

J87223 RECTIFIER
48 VOLTS, 100 AMPERES
OPERATING METHODS

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4. ROUTINE CHECKS	4	1.01 This section covers the operation of the J87223A and J87223B rectifiers in conjunction with the J87214C regulator unit and the J87223C and J87223D rectifier in conjunction with the J87277 regulator unit. The J87223A, J87223B, J87223C, and J87223D rectifiers are intended to automatically charge and float storage batteries of the 111A, 302B, and 303A power plants.	
5. TROUBLES	7	◆ Note: The J87223A, J87223B, J87223C, and J87223D rectifiers have been rated Manufacture Discontinued. They are replaced by the J87437 rectifier.◆	
TROUBLESHOOTING PROCEDURES	18	1.02 This section is reissued for the reasons listed below. Revision arrows are used to emphasize the more significant changes. The Equipment Test List is affected.	
Figures		(a) To indicate that the J87223A, B, C, and D rectifiers are rated Manufacture Discontinued (Mfr Disc.)	
1. Locally Constructed Equivalent of ITE-4175 Tool	4	(b) To add additional tools to Part 2	
2. Typical 70-Type Fuse Cap	6	(c) To add sub-subparagraphs 3.02(2)(a) and (b) and Fig. 1	
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NOTICE

Not for use or disclosure outside the Bell System except under written agreement

- (d) To add paragraph 4.08
- (e) To add additional information to Table A
- (f) To add Fig. 11.

1.03 This rectifier is adaptable for connection to a 190- to 250-volt or 380- to 500-volt 60-Hz, 3-phase power source and has a rated output of 0 to 100 amperes at 48 volts direct current. The dc output voltage regulation is ± 0.5 percent for load and line variation. The rectifier utilizes PNP devices for 3-phase, full-wave rectification and a self-contained transistorized regulating circuit which controls the PNP devices and automatically limits the output current. In addition, an alarm circuit is provided to shut down the rectifier when the charge fuse or control fuse blows or when the rectifier is putting out current at higher than normal voltages or when the output filter capacitor fuse and its alarm fuse blow.

Danger: *Voltages inside the rectifier case are over 150 volts to ground. Avoid all contact with terminals. Do not allow a test pick to touch two metal parts at the same time or destructive and dangerous short circuits may occur. Disconnect the alternating current supply before working on the rectifier except when necessary to make tests.*

1.04 This rectifier is designed to mount on a 23-inch relay rack and can be serviced and maintained from the front. Access to the rear is made possible by a removable rear cover.

1.05 The meter, controls, and some fuses are mounted on a hinged panel for access, maintenance, or replacement.

1.06 Options are provided for operations as follows (with any option, the output current meter is in the ground lead):

- (a) For use in a 48-volt positive plant (negative ground)
- (b) For use in a 48-volt negative plant (positive ground).

1.07 Routine checks are intended to detect defects in the equipment and, insofar as possible,

to guard against circuit failures. Checks other than those required by trouble conditions should be made during a period when they will not interfere with service.

1.08 This issue of the section is based on the following drawings:

◆SD-81552-01, Iss 15BU—J87223A and J87223B Rectifier (Mfr Disc.)

SD-81756-01, Iss 27BU—J87223C and J87223D Rectifier (Mfr Disc.)

SD-81543-03, Iss 8D—J87214C Regulator

SD-81760-01, Iss 7A—J87277 Regulator (A&M Only)

SD-82398-01, Iss 1—J87437A Rectifier◆

If this section is to be used with equipment or apparatus reflecting later issue(s) of the drawing(s), reference should be made to the SDs and CDs to determine the extent of the changes and the manner in which the section may be affected. For a detailed description of operation, see the corresponding circuit description.

1.09 For more detailed information on the operation and maintenance of individual equipment or apparatus, refer to the appropriate Bell System Practices.

Note: When a rectifier is connected to the plant load and controlled by the plant control circuit, the appropriate power plant Bell System Practice supersedes the individual rectifier Operating Methods Bell System Practice.

1.10 On the J87223C and J87223D rectifiers, a gradual increase in output current circuit (walk-in) feature is provided as option ZC to eliminate an undesirable output current surge when ac power is applied at the input of the rectifier. A fuse has been placed on the battery side of the capacitor bank to protect the output filter capacitors from excessive ripple due to abnormal line voltages or component failure. The operation of the fuse will cause the RFA alarm lamp to light and the rectifier to shut down and lock out.

2. LIST OF TOOLS AND TEST APPARATUS

CODE OR SPEC NO.	DESCRIPTION
TOOLS	
141	Cord Tip
411C	Test Pick
◆KS-6278	Connecting Clip
720A	Voltage Pickup Tool
ITE-4175	Weatherproof Socket (or equivalent)
—	100-Watt, 120-Volt Lamp Bulb◆
TEST APPARATUS	
W1AF	Cord
KS-20538	Volt-Ohm-Milliammeter
KS-8039	Volt-Milliammeter
T921	Oscilloscope, Tektronix (or equivalent)

3. OPERATION

A. Preparing to Start

3.01 When preparing the rectifier for service, check that:

- (a) The ON-OFF key is in the OFF position.
- (b) The proper size fuses are provided and removed from the rectifier.

Note: The charge (CHG) and associated alarm fuses, the control battery fuse, and a fine voltage adjust feature may be located externally, but in close proximity to the rectifier.

- (c) All external connections are made in accordance with the schematic drawing covering the associated circuit of which the rectifier is a part.

(d) The option wiring is correct for the service to be used.

(e) The T1, T2, and T3 input transformer taps used are correct for the power supply voltage as measured with a KS-20538 volt-ohm-milliammeter.

Danger: When using the KS-20538 volt-ohm-milliammeter, the leads should be carefully examined to make sure the insulation is undamaged. The leads should be connected at the instrument before making contact with the circuit to be tested.

(f) The VOLTS ADJ (R11 for J87223A and J87223B rectifiers, R14 for J87223C and J87223D rectifiers) potentiometer is in the maximum counterclockwise (ccw) position.

(g) The FINE ADJ VOLTS (R27 for J87223A and J87223B rectifiers, R40 for J87223C and J87223D rectifiers) potentiometer is in the center position.

B. Starting

3.02 When placing the rectifier into service, proceed as follows:

- (1) Install all fuses **except** the CHG and the associated alarm fuse.
- (2) ◆Install the associated CHG and alarm fuse as follows:

(a) Connect the ITE-4175 tool, or a locally constructed equivalent (see Fig. 1) across the CHG fuse block terminals.

