526A POWER PLANT
OPERATING METHODS

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1. GENERAL

1.01 The 526A (J86651) power plant is designed to provide reserve 120-volt, single-phase, 60-hertz ac power for critical loads that can withstand ac power interruptions for at least 2/10 second. It is powered by a nominal 140-volt dc power plant. The 526A power plant uses a solid state inverter and a control unit that automatically transfers the load from the regular to the reserve ac source if a power failure occurs in the regular source. The plant is designed to meet the requirements of KS-21469 List 1.

1.02 When this section is reissued, the reason for reissue will be listed in this paragraph. This issue does not affect the Equipment Test List.

1.03 The power plant output capacity is rated at 8 KW. Normally the power is supplied by local commercial power and the reserve power is supplied by the solid state inverter which is started when the commercial power voltage drops to 108 ±1 volts rms or below.

Warning: Voltages inside the power plant and between terminals may exceed 150 volts to ground. Extreme care must be exercised to prevent accidentally starting parts of the plant on which maintenance work is to be done. Before starting work, prevent automatic starting of equipment by removing fuses, blocking relays, opening switches, etc, as necessary. When maintenance work has been completed, make sure the circuit has been restored to normal.

1.04 Visual indication of plant status is provided by lamps, located on the control panel, which are visible through cutouts in the front doors. Alarm cutoff keys are provided to silence the PLANT AC OUTPUT major audible alarm and the INVERTER SUPPLYING LOAD minor audible alarm. The alarm is silenced by depressing the MAJOR ACO(S2) or MINOR ACO(S3) switch.

1.05 Checks and adjustments other than those due to trouble conditions should be performed during a period when they will cause the least interference with service.

1.06 These instructions are based on schematic drawing SD-82353-01, Issue 1. For a detailed description of how the circuit operates, refer to the corresponding circuit description. 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 The abbreviations cw and ccw refer to clockwise and counterclockwise, respectively.

2. LIST OF TOOLS AND TEST APPARATUS

CODE OR SPEC NO.	DESCRIPTION
TOOLS	
—	3-Inch C Screwdriver

TEST APPARATUS

KS-20599 L4	Digital Volt-Ohm-Milliammeter or equivalent
—	Variable voltage dc supply, 0 to 150 volts, with self-contained meter
—	Variac*, General Radio Co Type W5MT3, 0—140 Volt Output
	Counter, Hewlett Packard Model 5381A or equivalent
—	True RMS Voltmeter with 150 volt scale, Hewlett Packard Model 3400A or equivalent (See note)

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Note: The Hickok Model 3420 Universal true RMS Multimeter/Counter is a suitable substitute.

Caution: When using the Hewlett-Packard 3400A true RMS voltmeter, isolate the unit from ground by using any ac ground isolation plug, such as the Hubbell No. BL12-767 three-prong to two-prong plug. If the meter is not isolated from ground, erroneous reading and damage to the equipment may result.

Warning: Isolation of the voltmeter from ground creates a potential hazard. Avoid bodily contact between the test voltmeter and other components, conductors, or ground. Use of a meter not requiring ground isolation is preferred.

3. OPERATION

3.01 ***Preparing to Start:*** When preparing to put the 526A power plant in service, check that:

(a) The circuit breaker switch, CB1, is in the OFF position.

(b) The 120-volt ac supply fuse (F4, LINE REF, Bussmann ABC8) is available but not installed.

(c) The 120-volt ac inverter fuse (F5, INV REF, Bussmann ABC8) is installed at the fuse panel.

(d) The DC CONTROL fuses (F1, F2, Bussmann ABC3) are installed at the fuse panel.

(e) The thyristor protection fuse (F3, Chase-Shawmut A252250, 250 ampere) is in place and connected.

Note: Fuse F3 is mounted on an angle bracket at the rear of the cabinet approximately one third the way up from the bottom.

(f) The OUTPUT REF fuse (F6, Bussmann ABC3) is installed at the fuse panel.

(g) The AC OUTPUT fuses (L1 through L10, Bussmann Type NON) have been installed, as required, at the fuse panel.

(h) The AC fuse alarm fuses (L1A through L10A, 1/2 ampere) have been installed at the fuse panel.

3.02 ***Starting:*** To place the plant in service, proceed as follows:

(1) Install the 120-volt F4 LINE REF (Bussmann ABC8) ac supply fuse.

