



# MAINTENANCE INSTRUCTION

## SCR ASSEMBLY 8451653

### DESCRIPTION

Main generator field excitation is provided by the D14 alternator three-phase output through the silicon controlled rectifier (SCR) assembly, Fig. 1. The SCR assembly consists of a three-phase bridge rectifier circuit and related transient voltage suppression circuitry. To obtain a controllable current level, one diode in each leg of the bridge is replaced with a silicon controlled rectifier.

Four extruded aluminum heat sinks are used in the SCR assembly. These heat sinks are mounted to two molded polyester end brackets to provide electrical insulation while allowing maximum circulation of air. The six bridge rectifier diodes are mounted on three of the heat sinks. The fourth heat sink contains a series diode (SD) and a "free wheeling" diode (FWD) which protects the SCR's from high reverse voltages.

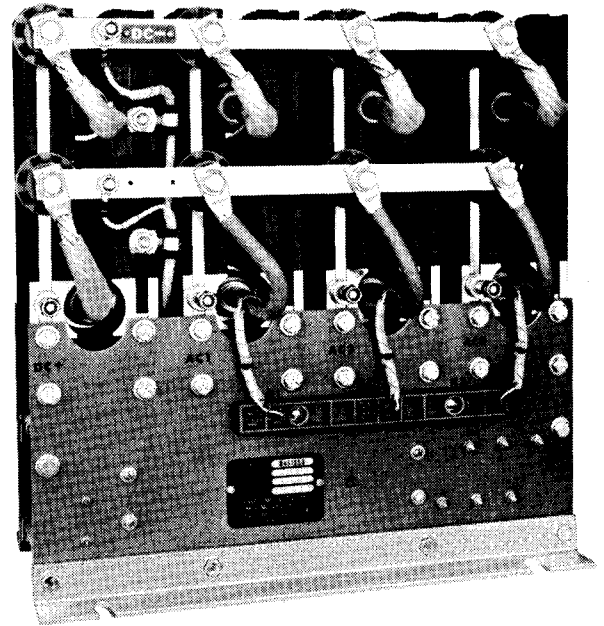
The commutation suppression capacitors are mounted on the rear end bracket and the commutation suppression resistors are mounted on the front end bracket. Also mounted on the front end bracket are the surge suppression assembly and a reverse voltage protection diode (RD).

Refer to Fig. 2 for a schematic diagram of the SCR assembly.

### MAINTENANCE

The SCR assembly requires no routine maintenance other than visual inspection. The unit should not be disassembled for inspection and the nuts that fasten the silicon devices to the heat sinks should not be disturbed. These nuts must be tightened to a specified torque to ensure proper heat transfer.

If the SCR assembly is suspected of failure, the unit should be inspected and bench tests performed as necessary to isolate the malfunctioning component.



18966

Fig. 1 - SCR Assembly

## INSPECTION AND TESTS

### VISUAL INSPECTION

1. Remove dust and dirt with a brush or air hose.
2. Check molded parts for breaks and cracks.
3. Check for damaged and loose terminals.
4. Check wiring for damaged insulation.

### SCR BRIDGE DEVICES

The SCR bridge test qualifies an SCR bridge with respect to the condition of the silicon diodes (open or shorted) and the gating capabilities of



Material Description - SCR Test Box

Lamp and lamp holder, 12 V DC

Voltmeter, DC, 0-20 V scale

Milliammeter, DC, 0-200 ma scale

Rheostat, 100 ohm, 10 watt-minimum

Rheostat, 1000 ohm, 10 watt-minimum

Resistor, 10 ohm, 10 watt-minimum

Switch, pushbutton, spring loaded-normally open,  
2 requiredSwitch, pushbutton, spring loaded-normally  
closed, 3 required**TEST PROCEDURE**

