TROUBLE CLEARING METHODS FOR J87224A, B, C, AND D RECTIFIER

1. GENERAL

1.01 This appendix provides a systematic means of troubleshooting the J87224A and J87224B rectifier in conjunction with the J87214C regulator unit and the J87224C and J87224D rectifier in conjunction with the J87277 regulator unit.

1.02 It is reissued to:

- Update the format to conform with Pacific Company (PAC) Standards.
- Include the appropriate legend on Page 1 in accordance with AT&T's "Guidelines and Procedures for Safeguarding Information" and PAC's System Instruction (SI) 178.

Note: Marginal arrows used to denote changes are omitted.

2. DESCRIPTIVE INFORMATION

2.01 The trouble clearing procedures are arranged to check the most probable cause of rectifier failure first.

2.02 These procedures include:

- Visual inspections.
- Voltage measurements with a volt-ohmmeter.
- Signal tracing with an oscilloscope.

2.03 The troubleshooting information is contained in two charts:

- Chart A analyzes ***NO DC OUTPUT CURRENT,*** dealing mainly with the power components.
- Chart B troubleshoots the ***REGULATOR CIRCUIT AND ERROR DETECTOR.***

2.04 Note that the measurement procedures for DC voltages shall be the same throughout this section. The terminal number shown first will always be the positive terminal.

2.05 All voltage and resistance measurements are to be made using a KS-14510 volt-ohmmeter.

2.06 When using an oscilloscope, connect only one lead from the scope to the rectifier. A properly grounded scope must be used. ***Do not connect the ground lead of the oscilloscope to any part of the rectifier.***

3. CHART A — NO DC OUTPUT CURRENT (POWER STAGES)

3.01 One of the most important steps in the installation of the rectifier is to have the proper tap selection on the primary of the transformer and the proper AC phasing.

3.02 The tap value should be selected in accordance with the chart on the schematic diagram of the rectifier under test.

3.03 In order to determine the proper phase sequence, the following procedure should be followed. Starting with the (volts-adjust) potentiometer in the full CCW position, slowly rotate it in the CW direction until the rectifier is regulating at the desired output voltage. Then turn the ON-OFF switch to OFF and back to ON. The rectifier should then regulate at the same voltage. If the rectifier does not restart, then reverse any two of the three input leads.

