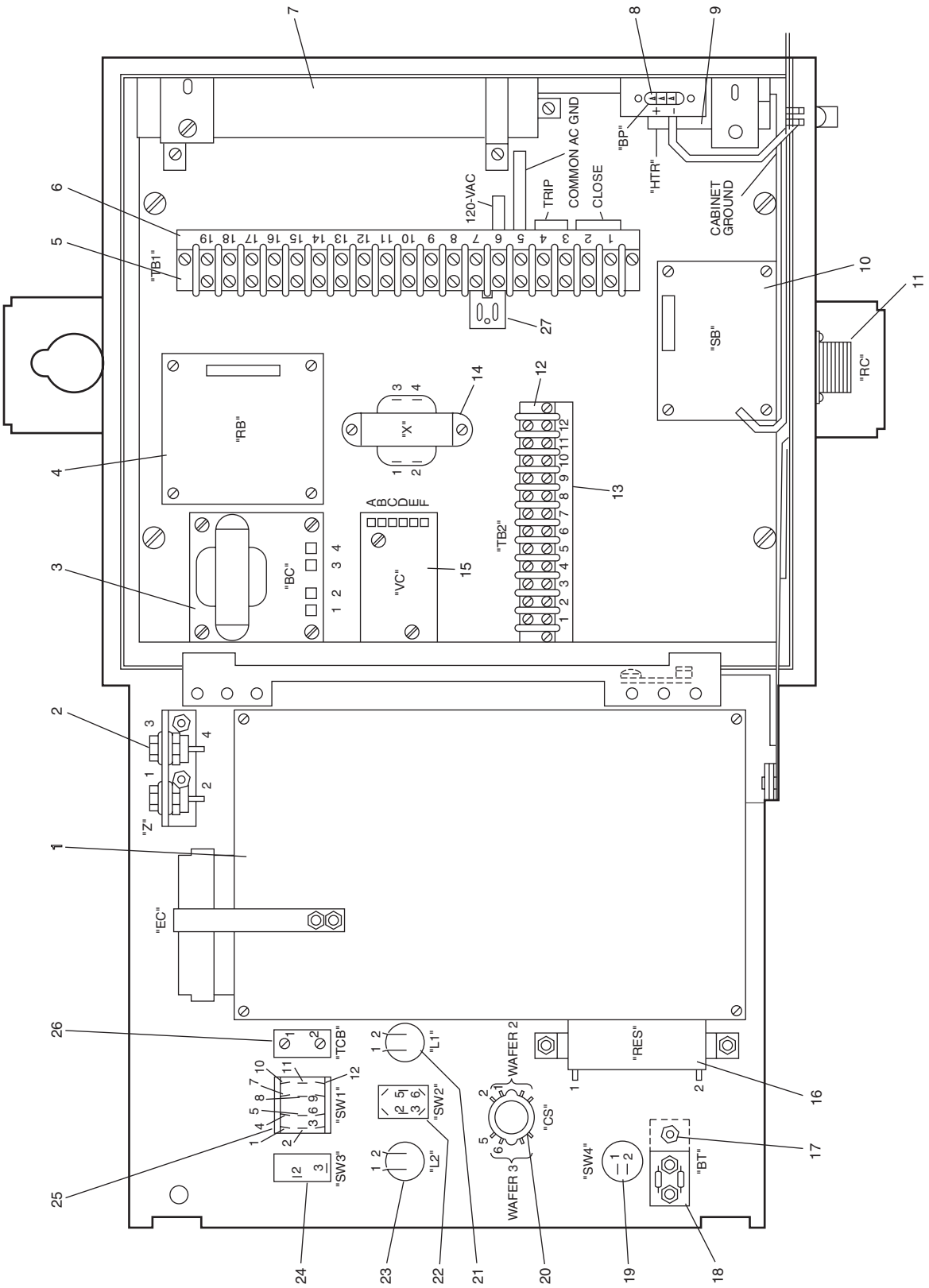


Figure 33.
Sectionalizer Control Assembly.

Sectionalizer Control Assembly (Figure 33)

Item No.	Description	Catalog Number	Qty. per Assy.
1	Control circuit board assembly	KA149GW	1
	Circuit Board only	KA175GV	1
2	Zener diode assembly	KA154PC2	1
	Zener diode only	KP4012A44	2
3	Battery charger circuit board assembly	KA83GV	1
4	Relay board assembly	KA138GW	1
5	Terminal strip	KP2101A23	1
6	Marker strip	KP2101-223	1
7	Battery	KA450ME2	1
8	Battery plug assembly	KA93GV	1
9	Heater assembly	KA852ME4	1
10	Surge board assembly	KA143GW	1
11	Receptacle assembly	KA145GW	1
12	Terminal strip	KP2101A16	1
13	Marker strip	KP2101-216	1
14	Transformer assembly	KA234ME	1