Requirement: The lamp in the tool glows brightly initially and then dims out in approximately 15 seconds. When the tool lamp extinguishes, the filter capacitors should be charged.

Warning: If the tool lamp fails to light, or does not dim out in approximately 30 seconds, remove the tool promptly. **DO NOT INSTALL THE CHG FUSE until the trouble has been located and cleared.**

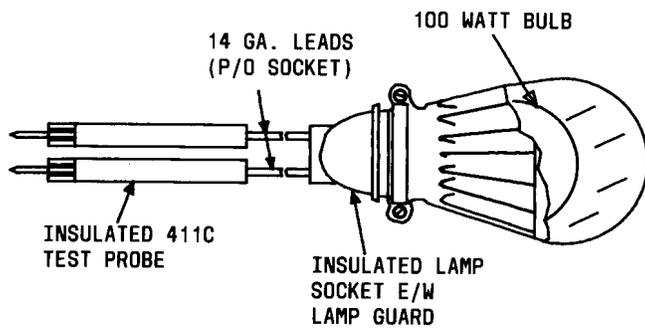


Fig. 1—Locally Constructed Equivalent of ITE-4175 Tool

(b) When the tool lamp extinguishes, remove the tool from the fuseholder terminals and promptly install the CHG fuse and associated alarm fuse.

Warning: *The rectifier filter capacitors start to discharge as soon as the tool is removed from the fuseholder terminals. Install the CHG fuse quickly to avoid loss of charge voltage.*

- (3) Apply the input power by operating the ON-OFF key to the ON position.
- (4) Connect the KS-8039 meter to the output terminals of the rectifier.
- (5) Rotate the VOLTS ADJ potentiometer clockwise (cw) until the voltage output of the rectifier satisfies the battery float requirement of the associated power plant. If there are no other voltage requirements, adjust the battery voltage to 2.17 volts per cell.
- (6) Adjust the FINE ADJ VOLTS potentiometer if a vernier adjustment is required. Rotate the potentiometer cw to increase the output and ccw to decrease the output.
- (7) Disconnect the KS-8039 meter.

Note: The CC potentiometer on the J87223A and J87223B rectifier (CL on the J87223C and J87223D rectifiers) is factory set to current limit at 100 amperes. If an adjustment is required, see paragraph 4.05.

C. Stopping

- 3.03 Remove the input power by operating the ON-OFF key to the OFF position.

Note: It will not be necessary to remove the fuses or adjust the potentiometers unless the rectifier will be out of service for an extended period of time.

4. ROUTINE CHECKS

4.01 If the relays are mounted on circuit boards, they cannot be checked and must be replaced in case of malfunction. If possible, periodically check all other relays for condition of contacts, making sure that they are in accordance with the circuit requirements table and Bell System Practices which apply.

4.02 Output Voltage Check:

Note: Output voltage check instructions on the associated power plant maintenance section supersede the information in the following paragraph.

Check the battery float voltage on the associated power plant voltmeter. TST (S2) switch should be in the midposition. This check should be made only when the rectifier is at a partial load below its current limit setting. Output voltage adjustments, when the rectifier is in current limit or at no load, are not valid. If output voltage adjustment is needed, the VOLTS ADJ potentiometer should be adjusted to the desired output. If a vernier adjustment is required, adjust the FINE ADJ VOLTS potentiometer. The full range of the FINE ADJ VOLTS potentiometer is about 1 volt.

4.03 **Regulator Check:** To check the regulator unit, proceed as follows:

- (1) Momentarily operate the TST (S2) switch to the FL position.

Requirement: The rectifier output increases.

- (2) Momentarily operate the TST (S2) switch to the NL position.

Requirement: The rectifier output decreases.

- (3) Verify that rectifier output goes back to normal after TST (S2) switch is released.

Note: The TST (S2) switch should be held operated only long enough to check the proper operation of the regulator unit. Do not hold it operated longer than necessary since it can affect plant operation.

- (4) If requirements in (1) and (2) are not met, refer to Part 5.

4.04 Electrolytic capacitors should be maintained in accordance with Section 032-110-701.

4.05 Current Limiting Potentiometer Check:

To check the adjustment of the current limit potentiometer, proceed as follows:

Note 1: The current limit potentiometer is designated CC for J87223A and J87223B rectifiers; CL for J87223C and J87223D rectifiers.

Note 2: A minimum load of 110 amperes must be available to load the rectifier to be checked either by using the office load or adding an artificial load or a combination of both.

Warning: **Do NOT exceed 110 amperes if the rectifier fails to limit.**

- (1) Operate ON-OFF key to OFF.
- (2) Rotate the VOLTS ADJ potentiometer fully ccw.
- (3) Set the FINE ADJ VOLTS potentiometer to midposition.
- (4) Connect the KS-8039 meter to the output terminals.
- (5) Operate ON-OFF key to ON.
- (6) Rotate the VOLTS ADJ potentiometer cw.

Requirement: The rectifier current limits at 100 amperes.

Warning: **The current limit potentiometer is factory adjusted for 100 amperes. Do NOT exceed 110 amperes.**

Note: If the requirement in (6) is met, proceed to (9). If the rectifier current limits under 100 amperes, proceed to (7). If the rectifier limits above 100 amperes, proceed to (8).

(7) If the rectifier current limits under 100 amperes, rotate the current limit potentiometer cw until rectifier limits at 100 amperes. It may be necessary to readjust the VOLTS ADJ potentiometer.

(8) If the rectifier current limits above 100 amperes, rotate the current limit potentiometer ccw until the rectifier limits at 100 amperes.

(9) Readjust the output voltage in accordance with subparagraphs 3.02(5) and (6).

(10) Operate ON-OFF key to OFF.

(11) Disconnect the KS-8039 meter.

4.06 70-Type Fuse Check: To check the 70-type fuses, proceed as follows:

Note: The later designed fuse caps for 70-type fuses contain an aperture or slot adjacent to the hole for the colored bead, providing access to the alarm test point. (See Fig. 2.) The new P-344900 fuse cap assembly is for use on nonmodular fuse block (18A, 19A, and 21A) and the P-11F667 fuse cap assembly is for use on modular fuse blocks (22- through 27-type). This style cap should be used when testing fuse alarms.

