610B POWER PLANT
OPERATING METHODS

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1. GENERAL

1.01 The 610B power plant contains a dc-to-dc converter and is equipped with either a step regulator or voltage regulator. Where additional reliability is required, duplicate load-sharing converters are paralleled across the load. Should one of the duplicate converters fail, the other converter would automatically assume the load. The plant is primarily intended to supply coin control power, but may be used wherever its characteristics and design apply. The plant converter operates from a nominal -48 volt dc input and provides a nominal positive and negative 120-volt 0.50 ampere maximum output when the converter is equipped with a step regulator or a nominal positive and negative 120- or 130-volt 0.75 ampere

maximum output when the converter is equipped with a voltage regulator.

1.02 This section is reissued to state that this equipment is rated Mfr Disc. and to add paragraph 4.13. This reissue does affect the Equipment Test List. Revision arrows are used to indicate significant changes.

1.03 If the step regulator is provided, an alarm will be activated if a no-voltage condition exists. The step regulator keeps the output voltage within allowable tolerances provided the dc input voltage does not fall below approximately 47.5 volts. If the dc input voltage does fall below 47.5 volts, the step regulator will attempt to increase the output voltage by switching taps on the T1 transformer. No automatic shutdown and no HV start switches are provided when the plant contains the step regulator. The plant is always connected to the dc input power and to the load when the associated fuses are properly installed.

Warning: Hazardous voltages may be encountered in the plant. Avoid all contact with terminals. Do not allow a test pick to touch two metal parts at the same time as dangerous or destructive short circuits may occur.

1.04 ▶With the use of a voltage regulator, an alarm will be activated if a no-voltage, low-voltage, or high-voltage condition occurs.◀

1.05 Routine checks should be performed during a period when they will cause the least service interruption.

1.06 The instructions given in this section are based on the following circuit schematic drawings. For detailed descriptions of circuit operation, refer to the corresponding circuit descriptions.

SD-81504-01, Iss ▶17B◀ —Power Supply Circuit, DC to DC Transistor Converter, ±120 Volt or ±130 Volt Output, -48 Volt Input, 610B Plant

SD-81061-01, Iss 15B—300 Type Plants, Power Audible Alarm Circuit, 302A and 302B Plants

SD-96188-01, Iss 37B—Audible and Visual Alarm Circuit With Aisle Pilot and Distinctive Alarms

If this section is to be used with equipment or apparatus that is associated with earlier or later issues of the circuit schematic drawings, 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, TEST APPARATUS, AND MATERIALS

CODE OR SPEC NO.	DESCRIPTION
TOOLS	
—	3-Inch C Screwdriver
TEST APPARATUS	
KS-8039	Volt-Milliammeter
—	▶Test Cord equipped with H. H. Smith test probe pin tip #303 on each end
—	W1AF Cord, equipped with 360A cord tip, 108 cord tip, and KS-6278 insulated alligator clip on each end.◀
MATERIALS	
KS-14666	Cleaning Cloth

Note: Equivalents may be substituted.

3. OPERATION

A. Preparing to Start

3.01 When preparing to start the power plant, proceed as follows:

(1) Verify that all external connections are made in accordance with the associated circuit schematic drawings.

(2) Verify that the associated fuses are not installed in their respective fuse holders.

(3) Connect the KS-8039 volt-milliammeter, set on the 75 VOLTS scale, to the BAT and GRD input leads of the plant.

Requirement: The KS-8039 meter should indicate between 45 and 52 volts when providing ±120 volt outputs or between 44 and 52 volts when providing ±130 volt outputs.

(4) Disconnect the KS-8039 meter.

B. Starting Power Plant ▶(Plant Equipped With Step Regulator)◀

3.02 To start the power plant when step regulation is provided, proceed as follows:

(1) Install all associated fuses of the proper type and size in their respective fuse holders.

(2) Verify that the SR TEST (R30) potentiometer is rotated fully cw.

