111A (J86470) POWER PLANT
OPERATING METHODS

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1. GENERAL

1.01 The 111A power plants consist of control units and 24- and 48-volt rectifiers housed in cabinets or relay racks. The plants may be used with any system where their design and characteristics apply.

1.02 This section is reissued to:

(a) Add information on rectifiers J87434A, J87435A, J87436A, J87437A, J87438A, J87439A, and KS-19210

(b) Add information on the alarm surveillance and control interface

(c) Make various corrections and admonishment updates.

Revision arrows are used to emphasize the more significant changes. This issue does not affect the Equipment Test List.

1.03 These plants have capacities of 40, 120, 400, 600, and 800 amperes. The 40-, 400-, 600-, and 800-ampere plants may be used for either variable or constant loads up to these ratings. The 120-ampere assemblies are limited to 120 amperes of charging current. This permits a rating of 120 amperes for variable loads but requires that the rating be reduced for constant loads to permit recharging of batteries after a power failure. The reduction usually results in a rating of 80 amperes or more.

1.04 ▶The 40-ampere 111A power plant, in accordance with SD-81769-01, operates on 120-volt or 208- to 240-volt 60-Hz, single-phase ac power. The 120-ampere 111A power plants, in accordance with SD-81424-01 and SD-81466-01, operate on 208- to 240-volt 60-Hz, single-phase ac power. The 800-ampere plants, in accordance with SD-81612-01 and SD-81613-01, operate on 208- to 240-volt or 480-volt 60 Hz, 3-phase or single-phase ac power. The 400- and 600-ampere plants, in accordance with SD-81501-01, operate on 208- to 240-volt or 480-volt 60 Hz, 3-phase or single-phase ac power. The 40-, 120-, and 800-ampere plants are designated to provide a 24- or 48-volt, positive or negative power supply. The 400- and 600-ampere plants are designed to provide a negative 48-volt power supply. Each plant includes rectifiers as described in (a) through (f) to supply the load and charge the battery. In addition to the rectifiers, the plants include control and distribution equipment mounted in cabinets or on relay racks and batteries mounted on battery stands or within the cabinet for the 40-ampere plant.◀

(a) The 40-ampere 111A power plant, in accordance with SD-81769-01, operates with J87211B, 24-volt 11-ampere, or J87328A, 15-ampere 24-volt

rectifiers. The plant is designed to operate with one to five rectifiers.

(b) ▶The 120-ampere 24-volt plant, in accordance with SD-81466-01, operates with J86231A and/or J87232A, 30-ampere rectifiers or J87434A, 35-ampere rectifiers. The plant is designed to operate with a maximum of five rectifiers.

(c) The 120-ampere 48-volt plant, in accordance with SD-81424-01, operates with J86231A and/or J87233A, 30-ampere rectifiers or J87435A, 35-ampere rectifiers. The plant is designed to operate with a maximum of five rectifiers.

(d) The 400- and 600-ampere 48-volt plant, in accordance with SD-81501-01, operates with J86231A or J87233A 30-ampere rectifiers; J87435A 35-ampere rectifiers; J86295 or J87439A 200-ampere rectifiers and J87261A, B, G, or K charge bay assemblies. The rectifiers and charge bay assemblies may be used alone or in any combination with each other. The plant is designed to operate with a maximum of twelve rectifiers not to exceed a maximum charging capacity of 800 amperes.

(e) The 800-ampere 24-volt plant, in accordance with SD-81612-01, operates with J87211B 11-ampere rectifiers; J87232A 30-ampere rectifiers; J87434A 35-ampere rectifiers; J87222A, B, C, or D, J87436A or KS-20491 100-ampere rectifiers; J87438A 200-ampere rectifiers; KS-19210 400-ampere rectifiers and J87260A, B, E, or G charge bay assemblies. The rectifiers and charge bay assemblies may be used alone or in any combination with each other. The plant is designed to operate with a maximum of twelve rectifiers not to exceed a maximum charging capacity of 1200-amperes.

(f) The 800-ampere 48-volt plant, in accordance with SD-81613-01, operates with J87233A 30-ampere rectifiers; J87435A 35-ampere rectifiers; J87223A, B, C, or D, J87437A or KS-20493 100-ampere rectifiers; J87439A 200-ampere rectifiers, KS-20489 or KS-20490 400-ampere rectifiers, and J87261A, B, G, or K charge bay assemblies. The rectifiers and charge bay assemblies may be used alone or in any combination with each other. The plant is designed to operate with a maximum of twelve rectifiers not to exceed a maximum charging capacity of 1200 amperes.◀

1.05 The 800-ampere ▶positive◀ 24-volt plant and the 800-ampere ▶negative◀ 48-volt plant may be paired to produce a maximum output of 1600-amperes. The supply voltages of opposite polarity (24 volts and 48 volts) are paired to permit the use of common ground feeders for the charge and discharge conductors.

1.06 Where provided, the J87339A rectifier sequence control unit provides for manual and automatic shutdown and sequence starting of preselected groups of voltage-regulated rectifiers. The sequence operation occurs when ac power is transferred from commercial power to engine standby power, or vice versa, due to power failure or during routine engine test. The rectifier sequence control reduces the excessive inrush current due to initial rectifier loads on the standby engine alternator and commercial power when transfer from one to the other takes place.

1.07 Instructions are based upon the following drawings. For a detailed description of the operation of individual circuits, refer to the corresponding circuit description.

Charge and Discharge Circuits

SD-81424-01, Iss ▶15◀ —Charge and Discharge Circuit, 10 to 120 Amperes, 48 Volts

SD-81466-01-1, Iss ▶13◀ —Charge and Discharge Circuit, 10 to 120 Amperes, 24 Volts

SD-81501-01, Iss ▶16◀ —Charge and Discharge Circuit ▶10 to 400 Amperes.◀

SD-81612-01, Iss ▶24◀ —Charge and Discharge Circuit, 0 to 800 Amperes, 24 Volts

SD-81613-01, Iss ▶18◀ —Charge and Discharge Circuit, 0 to 800 Amperes, 48 Volts

SD-81769-01, Iss ▶5◀ —Charge and Discharge Circuit, ▶1◀ to 40 Amperes, 24 Volts

Rectifier Circuits

SD-81396-01, Iss 7—J86231A Rectifier Circuit, 30 Amperes, 24 and 48 Volts

SD-81410-01, Iss ▶14◀ —J86295 Rectifier Circuit, 200 Amperes, 48 Volts

SD-81552-01, Iss ▶14◀ —J87223A and B Rectifier Circuit, 100 Amperes, 48 Volts

SD-81553-01, Iss ▶13◀ —J87222A and B Rectifier Circuit, 100 Amperes, 24 Volts

SD-81567-01, Iss ▶13◀ —J87211B Rectifier Circuit, 11 Amperes, 24 Volts

▶SD-81596-01, Iss 9—J87232A Rectifier Circuit, 30 Amperes, 24 Volts

SD-81597-01, Iss 9—J87233A Rectifier Circuit, 30 Amperes, 48 Volts◀

SD-81627-02, Iss ▶4◀ —KS-19210 Rectifier Circuit, 400 Amperes, 24 Volts

SD-81705-01, Iss 3—J87260A, B, and ▶G◀ , J87261A, B, and ▶K◀ Charge Bay Assembly Circuit, 100 to 400 Amperes, 24 and 48 Volts

