610A POWER PLANT
OPERATING METHODS

1. GENERAL

1.01 The 610A power plant provides a positive or negative 130 volts dc from a −48 volt central office battery supply. This plant is designed primarily for plate battery supply in N and O Carrier equipment.

1.02 This section is reissued to add reference to the Centralized Status, Alarm, and Control Systems (CSACS). This issue does not affect the Equipment Test List.

> ***Warning: Voltages inside the converter may exceed 150 volts to ground. 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.***

1.03 The basic units of the 610A power plant are the J86497A, L4 dc-to-dc converter, the J86497A, L6 automatic load transfer panel, ▶and the J86497A, L7 CSACS alarm panel.◀ The List 4 circuit is a voltage regulated 130-volt, 1.5 ampere dc-to-dc converter. The List 6 circuit is an automatic load transfer panel which replaces the "Manufacture Discontinued" List 5 load transfer circuit. ▶The List 7 circuit provides the necessary relay contacts and terminals for connecting the List 4 circuit to CSACS.◀

1.04 This issue of the section is based on the following drawing:

SD-81482-01, Issue ▶9B.◀

For a detailed description of the operation, see the corresponding circuit description. If this section is to be used with equipment or apparatus that is associated with an earlier or later issue of the schematic drawing, 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.

2. LIST OF TOOLS AND TEST APPARATUS

CODE OR SPEC NO.	DESCRIPTION
TOOLS	
—	3-Inch C Screwdriver
—	Blocking Tool (Required in 4.06). See Section 069-020-801)
TEST APPARATUS	
KS-14510	Volt-Ohm-Milliammeter

Note: An approved digital multimeter is a suitable substitute.

3. OPERATION

A. Description

3.01 ***Plant Arrangement:*** The 610A power plant may be operated in the following three configurations:

(a) Single converter—no stand-by ("B" option)

(b) One converter, one stand-by converter, and an automatic load transfer panel ("H" option)

(c) Two converters, one stand-by converter, and an automatic load transfer panel ("G" option).

Note: If two regular converters are provided, the outputs are the same polarity and are not connected in parallel.

3.02 ***Automatic Load Transfer:*** The automatic load transfer circuit (J86497A, L6) is designed to switch the load to a stand-by converter should the regular converter fail. In the three converter configuration, either one of the two regular converters can fail, and the associated load will be transferred to the stand-by converter. If the

stand-by converter is carrying the load from one of the two regular converters, the transfer circuit prevents the remaining regular converter load from transferring to the loaded stand-by (which would result in an overload of the stand-by) should the remaining regular converter fail.

3.03 ***Manual Load Transfer:*** The MAN TRNS key is provided on the transfer panel to manually transfer the load from a regular converter to the stand-by converter. The RST key is provided to transfer the load from the stand-by converter back to the regular converter.

3.04 ***Plant Regulation:*** The dc-to-dc converter regulates the output voltage by means of a step-type regulator. When the input voltage dips below its low limit, a tap changing relay (VR), releases to increase the turns ratio of T1 transformer in the power circuit. The converter output will increase by approximately 8 volts. When the input battery voltage increases to the float value, the tap changing relay (VR) operates to reduce the output voltage by approximately 8 volts. This returns the converter output to a nominal 130 volts. The converter does not regulate the output voltage for load changes. The output voltage may vary + or −8 volts from no load to full load.

3.05 ***Voltage Adjustment:*** The ADJ VOLTS COARSE (S1) and FINE (S2) switches are provided on each converter to adjust the output voltage of the converter.

3.06 ***Plant Alarms:*** A minor alarm is provided to indicate failure of either regular converter. A major alarm is provided to indicate failure of any two converters in the plant. ▶If the plant is equipped with an operative J86497A, L7 panel, these alarms are transmitted to a CSACS central monitoring station each time an alarm is activated.◀

B. Preparing to Start

3.07 Before starting the power plant, check the following.

(1) All input, output, and alarm leads are properly connected in accordance with the associated schematic drawings.

(2) The −48 volt input fuse, located at the power distribution fuse panel, is available but not installed.

(3) The 130-volt output fuse, located at the load circuit battery distributing fuse panel, is available but not installed.