Item No.	Description	Catalog Number	Qty. per Assy.
15	Voltage charging board assembly	KA174GV1	1
16	Resistor	KP4023A26	1
17	Insulated terminal, red	KP2081A3	1
	Insulated terminal, black	KP2081A2	1
	Link and terminal assembly	KA894ME	1
18	Circuit board assembly	KA145GV	1
	Insulator	KP677GV	1
19	Momentary switch, SPST	KP2167A1	1
20	Rotary switch	KA1139ME2	1
	Rotary switch knob	KP2069A8	1
21	Indicator, green	K99904310112A	1
22	Toggle switch, DPDT	KP2124A6	1
23	Indicator, red	K99904310170A	1
24	Toggle switch, SPST	KP2124A2	1
25	Toggle switch, 4PDT	KP2124A16	1
26	Circuit breaker	KP2293A1	1
27	Varistor assembly	KA2005ME2	1

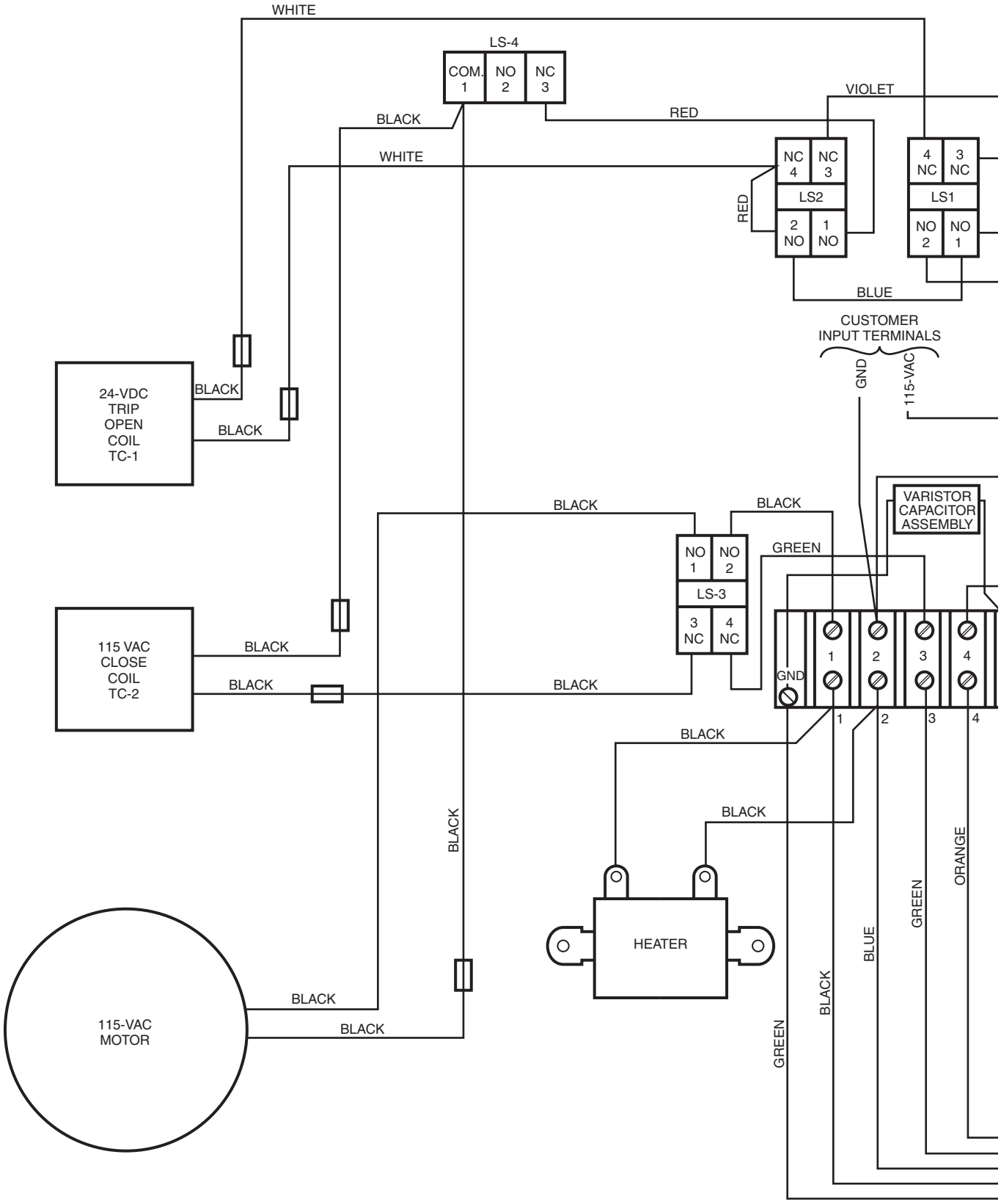
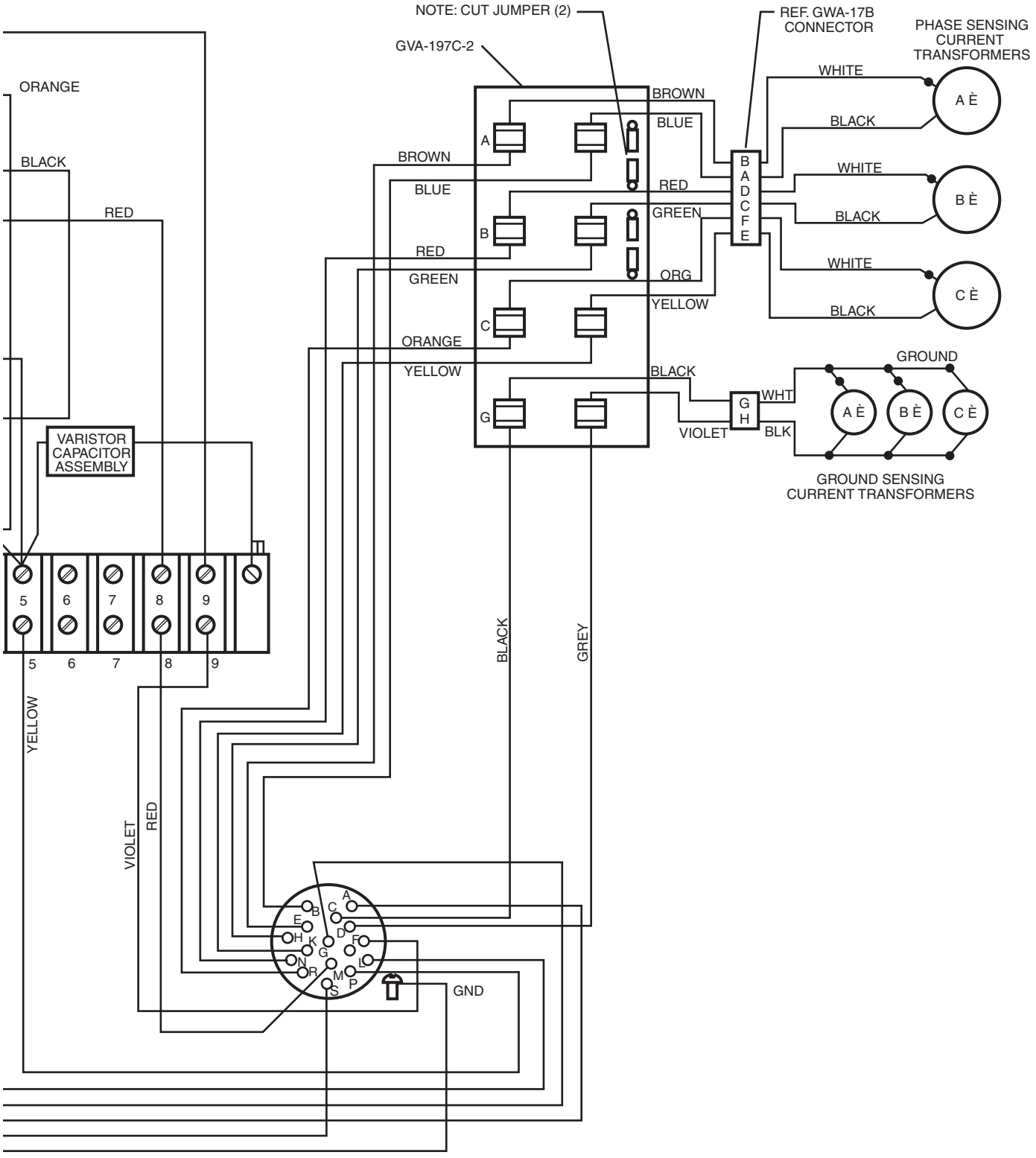


