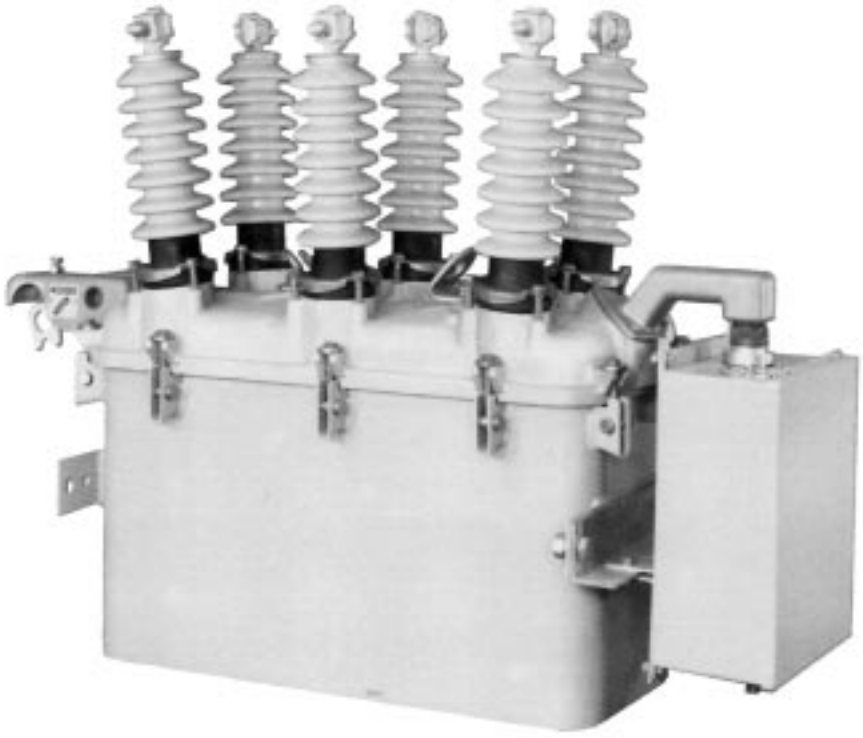
# Sectionalizers

COOPER Power Systems

## Types GN3E and GN3VE Maintenance Instructions

Service Information
S270-15-2



88957KMA

**Figure 1.**
**Type GN3E three-phase sectionalizer.**

**WARNING:** Do not operate this equipment out of oil. Operation out of oil will result in flashovers that will damage the equipment and may cause severe personal injury.

## 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 Statement Definitions

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.

**CAUTION:** Before maintaining or testing this equipment, carefully read and understand the contents of this manual. Improper maintenance or testing procedures can cause damage to the sectionalizer and possible mis-operation.

**WARNING:** Do not operate this equipment out of oil. Operation out of oil will result in flashovers that will damage the equipment and may cause severe personal injury.

**CAUTION:** Follow all approved safety practices when lifting and mounting the sectionalizer. Use the lifting strap on the sectionalizer head casting. Lift the load smoothly and do not allow the load to shift. Improper lifting may result in equipment damage.

**WARNING:** Be sure to follow all locally approved procedures and safety practices when removing the sectionalizer from service. Improper handling may result in severe personal injury and equipment damage.

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

### Additional Information

These instructions do not claim to cover all details or variations in the equipment, procedures, or process described, nor to provide directions for meeting every possible contingency during installation, operation, or maintenance. 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 S270-15-2* covers maintenance instructions for the Types GN3E and GN3VE 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.

# DESCRIPTION AND OPERATION

## 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 deenergize 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 7-1/2 minute 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 three and one-half amps 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.

The sectionalizer is also equipped with an inrush-current restraint feature which distinguishes between inrush currents and fault currents.

## Description of Operation

The Types GN3E and GN3VE sectionalizers open all three phases simultaneously. The unit consists of three sets of double-break open-type contacts operating in oil, connected to a common electronically controlled operating mechanism. The mechanism can also be operated manually. Manual control consists of a yellow handle, located under the sleet hood, which is used to close the sectionalizer and can also be used to manually open the sectionalizer.

For automatic tripping, a bi-stable actuator trip mechanism is operated from the electronic sensing-and-counting system. Bistable actuation is provided by a permanent magnet-and-coil assembly mounted on a spring loaded frame and linkage (Figure 2). When the sectionalizer is closed, the armature below the trip rod is held against the core by the magnetic force produced by the permanent magnet. In this state, a compressed spring is trying to pull the trip shaft away from the core. During the tripping operation, a silicon-controlled rectifier connects charged capacitors across the coil of the magnetic tripping assembly. The counterflux produced by the discharge of the capacitors is sufficient to allow the spring to override the magnetic force and operate the trip linkage; resetting the assembly for the next opening operation.

88970KMA

**Figure 2.**
**Bi-stable actuator.**

## Electronic Control Circuit

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

Bushing current transformers (BCTs) sense the current flowing through the sectionalizer. Three transformers connected in a wye (star) configuration sense phase currents. Three additional BCTs, connected in parallel, sense the ground- (earth-) or zero sequence current. By selecting the proper plug-in resistors, these signals can be rectified and adjusted to the desired minimum actuating-current level.

To generate and register a count pulse, a current above the preset minimum actuating level must be flowing through the sectionalizer (downline fault). 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 completes the discharge path for the trip-energy-storage capacitors through the coil of the low-energy tripper which, in turn, trips the sectionalizer mechanism to open the sectionalizer contacts.

The pulse counter has a 60-second memory for each count. Thus, the preset number of counts must be registered within one minute for the sectionalizer to open. The control will reset (completely forget the registered count pulses that do not reach the preset number) within 7-1/2 minutes.

Types GN3E and GN3VE electronic sectionalizers contain a count-restraint feature. This feature prevents the sectionalizer from counting fault currents interrupted by a downline protective device. The current restraint will block the generation of a count pulse as long as at least 3-1/2 amps of load current are flowing through the sectionalizer after the fault current disappears.

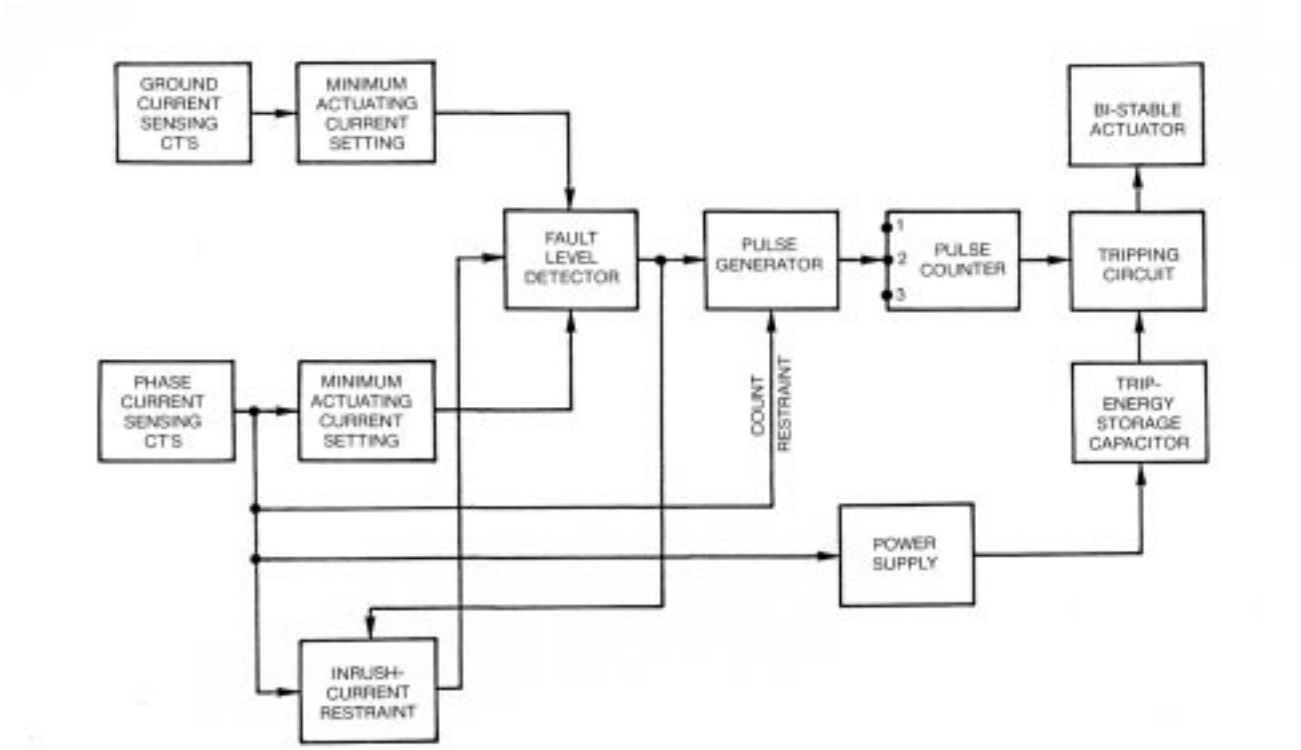



**Figure 3.**
**Functional block diagram of electronic control for Types GN3E and GN3VE sectionalizers.**

The sectionalizer 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 its normal manner. 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* after current flow through the sectionalizer is restored. After this time, the sectionalizer control returns to 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 multi-grounded-wye systems, 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 twice 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 the Z selected.

The control is powered by the load and/or fault current flowing through the sectionalizer. This also charges the trip-energy-storage capacitors. In most cases, the charging time of the capacitors is less than the clearing time of the Cooper Power Systems three-phase reclosers with which the GN3E and GN3VE sectionalizers are specifically intended to coordinate, see Figure 5.