(4) The 2-ampere, OUTPUT fuse located on the converter panel is installed.

C. Starting

3.08 To start a regular converter in the power plant, proceed as follows.

(1) Install the −48 volt input fuse (located on the power distribution fuse panel) for the first converter.

(2) Connect the KS-14510 volt-ohm-milliammeter, set on the 60 DC VOLTS scale, across terminals 1(−) and 3(+) (GRD) on terminal strip TS(A) located on the converter rear panel.

Requirement: The KS-14510 meter indicates −48 ±2 volts dc.

Note: If the input voltage is not within the required nominal limits, check the −48 volt supply. The emergency input voltage limits are 45- to 52-volts dc.

(3) Install the 130-volt output fuse (located at the load circuit battery distribution fuse panel).

(4) Momentarily operate and release the RST1 reset key.

(5) Connect the KS-14510 meter, set on the 300 DC VOLTS scale, across terminals 9 and 11 on terminal strip TS(A) located on the converter rear panel. Observe proper polarity.

Requirement: The KS-14510 meter indicates 130 ±6 volts dc or the reduced voltage value per "R" option as specified in SD-81482-01, Issue ▶9B.◀

Note: If the requirement is not met, adjust voltage in accordance with 4.04.

(6) Connect the KS-14510 meter, set on the 0.3 DC VOLTS scale, across the LOAD TEST + and − test jacks.

Requirement: The KS-14510 meter indicates no greater than 0.156 volts dc.

Note: If the voltage exceeds 0.156 volts dc across the LOAD TEST + and − test jack, an excessive load current is indicated. Refer the condition to the supervisor.

(7) Repeat the starting procedure in (1) through (6) for the second regular converter (if provided).

3.09 To start a stand-by converter in the power plant, proceed as follows.

(1) Verify that the regular converter(s) is operating as outlined in 3.08 (1) through (6).

(2) Install the −48 volt input fuse (located on the power distribution fuse panel) for the stand-by converter.

(3) Connect the KS-14510 volt-ohm-milliammeter, set on the 60 DC VOLTS scale, across terminals 1(−) and 3(+)(GRD) on terminal strip TS(A) located on the stand-by converter rear panel.

Requirement: The KS-14510 meter indicates −48 ±2 volts dc.

Note: If the input voltage is not within the required nominal limits, check the −48 volt supply. The emergency input voltage limits are 45- to 52-volts dc.

(4) Momentarily operate and release the MAN TRANS 1 key.

Requirement: The load is transferred from converter 1 to the stand-by converter. The TRANS 1 lamp lights and a minor alarm is provided.

(5) Connect the KS-14510 meter, set on the 300 DC VOLTS scale, across terminals 9 and 11 on terminal strip TS(A) located on the stand-by converter rear panel. Observe proper polarity.

Requirement: The KS-14510 meter indicates 130 ±6 volts dc, or the reduced voltage value per "R" option as specified in SD-81482-01, Issue ▶9B.◀

Note: If the requirement is not met, adjust output voltage in accordance with 4.04.

(6) Connect the KS-14510 meter, set on the 0.3 DC VOLTS scale, across the LOAD TEST + and − test jacks.

Requirement: The KS-14510 meter indicates no greater than 0.156 volts dc.

Note: If the voltage exceeds 0.156 volts dc across the LOAD TEST + and − test jacks, an excessive load current is indicated. Refer the condition to the supervisor.

(8) Momentarily operate and release the RST 1 reset key.

Requirement: The load is transferred from the stand-by converter back to converter 1. The TRANS 1 lamp extinguishes and the minor alarm is retired.

D. Stopping

3.10 To stop a regular converter in the power plant, proceed as follows.

Note: If the plant consists of a single converter without a stand-by converter, proceed to (2).

(1) If the plant is provided with a stand-by converter, momentarily operate the MAN TRANS ( ) key to transfer the load from the converter being removed from service to the stand-by converter.

(2) Remove the −48 volt input fuse (located at the battery distribution fuse panel) for the regular converter being removed from service.

Caution: Do not attempt to remove the 130-volt output fuse if the plant is equipped with a stand-by converter. The 130-volt output fuse connects the load to the stand-by converter when the regular converter is removed from service.