Warning: **Due to possible fuse and/or equipment damage, the former procedure of testing fuse alarms by inserting a 411C tool or a 266C tool (wire burnisher) held in a 265C tool (contact burnisher holder) beside the colored bead on older fuse caps without the slot or aperture should be discontinued.**

- (1) Prepare the alarm test cord by connecting one end of the W1AF testing cord to the 141 cord tip and 720A voltage pickup tool. (The KS-6278 connecting clip may be used to replace the 720A voltage pickup tool.) On the opposite end of the W1AF testing cord, connect the 411C test tool. (See Fig. 3.)

(2) Install the 720A voltage pickup tool in a spare 70-type fuse position in the associated power plant. (If the 720A tool is not available, obtain the same polarity voltage supply by connecting a KS-6278 connecting clip with the W1AF testing cord to the positive or negative bus bar.)

Caution: Test only the fuses associated with the same polarity voltage supply.

(3) With the tip of the 411C tool (attached to the battery connected W1AF cord), touch the exposed alarm test point on the fuse cap of the alarm fuse associated with the CHG fuse.

Requirement: The RFA alarm is operated; the rectifier shuts down and locks out.

- (4) Remove the 411C tool from the fuse cap.
- (5) Operate the ON-OFF switch to OFF and then to ON to restart the rectifier.

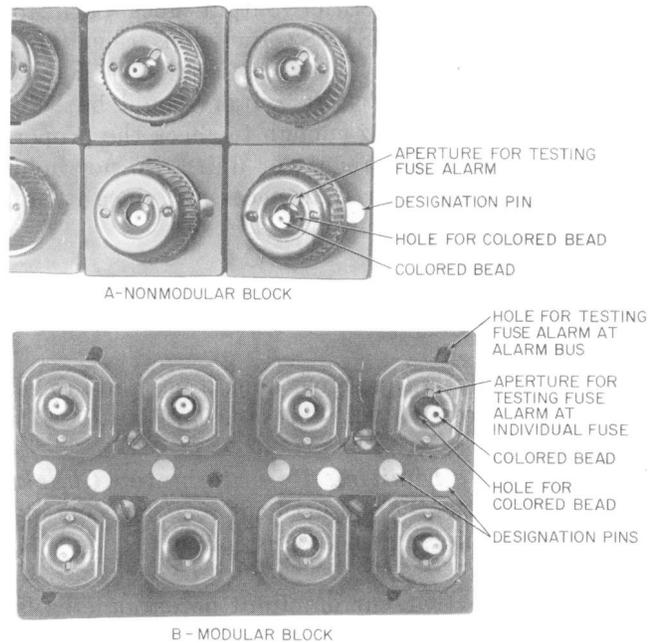


Fig. 2—Typical 70-Type Fuse Cap

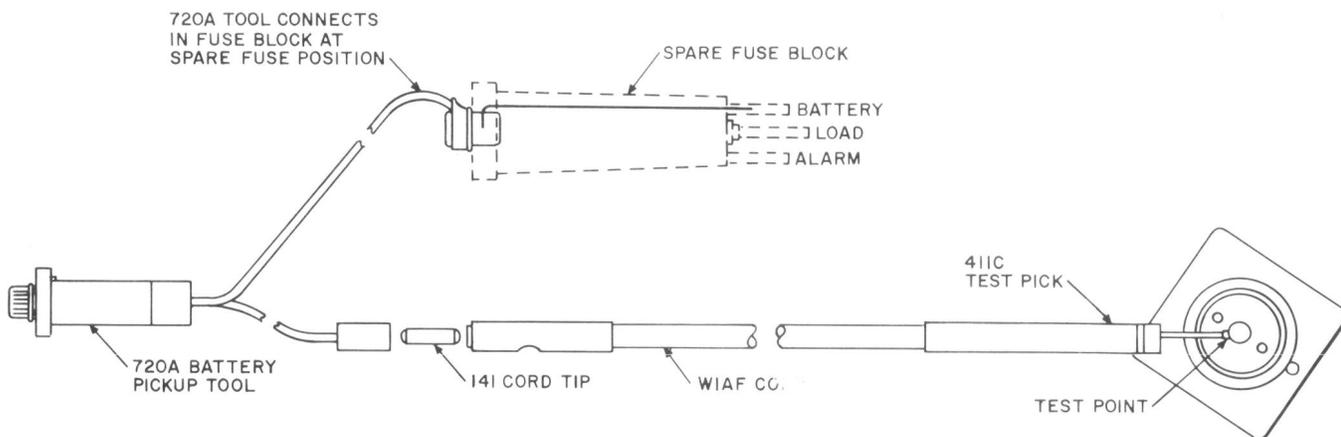


Fig. 3—Fuse Alarm Testing Cord—Tool Connection

- (6) Repeat (3), (4), and (5) for the F3, F4, and F5 fuses.
- (7) Remove the 720A tool from the spare fuse position. (If the KS-6278 connecting clip is used, disconnect the clip from the bus bar.)

Note: Steps (8), (9), (10), and (11) are not required for all rectifiers. (See paragraph 1.10.)

- (8) Disconnect the 720A tool and 141 cord tip from the W1AF cord and connect the KS-6278 connecting clip to the W1AF cord. Connect the KS-6278 connecting clip to ground.
- (9) With the tip of the 411C tool (attached to the ground connect W1AF cord), touch the exposed alarm test point on the fuse cap of F7 fuse on the J87223C and D rectifiers or F6 fuse on the J87223A and B rectifiers.

Requirement: The rectifier failure alarm is operated; the rectifier shuts down and locks out.

- (10) Remove the 411C tool from the fuse cap.
- (11) Disconnect the KS-6278 connecting clip.
- (12) Operate the ON-OFF switch to OFF and then to ON to restore the rectifier.

4.07 Ammeter Accuracy Check: When the rectifier is supplying a load and the rectifier ammeter is reading 100 amperes, the voltage drop across the R17 shunt, measured with the KS-8039 volt-milliammeter, should be between 32 to 35 millivolts.

4.08 Surge Protector Check: Periodically, a visual check should be performed on the 290A surge protector to verify the RV1, RV2, and RV3 varistors present a uniform bright red color appearance and that all the other component parts and wired connections are mounted securely in place. To check the fuse fail alarm of the 290A surge protector, proceed as follows:

Note: Alarm circuitry of this unit will not detect an open varistor within the circuit.

- (1) Operate the rectifier ON-OFF key to the OFF position.
- (2) Remove FA1 fuse from the 290A surge protector.
- (3) Operate the rectifier ON-OFF key to the ON position.