3.04 If the rectifier does not perform properly, consult Chart A.

NOTICE
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Bell System except under written agreement

CHART A

NO DC OUTPUT CURRENT

TROUBLE CONDITION	CHECK OUT PROCEDURE	CORRECTIVE ACTION REQUIRED
RECTIFIERS TEND TO FLOAT THE BATTERIES AT AN IMPROPER VOLTAGE LEVEL.	SLOWLY ROTATE VOLTS ADJUST POTENTIOMETER TO SEE IF CHARGING CURRENT CAN BE VARIED.	SET VOLTS ADJUST POTENTIOMETER TO PROPER FLOAT VALUE.
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.
AC CONTACTOR NOT OPERATING.	OPERATE THE ON-OFF SWITCH TO ON. CHECK FOR BATTERY VOLTAGE ACROSS C1 AND C2 (C3 AND C4 ON J87224), OBSERVING PROPER POLARITY. CHECK CONTACTOR FUSE WHICH IS LOCATED ON THE FRONT PANEL OF THE RECTIFIER TO SEE IF IT HAS FAILED.	IF BATTERY VOLTAGE DOES NOT APPEAR AT THESE POINTS, MAKE SURE TR RELAY AND RFA RELAY ARE NOT OPERATED. ALSO, CHECK TO SEE THAT CONTACT SPRINGS ARE SEATED PROPERLY IN THEIR HOLDERS. REPLACE FUSE. VERIFY THAT THE OFF SWITCH IS IN THE OFF POSITION WHEN THE FUSE IS BEING REPLACED.
AC CONTACTOR WILL NOT REMAIN OPERATED AFTER THE RECTIFIER IS TURNED ON.	THIS MAY BE DUE TO AN OPERATED RFA RELAY. THE RFA RELAY IS OPERATED BY PLACING GROUND ON THE "HV" LEAD. CHECK TO SEE IF GROUND POTENTIAL IS PRESENT AT THE "HV" LEAD.	IF THE BATTERY FLOAT VOLTAGE IS INCORRECT, ROTATE VOLTS-ADJUST 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 BELL SYSTEM PRACTICE (BSP) FOR ASSOCIATED PLANT.
RECTIFIER DOES NOT SHOW ANY INDICATION OF DC OUTPUT CURRENT.	AFTER CHECKING FOR FAILED AC INPUT FUSES, CHECK TO SEE IF THE F1 CHG FUSE HAS FAILED.	REPLACE THE F1 FUSE. DO NOT REPLACE THE CHG ALARM FUSE UNTIL THE MAIN DC OUTPUT FUSE IS REPLACED.
NO OUTPUT FROM THE CR BRIDGE.	MEASURE AC INPUT TO BRIDGE.	IF THERE IS NO AC VOLTAGE APPEARING AT THE INPUT OF THE BRIDGE, BUT THERE IS THE PROPER AC VOLTAGE APPEARING AT THE TRANSFORMER SECONDARY, CHECK LEAD CONNECTIONS FROM TRANSFORMER TO CR BRIDGE. TURN THE RECTIFIER OFF BEFORE PHYSICALLY CHECKING LEADS.
NO OUTPUT FROM THE CR BRIDGE AND/OR THE AC INPUT FUSES REPEATEDLY FAIL WHEN THE RECTIFIER IS TURNED ON. THIS HAPPENS EVEN THOUGH THE LEAD CONNECTION TO THE POWER TRANSFORMER AND CR BRIDGE HAVE BEEN CHECKED FOR POSSIBLE FAULTS.	CHECK THE "CR" BRIDGE FOR POSSIBLE DAMAGE 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.