Requirement: Indicator light LINE SUPPLYING LOAD will illuminate.

(2) Connect the true rms voltmeter between the LINE TP3 and NEUT TP4 AC OUTPUT test jack 8 on the control panel.

Requirement: The voltmeter indicates 120, ±6 volts rms.

(3) Disconnect the meter from the LINE TP3 and NEUT TP4 AC OUTPUT jacks.

(4) Depress pushbutton S1 until indicator light CAPACITOR CHARGING extinguishes.

(5) Place the dc input circuit breaker CB1 in the ON position.

Requirement: Indicator lamp DC POWER ON illuminates.

(6) To test the operation of the inverter while the ac line is supplying the load, push the INVERTER TEST switch.

Requirement: Indicator light INVERTER RUNNING illuminates if the inverter is operating properly.

Note 1: In this test, load power is still provided by the ac line.

Note 2: When the switch is released, the inverter will shut down and return to standby condition after a short delay.

3.03 ***Stopping:*** To remove the power plant from service, proceed as follows:

(1) Place the dc input circuit breaker CB1 in the OFF position.

Requirement: Indicator light DC POWER ON extinguishes.

Note: The inverter is now disabled; however, line ac is still available to the load. The ac must be removed external to the inverter.

Requirement: Indicator light LINE SUPPLYING LOAD is illuminated.

(2) To remove the line ac, remove the LINE REF (F4) fuse.

Requirement: Indicator light OUTPUT FAIL ALM is illuminated.

(3) Remove DC CONTROL (F1) fuse.

Requirement: All indicator lights are extinguished.

4. ROUTINE CHECKS

4.01 Electrolytic capacitors should be maintained in accordance with Section 031-110-701. Testing and handling of circuit packs and semiconductor devices should be maintained in accordance with Section 032-173-301.

4.02 The purpose for making routine checks on this plant is to determine whether all the features, indications, and alarms are in proper operating condition.

4.03 ***Fuses and Alarms:*** Check all fuse failure alarms and indicators periodically as covered in Table A. Before substituting blown fuses, the operator should ascertain whether the test would shut down essential equipment. If such is the case, it may be desirable to postpone these tests until a lighter load period.

4.04 ***Voltage Monitor:*** To check the input voltage monitor, proceed as follows.

AC Line Control CP ACLC

(1) Disconnect the commercial ac line by removing LINE REF (F4) fuse.

Requirement: Indicator lights INVERTER RUNNING, DC POWER ON and INVERTER SUPPLYING LOAD are illuminated.

(2) Polarize the W5MT3 Variac output to match the commercial line voltage as follows (refer to Fig. 1):

Warning: The Variac output potential may exceed 140 volts ac. Always set the Variac dial to 0 volt before making connections to the Variac terminals. Use extreme care and avoid handling energized leads.

(a) Set the Variac dial to 0 volt position, and connect the Variac ac service cord to a suitable 120-volt outlet.

(b) Connect one lead of the KS-20599 L4 digital volt-ohm-milliammeter, set to the ACV function, to the N (neutral) test jack on the AC LINE CONTROL circuit pack.

(c) Rotate the Variac dial cw to the 120-volt position.

(d) Temporarily connect the other lead from the ac voltmeter alternately between the two output terminals on the Variac. Note the voltage indication on the voltmeter at each terminal.

(e) Determine which Variac terminal results in a 0 volt indication. This lead will connect to the N (neutral) test jack.

TABLE A

FUSES

FUSE LOCATION	FUSE DESIGNATION	FUSE TYPE	INDICATION		
			ALARMS	ALARM LAMPS	SUPPLEMENTARY INFORMATION
Fuse Panel	DC Control F1, F2	Bussman ABC3	None	None	F1 — No voltage at TP1 F2 — DC POWER ON lamp extinguished
Angle Bracket at Rear of Cabinet	THYRISTOR PROTECTION F3	Chase — Shawmut A252250	Minor	DC POWER ON lamp on	Local and remote alarm indication.
Fuse Panel	LINE REF F4	Bussman ABC 8	Minor	LINE SUPPLYING LOAD lamp off. INVERTER SUPPLYING LOAD and INVERTER RUNNING lamps on.	Local and remote alarm indication.
Fuse Panel	INV REF F5	Bussman ABC8	None	None	Inverter will not start when the INVERTER TEST switch is operated and lamp INVERTER RUNNING will not illuminate.
Fuse Panel	OUTPUT REF F6	Bussman ABC3	Major	Output FAIL ALM lamp on	Local and remote alarm indication.
Fuse Panel	AC OUTPUT FUSES				
	L1-L10	Bussman type NON	Major	AC FUSE ALM lamp on	Local and remote alarm indication.
	L1A-L10A	W. E. type 70G	Major	AC FUSE ALM lamp on	Local and remote alarm indication.