SD-81753-01, Iss ▶25◀ —J87222C and D Rectifier Circuit, 100 Amperes, 24 Volts

▶SD-81756-01, Iss 18—J87223C and D Rectifier Circuit, 100 Amperes, 48 Volts◀

SD-81995-01, Iss ▶8◀ —KS-20489 Rectifier Circuit, 400 Amperes, 48 Volts

SD-81996-01, Iss 5—KS-20490 Rectifier Circuit, 400 Amperes, 48 Volts

SD-81997-01, Iss ▶6◀ —KS-20491 Rectifier Circuit, 100 Amperes (Lorain Products Corp)

SD-81999-01, Iss ▶7◀ —KS-20493 Rectifier Circuit, 100 Amperes, 48 Volts (Lorain Products Corp)

SD-82008-01, Iss 2—J87328 Rectifier Circuit, 15 Amperes, 24 Volts

SD-82299-01, Iss 1—J87260E and J87261G Charge Bay Assembly Circuit, 100 ▶to 400 Amperes, 24 and 48 Volts◀

SD-82395-01, Iss 1—J87434A Rectifier Circuit, 35 Amperes, 24 Volts◀

SD-82396-01, Iss 1—J87435A Rectifier ▶Circuit, 35 Amperes, 48 Volts◀

SD-82397-01, Iss 1—J87436A ▶Rectifier Circuit, 100 Amperes, 24 Volts◀

SD-82398-01, Iss 1—J87437A ▶Rectifier Circuit, 100 Amperes, 48 Volts

SD-82399-01, Iss 1—J87438A Rectifier Circuit, 200 Amperes, 24 Volts

SD-82400-01, Iss 1—J87439A Rectifier Circuit, 200 Amperes, 48 Volts

SD-82401-01, Iss 2—KS-20493 Rectifier Circuit, 100 Amperes, 48 Volts (North Electric Co)

SD-82462-01, Iss 1—KS-20491 Rectifier Circuit 100 Amperes, 24 Volts (North Electric Co)◀

Alarm Circuits

SD-81472-01, Iss 9—Power Audible Alarm Circuit

SD-81061-01, Iss 18—Power Audible Alarm Circuits, 300 Type Plants

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.

1.08 The individual rectifiers should be adjusted in accordance with the appropriate Bell System Practices.

Section 169-238-301 J86231
Section 169-245-301 J87211
Section 169-255-301 J87223
▶Section 169-260-301 J87232
Section 169-261-301 J87233◀
Section 169-469-301 J87328
Section 169-630-301 J86295
Section 169-630-302 J86295
Section 169-630-303 J86295
Section 169-648-301 J87222
▶Section 169-704-313 KS-19210 L23 and L24◀
Section 169-741-301 KS-20489
Section 169-742-301 KS-20490
▶Section 169-743-301 KS-20491 (Lorain Products Corp)
Section 169-745-301 KS-20493 (Lorain Products Corp)

Section 169-267-301 J87434A
Section 169-267-305 J87435A
Section 169-652-305 J87436A
Section 169-652-306 J87437A
Section 169-652-307 J87438A
Section 169-652-308 J87439A
Section 169-743-302 KS-20491 (North Electric Co)
Section 169-745-302 KS-20493 (North Electric Co)◀

1.09 Routine checks should be made during a period when they will cause the least service reaction.

1.10 When it is necessary to have a test load connected to the power plant, refer to Section 171-123-101.

1.11 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 requirements tables on the circuit drawings.

1.12 ▶The J87260A, B, and G charge bay assemblies are equipped with one to four J87222A, B, C, or D rectifiers or J87436A rectifiers or a combination of these rectifiers. The J87261A, B, and K charge bay assemblies are equipped with one to four J87223A, B, C, or D rectifiers or J87437A, rectifiers or a combination of these rectifiers. The J87260E charge bay assembly is equipped with one to four KS-20491 rectifiers. The J87261G charge bay assembly is equipped with one to four KS-20493 rectifiers. Unless otherwise specified, information pertinent to the individual rectifiers included in this section shall also pertain to the rectifiers which are part of the charge bay assemblies.

1.13 If a J87309E alarm surveillance and control interface panel and wiring option is provided, an alarm is sent to the alarm surveillance and control interface whenever a local alarm is activated.◀

2. LIST OF TOOLS, MATERIALS, AND TEST APPARATUS

CODE OR SPEC NO.	DESCRIPTION
TOOLS	
—	Blocking Tools as required. (Use and apply as covered in Section 069-020-801.)
MATERIALS	
—	Dry Cell, 1-1/2 Volts (as required)
TEST APPARATUS	
2W17A	Cord (W2W Cord Equipped with One 310 Plug and Two 360 Tools)
35-Type	Test Set
KS-16979	Volt-Ohm-Milliammeter
▶KS-20599, L4	Volt-Ohm-Milliammeter◀

Note: Equivalent may be substituted.

3. DESCRIPTION

3.01 The battery for the 24-volt plants consists of 12 cells connected in series to provide a battery discharge voltage of 26 volts. In the 120-ampere 24-volt plant, in accordance with SD-81466-01, countercells are provided as an option to reduce the plant output voltage to 24 volts. In 48-volt plants, the battery consists of 24 cells connected in series. For the 800-ampere 48-volt plant, the battery provides a discharge voltage of 52 volts. The 120-ampere plant, in accordance with SD-81424-01, and the 400-ampere plant are provided with countercells and associated equipment as an option to provide a battery discharge voltage of 50 volts.

3.02 The rectifiers are connected to the ac power supply and regulate automatically to correct the dc output voltage for variations in the input voltage and load current. For 52-volt applications, the 48-volt 600-ampere capacity plant can provide 600 amperes for constant or variable loads. For 50/52-volt applications, only 400 amperes can be provided.

3.03 ***Operation of J87339A Rectifier Sequence Control Unit:*** With the TRA1 through TRA4 switches in the NORM position, the engine control circuit controls the stopping and sequence starting of each group of rectifiers. In the event of an ac power transfer, the rectifiers are stopped and the rectifiers controlled by the

TRA1 switch come back on immediately. The rectifiers controlled by the TRA2 switch come on approximately 1 second later. The rectifiers controlled by the TRA3 switch come on approximately 1 second after the TRA2 switch controlled rectifiers come back on. The rectifiers controlled by the TRA4 switch come on approximately 1 second after the TRA3 switch controlled rectifiers come back on. Operation of any TRA( ) switch to the MAN-STOP position stops all rectifiers within its group and higher numbered groups. The associated MAN GD lamps for the stopped rectifiers are lighted. Restoring the TRA( ) switch to the NORM position will sequence start the associated group and higher numbered groups of rectifiers, with a 1-second delay between the starting of each group. Operation of the TRA( ) switch to the STOP-BY-AUTO-ENG position prevents its group and any higher numbered group from starting when the RO lead is grounded by the engine circuit. By pre-selection, some of the rectifier groups are held off to prevent overloading of small capacity automatic engines. Upon the return of commercial power, all rectifiers are started in sequence. If multiple engines are furnished to provide additional load capacity, additional rectifiers may be started by restoring the TRA( ) switch to the NORM position.

