J87224 RECTIFIER

OPERATING METHODS

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1. GENERAL

1.01 The J87224 rectifier operates in conjunction with the J87214C regulator unit to automatically charge and float storage batteries of the 400- and 700-type power plants.

1.02 This section is reissued to:

- Incorporate an addendum
- Add a procedure for removing the rectifier from service
- Update trouble chart.

Revision arrows are used to emphasize the more significant changes. This issue affects the Equipment Test List.

1.03 The rectifier is adaptable for connection to a 3-phase, 60-hertz nominal, 208-, ▶240-◀ volt, or 480-volt ac input, depending upon the transformer option used. The rated output is 0 to 100 amperes at 130 ▶or 152◀ volts dc. The rectifier with its associated regulator unit will maintain the connector battery voltage within ±0.5 percent for any combination of load current variations from 1 to 100 amperes and ac line voltage variations of ±10 percent.

1.04 The rectifier utilizes PNPN devices for 3-phase full-wave rectification and a self-contained transistorized regulating circuit which controls the PNPN devices and automatically limits the output current. In addition, an alarm circuit is provided to shut down the rectifier when the charge fuse (CHG) or control fuse A or B blows or when the rectifier is putting out current at higher than normal voltages.

> ***Danger: Voltages inside the rectifier case are over 150 volts to ground. Avoid all contact with terminals. Do not allow a test pick to touch two metal parts at the same time or destructive and dangerous short circuits may occur. Disconnect the alternating current supply before working on the rectifier except when necessary to make tests.***

1.05 This rectifier is designed to mount on a 23-inch relay rack and can be serviced and maintained from the front. Access to the rear is made possible by a removable rear cover.

1.06 Options are provided for operation as follows. With any option, the output current meter is in the ground lead.

(a) For use in a 130-volt positive plant (negative ground).

(b) For use in a 130-volt negative plant (positive ground).

1.07 Routine checks are intended to detect defects in the equipment and to guard against circuit failures. Checks other than those required by trouble conditions should be made during a period when they will not interface with service.

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1.08 This issue of the section is based on the following:

SD-81593-01, Issue 17AR

SD-81543-03, Issue 8D

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.

1.09 For more detailed information on the operation and maintenance of individual equipment or apparatus, refer to the appropriate Bell System Practices.

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

1.11 ▶When the rectifier is connected to the plant load and controlled by the plant control circuit, the appropriate plant Bell System Practice supersedes the rectifier's Operating Methods Bell System Practice.◀

2. TOOLS AND TEST APPARATUS

CODE OR SPEC NO.	DESCRIPTION
TOOLS	
—	3-inch C Screwdriver
TEST APPARATUS	
KS-14510	Volt-Ohm-Milliammeter
KS-8039	Volt-Milliammeter

3. OPERATION

Preparing to Start

3.01 When preparing to place the rectifier into service, check that:

(a) The ON-OFF key is in the OFF position.

(b) The proper size fuses are provided and removed from the rectifier and associated ac power supply.

(c) All external connections are made in accordance with the SD drawing covering the associated circuit of which the rectifier is a part.

(d) The option wiring is correct for the service to be used.

(e) The T1, T2, and T3 input transformer taps used are correct for the power supply voltage as measured with a KS-14510 meter.

▶Danger:◀ When using any portable instrument, the leads should be carefully examined to make sure the insulation is undamaged. The leads should be properly connected to the instrument before making any contact with the circuit to be tested. If connections are to be changed from one instrument range to another, the power should first be disconnected from the equipment being tested or if test picks are being used, they should be removed from the equipment under test.

(f) The ADJ VOLTS potentiometer is rotated to the maximum ccw position.

(g) The FINE ADJ VOLTS potentiometer is adjusted to its midposition.

(h) The S2 switch on the external fuse panel ("ZB" option) is in the midposition.

