660-TYPE POWER PLANT
OPERATING METHODS

1. GENERAL

1.01 The 660 power plant (J86882A, J86883A, and J86884A) converts negative 48-volt central office battery to a 130-volt dc output. It is designed primarily for small loads up to a maximum of 15 amperes.

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

Warning: Voltages in the converter may be over 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 660 power plant uses multiple 2-ampere or 5-ampere dc-to-dc converters to provide a positive or negative 130-volt dc supply. Converters of the same rated capacity are arranged for parallel operation. Up to four 2-ampere converters may be connected in parallel to deliver a maximum of 6 amperes and up to four 5-ampere converters may be paralleled to deliver a maximum of 15 amperes. Since there is no 130-volt battery associated with the 660 power plant, one more converter than the number required to carry the peak load is provided so that failure of a single converter will not reduce the capacity of the plant.

1.04 The converters are provided with load lead disconnect (P) plugs per "S" option. The individual disconnect plugs are added between the 130-volt converter output and the positive or negative bus bar. This added feature removes a service hazard that exists when a single converter requires maintenance or removal.

1.05 The plant provides a minor alarm to indicate the failure of a single converter, and a major alarm is provided to indicate the failure of two converters or a failure of a load distribution fuse. If the converters are mounted in an enclosed cabinet, a MULT ALARM lamp is provided on the frame to indicate either the failure of a converter or the operation of a discharge fuse. ▶If a J87309E CSACS interface panel and wiring option "A" are provided, an alarm is also sent to the CSACS office to which the plant is interconnected. Operation of the ACO switch per 1.06 does not extinguish this alarm.◀

1.06 An alarm cutoff ACO (S1) switch is provided per "G" option to silence a minor alarm. Depressing the ACO (S1) switch opens the minor alarm leads and lights the ACO lamp. After the minor alarm condition is cleared, the ACO (S1) switch must again be operated to close the alarm leads and extinguish the ACO lamp.

1.07 This issue of the section is based on drawing SD-81889-01, ▶Issue 6B.◀ 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.

1.08 For more detailed information on the operation and maintenance of individual equipment, refer to the appropriate Bell System Practice.

161-279-301—KS-19815 DC-to-DC Converter, 130 Volt Supply Circuit
161-283-302—KS-19303, L3 DC-to-DC Converter, 130 Volt Supply Circuit (Rated Mfr. Disc. and replaced by the KS-19815, L2)

1.09 Checks and adjustments, other than those required by trouble conditions, should be made during a period when they will not interfere with service.

2. LIST OF TOOLS AND TEST APPARATUS

CODE OR SPEC NO.	DESCRIPTION
TOOLS	
—	3-Inch Screwdriver
◗W1AF◖	Testing Cord, 8 feet 6 inches long (Equipped with a 360A tool at each end)
141	Cord Tip
411C	Test Tool
720A	Test Voltage Pickup Tool (or one KS-6278 Connecting Clip)
768A	Blocking Tool
—	70-Type Fuse (blown)
TEST APPARATUS	
KS-8039	Volt-Milliammeter (a digital multimeter is a suitable substitute)

3. OPERATION

Note: The operating procedures refer to one bus of a given polarity. If both positive and negative polarity buses are supplied in the bay, follow the procedures for one bus, and, if necessary, repeat the procedure for the other bus.

A. Preparing to Start a Complete Bus

3.01 Before putting the power plant in service, check the following.

(1) The converter INPUT circuit breaker is in the OFF position.

(2) The 48-volt input fuse, located at the 48-volt power board, is removed for each converter.

(3) The load lead disconnect P1-P4 plug, if provided ("S" Option), is connected in the associated J1-J4 socket. The J socket is located on the back of the alarm and discharge fuse panel. Remove the face plate of the alarm and discharge fuse panel for access to the disconnect socket.

(4) The converters are connected for proper output polarity.

(5) The OUTPUT ADJ VOLTS potentiometer on each converter is rotated fully counterclockwise (ccw).

