523A (J86641) POWER PLANT
1.5 KW AC
OPERATING METHODS

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1. GENERAL

1.01 The 523A (J86641) power plant is powered by a battery source of -48.25 to -52.5 volts dc. The plant provides continuous 117-volt single phase, 59.5 ±0.5 Hz alternating current, at 1.5 kW maximum, for use as an alternate supply for critical loads which cannot withstand ac power interruptions for more than a few seconds and still provide satisfactory service. The power plant incorporates the KS-19951 (Mfr Disc.) inverter or the KS-21353 inverter and a control unit that will automatically transfer the load from the regular commercial supply to the reserve supply if the commercial supply fails. The manual selection of either the commercial ac power or the inverter ac power at the output terminals of the plant is provided by the OPERATION SELECTOR (SI) (OSS) switch. The OSS switch is located on the control unit panel.

1.02 This section is reissued to:

(a) Show the KS-19951 inverter rated Mfr Disc.

(b) Add the KS-21353 inverter

(c) Describe the Wye adapter

(d) Show wiring configuration of suggested components.

Revision arrows are used to emphasize the more significant changes. This issue does affect the Equipment Test List.

1.03 Either commercial power or the inverter output may be selected for the prime power by depressing the OPERATION SELECTOR (SI) switch. The illumination of the upper half of the switch (COML PWR) or the lower half (INVR PWR) will show which has been selected. Normally, the commercial power is selected as the prime source of power while the inverter runs without load, ready to be automatically switched to carry the load when the prime power is reduced or fails. The prime power is automatically switched back to the load when the prime voltage is restored.

Danger: 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 Lamps located on the control panel give a visual indication of plant status. Minor alarms will be issued if either the commercial line voltage or the inverter output voltage falls below the monitor settings. Major audible and visual alarms will be issued if both the commercial and the inverter voltages fall below their monitor release settings. Major alarms are issued if an ac load distribution fuse and its associated alarm fuse are operated. If option M is furnished, minor and major transmitted alarms are also provided for connection to alarm sending circuits. An alarm cutoff key S3 MAJOR ACO, MINOR ACO switch is provided to silence a major or minor alarm.

1.05 More detailed information on the operating methods of the inverters is shown in the following sections:

SECTION	INVERTER
161-234-301	KS-19951
161-203-301	KS-21353

1.06 The power plant will function with the following circuits:

SD-1P131-01	▶Telecommunications Alarm Surveillance and Control System (TASC)◀
SD-80730-01	Audible And Visual Alarm Circuit
SD-81185-01	Power Service Circuit

1.07 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.

1.08 These instructions are based on schematic drawing SD-81840-01 ▶Issue 11B and CD-81840-01, Issue 3B.◀ 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.

2. LIST OF TOOLS AND TEST APPARATUS

CODE OR SPEC NO.	DESCRIPTION
TOOLS	
—	3-Inch C Screwdriver
—	Wye Adapters (See Note 1)
TEST APPARATUS	
—	Variac,* General Radio Co Type W5MT3, 0-140 Volt Output
KS-8039	DC Volt-Milliammeter, or
KS-20599,L4	▶Digital Multimeter◀
—	Hewlett-Packard 5211B Electronic Counter (or equivalent) (See note 2)
—	True RMS Voltmeter with 150-Volt Scale, Hewlett-Packard Model 3400A, or equivalent (See Note 2)
—	Isolation Plug, Hubbell No. BL-12-767 or equivalent
—	Ground Fault Circuit Interrupter, Hubbell No. GFP115, or equivalent

*Registered Trademark of General Radio Co.

Note 1: ▶Wye adapters (two required) are locally constructed test cords (see Fig. 2). Each cord is made with 2-pin plugs, such as KS-19531, and one female connector, such as the 360A tool. Insulated wire, 18-gauge or 20-gauge, may be used to join the connectors. Each lead from the Variac should be terminated

with a 360A tool, or equivalent, to facilitate connection to the Wye adapter.◀

Note 2: The Hickok Model 3420 Universal True RMS Multimeter/Counter is a suitable substitute.

Note 3: ▶The meter used to measure volts RMS will be referred to as AC meter or AC voltmeter.

Danger: When using the Hewlett-Packard 3400A true RMS voltmeter, the unit must be isolated from ground. If the meter is not isolated from ground, erroneous readings and/or damage to the equipment may result. To avoid the shock hazard inherent in using an ac operated instrument that has been isolated from ground, use the following procedure.