Caution: When the Variac neutral output terminal is determined, do not disconnect the Variac input ac service cord if the cord is not equipped with a three-prong plug. If the ac service cord is equipped with a two-prong plug, the Variac output must be polarized as in (a) through (e) if the plug is disconnected.

(f) Set the Variac dial to 0 volt position.

(g) Disconnect the ac voltmeter from the AC test jack.

(3) Connect the Variac output lead selected as neutral in (2)(e) to terminal 2 of CP-ACLC and the other Variac lead to terminal 1 of CP-ACLC.

(4) Connect the leads of the KS-20599 L4 volt-ohm-milliammeter, set to the ACV function, to terminals 1 and 2 of CP-ACLC.

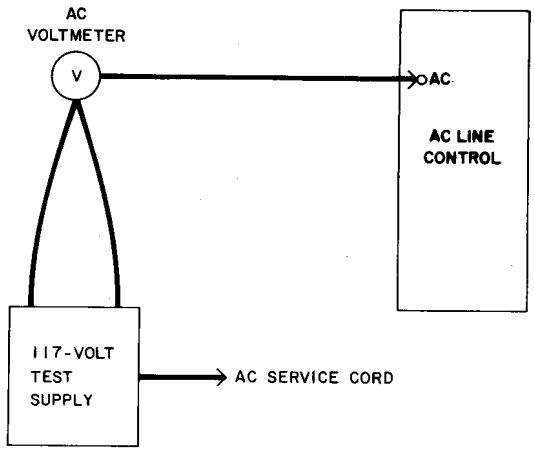


Fig. 1—Polarizing 120-Volt Test Supply to Commercial Supply

(5) Slowly rotate the Variac dial cw until indicator lamp DS1 on CP-ACLC just illuminates.

Requirement 1: Within 5 to 7 seconds, contactor K1 operates and contactor K2 releases. The load transfers to commercial power, and the inverter shuts down.

Requirement 2: Indicator lamp LINE SUPPLYING LOAD illuminates and indicator lamps INVERTER RUNNING and INVERTER SUPPLYING LOAD extinguish.

Requirement 3: The voltage measured is 113 ±1 volts.

(6) If requirement 3 in (5) is not met, adjust R4 on CP-ACLC fully ccw.

Requirement 1: The inverter will start and take the load. Indicator lamps INVERTER RUNNING and INVERTER SUPPLYING LOAD illuminate and lamp LINE SUPPLYING LOAD extinguishes.

Requirement 2: Indicator lamp DS1 on CP-ACLC extinguishes.

(7) Adjust the Variac output to read as close as possible to 113 volts.

(8) Slowly adjust R4 cw on CP-ACLC until DS-1, located on CP-ACLC, just illuminates.

Requirement: Within 5 to 7 seconds, contactor K1 operates and the load is transferred to commercial power.

Note: If this requirement cannot be met by adjusting R4, replace the AC Line Control circuit pack.

(9) Slowly rotate the Variac dial ccw until the indicator lamp DS1 on CP-ACLC just extinguishes.

Requirement 1: Contactor K1 releases, the inverter starts and contactor K2 operates. Indicator lamps INVERTER RUNNING and INVERTER SUPPLYING LOAD illuminate and indicator lamp LINE SUPPLYING LOAD extinguishes.

Requirement 2: The voltage measured is 108 ±1 volts.

(10) If requirement 2 in (9) is not met, adjust R24 on CP-ACLC fully ccw. Rotate the Variac dial cw until indicator lamp DS1 on CP-ACLC just illuminates and K1 operates. Adjust Variac output to read as close as possible to 108 volts. Slowly adjust R24 cw until indicator lamp DS1 just extinguishes.

Requirement: Contactor K1 releases, the inverter starts and contactor K2 operates. Indicator lamps INVERTER RUNNING and INVERTER SUPPLYING LOAD illuminate and indicator lamp LINE SUPPLYING LOAD extinguishes.