3.04 ***TST-NOR-CHG Key:*** In offices where the maximum allowable voltage for the 120-ampere, 50/52-volt plant, in accordance with SD-81424-01, and the 400-ampere, 50/52-volt plant, in accordance with SD-81501-01, is 50 volts, a TST-NOR-CHG key is provided in the charge and discharge circuit to control the switching of the countercell (CEMF) as follows. The TST-NOR-CHG key is located on the common control equipment.

(a) When the TST-NOR-CHG key is in the NOR position, the CEMF cell is out of the circuit and the discharge voltage will be the same as the battery voltage (52 volts).

(b) When the TST-NOR-CHG key is operated to the TST position, under normal conditions the CEMF cell is in the circuit and the discharge voltage will be equal to the battery less the drop in the CEMF cells or approximately 50 volts. If the discharge voltage decreases to 47.75 volts, the CEMF cell is taken out of the circuit and the discharge voltage increases. When the output voltage rises to 50.75, the CEMF cell is returned to the circuit.

(c) When the TST-NOR-CHG key is operated to the CHG position, the CEMF cell is normally in the circuit and the circuit is arranged so the rectifiers will regulate at the discharge voltage and the battery will be overcharged to a voltage equal to the discharge voltage plus the drop in the CEMF cell.

(d) If connected loads cannot tolerate 52-volt operation, make the TST-NOR-CHG key inoperative to prevent 52-volt operation as follows.

(1) ***120-Ampere Plant—SD-81424-01:*** Remove the lead from terminal 2B (K option) on the TST-NOR-CHG key; insulate the lead; and connect a strap between terminals 2A and 3A (J option). Place a tag on the disconnected lead with the following information: "This lead disconnected and strap connected between terminals 2A and 3A of TST-NOR-CHG key to prevent 52-volt operation of plant."

(2) ***400-Ampere Plant—SD-81501-01:*** Remove the lead from terminal 6 (Q option) on the TST-NOR-CHG key; insulate the lead; and connect a strap between terminals 3 and 4 (N option). Place a tag on the disconnected lead with the following information. "This lead disconnected and strap connected between terminals 3 and 4 of TST NOR-CHG key to prevent 52-volt operation of plant."

Note: If H option is provided in the power plant, Q option may be reconnected and the tag removed.

3.05 In the 120-ampere 24-volt plants, countercells are provided as an option to reduce plant output to 24 volts. The CEMF cells are controlled by a voltmeter relay which also shuts down faulty rectifiers and sends alarms. If the CEMF cells are provided, the discharge voltage will be equal to the battery voltage less the drop in the CEMF cells or approximately 24 volts. When the discharge voltage decreases to 22.5 volts, the CEMF cell is shorted out and the discharge voltage increases to approximately 24.25 volts. When the discharge voltage increases to 25.25 volts, the CEMF cell is inserted in the circuit to reduce the discharge voltage to approximately 23.25 volts. The discharge voltage will return to the normal 24 volts when the battery is restored to float voltage.

3.06 An ammeter is provided for indicating the office load and a voltmeter for indicating the battery voltage. A BAT-DISCH-CO key is provided in the 50/52-volt 120-ampere plant in accordance with SD-81424-01, and in the 24-volt 120-ampere plant in accordance with SD-81466-01 to indicate discharge as well as battery voltage. In 50/52-volt 400- and 600-ampere plants, a BAT-DISCH key and a separate nonlocking CO key are provided. With the BAT-DISCH-CO or BAT-DISCH key operated to BAT, the voltmeter indicates the battery voltage. With the key operated to DISCH, the voltmeter indicates the discharge voltage. If, in the 50/52-volt 120- or 400-ampere plant, or the 24-volt 120-ampere plant, the countercell is automatically switched out of the circuit due to an open circuit in the cell, the BAT-DISCH-CO key must be operated to CO or the CO key depressed to restore the circuit to normal after the trouble has been cleared.

3.07 Similar 111A power plants, up to a total of three plants, may be paralleled. In paralleled plants, the TST-NOR-CHG key, if provided, is operative only in the originating discharge circuit. In the supplementary paralleled plants, a TST-NO-CHG key is not provided. Operation of the TST-NOR-CHG key in the originating discharge circuit synchronizes the switching of the countercells of the paralleled plants into and out of the circuit. The functions of the BAT-DISCH-CO or BAT-DISCH and CO keys in paralleled plants are the same as those described in paragraph 3.06 for nonparallel plants. However, if a countercell is automatically switched out of the circuit due to failure of the cell, the BAT-DISCH-CO key or CO key of the plant with which the faulty countercell is associated must be operated to restore the circuit to normal after the trouble has been cleared.

3.08 Major alarms are provided to indicate high or low discharge voltage, failure of any dc fuse other than those mounted on the rectifiers, and an open countercell. The circuit is returned to normal after the condition which caused a countercell to fail has been corrected. Minor alarms are provided to indicate failure of any RC ▸or RB◂ fuse in the rectifier sensing circuit ▸and rectifier failure.◂

4. OPERATION

Danger 1: Voltages inside the rectifier units may exceed 150 volts to ground and between terminals. 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.

Danger 2: ▸All 111A power plants that are located in community dial offices are not equipped with charge fuses. In power plants so provided, remove the battery power disconnect "B" lead at the "CHG BATT" bus in the control unit to eliminate the potentially hazardous condition before doing any maintenance work on the plant.◂

A. Preparing to Start

4.01 Before putting the plant in service, check the following.

(a) Rectifiers, listed in paragraph 1.08, are ready for plant operation in accordance with the Bell System Practices covering the operating methods for the rectifier.

(b) J86231A; J87222A, B, C, or D; J87211B; and J87223A, B, C, or D rectifier ON-OFF keys are in the OFF position.

(c) J86295 rectifier RECT NOR-OFF switch is in the OFF position.

(d) J87232A, J87233A, and J87328A rectifier (CB1) input circuit breaker is in the OFF position.

(e) KS-20489 and KS-20490 rectifier POWER ON/OFF is in the OFF position.

(f) KS-19210, ▸KS-20491◂ and ▸KS-20493◂ rectifier POWER ON-POWER OFF switch is in the POWER OFF position.

(g) ▸J87436A, J87437A, J87438A, J87439A rectifier POWER ON/OFF switch is in the OFF position and the DC OUTPUT circuit breaker (CB1) is in the ON position.