(1) ***Connect the ground fault circuit interrupter, Hubbell No. GFP115 or equivalent, to a 115-volt source.***

(2) ***Insert the isolation plug, Hubbell No. BL-12-767 or equivalent, into the ground fault circuit interrupter.***

(3) ***Connect the ac operated instrument to the isolation plug.***

Isolation of the voltmeter from ground creates a potential hazard. Avoid bodily contact between the test voltmeter and other components, conductors, or ground.◀

3. OPERATION

3.01 Operating methods for the KS-19951 ▶(Mfr Disc.) and KS-21353◀ inverters are covered in Sections 161-234-301 ▶and 161-203-301, respectively.◀

3.02 ***Preparing to Start:*** When preparing to put the 523A power plant in service, check that:

(a) The OPERATION SELECTOR (S1) switch is in the COML PWR position.

(b) The 117-volt RPP1 ac supply fuse is available but not installed.

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

▶***Caution: The inverter must not be started with the load connected. Make sure that the OPERATION SELECTOR (S1) switch is in the COML PWR Position.***◀

(1) Install the 117-volt RPP1 ac supply fuse ▶to apply commercial power to the plant.◀

Requirement: The POWER ON and COML PWR lamps light.

(2) Connect the AC voltmeter between the J1 and J2 AC OUTPUT test jacks.

Requirement: The voltmeter indicates 117 ±6 volts.

(3) Install the 48-volt dc input fuse RPP2 at the fuse panel to apply battery power and start the inverter.

(4) Install fuses 1 through 23 to apply commercial power from the plant to the load.

(5) Operate the OPERATION SELECTOR (S1) switch to INVR PWR to transfer the load from commercial power to inverter ac power.

Requirement: The INVR PWR lamp lights and the COML PWR lamp extinguishes. The AC voltmeter connected at J1 and J2 test jacks indicates 117 ±6 volts.

(6) Disconnect the meter from J1 and J2 test jacks.

(7) Operate the OPERATION SELECTOR (S1) switch to the COML PWR position.

Requirement: The load transfers to commercial power and the COML PWR lamp lights.

Note: The plant should normally operate from commercial power with the inverter operating continuously as standby power.

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

(1) Verify that the OPERATION SELECTOR (S1) switch is in the COML PWR position.

(2) Remove the FA REL INPUT F5 fuse (if ▶option P is◀ provided).

(3) Remove the load distribution F6 through F23 fuses at the AC LOAD SERVICE panel.

(4) Remove the KS-19951 inverter from service in accordance with Section 161-234-301 ▶or KS-21353 inverter in accordance with Section 161-203-301.◀

(5) Remove the ac input RPP1 fuse.

(6) Remove necessary fuses to disconnect the -48 volt dc supply to the alarms, relays, and the inverter.

4. ROUTINE CHECKS (PLANTS WITH KS-19951 INVERTERS)

Note: Routine checks, except paragraphs 4.01, 4.02, and 4.03, are performed differently on plants equipped with KS-19951 inverters than on plants with KS-21353 inverters. Checks on voltage monitors on plants with KS-21353 inverters are covered in Part 5.

4.01 Electrolytic capacitors should be maintained in accordance with Section 032-110-701. 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 or not 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 Monitors on Plants Equipped With KS-19951 Inverters:*** To check the input voltage monitors, proceed as follows:

Inverter Monitor

(1) Operate the OPERATION SELECTOR (S1) switch to the INVR PWR position.

TABLE A

FUSES

FUSE LOCATION	FUSE DESIGNATION	INDICATION		
		ALARMS	ALARM LAMPS	SUPPLEMENTARY INFORMATION
Control Panel (Substitute a blown 70-type fuse to obtain the indications.)	AC OUTPUT TEST JACKS NEUT (F1) LINE (F2)	 None None	 None None	 Operated fuse indicated visually.
	MON INPUT COML (F3) INVR (F4)	 Minor Minor	 COML FAIL INVR FAIL	 Operated fuse indicated visually
	FA REL INPUT (F5)	None	None	Operated fuse indicated visually.
	LOAD and ALARM FUSES (F6-23)	Major	FUSE ALARM	An operated LOAD FUSE will also be indicated visually by its associated ALARM FUSE.

Requirement: The load transfers to the inverter and the INVR PWR lamp lights.

(2) Connect the AC voltmeter, ▶set to the 150 VOLTS AC range◀ to the AC IN (TP1 and TP2) test jacks located on the MONITOR INVR (CP1) circuit pack.