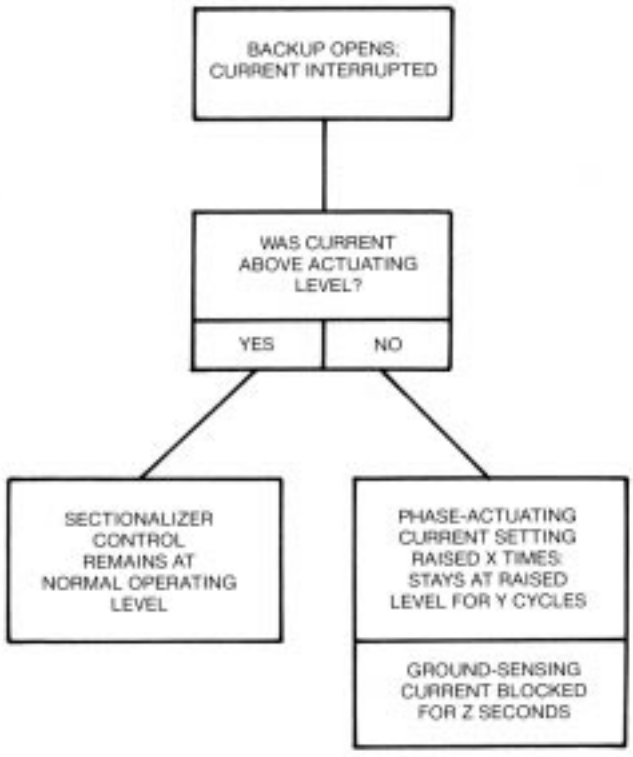



**Figure 4.**
**Logic diagram for inrush-current-restraint feature.**

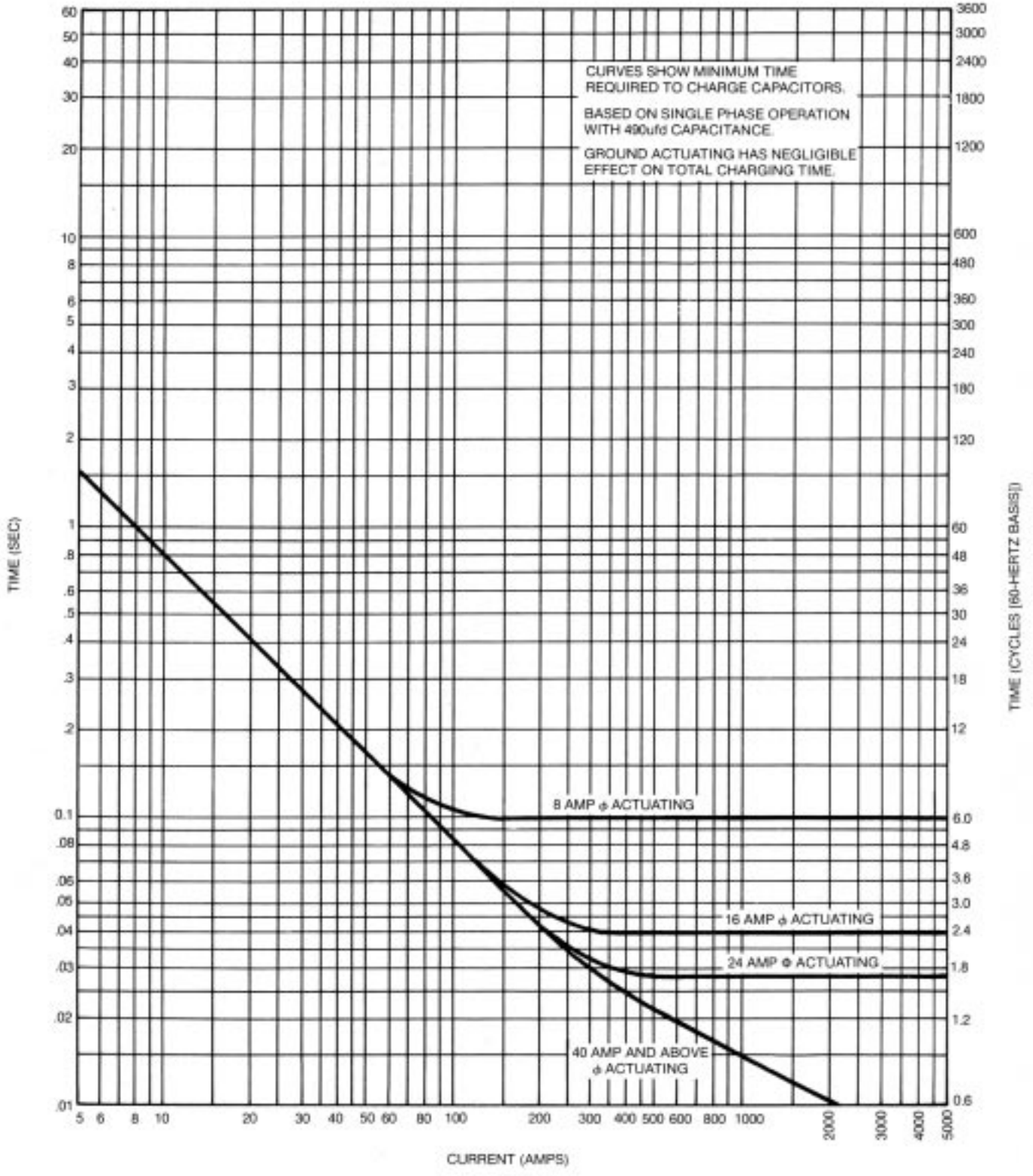



**Figure 5.**
**Capacitor charging time.**

# RATINGS

## Control Data

| | |
|---|---|
| Phase-minimum-actuating current (amps) | 16 24, 40, 56, 80, 112,160, 224, 256, 296, 320 |
| Ground-minimum-actuating current (amps) | 3.5, 7, 16, 28, 40, 56, 80, 112, 160, 224, 320, BLOCK |
| Number of counts-to-open | 1, 2, 3 |
| Count reset (minutes) | 7-1/2 |
| 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

| Description | GN3E | GN3VE |
|---|---|---|
| Nominal voltage (kv) | 15.5 | 27 |
| Rated maximum voltage (kv) | 14.4 | 24.9 |
| Impulse withstand 1.2x50 microsecond wave (BIL) (kv) | 110 | 125 |
| 60 hertz withstand | | |
| Dry 1 minute (kv) | 50 | 60 |
| Wet 10 seconds (kv) | 45 | 50 |
| Continuous current rating (amps) | 200 | 200 |
| Rated symmetrical interrupting current (amps rms) | 440 | 440 |
| Rated making current, asymmetrical (amps rms) | 9000 | 9000 |
| Short-time ratings (amps rms) | | |
| 10-seconds symmetrical | 2600 | 2600 |
| 1-second symmetrical | 5700 | 5700 |
| Momentary maximum, asymmetrical (amps rms) | 9000 | 9000 |
| Creepage distance, standard bushing (in.) | 10-7/8 | 17 |

# MAINTENANCE

## Frequency of Maintenance

Because sectionalizers are applied under widely varying operating and climatic 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:

## Periodic Inspection and Maintenance

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

1. Bypass and remove sectionalizer from service.
2. Inspect external components.
   A. Check for broken or cracked bushings, paint scratches, and other mechanical damage.
   B. Close and trip the sectionalizer manually several times to check the manual operation. Leave sectionalizer in tripped position.
3. Loosen bolts that secure head casting and remove mechanism from tank. (If tank and head do not separate easily, break gasket seal by carefully prying them apart.) Allow oil to drain off mechanism.
4. Inspect contacts for erosion.
   A. Slight pitting and discoloration can be dressed with crocus cloth.
   B. Replace both the moving and the 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 internal mechanism with clean, dry transformer oil.

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

6. Replace head gasket.
7. Inspect tank liners.
   A. Soft or spongy areas indicate that water has been absorbed. Replace liners if this condition exists.
   B. The plastic liner used in the Type GN3VE sectionalizer can be wiped clean with a clean, lint-free cloth and clean, dry, transformer oil.
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.
9. Inspect circuit components attached to the recloser 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.
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 1 in. from top of tank, with mechanism removed. Capacity is approximately 13 gallons. See Oil Condition following.
11. Replace mechanism into tank.
    A. Install head bolts and tighten evenly to 11-16 ft-lbs torque.
12. Manually close and trip the unit several times to check for proper operation of mechnism.
13. Perform an insulation withstand test (see page 7 for procedure).

## 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 such 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 75% of the rated low-frequency withstand voltage (37.5 kv test voltage for Type GN3E and 45 kv test voltage for Type GN3VE).

TEST 1:
**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:
**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:
**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.

A. 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.

B. If the sectionalizer fails the closed-contacts tests (Tests 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.

## 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:

Figure 6 shows the sectionalizer inrush restraint circuit board/operator control panel, refer to it to locate the various jumpers and resistor plugs that are mentioned in the testing procedure.

### Test Circuit and Equipment

A suggested test circuit is shown in Figure 7. 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.

88969KMA

**Figure 6.**
**Sectionalizer control panel.**

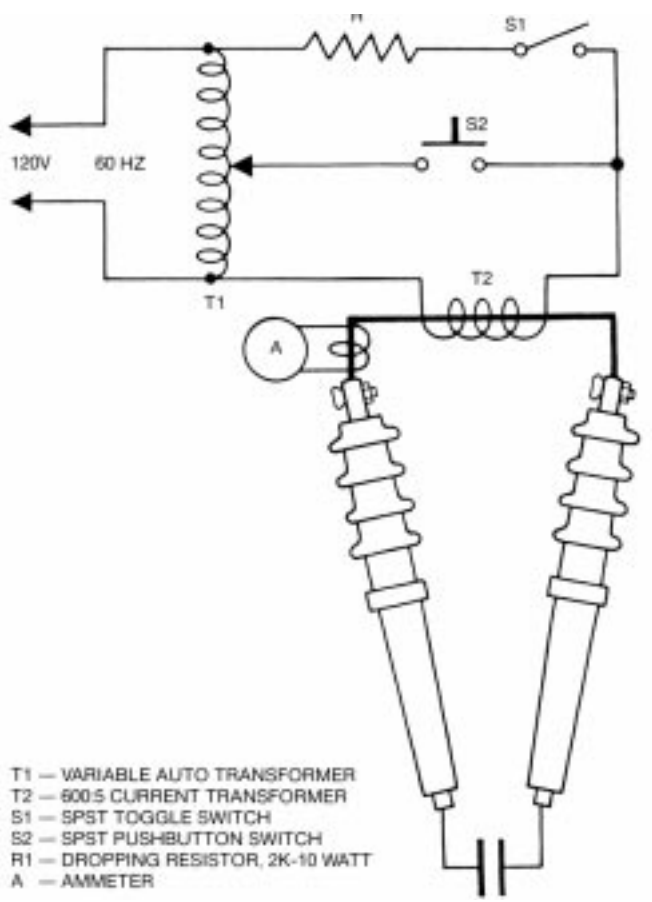



**Figure 7.**
**Test circuit schematic.**

# 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. Install a "BLOCK" actuating current resistor plug (KGN124E000) into the ground resistor socket to disable the ground sensing circuit.
2. Program sectionalizer for one count-to-open by moving the COUNTS-TO-OPEN jumper wire to the "1" position.
3. Manually close sectionalizer.
4. With test circuit connected to phase A and S1 open, hold S2 closed and slowly raise 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 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. Upon completion of this portion of the test, remove the block resistor plug from the ground actuating socket and replace the original resistor plug.

#### Ground Minimum Actuating Current

To prevent the possibility of a false count, the phase sensing portion of the sectionalizer control circuit must have an actuating current resistor plug that is at minimum two times the current rating of the installed ground actuating current plug. The following procedure can be used:

1. Check that the phase actuating current resistor plug is at minimum two times the value of the ground actuating current resistor plug.
2. Check that sectionalizer control is set for one count-to-open.
3. Manually close sectionalizer.
4. With the test circuit connected to phase A and S1 open, hold S2 closed and slowly raise 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 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.

### COUNT RESTRAINT

The count restraint feature prevents erroneous counts of overcurrents interrupted by downline protective devices by blocking the counting operation as long as a minimum of three and one-half amp of uninterrupted line current flows through the sectionalizer.

The operation of the count restraint can be verified by superimposing an interruptable 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. Install a "BLOCK" actuating current resistor plug (KGN124E000) into the ground resistor socket to disable the ground sensing circuit.
2. Check that sectionalizer is set for one count-to-open.
3. Manually close sectionalizer.
4. With test circuit connected to phase A and S1 closed (to simulate a constant load current of approximately six amps), hold S2 closed and raise 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 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<br>Sectionalizer Must Not Count Below (amps) | Column B<br>Sectionalizer Must Count At (amps) |
|---|---|---|
| 3.5 | 3 | 4 |
| 7 | 6.3 | 7.7 |
| 16 | 14.4 | 17.6 |
| 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 |

### NUMBER OF COUNTS-TO-OPEN

The number of counts-to-open can be verified by interrupting an overcurrent through the sectionalizer the 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. Install a "BLOCK" actuating current resistor plug (KGN124E000) into the ground resistor socket to disable the ground sensing circuit.
2. Program sectionalizer for three counts-to-open by moving the COUNTS-TO-OPEN jumper wire to the "3" position.
3. Manually close sectionalizer.
4. With test circuit connected to phase A and S1 open, close S2 and raise 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 2 counts-to-open setting, set the COUNTS-TO-OPEN SELECTOR jumper to the "2" position 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 without interruption. All count retention is lost in a maximum of seven and one-half minutes.

The pulse counter has a 60-second memory for each count. Thus, the preset number of counts must be registered within one minute for the sectionalizer to open. The control will reset (completely forget the registered count pulses that do not reach the preset number) within 7-1/2 minutes.

Operation 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 time. 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. Install a "BLOCK" actuating current resistor plug (KGN124E000) into the ground resistor socket to disable the ground sensing circuit.
2. Program sectionalizer control for 2 COUNTS-TO-OPEN.
3. Manually close sectionalizer.
4. With test circuit connected to phase A and S1 open, close S2 and raise 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 approximately 30 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 more than 7 minutes.
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).