(3) Connect the KS-8039 volt-milliammeter, set on the 75 VOLTS scale, to the SR GRD (positive lead) and SR TEST (negative lead) test jacks.

(4) Verify that the SR relay is operated.

(5) Slowly rotate the SR TEST (R30) potentiometer ccw until the SR relay releases.

Requirement: The KS-8039 meter should indicate between 46.9 and 47.7 volts.

Note: If the requirement in (5) is met, proceed to (10). If the requirement is not met, continue with (6).

(6) Rotate the SR ADJ (R31) potentiometer fully cw and observe that the SR relay releases.

(7) Adjust the SR TEST (R30) potentiometer until the KS-8039 meter indicates 47.3 volts.

(8) Slowly rotate the SR ADJ (R31) potentiometer ccw until the SR relay operates.

(9) Repeat Steps (2) through (5).

(10) Rotate the SR TEST (R30) potentiometer fully cw.

(11) Disconnect the KS-8039 meter.

(12) Verify that the plant is supplying the required outputs to the load by following the appropriate procedures in paragraph 4.03.

C. Starting Power Plant ▶(Plant Equipped With Voltage Regulator)◀

3.03 To start the power plant when voltage regulation is provided, proceed as follows:

Caution: All fuses except F3 and F4 must be installed prior to applying the -48 volt input power to the converters to prevent short circuit load damage during the initial starting phase.

(1) Insert all fuses, except ▶-120V or -130V 2AMP load fuse (F3) and +120V or +130V 2AMP load fuse (F4),◀ in their respective fuse holders prior to applying the -48 volt input power to the converter.

(2) Install the ▶-120V or -130V 2AMP load fuse (F3) and +120V or +130V 2AMP load fuse (F4)◀ in their respective fuse holders only after the converters have started.

Caution: A prolonged delay in operating the HV switch to the desired position may result in a thermal runaway of the bridge transistors causing serious equipment damage.

(3) Momentarily operate the HV START ▶rotary◀ switch to the START ADJ-2 position or momentarily depress the HV ADJ-2 key.

(4) Verify that the plant is supplying the required outputs to the load by following the appropriate procedures in paragraph 4.04.

D. Stopping Power Plant

3.04 To stop the power plant, remove all associated fuses from their respective fuse holders.

Note: If the plant is to be left 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.

4. ROUTINE CHECKS

A. Clean Ventilating Passages

4.01 Keep ventilating passages unobstructed to ensure adequate cooling during operation.

B. Step Regulator Check (Plant Equipped With Step Regulator)

4.02 To check the step regulator in the plant, proceed as follows:

(1) Verify that the SR TEST (R30) potentiometer is rotated fully cw.

(2) Connect the KS-8039 volt-milliammeter, set on the 75 VOLTS scale, to the SR GRD (positive lead) and SR TEST (negative lead) test jacks.

(3) Verify that the SR relay is operated.

(4) Slowly rotate the SR TEST (R30) potentiometer ccw until the SR relay releases.

Requirement: The KS-8039 meter should indicate between 46.9 and 47.7 volts.

Note: If the requirement in (4) is met, proceed to (10). If the requirement is not met, continue with (5).

(5) Rotate the SR ADJ (R31) potentiometer fully cw and observe that the SR relay releases.

(6) Adjust the SR TEST (R30) potentiometer until the KS-8039 meter indicates 47.3 volts.

(7) Slowly rotate the SR ADJ (R31) potentiometer ccw until the SR relay operates.

(8) Repeat Steps (1) through (4).

(9) Rotate the SR TEST (R30) potentiometer fully cw.

(10) Disconnect the KS-8039 meter.

C. Output Voltage Check ⏵(Plant Equipped With Step Regulator)⏴

4.03 To check the plant output voltage when step regulation is provided, proceed as follows:

(1) Connect the KS-8039 volt-milliammeter, set on the 150 VOLTS scale, to the -120V test jacks.