Note: If this requirement cannot be met by adjusting R24, replace the AC Line Control circuit pack.

(11) Set the Variac dial to 0 volt and disconnect the Variac ac service cord from the 120-volt outlet.

(12) Disconnect the Variac and the ac voltmeter from the circuit pack.

(13) Reconnect the commercial line by replacing the LINE REF (F4) fuse.

Requirement 1: Indicator lights INVERTER RUNNING and INVERTER SUPPLYING LOAD are extinguished.

Requirement 2: Indicator light LINE SUPPLYING LOAD is illuminated.

Low Voltage Shutdown (CP-LVS)

(1) Place circuit breaker CB1 in the OFF position.

Requirement 1: Indicator lamp LINE SUPPLYING LOAD is illuminated.

Requirement 2: Indicator lamp INVERTER FAULT ALARM (remote) illuminates.

(2) Disconnect and insulate the lead from terminal 4 of TB5.

(3) Connect a variable dc source to pins 2 (+) and 3 (-) of CP-LVS and adjust the dc source to 120 volts.

Requirement: Indicator light DS1, located on CP-LVS is illuminated.

(4) Slowly reduce the power supply voltage until indicator lamp DS1 on CP-LVC just extinguishes.

Requirement: The power supply voltage is in the range of 115 to 118 volts.

(5) If the requirement in (4) is not met, adjust R3 on CP-LVS fully ccw using the 3-inch C screwdriver and set the voltage of the power supply to 117 volts.

Requirement: Indicator light DS1 on CP-LVS is illuminated.

(6) Using the 3-inch C screwdriver, adjust potentiomter R3 slowly cw until indicator lamp DS1 extinguishes.

(7) As a check, increase the power supply voltage.

Requirement: Lamp DS1 illuminates.

(8) Decrease the power supply voltage slowly, noting at what voltage DS1 extinguishes.

Requirement: The voltage at which DS1 extinguishes is 117 volts.

(9) Repeat (5) through (8) until the requirement of (8) is met.

(10) Disconnect the variable power supply and reconnect the lead removed in (2).

(11) Refer to the starting procedures before closing circuit breaker CB1.

Output Frequency Adjustment (CP-TD)

The output frequency of the inverter has been factory set at 60 Hz. It is recommended that no change be made in the setting. If, however, a readjustment becomes necessary, use the following adjustment procedure.

(1) Connect a Hewlett Packard Model 5381A, or equivalent, frequency counter to test points TP3 (LINE) and TP4 (NEUT) located on the control panel.

(2) Disconnect the commercial ac line by removing LINE REF (F4) fuse.

Requirement: Indicator lights INVERTER RUNNING, DC POWER ON, and INVERTER SUPPLYING LOAD are illuminated.

(3) To adjust the output frequency, turn potentiometer R23, located on CP-TD, cw to increase or ccw to decrease the output frequency.

Note: The frequency is adjustable between 58 and 62 Hz.

(4) Disconnect the frequency counter and replace LINE REF (F4) fuse.

Requirement 1: Indicator lights INVERTER RUNNING, DC POWER ON, and INVERTER SUPPLYING LOAD are extinguished.

Requirement 2: Indicator light LINE SUPPLYING LOAD is illuminated.

5. TROUBLES

5.01 In general, troubles which may occur in the 526A power plant will be indicated by various visual and audible alarms. Table B lists the alarm lamps with their trouble indications.

5.02 ***Trouble Chart:*** The troubles and possible causes listed are not necessarily all-inclusive, but are merely indicative of some of the problems

TABLE B

ALARM LAMPS

LOCAL ALARM LAMPS							TROUBLE INDICATION
INVERTER FUSE ALARM	OUTPUT FAIL ALM	AC FUSE ALM	MAJOR ACO	MINOR ACO	INVERTER RUNNING	INVERTER SUPPLYING LOAD	
		X					Any ac output distribution fuse has blown
	X		*				AC power to the loads is interrupted
					X		Inverter operating but not necessarily supplying the loads
				*		X	Commercial voltages dropped below 108 ± 1 volts
X							F3 fuse operated

* The MINOR and MAJOR ACO lamps will light only when an alarm has been retired manually by depressing one of the switches as indicated.

that may be encountered when the 526A power plant is not operating normally. In the case of visual alarms, the operator can identify the trouble location by designation of the lamp which is lighted on the control panel. In the case of fuse alarms, Table A will assist the operator in locating the difficulty. In addition to the alarms shown in Table B, contacts are available for an INVERTER FAULT ALARM as a remote indication, both visual and audible, and as a status indication which indicates when input circuit breaker CB1 is in the OFF position, has tripped, or fuse F3 has operated.