(i) ▶The phase sequence of the input 3-phase ac power supply is L3, L2, L1.◀

Starting

3.02 To place the rectifier in service, proceed as follows.

(a) Install control fuses A ▶(fuse F3)◀ and B ▶(fuse F2).◀

(b) Install the ▶F1◀ CHG fuse and then its associated alarm fuse.

Note: Sparking will occur when the ▶F1◀ CHG fuse is inserted due to charging of the filter capacitors in the rectifier.

(c) Install the ac service fuses.

(d) Operate the ON-OFF key to the ON position.

(e) Rotate the ADJ VOLTS potentiometer cw until the ▶rectifier delivers some load current (less than 100 amperes) at the battery float voltage.◀

(f) If a vernier adjustment is required, adjust the FINE ADJ VOLTS potentiomter cw to increase the voltage or ccw to decrease the voltage.

Note: The CC potentiometer is factory set for a constant current of 100 amperes.

Removing From Service

3.03 ▶To remove the rectifier from service, proceed as follows.

(a) Operate S1 to the OFF position

(b) Operate the fused power service switch or circuit breaker to the OFF position.

(c) Remove F1 CHG and associated alarm fuse, F2, and F3 fuses.

(d) The rectifier is now out of service.

Note 1: The ac service has been removed from the cabinet.

Danger: Battery voltage is still present on the battery terminals on certain fuse blocks depending on the option furnished. Also battery is still connected to the regulator. To disconnect the battery from the regulator remove the appropriate fuse in the associated power plant.

Warning: Connect the electrolytic capacitors of the output filter to a source of direct current of suitable voltage and polarity in accordance with Section 032-110-701.◀

4. ROUTINE CHECKS

4.01 As often as local experience demands, the relays should be inspected for adjustment and condition of contacts, making sure that they are in accordance with the Circuit Requirements Tables and Bell System Practices which apply.

4.02 ▶Periodically check the battery float voltage on the associated power plant voltmeter. This check should be made only, when the rectifier is delivering a partial load below its current limit setting. Output voltage adjustments are not valid when the rectifier is in current limit or at no load. If output voltage adjustment is needed, the VOLTS ADJ potentiometer should be adjusted to the desired output. On rectifiers equipped with ZB option, switch S2 TST should be in the midposition. If a vernier adjustment is required, adjust the FINE ADJ VOLTS potentiometer. The full range of the FINE ADJ VOLTS potentiometer is about one volt.

Note: Output voltage check instructions on the associated power plant maintenance BSP supersedes the above instructions.◀

4.03 Electrolytic capacitors should be maintained in accordance with Section 032-110-701.

4.04 ***Regulator Operation ("ZB" Option):*** The operation of the regulator circuit can be checked using the S2 TST switch on the external fuse panel. To check the rectifier, proceed as follows.

(a) Operate the S2 TST switch to the FL position. This places the ▶RV1◀ varistor in the circuit causing a voltage drop in the regulator lead. The rectifier will sense the voltage drop and raise its output voltage to compensate. The rectifier output current will increase correspondingly. ▶Release the◀ S2 ▶TST◀ switch. ▶It should return◀ to the ▶mid◀ position. The rectifier output voltage will return to the battery float voltage.

(b) Operate the S2 TST switch to the NL position. This shorts out the ▶RV1◀ and ▶RV2◀ varistor causing a voltage increase on the regulator lead. The rectifier will sense the voltage increase and lower its output to compensate. The rectifier output current will decrease correspondingly. ▶Release◀ the S2 TST switch. ▶It should return to the mid◀ position. The rectifier output voltage will return to the battery float voltage.

5. TROUBLES

5.01 If the F1 CHG, ▶F2 B, F3 A, F4 CONT ALM (ZB option) or F5 FL (R option)◀ fuse is blown, the RFA ▶lamp is lighted,◀ the RFA relay is operated and held until released by operation of the ON-OFF key.