Figure 34.
Type GWC sectionalizer interconnection diagram.


NOTE: CUT JUMPER (2)
GVA-197C-2
REF. GWA-17B CONNECTOR
PHASE SENSING CURRENT TRANSFORMERS
ORANGE
BLACK
RED
BROWN
BLUE
RED
GREEN
ORANGE
YELLOW
BROWN
BLUE
RED
GREEN
ORG
YELLOW
BLACK
VIOLET
WHT
BLK
WHITE
BLACK
WHITE
BLACK
WHITE
BLACK
A È
B È
C È
GROUND
A È
B È
C È
GROUND SENSING CURRENT TRANSFORMERS
VARISTOR CAPACITOR ASSEMBLY
5
6
7
8
9
5
6
7
8
9
YELLOW
VIOLET
RED
BLACK
GREY
GND

"SW1" REMOTE ON/OFF		
Term	To	Color
2	CS-5	BRN
3	TB1-3	VIO
5	L2-1	RED
6	TB1-1	BLU
10	TB1-9	ORG
11	TB1-8	YEL
12	TB1-7	GRN

"SW2" LMP. TEST and CONTACTOR POS.		
Term	To	Color
1	CS-6	BLK
2	L2-2	ORG
3	BT-1	WHT
3	SW2-6	WHT
4	TB1-12	GRY
5	L1-2	YEL
6	SW2-3	WHT
6	TB2-1	WHT

