J87320A

RECTIFIER

OPERATING METHODS

CONTENTS PAGE

1. GENERAL

1.01 The J87320A rectifier is primarily intended for use with the TIDI sound circuit; however, it may be used wherever its design and characteristics apply. The rectifier is designed to operate on 105- to 129-volts ac, single-phase, 60-Hz power. The outputs of the rectifier are +24 volts dc (±4%) at 0.5 to 0.75 ampere and −24 volts dc (±4%) at 0.5 to 1.25 amperes. The maximum output voltage ripple is 0.5 millivolt rms and the maximum output impedance is 0.2 ohm for frequencies of 0 to 16 KHz.

1.02 The abbreviations cw and ccw used herein, refer to clockwise and counterclockwise, respectively.

1.03 Routine checks are intended to detect defects and to guard against circuit failures which are liable to interfere with service. Checks and adjustments, other than those required by trouble conditions, should be made when they will cause the least unfavorable reaction to service.

1.04 The instructions are based on circuit schematic drawing SD-81876-01. For detailed description of the operation, see the corresponding circuit description.

1.05 The power supply will function with the following circuit:

SD-6G007-01 TIDI Sound Circuit

2. LIST OF TOOLS AND TEST APPARATUS

CODE OR SPEC NO.	DESCRIPTION
—	3-Inch C Screwdriver
—	P Long-Nose Pliers
TEST APPARATUS	
—	Voltmeter, Electronic Ballantine Laboratories Inc., Model 300G (or equivalent)
KS-14510	Volt-Ohm-Milliammeter
—	Variac®, General Radio, W2
—	70A-Type Fuse
—	70B-Type Fuse

3. OPERATION

3.01 *General:*

(a) The nominal 117-volt ac, 60-Hz power is rectified and filtered to provide voltages of nominal +28 volts dc and −28 volts dc. The +28 volts dc is regulated by a series voltage regulator to provide the required +24 volt dc

output. Similarly, the —28 volts dc is regulated by its own series voltage regulator to provide the —24 volt dc output.

(b) The series voltage regulators maintain the output voltage of the +24 volt and —24 volt dc supply within plus or minus 4 percent of 24 volts dc output at any output current between 0.5 amperes and rated output current (see 1.01), despite variations of ac input voltage between 105- and 129-volts ac.

(c) An office alarm circuitry is energized if one or both output voltages reach the preset high or low voltage limits. The maximum trouble voltage is 30 volts dc and the minimum trouble voltage is 10 volts dc.

PREPARING TO START

3.02 When preparing to place the power supply into service initially, check that:

(1) All external connections are made in accordance with the SD drawing covering the associated circuit of which the unit is a part.

Caution: Before making electrical connections, be certain that all power to the circuit is removed.

(2) Nominal 50-volt dc battery is supplied at terminals 13, 14, and 15 of P1 to provide voltage to energize the office alarm circuitry. One to four signals to the office alarm circuit is sent by the contacts of K1 relay.

(3) Proper size fuses are installed in F1 and F2 fuse sockets. If it is necessary to replace either fuse, replace only with the fuse-type and size or equivalent as follows:

FUSE	TYPE	SIZE
F1	70A	1-1/3 ampere
F2	70B	2 ampere

INITIAL ADJUSTMENTS

3.03 The rectifier is operating when ac input power is applied from the ac distribution panel and the F1 and F2 fuses are installed. The rectifier is regulated and no adjustment should be necessary for proper operation.

3.04 Using the KS-14510 volt-ohm-milliammeter, set to the 60-VOLT DC range, check the dc output voltage for ±24 volts dc to ±GRD.

4. ROUTINE CHECKS

4.01 The rectifier output voltage is set during manufacture and does not ordinarily need adjustment. However, if adjustment is required, the output voltage is adjusted and checked as follows:

(a) ***Positive Output Voltage:***

(1) Connect the KS-14510 volt-ohm-milliammeter, set to the 60-VOLT DC range, from terminal 7 of P1 (+24 volt output) to terminal 8 (+GRD).