1. Disconnect one of the quick disconnect leads from the reverse diode (RD), Fig. 4.
2. Disconnect suppressor assembly from bridge circuit by removing leads from following terminals on suppressor assembly: AC1, AC2, AC3, and DC+.
3. Connect test leads between SCR assembly and SCR test box, Fig. 5.
4. Rotate test box rheostats to maximum resistance position.
5. Connect battery to test box, Fig. 5.
6. If test lamp comes on, SCR1 is shorted.
7. Press pushbuttons D and S. If test lamp comes on, FWD is conducting. If test lamp stays off, FWD is open.
8. Press pushbutton D. If test lamp comes on, SD is shorted.
9. Press pushbutton S. If test lamp comes on, D1 is shorted.
10. Slowly decrease resistance of the 1000 ohm rheostat until the test lamp comes on. This indicates that SCR1 is conducting. If rheostat resistance is decreased to zero ohms and test lamp does not come on, SCR1 is open.
11. Increase resistance of the 1000 ohm rheostat by 50 to 100 ohms (just less than 1/10 of full range).
12. Press pushbutton B momentarily. The test lamp goes off, indicating that SCR1 is turned off. If test lamp does not remain off, repeat Steps 11 and 12.
13. Slowly decrease resistance of the 100 ohm rheostat until the test lamp comes on.