"SW3" ONE COUNT-TO-OPEN SWITCH		
Term	To	Color
2	EC-20	WHT
3	EC-22	BLK

"SW4" BATTERY TEST SWITCH		
Term	To	Color
1	RES-1	BRN
2	BT-3	RED
2	CS-1	RED

"L2" RED LIGHT — CONTACT INDICATION		
Term	To	Color
1	L1-1	RED
1	SW1-5	RED
2	SW2-2	ORG

"L1" GRN LIGHT — CONTACT INDICATION		
Term	To	Color
1	L2-1	RED
1	CS-1	RED
2	SW2-5	YEL

"HTR" HEATER ASSEMBLY		
Term	To	Color
1	TB1-11	BRN
2	TB2-2	BRN

"RES" BATTERY TEST RESISTOR		
Term	To	Color
1	SW4-1	BRN
2	BT-2	BLK
2	BP(-)	BLK

"EC" EDGE CONNECTOR		
Term	To	Color
2	Z-4	RED
3	Z-1	WHT
7	TB2-4	WHT
8	TB2-5	GRY
14	TB2-8	VIO
15	TB2-7	BLU
16	TB2-6	GRN
17	TB2-3	YEL
18	VC-D	ORG
19	TB1-18	RED
20	SW3-1	WHT
21	TB1-19	BRN
22	SW3-2	BLK

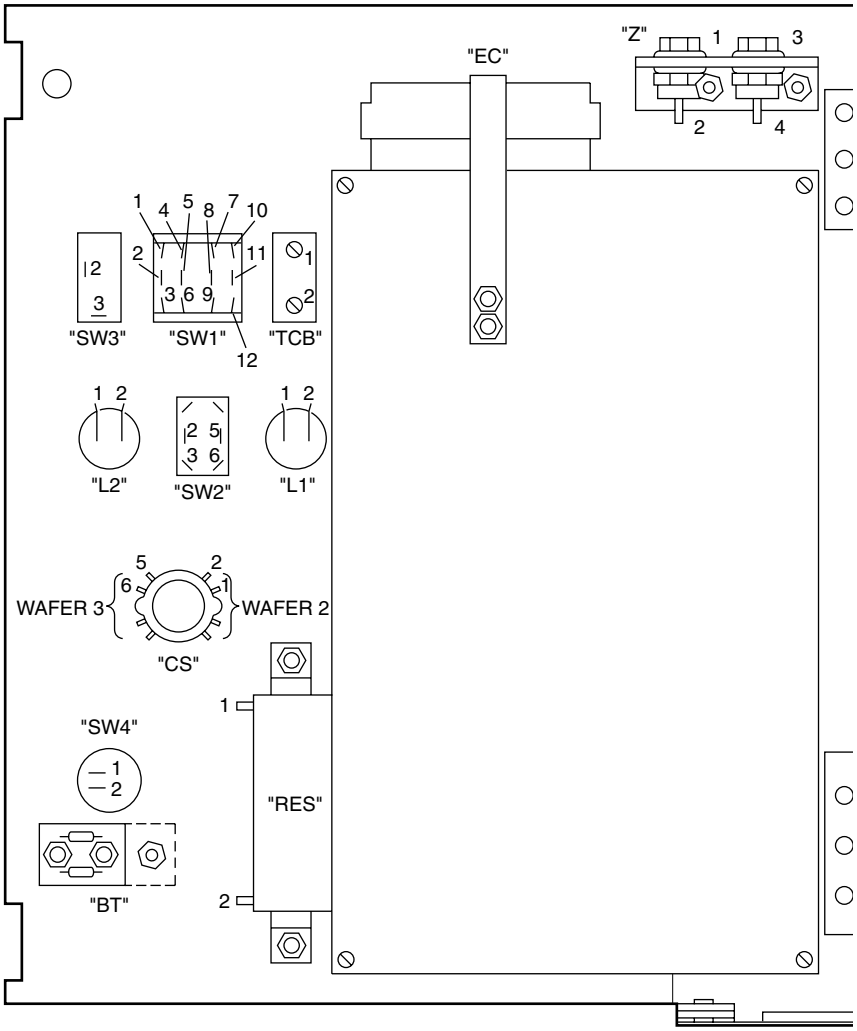
"RC" RECEPTACLE		
Pin	To	Color
A	SB-1	BRN
B	SB-2	RED
C	SB-3	ORG
D	SB-4	YEL
E	SB-5	GRN
F	SB-16	BLU
G	SB-14	GRN
H	SB-6	BLU
K	SB-7	VIO
L	SB-13	YEL
M	SB-12	ORG
N	SB-8	GRY
P	SB-11	RED
R	SB-9	WHT
S	SB-10	BRN