Requirement: The rectifier does not start and the RFA alarm is operated.

- (4) Operate the rectifier ON-OFF key to the OFF position.
- (5) Replace the FA1 fuse in the 290A surge protector.
- (6) Operate the rectifier ON-OFF key to the ON position.

Requirement: The rectifier starts and the RFA alarm is retired.

- (7) Repeat Steps (1) through (6) for fuse FA2 on the 290A surge protector.
- (8) Repeat Steps (1) through (6) for fuse FA3 on the 290A surge protector.◀

5. TROUBLES

5.01 Troubles which may occur in the plant are usually indicated by alarm lamps. The RFA lamp indicates a blown 70-type fuse in the rectifier. The ac input power may also be disconnected from the rectifier.

5.02 Failure of the rectifier will be listed in two sections. The first section (Table A) will analyze no dc output current. It will deal with the power components. The second section will troubleshoot the regulator circuit and error detector. Figures 4 through 11 show component and test point location for the various circuit boards.

TABLE A

NO DC OUTPUT CURRENT

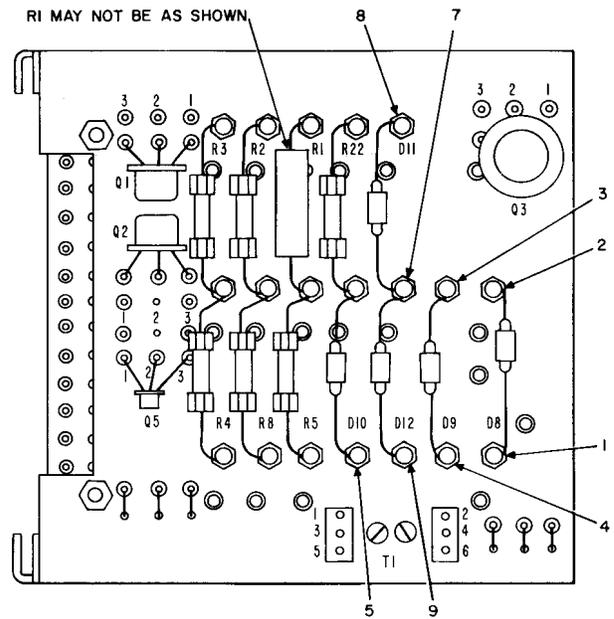
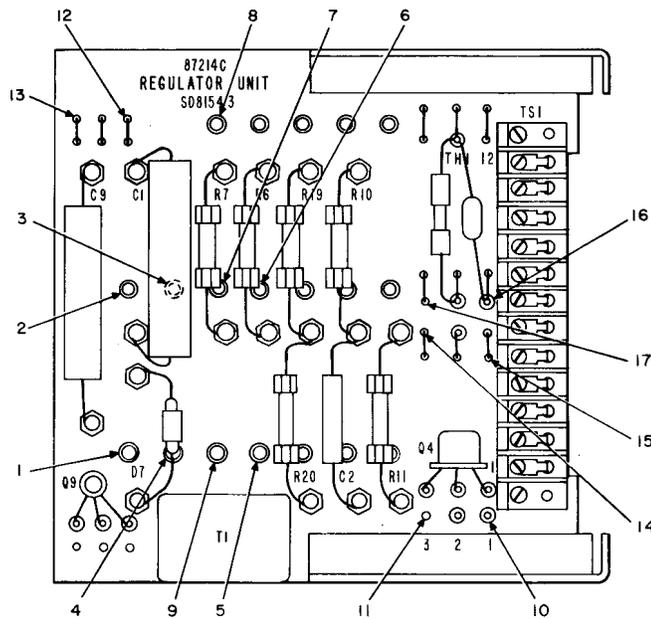
TROUBLE CONDITION	CHECK OUT PROCEDURE	CORRECTIVE ACTION REQUIRED
A. Rectifier will not deliver current after the ON-OFF switch is turned OFF, then ON. ♦ RFA lamp off ♦		<p>♦ (a) Check plant REG fuse. Replace if operated. ♦</p> <p>(b) Reverse any two of the three input leads.</p>
B. Rectifier will drop load suddenly to zero or to a very low output. ♦ RFA lamp off ♦		Reverse any two of the three input leads.
C. Rectifiers tend to float the batteries at an improper voltage level	Slowly rotate VOLTS ADJ potentiometer to see if charging current can be varied	Set VOLTS ADJ potentiometer to proper float value.
D. No ac input	Measure ac voltage across terminals L1-L2, L2-L3, and L1-L3 of ac contactor	If there is no voltage at these points, replace ac input fuses.
E. AC contactor not operating. ♦ RFA lamp is lighted. No fuses are operated ♦	Operate the ON-OFF switch to ON	Verify TR relay and RFA relay are not operated. Also, check to see that contact springs are seated properly in their holders.
F. AC contactor will not remain operated after the rectifier is turned on. ♦ RFA lamp comes on. No fuses operated ♦	This may be due to ground on the HV lead ♦ caused by high output voltage. ♦ Check to see if ground potential is present at the HV lead	If the battery float voltage is incorrect, rotate VOLTS ADJ potentiometer of the rectifiers ccw until proper voltage setting is reached. If ground still appears on the HV lead, check wiring to charge and discharge circuit; also consult the Bell System Practice for associated power plant.
G. ♦ AC contactor not operating. RFA lamp lighted	<p>(1) Check for operated fuse at the following positions: F2 CHG ALM, F3 CONTR, F4 ALM, F6 FL ALM and F7 FL</p> <p>(2) Check for operated FA1, FA2, or FA3 fuse on 290A surge protector circuit pack</p>	<p>Replace operated fuse(s) and restart rectifier.</p> <p>Replace the operated fuse(s) and restart the rectifier. If fuse (s) operate again, replace 290A surge protector circuit pack with factory adjusted spare. ♦</p>

TABLE A (Contd)

NO DC OUTPUT CURRENT

TROUBLE CONDITION	CHECK OUT PROCEDURE	CORRECTIVE ACTION REQUIRED
H. No output from the rectifier stack	Measure ac input to rectifier stack	If there is no ac voltage appearing at the input of the rectifier stack but there is proper ac voltage appearing at each transformer secondary, check lead connections from transformer to rectifier stack. Turn the rectifier OFF before physically checking leads.
I. No output from the rectifier stack and/or the ac input fuses repeatedly fail when the rectifier is turned on. This happens even though the lead connections to the power transformer and rectifier stack have been checked for possible faults	Check the rectifier stack for possible damaged diodes or SCRs. A damaged diode or SCR will indicate a complete short circuit	If any components are found damaged in the CR bridge, replace the entire assembly.
J. Normal output but repeated transformer failures in the power stage. This is caused by an open winding in the secondary of delta connected transformers T1, T2, and T3	Remove ac power and/or operate CB to the OFF position. Disconnect secondary terminals of T1, T2, and T3. Connect a KS-20538 VOM across terminals 6 and 7 of T1, T2, and T3, one at a time, to check dc resistance of the windings. The KS-20538 VOM should indicate 0 to 3 ohms	High resistance will indicate an open winding. Replace transformer as necessary.