Note: If the plant consists of a single converter without a stand-by converter, remove the 130-volt output fuse located at the load circuit battery distributing fuse panel.

3.11 To stop a stand-by converter, proceed as follows.

(1) Verify that the regular converter(s) is carrying the 130-volt load and operating under normal conditions.

Caution: If the stand-by converter is carrying the 130-volt load, momentarily operate and release the RST reset key to transfer the load back to the regular converter.

(2) Remove the −48 volt input fuse (located at the battery distribution fuse panel) for the stand-by converter.

4. ROUTINE CHECKS

4.01 The following routine checks should be performed periodically to ensure proper operation of the plant circuits.

A. Ventilating Passages

4.02 Clean the ventilating passages in accordance with local procedures to ensure adequate cooling of the converter(s) during operation.

B. Voltage Regulator Adjustment

4.03 Adjust the converter step-type voltage regulator as follows.

(1) Remove the load from the converter under test.

Note: If the stand-by converter is provided, momentarily operate the MAN TRANS key to transfer the load to the stand-by converter, or operate the RST reset key to remove the load from the stand-by converter and return the load to the regular converter.

(2) Connect the KS-14510 volt-ohm-milliammeter, set on the 60 DC VOLTS scale, across terminals 1 (−) and 3 (+) (GRD) on terminal strip TS(A) located on the converter rear panel.

Requirement: The KS-14510 meter indicates −48 ±2 volts dc.

(3) Using the 3-inch C screwdriver, rotate the VR ADJ potentiometer fully clockwise. The VR relay is released.

(4) Connect the KS-14510 meter, set on the 60 DC VOLTS scale, across the VR TEST (−) and VR GRD (+) test jacks.

(5) Adjust the VR TEST potentiometer until the KS-14510 meter indicates 48.0 volts dc.

(6) Slowly rotate the VR ADJ potentiometer counterclockwise until the VR relay operates.

(7) Readjust the VR TEST potentiometer slowly until the VR relay just releases.

Requirement: The KS-14510 meter indicates 47.5 ±2 volts dc.

(8) Rotate the VR TEST potentiometer fully cw. Check that the VR relay is operated.

(9) Disconnect the meter.

C. Output Voltage Adjustment

4.04 To adjust the converter output voltage, proceed as follows.

(1) Verify that the converter voltage regulator is properly adjusted in accordance with 4.03.

Requirement: The VR relay is operated.

(2) Verify that the converter is operating at normal load.

(3) Connect the KS-14510 volt-ohm-milliammeter, set on the 300 DC VOLTS scale, across the OUTPUT + and − test jacks.

Requirement: The KS-14510 meter indicates a nominal 130 volts dc.

Note 1: If the converter output voltage value is reduced per "R" option, the nominal output voltage should be 130 volts, less the voltage reduction (6.8 to 18 volts), determined by zener diode CR3. Refer to Table A, SD-81482-01, Issue ▶9B.◀

Note 2: If the requirement is met in (3), no voltage adjustment is necessary. If the requirement is not met, continue with (4).

(4) Operate S2 ADJ VOLTS FINE switch to the HIGH position to increase the output voltage, or to the LOW position to decrease the output voltage. If the output voltage can not be adjusted to the desired value by the S2 FINE switch, operate the S1 ADJ VOLTS COARSE switch to the HIGH position to increase the output voltage or to the LOW position to decrease the output voltage.

(5) Disconnect the meter.

D. Load Current Check

4.05 To check the converter output load current, proceed as follows.

(1) Verify that the converter is operating at the nominal input voltage of −48 volts dc and the nominal output voltage of 130 volts dc.

Note: If the requirement is not met in (1), refer to 4.04.

(2) Verify that the output load is switched to converter under test.

(3) Connect the KS-14510 volt-ohm-milliammeter, set on the 0.3 DC VOLTS scale, across the LOAD TEST + and − test jacks.

Requirement: At full load current of 1.5 amperes, the KS-14510 meter indicates 0.15 ±0.006 volts dc.

Note: If the voltage exceeds 0.156 volts dc across the LOAD TEST + and − test jacks, an excessive load current is indicated. Refer the condition to the supervisor.