"BT" BATTERY TERMINALS		
Term	To	Color
1	Z-1	WHT
1	SW2-3	WHT
2	RES-2	BLK
3	SW4-2	RED
3	TB1-17	RED

"Z" ZENER DIODE ASSEMBLY		
Term	To	Color
1	EC-3	WHT
1	BT-1	WHT
2	Z-3	BLK
3	Z-2	BLK
4	EC-2	RED
4	TB2-10	RED

CABINET GROUND	
From	Color
Receptacle Mtg. Srew	GRN
SB-GND	GRN
Back Panel	GRN

"TCB" 5A CIRCUIT BREAKER		
Term	To	Color
1	TB1-6	RED
2	TB1-11	BRN



"BP" BATTERY PLUG		
Term	To	Color
+	BC-2	RED
—	RES-2	BLK

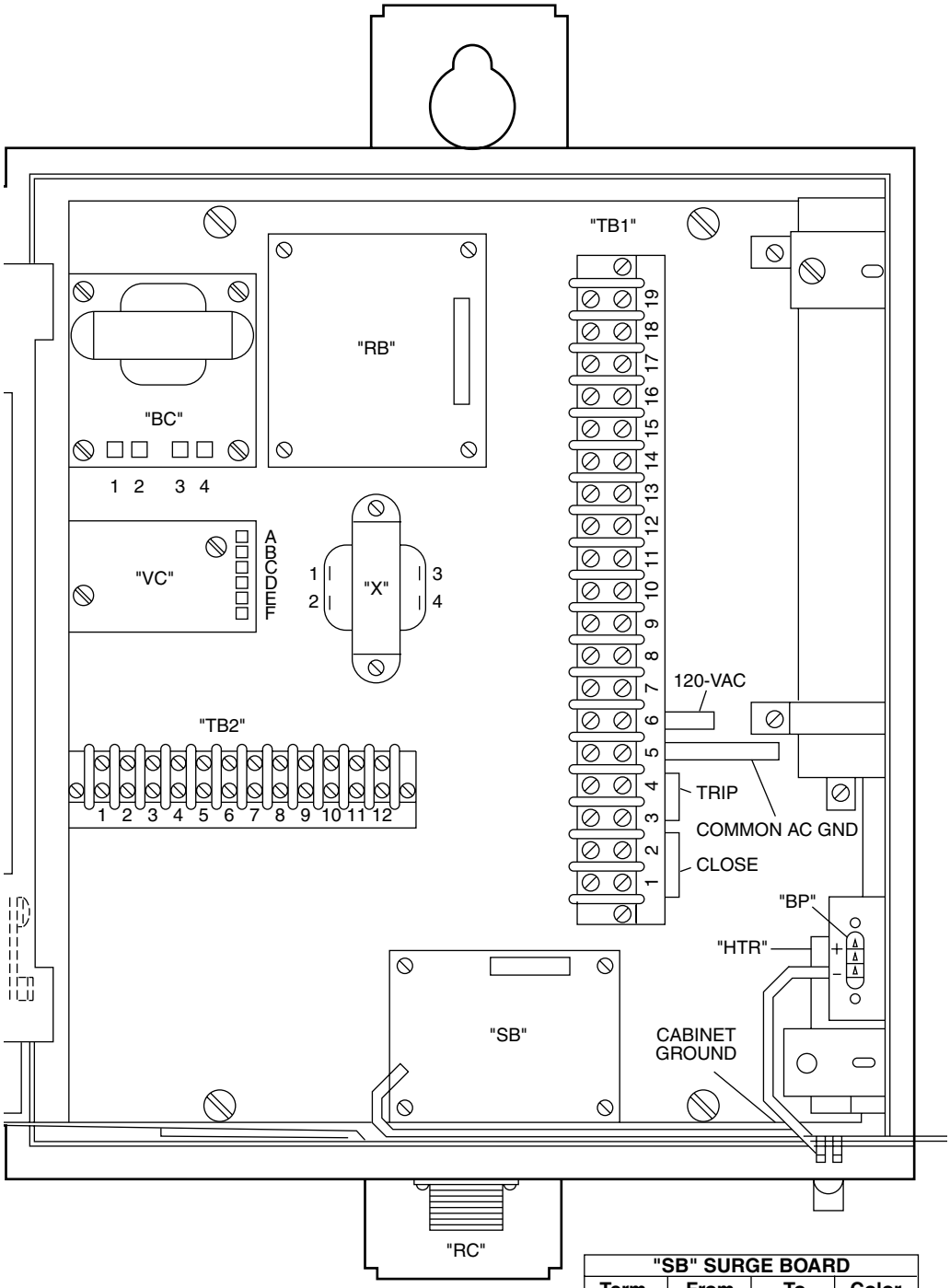
"X" TRANSFORMER 120/25 VAC		
Term	To	Color
1	VC-A	YEL
2	VC-B	GRN
3	BC-3	BRN
4	BC-4	WHT

"VC" VOLTAGE CHARGING BOARD		
Term	To	Color
A	X-1	YEL
B	X-2	GRN
C	GND	WHT
D	EC-18	ORG

"BC" BATTERY CHARGER		
Term	To	Color
1	TB2-2	WHT
1	BC-4	WHT
2	TB1-17	RED
2	BP(+)	RED
3	TB1-10	BRN
3	X-3	BRN
4	BC-1	WHT
4	X-4	WHT

"RB" RELAY BOARD		
Term	To	Color
1	TB1-5	BRN
2	TB1-10	RED
3	TB1-14	ORG
4	TB1-13	YEL
5	TB1-17	GRN
6	TB1-2	BLU
7	TB1-15	VIO
8	TB1-12	GRY
9	TB1-16	WHT
10	TB1-18	BLK
11	TB2-10	WHT /BRN
12		
13	TB1-19	WHT /RED

Figure 35.
Type GWC control interconnection diagram.