4. CHART B — REGULATOR AND ERROR DETECTOR

4.01 Other rectifier trouble conditions, such as no DC output current or inability to adjust 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 test procedures and wiring continuity inspections (Chart A) have been made.

4.02 The regulator and error detector circuits are composed of card assemblies (printed circuit boards in the C and D codes).

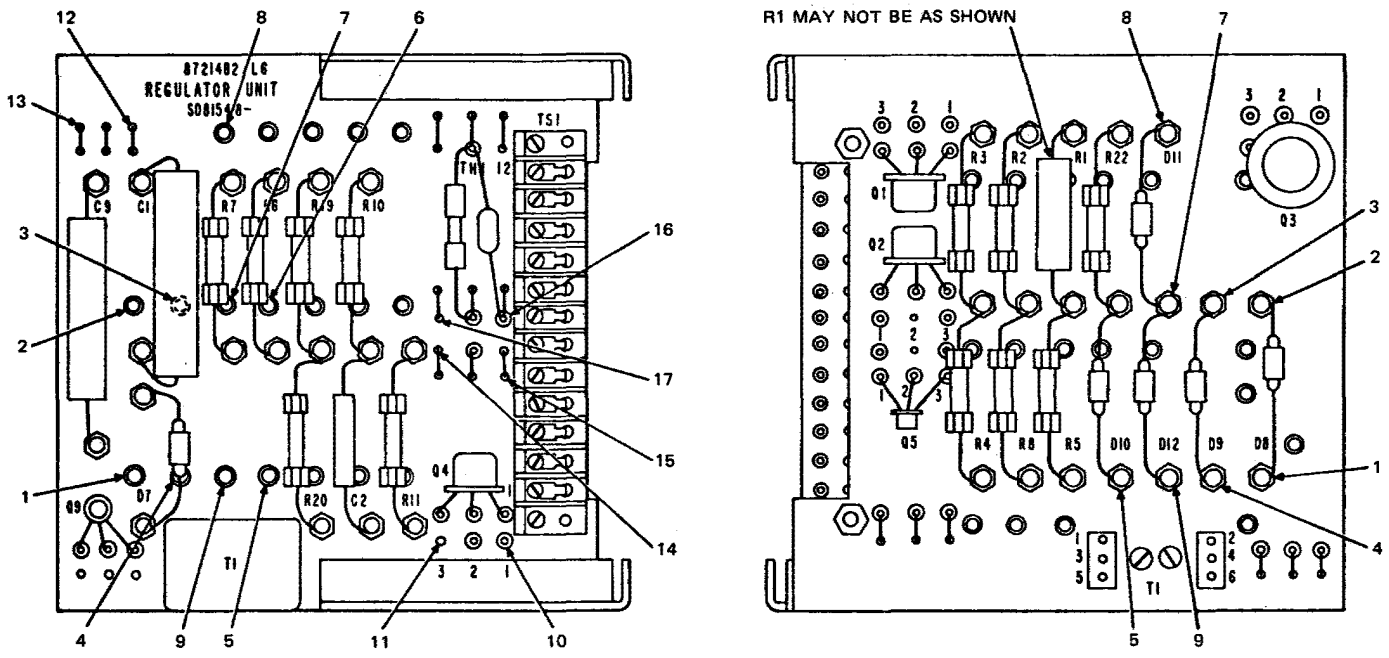
4.03 Figs. 1 through 5 illustrate the various point-to-point voltage measurements which can be made in order to troubleshoot the circuit cards.

