

**J87228A RECTIFIER**  
**130 VOLTS, 10 AMPERES**  
**OPERATING METHODS**

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**1. GENERAL**

1.01 The J87228A rectifier and its associated regulated control unit (J87214B or J87214C) is primarily intended to automatically charge and float the storage batteries in the 410B, 411A, 414B, and 420A power plants.

1.02 This section is reissued to:

- (a) Add the 420A power plant as a J87228A rectifier application
- (b) Incorporate an addendum
- (c) Update the admonishments to the latest standards.

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

1.03 The T1 input transformer of the J87228A rectifier is equipped with taps to allow the rectifier to operate from an ac input of 200 to 250 volts  $\pm 10$  percent, 60-Hz  $\pm 3$  percent. The rectifier will provide an output of from 1 to 10 amperes at 125 to 153 volts dc. The rectifier with its associated regulator unit will keep the dc output

within  $\pm 1$  percent for any combination of load current provided that the ac input power is within allowable tolerances.

1.04 The rectifier will automatically shut down if the CHG or A fuse fails or if the rectifier exceeds rated output. The internal CHG and its fuses have been replaced by fuses in the charge and discharge circuit of the plant.

***Danger 1: Voltages inside the rectifier cabinet exceed 150 volts to ground. Avoid all contact with terminals. Do not allow a test pick to touch two metal parts at the same time as dangerous or destructive short circuits may occur.***

***Danger 2: Before performing maintenance on the J87228A rectifier, disconnect the ac input to the rectifier except when necessary to perform tests.***

1.05 The rectifier is designed to mount on a 23-inch relay rack and can be serviced and maintained from the front. The rear of the rectifier is accessible by removing the rear cover. Terminal strips are provided at the top of the rectifier for the connection of the ac input power and dc output power.

1.06 The rectifier is used to float and charge the batteries in 59-cell, 63-cell, 66-cell, and 70-cell power plants.

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

**NOTICE**

Not for use or disclosure outside the Bell System except under written agreement

**SECTION 169-254-301**

SD-80914-01	400 Type Plants, Positive 152-Volt Charge Circuit, 420A Plant
SD-81301-01, Issue 15AR	400 Type Plants, 130-Volt Charge Circuit, Positive and Negative, 63-, 66-, or 70-cell Batteries, 410B Plant
SD-81543-02, Issue 1	Regulated Rectifier Control Circuit, Semiconductor Type, J87214B
SD-81543-03, Issue 5AC	Regulated Rectifier Control Circuit, Semiconductor Type, J87214C
SD-81576-01, Issue 10A	Regulated Rectifier, 130 Volts, 10 Amperes DC, Semiconductor Type, J87228A
SD-81618-01, Issue 2D	400 Type Plants, Charge and Discharge Circuit, 120 Amperes, 130 Volts, Positive or Negative, 63- or 66-Cell Batteries, 411 and 412 Type Power Plants
SD-82040-01, Issue 1	Charge and Discharge Circuit, Positive 125-Volt, 10-Ampere, 59-Cell Battery, 414B Type Power Plant, J86892

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.

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

**1.09** Refer to the following Bell System Practices for the operating methods of the 410B, 411A, 414B, ♦420A♦ power plants.

<b>SECTION</b>	<b>TITLE</b>
167-643-301	Power Plant, 410B (J86465), Operating Methods
♦167-645-301	420A (J86578) Power Plant, Type J and K Carrier Stations Having AC Power Available, Operating Methods♦

<b>SECTION</b>	<b>TITLE</b>
167-649-301	411A (J868862) and 411B (J86863) Power Plants, Operating Methods
167-649-303	414B Power Plant, J86892, Operating Methods

**2. LIST OF TOOLS AND TEST APPARATUS**

<b>CODE OR SPEC NO.</b>	<b>DESCRIPTION</b>
<b>TOOLS</b>	
—	3-Inch C Screwdriver
<b>TEST APPARATUS</b>	
KS-8039	Volt-Milliammeter
♦KS-20538♦	Volt-Ohm-Milliammeter (or equivalent)

**3. OPERATION**

**3.01 *Preparing to Start:*** When preparing to start the rectifier, proceed as follows.

- (1) Verify that the AC INPUT (CB1) circuit breaker is in the OFF position.
- (2) Verify that the VOLT ADJ (R17) potentiometer is rotated fully ccw.
- (3) Verify that the associated ac input service fuses are not installed in their respective fuse holders.
- (4) Verify that the CHG fuse, associated alarm fuse (1/2 ampere), and A fuse, or the corresponding fuses in the plant charge and discharge circuit are not installed in their respective fuse holders. (See 1.04.)
- (5) Verify that all external connections are made in accordance with the associated circuit schematic drawings.
- (6) Verify that the correct T1 input transformer taps have been connected for the nominal ac input service voltage that the rectifier is to operate from by proceeding as follows.

