POWER PLANT
425A (J86832)
12 VOLTS, 1600 AMPERES
OPERATING METHODS

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1. GENERAL

1.01 The 425A power plant is used in the TD-2 Radio System to provide a negative 12-volt filament supply for loads of 60 through 1600 amperes.

1.02 This section is reissued to revise Part 4, ROUTINE CHECKS. This reissue does not affect the Equipment Test List.

1.03 The 425A (J86832) plant operates on 60-Hz input power and provides negative 12-volt direct current for loads up to 1600 amperes. The plant is automatically regulated and is intended for fully unattended operation. Under normal operating conditions, from two to five KS- rectifiers, each rated 400 amperes, are connected to the common charge-discharge bus to supply the discharge current and battery charge and float current.

1.04 Each KS- rectifier is equipped with an ammeter to indicate its output current. The J86832A initial charge-discharge bay is furnished with a voltmeter for reading voltage at the common charge-discharge bus and an ammeter to indicate the total plant load. Alarms are provided in the plant to indicate trouble conditions whether due to rectifier failure, fuse failure, or high or low float voltage.

1.05 A 6-cell battery furnishes a reserve supply in case of power failure. Resistances in series with the load leads during normal operation are short-circuited by contactors in case of low battery voltage to maintain voltage on the equipment. The short-circuiting contactors are automatically operated under control of the low-voltage contact of the float-voltage relay. As a safeguard, these contactors are also operated under control of the low-voltage relay.

1.06 Provision is made to overcharge the battery at 2.2 volts per cell. This is done by manually operating the OVERCHARGE switch to change the regulated output voltage from a float to an overcharge voltage.

1.07 If the output current of any rectifier unit is less than 10 amperes, the LO-CUR lamp on the rectifier will light. If the battery voltage drops below the limits of the FLOAT relay and remains low for about 30 seconds, the FLOAT VOLT lamp will light and an alarm will be given. If the plant is connected to an ac low voltage and engine failure alarm circuit and the trouble was not due to an ac supply failure, a rectifier failure alarm will be given and the RECTIFIER LOW CURRENT lamp in the charge-discharge bay will light. However, if the trouble was due to an ac supply failure, a rectifier failure alarm will not be given.

1.08 If the battery voltage rises above the limits of the FLOAT relay and remains high for about 30 seconds, this relay lights the FLOAT

VOLT lamp, gives an alarm, and opens the circuit breaker or contactor of the rectifier or rectifiers producing the high voltage. When the rectifier shuts down, the RECTIFIER OFF lamp on the initial charge-discharge bay will light.

1.09 An HLV high-low voltage relay with wider limits (11.5 through 14.0 volts) than the FLOAT relay (12.5 through 13.5 volts) gives an immediate alarm and lights the HI-LO lamp if the battery voltage drops below 11.5 volts. If the battery voltage rises and remains above 14.0 volts for a few seconds, any rectifier carrying more than approximately 15 amperes will shut down.

1.10 Failure of a REG, FLOAT, or HI-LO fuse causes audible and visual alarms and lights the CONTROL FUSE lamp. Failure of an alarm-type fuse in any rectifier causes audible and visual alarms and lights the RECTIFIER FUSE lamp in the plant. Failure of a discharge fuse in the plant causes audible and visual alarms and lights the DISCHARGE FUSE lamp. The FUSE ALARM lamp in the supplementary bay is also lighted.

1.11 A charge fuse failure in the plant causes no alarm unless the plant voltage becomes low as a result. Under some conditions, a rectifier unit may fail and give no indication of failure except the lighting of the LO-CUR lamp in the rectifier.

1.12 Routine checks should be made during a period when there will be minimum interference with service.

1.13 The instructions are based on circuit drawing SD-81732-01. For a detailed description of the operation of the circuit, see the corresponding circuit description.

1.14 For more detailed information on the operation and maintenance of individual equipment or apparatus, refer to the appropriate Bell System Practices. All relays and other apparatus should be adjusted, when required, in accordance with these sections and the circuit requirement tables on the circuit drawings.

2. LIST OF TEST APPARATUS

CODE OR SPEC NO.	DESCRIPTION
TEST APPARATUS	
35-Type	Test Set
411B	Test Pick (2 reqd)
W1AF	Cord
KS-8039	Volt-Milliammeter

3. OPERATION

Preparing to Start

3.01 When preparing the plant for service, check that:

(a) Spare fuses of correct size are available.

(b) Discharge resistors have been connected in accordance with SD-81732-01 for each of the loads.