**Phase Inrush-Current Restraint Testing**

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

1. Install a "BLOCK" actuating current resistor plug (KGN124E000) into the ground resistor socket to disable the ground sensing circuit.
2. Set the sectionalizer for 1 count to open by moving the COUNTS-TO-OPEN jumper lead to the "1" position.
3. Move the PHASE INRUSH RESET jumper lead to the TEST position.
4. Manually close sectionalizer.
5. With test circuit connected to phase A and S1 open, hold S2 closed and raise 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 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 phase inrush restraint feature is operating.
9. Reset inrush restraint as follows:
   A. Return the PHASE INRUSH RESET jumper lead to any finite value.
   B. Hold S2 closed for several seconds.
   C. Return the PHASE INRUSH RESET jumper lead to the TEST position.
10. Again hold S2 closed and raise 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 more than twice the appropriate 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 slightly 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. Manually close the sectionalizer.
18. Repeat step 15 to simulate a fault condition.
19. ReleaseS2. The sectionalizer should open verifying that the inrush restraint feature has not been activated.
20. Install the original ground current resistor plug and return the counts-to-open and phase inrush reset jumpers to their normal operating positions.

**Ground Inrush-Current Restraint Testing**

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

1. Set the sectionalizer for 1 count-to-open by moving the COUNTS-TO-OPEN jumper lead to the "1" position.
2. Set the duration of ground current sensing block to 5.0 seconds by moving the GROUND INRUSH RESET jumper lead to Terminal Tab 5.0.
3. Manually close the sectionalizer.
4. With test circuit connected to Phase A, and S1 open, hold S2 closed and raise test current to slightly below the appropriate value shown in Column A of Table 1.
5. Hold S2 closed for approximately 5 seconds to insure stabilization of the inrush restraint circuits.
6. Release S2 to simulate a backup opening with only load current flowing.
7. Close S2 and adjust the test current to any value greater than the appropriate value shown in Column B of Table 1, releasing S2 in less than 5 seconds. The sectionalizer should not open, verifying operation of the inrush-current restraint.

8. Close S2 for approximately 7 seconds and release, simulating a backup opening due to fault current. The sectionalizer should count the current interruption and open.
9. Manually close the sectionalizer.
10. Close and release S2 in less than 5 seconds. The sectionalizer will count the current interruption and open. The inrush current restraint should not be activated since fault current was present during the previous current interruption.
11. Reset the counts-to-open and the ground inrush reset to their normal operating positions after testing is complete.

## Post-Test Procedures

After testing is complete, make sure all control settings are programmed to the operating parameters as originally specified.

## Current Transformers

Three 800:1 phase-current sensing transformers are mounted on the right-side bushings and three 2000:1 ground-current sensing transformers are mounted on the left-side bushings, under the head of the sectionalizer.

The secondaries of the phase sensing transformers are wired in a “wye” configuration and are connected to terminals 9-10-11-12 of the terminal board, below the programming circuit board. This terminal board is located under the sectionalizer head casting, untanking and mechanism removal will be necessary.

The secondaries of the ground sensing transformers are wired in parallel and are connected to terminals 7-8 of the terminal block (Figure 9).

To check current transformers for proper output proceed as follows:

1. Connect bushings of all three phases in series as shown in Figure 8.

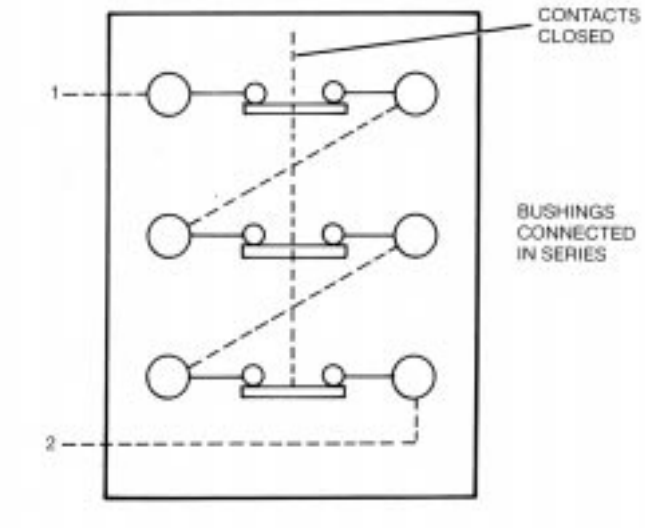



**Figure 8.**
**Test circuit for checking bushing current transformers.**

2. Disconnect, and tag, the three white phase-current transformer leads from terminals 10, 11, and 12 and connect all three leads to one side of a 0-500 milliammeter. Disconnect black lead from terminal 9 and connect it to other side of meter.
3. Short circuit ground-current transformer leads at terminals 7 and 8.
4. Manually close sectionalizer and energize the test circuit by connecting a 100-amp low-voltage ac current source to points 1 and 2 in Figure 8.
5. For proper output the milliammeter should indicate 375 ± 10% ma.
   A. If meter reads 250 ma—one current transformer is open.
   B. If meter reads 125 ma—one current transformer is reversed.
   C. If meter reads 0 ma—one or more current transformers are shorted.
6. With leads 7 and 8 connected to the milliammeter and leads 9 10, 11 and 12 shorted the output of the ground current transformers should be 150 + 10% ma.
   A. If meter reads 100 ma—one current transformer is open.
   B. If meter reads 50 ma—one current transformer is reversed.
   C. If meter reads 0 ma—one or more current transformers are shorted.

If proper output is not obtained check individual transformers for continuity and resistance; replace faulty current transformers.

## 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 9 shows the interconnection between the various electrical components of the sectionalizer.
2. Check the toggle and associated linkage and springs for mechanical binding by closing the sectionalizer and tripping it manually several times.

**For Schematic diagram see Figure 9 in document S270152a.pdf**

**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 bi-stable actuator assembly may be malfunctioning. Replace damaged or inoperative components as required.

A. Check the bi-stable actuator assembly to see if it has—or has not—released.

NOTE: There should be approximately 1/16-in. clearance between reset lever and roller, when the unit is open. There should also be approximately 1/16-in. clearance between the trip pin and the toggle latch assembly, when the unit is closed (Figure 10).

(1) If the bi-stable actuator assembly actuated the toggle assembly should be released. If the malfunction is the result of mechanical binding of the toggle or the associated linkages check the engagement surface of the toggle to make sure there are no rough spots or burrs. Repair as required.

(2) If the bi-stable actuator assembly did not actuate, check the dc resistance of the trip coil:

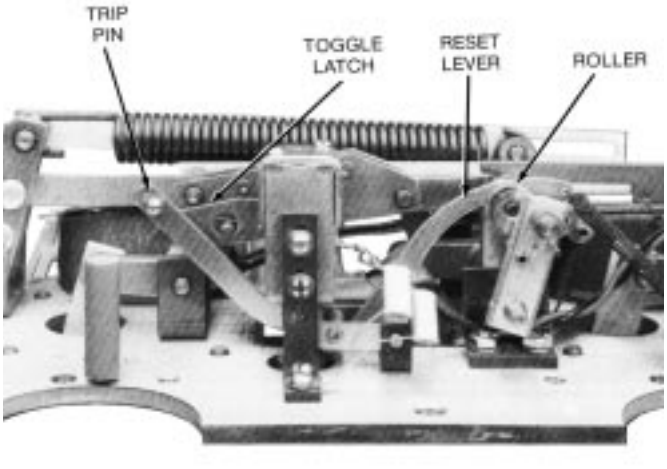
With the red and the black leads removed from the control circuit board the resistance should measure approximately 6.5 ohms.

If the bi-stable actuator assembly is damaged or inoperative it must be replaced. During installation be sure that there is approximately 1/16-in. clearance between the reset lever and the roller, when unit is open (Figure 10). There should also be approximately 1/16-in. clearance between the trip pin and the toggle latch assembly, when the unit is closed.

(3) If the bi-stable actuator assembly appears to be operative check the Zener diode, mounted on the mechanism frame. If the Zener diode is damaged replace it.

NOTE: The dc voltage across the Zener diode will be approximately 16 Vdc, when a single phase load current of 3-1/2 amps is flowing through the sectionalizer. A dc voltage of approximately 18 Vdc will be present when a three phase load current of 3-1/2 amps is flowing through the sectionalizer.

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




88963KMA

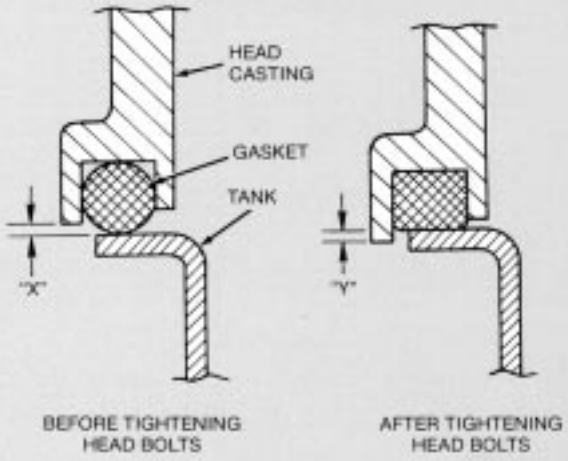
**Figure 10.**
**Bi-stable actuator and linkage.**

## 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.

**CAUTION:** When reinstalling the sectionalizer mechanism into the tank, make sure that the head casting is centered on the flange of the tank before tightening the head bolts. As the head bolts are tightened, the gasket is compressed. The clearance (X) between the outer lip of the casting and tank flange becomes an interference (Y) when the head bolts are torqued to their required 11 to 16 ft-lbs.

If the casting is not centered, the outer lip of the casting will hang up on the edge of the flange, preventing a positive seal and possibly cracking the casting. If a positive seal is not made, water and other contaminants may enter the sectionalizer tank.




## 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.

### TYPE GN3E BUSHINGS

A damaged bushing can be replaced with the sectionalizer either tanked or untanked, depending upon the circumstances of the damage.

- If the bushing porcelain is accidentally chipped during installation of the sectionalizer, and it is obvious that no other damage has occurred, the bushing porcelain only can be replaced without untanking.
- If the bushing has been damaged while in service or storage, the sectionalizer must be untanked. Water or other contaminants may have entered the tank (test the oil) the bushing lead may be damaged (either mechanically or electrical flashover), or pieces of porcelain may have fallen into the tank.

**Replacing the Bushing Porcelain with the Sectionalizer Tanked**

Refer to Figures 11 and 12 and proceed as follows:

1. Unscrew the bushing terminal and discard the terminal gasket.
2. Remove the three hex head capscrews and clamps that secure the bushing to the head and lift out the porcelain.
3. Remove and discard the lower bushing gasket.

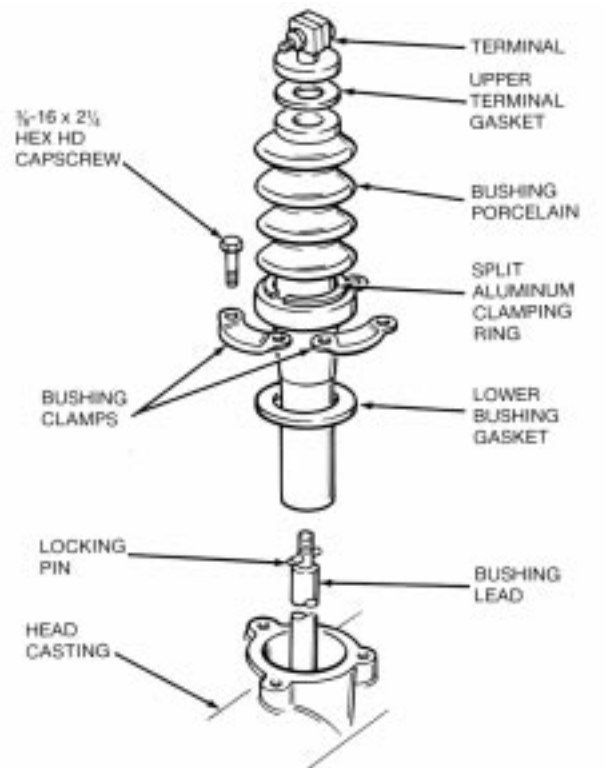



**Figure 11.**
**Replacing bushing ceramic with sectionalizer tanked, Type GN3E.**

4. Twist off the split aluminum clamping ring from the old porcelain. If it is in good condition install it on the new porcelain; replace with new ring if damaged.