5.02 Should a diode or PNPN device in the rectifier stack become defective, replace the complete rectifier stack.

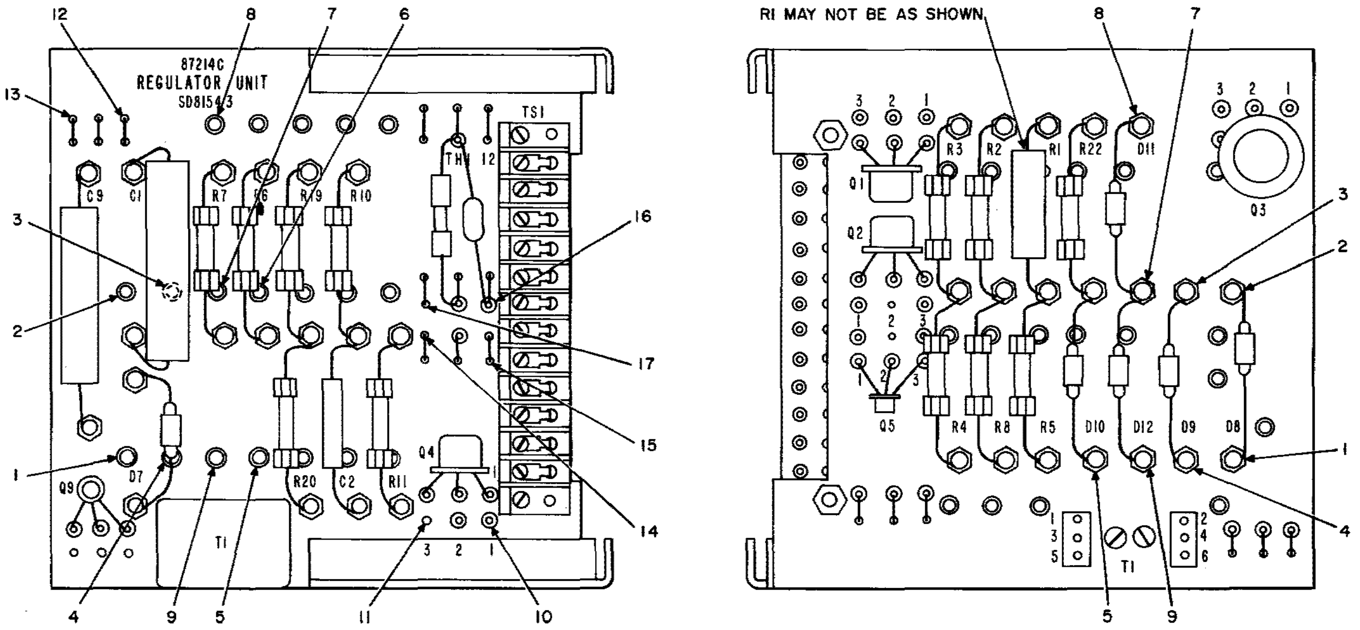
5.03 Should any component of the regulator unit become defective, replace the complete regulator.

> ▶***Warning:***◀ ***In making continuity checks, use the ohmmeter portion of the KS-14510 meter. Do not use the X10,000 position for testing transistors ▶or diodes,◀ as the higher voltage used may damage them.***

Trouble Chart

5.04 Should any of the following troubles develop, check the possible causes listed. If the trouble is not found, look for loose or open connections or short circuits due to foreign matter lying across wiring terminals. ▶Information on regulator units CP1 (Fig. 1) and CP2 (Fig. 2) are included for the convenience of maintenance personnel.◀