(2) The positive output voltage is increased by rotating potentiometer R12 cw and decreased by rotating potentiometer R12 ccw. Adjust to +24 volts dc.

(3) Disconnect the KS-14510 volt-ohm-milliammeter.

(b) ***Negative Output Voltage:***

(1) Connect the KS-14510 volt-ohm-milliammeter, set to the 60-VOLT DC range, to terminal 14 of P1 (—24 volt output) and to terminal 9 of P1 (—GRD).

(2) The negative output voltage is increased by rotating potentiometer R15 ccw and is decreased by rotating potentiometer R15 cw. Adjust to —24 volts dc.

(3) Disconnect the KS-14510 volt-ohm-milliammeter.

4.02 The crowbar circuit adjustment is set during manufacture and should not require adjustment. If adjustment is required, the crowbar circuit is adjusted as follows:

(a) ***Positive Crowbar Circuit Adjustment:***

(1) Disconnect the input power to the rectifier.

(2) Disconnect the load from the rectifier.

(3) Short the collector-emitter of transistor Q1.

(4) Connect the KS-14510 volt-ohm-milliammeter, set to the 60-VOLT DC range, from terminal 7 of P1 (+24 volt output) to terminal 8 of P1 (+GRD).

(5) Check that F1 fuse is good.

(6) Rotate potentiometer R26 fully ccw.

(7) Connect a 117-volt, 60-Hz power source through the General Radio W2 Variac to the input of the rectifier.

(8) Operate the power supply under a no load condition and adjust the Variac until the output voltage, as indicated on the KS-14510 volt-ohm-milliammeter, is +29 volts dc.

(9) Slowly rotate potentiometer R26 cw until F1 fuse blows.

(10) Remove the input power from the rectifier.

(11) Disconnect the General Radio W2 Variac.

(12) Remove the short from the collector-emitter of transistor Q1.

(13) Disconnect the KS-14510 volt-ohm-milliammeter.

(14) Connect the load to the rectifier.

(15) Install a new F1 fuse.

(16) Connect the input power to the rectifier.

(b) ***Negative Crowbar Circuit Adjustment:***

(1) Disconnect the input power from the rectifier.

(2) Remove the load from the rectifier.

(3) Short the collector-emitter of transistor Q2.

(4) Connect the KS-14510 volt-ohm-milliammeter, set to the 60-VOLT DC range, from terminal 14 of P1 (−24 volt output) to terminal 9 of P1 (−GRD).

(5) Check that F2 fuse is good.

(6) Rotate potentiometer R30 fully ccw.

(7) Connect a 117-volt, 60-Hz power source through the General Radio W2 Variac to the input of the rectifier.

(8) Operate the power supply under a no load condition and adjust the Variac until the output voltage, as indicated on the KS-14510 volt-ohm-milliammeter, is −29 volts dc.

(9) Slowly rotate potentiometer R30 cw until F2 fuse blows.

(10) Remove the input power from the rectifier.

(11) Disconnect the General Radio W2 Variac.

(12) Remove the short from the collector-emitter of transistor Q2.

(13) Disconnect the KS-14510 volt-ohm-milliammeter.

(14) Connect the load to the rectifier.

(15) Install a new F2 fuse.

(16) Connect the input power to the rectifier.

4.03 The office alarm circuit is energized by the failure of F1 or F2 fuse (see 4.02). To check the alarms, proceed as follows:

(1) Remove F1 fuse.

Requirement: Office alarm is energized.

(2) Install F1 fuse.

Requirement: Office alarm is extinguished.

Repeat (1) and (2) for F2 fuse.

4.04 Periodically check the ripple of the output of the rectifier. Normal office load or equivalent resistance must be connected to the output of the rectifier. Proceed as follows:

(1) Connect the Ballantine Model 300G electronic voltmeter from terminal 7 of P1 (+24 volt output) to terminal 8 of P1 (+GRD).

Requirement: The meter indication shall be equal to or less than 0.5 millivolt rms.

(2) Remove the Ballantine Model 300G electronic voltmeter.