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

5. Using a new gasket, install the new porcelain over the bushing rod and into the head. Make sure the roll pin on the end of the rod is seated into the locking groove at the top of the porcelain.
6. Position the clamping ring with the split centered between two clamping bolts.
7. Reassemble the bushing to the head casting with the bushing clamps. Tighten the clamping bolts evenly, a little at a time, to a torque of 6-10 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.

8. Install a new terminal gasket and reassemble the terminal to the bushing rod with 20-25 ft-lbs of torque.

   NOTE: Apply a very small amount of petroleum jelly to the knurled surface of the inside face of the terminal before assembling the terminal to the bushing rod.

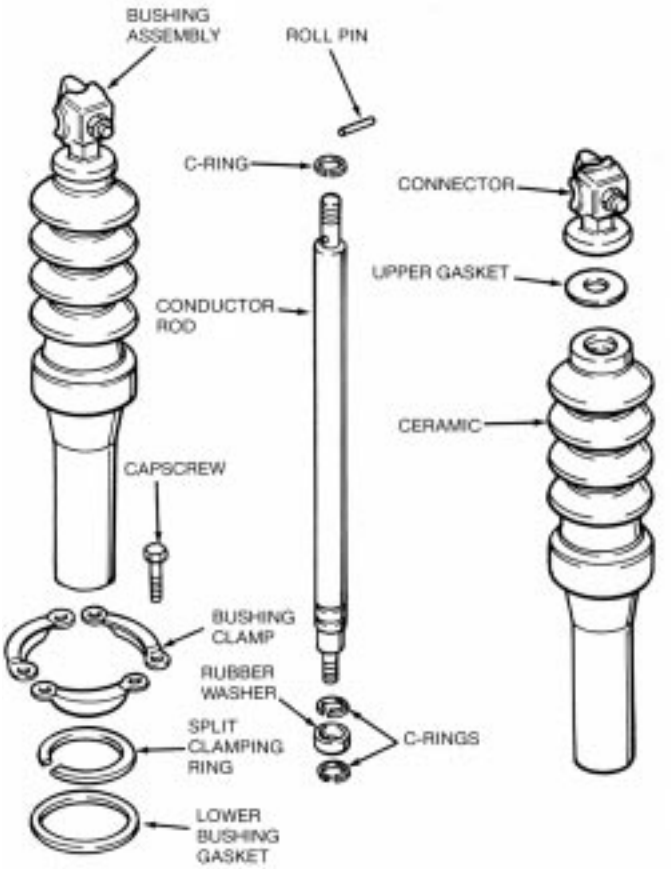



**Figure 12.**
**Bushing parts, Type GN3E.**

**Replacing the Bushing with the Sectionalizer Untanked**

Refer to Figure 12 and proceed as follows:

1. Disconnect the appropriate bushing lead from the bottom end of the bushing rod.
2. Remove the three hex head capscrews and clamps that secure the bushing to the head and lift out the complete bushing assembly.
3. Remove and discard the lower bushing gasket.
4. The complete bushing assembly can be replaced or new porcelain only can be installed depending upon the extent of damage. If new porcelain only is to be installed, proceed as follows:
   A. Unscrew the bushing terminal and withdraw the rod from the bottom of the porcelain; discard the terminal gasket.
   B. Insert the rod assembly all the way into the new porcelain, making sure the roll pin is seated in the locking groove in the top of the bushing.
   C. Assemble the terminal to the bushing rod using a new terminal gasket; tighten to a torque of 20-25 ft-lbs.

      NOTE: Apply a very small amount of petroleum jelly to the knurled surface of the inside face of the terminal before assembling the terminal to the bushing rod.

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 the ring if damaged.

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

6. Install the bushing assembly (new or reworked) into the head using a new lower bushing gasket. Position the bushing with the stud-end of the terminal pointing outward.
7. Position the clamping ring with the split centered between two clamping bolts.
8. Reassemble the bushing to the head casting. Tighten the clamping bolts evenly, a little at a time, to a torque of 6-10 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.

9. Reconnect the lead to the bushing rod.

**TYPE GN3VE BUSHINGS**

The bushings used in the Type GN3VE sectionalizer are oil-filled. The special fixtures and procedures required to assemble these bushings is beyond the scope of normal shop maintenance repair. Therefore if a Type GN3VE bushing is in any way damaged, the complete bushing assembly must be replaced.

Refer to Figure 13 and proceed as follows:

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

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

5. Install the new bushing assembly into the head using a new lower bushing gasket. Position the bushing with the stud-end of the terminal pointing outward.
6. Position the clamping ring with the split centered between two clamping bolts.
7. Reassemble the bushing to the head casting. Tighten the clamping bolts evenly, a little at a time, to a torque of 6-10 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.

8. Reconnect the lead to the bushing rod.

## Current Transformer Replacement

To replace a damaged or mis-operating current transformer remove the mechanism from the head (see Removing Mechanism from Head topic) and proceed as follows:

1. Cut black and white leads close to the faulty transformer.
2. Lift current transformer off bushing or remove from mechanism assembly as appropriate.
3. Install replacement transformer with its polarity mark (black dot near white lead) positioned to match the other two transformers.
4. Cut transformer leads to proper length and slide heat shrinkable tubing over end of leads.
5. Splice existing wiring. Solder connections with rosin-core solder.
6. Heat shrink tubing to seal splice joint.

## Contacts

The Types GN3E and GN3VE sectionalizers use an open-type, double-break contact arrangement. When contact replacement is necessary the entire contact assembly or contacts only can be installed.

**STATIONARY CONTACT REPLACEMENT**

To replace the stationary contacts proceed as follows, refer to Figure 14:

1. Disconnect bushing leads from contact studs and pull leads away.
2. Remove contact retainers, stationary contact assemblies and contact rollers.
3. Install new contact assemblies, contact rollers and retainers.
4. Connect bushing leads.
5. Check contact adjustment, refer to Adjustments.

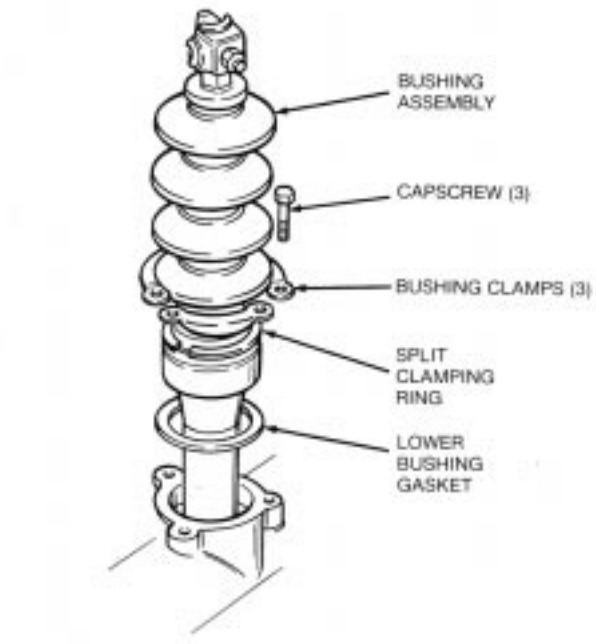
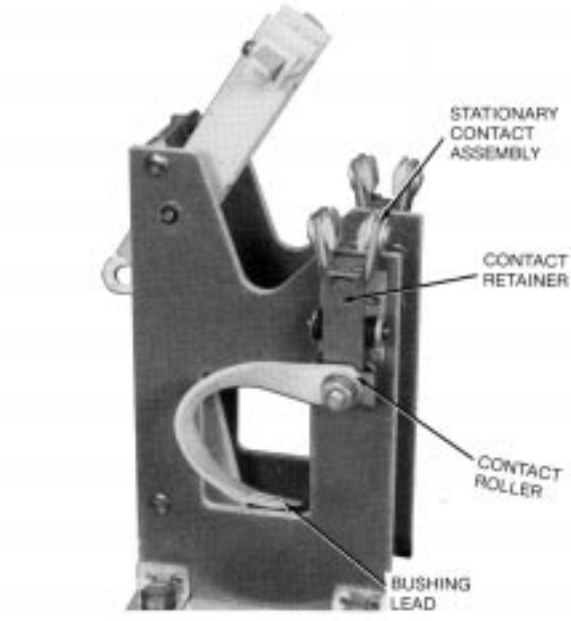



**Figure 13.**
**Bushing removal, Type GN3VE.**




88968KMA

**Figure 14.**
**Stationary contact.**

**MOVING CONTACT BAR REPLACEMENT**

NOTE: The moving contact arm assembly on Type GN3E sectionalizers after serial number 4669 and GN3VE sectionalizers after serial number 1000 can be replaced individually. Sectionalizers prior to these serial numbers will require replacement of the entire contact box assembly.

To replace the moving contact bar on Type GN3E sectionalizers before serial number 4670 and GN3VE sectionalizer before serial number 1000 refer to Figure 15 and proceed as follows:

1. Remove screw, lockwasher, retaining clip and spacer.
2. Remove self-tapping screws.
3. Remove contact bar and insulating spacers.
4. Hold the center insulating spacer in position and slide new contact bar into place.
5. Install retaining clip and spacer, secure with lockwasher and screw.
6. Slide outside insulators into position.
7. Apply a drop of Loctite #242 to each insulator retaining screw and tighten firmly.
8. Check contact adjustment, refer to Adjustment following.