5.03 If the trouble is not located with the assistance of the indicators and trouble chart, and a check shows no loose connections or short circuits due to foreign matter lying across wiring terminals, reference must be made to the schematic diagrams and circuit description for individual components.

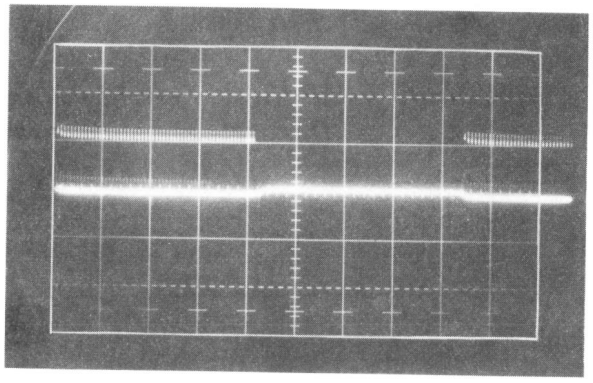
5.04 Individual component resistance measurements and continuity checks should be made with the power plant disconnected from input power and output load. Refer to the appropriate Bell System Practices for checking semiconductor devices, capacitors, transformers, and inductors.

Caution: When using an ohmmeter for checking semiconductors, use mid-range scales (scales below RX 10,000 and above R X 10). The high scale ohmmeter voltage may damage the semiconductor device. A scale too low can force excessive current through some semiconductors. Refer to Section 032-173-301.

5.05 Before disconnecting leads, mark or record the connections.

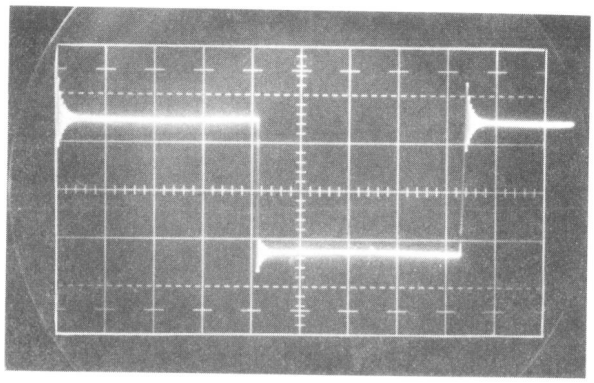
5.06 Do not solder or unsolder connections to diodes before referring to Section 032-173-301.

5.07 Fig. 2 through 7 have been included to aid in troubleshooting the 526A power plant.



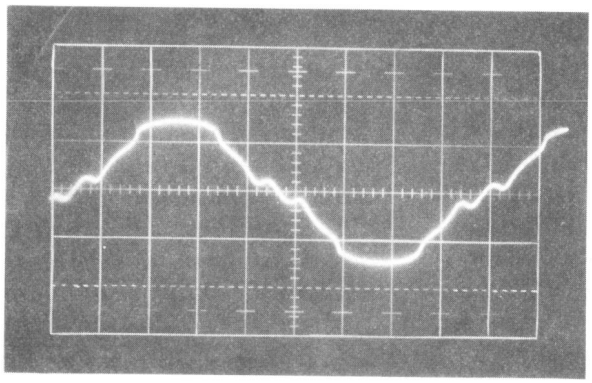
VERT. 5 VOLTS/DIV.
HORIZ. 2 MSEC/ DIV.

Fig. 2—Thyristor Driver CP—TD Terminals 4 to 3 or 6 to 5



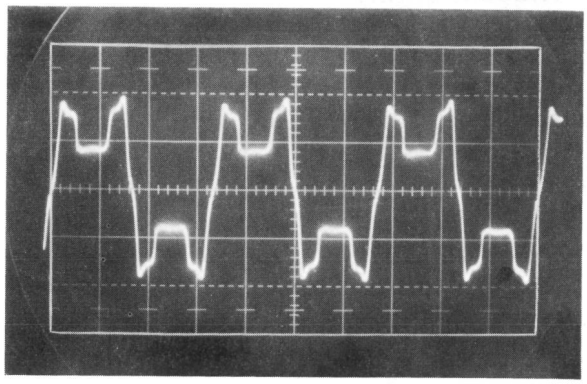
VERT. 100 VOLTS/DIV.
HORIZ. 2 MSEC/DIV.