(3) Rotate the VOLTS ADJ (R2) potentiometer of the KS-19951 inverter ccw until the voltage, as observed on the AC meter, is 106 volts.

Requirement: The A1 relay releases, the minor audible and visual alarms are activated, the INVR FAIL lamp lights, and the plant load is transferred to commercial power after a delay of approximately 6 seconds, if commercial power is above 111 ±1 volts.

(4) Rotate the VOLTS ADJ (R2) potentiometer cw until the output voltage as indicated on the AC meter is 111 volts.

Requirement: The INVR FAIL lamp extinguishes and the INVR ALARM RESET lamp lights.

Note: If the requirements in (3) and (4) are met, continue with (5); if not, remove the MONITOR INVR (CP1) circuit pack and replace it with a factory adjusted unit. Repeat (1) through (4) to make sure the new unit is properly adjusted. Return the defective circuit pack to the factory for repair and/or adjustment.

(5) Rotate the VOLTS ADJ (R2) potentiometer cw until the inverter output is 117 volts.

(6) Depress the INVR ALARM RESET (S2) switch to retire the alarms.

Requirement: The load transfers to inverter power and the alarms extinguish.

Commercial Monitor ▶(Plant with KS-19951 Inverter)◀

Note: The OPERATION SELECTOR (S1) switch is to remain in the INVR PWR position.

(7) Remove the COML F3 fuse to disconnect commercial power from the MONITOR COML (CP1) circuit pack.

Requirement: The COML FAIL lamp lights.

(8) Disconnect the AC voltmeter from TP1 and TP2 test jacks of the MONITOR INVR circuit pack.

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

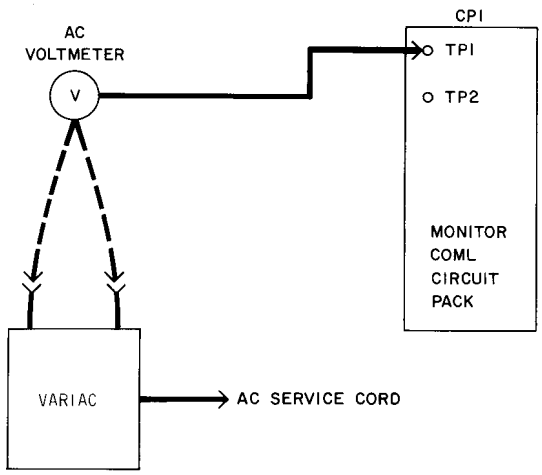

Fig. 1—Polarizing Variac to Commercial Supply

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 117-volt outlet.

(b) Connect one lead of the AC meter, set on the 150 volts range, to the AC IN ▶TP1◀ (neutral) test jack on the MONITOR COML (CP1) circuit pack.

(c) Rotate the Variac dial cw to the 117-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 AC IN ▶TP1◀ (neutral) test jack.

Warning: When the Variac neutral output terminal is determined, do not disconnect the Variac input ac service cord. ▶Even if equipped with a 3-prong plug, the polarity of the receptacle must still be checked.◀

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

(g) Disconnect the AC voltmeter from ▶TP1◀ test jack.

(10) Connect one Wye adapter (see Fig. 2) at the TP1 test jack and a second Wye adapter at the TP2 test jack on the MONITOR COML (CP1) circuit pack. The Wye adapter provides connections at each test jack for one voltmeter lead and one lead from the Variac.

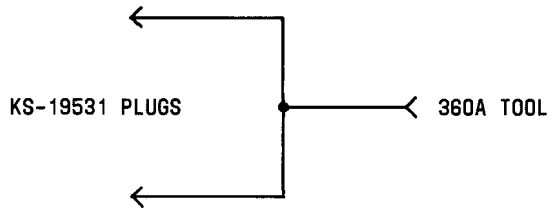

Fig. 2—Wye Adapter

(11) Connect the AC voltmeter between the TP1 and TP2 test jacks on the MONITOR COML (CP1) circuit pack.

(12) Using suitable connecting leads, connect the Variac to the AC IN test jacks on the MONITOR COML (CP1) circuit pack as follows.

(a) Verify that the Variac dial is set to 0 volt position.

(b) Connect the Variac output lead selected as neutral in (9)(d) and (e), to the ▶TP1◀ (neutral) test jack and the other Variac lead to TP2 test jack.

(13) Rotate the Variac dial cw until the AC voltmeter indicates 117 ±1 volts.