(4) Disconnect the meter.

E. Automatic Transfer and Alarms Check

4.06 Periodically check the power plant automatic transfer and alarm circuits as follows.

(1) Remove the 2-ampere OUTPUT fuse from converter 1 (first regular converter).

Requirement: Converter 1 shuts down and the load is transferred to the stand-by converter. The NV lamp on converter 1 lights (white), the TRANS 1 lamp lights, and a minor alarm is provided.

(2) Replace the 2-ampere OUTPUT fuse removed from converter 1.

Requirement: The NV lamp extinguishes and the minor alarm is retired.

(3) Momentarily operate and release the RST 1 reset key.

Requirement: The load transfers back to converter 1 and the TRANS 1 lamp extinguishes.

(4) Repeat (1) through (3) for converter 2 (second regular converter in a three-converter).

(5) Remove the 2-ampere OUTPUT fuse from the stand-by converter.

Requirement: The NV lamp on the stand-by converter lights and a minor alarm is provided.

(6) Block the NV relay nonoperated on the stand-by converter.

Note: Refer to Section 069-020-801 for procedures and tools required to block relays.

(7) With the NV relay blocked nonoperated, replace the 2-ampere OUTPUT fuse in the stand-by converter.

(8) Momentarily operate and release the MAN TRANS 1 key.

Requirement: The load transfers to the stand-by converter. The TRANS 1 lamp lights and a major alarm is provided (alarm relay A is operated).

(9) Momentarily operate and release the RST 1 reset key.

Requirement: The load transfers back to converter 1. The TRANS 1 lamp extinguishes. The major alarm is retired (alarm relay A is released).

(10) Remove the blocking tool from the NV relay of the stand-by converter.

Requirement: The NV lamp extinguishes on the stand-by converter and the minor alarm retires.

5. TROUBLES

5.01 In general, the only items likely to become defective with use are the electrolytic capacitors and semiconductor devices.

5.02 If trouble develops, check the possible causes in the order given below. If the trouble is not apparent, check for loose or open connections or short circuits due to foreign matter lying across wiring terminals. If the trouble cannot be determined from the possible causes listed below, it is advisable to check all resistors for the resistance value shown on SD-81482-01.

Warning: Before removing or installing components in the converter, remove the converter from service.

TROUBLE	POSSIBLE CAUSE
No output voltage	Battery not connected
	Blown fuses
	Shorted capacitors
	Defective bridge transistors (see 5.03).
Low output voltage	Output voltage improperly adjusted (see 4.04).
	Damaged capacitors
	Failure of semiconductor devices.
High output voltage	Output voltage improperly adjusted (see 4.04).
	Step voltage regulator improperly adjusted (see 4.03).
	Damaged capacitors
Erratic output	Loose connections

5.03 ***Test for a Shorted Transistor Q1-Q4:*** Check for a shorted bridge transistor (Q1 through Q4) as follows.

(1) Remove load from the converter under test.

(2) Remove the −48 volt input fuse (located at the power distribution fuse panel).

(3) Discharge electrolytic capacitors C1, C3, C4, C5, C6, C7, and C8 by temporarily connecting a 100-ohm, 10-watt resistor across the capacitor + and − terminals.

(4) Remove the transistor retaining nuts and disconnect the transistors from their sockets.

(5) Using the KS-14510 volt-ohm-milliammeter set on the OHMS X10 scale, measure the resistance across the collector and the emitter in both directions.

Requirement: The ohmmeter indicates a high resistance in each direction.

Note: A low resistance indication shows a shorted transistor. Replace transistors as required.

(6) Mount the transistors in their sockets and replace the retainer nuts.

(7) Check each transistor after reconnecting the transistor in the circuit to make sure that its collector has not been accidentally grounded. To check for a grounded collector, proceed as follows.

(a) Connect the KS-14510 meter, set on the OHM X10 scale, between one of the screws which mount the transistor, and a mounting screw of the associated socket.

Requirement: The ohmmeter should indicate an infinite resistance.

Note: A zero indication shows the collector is grounded. Remove the transistor and check the transistor pins and the insulator wafer.