(h) J87434A and J87435A rectifier (CB1) input circuit breaker is in the OFF position and the (CB2) output circuit breaker is in the ON position.◂

(i) Correct size fuses are in place and spare fuses are available.

(j) On 120-, 400-, and 600-ampere, 50/52-volt plants:

(1) TST-NOR-CHG key on control panel is in NOR position for 52-volt or in TST position for 50-volt operation. In the latter case, the 52-volt operation may be prevented by making the TST-NOR-CHG key inoperative as covered in paragraph 3.04.

(2) BAT-DISCH-CO or BAT-DISCH key on control panel is in BAT position.

4.02 To perform tests or make adjustments, it may be necessary to remove the front covers to gain access to the equipment in the control cabinet. On most of the new equipment, the covers are secured to the cabinet with bayonet-type fastening devices. On some of the older equipment (such as J86470A and B plants equipped with J86231A rectifiers), the covers are secured to the cabinet with fuse-type spring clips which are mounted at each corner on the inside of the cover and which clip to cylindrical supports on the cabinet. To remove the covers using the fuse-type spring clips, grasp the upper edge of the rectangular opening in the cover with both hands and carefully pull the cover away from the cabinet. The covers are heavy and extreme care should be exercised when removing the covers to avoid dropping them. When remounting the covers using fuse-type spring clips, be sure that the spring clips are fastened securely to the supports on the cabinet.

4.03 Before putting the plant in service, adjust the output voltage of each rectifier, where provided, in accordance with (a) through (j) to float the battery at 2.17 volts per cell. Where more than one rectifier is provided, start the adjustment with any one of the rectifiers.

(a) Rotate the output voltage potentiometer on the rectifier, to be adjusted, to its extreme ccw position. For the J86295 rectifier, set the ADJ VOLTS FINE potentiometer at its approximate midrange position.

(b) Operate the ON-OFF key, POWER ON/OFF, CB1 ▶input◀ circuit breaker, or RECT NOR-OFF, POWER ON-POWER OFF switch on the rectifier to be adjusted, to the ON, POWER ON or NOR position. The ON-OFF key, CB1 ▶input◀ circuit breaker, or RECT NOR-OFF switch on all other rectifiers must be in the OFF position.

(c) Connect a test load, equal to approximately 50 percent of the rated current capacity of the rectifier to be adjusted, to the discharge bus bar in the plant. See Section 171-123-101.

(d) With the BAT-DISCH-CO or BAT-DISCH key, if provided, in the BAT position, gradually rotate the VOLT ADJ, ADJ VOLTS, ▶OUT VOLTS ADJ,◀ OUTPUT VOLTS ADJUST, or ADJ VOLTS COARSE potentiometer on the rectifier cw until the plant voltmeter indicates the proper voltage. The plant voltmeter should indicate ▶26.04◀ volts for 24-volt plants or ▶52.08◀ volts for 48-volt plants. If the voltage goes high, rotate the potentiometer ccw to lower the voltage. For the J86295 rectifier, similarly adjust, if necessary, the ADJ VOLTS FINE potentiometer to obtain a finer adjustment of the output voltage.

(e) After adjustment, operate the ON-OFF key, CB1 ▶input◀ circuit breaker, or RECT NOR OFF, or POWER ON-POWER OFF switch on the rectifier to the OFF position.

(f) Adjust the test load, as required, when adjusting each rectifier. After all rectifiers have been adjusted, disconnect the test load.

B. Initial Adjustments

4.04 Put the plant in service by operating the ON-OFF key, CB1 ▶input◀ circuit breaker, or RECT NOR-OFF, or POWER ON-POWER OFF switch on each rectifier to the ON, POWER ON or NOR position. Check whether the plant voltmeter indicates the voltage specified in subparagraph 4.03(d). If necessary, adjust the output of the rectifiers in accordance with (a) or (b) to obtain the proper output voltage. No attempt should be made to make each rectifier share the load equally over the entire rectifier current range.

High Battery Voltage

(a) If the battery voltage is high, locate the rectifier with the highest output current as indicated by the individual rectifier ammeter, and adjust as follows. Rotate ccw the output voltage potentiometer (VOLTS ADJ on J86231A,

KS-19210, or J87211B rectifier; ADJ VOLTS COARSE on J86295 or ADJ VOLTS on J87222A, B, C, D; J87223A, B, C, or D; J87232A; or J87233A rectifier; OUTPUT VOLTS ADJUST on KS-20489, KS-20490, J87417A, and J87418; ▶OUTPUT VOLTS ADJ on J87434A, J87435A, J87436A, J87437A, and J87438A rectifiers)◀ until the rectifier ammeter indicates a slight decrease in battery charging current. For the J86295 rectifier, similarly adjust, if necessary, the ADJ VOLTS FINE potentiometer to obtain a slighter decrease in battery charging current. Recheck the voltage indication on the plant voltmeter. Repeat this procedure, if necessary, on the other rectifiers until the plant voltmeter indicates the proper battery voltage.

Low Battery Voltage

(b) If the battery voltage is low, locate the rectifier with the lowest output current as indicated by the individual rectifier ammeter, and adjust as follows. Rotate cw the output voltage potentiometer (VOLT ADJ on J86231A, J87211B, KS-19210, or J87328A rectifier; ADJ VOLTS COARSE on J86295 rectifier; or ADJ VOLTS on J87222A, B, C, or D; J87223A, B, C, or D; J87232A; or J87233A rectifier; OUTPUT VOLTS ADJUST on the KS-20489, KS-20490, J87417A, and J87418A; ▶or OUTPUT VOLTS ADJ on the J87434A, J87435A, J87436A, J87437A, and J87438A◀ rectifiers) until the rectifier ammeter indicates a slight increase in battery charging current. For the J86295 rectifier, similarly adjust, if necessary, the ADJ VOLTS FINE potentiometer to obtain a slighter increase in battery charging current. Recheck the voltage indication on the plant voltmeter. Repeat this procedure, if necessary, on the other rectifiers until the plant voltmeter indicates the proper output voltage.

C. Operation of Plant

Note: ▶Plants wired per SD-81612-01, ZA option and SD-81613-01, ZF option, rectifiers 1 through 6 have individual RC fuses.◀ Rectifiers 7 and 8 share the RC7 fuse. If work is to be performed on either rectifier 7 or 8, both should be removed from service to prevent service reaction.

Warning: At the battery distribution circuit breaker board, observe the following ▶admonishment◀ on the red 15-ampere circuit breakers assigned to supply TWT power (SD-81612-01, FS-13): "Trip off breakers at T/R Bay TWT power supply before tripping red breaker". Switching off the red 15-ampere circuit breaker before the circuit breaker on the converter in the TWT power supply is switched off can cause damage to the traveling wave tube.