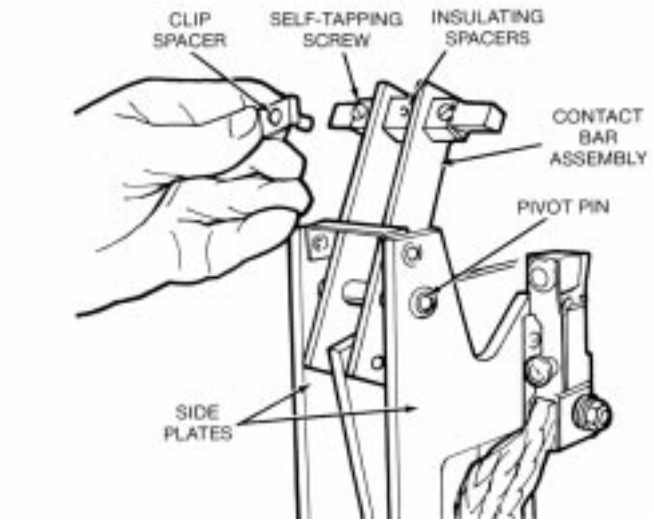
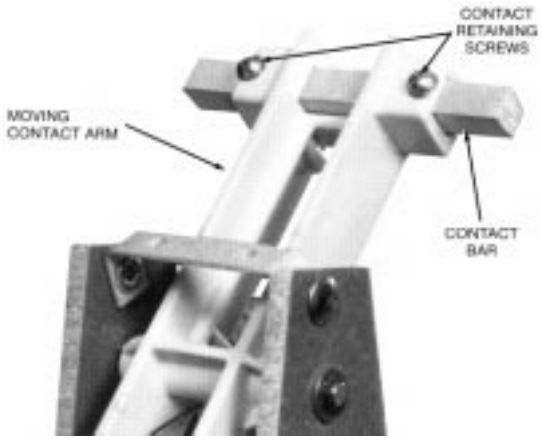



**Figure 15.**
**Moving contact bar.**

To replace the moving contact bar on Type GN3E sectionalizers after serial number 4669 and GN3VE sectionalizers after serial number 999 refer to Figure 16 and proceed as follows:




88956KMA

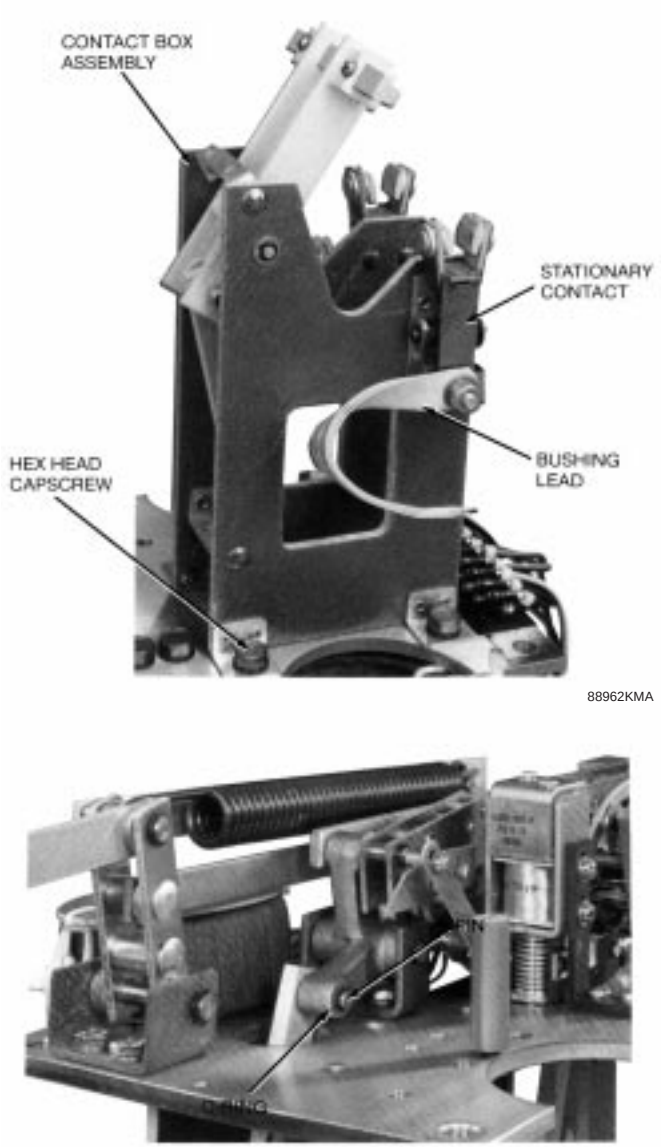
**Figure 16.**
**Moving contact bar.**

1. Remove two screws and lockwashers that secure moving contact bar to moving contact arm assembly.
2. Slide moving contact bar from arm assembly.
3. Install new contact bar.
4. Apply a drop of Loctite #242 to each screw and tighten firmly, until teeth of lockwasher imbed into moving contact arm assembly.
5. Check contact adjustment, refer to Adjustments following.

**CONTACT ASSEMBLY REPLACEMENT**

To replace the contact box assembly refer to Figure 17 and proceed as follows:

1. Remove mechanism from head, refer to Removing Mechanism from Head topic following procedure.
2. Remove bushing leads from stationary contacts.
3. Remove C-ring and pin to free operating link.
4. Remove hex head capscrews and contact box assembly.
5. Place replacement contact box assembly into position, secure with lockwasher and hex head capscrew removed.
6. Secure operating link to bell crank with pin and C-ring.
7. Install stationary contacts and attach bushing leads.
8. Check contact adjustment, refer to Adjustments following.




88962KMA

**Figure 17.**
**Contact box replacement.**

88958KMA

## Removing Mechanism from Head

When removing sectionalizer mechanism from head the following procedure may be used:

1. Remove inrush restraint cabinet and receptacle assembly.
2. Remove, and tag, receptacle leads from terminal board and control circuit board.
3. Remove and tag current transformer leads from terminals 9 through 12 on terminal board.
4. Remove cover plate from underside of head casting, next to the sleet hood, to gain access to closing linkage.
5. Disconnect linkage from manual operating handle bell crank by removing C-ring and pin, Figure 18.
6. Disconnect leads from bushings.
7. Remove eight bolts and lockwashers that attach mechanism base plate to head casting.
8. When mechanism is lifted from head, the phase sensing current transformers will remain on their bushings; the ground sensing transformers, which are attached to the base plate by nylon straps, will be removed with the mechanism.

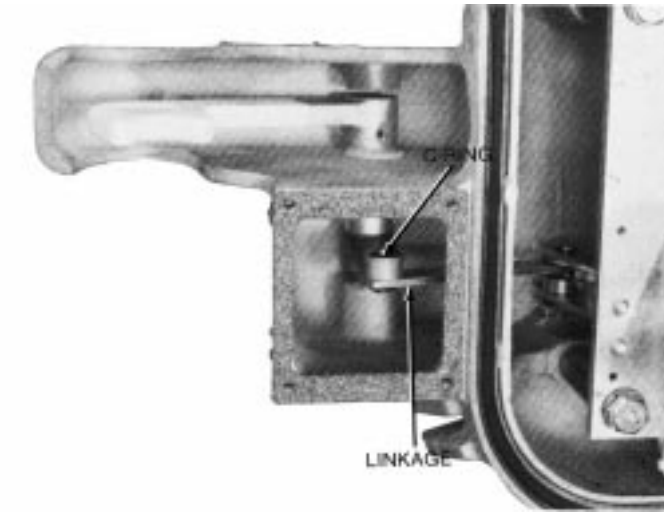



**Figure 18.** 88966KMA
**Operating handle-mechanism linkage.**

## Installing Mechanism into Head

When installing sectionalizer mechanism into head the following procedure may be used:

1. If phase sensing current transformers have been removed they must be reinstalled on the sleet hood side bushings, with the polarity mark on each transformer having the same orientation.
2. Position the eight pipe spacers over the threaded holes in head assembly.
3. Carefully place sectionalizer assembly over spacers. Install hardware and tighten evenly to avoid any binding of the mechanism.
4. Adjust spacers until current transformers are tight, see Figure 19.
5. Assemble linkage to manual operation handle bell crank, secure with pin and C-ring, see Figure 12.
6. Install cover plate over linkage compartment.
7. Install a new receptacle gasket.
8. Install receptacle and current transformer leads onto terminal board. Connect receptacle leads to control circuit board, refer to Figure 9.
9. Install receptacle and inrush restraint cabinet.

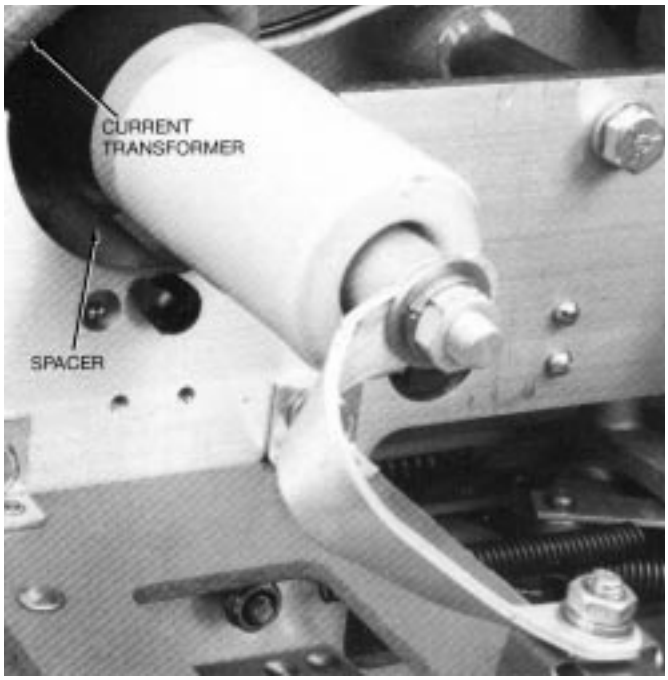



**Figure 19.** 88960KMA
**Current transformer spacer adjustment.**

## Operating Mechanism when Removed from Head

1. *To Close*—An adjustable wrench attached to linkage assembly, as shown in Figure 20, can be used as an operating lever to close the sectionalizer.

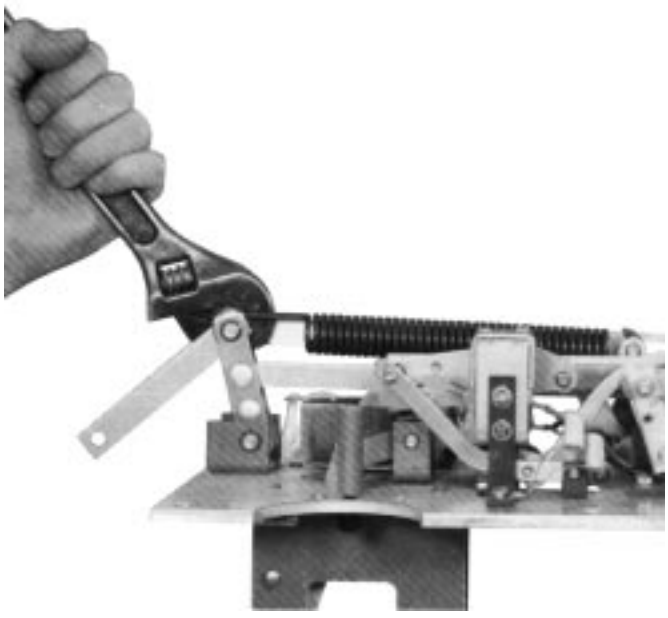


**Figure 20.** 88965KMA
**Manually closing the mechanism.**

2. *To Open*—Apply a slight pressure to toggle latch release lever (Figure 21) to trip mechanism.

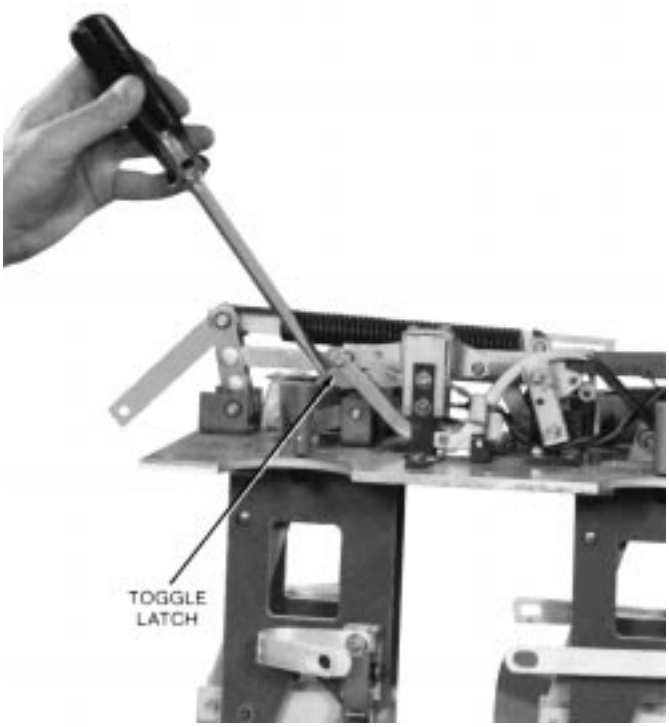



**Figure 21.** 88961KMA
**Manually opening the mechanism.**

## Mechanism Assembly

The mechanism assembly should require very little or no maintenance and need not be disassembled. If repacement of a worn or broken part is necessary, disassemble only to the extent required to install the new part.

