

**POWER SUPPLIES**  
**J86440A AND J86470U**  
**24 VOLTS, 12 AND 40 AMPERES**  
**OPERATING METHODS**

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**1. GENERAL**

**1.01** The J86440A (6, 12 or 22 amperes) and J86470U (40 amperes) power supplies with battery reserve are used to provide a  $\pm 24$  volt supply for the TD2 Radio Relay System but can be used with any system where the design and characteristics apply.

**1.02** This section is reissued to include information on test set connections used for high- and low-voltage alarm checks.

Revision arrows are used to emphasize the more significant changes. This reissue does not affect the Equipment Test List.

**1.03** Each power supply requires a 210- to 250-volt, 60-Hz, single-phase AC input. The regulated rectifiers keep the voltage within close float limits except during a power failure when the battery is unregulated. Alarms are provided to indicate high- or low-battery voltages, rectifier failure, and the failure of a discharge or distribution fuse.

**1.04** The J86440A, 24-volt supply with battery reserve employs a 9-ampere regulated metallic-type rectifier which may be used for constant loads, such as filament supply, up to 6 amperes and for intermittent loads, such as central office supply, up to 9 amperes. By the addition of two supplemental 15-ampere semiconductor-type rectifiers, and by replacing the metallic-type rectifier with a semiconductor-type rectifier, the plant may be used for intermittent loads up to 45 amperes, dependent upon the recharge capacity desired. Also, a provision for additional rectifiers is provided. Increased battery reserve may be obtained by the addition of an auxiliary battery, and increased battery voltage may be obtained by replacing the standard 11-cell batteries with 12-cell batteries. These batteries were formerly located in the bay but have now been moved to stands located externally from the bay. When used to supply power to a transmission system, a third redundant rectifier must be provided.

**1.05 J86470U Power Supply:** The J86470U power supply (as used in the 111A plant) is used in new installations to provide a 24-volt 40-ampere positive or negative power source with a floated 12-cell battery from a 210- to 250-volt, 60-Hz, single-phase supply. From one to five J87328 or J87211B rectifiers are connected to the 12-cell, 24-volt battery, depending on the plant capacity desired, to automatically maintain the battery at approximately 26 volts. The use of these rectifiers provides a substantial increase in plant capacity. When battery voltage reaches 24 volts, a minor alarm is given. If the battery voltage drops to 22.5 volts, a major alarm is given. Major alarms are also given at high voltage (27 volts) and in addition, faulty rectifiers, responsible for the high voltage, are automatically shut down. Refer to CD-81769-01 for a detailed description of

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the alarm circuit. An ammeter, a voltmeter, and regulation, discharge, and control fuses are provided. The ammeter and voltmeter indicate plant load and battery voltage, respectively.

**1.06** This issue of the section is based on the following drawings:

SD-56193-01, Iss 12—Alarm Sending Circuit

SD-56230-01, Iss 26—Distribution Fuse, Individual Audible and Visual Alarm Circuit

SD-81093-01, Iss 7—9-Ampere Rectifier, Metallic Type, J86243A

SD-81567-01, Iss 11—11-Ampere Rectifier, Semiconductor Type, J87211B (Mfr Disc.)

SD-82008-01, Iss 1—24V, 15 Amp, Regulated Rectifier, J87328A

◆SD-81769-01, Iss 5B—Charge and Discharge Circuit, 0 to 40 Amperes, 24 Volts, J86470U

SD-81091-01, Iss 13B—Charge and Discharge Circuit, 24 Volts, 6, 12, and 22 Amperes, J86440A.◆

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.

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

***Danger: Voltages inside the rectifier units may exceed 150 volts to ground and between terminals. Avoid all contact with terminals. Do not allow a test pick to touch two metal parts at the same time as destructive or dangerous short circuits may occur.***

**2. LIST OF TOOLS, MATERIALS, AND TEST APPARATUS**

CODE OR SPEC NO.	DESCRIPTION
<b>TOOLS</b>	
—	Blocking tools as required. (Use and apply as covered in Section 069-020-801.)
<b>MATERIALS</b>	
—	Dry Cell, 1-1/2 volts (as required)
<b>TEST APPARATUS</b>	
2W17A	Cord (W2W Cord Equipped with One 310 Plug and Two 360 Tools)
35-Type	Test Set
KS-16979	Volt-Ohm-Milliammeter/or
KS-8039	Volt-Ohm-Milliammeter