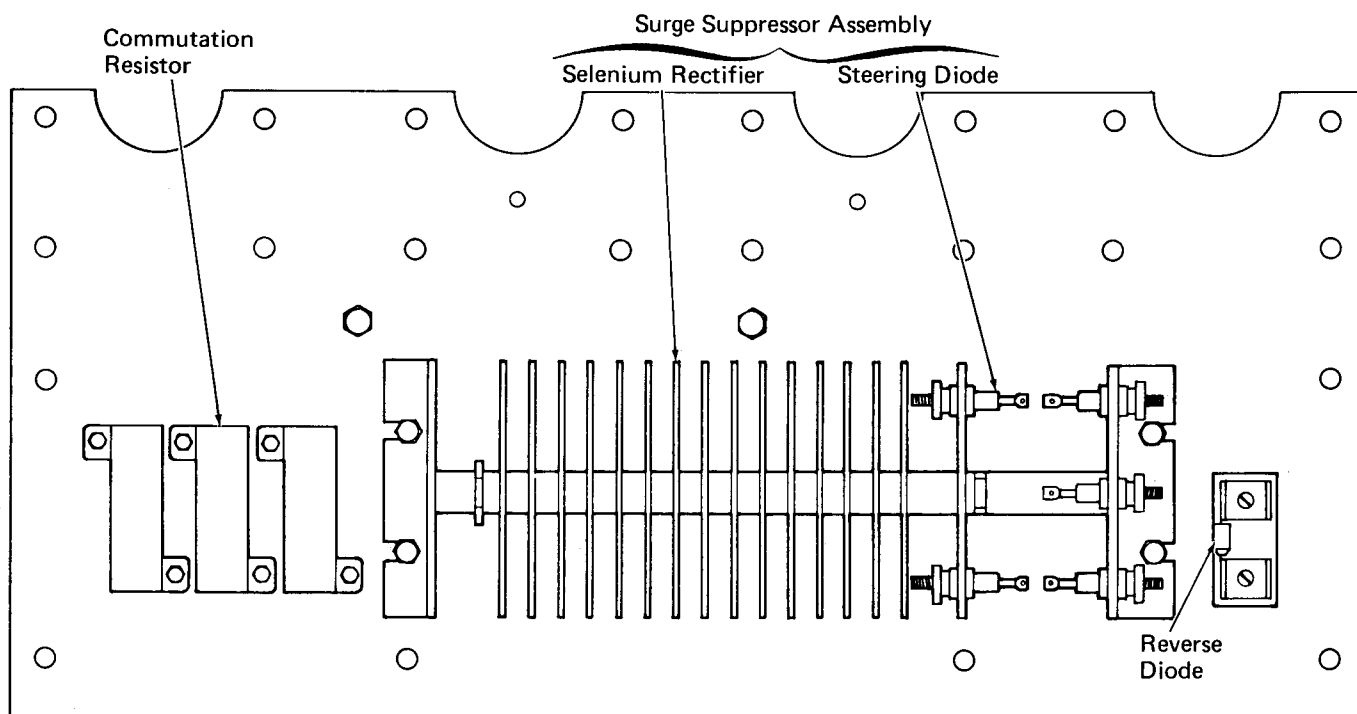


Fig. 4 - Front End Bracket, Inside View

18969

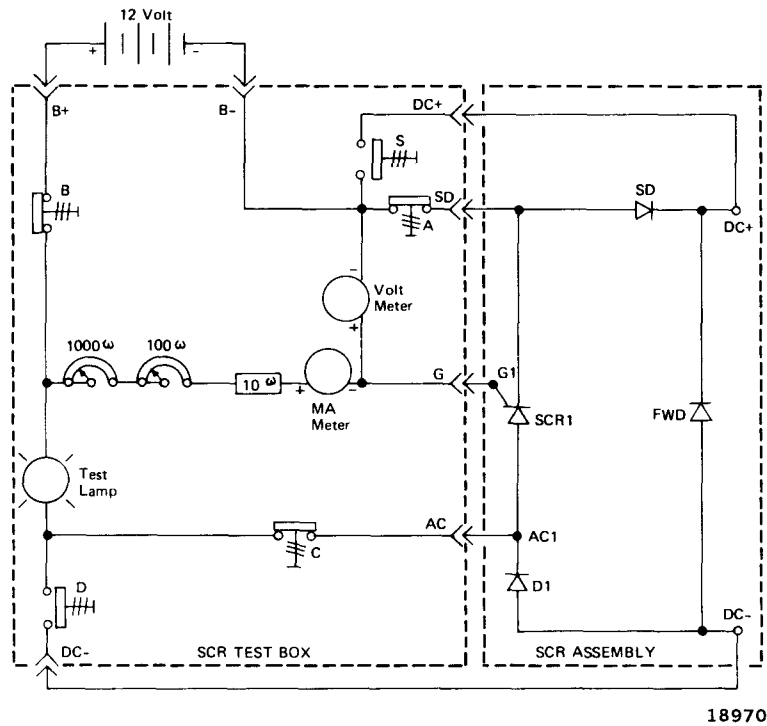


Fig. 5 – SCR Assembly Test Setup

14. Observe voltmeter and milliammeter indications. Gate voltage should be less than 3 V DC. Gate current should be 30 to 75 milliamps DC. If indicated values are not as specified, SCR1 should be replaced.
15. Press pushbuttons S and A. If test lamp comes on, SD is conducting. If test lamp does not come on, SD is open.
16. Press pushbuttons C and D. If test lamp comes on, D1 is conducting. If test lamp does not come on, D1 is open.
17. Rotate both rheostats to maximum resistance position.
18. Disconnect battery from test box.

**CAUTION:** To prevent voltmeter damage in Step 19, either disconnect voltmeter from test box or reverse voltmeter input connections.

19. Reconnect battery to test box as follows:
  - a. Battery "+" to test box "B-."
  - b. Battery "-" to test box "B+."

20. If test lamp comes on, FWD is shorted.

21. Disconnect battery from SCR test box.
22. Disconnect test leads from circuit points AC1 and G1 on SCR assembly and connect to AC2 and G2.
23. Perform Steps 5, 6, 9 through 14, and 16 through 18 to check operation of SCR2 and D2.
24. Disconnect test leads from circuit points AC2 and G2 on SCR assembly and connect to AC3 and G3.
25. Perform Steps 5, 6, 9 through 14, and 16 through 18 to check operation of SCR3 and D3.
26. Disconnect test leads from SCR assembly.
27. Reconnect leads to reverse diode (RD), Fig. 4, and suppressor assembly.

### SELENIUM RECTIFIER

1. Visually inspect the selenium rectifier, Fig. 4, for blistered paint, a general symptom of a shorted rectifier.
2. Remove quick disconnect lead from -DC terminal on selenium rectifier.

- Using an ohmmeter, test the selenium rectifier for ability to conduct in the forward direction and block in the reverse direction.
- Reconnect quick disconnect lead to -DC terminal on selenium rectifier.

## STEERING DIODES

Using an ohmmeter, check forward and reverse resistance of each steering diode, Fig. 4, individually to isolate shorted or open diodes.

## COMMUTATION CIRCUITS

The commutation resistors, Fig. 4, and capacitors, Fig. 6, should be checked individually with an ohmmeter to isolate defective components.

## REVERSE DIODE

- Remove one of the quick disconnect leads from the reverse diode (RD), Fig. 4.
- Using an ohmmeter, check forward and reverse resistance of RD to determine open or shorted component.
- Reconnect quick disconnect lead to RD.