(c) Each rectifier unit has been adjusted as closely as practicable for floating at 13.0 volts at any load from 100 through 300 amperes and overcharging at 13.2 volts at any load from 100 to 300 amperes. Maximum overcharge voltage is determined by circuit voltage limitations.

(d) MANUAL ADJUST potentiometer is fully counterclockwise.

(e) Rectifier adjustments have been made in accordance with the appropriate Bell System Practices.

Note: After rectifier adjustments have been made in accordance with the appropriate Bell System Practices, no further plant adjustments are required.

Starting

3.02 When placing the plant into service, proceed as follows.

(1) Install all ac and dc fuses.

(2) Starting with the lowest numbered rectifier, operate the AC INPUT control of each rectifier to the ON position. (For KS-19424 List

1 modified and List 3, depress POWER ON button.)

Stopping

3.03 Operate AC INPUT control to OFF. (For KS-19424 List 1 modified and List 3, depress the POWER OFF button.)

Caution: If the rectifier is to be left out-of-service, remove the ac supply fuses and the dc charge and regulation fuses.

4. ROUTINE CHECKS

4.01 ***Automatic Operation:*** The plant is entirely automatic and should require no operating attention other than periodic overcharging and check of float voltage.

4.02 ***Overcharging:*** Periodically operate the OVERCHARGE switch. The OVERCHARGE lamp will light. After overcharging is completed, operate the OVERCHARGE switch. The OVERCHARGE lamp will extinguish.

4.03 ***Batteries:*** Periodically check the batteries as covered in Section 157-601-701.

4.04 ***Rectifier:*** Periodically check the rectifiers as covered in the appropriate Bell System Practices.

4.05 ***Relays:*** Check the power plant relays in accordance with the associated circuit requirement tables and Bell System Practices whenever operation indicates trouble or doubtful adjustment. Monthly routine checks should be made until local experience indicates a longer interval will be satisfactory.

4.06 ***C Load Contactors:*** To check operation of the C load contactors, proceed as follows.

(a) Turn MAN ADJUST potentiometer in the rectifier fully counterclockwise and operate enough rectifiers to the manual position to cause closure of the low contacts of the FLOAT voltage relay. The L1 relay and C load contactors should operate. When the C load contactors have operated, check the voltage at the radio bay load distribution lugs associated with the C contactor using the KS-8039 volt-milliammeter. If the C contactors are wired as shown in SD-81732-01, Fig. 13, the voltage measured at each distribution lug shall be 11.3 through 11.8 volts. In the case of C contactors wired as shown in SD-81732-01, Fig. 11 and 12, the voltage shall be 11.65 through 12.39 volts.

(b) Release the contactors by restoring the rectifiers to automatic control. This should cause the low contacts of the FLOAT voltage relay to open. The L1 relay and C contactors should release.

(c) Check the voltage at the distribution lugs with the contactors released. This voltage in all cases shall be 10.9 through 11.1 volts. In the case of C contactors wired as shown in Fig. 11 and 12, the voltage with the contactors released shall be at least 1.25 volts lower than the corresponding voltage with the contactors operated.

4.07 ***Alarms:*** Periodically check the following alarms.

(a) ***CONTROL FUSE AND RECTIFIER FUSE:*** Check the alarm associated with each REG fuse, voltmeter relay fuse, and alarm-type rectifier fuse which is connected to the alarm circuit by using a W1AF cord equipped with two 411B test picks. Connect one test pick of the W1AF cord to the terminal of the fuse and momentarily connect the other test pick of the cord to the associated alarm stud. Note that the alarm operates while the cord is connected.

(b) ***DISCHARGE FUSE***

(1) Check the alarm fuse shunting the larger discharge fuse by removing the alarm fuse and inserting a fuse with a released alarm cap. Note that the alarm operates while the fuse is inserted.

(2) Check the alarm of each 70-type discharge fuse by connecting one test pick of the W1AF cord to the terminal of the fuse. Momentarily connect the other test pick of the cord to the associated alarm stud. Note that the alarm operates while the cord is connected.

(c) ***FLOAT VOLT and HI-LOW VOLT HIGH VOLTAGE ALARMS*** (rectifier shutdown): Check the FLOAT VOLT and HI-LOW VOLT

alarms and consequent rectifier shutdown for high-voltage operation as follows.

(1) ***General:*** The following procedure is arranged so that high voltage is applied only once to each voltage relay and each rectifier shutdown is checked individually thereafter. Checking the rectifier shutdowns individually should prevent excessive drops in plant voltage and thus avoid operating the load contactors.