(6) The OUTPUT FUSE located on the converter panel is removed. To remove the OUTPUT FUSE, press in and down.

(7) All load distribution fuses associated with the bus are removed.

Caution: Inductive filtering should not be used between the 48-volt battery and the converter inputs since an input filter may cause voltage peaks which may damage components in the converter.

B. Starting a Complete Bus

3.02 To place the power plant in service, proceed as follows.

(1) Install the 48-volt input fuse, located at the 48-volt power board, for each converter associated with the bus.

(2) Operate the INPUT circuit breaker for one converter to the ON position.

(3) Adjust the ADJ VOLTS potentiometer clockwise (cw) until the OUTPUT VOLTS voltmeter indicates 130 volts dc.

(4) Repeat (2) and (3) for each converter associated with the bus.

(5) Install the OUTPUT FUSE located on each converter.

(6) Permit all converters associated with the bus to operate at no-load for at least 5 minutes.

Note: One converter in addition to the number of converters required to carry the bus load should be connected to the bus so that a failure of a single converter will not reduce the capacity of the plant.

(7) Install the load distribution fuses (see 3.03 before installing load fuses).

(8) Adjust the bus voltage in accordance with 3.04.

3.03 ***CHG SEL Switch:*** To install load fuses for plants with decentralized filters, the CHG SEL switch is operated. This places the CHG resistor in series with the load to limit the filter charging current, thereby preventing fuse operation. To install a load fuse in these plants, proceed as follows.

(1) Operate the CHG SEL switch to the selected load position (LOAD 1 or LOAD 2).

(2) Install the load fuse.

(3) Operate the CHG SEL switch to the center position.

3.04 ***Bus Voltage Adjustment:*** To adjust the bus voltage, proceed as follows.

(1) Connect the KS-8039 volt-milliammeter, set on the 150 VOLTS DC scale, across the positive or negative and ground bus bars.

Requirement: The KS-8039 meter indicates 130 $\pm$5 volts dc.

There is no requirement for the converters in this plant to share the load current equally. The individual converter should be adjusted as close to 130 volts as possible, always maintaining a voltage of 130 volts at the plant bus.

(2) If the KS-8039 meter indicates that the bus voltage is too high or too low and/or all converter OUTPUT ammeters do not indicate the same load current, proceed as follows.

Note: If the bus voltage is 130 volts and all the converters are delivering load current, do not readjust any controls or shut down any converter. If the bus voltage is not 130 volts dc, continue in accordance with (a) or (b).

(a) ***Low Bus Voltage:*** If the bus voltage is low, adjust the converter whose ammeter indicates the least amount of load current as follows.

(1) Rotate the ADJ VOLTS potentiometer cw until the load current indicated on the OUTPUT AMMETER increases.

(2) Recheck the bus voltage.

(3) Repeat (1) and (2) until the KS-8039 meter indicates 130 volts dc.

(4) Disconnect the test meter.

(b) ***High Bus Voltage:*** If the bus voltage is high, adjust the converter whose ammeter indicates the greatest amount of load current as follows.

(1) Rotate the ADJ VOLTS potentiometer ccw until the load current indicated on the OUTPUT AMMETER decreases.

(2) Recheck the bus voltage.

(3) Repeat (1) and (2) until the KS-8039 meter indicates 130 volts dc.

(4) Disconnect the test meter.

C. Restoring a Single Converter to Service

3.05 To restore an individual converter to service, proceed as follows.

(1) Verify the following.

(a) Converter INPUT circuit breaker is in OFF position.

(b) The 48-volt converter input fuse, located at the 48-volt power board, is installed.

(c) Load lead disconnect P1-P4 plug, if provided, is connected in the associated J1-J4 socket. Remove face plate of alarm and discharge fuse panel for access to disconnect socket.

(d) Converter OUTPUT FUSE is removed.

(2) Connect the KS-8039 volt-milliammeter, set on the 150 VOLTS DC scale, across the positive or negative and ground bus bars.

(3) Note the bus voltage that is indicated on the KS-8039 meter.