## REMOVAL AND REPLACEMENT

### HEAT-SINK MOUNTED COMPONENTS

- Disconnect the flexible lead, on the diode being removed, from the bus bar by removing the hex-head bolt, lockwasher, and plain washer. If replacing SCR1, 2, or 3, also disconnect the quick disconnect cathode (K) and gate (G) leads from the terminal board. Refer to Fig. 7 for physical location of suspect silicon device.
- Slide the special diode socket 8361524, Fig. 8, on the diode stud, ensuring that flexible lead extends out through the cutout in the socket. Attach drive wrench to socket.
- While holding the diode stud end, loosen and remove the diode nut and washer assembly with a 1-1/8" socket and a drive wrench. Remove diode from heat sink.
- Clean the heat sink mounting surface with a cloth.
- Apply thermal grease 8346481 to the hex base of the replacement diode. Apply sufficient grease to cover the entire hex base mounting area, but do not apply to threads.

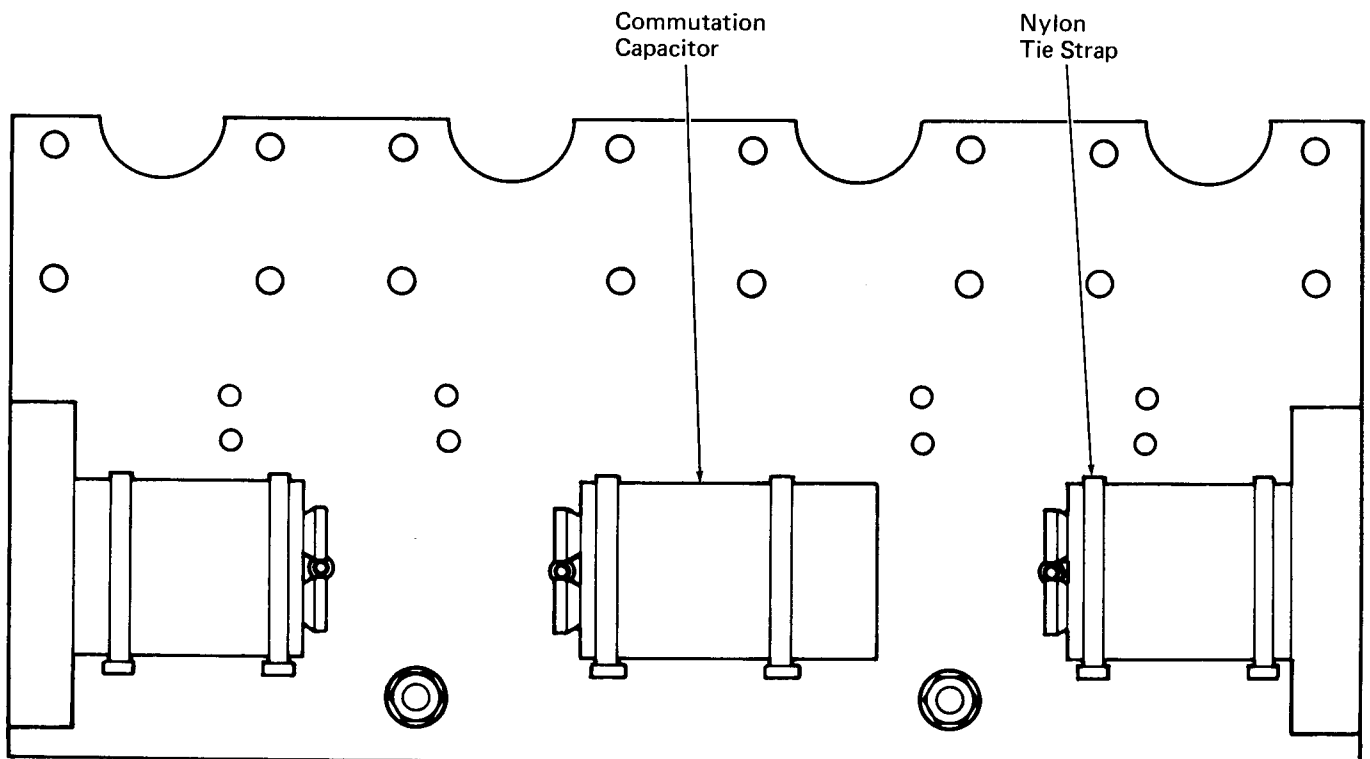
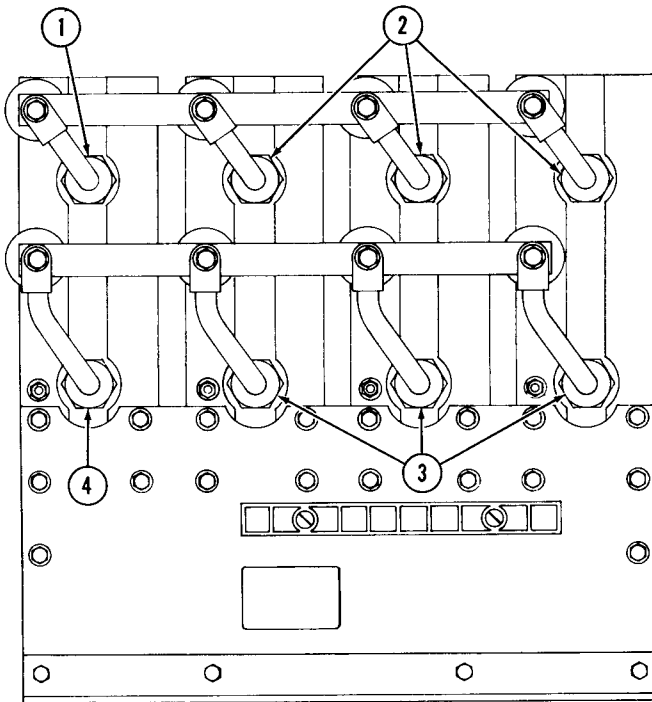