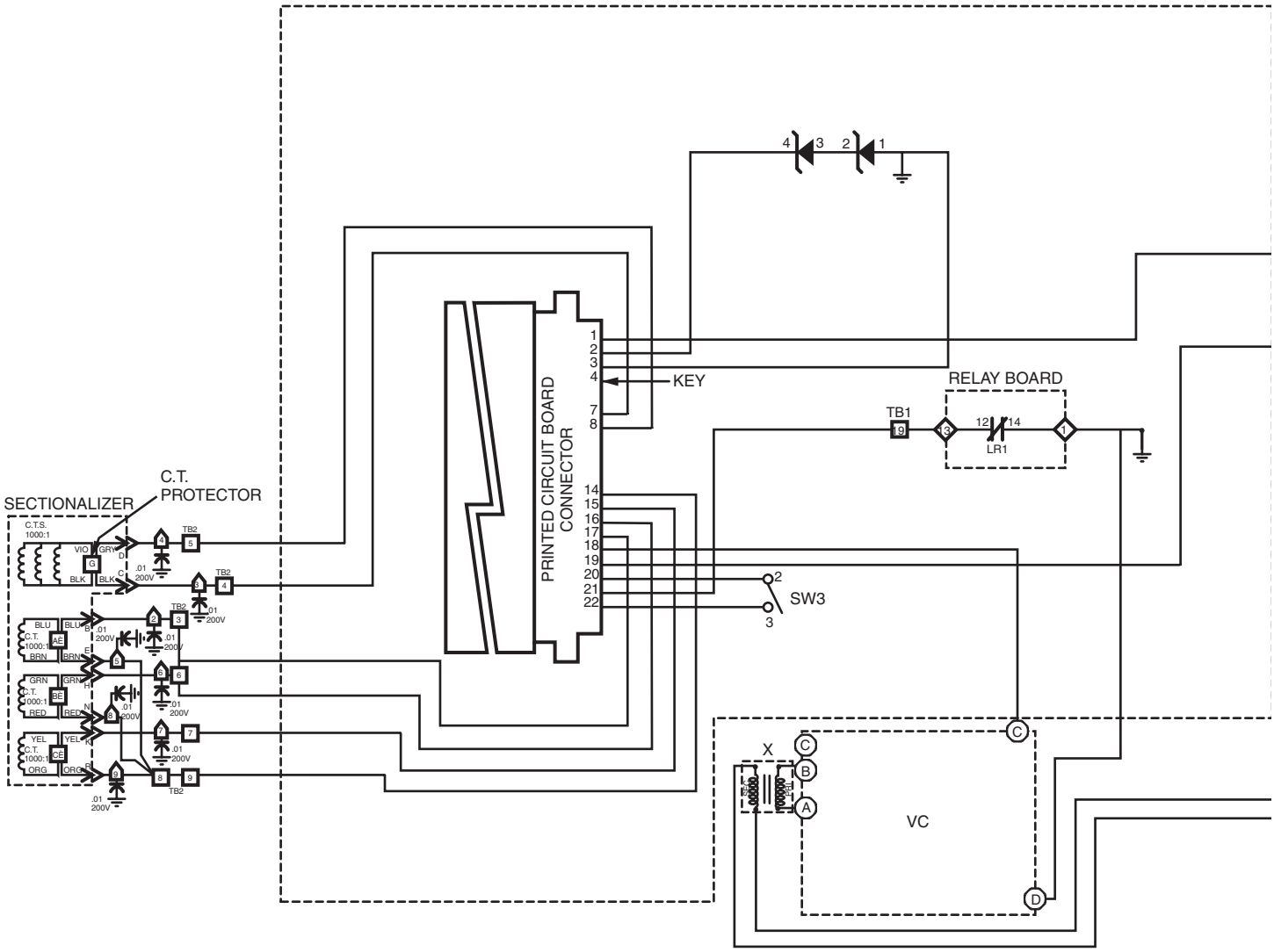
CUSTOMER CONNECTIONS		
Function	**Term**	**Customer Supply**
"SW1"	TB1-9 TB1-8 TB1-7	REMOTE ON-OFF STATUS
Motor, close Coil, Heater & Battery Charger	TB1-6 TB1-5	120 Vac Common AC GND
REMOTE TRIP	TB1-4 TB1-3	 TRIP
REMOTE CLOSE	TB1-2 TB1-1	 CLOSE

"TB2" TERMINAL BLOCK				
Color	**Bottom**	**Term**	**Top**	**Color**
BRN	SB-1	1	TB2-2	BLK
WHT	SW2-6	1	TB1-5	BRN
		2	TB2-1	BLK
BRN	HTR-2	2	BC-1	WHT
RED	SB-2	3	EC-17	YEL
ORG	SB-3	4	EC-7	WHT
YEL	SB-4	5	EC-8	GRY
BLU	SB-6	6	EC-16	GRN
VIO	SB-7	7	EC-15	BLU
GRY	SB-8	8	EC-14	VIO
		8	TB2-9	BLK
GRN	SB-5	9	TB2-8	BLK
WHT	SB-9	9		
RED	Z-4	10	RB-11	WHT /BRN