4.05 ***Stopping and Starting the J86231A Rectifier:*** Operate the ON-OFF key on the rectifier to be removed from service to OFF. If the rectifier is to be left out of service, first remove the ac fuse in the power service cabinet. Remove the CHG alarm fuse, CHG fuse, F1 fuse, and F2 fuse from the rectifier in that order. Remove the RC regulating fuse associated with the rectifier from the plant control panel. To restore the rectifier to service, remount the fuses in reverse order of removal. Then, operate the ON-OFF key to ON.

4.06 ***Stopping and Starting the J86295 Rectifier:*** Operate the REC OFF-NOR switch on the rectifier to be removed from service to OFF. If the rectifier is to be left out of service, first remove the ac fuse in the power service cabinet. Remove the BCF-A fuse (F11), the CHG alarm fuse (F9), and CHG fuse (F8) from the rectifier in that order. Remove the RB regulating fuse associated with the rectifier (see note preceding paragraph 4.05) from the plant control panel. To restore the rectifier to service, remount the fuses in reverse order of removal. Then, operate the RECT OFF-NOR switch to NOR.

4.07 ***Stopping and Starting the J87222 or J86223 Rectifier:*** Operate the ON-OFF key on the rectifier to be removed from service to OFF. If the rectifier is to be left out of service, first remove the ac fuse in the power service cabinet. Remove the CHG alarm fuse, CHG fuse (F1), F2 fuse, and F3 fuse from the rectifier in that order. Then, remove the RC regulating fuse associated with the rectifier from the plant control panel. To restore the rectifier to service, remount the fuses in reverse order of removal. Then, operate the ON-OFF key to ON.

4.08 ***Stopping and Starting the J87211B Rectifier:*** Operate the ON-OFF key on

the rectifier to be removed from service to OFF. Operate the DC circuit breaker to the OFF position. If the rectifier is to be left out of service, remove the ac line fuse from the power service cabinet and the F1 fuse in the rectifier, if provided. To restore the rectifier to service, replace the ac line fuse and F1 fuse, if provided, and operate the ON-OFF key and the DC circuit breaker to ON.

4.09 ***Stopping and Starting the J87232A or J87233A Rectifier:*** Operate the circuit breaker on the rectifier to be removed from service to OFF. If the rectifier is to be left out of service, remove the RC regulating fuse associated with the rectifier from the plant control panel. To restore the rectifier to service, remount the fuse and operate the circuit breaker to ON.

4.10 ***Stopping and Starting the J87434A and J87435A Rectifiers:*** To stop the rectifiers, operate the input circuit breaker (CB1) to OFF. If the rectifier is to be out of service for an extended period of time, operate the output circuit breaker (CB2) to the OFF position, remove the ac service fuses, remove rectifier fuses F1 and F2, and remove the RC regulating fuse on the plant control panel. To restore the rectifier to service, remount the fuses in the reverse order of removal.

To start the rectifiers, proceed as follows.

(1) Observe all prestart instructions in the rectifier Operating Methods sections.

(2) Operate the POWER ON-OFF switch (option W) or input circuit breaker (CB1) (option X) to the ON position.

(3) After 30 seconds operate the output circuit breaker (CB2) to the ON position to connect the rectifier to the load.

(4) If the voltage output of the rectifier is not equal to the battery float requirements, rotate the OUTPUT VOLTS ADJ potentiometer as required to acquire the normal operating voltage.

Note: The rectifiers have a walk-in feature that causes the output dc voltage to increase gradually. Wait at least 30 seconds after turn-on, before measuring and adjusting the output voltage.

4.11 ***Stopping and Starting the J87328A Rectifier:*** Operate the CB1 circuit breaker on the rectifier to be removed from service to OFF. If the rectifier is to be left out of service for an extended period of time, remove the ac service fuse and dc output fuse. To restore the rectifier to service, remount the ac service fuse and dc output fuse and operate the CB1 circuit breaker to ON.

4.12 ***Stopping and Starting the KS-19210 Rectifier:*** To stop the rectifier, proceed as follows.

(1) Slowly rotate the VOLT ADJ potentiometer fully ccw.

(2) Operate the POWER ON-POWER OFF switch to the OFF or POWER OFF position.

(3) If the rectifier is to be left out of service for a long period of time, set the DC OUTPUT switch to the OFF position and operate the CB1 circuit breaker to the OFF position.

To start the rectifier for normal operation, proceed as follows.

(1) Perform the capacitor charging procedure as outlined in the rectifiers Bell System Practices, placing the DC OUTPUT switch in the BAT position.

Note: The rectifier output voltage, set when the rectifier is not connected to the plant, may increase as much as a volt when the rectifier is connected to the plant, due to the plant sense control circuit. If there is reason to believe that the rectifier float voltage may be set high enough to cause shutdown or lockout when the rectifier is started, the VOLT ADJ potentiometer should be adjusted ccw substantially (even to stop if desired) before starting. After the rectifier is started, the float voltage should be adjusted upward to the proper value as specified in paragraph 4.03.

(2) Verify that the CB1 circuit breaker is in the ON position.

(3) Operate the POWER ON-POWER OFF switch to the POWER ON position.

(4) Slowly adjust the VOLT ADJ potentiometer until the plant voltmeter indicates the value specified in paragraph 4.03.

Note 1: The voltage reading at the rectifier is not always the same as the voltage reading at the power plant meter. Any difference will be due to line drop or meter error, or it may be due to another rectifier determining the voltage on the plant meter. When the rectifier is connected to the plant, the plant voltmeter reading is considered to be correct, not the rectifier voltmeter reading.

4.13 ***Stopping and Starting the KS-20489 and KS-20490 Rectifiers:*** To stop the rectifier for normal operation, proceed as follows:

(1) Reference the capacitor discharging procedures and cautions as outlined in the rectifiers Bell System Practices Operating Procedures.

(2) Operate the POWER ON/OFF switch on the rectifier to be removed from service to OFF. Operate the DC OUTPUT switch to OFF. If the rectifier is to be left out of service, remove the ac input fuses.

To start the rectifier, proceed as follows.

(1) Replace ac input fuses.

(2) Reference the capacitor charging procedures and cautions as outlined in the rectifiers Bell System Practices Operating Procedures.

(3) Operate the DC output switch to BAT.

(4) Operate the POWER ON/OFF switch to ON.

4.14 ***Stopping and Starting the J87417A and J87418A Rectifiers:*** Operate the POWER ON-POWER OFF switch to OFF. If the rectifier is to be left out of service for an extended period of time, remove the ac service fuses and external charge and charge alarm fuses and disconnect the plant control cable. To start the rectifier, reference the capacitor charging and discharging procedures and cautions as outlined in the rectifiers Bell System Practices Operating Procedures. Replace the fuses and plant control cable and operate the POWER ON-POWER OFF switch to ON.

4.15 ***Stopping and Starting the J87436A and J87437A Rectifiers:*** To stop the rectifiers, operate the POWER ON-OFF switch (S2) to OFF. If the rectifier is to be out of service for an extended period of time, operate the DC OUTPUT circuit breaker (CB1) to the OFF position, remove the ac service fuses, remove the RC regulating fuse on the plant control panel, disconnect the J1 connector from circuit pack CPS SP1. To restore the rectifier to service, remount fuses and connect the J1 connector in the reverse order.