Fig. 3—Transformer T1 Primary Terminals 1 to 3 or 2 to 4



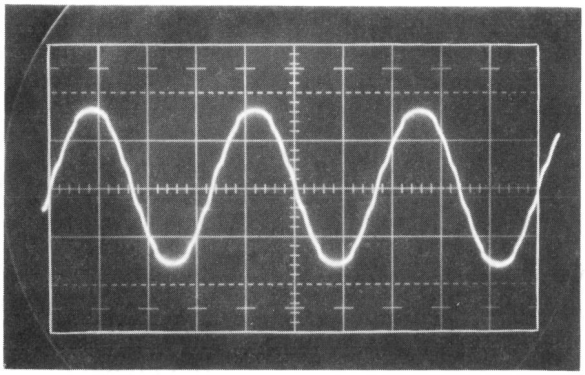
VERT. 100 VOLTS/DIV.
HORIZ. 2 MSEC/DIV.

Fig. 4—Transformer T1 Secondary Terminals 5 to 6



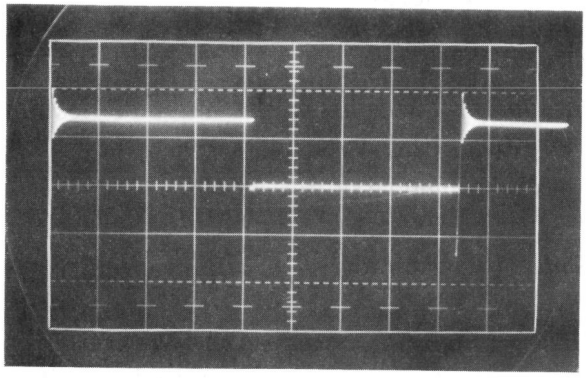
VERT. 20 VOLTS/DIV.
HORIZ. 5 MSEC/DIV.

Fig. 5—Inductor L4 Terminals 1 to 4



VERT. 100 VOLTS/DIV.
HORIZ. 5 MSEC/DIV.

Fig. 6—Inverter AC Output



VERT. 200 VOLTS/DIV.
HORIZ. 2 MSEC/DIV.

Fig. 7—Thyristor Voltage CR5 or CR6 Cathode to Anode

TROUBLE CHART

SYMPTOM	POSSIBLE CAUSE	CORRECTIVE ACTION
(a) OUTPUT FAIL ALM lamp lights.	Local commercial below 108 ±1 volts and	
	(1) Fuse F5 operated.	Check for short circuits in wiring in coils of contactor K2, or relay K6 and in capacitor C9. Replace the defective component.
	(2) Shorted diode CR4 or shorted capacitor C2.	Check voltage at terminals 1 and 2 of circuit pack CP-TD for 15 volts dc. If this requirement is not met, replace the defective component.
	(3) Open coil in contactor K2.	Check coil for continuity and replace contactor if defective.
	(4) Defective circuit pack CP-TD.	With a suitable oscilloscope, compare waveforms of CP-TD with Fig. 2. If the waveform does not agree, replace CP-TD with a spare and send the defective CP to a service center for repair.
(b) AC FUSE ALM lamp lights.	Short circuit on load or output leads.	Locate and remedy the cause of the operated fuse; replace both fuses making certain to replace the supply fuse and then the alarm fuse.
(c) INVERTER FUSE ALM lamp lights.	Fuse F3 operated due to defective thyristors CR5 and CR6, defective diodes CR7 and CR8, shorted capacitors C5.1—C5.3 or defective CP-TD.	Check per appropriate BSP and replace defective component.
(d) DC POWER ON lamp extinguished.	Circuit breaker CB1 is in OFF position.	If in OFF position use starting procedure per paragraph 3.02.
(e) INVERTER RUNNING and INVERTER SUPPLYING LOAD lamps illuminated.	(1) Local commercial power below 108 ± 1 volts.	None.
	(2) Defective contactor, K1 or capacitor C8.	Replace defective component in accordance with BSP.
	(3) Fuse F4 operated.	Check for short circuits in wiring shorted capacitor C8, shorted coil of contactor K1. Replace if defective. Check for shorted input on CP-ACLC. If shorted, replace with spare and send defective CP to service center for repair.