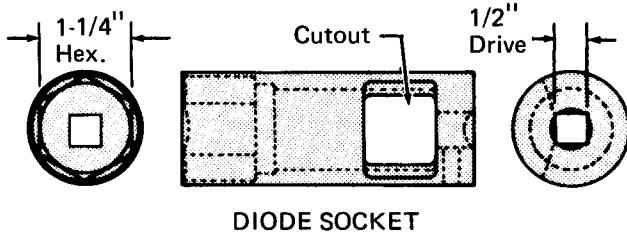
Fig. 6 - Rear End Bracket, Inside View



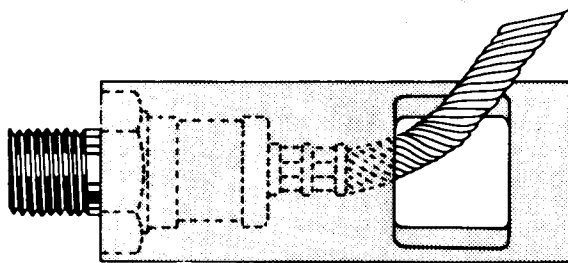
1. Free Wheeling Diode (FWD)  
 2. Silicon Bridge Diodes  
 3. Silicon Controlled Bridge Rectifiers (SCR)  
 4. Silicon Series Diode (SD)

Fig. 7 - Silicon Device Locations

18972



DIODE SOCKET



DIODE SOCKET APPLIED TO DIODE

18973

Fig. 8 - Special Diode Socket 8361524

out through the cutout. Attach drive wrench to socket.

8. While holding the diode stud end, use a torque wrench and 1-1/8" socket to tighten the nut and washer assembly to 300 ± 25 in.-lbs.

9. Connect the diode flexible lead to the bus bar using the hex-head bolt, lockwasher, and plain washer. If installing SCR1, 2, or 3, also connect the quick disconnect G and K leads to the terminal board.

### SURGE SUPPRESSOR ASSEMBLY 8452963

The surge suppressor assembly, Fig. 4, consists of the selenium rectifier and the steering diodes. Two types of suppressors are presently in use. The original suppressor contained four steering diodes, while the replacement suppressor contains eight steering diodes. Defective steering diodes can be replaced individually on both the original and replacement types of suppressors. Refer to steering diode replacement procedure.