4.04 If the regulator card is to be removed (A code only), care should be taken so as not to short the "RC" lead, "RB" lead to the "RG" lead. Also remove the Regulator (REG) fuse in the power plant. These leads will have battery connected to them even though the rectifier is turned off and the Charge "(CHG) FUSE" is removed.

CHART B

REGULATOR CIRCUIT AND ERROR DETECTOR

RECTIFIER	TROUBLESHOOTING INFORMATION
J87224 A AND B	FIGS. 1, 2, AND 5
J87224 C AND D	FIGS. 3 AND 4



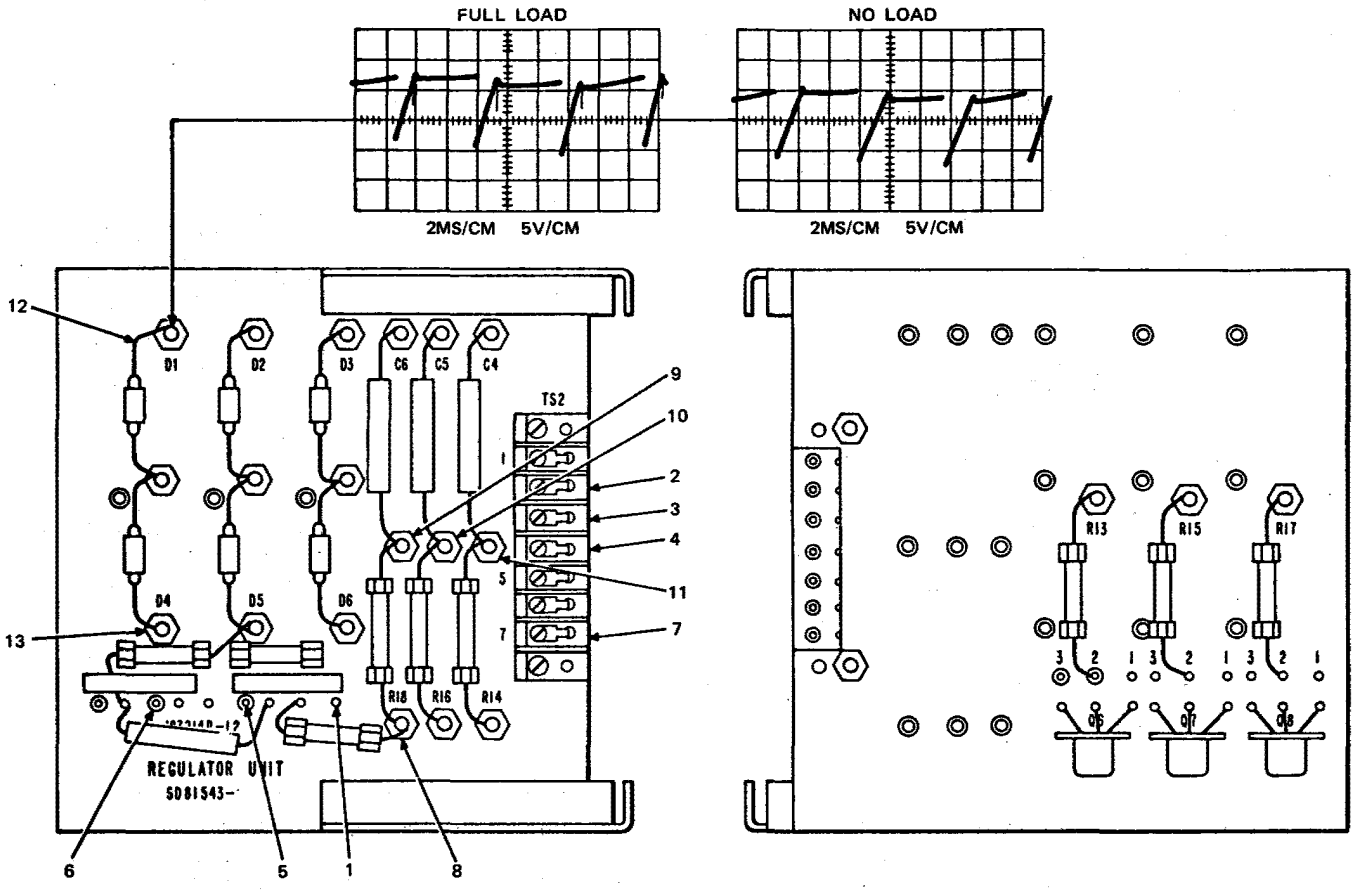
TERMINAL	APPROX. READING	POSSIBLE CAUSE FOR INCORRECT READING
3 - 4 5 - 6 7 - 8 9 - 7	5.5 - 6.6 VOLTS — DC 5.5 - 6.6 VOLTS — DC 5.5 - 6.6 VOLTS — DC 5.5 - 6.6 VOLTS — DC	DEFECTIVE D9 DEFECTIVE D10 DEFECTIVE D11 DEFECTIVE D12
10 - 11	0.5 - 13 VOLTS — DC	REMOVE THE CHG. FUSE AND TURN THE VOLTS ADJ. POT 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: THE WESTERN ELECTRIC 420A DIODE CAN BE REPLACED WITH THE WESTERN ELECTRIC 4468.