**3. OPERATION**

**3.01 Preparing to Start:**

(a) **J86440A Power Supply:** Before putting the power supply into service, check that:

- (1) The correct ac and dc fuses are available.
- (2) The OC1 and OC2 potentiometers are rotated completely counterclockwise.
- (3) The CHG-FLT key is operated to the FLT position.
- (4) All external connections are made in accordance with the SD drawings covering the associated circuits of which the power supply is a part.
- (5) Each rectifier unit has been adjusted for floating the battery at 23.87 volts for 11-cell operation or 26.04 volts for 12-cell operation in accordance with the following sections:

169-616-301 (J86243A)

169-245-301 (J87211B)

169-469-301 (J87328A)

(b) **J86470U Power Supply:** Before putting the power supply into service, check that:

- (1) The correct ac and dc fuses are available.
- (2) All external connections are made in accordance with the SD drawings covering the associated circuits of which the power supply is a part.
- (3) Each rectifier unit has been adjusted for floating the battery at 26.04 volts in accordance with the following sections:

169-245-301 (J87211B)

169-469-301 (J87328A)

**3.02 Starting:** To start either of the power supplies, proceed as follows:

- (1) Verify that the procedure in paragraph 3.01 has been followed.
- (2) Install the dc fuses in the power supply.
- (3) Install the input and output fuses, and/or operate the AC switch and the CB1 circuit breaker to the ON position on each rectifier.
- (4) Verify that the plant voltage is 23.87 volts for 11-cell operation or 26.04 volts for 12-cell operation. If plant voltage is not as specified, adjust the VOLT ADJ potentiometer in the rectifiers to increase the lower of the rectifier outputs if the voltage is low; or decrease the higher of the rectifier outputs if the plant voltage is high.

**Note:** The J87211B rectifiers do not provide output voltage if there is no load current required. Therefore, with the rectifier properly operating, output voltage measured at the test jacks will indicate a minimum voltage equal to the battery potential.

- (5) Once the above procedures have been completed, plant operation is automatic and the units are continuously in service.

**3.03 Stopping:** To remove either of the power supplies from service, proceed as follows:

- (1) Remove the AC input and DC output fuses and/or operate AC and CB1 circuit breakers to the OFF position in the rectifiers.
- (2) Remove the DC fuses in the plant control circuit.

**3.04 Battery Charging**

(a) **J86440A Power Supply:**

- (1) Verify that the plant is operating normally.
- (2) Operate the CHG-FLT key to the CHG position.
- (3) Slowly rotate the OC1 and OC2 potentiometers clockwise, keeping the output current in the rectifiers within limits until the desired charge voltage is obtained.

**Note:** For charge voltages, refer to Section 157-601-701.

- (4) After charging has been completed, rotate OC1 and OC2 potentiometers completely counterclockwise and operate the CHG-FLT key to the FLT position.

(b) **J86470U Power Supply:**

- (1) Verify that the plant is operating normally.
- (2) Increase the output of the rectifiers by slowly rotating the VOLT ADJ potentiometer clockwise on the rectifiers until the desired charge voltage is obtained.

**Note:** For information on charge voltages, refer to Section 157-601-701.

- (3) After charging has been completed, slowly rotate the VOLT ADJ potentiometer on the rectifiers counterclockwise until the plant meter indicates the plant float voltage (refer to paragraph 3.02).

#### 4. ROUTINE CHECKS

**4.01 General:** The purpose of making routine checks on this equipment is to determine

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whether or not all the features, indications, and alarms are in proper operating condition. The checking time and testing intervals should be based on local conditions and past experience. Fully automatic features of the plant can be assumed to be operating properly if all the conditions in Part 3 are fulfilled during the routine checks.

**4.02 Batteries:** Maintain the batteries in accordance with Sections 157-601-301 and 157-601-701.

**4.03 Rectifiers:** Check the rectifiers, as required, in accordance with the appropriate Bell System Practices.

**4.04 Relays:** Such checks of the power supply relays, as are consistent with operating conditions, should be made in accordance with Section 040-254-701 whenever operation indicates doubtful adjustment or trouble conditions.

**4.05 Voltmeter Calibration Check:** To check the accuracy of the plant voltmeter, connect the KS-8039 meter across the plant voltmeter and check the indication on both meters. If disagreement exists, plant meter error should be indicated in some way.

