

## 105E (J86814) POWER PLANT OPERATING METHODS

### 1. GENERAL

**1.01** This section describes the operation of the 105E power plant. This plant is intended for general purpose application including PBX.

**1.02** This section is reissued to correct the setting and adjusting procedure of the VR relay. This reissue does not affect the Equipment Test List.

**1.03** Instructions are based on the following drawings. For detailed description of the operation of the individual circuits, refer to the corresponding circuit description.

SD-81540-01      Rectifier Circuit—11 Amperes, 48 Volts

SD-81567-01      Rectifier Circuit—11 Amperes, 24 Volts

SD-81541-01      Regulator Circuit

SD-81591-01      Charge and Discharge Circuit—48 Volts, 30 Amperes

SD-81603-01      Charge and Discharge Circuit—24 Volts, 30 Amperes

**1.04** Routine checks should be made during a period when they will cause the least amount of service reaction.

**1.05** 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.

**1.06** Unless otherwise specified, all voltage and circuit readings called for in this section may be taken with the KS-8039 volt-milliammeter.

*Caution: Voltages inside the rectifier unit exceed 150 volts to ground and between terminals. Observe the cautions in sections covering operating methods for the rectifiers.*

**1.07** The abbreviations cw and ccw refer to clockwise and counterclockwise, respectively.

### 2. LIST OF TOOLS AND TEST APPARATUS

CODE OR SPEC NO.	DESCRIPTION
<b>TOOLS</b>	
411B	Test Pick
W1AF	Cord (8-1/2 feet long equipped with one 360A tool at each end)
KS-6278	Connecting Clip
—	3-Inch C Screwdriver
—	Blocking Tools as Required. Use and Apply as Covered in Section 069-020-801.
<b>TEST APPARATUS</b>	
KS-8039	DC Volt-Milliammeter
KS-14510	Volt-Ohm-Milliammeter
—	35-Type Test Set

### 3. OPERATION

#### Description

**3.01** The 24-volt 105E power plant with negative or positive battery uses the 24-volt, 11-ampere J87211B rectifiers to float the load and charge the batteries. The 48-volt 105E power plant with negative or positive battery uses the 48-volt, 11-ampere J87211A rectifier to float the load and charge the batteries. In addition to the rectifiers, these plants include control and distribution equipment and batteries mounted in cabinets or on standard relay racks. The power plants are designed to

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operate on 105- to 125- or 200- to 250-volt, 60-Hz single-phase ac power.

**3.02** The battery equipment of the 105E 24-volt plant consists of 12 cells connected in series providing a normal output voltage of 26 volts. The battery equipment of the 105E 48-volt plant consists of 24 cells connected in series providing 52-volt normal discharge voltage. An optional CEMF circuit may be provided which is automatically switched out when the discharge voltage decreases to  $\phi 22.25\phi$  volts for 24-volt plant or  $\phi 46.50\phi$  volts for 48-volt plant and switched in as the voltage increases toward normal float voltage.

**Caution:** *During plant operation the VR relay is normally operated and it is released only on low voltage or open CEMF cells. Do not manually operate the relay under these conditions inasmuch as this will cause the "S" contact of the relay to release, thereby removing a short across the open CEMF cells resulting in zero output voltage.*

**3.03** The basic plant is equipped with an alarm lead to indicate blown discharge fuses. An optional voltage alarm may be obtained which will indicate major alarms for blown fuses and a minor alarm for low voltage caused by power failure, rectifier failure, or overload.

**3.04** The rectifiers are equipped with an ac switch, dc output circuit breaker, and an ammeter for reading the output current of the rectifier. REG VOLTS J1 and J2 jacks are also provided for measuring the charge voltage.

**3.05** The rectifiers are continuously connected to the ac power supply. Automatic regulation is performed using self-contained transistorized circuits in the rectifier. Both 24- and 48-volt, 30-ampere plants are so designed that there is no functional reason to limit their ultimate capacity, but economics will probably dictate the use of the 111A power plant for loads exceeding 30 amperes. The power plant may have a feature which will be suitable for intermittent loads of high discharge, over 30 amperes, and long recharge. This feature will be used on systems which have peak load periods of short duration and also where the system requires dc reserve during power failure conditions when the system normally operates from ac power.