"TB1" TERMINAL BLOCK				
Color	**Left**	**Term**	**Right**	**Color**
BRN	EC-21	19	RB-13	WHT /RED
RED	EC-19	18	RB-10	BLK
RED	BT-3	17	RB-5	GRN
RED	BC-2	17		
WHT /BRN	CS-5	16	RB-9	WHT
BLK	TB1-4	15	RB-7	VIO
BLU	SB-16	15		
GRN	SB-14	14	RB-3	ORG
YEL	SB-13	13	RB-4	YEL
ORG	SB-12	12		
GRY	SW2-4	12	RB-8	GRY
BRN	TCB-2	11	TB1-10	BRN
BRN	HTR-1	11		
BRN	BC-3	10	RB-2	RED
BRN	SB-10	10	TB1-11	BRN
ORG	SW1-10	9		
YEL	SW1-11	8		
GRN	SW1-12	7		
RED	TCB-1	6		
RED	SB-11	6		
BRN	TB2-1	5		
BRN	RB-1	5		
BLK	CS-6	4		
BLK	TB1-15	4		
VIO	SW1-3	3		
WHT /RED	CS-2	2		
BLU	RB-6	2		
BLU	SW1-6	1		

"SB" SURGE BOARD			
Term	**From**	**To**	**Color**
1	RC-A	TB2-1	BRN
2	RC-B	TB2-3	RED
3	RC-C	TB2-4	ORG
4	RC-D	TB2-5	YEL
5	RC-E	TB2-9	GRN
6	RC-H	TB2-6	BLU
7	RC-K	TB2-7	VIO
8	RC-N	TB2-8	GRY
9	RC-R	TB2-9	WHT
10	RC-S	TB1-10	BRN
11	RC-P	TB1-6	RED
12	RC-M	TB1-12	ORG
13	RC-L	TB1-13	YEL
14	RC-G	TB1-14	GRN
15			
16	RC-F	TB1-15	BLU
GND		CAB. GND	GRN

"CS" PISTOL GRIP SWITCH			
Term	**Wafer**	**To**	**Color**
1	2	L1-1	RED
1	2	SW4-2	RED
2	2	TB1-2	WHT /RED
5	3	TB1-16	WHT /BRN
5	3	SW1-2	BRN
6	3	TB1-4	BLK
6	3	SW2-1	BLK