(4) Operate the converter INPUT circuit breaker to the ON position.

(5) Observe the converter OUTPUT VOLTS voltmeter and adjust the ADJ VOLTS potentiometer until the converter voltmeter indicates 0.5 volt lower than the indication on the KS-8039 meter.

(6) Permit the converter to operate at no-load for at least 5 minutes.

(7) Operate the converter INPUT circuit breaker to the OFF position.

(8) Install the converter OUTPUT FUSE.

(9) Operate the converter INPUT circuit breaker to the ON positon.

Requirement: The CONVERTER FAIL lamp extinguishes.

Note: If the ACO (S1) switch was operated to silence the minor alarm, operate the ACO (S1) switch to close the minor alarm leads. The ACO lamp extinguishes. ▶If wiring option "A" is provided, the CSACS alarm is not extinguished.◀

(10) Adjust the bus voltage in accordance with 3.04.

D. Removing Complete Bus From Service

3.06 To remove a complete bus from service, proceed as follows.

Note: If all converters are turned off, a major alarm will be initiated. The alarm cutoff ACO switch will not silence ▶local alarms or CSACS alarms.◀

(1) Slowly remove all load distribution fuses.

(2) Operate the INPUT circuit breaker on each converter to the OFF position.

(3) Remove the OUTPUT FUSE from each converter. To remove fuse, press in and down.

(4) If it is desirable to disconnect the dc input power to the converter, remove all 48-volt dc input fuses from the 48-volt power board.

Note: If the converters are to remain out of service for an extended period of time, refer to Section 032-110-701 for information on maintaining electrolytic capacitors when they are not in service.

E. Removing Individual Converter From Service

3.07 To remove an individual converter from service, proceed as follows.

Caution: If one of the converters is removed from service and a second converter should fail, the plant bus may lose power, or the remaining converters may not be able to supply all the load requirements. If necessary, connect a spare converter before disconnecting any converter to prevent overloading the remaining units.

Note: If one converter is removed from service, a minor alarm is initiated.

(1) Operate the INPUT circuit breaker on the converter being removed from service to the OFF position.

(2) Operate the alarm cutoff ACO (S1) switch, if provided ("G" Option), to silence the minor alarm. ▶The CSACS alarm is not extinguished.◀

(3) If routine maintenance is to be performed on the converter, disconnect the P( ) plug from the J( ) socket.

Caution: When disconnecting the P( ) plug, verify that the plug being disconnected is the plug associated with the converter under test.

(4) To disconnect the dc input power to the converter, remove the 48-volt input fuse from the 48-volt power board.

(5) When maintenance is complete on the converter, restore the converter to service in accordance with 3.05.

4. ROUTINE CHECKS

Note 1: Periodically adjust the converter high and low voltage alarms in accordance with the converter Bell System Practice as given in 1.08.

Note 2: ▶Notify the CSACS central monitor prior to commencing and upon completion of any alarm check which will activate alarms to the CSACS central monitor. This will assure that the CSACS circuit is functioning properly and will be retired at the central monitor upon completion of the checks.◀

A. Alarms Check

4.01 ***Load Fuse Failure Alarm:*** To verify that the plant provides a major alarm due to a load fuse failure, proceed as follows.

Fuse Cap With Test Point

Note: The later design of fuse caps for 70-type fuses contain an aperture or slot adjacent to the hole for the colored bead, providing access to the alarm test point (see Fig. 1). The P-344900 fuse cap assembly is for use on nonmodular fuse blocks (18A, 19A, and 21A) and the P-11F667 fuse cap assembly is for use on modular fuse blocks (22- through 27-type). This style cap should be used when testing fuse alarms.

Caution: Due to possible fuse damage, the former procedure of testing fuse alarms by inserting a 411C tool or a 266C tool (wire burnisher) held in a 265C tool (contact burnisher holder) beside the colored bead on older fuse caps without the slot or aperture, should be discontinued.