# ADJUSTMENTS

Adjustments described in this section may be required when the sectionalizer has been disassembled or when new parts are installed.

## Contact Structure

**1.** With moving contacts in the open position, the space between the stationary contacts should measure 0.281 ± 0.010 inch.

NOTE: The stationary contact assembly is normally preadjusted during manufacture to obtain this clearance. Bend the contact fingers as required if the spacing is not within specified tolerances. After adjustment both stationary contacts must make at the same time (within 1/32 of contact travel).

**2.** With mechanism closed the movable contacts should be with 1/16-in. of full engagement as measured between the movable contact bar support arm and the bottom of side plate of the contact box as shown in Figure 22.

To obtain this dimension, adjust effective length of insulated operating link by adjusting attaching point for the contact arm assembly in the slotted hole of the link. Be sure to tighten elastic stop nut when adjustments are complete.

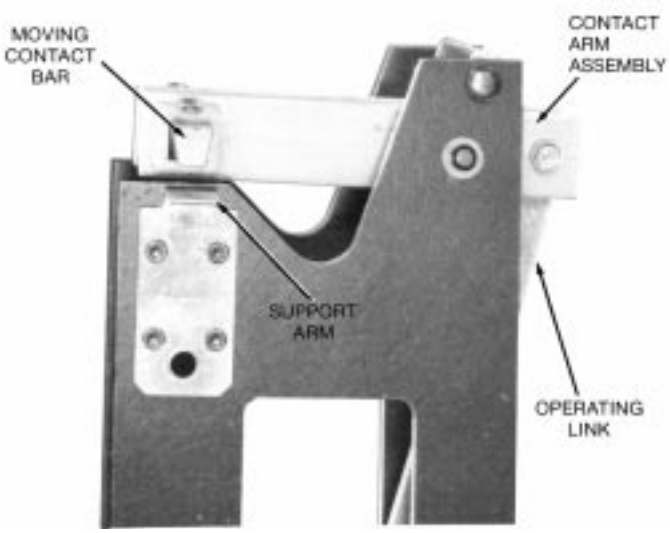



**Figure 22.** 88959KMA
**Adjustment of contact engagement.**

## Operating Handle Overtravel

Move manual operating lever slowly from open to closed position. Latching should be felt 1/32 to 1/16 inch before lever contacts stop bolt (see Figure 23). If necessary, adjust stop bolt to obtain this condition. Tighten jam nut when adjustment is complete.

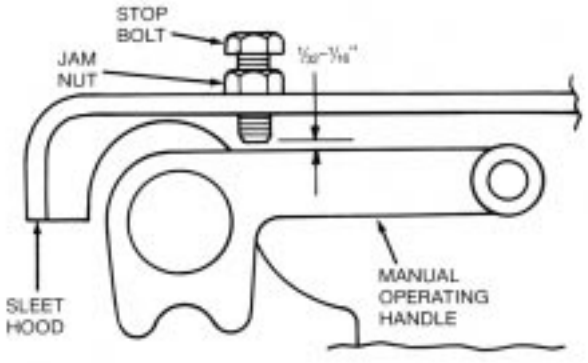



**Figure 23.**
**Operating handle overtravel adjustment.**

## Bi-Stable Actuator

1. With sectionalizer open, position the bi-stable actuator to obtain a 1/16-in. clearance between reset lever and the roller, see Figure 24.
2. With sectionalizer closed, adjust the trip pin 1/16-in. from the toggle latch release lever (see Figure 24).

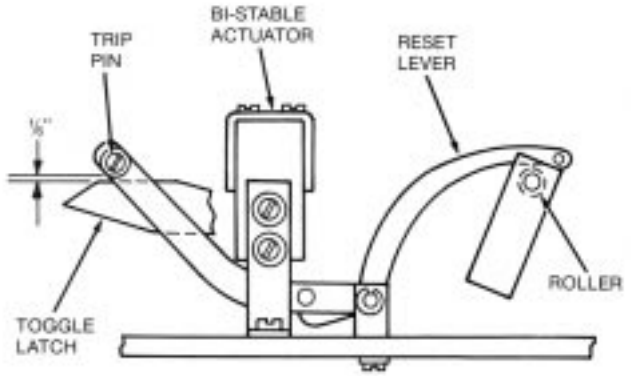



**Figure 24.**
**Bi-stable actuator adjustment.**

## Mechanical Adjustment

With sectionalizer mechanism removed from the head casting, adjust stop bolt, see Figure 25, to obtain enough clearance between the main shaft holding latch and the trip lever latch assembly to enable trip latch to move freely (approximately 1/32-in )

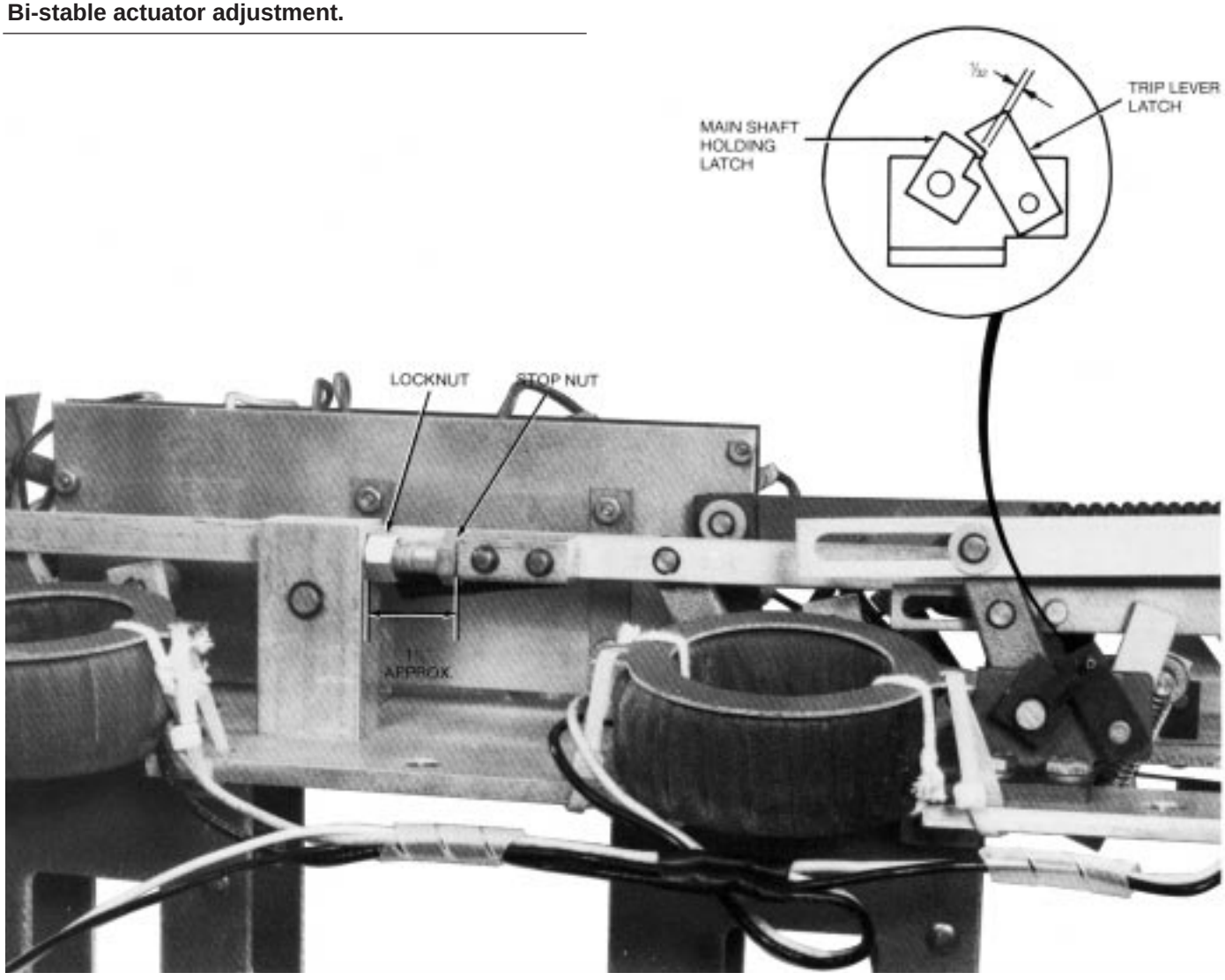



**Figure 25.**
**Mechanism adjustment.**

88964KMA

## 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 and sectionalizers that may not be readily locally available.

To assure correct receipt of any parts order, always include sectionalizer 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.

All parts carry the same warranty as any whole item of switchgear, i.e. against defects in material or workmanship within a period of one year from date of shipment.

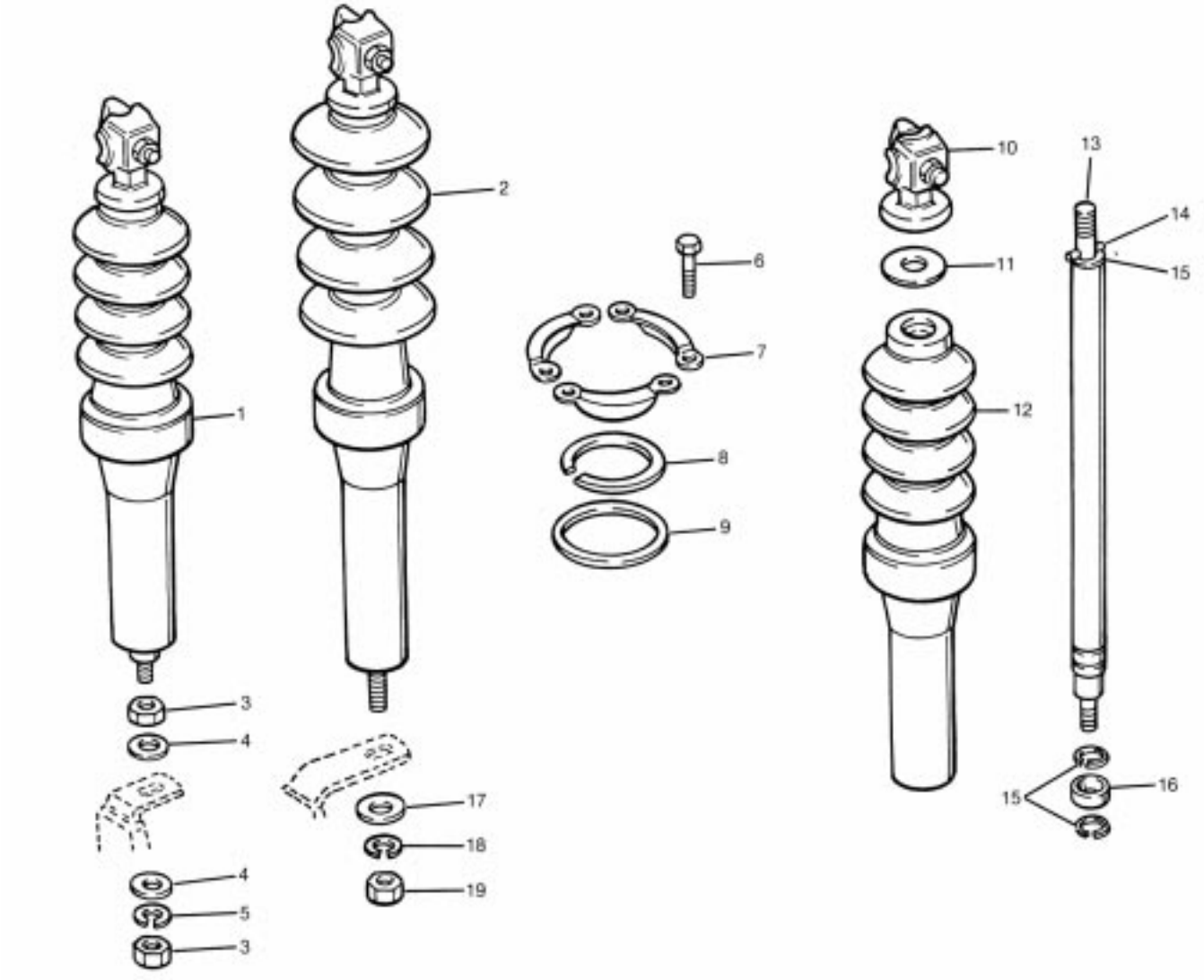



**Figure 26.**
**Bushing parts — exploded view.**

## Bushing Assemblies (Figure 26)

| Item No. | Description | Catalog Number | Qty per Assy. |
|---|---|---|---|
| 1 | Bushing assembly—<br>Type GN3E | | |
| | Standard creepage | KA160E4 | 6 |
| | 17-inch extra-creepage | KA160E5 | 6 |
| 2 | Bushing assembly—<br>Type GN3VE | KA74GN3 | 6 |
| 3 | Hex jam nut, 1/2-13, brass | K880725113050K | 12 |
| 4 | Flat washer, 1/2, brass | K900525056125K | 12 |
| 5 | Split lockwasher, 1/2, bronze | K830830050000A | 6 |
| 6 | Capscrew, hex hd, 3/8-16 x 1-5/8, stl | K730101137162Q | 18 |
| 7 | Bushing clamp | KP41L | 18 |
| 8 | Clamping ring | KP121L | 6 |
| 9 | Lower bushing gasket | KP2090A29 | 6 |
| 10 | Terminal | KA143L | 1 |