(3) Connect the Ballantine Model 300G electronic voltmeter from terminal 14 of P1 (—24 volt output) to terminal 9 of P1 (—GRD).

Requirement: The meter indication shall be equal to or less than 0.5 millivolt rms.

(4) Remove the Ballantine Model 300G electronic voltmeter.

4.05 Periodically inspect the relay for condition of contacts. The relay is not adjustable and should be replaced if a malfunction occurs.

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

5. TROUBLES

5.01 Various trouble symptoms and possible causes are listed in 5.05. A trouble test procedure opposite each cause will isolate the trouble to a few possible defective components. Since some unsatisfactory conditions will damage more than one component, all checks listed under a given cause should be made even though defective components are revealed before the entire check procedure has been completed.

5.02 Component test procedures are made with the rectifier disconnected from the external input power and output load. Before testing the components, remove the main ac distribution fuse and F1 and F2 fuses. When necessary, momentarily shunt capacitors with a 100-ohm resistor to be certain they are completely discharged. If any charge is left on the capacitors, it may cause inaccuracy in resistance readings.

Caution: In making continuity checks use the ohmmeter position of the KS-14510 volt-ohm-milliammeter. Do not use the X10,000 position for testing semiconductors as the higher voltage used may damage them.

5.03 Circuit packs and semiconductor devices should be maintained in accordance with Section 032-173-301. Refer to this section before starting troubleshooting procedures.

5.04 Before disconnecting leads, mark, tag, or record the connection.

TROUBLE CHART

5.05 Should any of the following troubles develop, it is suggested that the possible cause be checked in the order given. Check for loose or open connections or short circuits due to foreign matter lying across wiring terminals.

TROUBLES	POSSIBLE CAUSE
(a) No ±24 volt output, main ac distribution fuse blown, F1 and F2 fuses good, office alarm given.	T1 transformer shorted. CR1 rectifier shorted. C1, C2, C3.1, C3.2, or C4 shorted. Short in wiring.
(b) No +24 volt output, F1 fuse blown, office alarm given.	Short circuit in load. C5 shorted. Q6 (CP1) shorted. Q8 (CP1) shorted. CR5 (CP1) shorted.
(c) No —24 volt output, F2 fuse blown, office alarm given.	Short circuit in load. C6 shorted. Q7 (CP1) shorted. Q9 (CP1) shorted. CR6 (CP1) shorted.

TROUBLES	POSSIBLE CAUSE
(d) Ripple indication greater than 0.5 millivolt rms on +24 volt output, F1 fuse good, no office alarm given.	L1 shorted. C1, C2, or C5 open.
(e) Ripple indication greater than 0.5 millivolt rms on −24 volt output, F2 fuse good, no office alarm given.	L2 shorted. C3.1, C3.2, C4, or C6 open.
(f) +24 volt output exceeded 30 volts dc, office alarm given, F1 fuse blown.	Input voltage too high. CR2 shorted. Q1 shorted. Q1 (CP1) or Q3 (CP1) shorted. CR3 (CP1) or RV1 (CP1) open.
(g) Unable to adjust to +24 volt output.	Input voltage out of limits. CR2 shorted. Q1 shorted. Q1 (CP1) or Q3 (CP1) shorted. CR3 (CP1) or RV1 (CP1) open.
(h) −24 volt output exceeded 30 volts dc, office alarm given, F2 fuse blown.	Input voltage too high. CR3 shorted. Q2 shorted. Q2 (CP1) or Q4 (CP1) shorted. CR4 (CP1) or RV2 (CP1) open.
(i) Unable to adjust to −24 volt output.	Input voltage out of limits. CR3 shorted. Q2 shorted. Q2 (CP1) or Q4 (CP1) shorted. CR4 (CP1) or RV2 (CP1) open.
(j) +24 volt output below 10 volts dc, alarm is given.	Low input voltage. Defective Q3 (CP1), Q1 (CP1), R12 (CP1), or Q1.
(k) −24 volt output below 10 volts dc, alarm is given.	Low input voltage. Defective Q2 (CP1), Q4 (CP1), R15 (CP1), or Q2.