### Preparing to Start

**3.06** Before putting the plant in service, check the following.

- (a) The rectifiers are ready for plant operation in accordance with the sections covering the operating methods for the rectifiers (Section 169-245-301).
- (b) Rectifiers, AC switch, and CB1 circuit breaker are in the OFF position.
- (c) Correct size fuses are in place and spare fuses are available.

### Adjustments

**3.07** To adjust the alarm circuit, proceed as follows.

**Note:** This adjustment is to be made before installing the VR fuse with the rectifier floating the battery at 26.04 volts for the 24-volt plant, or 52.1 volts for the 48-volt plant.

- (1) Block VR relay released.
- (2) Connect the KS-8039 volt-milliammeter across the discharge bus and ground.
- (3) Connect strap or clip lead across R8 and R4 resistors for the 24-volt plant, or across R8 for the 48-volt plant.
- (4) Rotate R6 rheostat fully cw.
- (5) Rotate R7 rheostat fully ccw.
- (6) Insert VR fuse and remove block from VR relay. If the relay does not stay released, adjust it to meet nonoperate requirements as specified in the circuit requirement table.
- (7) Adjust the rectifier output to read 25.50 volts for the 24-volt plant, or 51 volts for the 48-volt plant.
- (8) Slowly rotate R6 ccw until the VR relay operates. If rotating R6 fully ccw does not operate VR relay, check relay adjustment as specified in the circuit requirement table.

- (9) If VR relay remains operated, proceed to (12).
- (10) If VR relay releases or chatters, strap out R3 resistor.
- (11) If chatter continues, strap out R1.
- (12) Adjust the rectifier output to read 24.50 volts (or 22.25 volts with CEMF cells) for the 24-volt plant, or 47.50 (or 46.25 volts with CEMF cells) for the 48-volt plant.
- (13) If VR relay releases above the voltages listed in the preceding step, follow with (10) and (11).

**Note:** A dummy load will hasten voltage decrease.

- (14) Slowly rotate R7 cw until the VR relay releases. If the VR relay releases, continue with (16), otherwise go to (15).
- (15) If rotating R7 fully cw does not release the VR relay, move the following straps to increase resistance.
  - (a) Remove strap from R8 and strap R1, R3, and R4 for the 24-volt plant, or remove strap from R8 and strap R1 and R3 for the 48-volt plant. Rotate R7 fully ccw and manually operate the VR relay. If the VR relay does not release when (14) is repeated, continue with (b), otherwise go to (16).
  - (b) Remove strap from R1. Rotate R7 fully ccw and manually operate the VR relay. If the VR relay does not release when (14) is repeated, continue with (c), otherwise go to (16).
  - (c) Remove strap from R3. Rotate R7 fully ccw and manually operate the VR relay. Slowly rotate R7 cw until the VR relay releases. In the case of the 48-volt plant continue with (16). In the case of the 24-volt plant, if the VR relay does not release when (14) is repeated, go to (d), otherwise continue with (16).
  - (d) Remove strap from R4 (24-volt plant only). Rotate R7 fully ccw and manually operate the VR relay. Slowly rotate R7 cw until the VR relay releases.

(16) Slowly increase the rectifier output and verify that the VR relay operates at 25.25 to 25.50 volts for the 24-volt plant, or 50.75 to 51.00 volts for the 48-volt plant. Minor changes of operate value may be made by rotating R6 ccw to operate at a lower voltage.

(17) Slowly reduce the rectifier output and verify that the VR relay releases at 24.50 to 24.25 (or 22.50 to 22.25 volts with CEMF cells) for the 24-volt plant. For the 48-volt plant, reduce the rectifier output and verify that the VR relay releases at 47.75 to 47.50 (or 46.50 to 46.25 volts with CEMF cells). Minor changes of operate value may be made by rotating R7 ccw to release at a lower voltage.

(18) If clip leads were used, strap permanently and repeat (16) and (17).

**3.08** Before connecting plants with more than one rectifier to the office load, proceed as follows.

(1) Adjust the VOLTS ADJ potentiometer (regulator unit) of each rectifier, if necessary, to float the battery at 2.17 volts per cell. Start the adjustment with the rectifier which is to operate last. Then make the adjustment on each preceding rectifier, adjusting the output of the first operating rectifier last. The CC potentiometer is factory adjusted and should not be readjusted.