SECTION 169-255-301



TERMINAL	APPROX. READING	POSSIBLE CAUSE FOR INCORRECT READING
3 - 4 5 - 6 7 - 8 9 - 7	5.5 - 6.6 VOLTS - DC 5.5 - 6.6 VOLTS - DC 5.5 - 6.6 VOLTS - DC 5.5 - 6.6 VOLTS - DC	DEFECTIVE D9 DEFECTIVE D10 DEFECTIVE D11 DEFECTIVE D12
10 - 11	0.5 - 13 VOLTS - DC	REMOVE THE CHG. FUSE AND TURN THE VOLTS ADJ. POT CW. THE VOLTAGE ACROSS 10 - 11 SHOULD GO FROM 13 VOLTS TO A LOWER VALUE. IF THIS DOES NOT HAPPEN AND THE VOLTAGE AT 10 - 11 IS ZERO AND THE RECTIFIERS OUTPUT VOLTAGE IS EXTREMELY HIGH, Q3 AND/OR Q4.
12 - 13	25 VOLTS - DC	IF LOWER THAN 20 VOLTS, REPLACE Q5.
14 - 15	12 - 24 VOLTS - DC	THIS VOLTAGE SHOULD GO FROM 24 VOLTS TO 12 VOLTS AS THE VOLT ADJ. POT IS TURNED CW. IF THIS DOES NOT HAPPEN, REPLACE Q3 AND Q9.
16 - 17	0 - 18 VOLTS - DC * 0 - 12 VOLTS - DC **	THIS VOLTAGE SHOULD VARY WITH THE VOLTS ADJ. POT. AS THE POT IS TURNED CW, THE VOLTAGE SHOULD DECREASE. IF THIS DOES NOT HAPPEN, REPLACE Q2.

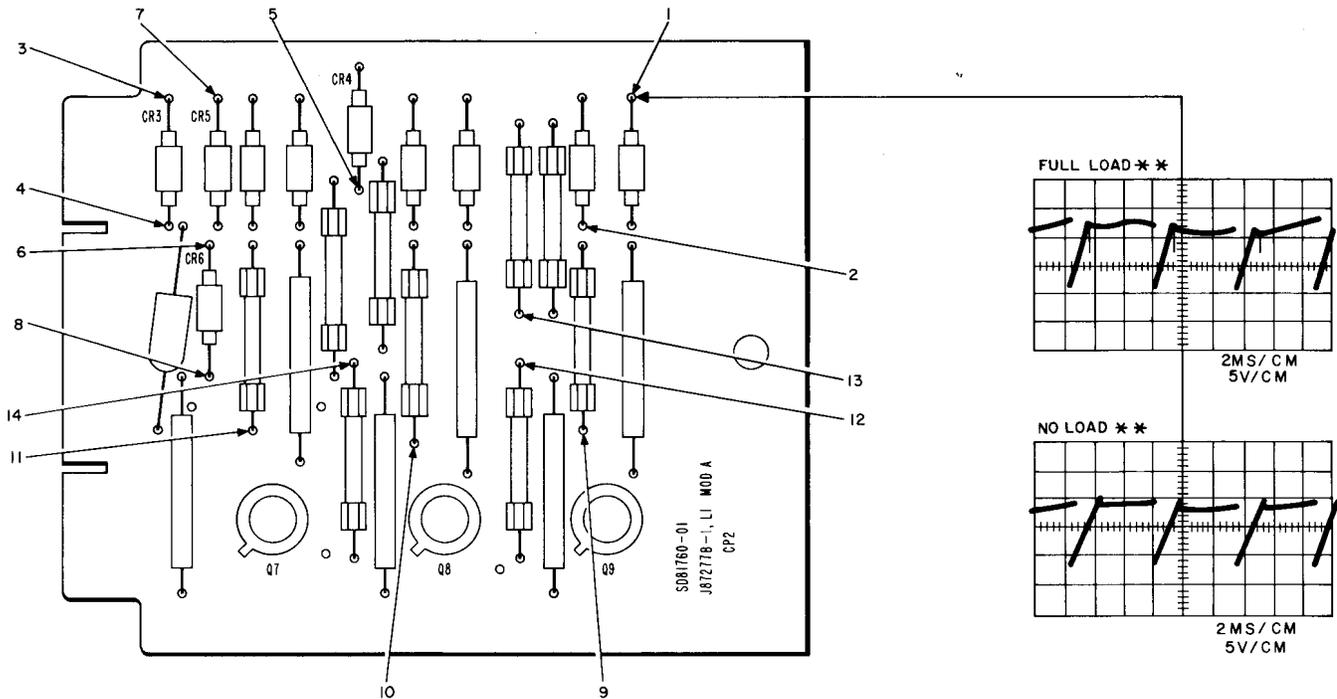
NOTE:

* 48 VOLT AND 130 VOLT RECTIFIERS ONLY.