Requirement: The KS-8039 meter should indicate between -100 and -120 volts.

(2) Disconnect the KS-8039 meter.

(3) Connect the KS-8039 meter, set on the 150 VOLTS scale, to the +120V test jacks.

Requirement: The KS-8039 meter should indicate between +100 and +120 volts.

(4) Disconnect the KS-8039 meter.

Note: If the requirements in (1) and (3) are not met, verify that the input voltage to the plant is within allowable tolerances and then check the adjustment of the step regulator in accordance with paragraph 4.02. Repeat Steps (1) through (4). If the requirements are not met after adjusting the step regulator, trouble conditions may be present in the equipment and should be repaired if necessary.

(5) If duplicate converters are provided in the plant, repeat the procedures in (1) through (4) that apply on the duplicate converter.

D. Output Voltage Check ⏵(Plant Equipped With Voltage Regulator)⏴

4.04 To check the plant output voltage when voltage regulation is provided, proceed as follows:

(1) Connect the KS-8039 volt-milliammeter, set on the 150 VOLTS scale, to the -120V or -130V test jacks, depending upon which wiring option is used.

Requirement: The KS-8039 meter should indicate between -116 and -120 volts (-120V jacks) or -125 and -135 volts (-130V jacks).

(2) Disconnect the KS-8039 meter.

(3) Connect the KS-8039 meter, set on the 150 VOLTS scale, to the +120V or +130V test jacks, depending upon which wiring option is used.

Requirement: The KS-8039 meter should indicate between +116 and +120 volts (+120V jacks) or +125 and +135 volts (+130V jacks).

(4) Disconnect the KS-8039 meter.

Note: If the requirements in (1) and (3) are not met, verify that the input voltage to the plant is within allowable tolerances and then repeat Steps (1) through (4). If the requirements are still not met, trouble conditions may be present and the equipment should be repaired.

(5) If duplicate converters are provided in the plant, repeat the procedures in (1) through (4) that apply on the converter.

E. NV Alarm Check (Plant Equipped With One Converter and Step Regulator)

4.05 To check the NV alarm when the plant is equipped with one converter and step regulator, proceed as follows:

(1) ▶Using a W1AF cord, equipped with a 360A cord tip, a 108 cord tip, and a KS-6278 insulated alligator clip on each end, manually release the NV relay by placing a short across the winding of the NV relay coil located on the step regulator panel.◀

Requirement: The NV relay releases, the NV lamp lights, and a major alarm is activated.

(2) Remove the short from the NV relay coil.

Requirement: The NV relay operates and the NV lamp and major alarm extinguish.

F. NV Alarm Check (Plant Equipped With Duplicate Converters and Step Regulators)

4.06 To check the NV alarm when the plant is equipped with duplicate converters and step regulators, proceed as follows:

(1) Remove the +120V ▶2AMP load fuse◀ (F2) that is associated with converter 1 from its respective fuse holder.

Requirement: The associated NV relay releases, the NV lamp lights, and a minor alarm is activated.

(2) Install the +120V ▶2AMP load fuse◀ (F2) removed in (1) in its respective fuse holder.

Requirement: The associated NV relay operates and the NV lamp and minor alarm extinguish.

(3) Remove the +120V ▶2AMP load fuse◀ (F2) that is associated with converter 2 from its respective fuse holder.

Requirement: The associated NV relay releases, the NV lamp lights, and a minor alarm is activated.

(4) ▶Using a W1AF cord equipped with a 360A cord tip, a 108 cord tip, and a KS-6278 insulated alligator clip on each end, manually release the NV relay that is associated with converter 1 by placing a short across the winding of the NV relay coil located on the step regulator panel.◀

Requirement: The NV lamp that is associated with converter 1 lights, the minor alarm retires, and a major alarm is activated.

(5) Restore the NV relay that was released in (4) to normal operation.