**4.06 Discharge fuse alarms** may be checked by inserting a blown fuse in a spare fuse holder. This should light the FA lamp and connect ground to alarm circuits to give audible and visual alarms. Removal of the blown fuse should silence the alarms and extinguish the lamp.

**4.07 The ABS (alarm battery supply) fuse alarm** may be checked by inserting a blown alarm-type fuse in place of the alarm-type fuse in parallel with the ABS fuse. Audible and visual alarms are sent to the office alarm system and the FA lamp in the power supply lights. Reinserting the removed fuse should silence the alarms and extinguish the lamp.

**4.08 The alarm multiple** should be checked as often as conditions demand to be sure that major and minor alarms in other parts of the building will operate in conjunction with corresponding audible alarms in the power room.

**4.09 High- and Low-Voltage Alarm Checks**

(a) **J86440A Power Supply:**

(1) Position the keys and switch of the 35-type test set as follows:

BAT & GRD Co key to Operated  
REV key to Normal  
VM key to Normal  
G switch to Open

(2) Using a 2W17A cord, connect dry cells to the test BAT & GRD jack of the test set as required (estimate 1-1/2 volts per cell) to operate the FLOAT (VR1) or the HLV (VR2) relays to their high contacts, connecting the positive terminal of the dry cells to the tip lead of the cord and the negative terminal to the ring lead of the cord. The locking levers of No. 1 through 4 keys should be open and all resistance sliders should be in their extreme right positions. Close the locking lever of the No. 1 key and move the No. 1 resistor sliders to their extreme left position. Under these conditions, the test set has its least resistance and the dry cells are out of the circuit.

(3) Block nonoperated the RF relay with each rectifier, if provided, or disconnect the CMD or RFA and HV leads from each rectifier.

(4) Using a 2W17A cord, connect the T & R jack of the test set to the test battery supply and the voltmeter relay [FLOAT (VR1) relay for float alarm check or HLV (VR2) relay for high- and low-voltage alarms]. Connect the ring lead of the cord to the test battery supply and the tip lead of the cord to the negative (-) terminal of the voltmeter relay.

(5) Using the 60-volt dc scale, connect the KS-16979 volt-ohm-milliammeter across the positive and negative terminal of the voltmeter relay.

(6) Remove the VR1 fuse for FLOAT alarm checks or the VR2 fuse for HIGH and LOW alarm checks.

(7) **Low-Voltage Test:** Gradually move the No. 1 sliders of the test set to the right, thus introducing resistance and lowering the voltage across the voltmeter relay.

**Requirement:** Audible and visual alarms are given in the power room and are also sent to the office alarm system when the indication on the KS-16979 meter reaches the voltage specified in Table A.

TABLE A

RELAY	CELLS/ OPTION	VOLTAGE
FLOAT (VR1)	11	22 ±0.5V
	12 (M Opt)	24 ±0.5V
	12 (D Opt)	25 +0-0.25V
HLV (VR2)	11	20V
	12 (M Opt)	20V
	12 (D Opt)	24 +0-0.25V

**Note:** Audible alarms can be silenced by operation of the ACO key; visual indications (FLOAT lamp in case of VR1 relay or HLV lamp in case of VR2 relay) are retained and can be extinguished only by returning the voltage to normal level.

**Caution:** If ACO key is used to silence audible alarms, make sure it is returned to normal after completion of test.

(8) **High-Voltage Test:** Move the No. 1 sliders to their extreme right positions. From the reading of the volt-ohm-milliammeter, determine whether the voltage has been reduced sufficiently to permit the introduction of dry cells without causing the high contact to make.

(9) Restore the BAT & GRD CO key to normal, and raise the voltage gradually by moving the No. 1 sliders toward the left to remove resistance from the circuit.

**Requirement:** Audible and visual alarms are given in the power room and are also sent to the office alarm system when the indication on the KS-16979 meter reaches the voltage specified in Table B.

**Note:** Audible alarms can be silenced by operation of the ACO key; visual indications (FLOAT lamp in case of VR1 or HLV lamp

TABLE B

RELAY	CELLS/ OPTION	VOLTAGE
FLOAT (VR1)	11	24 ±0.5V
	12 (M Opt)	26 ±0.5V
	12 (D Opt)	27 +0.25-0V
HLV (VR2)	11	26V
	12 (M Opt)	28V
	12 (D Opt)	28 +0.25-0V

in case of VR2 relays) are retained and can be extinguished only by returning the voltage to normal level.