** 24 VOLT RECTIFIERS ONLY.

Fig. 4—Regulator Unit, J87214C, CP1

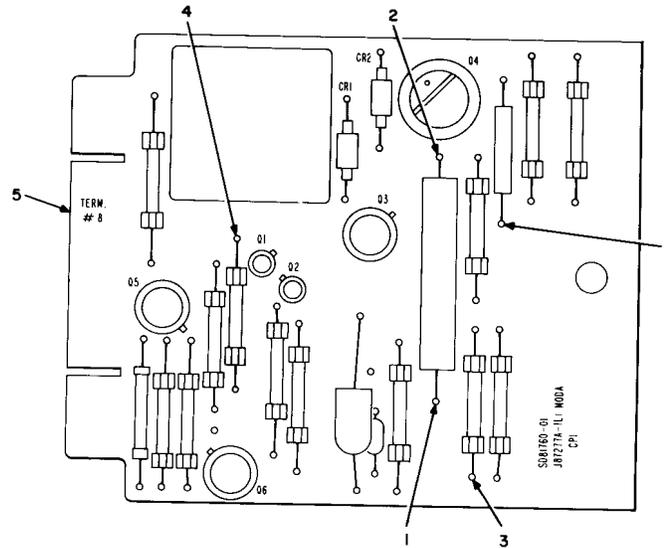
SECTION 169-255-301



TERMINAL	APPROX. READING	POSSIBLE CAUSE FOR INCORRECT READING
1 - 2	0.5 - 12 VOLTS - DC	THIS VOLTAGE WILL VARY DEPENDING ON THE LOAD. AS THE LOAD IS INCREASED, THIS VOLTAGE WILL DECREASE.*
3 - 4	5.5 - 6 VOLTS - DC	DEFECTIVE ZENER DIODE, CR3
5 - 6	5.5 - 6 VOLTS - DC	" " " " " " CR4
6 - 7	5.5 - 6 VOLTS - DC	" " " " " " CR5
8 - 9	5.5 - 6 VOLTS - DC	" " " " " " CR6
8 - 9	4.5 VOLTS - DC	DEFECTIVE Q9
8 - 10	4.5 VOLTS - DC	" " Q8
8 - 11	4.5 VOLTS - DC	" " Q7
12 - 13	25 VOLTS - AC	NO SECONDARY VOLTAGE FROM TRANSFORMER/S OR OPEN LEAD FROM TRANSFORMER TO CARD.
12 - 14	25 VOLTS - AC	
13 - 14	25 VOLTS - AC	

* THIS IS NOT A TROUBLE CONDITION, IT IS NORMAL OPERATION.
 ** TO OBTAIN THESE TRACES, THE VERTICAL INPUT TO THE T921 OSCILLOSCOPE SHOULD BE INVERTED BY OPERATING THE POLARITY SWITCH ON THE OSCILLOSCOPE.

Fig. 6—Regulator Unit, J87277B, CP2

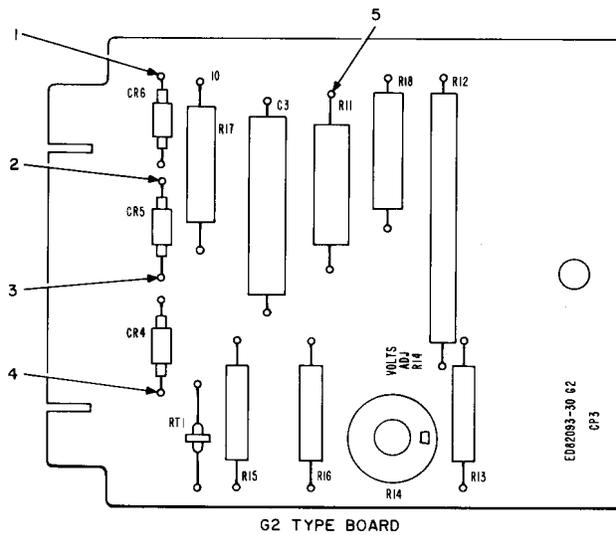
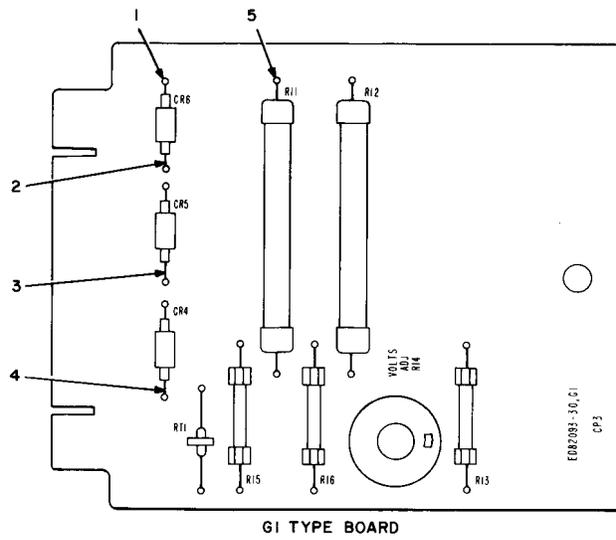


TERMINAL	APPROX. READING	POSSIBLE CAUSE FOR INCORRECT READING
1 - 2	25 VOLTS - DC	IF LOWER THEN 20 VOLTS, THEN Q4 IS DEFECTIVE.
3 - 4	0 - VOLTS - DC	AS THE VOLTS ADJ. POTENTIOMETER IS TURNED FROM THE MAXIMUM CW POSITION TO THE MAXIMUM CCW POSITION, THIS VOLTAGE SHOULD GO FROM ZERO TO APPROX. 10 VOLTS. IF NOT, THEN Q1 AND/OR Q2 IS/ARE DEFECTIVE.
5 - 6	0 - 8 VOLTS - DC	AS THE VOLTS ADJ. POTENTIOMETER IS TURNED FROM THE CW POSITION TO THE CCW POSITION, THE VOLTAGE SHOULD GO FROM ZERO TO APPROX. 8 VOLTS. IF NOT, Q3 IS DEFECTIVE.

NOTE :

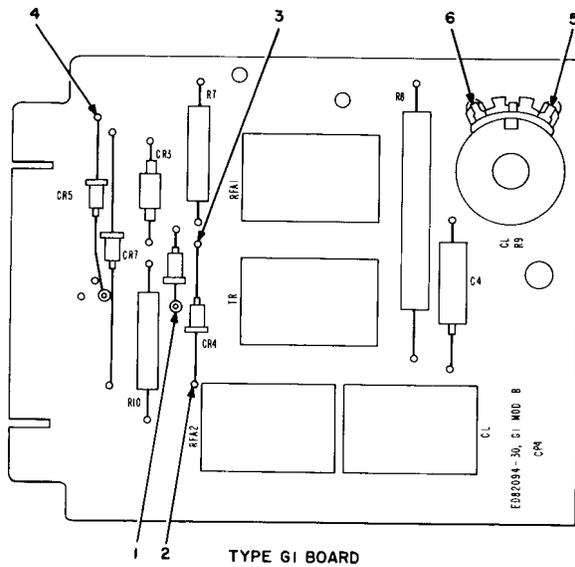
IT IS RECOMMENDED THAT THIS ENTIRE CARD BE REPLACED RATHER THAN CHANGING INDIVIDUAL COMPONENTS. WHEN MEASURING TERMINALS 3 AND 4, 5 AND 6, REMOVE THE CHARGE FUSE.