Requirement: The NV lamp that is associated with converter 1 extinguishes, the major alarm retires, and a minor alarm is activated.

(6) Install the +120V ▶2AMP load fuse◀ (F2) removed in (3) in its respective fuse holder.

Requirement: The associated NV relay operates and the NV lamp and minor alarm extinguish.

G. NV Alarm Check (Plant Equipped With One Converter and Voltage Regulator)

4.07 To check the NV alarm when the plant is equipped with one converter and voltage regulator, proceed as follows:

(1) ▶Using a W1AF cord, equipped with a 360A cord tip, a 108 cord tip, and a KS-6278

insulated alligator clip on each end, manually release the NV relay by placing a short across the winding of the NV relay coil located on the voltage regulator panel.◀

Requirement: The NV relay releases, the HNV or NV lamp lights (depending upon which option is used), and a major alarm is activated.

(2) Remove the short from the NV relay coil.

Requirement: The NV relay operates, the HNV or NV lamp extinguishes (depending upon which option is used), and the major alarm retires.

H. NV Alarm Check (Plant Equipped With Duplicate Converters and Voltage Regulators)

4.08 To check the NV alarm when the plant is equipped with duplicate converters and voltage regulators, proceed as follows:

(1) Remove the +120V or +130V ▶2AMP load fuse◀ (F4) associated with converter 1 from its respective fuse holder.

Requirement: Converter 1 shuts down, the associated NV relay releases, the HNV or NV lamp lights, and a minor alarm is activated.

(2) Install the +120V or +130V ▶2AMP load fuse◀ (F4) removed in (1) in its respective fuse holder and restart converter 1 by following the procedures in ▶subparagraph 3.03(3).◀

Requirement: The associated NV relay operates, the HNV or NV lamp extinguishes, and the minor alarm retires.

(3) Remove the +120V or +130V ▶2AMP load fuse◀ (F4) that is associated with converter 2 from its respective fuse holder.

Requirement: Converter 2 shuts down, the associated NV relay releases, the HNV or NV lamp lights (depending upon which option is used), and a minor alarm is activated.

(4) ▶Using a W1AF cord equipped with a 360A cord tip, a 108 cord tip, and a KS-6278 insulated alligator clip on each end, manually release the NV relay that is associated with converter 1 by placing a short across the winding of the NV relay coil located on the voltage regulator panel.◀

Requirement: The HNV or NV lamp that is associated with converter 1 lights, the minor alarm retires, and a major alarm is activated.

(5) Restore the NV relay that was released in (4) to normal operation and restart converter 1 by following the procedure in ▶subparagraph 3.03(3).◀

Requirement: The HNV or NV lamp that is associated with converter 1 extinguishes, the major alarm retires, and a minor alarm is activated.

(6) Install the +120V or +130V ▶2AMP load fuse◀ (F4) removed in (3) in its respective fuse holder and restart converter 2 by following the procedures in ▶subparagraph 3.03(3).◀

Requirement: The minor alarm retires.

I. FA Alarm Check

4.09 To check the FA alarm in the plant, proceed as follows:

(1) ▶Using an assembled test cord equipped with an H. H. Smith test probe pin tip #303 on each end, insert one test probe tip into the -120V or -130V test jack; then touch the other test probe tip to the F7 fuse holder alarm test aperture.◀

Requirement: The FA relay operates, the FA lamp lights, and the office audible alarm is activated.

(2) ▶Remove the test probe tip from the fuse holder alarm test aperture.◀

Requirement: The FA relay releases, the FA lamp extinguishes, and the office audible alarm retires.

(3) Repeat (1) and (2), using the F8, F11, and F12 fuse holders.

(4) ▶Using the assembled test cord in (1), insert one test probe tip into the +120V or +130V

test jack; then touch the other test probe tip to the F9 fuse holder alarm test aperture.◀

Requirement: The FA1 relay operates, the FA lamp lights, and the office audible alarm is activated.