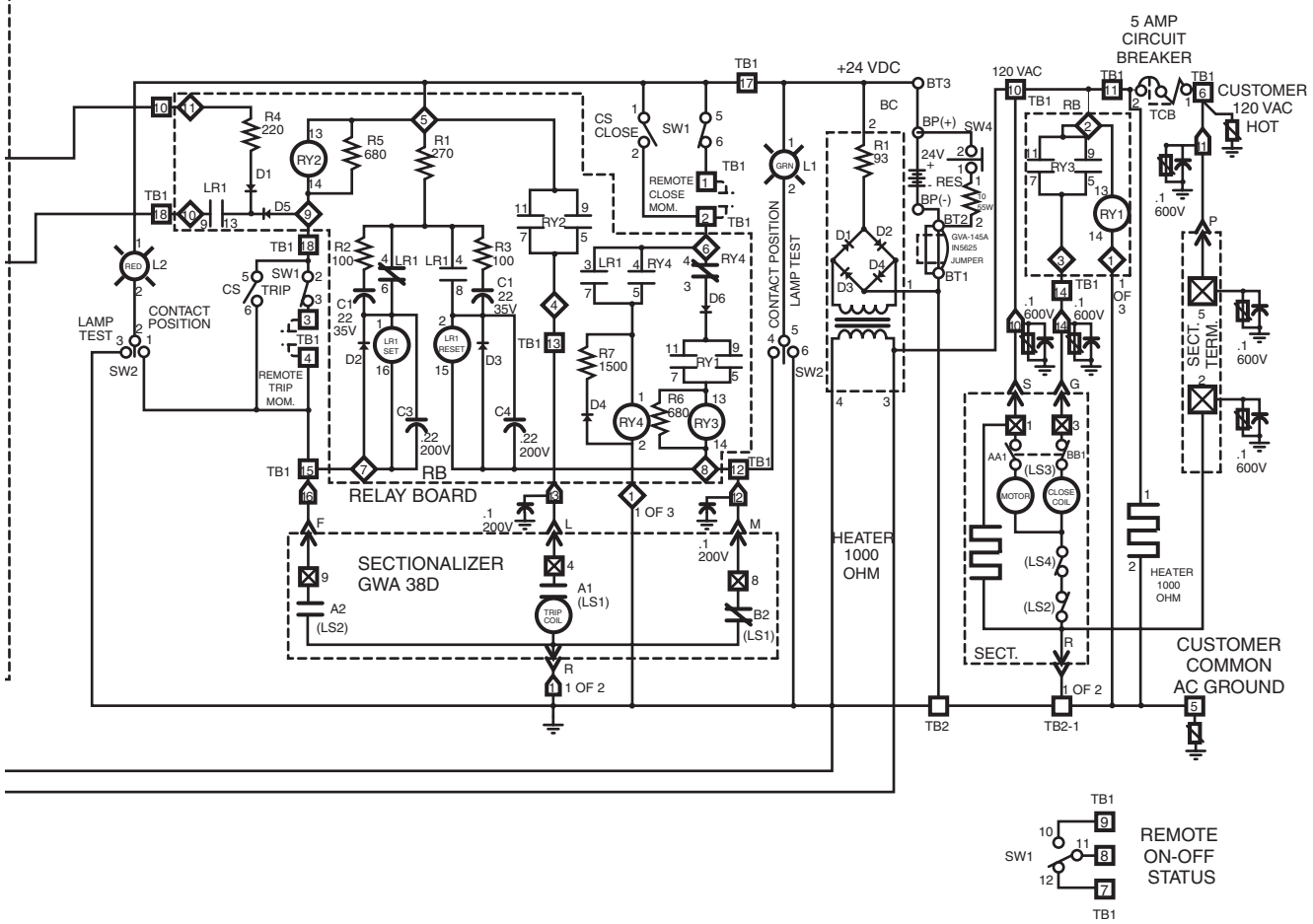


ITEM	DESCRIPTION
A1,A2	SWITCH CONTACTS (OPEN WHEN UNIT IS OPEN)
AA1	MOTOR CONTACTS (OPEN WHEN CLOSING SPRINGS CHARGED)
BB1	CLOSE COIL CONTACTS (CLOSED WHEN CLOSING SPRINGS CHARGED)
AA2	MANUAL TRIP SWITCH (OPEN WHEN TRIP HANDLE IS DOWN)
BC	BATTERY CHARGER (GVA-83B)
CS	CLOSE- TRIP SWITCH
L1	GREEN LIGHT (OPEN INDICATION)
L2	RED LIGHT (CLOSE INDICATION)
LR1*	LATCH RELAY, 12 VDC COIL, 4DPT (MAIN CONTACT POSITION INDICATOR)
RB	RELAY BOARD (GWA-138C)
B1,B2	SWITCH CONTACTS (CLOSED WHEN UNIT IS CLOSED)

ITEM	DESCRIPTION
RY1*	RELAY, 120 VAC COIL, DPDT 9120 VAC INDICATOR)
RY2*	RELAY, 24 VDC COIL, DPDT (TRIP RELAY)
RY3*	RELAY, 24 VDC COIL, DPDT (CLOSE RELAY)
RY4*	RELAY, 24 VDC COIL, SPDT (ANTI-PUMP RELAY)
SW1	REMOT ON-OFF SWITCH, 4PDT
SW2	LAMP TEST- CONTACT POSITION SWITCH DPDT (MOM)
SW3	ONE COUNT TO OPEN SWITCH, SPST
SW4	BATTERY TEST PUSHBUTTON SWITCH
TB1	TERMINAL BLOCK 19 POSITION (CONTROL)
TB2	TERMINAL BLOCK 10 POSITION (CONTROL)
VC	VOLTAGE CHARGING BOARD (GVA 174B)
X	TRANSFORMER, 120 VAC SEC, 25 VAC PRI

*INCLUDED IN "RB" RELAY BOARD

Figure 36.
Type GWCschenatic diagram.



NOTE:

1. LR1 LATCHING RELAY SHOWN WITH LR1/RESET COIL EXERGIZED LAST.
2. SECTIONALIZER SHOWN WITH CLOSING SPRINGS CHARGED.
3. ALL RESISTOR VALUES ARE IN OHMS 1/2 WATT CARBON ±5% UNLESS OTHERWISE INDICATED.
4. ALL DIODES ARE 1N4004 UNLESS OTHERWISE INDICATED.
5. ALL PNP TRANSISTORS ARE 2N2905 UNLESS OTHERWISE INDICATED.
6. ALL NPN TRANSISTORS ARE 2N2102 UNLESS OTHERWISE INDICATED.
7. CAPACITOR VALUES ARE IN MICROFARADS.
8. □ INDICATES CIRCUIT BOARD PUSH-ON TERMINALS (TEST POINTS).
9. ○ INDICATES EDGE CONNECTOR TERMINAL, EC.
10. ○ INDICATES TERMINAL ON VOLTAGE CHARGING CIRCUIT BOARD, VC.
11. ≫ INDICATES CABLE CONNECTIONS BETWEEN CONTROL AND SECTIONALIZER, RC.
12. ◇ INDICATES RELAY BOARD CONNECTOR TERMINAL, RB.
13. ⌂ INDICATES SURGE BOARD CONNECTOR TERMINAL, SB.
14. ⊠ INDICATES SECTIONALIZER TERMINAL BLOCK.

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