To start the rectifiers, proceed as follows.

(1) Observe all prestart instructions in the rectifier Operating Methods sections.

(2) Operate the POWER ON-OFF switch to ON.

(3) After 30 seconds operate the DC OUTPUT circuit breaker to the ON position.

(4) If the voltage output of the rectifier is not equal to the battery float requirements, rotate the OUTPUT VOLTS ADJ potentiometer as required to obtain the normal operating voltage.

Note: These rectifiers have a walk-in feature that causes the output dc voltage to increase gradually. Wait at least 30 seconds after turn-on before measuring and adjusting the output voltage.

4.16 ***Equalizing or Boost Charge in 50/52-Volt, 120- and 400-Ampere Plants Only:*** The action to be taken for equalizing or boost charge is as follows.

Caution: If the 111A power plant is used with Electronic Switching Systems (ESS) (No. 1, No. 1A No. 2, TSPS, AIS, 4A ETS, etc), a boost charge to 2.20 volts per cell should not be scheduled. The voltage design of the components in the ESS Central Processor (CC, CS, and PS) will not tolerate the boost charge voltage of 2.20 volts per cell. If the battery is used to supply power during a power failure, they will recover full charge by using the normal float voltage of 2.17 volts per cell.

(a) ***Plants in Offices Where the Maximum Allowable Voltage Is 50 Volts:*** In these plants an equalizing or boost charge should not be given by means of the TST-NOR-CHG key except in the 400-ampere plant (SD-81501-01) that is equipped with H option. When any of the cells in the 120-ampere plant and the 400-ampere plant not equipped with H option fail to meet the voltage requirements covered in Section 157-601-701, the cell or cells should be given a boost charge on an individual cell basis. Boost charges are not required on a routine basis. If individual cells require a boost charge, refer to Section 157-601-701.

(b) ***Plants in All Other Offices Where 52-Volt Operation Is Permitted:*** Operate the TST-NOR-CHG key to CHG. After charging is completed, operate the TST-NOR-CHG key to NOR for 52-volt operation or to TST for 50-volt operation.

(c) ***Power Failure Procedure:*** If the countercell is in the circuit, the countercell will automatically switch out of the circuit and, upon restoration of power, automatically switch into the circuit when the battery reaches float voltage. In the 50-volt 400-ampere plant and in 52-volt plants, the TST-NOR-CHG key may be operated to CHG to restore battery voltage more quickly after a power failure.

Note: The restarting of the power plant should be automatic upon restoration of commercial ac power. If the J87339A rectifier sequence control unit is provided in the power plant, the restarting of the plant is also dependent upon the settings of the control unit switches. However, if the battery has been subjected to a deep discharge, it may be necessary to manually operate the ac power input relay or contactor to restart the rectifiers.

4.17 ***If, during an extended interval with emergency ac power, the emergency reserve engine does not have the capacity to operate sufficient charging units to maintain the battery at float voltage,*** the battery reserve may become insufficient for starting the plant after a deep discharge to below emergency volt limits. If this is the case, the following procedure should be employed.

(1) After it has been confirmed that the central office equipment is inoperative due to a low battery reserve, ***notify the supervisor and at his direction remove the discharge fuses.*** The removal of the office load generally allows the battery voltage to recover enough to start at least one charging unit.

(2) Using a portable voltmeter, check all of the batteries for a reversal of polarity in accordance with Sections 157-601-301 and 157-601-701. (See note.)

(3) Replace discharge fuses when the plant appears to function normally and all charging units are available.

Note: If one or more cells in a series becomes fully discharged while the remainder of the cells are still discharging, there will be a reversal, that is, a change of polarity on the discharged cells with adverse effects on the plates.◀

5. ROUTINE CHECKS

5.01 All routine checks in Part 5 are to be performed on the 24/26-volt plants and the 50/52-volt plants unless one of the plants is specifically referred to in the checks.

5.02 ***Battery Maintenance:*** Maintain the battery in accordance with Section 157-601-701.

5.03 ***50/52-Volt, 120- and 400-Ampere Plants Only:*** The operation of the C1 contactor should be checked as follows. With the TST-NOR-CHG key in the TST position and with the ON-OFF key, CB1 circuit breaker, or NOR-OFF switch on each rectifier operated to the position shown in the following table, read the voltages on the plant voltmeter with the BAT-DISCH-CO or BAT-DISCH key first operated to BAT and then to DISCH. In making this check, do not move the TST-NOR-CHG key from the TST position if the key has not been made inoperative [refer to subparagraph 3.04(d)]. Listen for the sound of the contactor operating or releasing, and allow time for the battery to stabilize before reading voltages.

TST-NOR-CHG KEY POSITION	RECTIFIER ON-OFF KEY, CB1 CIRCUIT BREAKER, OR NOR-OFF SWITCH	C1 CONTACTOR POSITION	VOLTMETER READING	
			BAT*	DISCH*
TST	ON or NOR	Released	52.08	50.00**
TST	OFF	Operated	50.00	50.00
TST	ON or NOR	Released	52.08	50.00**

* Position of BAT-DISCH-CO or BAT-DISCH key.

** Denotes approximate voltage.

5.04 ***Fuse Alarm—70-Type Fuse:*** Check the fuse alarm in accordance with Section 201-604-501.

Note: ▶For those plants that are provided with the alarm surveillance and control interface option, notify the alarm surveillance and control interface central monitor prior to beginning and upon completion of any alarm check. This will assure that the circuit is functioning properly and that the alarms will be retired at the central monitor upon completion of the checks.◀

5.05 ***Rectifier Failure Alarm:*** Block operated the RFA relay in the plant. This should cause the RFA lamp to light and the minor alarm to sound. Remove the block.

5.06 ***High- and Low-Voltage Alarms***

(a) Position the keys and switch of the 35-type test set as follows.

KEY	POSITION
BAT & GRD CO	▶Normal◀
REV	Normal
VM	Normal
SWITCH	
G	Open

Note: For information on the use and operation of the 35-type test set, refer to Sections 100-101-101 and 100-101-301.

Using a 2W17A cord, connect dry cells to the test BAT & GRD jack of the test set as required (estimate 1-1/2 volts per cell) to operate the voltmeter relay to its high contact (see the appropriate plant circuit requirement table), connecting the positive terminal of the dry cells to the tip lead of the cord and the negative terminal to the ring lead of the cord. ▶When testing positive power plants, operate the REV switch on the 35-type test set to the reverse position.◀ The locking levers of No. 1 through 4 keys should be open and all resistance sliders should be in their extreme right positions. Close the locking lever of the No. 1 key and move the No. 1 resistor sliders to their extreme left position. Under these conditions, the test set has its least resistance and the dry cells are out of the circuit.