(14) Operate the OPERATION SELECTOR (S1) switch to COML PWR position after the COML FAIL lamp is extinguished.

▶***Requirement:*** The COML PWR lamp lights.◀

Note: The normal time delay after recognizing the return of commercial power is 3 to 5 minutes.

(15) Rotate the Variac dial slowly ccw until the AC voltmeter indicates 106 volts.

Note: A time delay thermistor prevents transfer for 1 second at (or below) the 106-volt level, ▶unless a strap is applied, per option G, SD-81840, Issue 11B.◀

Requirement: The AC relay releases, the minor audible alarms are initiated, the COML ▶PWR lamp extinguishes, the COML◀ FAIL lamp lights, and the load is transferred to inverter power.

(16) Rotate the Variac dial cw until the AC voltmeter indicates 111 volts.

Requirement: The AC relay operates and the load is transferred back to commercial power after a time delay of 3 to 5 minutes. The minor alarms are retired.

Note: If the requirements in (15) and (16) are met, continue with (17); if not, remove the MONITOR COML circuit pack and replace it with a factory adjusted unit. Repeat (12) through (16) to make sure the new unit is properly adjusted. Return the defective circuit pack to the factory for repair and/or adjustment.

(17) Operate the OPERATION SELECTOR (S1) switch to INVR PWR position and observe that the load is transferred to the inverter.

(18) Set the Variac dial to 0 volt and disconnect the Variac ac service cord from the 117-volt outlet.

(19) Disconnect the AC voltmeter, and the Wye adapters from the MONITOR COML (CP1) circuit pack.

(20) Replace the COML F3 fuse.

Requirement: The COML FAIL lamp extinguishes.

(21) Operate the OPERATOR SELECTOR (S1) switch to COML PWR position.

Requirement: The COML PWR lamp lights.

4.05 Routine checks for the KS-19951 inverter are covered in Section 161-234-301.

5. ROUTINE CHECKS (PLANTS WITH KS-21353 INVERTERS)

5.01 ***Voltage Monitors on Plants Equipped With KS-21353 Inverters:*** To check the input voltage monitors, proceed as follows:

Inverter Monitor

If the plant is equipped with a KS-21353 inverter, the ac output of the inverter is determined by the frequency of the driver circuit (card A1) which is factory set at 59.5 Hz. Since it is not recommended that the inverter be adjusted, the W5MT3 Variac will be used to simulate the inverter and provide the necessary ac voltage for checking the inverter monitor.

(1) Operate the OPERATION SELECTOR (S1) switch to the COML PWR position.

Requirement: The COML PWR lamp lights.

(2) ▶Remove the INVR F4 fuse.

Requirement: The minor audible and visual alarms are activated and the INVR FAIL lamp lights.◀

(3) Polarize the Variac as outlined in sub-subparagraphs 4.04(9)(a) through 4.04(9)(g) except reference for connections are for the MONITOR INVR circuit pack instead of the MONITOR COML circuit pack.

(4) Connect one Wye adapter at the TP1 test jacks and a second Wye adapter at the TP2 test jack on the MONITOR INVR (CP1) circuit pack. The Wye adapter provides connections at each test jack for one voltmeter lead and one lead from the Variac.

(5) Connect the ac voltmeter between the TP1 and TP2 test jack on the MONITOR INVR (CP1) circuit pack.

(6) Using suitable leads, connect the Variac via the Wye adapter to the TP1 and TP2 test jack on the MONITOR INVR (CP1) circuit pack as follows:

(a) Verify that the Variac dial is set to 0 volt position.

(b) Connect the Variac output lead selected as neutral in sub-subparagraphs 4.04(9)(d) and (e), to the ▶TP1◀ (neutral) test jack and the other Variac lead to TP2 test jack.

(7) Rotate the Variac dial cw until the voltage, as observed on the true AC meter is 111 volts.

Requirement: The INVR FAIL lamp extinguishes and the INVR ALARM RESET lamp lights.

(8) Depress the INVR RESET switch to retire the alarms.

Requirement: The load transfers back to INVR power, the COML PWR lamp extinguishes, the INVR PWR lamp lights, and the alarms are retired.

(9) Adjust the Variac dial ccw until the AC IN voltage, as observed on the true AC meter, is 106 volts.

Requirement: The AI relay releases, the minor audible and visual alarms are activated, the INVR FAIL lamp lights, and the plant is transferred to commercial power after a delay of approximately 6 seconds, if commercial power is 111 ±1 volts.