- (a) Connect the ♦KS-20538♦ volt-ohm-milliammeter, set on the 300 AC VOLTS scale, to the input side of the AC INPUT (CB1) circuit breaker.
- (b) Install the associated ac input service fuses in their respective fuse holders.
- (c) Observe the indication of the ♦KS-20538♦ meter and determine what the nominal input voltage to the rectifier will be.
- (d) Disconnect the ♦KS-20538♦ meter from the rectifier.
- (e) Remove the associated ac input service fuses from their respective fuse holders.
- (f) Connect the T1 input transformer taps for the nominal ac input service voltage that was determined in (c).

**3.02 Starting:** To start the rectifier for normal operation, proceed as follows.

- (1) Verify that the procedures in 3.01 have been followed.
- (2) Install the A fuse, or the corresponding fuse in the plant charge and discharge circuit in its respective fuse holder. (See 1.04.)
- (3) Install the CHG fuse and then install the associated rectifier alarm fuse (1/2 ampere), or install the corresponding fuse in the plant charge and discharge circuit in its respective fuse holder. (See 1.04.)
- (4) Install the associated ac input service fuses in their respective fuse holders.
- (5) Operate the AC INPUT (CB1) circuit breaker to the ON position.
- (6) Connect the KS-8039 volt-milliammeter, set on the 300 VOLTS scale, to the BAT(B) bus bar and the GRD(G) bus bar.
- (7) Rotate the VOLT ADJ (R17) potentiometer on the rectifier cw until the KS-8039 meter indicates the nominal float voltage required by the batteries in the associated power plant.

- (8) Disconnect the KS-8039 meter from the rectifier.
- (9) Observe the indication on the OUTPUT (M1) ammeter of the rectifier.

**Requirement:** If the indication on the OUTPUT (M1) ammeter is greater than 11 amperes, it will be necessary to adjust the CC (R18) potentiometer by continuing with (10).

**Warning:** *Do not adjust the CC (R18) potentiometer on the rectifier unless the rectifier output battery voltage is within float limits and the connected load is less than the rated load for the rectifier.*

- (10) Verify that the load on the rectifier is less than the rated load for the rectifier.
- (11) Rotate the CC (R18) potentiometer on the rectifier fully ccw.
- (12) Increase the load on the rectifier until the OUTPUT (M1) ammeter indicates approximately 10.5 amperes (do not exceed 11 amperes).
- (13) Slowly rotate the CC (R18) potentiometer on the rectifier cw until the OUTPUT (M1) ammeter indicates 10 amperes.

**3.03 Stopping:** To remove the rectifier from service, proceed as follows.

- (1) Operate the AC INPUT (CB1) circuit breaker to the OFF position.
- (2) Remove the associated ac input service fuses from their respective fuse holders.
- (3) Where provided remove the rectifier alarm fuse (1/2 ampere) from its respective fuse holder.
- (4) Remove the CHG fuse or the corresponding fuse in the plant charge and discharge circuit from its respective fuse holder.
- (5) Remove the A fuse or the corresponding fuse in the plant charge and discharge circuit from its respective fuse holder.

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**Note:** If the rectifier 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

**4.01** Keep the ventilating passage of the rectifier unobstructed to ensure adequate cooling during operation.

**4.02** Inspect the ac input contactor and the relays in the rectifier for the condition of contacts and proper adjustment. If necessary, adjust the ac input contactor and the relays in accordance with the circuit requirements table and the Bell System Practices which apply.

**4.03 Rectifier Output Check:** To check the rectifier output voltage and current, proceed as follows.

- (1) Connect the ♦KS-20538♦ volt-ohm-milliammeter, set on the 300 AC VOLTS scale, to the input side of the AC INPUT (CB1) circuit breaker.