* 48 VOLT AND 130 VOLT RECTIFIERS ONLY.

** 24 VOLT RECTIFIERS ONLY.

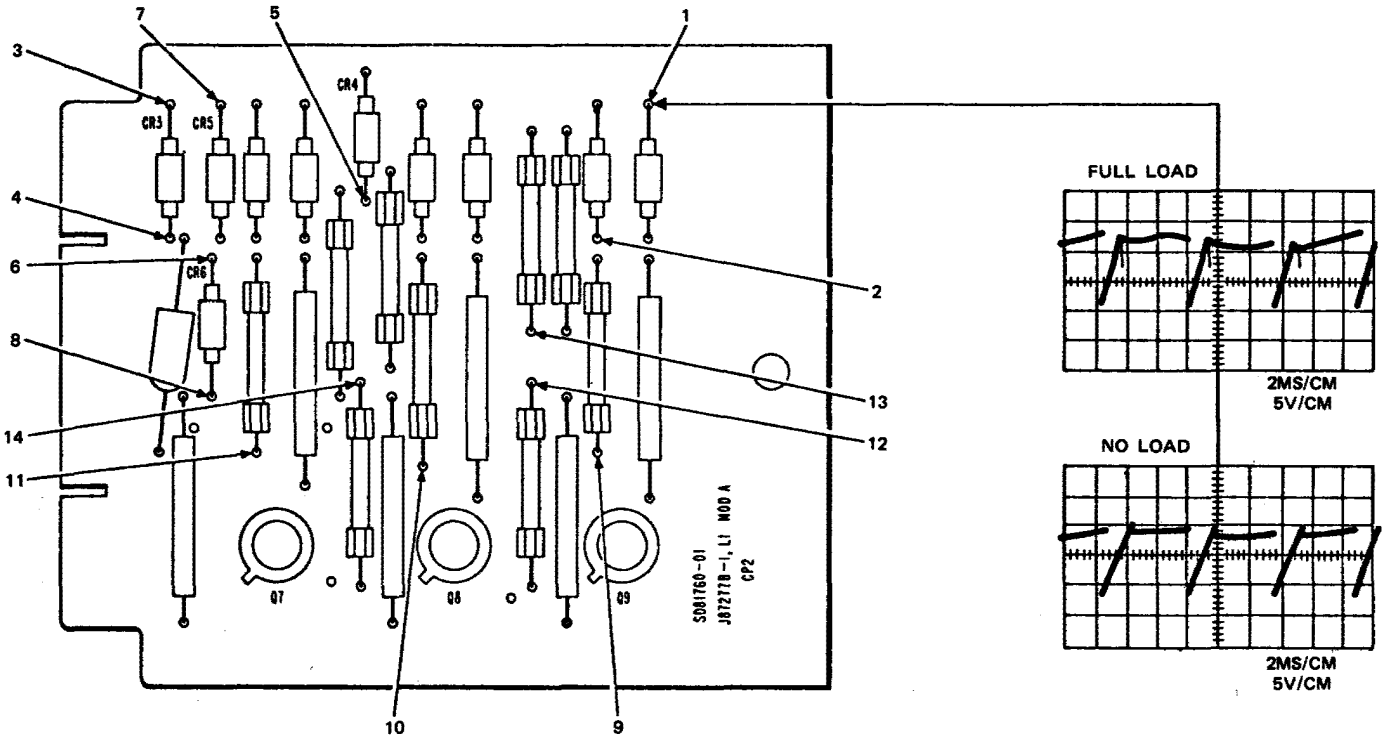
Regulator Unit J87214C CP1
Fig. 1



TERMINAL	APPROX. READING	POSSIBLE CAUSE FOR INCORRECT READING
7 - 2	25 VOLTS — AC	NO SECONDARY VOLTAGE FROM TRANSFORMER OR OPEN LEAD FROM TRANSFORMER TO CARD.
7 - 3	25 VOLTS — AC	
7 - 4	25 VOLTS — AC	
7 - 1	5.5 VOLTS — DC	Q6 TRANSISTOR DEFECTIVE
7 - 5	5.5 VOLTS — DC	Q7 TRANSISTOR DEFECTIVE
7 - 6	5.5 VOLTS — DC	Q8 TRANSISTOR DEFECTIVE
9 - 8	6 - 7 VOLTS — DC	IF VOLTAGE IS IN THE ORDER OF 9 - 12 VOLTS, THEN Q8 IS SHORTED
10 - 8	6 - 7 VOLTS — DC	IF VOLTAGE IS IN THE ORDER OF 9 - 12 VOLTS, THEN Q7 IS SHORTED
11 - 8	6 - 7 VOLTS — DC	IF VOLTAGE IS IN THE ORDER OF 9 - 12 VOLTS, THEN Q6 IS SHORTED
12 - 13	0.5 12 VOLTS — DC	THIS VOLTAGE WILL VARY DEPENDING ON THE LOAD. AS THE LOAD IS INCREASED, THIS VOLTAGE WILL DECREASE.*

* THIS IS NOT A TROUBLE CONDITION, IT IS NORMAL OPERATION.