(1) Prepare the alarm test cord (refer to Fig. 2) by connecting one end of the ▶W1AF◀ testing cord to the 141 cord tip and 720A voltage pickup tool. (The KS-6278 connecting clip may be used to replace the 720A voltage pickup tool.) On the opposite end of the ▶W1AF◀ testing cord, connect the 411C test tool.

(2) Install the 720A voltage pickup tool in a spare 70-type fuse position. (If the 720A tool is not available, obtain the same polarity 130-volt voltage supply by connecting a KS-6278 connecting clip with the ▶W1AF◀ testing cord to the positive or negative bus bar.)

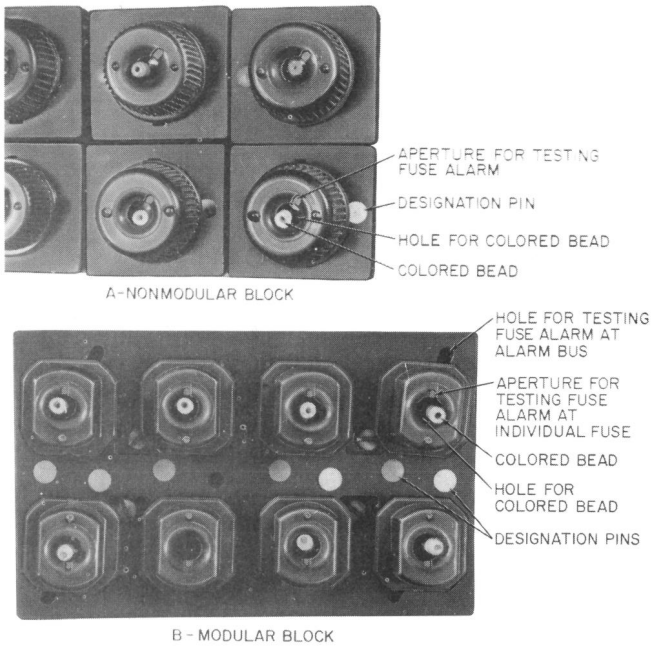

Fig. 1—Typical 70-Type Fuse Arrangement

Caution: Test only the fuses associated with the same polarity voltage supply.

(3) With the tip of the 411C tool (attached to the 130-volt connected W1AF cord) touch the exposed alarm test point on the fuse cap for one fuse.

Requirement: The FA relay operates; the FUSE ALARM (FA) lamp lights; the MULT ALARM lamp lights, if provided, and a major alarm is activated. ▶If wiring option "A" is provided, the CSAS alarm is activated.◀

Note: Tests made at the individual fuse cap check the contact between the fuse cap and the alarm bus bar. On modular type fuse blocks, there is also an aperture in the corner of the fuse block to test directly to the alarm bus bar (see Fig. 1).

(4) Remove the 411C tool from the fuse cap.