If the selenium rectifier is found to be defective in an original type suppressor, complete suppressor replacement is required. This necessitates drilling new mounting holes and possibly relocating commutation resistors. Refer to following procedure.

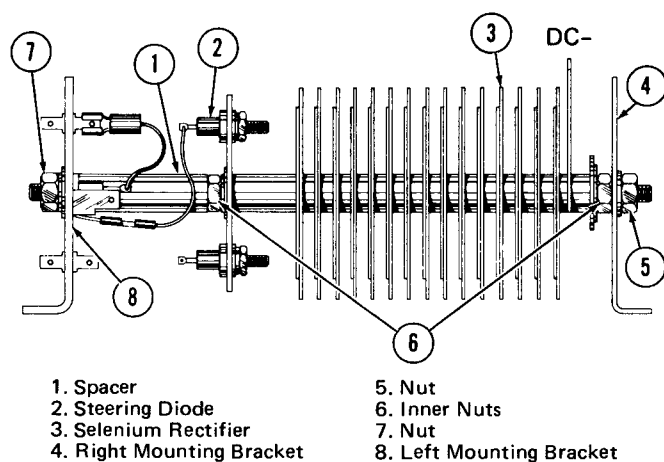
1. Remove all quick disconnect leads from suppressor assembly, Fig. 4.
2. Remove suppressor from end bracket by removing four screws, washers, lockwashers, and nuts.
3. Use replacement suppressor to determine locations of new mounting holes and commutation resistor(s). Drill necessary holes and relocate commutation resistor(s).
4. Install replacement suppressor and fasten screws, washers, lockwashers, and nuts.
5. Connect quick disconnect leads to suppressor assembly.

If the selenium rectifier is found to be defective in a new type suppressor, either the rectifier can be replaced as a component or a complete suppressor assembly, Fig. 9, can be installed.

Complete suppressor assembly replacement is accomplished by disconnecting the quick disconnect leads from the suppressor; removing the

6. Insert the diode into heat sink. Attach nut and washer assembly and turn until finger tight.

7. Slide the special diode socket 8361524 on the diode stud ensuring that flexible lead extends



18974

Fig. 9 - Surge Suppressor Assembly

four mounting screws, washers, lockwashers, and nuts; and reversing the procedure for installation of the new suppressor assembly.

### SELENIUM RECTIFIER 8452957

1. Disconnect quick disconnect leads from suppressor assembly, Fig. 9.
2. Remove suppressor assembly from end bracket by removing four screws, washers, lockwashers, and nuts.

**CAUTION:** When removing right mounting bracket (4, Fig. 9), and left mounting bracket (8), do not loosen or disturb inner nuts (6) since this could result in damage to the selenium rectifier.

3. Remove right mounting bracket (4) from suppressor assembly by removing nut (5) and lockwasher. Install mounting bracket on new selenium rectifier. Fasten with nut and lockwasher.
4. Disconnect quick disconnect leads from the steering diodes mounted on the left mounting bracket (8). Do not remove diodes from bracket.
5. Remove left mounting bracket (8) from suppressor assembly by removing nut (7), lockwasher, and plain washer.
6. Remove spacer (1) and install on new selenium rectifier.
7. Install left mounting bracket (8) on new selenium rectifier. Fasten with nut, lockwasher, and plain washer.

8. Remove four steering diodes (2) from aluminum heat sink on suppressor assembly and install on new selenium rectifier. Tighten diodes, at the hex mounting base, to  $13\text{-}1/2 \pm 1/2$  in.-lbs.

9. Reconnect quick disconnect leads.

10. Install new suppressor assembly on front end bracket, Fig. 4, using four screws, washers, lockwashers, and nuts.

### STEERING DIODES

**NOTE:** Refer to Module Repair Manual for techniques and standards to be followed when performing wire stripping, crimping, and soldering.

1. Disconnect leads from defective diode.
2. Remove defective diode by removing nut, flat washer, and lockwasher.
3. Install new diode using flat washer, lockwasher, and nut. Tighten nut finger tight. If installing diode in left mounting bracket (8, Fig. 9), ensure that faston connector is also in place.
4. Tighten diode, at the hex mounting base, to  $13\text{-}1/2 \pm 1/2$  in.-lbs.
5. Connect leads to new diode.