Fig. 7—Regulator Unit, J87277A, CPI

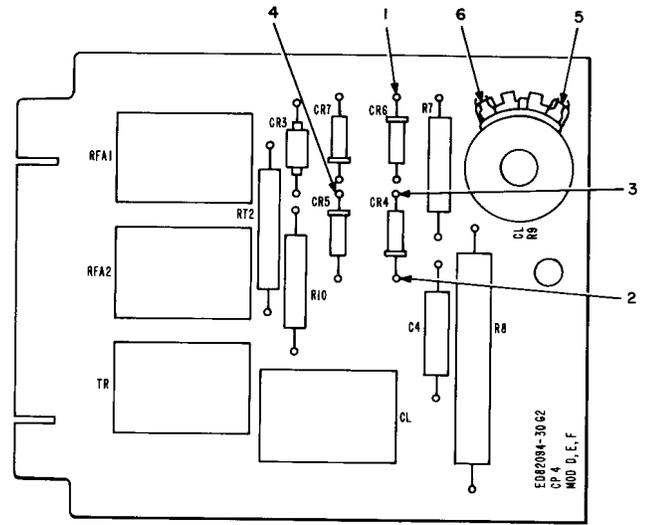


TERMINAL	APPROX. READING	POSSIBLE CAUSE FOR INCORRECT READING
1 - 2	5.5 - 6.6 VOLTS - DC	DEFECTIVE CR6 OR Q1 ON G2 TYPE BOARDS
2 - 3	5.5 - 6.6 VOLTS - DC	DEFECTIVE CR5 OR Q1 ON G2 TYPE BOARDS
3 - 4	5.5 - 6.6 VOLTS - DC	DEFECTIVE CR4 OR Q1 ON G2 TYPE BOARDS
5 - 4	BATTERY VOLTAGE	CHECK FOR OPERATED REG. FUSE. CHECK WIRING TO CARD (MEASURE VOLTAGE AT TSI, TERMINALS 1 - 2) IF BATTERY VOLTAGE APPEARS AT THIS POINT, THEN THERE IS AN OPEN BETWEEN TSI AND THE ERROR DETECTOR BOARD.

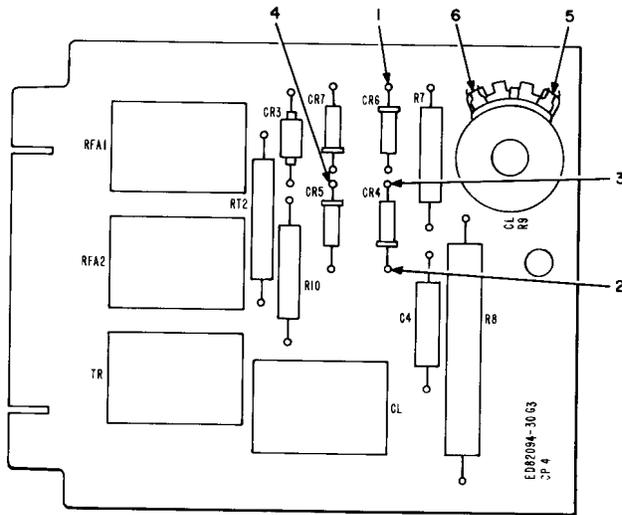
Fig. 8—Error Detector Circuit, ED-82093-30, CP3



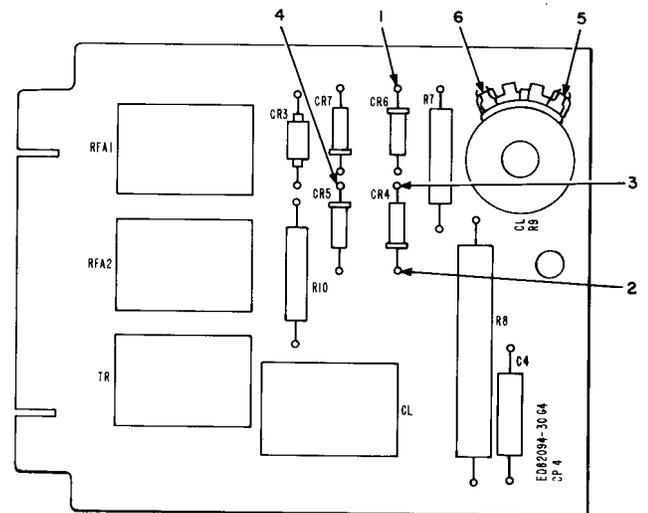
TYPE G1 BOARD



TYPE G2 BOARD



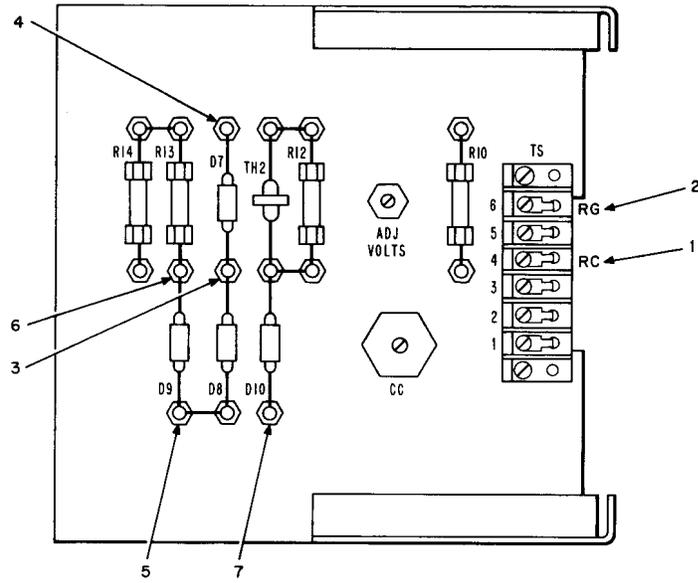
TYPE G3 BOARD



TYPE G4 BOARD

TERMINAL	APPROX. READING	POSSIBLE CAUSE FOR INCORRECT READING
1 - 2	75 VOLTS - AC / 100% LOAD 35 VOLTS - AC / 50% LOAD 6 VOLTS - AC / 10% LOAD	CHECK CONNECTIONS FROM CURRENT TRANSFORMER. CHECK CR4 - CR7 AS SHOWN BELOW.
3 - 4	85 VOLTS - DC / 100% LOAD 10 VOLTS - DC / 10% LOAD	DEFECTIVE DIODES CR4 - CR7.
5 - 6	CHECK WITH OHMMETER	REMOVE THE CARD FROM THE RECTIFIER. CHECK TO SEE THAT THE OHMIC VALUE OF THE POTENTIOMETER AGREES WITH THAT OF THE SCHEMATIC.