**Requirement:** The ♦KS-20538♦ meter should indicate the nominal ac input service voltage  $\pm 10$  percent.

**Note:** If the ac input service voltage is not within allowable tolerances, determine the reason for the ac input service voltage not being within allowable tolerances and repair if necessary. If the T1 input transformer taps are not properly connected for the nominal ac input service voltage, change the T1 input transformer taps in accordance with 3.01 (6).

- (2) Disconnect the ♦KS-20538♦ meter from the rectifier.
- (3) Connect the KS-8039 volt-milliammeter, set on the 300 VOLTS scale, to the BAT (B) bus bar and the GRD (B) bus bar.

**Requirement:** The KS-8039 meter indicates the nominal float voltage required by the batteries in the associated power plant.

**Note:** If the requirement in (3) is met, proceed to (5). If the requirement is not met, continue with (4).

- (4) Adjust the VOLT ADJ (R17) potentiometer on the rectifier until the KS-8039 meter indicates the nominal float voltage required by the batteries in the associated power plant.

- (5) Disconnect the KS-8039 meter from the rectifier.

- (6) Observe the indication on the OUTPUT (M1) ammeter of the rectifier.

**Requirement:** If the indication on the OUTPUT (M1) ammeter is greater than 11 amperes, it will be necessary to adjust the CC (R18) potentiometer by continuing with (7).

**Warning: Do not adjust the CC (R18) potentiometer on the rectifier unless the rectifier output battery voltage is within float limits and the connected load is less than the rated load for the rectifier.**

- (7) Verify that the load on the rectifier is less than the rated load for the rectifier.

- (8) Rotate the CC (R18) potentiometer on the rectifier fully ccw.

- (9) Increase the load on the rectifier until the OUTPUT (M1) ammeter indicates approximately 10.5 amperes (do not exceed 11 amperes).

- (10) Slowly rotate the CC (R18) potentiometer on the rectifier cw until the OUTPUT (M1) ammeter indicates 10 amperes.

### 5. TROUBLES

**5.01** When trouble is encountered in the rectifier, it is necessary to decide whether to locate the trouble with the rectifier operating or de-energized. The rectifier has been designed to make some parts accessible for testing with the input power connected. Trouble is easier to find if the rectifier is completely energized. If the trouble is of a nature that causes excessive output from the rectifier, perform the initial steps with the rectifier de-energized and energize it for short periods while electrical measurements are made. When operating the rectifier for more than a few minutes at a time while troubles exist in the rectifier, even though the output may not be excessive, may result in

some components becoming overheated. When testing the rectifier, be alert to the need for quickly shutting down the rectifier at any time until the trouble is localized and cleared.

**Warning:** *In making continuity checks, use the ohmmeter portion of the KS-20538 volt-ohm-milliammeter. Do not use the X10,000 position for testing semiconductors as the higher voltage may damage them.*

- 5.02 If a diode in the D1 rectifier stack becomes defective, replace the entire rectifier stack.
- 5.03 If any component in the associated regulator

unit becomes defective, replace the complete regulator.

5.04 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 connections, 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.

5.05 ♦If J option is provided, complete isolation of the rectifier from the battery can be achieved by removal of the "CHG" and "RECT CONT" fuses in the plant.♦

TROUBLE	POSSIBLE CAUSE	TROUBLE	POSSIBLE CAUSE
(a) No dc output power from the rectifier.	CHG fuse and associated alarm fuse (½ ampere) or the corresponding fuse in the plant charge and discharge circuit operated.		D1 rectifier stack defective. D3, D4, D5, or D6 diodes defective.
(b) No dc output current at low float voltage.	AC INPUT (CBI) circuit breaker in the OFF position.  Associated ac input service fuses blown.  No ac input power to the rectifier.  VOLT ADJ (R17) potentiometer rotated fully ccw.	(d) High dc output voltage from the rectifier	VOLT ADJ (R17) potentiometer not properly adjusted.  High ac input voltage to the rectifier.  Incorrect T1 input transformer taps being used.  D1 rectifier stack defective.  D3, D4, D5, or D6 diodes defective.
(c) Low dc output voltage at partial output current.	VOLT ADJ (R17) potentiometer not properly adjusted.  Low ac input voltage to the rectifier.  Incorrect T1 input transformer taps being used.	(c) Erratic dc output current from the rectifier.	Loose connection at the CC (R18) potentiometer.  Loose connection at the resistors.  Intermittent open or short in any component of the rectifier.