(2) With the KS-8039 volt-milliammeter connected across the REG VOLTS J1 and J2 jacks of the rectifier to be adjusted, operate the AC switch and the CB1 circuit breaker to the ON position making sure that the switch and CB1 circuit breaker on all other rectifiers are in the OFF position. The meter should indicate 26 volts output for the 24-volt plant and 52 volts output for the 48-volt plant. To obtain this output voltage, rotate the VOLTS ADJ potentiometer on the rectifier.

(3) To put the plant in service, operate the AC switch and the CB1 circuit breaker of each rectifier to the ON position and connect the load.

**3.09** In plants with only one rectifier, the plant is ready for service after readjustment of

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the rectifier and the office load may be connected to the plant.

### Operation of Plant

#### 3.10 Stopping and Starting the Rectifiers

(a) **Stopping the Rectifier:** On the rectifier to be removed from service, operate the AC switch and the CB1 circuit breaker to OFF. If the rectifier is to be left out of service, disconnect the ac power. First remove the ac fuses and then the regulator unit fuse. Replace these fuses in the reverse order of removal.

(b) **Starting the Rectifier:** Check that the correct fuses are in place. Operate the AC switch and the CB1 circuit breaker to the ON position.

**3.11 Power Failure Procedure—All Plants:** No action is required. If countercell is in circuit, the countercell will automatically switch out of circuit and, upon restoration of power, automatically switch into circuit.

## 4. ROUTINE CHECKS

**4.01 Battery Maintenance:** Maintain the battery in accordance with Sections 157-601-301 and 157-601-701. Any deviation of the battery float voltage from 26 volts for the 24-volt plant or from 52 volts for the 48-volt plant requires adjustment of the VOLTS ADJ potentiometers on the rectifiers. These adjustments should be made in accordance with 3.08.

**4.02 70-Type Fuse Alarm:** Check the fuse alarm in accordance with Section 201-604-501.

#### 4.03 Float Voltage Alarm:

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

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

(b) 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 (see appropriate plant circuit requirement table). Connect 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. 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 resistance sliders to their extreme left positions. Under these conditions, the test set has its least resistance and the dry cells are out of the circuit.

(c) Connect the BAT & GRD terminals of the 35-type test set to the discharge battery lead and the VR1 lead, respectively. Block operated the S contactor. Remove the VR fuse.

(d) Using the 60-volt dc scale, connect the KS-14510 volt-ohm-milliammeter across the positive and negative terminals of the VR relay.

(e) Gradually move the No. 1 resistor slider of the test set to the right, thus introducing resistance and lowering the voltage across the VR relay. Note that at the approximate voltage that the VR relay releases (see 3.07), the ALM lamp light lights, and a minor alarm sounds. Move the No. 1 resistance sliders to the extreme left positions to operate the VR relay and disconnect the alarm.

(f) Replace the VR fuse and remove the 35-type test set.

(g) Remove the volt-ohm-milliammeter.

**4.04 Float Voltage Check:** Using the 60-volt dc scale, connect the KS-14510 volt-ohm-milliammeter to the J1 (+) and J2 (-) jacks. The meter should indicate 2.17 volts per cell. If not, rotate the R7 (VOLTS ADJ) potentiometer cw to increase the rectifier output and ccw to decrease the rectifier output. Disconnect the KS-14510 volt-ohm-milliammeter.

## 5. TROUBLES

**5.01** The troubles listed in 5.02 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:** The shutdown rectifiers will not restart until rectifier AC switch has been operated

to OFF and returned to ON. Operate the CB1 circuit breaker to the ON position.

**5.02** The following chart shows the possible causes of a lighted alarm lamp (when furnished) together with the action to be taken.

LAMP	POSSIBLE CAUSE	ACTION
ALM lights.	FA relay operates.	Check fuses and replace as required.
	VR relay released due to low voltage.	Measure battery voltage; if low, re-adjust VOLTS ADJ potentiometer. [VR relay releases when discharge bus is below 24.25 volts (or 22.25 volts with CEMF cells) for the 24-volt plant or below 47.75 volts (or 46.25 volts with CEMF cells) for the 48-volt plant.] If battery voltage is normal, readjust R7 potentiometer (see 3.07).
	Operated VR fuse.	Check, and, if necessary, replace VR fuse.
	Open CEMF cell.	Measure voltage drop across the cell. If the voltage drop is more than 4 volts, replace cell.