**Caution:** If ACO key is used to silence audible alarms, make sure it is returned to normal after completion of test.

(10) When the high- and low-voltage alarm tests for the FLOAT (VR1) and HLV (VR2) relays have been completed, move the BAT & GRD CO key of the test set to the operated position. If not connected, connect the CMD or RFA and HV leads to the rectifiers from which they were disconnected. Remount the VR fuse (VR1 and/or VR2). Remove the test equipment; remove the blocking tools from the RF, RFA, and RFA-1 relays; and return ACO key to normal if operated.

(b) **J86470U Power Supply:**

(1) Position the keys and switch of the 35-type test set as follows.

BAT & GRD CO key to Operated  
REV key to Normal  
VM key to Normal  
G switch to Open

(2) Using a 2W17A cord, connect dry cells to the test BAT & GRD jack of the test set as required (estimate 1-1/2 volts per cell) to operate the voltmeter relay to its high contact, connecting the positive terminal of the dry cells to the tip lead of the cord and the negative terminal to the ring lead of the cord. The locking levers of No. 1 through 4 keys should be open and all resistance sliders should be in their extreme right positions.

Close the locking lever of the No. 1 key and move the No. 1 resistor sliders to their extreme left position. Under these conditions, the test set has its least resistance and the dry cells are out of the circuit.

(3) Block nonoperated the RF relay with each rectifier, if provided, or disconnect the CMD or RFA and HV leads from each rectifier.

(4) Using a 2W17A cord, connect the T & R jack of the test set to the test battery supply and the voltmeter relay (HL relay) as follows.

In positive plants, connect the ring lead of the cord to the positive (+) terminal of the voltmeter relay and the tip lead to the test battery supply. In negative plants, connect the ring lead of the cord to the test battery supply and the tip lead to the negative (-) terminal of the voltmeter relay. The negative terminal of the voltmeter relay is designated HR- in accordance with SD-81769-01.

(5) Using the 60-volt dc scale, connect the KS-16979 volt-ohm-milliammeter across the positive and negative terminal of the voltmeter relay.

(6) Remove the VR fuse from the plant control panel.

(7) **Low-Voltage Test:** Gradually move the No. 1 sliders of the test set to the right, thus introducing resistance and lowering the voltage across the voltmeter relay.

**Requirement:** Minor alarms are sent at 24 volts. When voltage reaches 22.5 volts, HLV lamp lights and major alarms are sent.

**Note:** The low contact setting of the HV relay may be raised or lowered to meet local voltage alarm requirements. If the new setting is more than  $\pm 3$  percent of the value shown in the circuit requirement table, erratic action of the meter may be incurred.

(8) **High-Voltage Test:** Move the No. 1 sliders to their extreme right positions. From the reading of the volt-ohm-milliammeter,

determine whether the voltage has been reduced sufficiently to permit the introduction of dry cells without causing the high contact to make.

(9) Restore the BAT & GRD CO key to normal, and raise the voltage gradually by moving the No. 1 sliders toward the left to remove resistance from the circuit.

**Requirement:** HLV lamp lights and major alarms are sent when voltage reaches 27 volts.

(10) When the high- and low-voltage alarm tests have been completed, move the BAT & GRD CO key of the test set to the operated position. If not connected, connect the CMD or RFA and HV leads to the rectifiers from which they were disconnected. Remount the VR fuse; remove the test equipment; and remove the blocking tools from the RF, RFA, and RFA-1 relays.

## 5. TROUBLES

As no switching is involved in these power supplies, any troubles should be limited to the rectifiers or individual components in the power supply circuit. If trouble occurs, proceed as in (a) through (g).

**Note:** Do not solder or unsolder connections to semiconductor devices before referring to Section 069-140-811.

(a) Check for loose or open connections and short circuits due to foreign matter lying across wiring terminals.

(b) Verify that the ac input is correct.

(c) Check for operated fuses.

(d) In the case of high or low voltage, check rectifier adjustments in accordance with the appropriate Bell System Practices. If necessary, troubleshoot the rectifiers in accordance with the above practices.

(e) Trouble in the alarm circuit should be located by following the information in Part 4.

(f) Time-delay TD2 relay and OC1 and OC2 potentiometers in the J86440A power supply require no maintenance. If they become defective in any way, they should be replaced with new units.

(g) If defective components are indicated in a specific portion or portions of a circuit, individual components can be checked conclusively by referring to the appropriate Bell System Practice.