Requirement: The FA relay releases; the FUSE ALARM (FA) lamp extinguishes; the

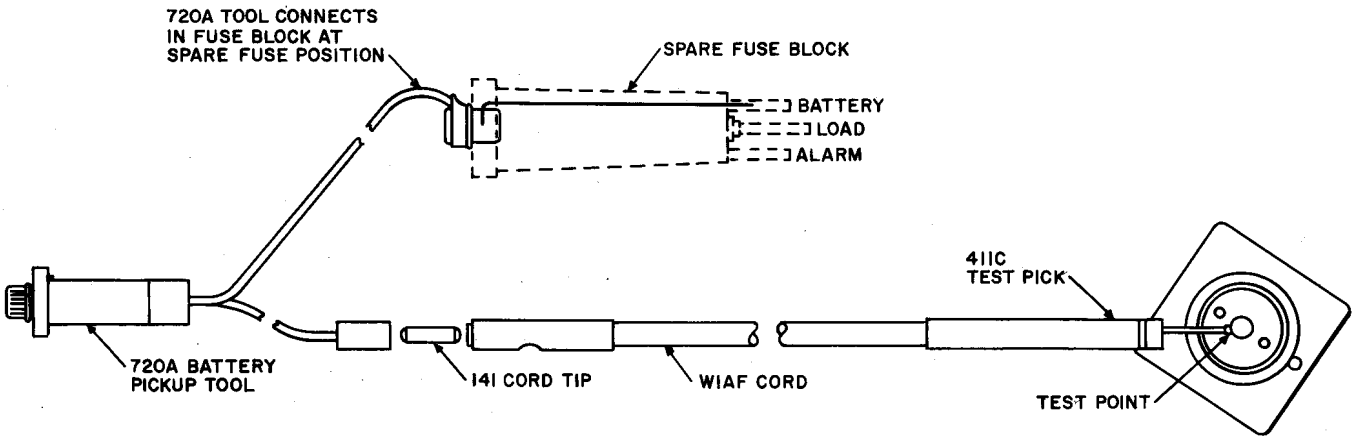

Fig. 2—Fuse Alarm Testing Cord—Tool Connection

MULT ALARM lamp extinguishes, if provided; and the ▶local major alarm is extinguished. The CSACS alarm, if provided, is not extinguished.◀

(5) Repeat (3) for each fuse.

(6) Remove the 720A tool from the spare fuse position. (If the KS-6278 connecting clip is used, disconnect the clip from the bus bar.)

4.02 ***Converter Failure Alarm:*** Perform the following check to verify that a minor alarm is activated if one converter fails, and a major alarm is activated, if two converters fail.

Note: Only the first two converters are wired to provide a major alarm.

(1) Verify that when one converter is removed from service, the remaining converters have the capacity to provide the bus load current.

(2) Open the front panel on Converter 1 and observe the K2 relay while performing (3). (The K2 relay is normally operated.)

(3) Operate the INPUT circuit breaker on Converter 1 to the OFF position.

Requirement: The K2 relay releases, and the CONVERTER FAIL lamp lights on the converter panel. A minor alarm is activated and the frame MULT ALARM lamp lights, if provided. ▶The CSACS alarm is activated, if provided.◀

(4) Open the front panel on Converter 2 and locate the K2 relay. (The K2 relay is normally operated and located near the K1 relay.)

Caution: Do not operate the K1 relay. When K1 operates, the converter shuts down.

(5) Block the K2 relay ***released*** by inserting the 768A blocking tool between the relay armature and backstop. (For additional information on relay blocking procedures, refer to Section 069-020-801.)

Requirement: Converter 2 ***does not*** shut down, however, the CONVERTER FAIL lamp on Converter 2 lights. A major alarm is activated. ▶The CSACS alarm is activated, if provided.◀

(6) Remove the relay blocking tool from the K2 relay on Converter 2.

Requirement: On Converter 2, the K2 relay operates and the CONVERTER FAIL lamp extinguishes. The major alarm is deactivated. ▶The CSACS alarm, if provided, is not deactivated.◀

(7) On Converter 1, operate the INPUT circuit breaker to the ON position.

Requirement: The CONVERTER FAIL lamp on Converter 1 extinguishes. The MULT ALARM lamp extinguishes, if provided, and the minor alarm is deactivated. ▶The CSACS alarm, if provided, is not deactivated.◀

(8) Close and secure converter front panels.

B. Bus Output Current and Voltage Check

4.03 ***Output Current Check:*** Since it is not necessary that the converters equally share the load, a periodic check should be made on converters indicating no output current to be sure that no malfunction exists. Raising the output voltage of the converter in question should cause it to deliver output current.

4.04 ***Output Voltage Check:*** To verify that the plant is supplying the required output voltage to the loads, adjust the output voltage in accordance with 3.04.

5. TROUBLES

5.01 The following troubles pertain to the supply circuit. For troubles in the converter units, refer to the appropriate Bell System Practices.

TROUBLE	POSSIBLE CAUSE
(a) Output voltage low	Converter(s) overloaded.
(b) Output voltage high	Converter(s) out of adjustment.
(c) No output current	Input supply open (fuse blown or converter malfunction).