(5) ▶Remove the test probe tip from the fuse holder alarm test aperature.◀

Requirement: The FA1 relay releases, the FA lamp extinguishes, and the office audible alarm retires.

(6) Repeat (4) and (5), using the F10, F13, and F14 fuse holders.

J. HV Alarm Check (Plant Equipped With Voltage Regulator)

4.10 To check the HV alarm when the plant is equipped with a voltage regulator, proceed as follows:

(1) Momentarily operate the HV START ▶rotary◀ switch to the ADJ-1 position or momentarily depress the HV ADJ-1 key.

Requirement: The HV relay operates, the HV or HNV lamp lights, and the office audible alarm is activated.

Note: If the requirement in (1) is met, wait 1 minute before continuing with (2).

(2) Momentarily operate the HV START ▶rotary◀ switch to the START ADJ-2 position or momentarily depress the HV ADJ-2 key.

Requirement: The HV relay releases, the HV or HNV lamp extinguishes, and the office audible alarm retires.

Note: If the requirements in (1) and (2) are met, proceed to (8). If the requirements are not met, continue with (3).

(3) Rotate the HV ADJ (R32) potentiometer fully ccw.

(4) ▶Operate and hold the HV START rotary switch to the ADJ-1 position or depress and hold the HV ADJ-1 key.◀

(5) Slowly rotate the HV ADJ (R32) potentiometer cw until the HV relay operates.

(6) Release the HV START ▶rotary◀ switch or the HV ADJ-1 key.

Note: Wait 1 minute before continuing with (7).

(7) ▶Repeat (1) and (2) to recheck adjustment.◀

(8) If duplicate converters are provided in the plant, repeat the procedures in (1) through (7) for the duplicate converter.

K. Polarity Alarm Checks (Plant Equipped With Voltage Regulator)

4.11 To check the polarity alarms when the plant is equipped with a voltage regulator, proceed as follows:

Note: When fuses are removed from their respective fuse holders to perform checks, install the fuses back into their respective fuse holders as soon as possible to prevent extended alarm indications at the associated TSPS office.

(1) Remove the -120V or -130V ▶2AMP load fuse◀ (F3) from its respective fuse holder.

Requirement: The converter shuts down and the NA relay releases (closes A1 and B1 leads to TSPS office alarm circuit).

(2) Install the -120V or -130V ▶2AMP load fuse◀ (F3) removed in (1) in its respective fuse holder and restart the converter by following the procedures in ▶subparagraph 3.03(3).◀

Requirement: The NA relay operates (opens A1 and B1 leads to TSPS office alarm circuit).

(3) Remove the +120V or +130V ▶2AMP load fuse◀ (F4) from its respective fuse holder.

Requirement: The converter shuts down and the PA relay releases (closes A2 and B2 leads to TSPS office alarm circuit).

(4) Install the +120V or +130V ▶2AMP load fuse◀ (F4) removed in (3) in its respective

fuse holder and restart the converter by following the procedures in ▶subparagraph 3.03(3).◀

Requirement: The PA relay operates (opens A2 and B2 leads to the TSPS office alarm circuit).

(5) If duplicate converters are provided in the plant, repeat the procedures in (1) through (4) that apply on the duplicate converter.

L. Low-Voltage Shutdown Check (Plant Equipped With Voltage Regulator and ZJ or ZK Options)

Caution: The performance of this test on single converter and voltage regulator equipped power plants will result in service interruption.

4.12 To check the low-voltage shutdown when the plant is equipped with a voltage regulator and ZJ or ZK options, proceed as follows:

(1) ▶Remove the -120V or -130V 1AMP fuse (F5) from its fuse holder for converter 1.◀

Requirement: The SP relay releases, converter 1 shuts down, the NV relay releases, the NV lamp lights, and the office alarms are activated.