(2) Remove the TD-1 timer and block released the L1 relay. Connect the 35-type test set to the 24-volt and ground terminals of the relay test block. Remove the FLOAT fuse and connect the test set to the positive and negative terminals of the VR1 relay for use as a variable resistor. With the voltage set at 13.0 volts, slowly increase the voltage, ▶by means of the slide wire on the 35-type test set,◀ until the FLOAT (VR1) relay makes on its high contact (do not exceed 13.7 volts).

Requirement: ▶The VR1 relay should make on its high contact at 13.5 volts and the H1 relay should operate immediately.◀

(3) Restore the circuit to normal as follows. Remove the 35-type test set, insert the FLOAT fuse, remove the block from the L1 relay, and insert the TD-1 timer.

(4) On all KS-19424 and KS-19700 rectifiers except the rectifier being tested, operate the TEST SELECTOR switch to the TST HL position and if necessary adjust the TCA potentiometer on the rectifier counterclockwise to light the LOW CUR alarm lamp. On all KS-19701 rectifiers except the rectifier being tested, place a jumper across contacts 3 and 5 of relay K3 in the rectifier. Check that the rectifier being tested does not have the LOW CUR lamp lighted. If necessary, adjust the VOLTS ADJ control slightly clockwise.

(5) Block operated the H1 relay.

Requirement: Within 15 to 45 seconds later, an office alarm should be given, the FLOAT VOLT lamp should light, and the rectifier being tested should shut down. When the rectifier shuts down, the RECTIFIER OFF lamp should light on the initial charge-discharge bay.

(6) Remove the blocking from the H1 relay operation. Repeat (4) and (5) on the next rectifier.

(7) If more than two rectifiers are provided, repeat (4), (5), and (6) until each rectifier has been tested.

(8) After the last rectifier FLOAT high-voltage shutdown has been checked, and with the circuit still blocked for shutdown of the last rectifier only, block released the L2 relay and connect the 35-type test set to the 24-volt and ground terminals of the relay test block. Remove the HI-LO fuse and connect the test set to the positive and negative terminals of the VR2 relay for use as a variable resistance. With the voltage set at 13.0 volts, slowly increase the voltage ▶by means of the slide wire on the 35-type test set◀ until the HLV (VR2) relay makes on its high contact (do not exceed 14.2 volts).

Requirement: ▶The HLV (VR2) relay should make on its high contact at 14.0 volts. The HLV alarm should be given immediately and the last rectifier should shut down.◀

(9) Restore the circuit to normal as follows. Remove the 35-type test set, insert the HI-LO fuse, and remove the block from the L2 relay.

(10) Place the rectifier back in operation. On the KS-19701 rectifiers, remove all jumpers and restore the rectifiers to normal operation.

Caution: When putting the plant back to normal, check that all relay blocking and insulators are removed so that automatic operation of the plant is not impaired.

(d) ***FLOAT Low Voltage, RECTIFIER OFF, and RECTIFIER LOW CURRENT Alarms:*** Check the FLOAT low voltage, RECTIFIER OFF, and RECTIFIER LOW CURRENT alarms as follows.

(1) Insulate make contacts 1, 4, 6, 10, and 11 on the L1 relay by placing a piece of Bell System bond paper over each contact and fold the paper so that it will not be detached when the relay operates. This should prevent operation of the C contactors and avoid changes of filament voltage in associated radio system. When preparing the paper for insulating contacts, avoid lint by cutting instead of tearing the paper to the required size.

(2) ▶Block released the L1 relay. Connect the 35-type test set to the 24-volt and ground terminals of the relay test block. Remove the VR1 fuse and connect the 35-type test set to the positive and negative terminals of the FLOAT (VR1) relay for use as a variable resistor. With the voltage set at 13.0 volts, remove the block from the L1 relay and then slowly decrease the voltage, by means of the slide wire on the 35-type test set, until the VR1 relay makes on its low contact.

Requirement: The FLOAT (VR1) relay should make on its low contact at 12.5 volts and the L1 relay should operate immediately.

(3) Block released the L1 relay. Remove the 35-type test set and insert the VR1 fuse. Leave top contacts 4, 6, 10, and 11 insulated but remove the insulator from top contact No. 1 on the L1 relay, taking care to relieve the pressure of the contacts against the insulator while removing the insulator. Remove the block from the L1 relay.◀

(4) Block operated the L1 relay.

Requirement: The FLOAT VOLT alarm operates within 15 to 45 seconds after blocking the relay.

(5) Operate the ALARM CUT-OFF switch to silence the alarms. Retire the alarms by first unblocking the L1 relay and then removing the insulation from the relay contacts.

(6) Operate the AC INPUT control to the OFF position on one rectifier with the other rectifiers operating.