TROUBLE	POSSIBLE CAUSE
No dc current	Failure or disconnection of the input power
	▶Blown output filter capacitor fuse (option R only) F5(FL) and F6(FL Alm.) due to: (a) Open thyristor or diode in rectifier stack (b) AC input voltage to input transformer exceeded maximum allowable for the taps that are connected (c) Unequal magnitudes of the three phases at the ac input◀
	Blown ac supply fuses or other fuses in the rectifier
Low dc voltage	Low input voltage
	Shorted capacitors
	Incorrect transformer taps used
	Defective D1, D2, D3, CR1, CR2, or CR3 rectifying element
	Potentiometer ADJ VOLTS not correctly adjusted
	▶Rectifier in current limit◀
High dc voltage	Potentiometer ADJ VOLTS not correctly adjusted
	Defective D1, D2, D3, CR1, CR2, or CR3 rectifying element
	▶Incorrect tranformer taps used◀
Erratic dc current	Loose connections at potentiometers or resistors
	Intermittent open or short in any component
	▶Leaky filter capacitors◀



TERMINAL	APPROX. READING	POSSIBLE CAUSE FOR INCORRECT READING
3 - 4 5 - 6 7 - 8 9 - 7	5.5 - 6.6 VOLTS - DC 5.5 - 6.6 VOLTS - DC 5.5 - 6.6 VOLTS - DC 5.5 - 6.6 VOLTS - DC	DEFECTIVE D9 DEFECTIVE D10 DEFECTIVE D11 DEFECTIVE D12
10 - 11	0.5 - 13 VOLTS - DC	REMOVE THE CHG. FUSE AND TURN THE VOLTS ADJ. POT CW. THE VOLTAGE ACROSS 10 - 11 SHOULD GO FROM 13 VOLTS TO A LOWER VALUE. IF THIS DOES NOT HAPPEN AND THE VOLTAGE AT 10 - 11 IS ZERO AND THE RECTIFIERS OUTPUT VOLTAGE IS EXTREMELY HIGH, Q3 AND/OR Q4.
12 - 13	25 VOLTS - DC	IF LOWER THAN 20 VOLTS, REPLACE Q5.
14 - 15	12 - 24 VOLTS - DC	THIS VOLTAGE SHOULD GO FROM 24 VOLTS TO 12 VOLTS AS THE VOLT ADJ. POT IS TURNED CW. IF THIS DOES NOT HAPPEN, REPLACE Q3 AND Q9.
16 - 17	0 - 18 VOLTS - DC * 0 - 12 VOLTS - DC **	THIS VOLTAGE SHOULD VARY WITH THE VOLTS ADJ. POT. AS THE POT IS TURNED CW, THE VOLTAGE SHOULD DECREASE. IF THIS DOES NOT HAPPEN, REPLACE Q2.