(2) Install the -120V or -130V ▶1AMP fuse◀ (F5) removed in (1) in its respective fuse holder and restart converter 1 by following the procedures in ▶subparagraph 3.03(3).◀

Requirement: The SP relay operates, the NV relay operates, converter 1 starts, and the NV alarm lamp and office alarms extinguish.

(3) ▶Remove the +120V or +130V 1AMP fuse (F6) from its fuse holder for converter 1.◀

Requirements: The SP relay releases, converter 1 shuts down, the NV relay releases, the NV lamp lights, and the office minor alarm is activated.

(4) Install the +120V or +130V ▶1AMP fuse◀ (F6) removed in (3) in its respective fuse holder and restart converter 1 by following the procedures in ▶subparagraph 3.03(3).◀

Requirement: The SP relay operates, the NV relay operates, converter 1 starts, and the NV alarm lamp and office alarms extinguish.

(5) If duplicate converters are provided in the plant, repeat the procedures in (1) through (4) that apply for converter 2.

M. ▶Low-Voltage Shutdown Check (Plant Equipped With Voltage Regulator and ZH Option)

Caution: The performance of this test on single converter and voltage regulator equipped power plants will result in service interruption.

4.13 To check the low-voltage shutdown when the plant is equipped with a voltage regulator and ZH option, proceed as follows:

(1) Remove both -120V and +120V 1AMP fuses or -130V and +130V 1AMP fuses from their fuse holder apertures for converter 1.

Requirement: The SP relay releases, converter 1 shuts down, the NV relay releases, the NV lamp lights, and the office alarms are activated.

(2) Install both -120V and +120V 1AMP fuses or -130V and +130V 1AMP fuses removed in (1) in their respective fuse holders and restart converter 1 by following the procedures in subparagraph 3.03(3).

Requirement: The SP relay operates, the NV relay operates, converter 1 starts, and the NV alarm lamp and office alarms extinguish.

(3) If duplicate converters are provided in the plant, repeat procedures (1) and (2) for converter 2.◀

5. TROUBLES

5.01 When trouble conditions develop in the plant, it is necessary to decide whether to locate the troubles with the plant operating or de-energized. Some components in the plant may become overheated when the plant is operated for more than a few minutes with trouble conditions existing in the equipment. If the trouble is of a nature that causes excessive output from the plant, take the

initial steps with the plant de-energized and energize it for short periods of time in order to make electrical measurements. When testing, it is essential to be alert in order to shut the plant down at any time until the trouble is localized and cleared.

Caution: In making continuity checks, use the ohmmeter portion of the KS-8039 volt-milliammeter. Do not use the X10,000 position for testing semiconductors as the higher scale meter voltage may damage them.

Note 1: Refer to Section 032-173-301 for information on testing semiconductor components.

Note 2: When performing maintenance on the power plant, it is advisable to have copies of the associated circuit schematic drawings and circuit descriptions available to aid in equipment identification, etc.

5.02 Various troubles that occur in the power plant and the possible causes are given in the following list. Should any of the following troubles develop, it is suggested that the possible causes be checked in the order given. If the trouble is not found, check for loose or open connections or short circuits due to foreign matter lying across wiring terminals. This list is not all inclusive and is meant only to be an aid in locating possible trouble conditions that might occur.

TROUBLE	POSSIBLE CAUSE
A. No output voltage	(1) No input battery voltage
A. No output voltage (Contd)	(2) Low input battery voltage (below —47.5 volts)
	(3) Associated fuses blown
	(4) Defective Q1 through Q4 transistors
	(5) Defective T2 transformer
	(6) Defective L1 inductor.
B. Low output voltage	(1) Defective voltage regulator
	(2) Defective capacitors
	(3) Defective semiconductor devices.
C. High output voltage	(1) Step regulator not properly adjusted or defective voltage regulator
	(2) Defective capacitors
	(3) Defective semiconductors devices.
D. Erratic output	Loose connections.