(b) Block nonoperated the RF relay with each J86231A and J87211B rectifier if provided. Block nonoperated the RFA relay with each J86295, J87232A, and J87233A rectifier if provided. Block nonoperated the RFA-1 relay in each J87222 and J87223 rectifier, if provided, or disconnect the CMD or RFA and HV leads from each rectifier. In the 800-ampere 24-volt plant, in accordance with SD-81612-01, block nonoperate relays H and L. This will put voltmeter relay HV in operated position, which will in turn operate K2 relay of the KS-19210 rectifier.

(c) Using a 2W17A cord, connect the T & R jack of the test set to the voltmeter relay (HL relay in 40-ampere and 120-ampere plants or HV relay in 400-, 600-, or 800-ampere plants) as follows. ▶In negative and positive plants, connect the ring lead of the cord to the positive (+) terminal of the voltmeter relay◀ and the tip lead to the negative (-) terminal of the voltmeter relay. The negative terminal of the voltmeter relay is designated (-) for the 120-ampere plant in accordance with SD-81466-01 and for the 800-ampere 24-volt plant; HR ▶or LR◀ for the 120-ampere plants in accordance with SD-81424-01; HR for the 400-, 600-, and 800-ampere 48-volt plants and the 40-ampere plants in accordance with SD-81769-01.

(d) Using the 150-volt dc scale, connect the KS-16979 volt-ohm-milliammeter across the positive and negative terminal of the voltmeter relay.

(e) ▶Connect an additional KS-16979 volt-ohm-milliammeter across the coil of the L relay.◀

(f) Remove VR fuse from the plant control panel.

(g) ***Low-Voltage Test:*** Gradually move the No. 1 sliders of the test set to the right, thus introducing resistance and lowering the voltage across the voltmeter relay. Note that at the point where the HLV alarm should come in (see plant circuit requirement table), the ◗volt-ohm-milliameter connected in (e) indicates a voltage.◖

Note: The low contact setting of the HV relay may be raised or lowered to meet local voltage alarm requirements. If the new setting is more than ±3 percent of the value shown in the circuit requirement table, erratic action of the meter may be incurred.

(h) ◗Disconnect the KS-16979 meter from across the coil of the L relay and reconnect it across the coil of the H relay.◖

(i) ***High-Voltage Test:*** Move the No. 1 sliders to their extreme right positions. From the reading of the volt-ohm-milliammeter across the voltmeter relay, determine whether the voltage has been reduced sufficiently to permit the introduction of dry cells without causing the high contact to make (see plant circuit requirement table). Restore the BAT & GRD CO key to normal, and raise the voltage gradually by moving the No. 1 sliders toward the left to remove resistance from the circuit. Note that at the point where the HLV alarm should come in (see plant circuit requirement table), the ◗volt-ohm-milliammeter connected in (h) indicates a voltage.◖

Note: ◗The high voltage trip level is set to protect the central office from high voltage but is ***not*** set sufficiently low to prevent the application of a slightly higher boost charge voltage that may cause damage to No. 1 ESS central processor components.◖

(j) When the high- and low-voltage alarm tests have been completed, move the BAT & GRD CO key of the test set to the operated position. If not connected, connect the CMD or RFA and HV leads to the rectifiers from which they were disconnected. Remount the VR fuse. Remove the test equipment. Remove the blocking tools from the RF, RFA, H, L, and RFA-1 relays.

5.07 ***Countercell Failure Alarm:*** In the 120-ampere 48-volt plant provided with countercells, block operated the No. 8 contact of the CO relay. In the 120-ampere 24-volt plant, provided with countercells, block operated the No. 10 contact of the CO relay. In 400-ampere plants, block operated the No. 8 contact of the CO1 relay. This should cause the CEMF lamp to light. Remove the block.

Warning: Take care to block operated only the No. 8 or No. 10 contact of the CO or CO1 relay to avoid shorting of the countercells and prevent possible damage to the connected equipment.

5.08 The operation of the countercell control circuit should be checked when the battery goes to the upper or lower limits to verify that the countercell control circuit is functioning properly.

(a) ***50/52-Volt, 120- and 400-Ampere Plants:*** To check the operation of the countercell control circuit in these plants, proceed as follows.

(1) Operate all rectifier input switches to the OFF position.

Note: As the battery voltage decreases, the discharge voltage will also decrease. When the discharge voltage drops to 47.75 volts, the low-voltage alarm is activated and after a time delay the control should operate and remove the countercell from the circuit.

(2) Operate all rectifier input switches to the ON position.

(3) Operate the TST-NOR-CHG key on the plant to the CHG position.

Note: As the battery voltage increases, the discharge voltage will also increase. When the discharge voltage increases to 50.75 volts, the low-voltage alarm is retired and after a time delay the control should operate and replace the removed countercell.

(4) Operate the TST-NOR-CHG key on the plant to the NOR position.

(b) ***24-Volt, 120-Ampere Plant:*** To check the operation of the countercell control circuit in this plant, proceed as follows.

(1) Operate all rectifier input switches to the OFF position.

Note: As the battery voltage decreases, the discharge voltage will also decrease. When the discharge voltage drops to 22.25 volts, the low-voltage alarm is activated and after a time delay the control should operate and remove the countercell from the circuit.

(2) Operate all rectifier input switches to the ON position.

(3) Operate the TST-NOR-CHG key on the plant to the CHG position.

Note: As the battery voltage increases, the discharge voltage will also increase. When the discharge voltage increases to 25.25 volts, the low-voltage alarm is retired and after a time delay the control should operate and replace the removed countercell.

(4) Operate the TST-NOR-CHG key on the plant to the NOR position.

5.09 *Rectifier Current-Limiting Circuit*

(a) Check that the current-limiting circuit in each rectifier limits the output current as follows:

RECTIFIER	CURRENT OUTPUT LIMIT AMPERES
J86231A	32
J87211B	11
J86295	200
J87222	100
J87223	100
J87232A	30
J87233A	30
♦J87434A	35
J87435A	35♦
J87328	15
KS-19210	400
KS-20489	400
KS-20490	400
♦KS-20491	100
KS-20493	100
J87436A	100
J87437A	100
J87438A	200
J87439A	200♦

To check, proceed as covered in (b) and (c).

(b) Apply a load to the rectifier that is slightly greater than the current output limit specified in (a). This may be done by turning off some or all of the operating rectifiers in the plant. If the office load is insufficient, connect a test load to the plant or turn off all of the rectifiers and allow the battery to discharge until the required load is available. If a test load is used, adjust the test load as required. See Section 171-123-101.

(c) Turn on the rectifier to be checked. Observe whether the current output indication on the rectifier ammeter is in agreement with the current output limit specified in (a). If the current output indication is not in agreement with the specified limit, adjust the current-limiting circuit in accordance with (d).

(d) To adjust the current-limiting circuit, apply a load to the rectifier in accordance with (b). Turn on the rectifier and proceed as follows.