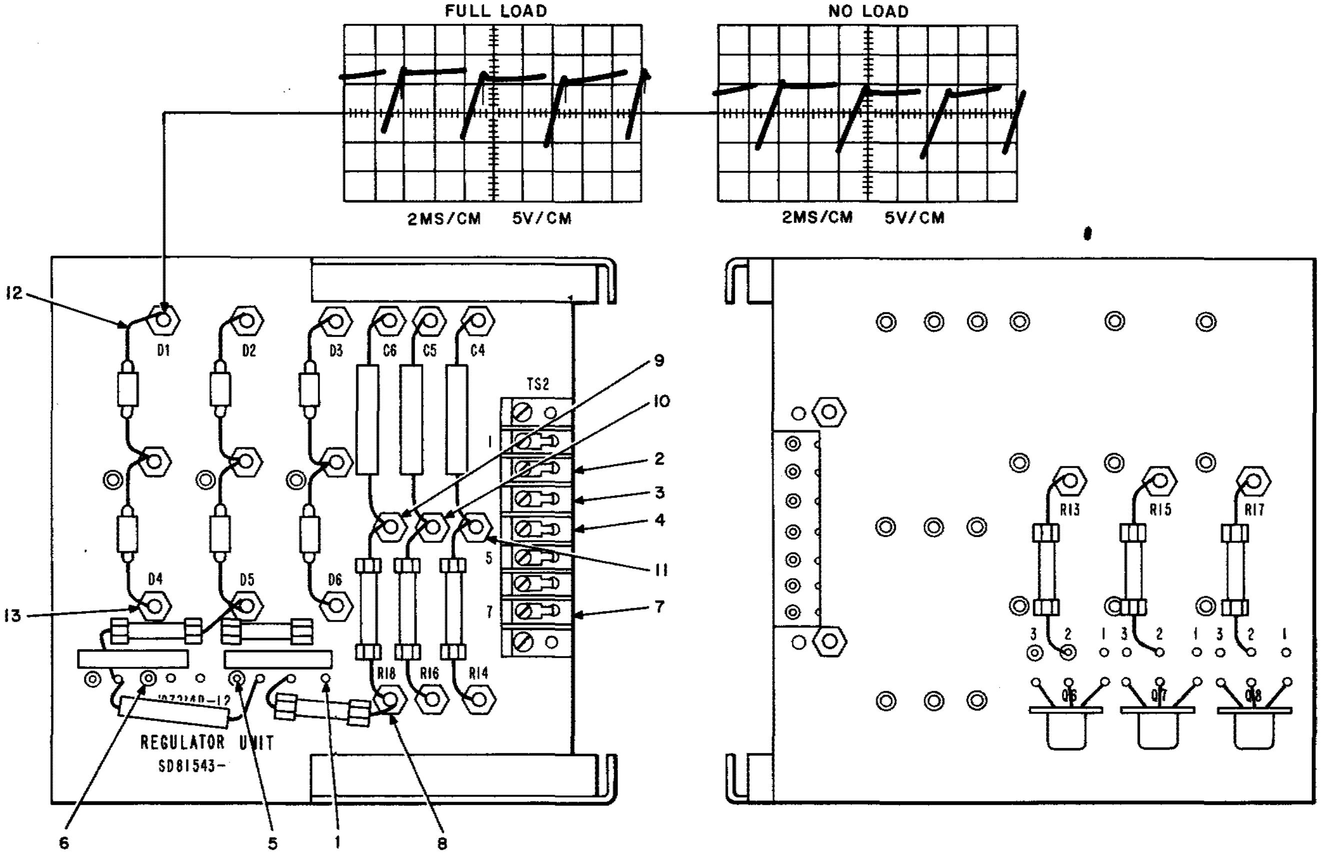
NOTE:

THE WESTERN ELECTRIC 420A DIODE CAN BE REPLACED WITH THE WESTERN ELECTRIC 446B.

* 48 VOLT AND 130 VOLT RECTIFIERS ONLY.

** 24 VOLT RECTIFIERS ONLY.

Fig. 1—Regulator Unit, J87214C CP1



TERMINAL	APPROX. READING	POSSIBLE CAUSE FOR INCORRECT READING
7 - 2 7 - 3 7 - 4	25 VOLTS - AC 25 VOLTS - AC 25 VOLTS - AC	NO SECONDARY VOLTAGE FROM TRANSFORMER OR OPEN LEAD FROM TRANSFORMER TO CARD.
7 - 1 7 - 5 7 - 6	5.5 VOLTS - DC 5.5 VOLTS - DC 5.5 VOLTS - DC	Q6 TRANSISTOR DEFECTIVE Q7 " " " " Q8 " " " "
9 - 8 10 - 8 11 - 8	6 - 7 VOLTS - DC 6 - 7 VOLTS - DC 6 - 7 VOLTS - DC	IF VOLTAGE IS IN THE ORDER OF 9 - 12 VOLTS, THEN Q8 IS SHORTED " " " " " " " " " " " " " " Q7 " " " " " " " " " " " " " " " " " Q6 " " "
12 - 13	0.5 12 VOLTS - DC	THIS VOLTAGE WILL VARY DEPENDING ON THE LOAD. AS THE LOAD IS INCREASED, THIS VOLTAGE WILL DECREASE.*

* THIS IS NOT A TROUBLE CONDITION, IT IS NORMAL OPERATION.

Fig. 2—Regulator Unit, J87214C CP2