(10) Increase the Variac output to 111 volts.

Requirement: The INVR FAIL lamp extinguishes and the INVR ALARM RESET lamp lights.

Note: If the requirements of (7) through (10) are met, continue with (11). If not, remove the MONITOR INVR circuit pack and replace it with a factory adjusted unit. Repeat (7) through (10) to make sure the new unit is properly adjusted. Return the defective circuit pack to the factory for repair and/or adjustment.

(11) Adjust the Variac dial cw until the AC IN voltage is 117 volts.

(12) Depress the INVR RESET (S2) switch to retire the alarms.

Requirement: The load transfers to INVR power and the alarms are retired.

Commercial Monitor (Used With KS-21353 Inverter)

Note: This check is performed in the same manner as subparagraphs 4.04(7) through (21).

5.02 Routine checks for the KS-21353 inverter are covered in Section 161-203-301.

6. TROUBLES

6.01 In general, troubles which may occur in the 523A power plant, the KS-19951 ▶or KS-21353◀ inverters will be indicated by various visual and audible alarms. Table B lists the alarm lamps with their trouble indications.

6.02 ***Trouble Chart:*** The troubles and possible causes listed are not necessarily all-inclusive, but are merely indicative of some of the problems that may be encountered when the 523A power plant is not operating normally. In the case of visual alarms, the operator can tell 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.

6.03 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.

6.04 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 midrange scales (scales below RX 10,000 and above RX 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.

6.05 Before disconnecting leads, mark or record the connections.

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

TROUBLE CHART

INDICATION	PROBABLE CAUSE	SUGGESTED REMEDY
(a) INVR FAIL lamp lights	Inverter output voltage or frequency out of limits	Measure the output frequency by connecting an electronic frequency counter or any suitable oscilloscope to the OUTPUT AC VOLTS (±) and (NEUT) jacks (located on the KS-19951 and KS-21353 inverters). The frequency should be 59.5 ±0.5 Hz. Connect the true RMS meter to the same jacks and observe that the voltage is 117 volts ±5 percent. If the output voltage and/or frequency are out of limits, follow procedure outlined in the following references.

INVERTER	SECTION	C D
KS-19951	161-234-301	81852-01
→KS-21353	161-203-301	82335-01←

	RPP2 inverter input fuse blown. MON INPUT INVR (F4) fuse blown. →Defective inverter or defective INVR monitor circuit pack (CP1)←	Defective inverter: Refer to Sections 161-234-301 and 701 →for the KS-19951 inverter; and 161-203-301 and 701 for the KS-21353 inverter.← Defective INVR monitor circuit pack CP1: Do not repair this circuit pack. If it becomes defective, replace with a factory adjusted unit and return the defective unit to the factory.
	→AI diode defective or installed with wrong polarity. ***Note:*** May be indicated by abnormal voltage at TP5 and TP6 (less than 22 volts dc)←	Repair or replace defective component in accordance with the Bell System Practice.
(b) COML FAIL lamp lights	Local commercial power failure or below 106 ±1 volts MON INPUT COML (F3) fuse blown. →Defective COML monitor circuit pack (CP1)←	Defective COML monitor circuit pack CP1: Do not repair this circuit pack. If it becomes defective, replace it with a factory adjusted unit. Return defective unit to the factory.

TROUBLE CHART (Contd)

INDICATION	PROBABLE CAUSE	SUGGESTED REMEDY
	Defective AC relay or CC section of K1 contactor. →AC diode defective or installed with wrong polarity. ***Note:*** May be indicated by abnormal voltage at TP5 and TP6 (less than 22 volts dc)←	Repair or replace defective component in accordance with the Bell System Practice.
(c) FUSE ALARM lamp lights	Any fuse F6 through F21 blown	Locate and remedy cause of blown fuse; replace blown fuse making sure to replace the supply fuse and then the alarm fuse.

TABLE B
ALARM LAMPS

ALARM LAMPS						ALARMS		TROUBLES
FUSE ALARM	COML FAIL	INVR FAIL	MAJOR ACO	MINOR ACO	INVR ALARM RESET	MAJ	MIN	
X			*			X		Any fuse F6 through F23 blown.
	X			*			X	Commercial voltage dropped below 106±1 volts and remains below 111±1 volts.
		X		*	X		X	Inverter voltage dropped below 106±1 volts and remains below 111±1 volts.
	X	X	*		X	X		Commercial and inverter voltages dropped below 106±1 volts and remains below 111±1 volts.

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