### COMMUTATION CIRCUIT COMPONENTS

Defective commutation resistors, Fig. 4, are removed by disconnecting the quick disconnect leads from the resistor and then removing the mounting screws, lockwashers, plain washers, and nuts. Attach the new resistor with the mounting screws, lockwashers, plain washers, and nuts. Reconnect leads to new resistor.

Defective commutation capacitors, Fig. 6, are removed by disconnecting the leads to the capacitor and removing the two nylon tie straps holding the capacitor to the rear end bracket. Attach the new capacitor to the rear end bracket, using two nylon tie straps. Tighten tie straps with tension tool set at  $65 \text{ lbs} \pm 10\%$ . Connect leads to new commutation capacitor.

### REVERSE DIODE

1. Remove quick disconnect leads from reverse diode, Fig. 4, mounting board.

2. Remove reverse diode assembly from front end bracket by removing two mounting screws, plain washers, lockwashers, and nuts.
3. Unsolder the defective reverse diode from the mounting board and solder the new diode in place.
4. Mount diode assembly to front end bracket using two mounting screws, plain washers, lockwashers, and nuts.
5. Reconnect quick disconnect leads to reverse diode mounting board.

## SERVICE DATA

### ELECTRICAL SPECIFICATIONS

#### SILICON CONTROLLED RECTIFIER (SCR) 8452948

Peak Forward Blocking Voltage	1000 V DC
Repetitive Peak Reverse Voltage	1000 V DC
RMS Forward Current - Max.	235 amps
Peak Forward Gate Current	2 amps
Peak Forward Gate Voltage	20 V DC
Peak Reverse Gate Voltage	2.5 V DC
Peak Forward Blocking Leakage Current	15 milliamps
Gate Trigger Current To Fire (@ 25° C)	30-75 milliamps
Gate Trigger Voltage To Fire (@ 25° C) - Max.	3 V DC
Forward On Voltage - Max.	1.8 V DC

#### BRIDGE DIODE 8452949

Reverse Voltage - Max.	1000 V DC
Average Forward Current - Max.	250 amps
Average Reverse Current - Max.	15 milliamps
Peak Forward Voltage Drop	1.62 V DC

#### FREE WHEELING DIODE (FWD) 8452952

Reverse Voltage - Max.	1200 V DC
Average Forward Current - Max.	250 amps
Average Reverse Current - Max.	15 milliamps
Peak Forward Voltage Drop	1.62 V DC

**SERIES DIODE (SD) 8452951**

Reverse Voltage - Max. . . . .	100 V DC
Average Forward Current - Max. . . . .	250 amps
Average Reverse Current - Max. . . . .	15 milliamps
Forward Voltage Drop . . . . .	1.0 - 1.62 V DC

**STEERING DIODE 8421019**

Reverse Avalanche Voltage . . . . .	500 - 1000 V DC
Average Forward Current - Max. . . . .	3 amps
Peak Reverse Current (@ 200 V DC) . . . . .	4 microamps
Peak Forward Voltage Drop (@ 25° C) . . . . .	0.75 V DC

**REVERSE DIODE (RD) 8373329**

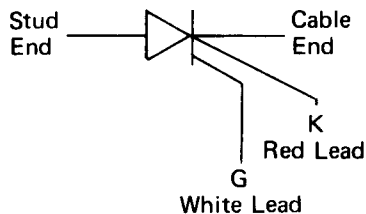
Reverse Voltage - Max. . . . .	800 V DC
Average Forward Current - Max. . . . .	1.2 amps
Average Reverse Current - Max. . . . .	10 microamps
Forward Voltage Drop - Max. . . . .	1.3 V DC

**SELENIUM RECTIFIER 8452957**

Blocking Voltage (@ 25° C) . . . . .	330 V DC
Peak Clamping Voltage . . . . .	900 V DC
Reverse Leakage Current (@25° C and 330 V DC) . . . . .	75 milliamps
Forward Voltage Drop (@ 25° C) - Max. . . . .	19.2 V DC

**PHYSICAL/ELECTRICAL REPRESENTATIONS**

SCR 8452948



Bridge Diode	8452949
FWD	8452952
SD	8452951
Steering Diode	8421019



18975