| Item No. | Description | Catalog Number | Qty. Per Assy. |
|---|---|---|---|
| 11 | Upper bushing gasket | KP2090A57 | 1 |
| 12 | Bushing ceramic—Type GN3E | | |
| | Standard creepage | KP130VR | 1 |
| | 17-inch extra-creepage | KP246VR | 1 |
| 13 | Bushing rod—Type GN3E | | |
| | Standard creepage | KP158GN3-1 | 1 |
| | 17-inch extra-creepage | KP158GN3-3 | 1 |
| 14 | Roll pin, 1/8 x 3/4 | K970801125075C | 1 |
| 15 | Retaining ring, C-Type, WA522 | K970901500000M | 3 |
| 16 | Rubber washer | KP2090AZ | 1 |
| 17 | Washer, flat, 3/8,brass | K900225037087A | 6 |
| 18 | Lockwasher, 3/8, brass | K900825037000A | 6 |
| 19 | Jam nut, 3/8-24, brass | K880725324037A | 6 |

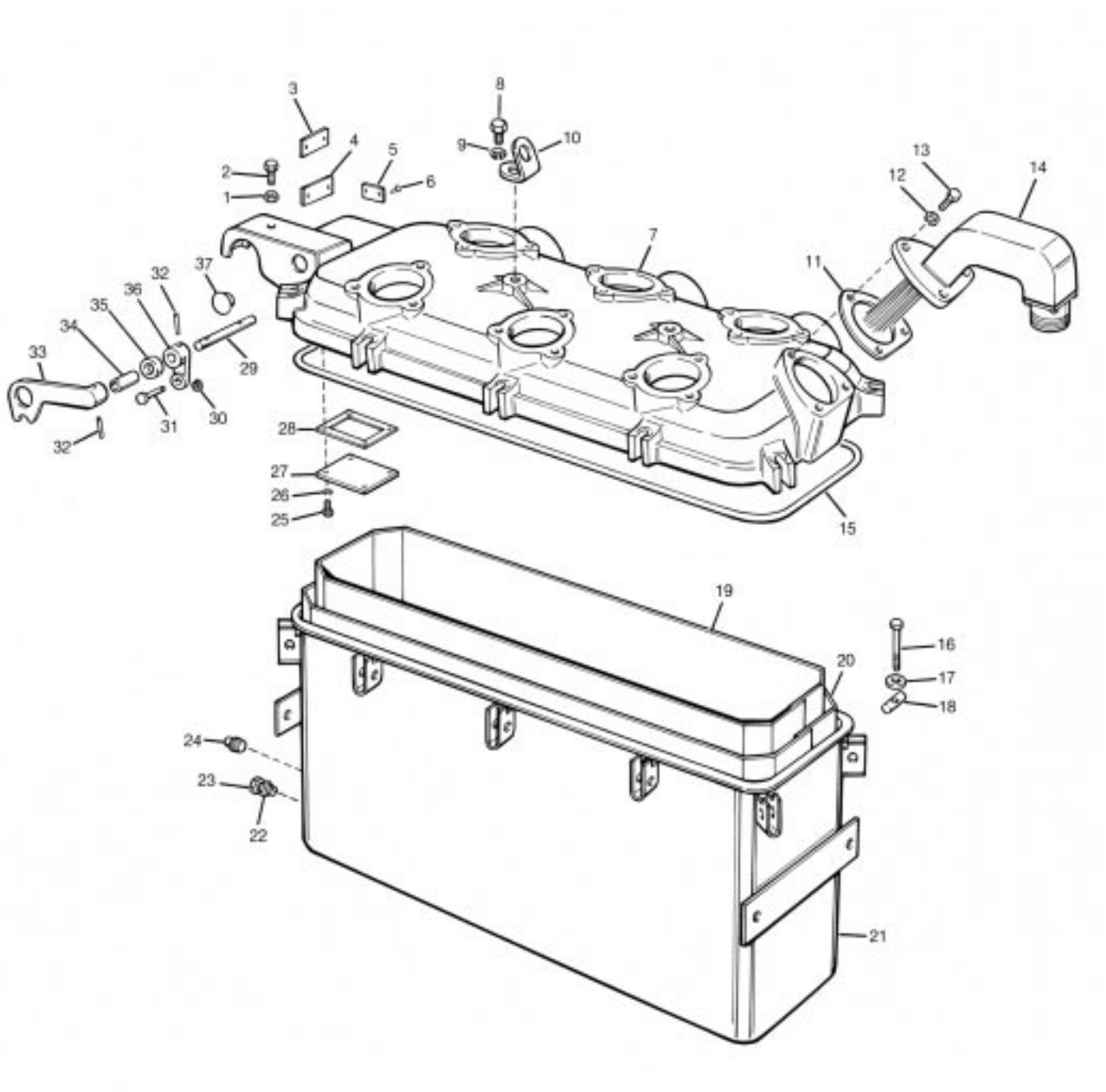



**Figure 27.**
**External components.**

## Head and Tank Assemblies (Figure 27)

| Item No. | Description | Catalog Number | Qty per Assy. |
|---|---|---|---|
| 1 | Hex nut, 3/8-16, stl | K880201116037Q | 1 |
| 2 | Capscrew, hex hd, 3/8-16 x 1, stl | K730101137100Q | 1 |
| 3 | Nameplate | | |
| | Type GN3E | KGN125E1 | 1 |
| | Type GN3VE | KGN163E | 1 |
| 4 | Current rating data plate | KGN172E | 1 |
| 5 | Lockout data plate | KP207GS | 1 |
| 6 | Machine screw, round hd #2 x 3/16. st stl | K751515102018A | 8 |
| 7 | Head casting | KGN113E1 | 1 |
| 8 | Capscrew, hex hd, 1/2-13 x 1-1/4, stl | K730101150125Q | 2 |
| 9 | Split lockwasher, med, 1/2, stl | K900801050000Z | 2 |
| 10 | Lifting lug | KP456H1 | 2 |
| 11 | Gasket | KGN119E1 | 1 |
| 12 | Split lockwasher, med, 1/4, stl | K900801025000Z | 3 |
| 13 | Capscrew, hex hd, 1/4-20 x 5/8, stl | K730101125062Q | 3 |
| 14 | Receptacle and cover assembly | KGN155EA | 1 |
| 15 | Gasket | KP2103A6 | 1 |
| 16 | Capscrew, hex hd, 3/8-16 x 3, stl | K730101137300Q | 10 |
| 17 | Washer | KP2028A33 | 10 |

| Item No. | Description | Catalog Number | Qty. per Assy. |
|---|---|---|---|
| 18 | Nut and pin combination | KP3061A3 | 10 |
| 19 | Tank liner | KP27GN3A | 1 |
| 20 | Tank liner, Type GN3VE only | KGN170E | 1 |
| 21 | Tank assembly | KA2GN3-2 | 1 |
| 22 | Ground clamp | KA227H | 1 |
| 23 | Capscrew, hex hd, 1/2-13 x 1, stl | K730101150100Q | 1 |
| 24 | Pipe plug | KP2007A3 | 1 |
| 25 | Machine screw, round hd #10-32 x 7/16, st stl | K721515310043A | 4 |
| 26 | Lockwasher, med, #10, st stl | K900815010000A | 4 |
| 27 | Cover plate | KP31H3 | 1 |
| 28 | Gasket | KP32H3 | 1 |
| 29 | Operating shaft | KP139GN3 | 1 |
| 30 | Retaining ring, WA516 | K970901312000M | 1 |
| 31 | Shaft | KP3125A2 | 1 |
| 32 | Roll pin, 5/32 X 7/8, stl | K970801156087M | 2 |
| 33 | Operating handle | KP6H3 | 1 |
| 34 | Bushing | KP3106A14 | 1 |
| 35 | Spacer | KP3182A4 | 1 |
| 36 | Lever | KP5H3 | 1 |
| 37 | Plug | KP2073A15 | 1 |