(1) ***J86231A Rectifier:*** Rotate the CC potentiometer cw to lower the current output limit indicated on the rectifier ammeter or ccw to raise the limit to 32 amperes.

(2) ***J86295 Rectifier:*** Rotate the CON CUR H potentiometer ccw to lower the

current output limit indicated on the rectifier ammeter or cw to raise the limit to 200 amperes.

(3) ***J87222, J87232A, or J87233A Rectifier:*** Rotate the CC potentiometer ccw to lower the current output limit indicated on the rectifier ammeter or cw to raise the limit to the current output limit specified in (a).

(4) ***J87211B Rectifier:*** The rectifier is provided with a DC circuit breaker to protect the rectifier in case of overload. The circuit breaker must be reset if operated.

(5) ***KS-19210 Rectifier:*** Adjust the HI CUR LIM potentiometer cw to raise the limit or ccw to lower the limit to meet the requirement in (a).

(6) ***J87223 Rectifier:*** Rotate the CL potentiometer ccw to lower the current output limit indicated on the rectifier ammeter or cw to raise the limit to the current output limit specified in (a).

(7) ***KS-20489 Rectifier:*** The CURRENT LIMIT (FULL LOAD) (R23) potentiometer is factory adjusted to limit the output current at 400 amperes and normally does not require field adjustment. However, if adjustment is required, rotate the CURRENT LIMIT (FULL LOAD) (R23) potentiometer ccw to decrease and cw to increase amperage.

(8) ***KS-20490 Rectifier:*** The FULL LOAD CURRENT LIMIT (R8) rheostat is factory adjusted to limit the output current to 400 amperes and does not generally require field adjustment. However, if adjustment is required, rotate the FULL LOAD CURRENT LIMIT (R8) rheostat ccw to decrease and cw to increase amperage.

(9) ***KS-20491 and KS-20493 Rectifiers:*** The CURRENT LIMIT ADJUST (R10) rheostat is factory set at 100 amperes. If adjustment is required, rotate the CURRENT LIMIT ADJUST (R10) rheostat ccw to decrease and cw to increase amperage.

(10) ***J87434A and J87435A Rectifiers:*** The current limiting potentiometer (R25), located on circuit pack CPS SP4, is factory set to limit the output current at 35 amperes. This setting has been made semipermanent and should not be adjusted.

(11) ***J87436A and J87437A Rectifiers:*** The current limiting potentiometer (R46) is factory set to limit current at 100 amperes. This setting has been made semipermanent and should not be adjusted.

(12) ***J87438A and J87439A Rectifiers:*** The current limiting potentiometer (R46) is factory set to limit current at 200 amperes. This setting has been made semipermanent and should not be adjusted.

5.10 ***Panel Voltmeter Accuracy Check:***

(1) Connect the Weston model 931 voltmeter across the terminals of the panel voltmeter, using the 75-volt scale.

(2) Manually adjust the first rectifier output until the battery voltage is maintained at 2.17 volts per cell (26 or 52 volts).

Note: If necessary, manually adjust additional rectifiers until float voltage is acquired.

(3) If the panel voltmeter reading is not within ±2 percent of its deflection as compared to the Weston model 931 voltmeter, adjust the panel voltmeter by turning the adjusting screw. Place a mask bearing the date and the legend ***Zero correct at (26 or 52) volts*** over the adjusting screw.

(4) Disconnect the Weston model 931 voltmeter.

6. TROUBLES

6.01 The troubles listed in paragraph 6.04 are only those in connection with the charge and discharge circuit. Troubles in the rectifier units are covered in sections on operating methods for the rectifiers.

Note: When rectifiers have been shut down, reference applicable Bell System Practice Operating Methods for the rectifier for instructions to restart.

6.02 ***50/52-Volt Plants:*** When working on normally short-circuited countercells, precautions should be taken to prevent automatic operation of the relay which removes the short on the countercell. On 50-volt plants, readjust the output of the rectifiers for a battery voltage reading of 50 volts on the plant voltmeter, following procedures similar to those convered in subparagraphs 4.04(a) and (b). Then operate the TST-NOR-CHG key to NOR. If the TST-NOR-CHG key has been made inoperative, block operated the C relay for the 120-ampere plant or C1A relay for the 400-ampere plant. On 52-volt plants, leave the TST-NOR-CHG key operated to NOR. After work is completed in 50-volt plants, operate the TST-NOR-CHG key to TST and readjust the output of the rectifiers for a battery voltage indication of 52 volts on the plant voltmeter as covered in subparagraphs 4.04(a) and (b). If relays were blocked, remove the block.

6.03 The following table shows the possible cause of a lighted alarm lamp and the action to be taken.

LAMP	POSSIBLE CAUSE	ACTION
FA	Operated circuit fuse	Check the leads from the operated fuse to the connected equipment for faulty insulation. Check for trouble in the connected equipment (see note).
RFA	Failure of rectifier	Check RFA, RECT FAIL, or ALM lamp on each rectifier or charge bay assembly. A lighted lamp indicates trouble in the rectifier or charge bay assembly. Check rectifiers in accordance with their respective Bell System Practices or circuit descriptions (CD). See note under paragraph 6.01. Check for accidental ground to faulty insulation on RFA or CMD leads.
HLV	High or low discharge voltage	Check for operated RB, RC, or VR fuses. Check rectifiers in accordance with their respective Bell System Practices or circuit descriptions (see note).
CEMF	Open countercell (automatically taken out of circuit)	Check countercell before operating BAT-DISCH-CO key to CO or pressing separate CO key to put countercell back in circuit.
◗RFA/ REG FUSE	Operated REG Fuse	Check for operated REG fuse. Replace as necessary.◖

Note: Correct cause of operated fuse before replacing it. Where alarm fuses are in parallel with supply fuses, replace the operated supply fuse first and then the alarm fuse.

6.04 ***Trouble Chart:*** The troubles and possible causes listed are not necessarily all-inclusive but are merely indicative of some of the difficulties that may be encountered when the various 111A power plants are not operating normally. If the trouble is not found with the assistance of the trouble chart and paragraph 6.03, reference must be made to sections covering the rectifier, the schematic diagrams, and circuit descriptions (see paragraph 1.07).

	TROUBLE	POSSIBLE CAUSE
(a)	No rectifier battery charging or low battery float voltage	Rectifier turned off (see note under paragraph 6.01).
		Failure of AC supply (no voltage) or AC supply fuse operated.
		Operated REG, RC, or RB fuse. Output voltage potentiometers out of adjustment; adjust in accordance with subparagraphs 4.04 (a) and (b).
		Equipment failure in rectifier; check rectifiers in accordance with their respective Bell System Practices or circuit descriptions (CD).
(b)	High battery float voltage	Operated REG fuse of J86295 and J86231A rectifiers; check rectifiers in accordance with their respective Bell System Practices. Output voltage potentiometers out of adjustment; adjust in accordance with subparagraphs 4.04 (a) and (b).
(c)	High or low discharge voltage in 50/52-volt plant	Failure of countercell or associated control equipment.