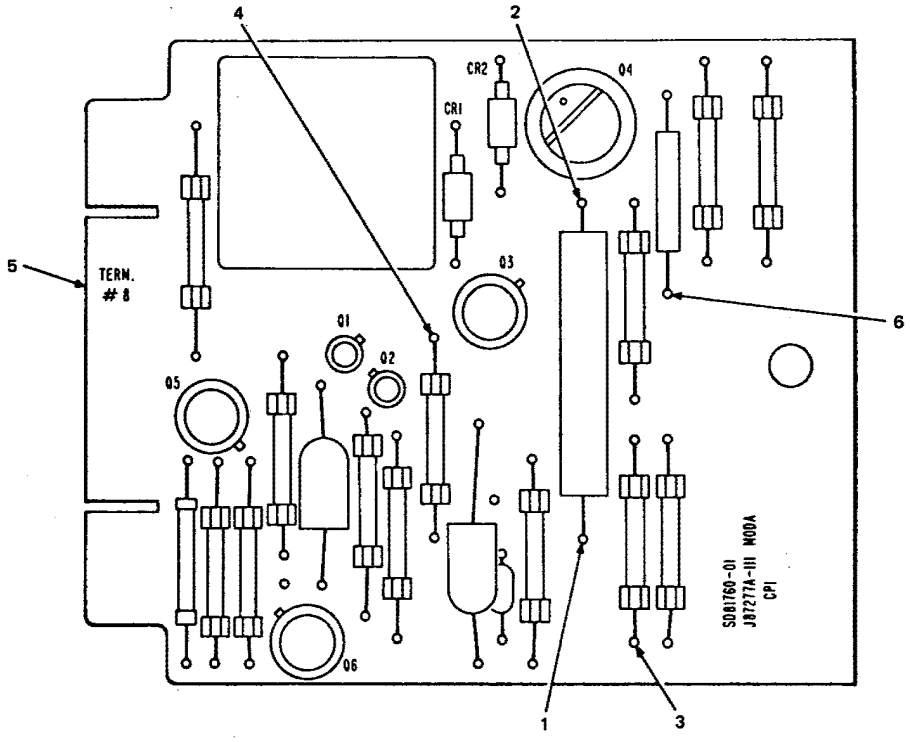
Regulator Unit J87214C CP2
Fig. 2



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 - 3	5.5 - 6 VOLTS — DC	DEFECTIVE ZENER DIODE, CR4
6 - 7	5.5 - 6 VOLTS — DC	DEFECTIVE ZENER DIODE, CR5
8 - 6	5.5 - 6 VOLTS — DC	DEFECTIVE ZENER DIODE, CR6
8 - 9	4.5 VOLTS — DC	DEFECTIVE Q9
8 - 10	4.5 VOLTS — DC	DEFECTIVE Q8
8 - 11	4.5 VOLTS — DC	DEFECTIVE 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.

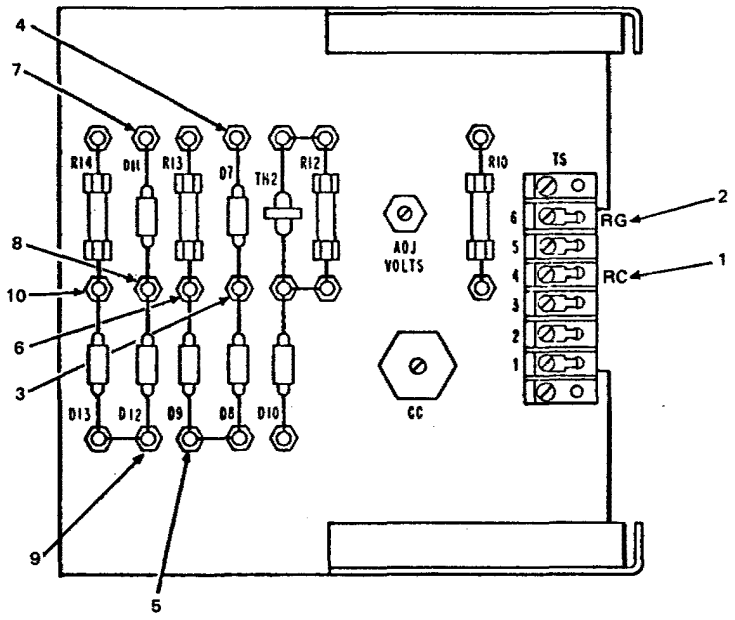
Regulator Unit J87277B CP2
Fig. 3



TERMINAL	APPROX. READING	POSSIBLE CAUSE FOR INCORRECT READING
1 - 2	25 VOLTS — DC	IF LOWER THAN 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.

Regulator Unit J87277A CP1
Fig. 4



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	5.5 – 6.6 VOLTS — DC	DEFECTIVE D7
5 – 3	5.5 – 6.6 VOLTS — DC	DEFECTIVE D8
6 – 5	5.5 – 6.6 VOLTS — DC	DEFECTIVE D9
7 – 8	19.8 – 24.2 VOLTS — DC	DEFECTIVE D11
8 – 9	19.8 – 24.2 VOLTS — DC	DEFECTIVE D12
9 – 10	19.8 – 24.2 VOLTS — DC	DEFECTIVE D13

Note: THE WESTERN ELECTRIC 420A DIODE CAN BE REPLACED WITH THE WESTERN ELECTRIC 446B.

* POLARITY DEPENDS ON RECTIFIER OPTION.

Error Detector Circuit
Fig. 5