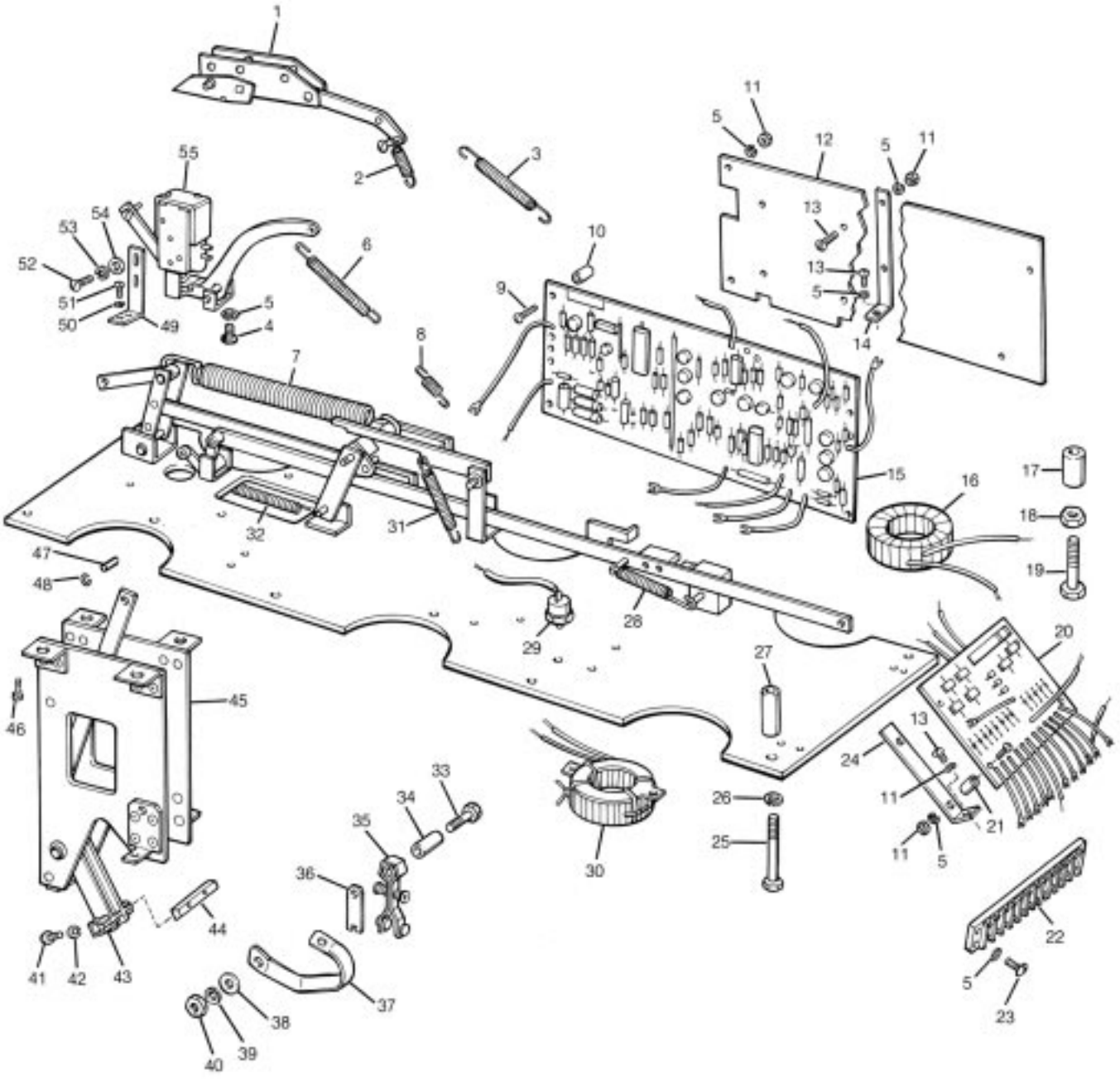



**Figure 28.**
**Sectionalizer mechanism.**

## Sectionalizer Mechanism (Figure 28)

| Item No. | Description | Catalog Number | Qty per Assy. |
|---|---|---|---|
| 1 | Toggle latch assembly | KA3GN3 | 1 |
| 2 | Unlatch spring | KP1001R | 1 |
| 3 | Spring | KP266GN3 | 1 |
| 4 | Machine screw, rd hd, #6-32 x 7/16, st stl | K721515106043A | 2 |
| 5 | Lockwasher, med, #6, st stl | K900815006000A | 20 |
| 6 | Tripper reset spring | KGN141E1 | 1 |
| 7 | Opening spring | KP596D | 1 |
| 8 | Latch spring | KP279GS | 1 |
| 9 | Machine screw, rd hd, #6-32 x 5/8, st stl | K721515106062A | 4 |
| 10 | Spacer | KP3006A40 | 4 |
| 11 | Hex nut, #6-32, st stl | K881015132006A | 8 |
| 12 | Shield | KGN122E1 | 1 |
| 13 | Machine screw, rd hd, #6-32 x 5/16, st stl | K721515106031A | 9 |
| 14 | Bracket | KP648ME | 2 |
| 15 | Control circuit board assembly | KGN115E | 1 |
| 16 | Current transformer, phase, 800:1 | KA100V6H2 | 3 |
| 17 | Spacer | KP3009A153 | 3 |
| 18 | Hex nut,1/4-20, nylon | K881054120025A | 3 |
| 19 | Machine screw, rd hd, 1/4-20 x 1-1/2, nylon | K721554125150A | 3 |
| 20 | Programming circuit board | KGN117E | 1 |
| 21 | Spacer | KP3007A142 | 4 |
| 22 | Terminal strip | KP2101A30 | 1 |
| 23 | Machine screw, rd hd, #6-32 x 1-1/8, st stl | K721515106112A | 4 |
| 24 | Bracket | KGN118E1 | 2 |
| 25 | Capscrew, hex hd, 3/8-16 x 3, stl | K730101137300Y | 8 |
| 26 | Lockwasher, med, 3/8, stl | K900801037000Z | 8 |
| 27 | Spacer | KP109GN3 | 8 |
| 28 | Mechanism spring | KP118GN3 | 1 |
| 29 | Diode, zener, 18V, 75W | KP4012A39 | 1 |
| 30 | Current transformer, ground, 2000:1 | KGN136EA | 3 |
| 31 | Spring | KP553R | 1 |
| 32 | Spring | KP98L | 1 |

| Item No. | Description | Catalog Number | Qty. per Assy. |
|---|---|---|---|
| 33 | Capscrew, hex hd, 1/4-20 x 1-1/4, brass | K730125125125A | 6 |
| 34 | Contact roller | KP256GR | 6 |
| 35 | Stationary contact assembly | KA64GN3-2 | 6 |
| 36 | Contact retainer | KP214GR | 6 |
| 37 | Leads | | |
| | Type GN3E | KP3252A23 | 18 |
| | Type GN3VE | KP3255A2 | 18 |
| 38 | Washer, flat, 1/4, brass | K900525026056A | 12 |
| 39 | Lockwasher, split, med, 1/4, brass | K900530025000A | 6 |
| 40 | Hex nut,1/4-20, brass | K880225120025A | 6 |
| 41 | Machine screw, rd hd, #6-32 x 1/2, st stl | K721515106050A | 6 |
| 42 | Lockwasher, internal tooth, #6 | K901032006000A | 6 |
| 43 | Movable contact arm | KP326GR | 3 |
| 44 | Moving contact bar | | |
| | GN3E before serial number 4670 and GN3VE before serial number 1000 | KA59GN32S | 3 |
| | GN3E after serial number 4669 and GN3VE after serial number 999 | KA81GN3 | 3 |
| 45 | Side plate and contact assembly, includes items 41, 42, 43 and 44 | KA85GN3 | 3 |
| 46 | Machine screw, hex hd, 5/16-18 x 1/2, stl | K830101131050Z | 12 |
| 47 | Pin | KP3124A15 | 3 |
| 48 | Retaining ring, Type C, WA-514 | K970901250000M | 3 |
| 49 | Bracket | KGN109E1 | 1 |
| 50 | Lockwasher, med, #10, st stl | K900815010000A | 2 |
| 51 | Machine screw, rd hd, #10-24 x 7/16, st stl | K721515110043A | 2 |
| 52 | Machine screw, rd hd, #8-32 x 5/16, st stl | K721515108031A | 2 |
| 53 | Lockwasher, med #8, st stl | K900815008000A | 2 |
| 54 | Washer, flat, #8, brass | K900525017037A | 2 |
| 55 | Bi-stable actuator assembly | | |

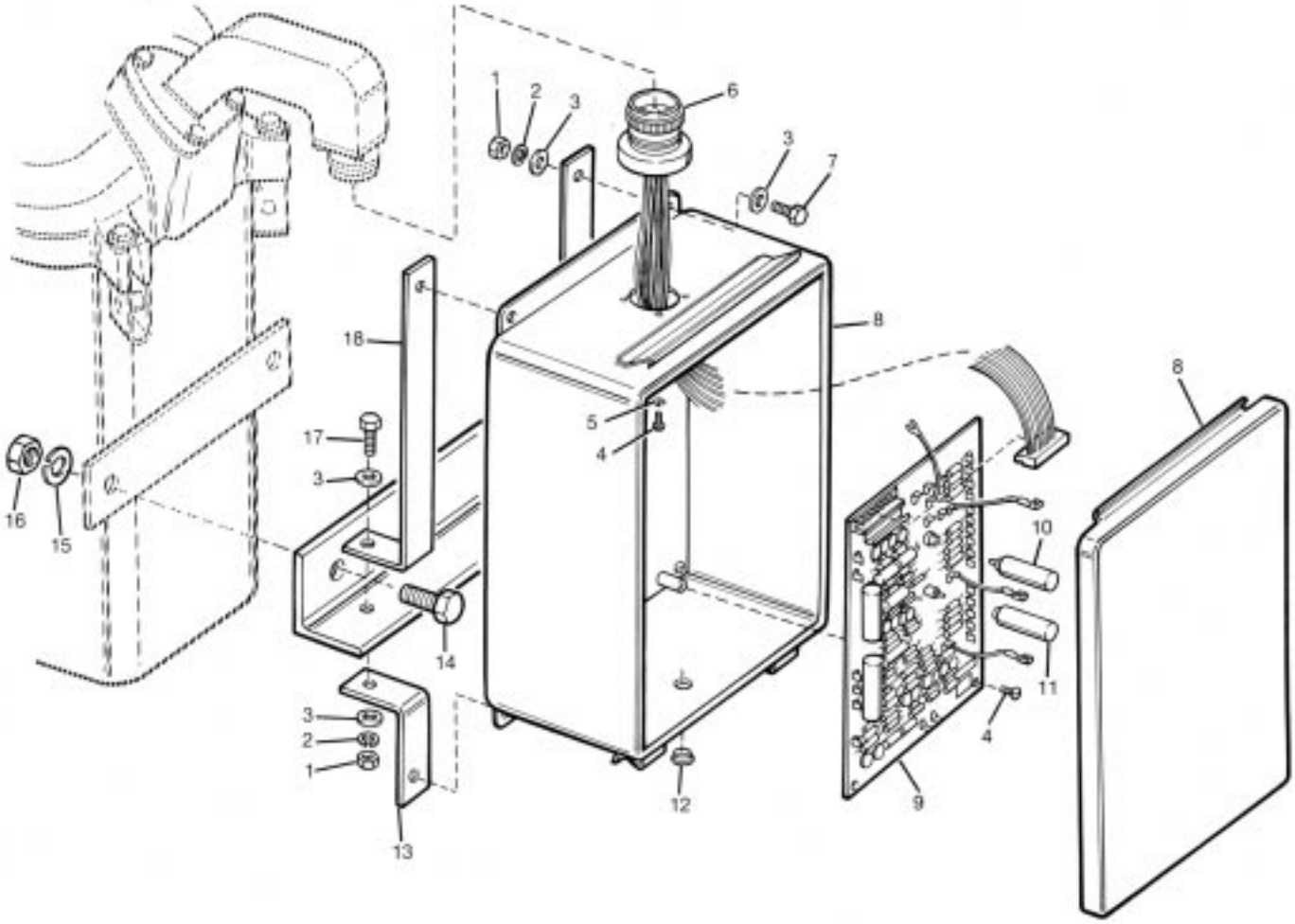



**Figure 29.**
**Inrush restraint cabinet.**

## Inrush Restraint Cabinet (Figure 29)

| Item No. | Description | Catalog Number | Qty per Assy. |
|---|---|---|---|
| 1 | Hex nut, 5/16-18, stl | K880201118031Q | 6 |
| 2 | Lockwasher, med, 5/16, stl | K900801031000Z | 6 |
| 3 | Washer, flat, 5/16, stl | K900201031000Z | 12 |
| 4 | Machine screw, rd hd, #6-32 x 3/8, stl | K721501106038Z | 8 |
| 5 | Lockwasher, med, #6, stl | K900801006000Z | 4 |
| 6 | Receptacle and wiring harness assembly | KGN176E | 1 |
| 7 | Capscrew, hex hd, 5/16-18 x 3/4, stl | K730101131075Q | 4 |
| 8 | Cabinet assembly | KGN149E | 1 |
| 9 | Inrush restraint circuit board assembly<br>GN3E before serial number 3877 and GN3VE before serial number 498 | KGN151E | 1 |
| | GN3E after serial number 3876 and GN3VE after serial number 497 | KGN175E | 1 |
| 10 | Ground actuating resistor (as req'd) | KGN124E__ | 1 |
| 11 | Phase actuating resistor (as req'd) | KGN123E__ | 1 |
| 12 | Vent plug | KP38GR | 1 |
| 13 | Bracket | KGN152E2 | 2 |
| 14 | Capscrew, hex hd, 5/8-11 X 1-1/4, stl | K730101162125Q | 2 |
| 15 | Lockwasher, med, 5/8, stl | K900801062000Q | 2 |
| 16 | Hex nut, 5/8-11, stl | K880101111062Q | 2 |
| 17 | Capscrew, hex hd, 5/16-18 x 1, stl | K730101131100Q | 2 |
| 18 | Bracket | KGN152E1 | 2 |

COOPER Power Systems

P.O. Box 1640
Waukesha, WI 53187
www.cooperpower.com

KTM
1/89