Fig. 9—Error Detector Circuit, ED-82094-30, CP4

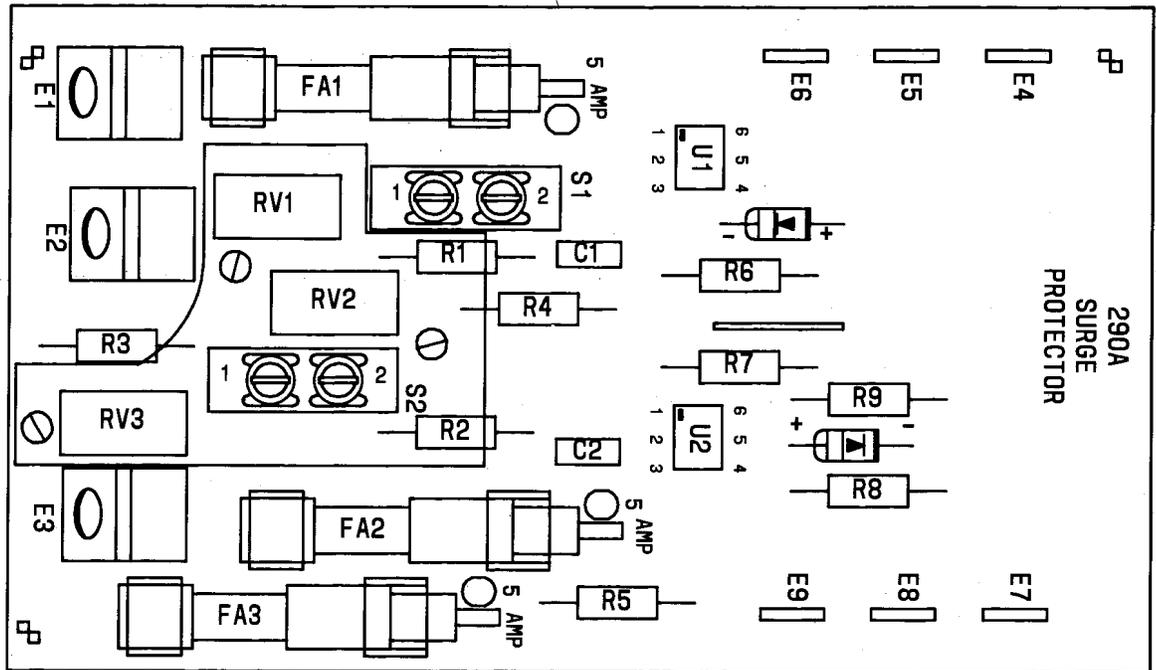


TERMINAL	APPROX. READING	POSSIBLE CAUSE FOR INCORRECT READING
1-2/2-1*	BATTERY VOLTAGE	CHECK CONNECTION TO TS3 - TS4. CHECK FOR AN OPERATED REG. FUSE.
3 - 4 5 - 3 6 - 5	5.5 - 6.6 VOLTS - DC 5.5 - 6.6 VOLTS - DC 5.5 - 6.6 VOLTS - DC	DEFECTIVE D7 DEFECTIVE D8 DEFECTIVE D9

NOTE:

* POLARITY DEPENDS ON RECTIFIER OPTION.

Fig. 10—Error Detector Circuit, J86214B, Regulator Unit



TERMINAL	APPROX. READING	POSSIBLE CAUSE FOR INCORRECT READING
E1 - E2	*5 MEGOHMS - Plus	**RV1 Failed
E2 - E3	*5 MEGOHMS - Plus	**RV2 Failed
E1 - E3	*5 MEGOHMS - Plus	**RV3 Failed

*Use KS-20538 meter set to 1 MEG scale.

**To check RV1, RV2, RV3 varistors, disconnect the 290A Surge Protector leads at E1-E9. Turn screws S1-1, S1-2, S2-1, S2-2 360° ccw. Upon completion of varistor checks, turn screws S1-1, S1-2, S2-1, S2-2 360° cw. Reconnect leads at E1-E9.

Fig. 11—290A Surge Protector

5.03 The procedures have been arranged to check the most probable cause of rectifier failure first. The procedures should start with a visual inspection, voltage measurements with a volt-ohmmeter, and finally, signal tracing with an oscilloscope. Typical waveforms are given in the appropriate figures. The measurement procedures for dc voltages shall be shown with the first terminal number as the positive terminal.

Note: To restart the rectifier after a trouble condition has been cleared, follow the procedure in paragraph 3.01.

Caution: The following precautions should be observed prior to and during the interval of detecting and clearing trouble of a faulty rectifier.

(a) When using an oscilloscope, select a properly grounded scope. Connect only one lead from the scope to the rectifier. **Do not connect the ground lead of the oscilloscope to any part of the rectifier.**

(b) If, for any reason, the regulator card in Fig. 7 or error detector card in Fig. 10 is to be removed, care should be taken to prevent a short from the RC or RB lead to the RG lead.

◆**Note:** It is recommended that the REG fuse in the power plant be removed before removing either card. The RC and/or RB leads will have battery connected to them even though the rectifier is turned off and the CHG fuse removed.◆

5.04 Other rectifier trouble conditions such as no dc output current or inability to readjust the rectifier to a desired regulating level may be a result of a damaged regulator or error detector card. The conditions which will damage the circuit cards are rare, and an investigation of the regulator

or error detector circuits should not be made until the preceding tests and wiring continuity checks have been made.

TROUBLESHOOTING PROCEDURES

5.05 The following chart should be consulted for the following rectifiers.

Note: All voltages shown in Fig. 4 through Fig. 10 are for a rectifier operating with normal output voltage and normal load unless otherwise shown.

RECTIFIER	TROUBLESHOOTING INFORMATION
J87223A	Fig. 4, 5, 10, ◆and 11◆
J87223B	Fig. 4, 5, 10, ◆and 11◆
J87223C	Fig. 6, 7, 8, 9, ◆and 11◆
J87223D	Fig. 6, 7, 8, 9, ◆and 11◆