Requirement: The RECTIFIER OFF and RECTIFIER LOW CURRENT lamps should light. At the same time, the other rectifiers should carry the load and maintain the float voltage.

(7) Operate the AC INPUT control to the ON position.

(8) Repeat (6) and (7) for each rectifier.

(e) ***HI-LO VOLT Low Voltage Alarms:*** Check the HI-LO voltage alarms as follows.

(1) Insulate make contacts 4, 6, 11, and 12 on the L2 relay by the method covered in (d).

(2) ▶Block release the L2 relay. Connect the 35-type test set to the 24-volt and ground terminals of the relay test block. Remove the HI-LO fuse and connect the test set to the positive and negative terminals of the HLV (VR2) relay for use as a variable resistor. With the voltage set at 13.0 volts, remove the block from the L2 relay and then slowly decrease the voltage by means of the slide wire on the 35-type test set, until the HLV (VR2) relay makes on its low contact.

Requirement: The HLV (VR2) relay should make on its low contact at 11.3 volts and the L2 relay and HI-LO VOLT alarm should operate immediately.

(3) Block released the L2 relay. Remove the 35-type test set and insert the HI-LO fuse. Remove the insulation from the L2 relay contacts and unblock the L2 relay.◀

4.08 ***Float Voltage Check***

(a) Check the total load as shown on the plant ammeter. The total load will vary from the sum of the individual rectifier load currents by that amount of current required to charge the batteries or to maintain them at float potential.

(b) Determine that the indication of the BAT VOLTS voltmeter in the plant is maintained at 13.0 volts. If the voltage is low, increase the output of the rectifier producing the lowest current. If the voltage is high, decrease the output of the rectifier producing the highest current. Although not a requirement, it is desirable to have the KS-19424 rectifiers adjusted so that the LO CUR alarm lamp is not

lighted and the J86244 rectifier adjusted so that the LC relay is not operated.

There is no requirement for the rectifiers in this plant to share the load current. This results in one rectifier taking all or most of the load until the plant load increases to the point where additional rectifiers must cut in to prevent the first rectifier from going to current limiting. This is perfectly normal; no attempt is to be made to try to force the rectifiers to share the load. The individual rectifiers are only to be adjusted to as close to 13.0 volts as normal meters indications permit. If the plant voltage is 13.0 volts and all of the rectifiers are delivering load current, do not readjust any controls or shut down any rectifiers.

5. TROUBLES

5.01 Table A shows the alarm lamps in alphabetical order, together with the functions. Action to be taken is also given.

TABLE A

LAMP	INDICATION	ACTION
ALARM CUT-OFF	Operation of alarm cut-off switch to silence local office alarms due to a FLOAT VOLT alarm.	Correct cause of FLOAT VOLT alarm. Operate ALARM CUT-OFF lamp switch.
CONTROL FUSE	Operation of REG, FLOAT, or HI-LOW fuse in plant.	Correct cause of blown fuse before replacing fuse.
DISCH FUSE	Operation of DISCHARGE fuse in plant.	Check for blown fuse in discharge fuse assemblies. Correct cause of blown fuse before replacing fuse.
FLOAT VOLT	Float voltage out of limits.	Check output of rectifiers. Check VR1 relay and FLOAT fuse.
FUSE ALARM	Operation of discharge fuse in supplementary discharge bay.	Check for blown fuse in supplementary discharge bay.
HI-LO VOLT	Battery voltage out of limits.	Check output of rectifiers. Check VR2 relay and HI-LO fuse.
OVERCHARGE	Operation of OVERCHARGE alarm switch.	Operate OVERCHARGE alarm switch after overcharging is completed.
RECTIFIER FUSE	Operation of alarm-type fuse in any rectifier.	Check for blown fuse in rectifier. Correct cause of blown fuse before replacing fuse.
RECTIFIER LOW CURRENT	Rectifier output below 10 amperes and low float voltage or rectifier off alarm.	Check rectifier output and adjustments.
RECTIFIER OFF	Rectifier circuit breaker or contactor is in OFF position.	Check rectifier adjustments.

5.02 No maintenance is required for TD-1 time delay relays. Replace this relay if it is defective.

5.03 ***Trouble Chart:*** The trouble and possible causes that follow are not necessarily all-inclusive but are merely indicative of some of the difficulties that may be encountered when the 425A plant is not operating normally.

TROUBLE	POSSIBLE CAUSE
Battery voltage high or low	Rectifier out of adjustment or defective component in rectifier. VR1 (FLOAT) relay out of adjustment or failing to close contacts.
Hunting	Rectifier out of adjustment.