RECTIFIERS

J86231A

OPERATING METHODS

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1. GENERAL

1.01 The J86231A rectifier provides a filtered, automatically regulated dc voltage to a battery and a resistance load or a resistance load only. The rectifier is a semiconductor-type rectifier. Regulation is obtained by using saturable reactor control from a self-contained transistor-type regulator circuit.

1.02 This section is reissued to add a test for rectifier shutdown on fuse operation and to correct the output at which the C relay operates. This reissue does affect the Equipment Test List.

1.03 These rectifiers were intended initially to provide filtered dc power for charging and floating 24- and 48-volt storage batteries in the 111A power plant. The rectifiers may also be used without batteries to supply a resistance load. Some of the rectifiers are designed for use at hardened sites.

Note: List numbers cover different rectifiers for use in 24- and 48-volt positive (negative ground) and negative (positive ground) power plants and for the rectifiers used in hardened sites.

1.04 These rectifiers are adaptable for connection to a 200- to 250-volt ± 10 percent, 60-Hz ± 2 percent, single-phase power source. The dc output voltage regulation is ± 1 percent for output currents of 0 to 30 amperes and including ± 8 percent ac input voltage variation. Silicon diodes are used for full wave rectification. Pin jacks are provided for voltage readings of the bias and control portion of the saturable reactor.

Caution: 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 destructive or dangerous short circuits may occur. Disconnect the alternating current supply by operating the ON-OFF key and removing the ac power service fuse, before working on the rectifier except when necessary to make tests.

1.05 Early J86231A rectifiers were equipped with a MAN CONT AUTO potentiometer and switch for manual control. (See Fig. 1.) Because the reliability of the automatic regulating devices in the rectifiers has been established, this manual control feature is not provided in rectifiers of later design.

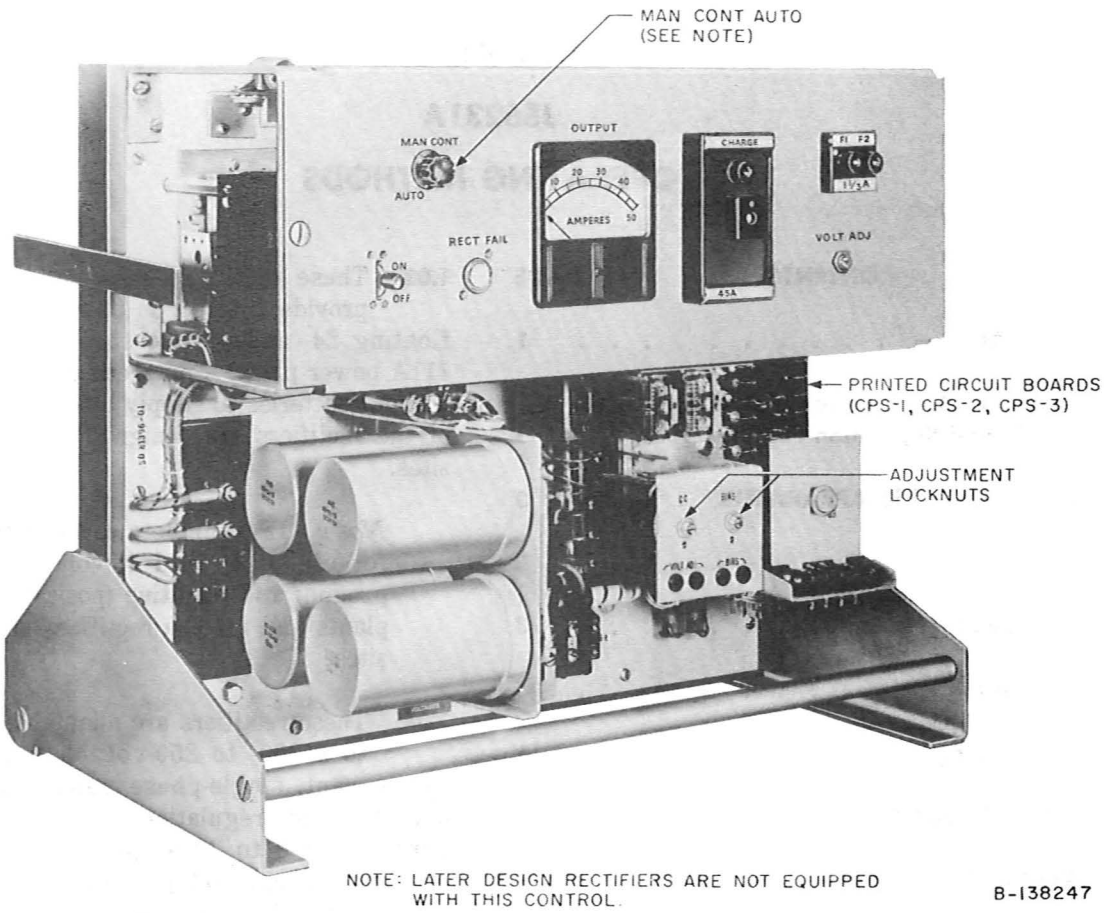

Fig. 1—J86231A Rectifier—Front View (Equipped with Manual Control)

1.06 The rectifier start control circuit requires a battery. The associated plant battery is used for this purpose. When the rectifier is used to supply a load without a plant battery, an auxiliary control battery is used.

1.07 An inductor, mounted externally to the rectifier, is used to limit battery noise. Additional filtering may be used where the rectifier supplies a resistance load without a battery.

1.08 Routine checks are intended to detect defects, particularly in infrequently operated parts of the equipment, and, insofar as possible, to guard against circuit failures which interfere with service. Checks and adjustments, other than those required by trouble conditions, should be made during a period when there will be a minimum interference with service.

1.09 Keeping the ventilating passages and rectifying elements clean is especially important to avoid excessive heating.

1.10 The instructions are based on the following drawings and the associated circuit descriptions.

J86231A Rectifiers—SD-81396-01

Regulator Circuits—SD-81452-01 (CPS-1, CPS-2, CPS-3)

1.11 For more detailed information on the operation and maintenance of individual equipment or

apparatus, refer to the appropriate Bell System Practice.

Field Modification for Removal of Manual Regulation Features

1.12 The J86231A List D field modification kit consists of the necessary equipment and wiring for removal of the manual regulation features from the rectifier circuit.

2. TOOLS AND TEST APPARATUS

CODE OR SPEC NO.	DESCRIPTION
TOOLS	
KS-6278 (2 reqd)	Connecting Clip
R-2698	1/2- and 9/16-Inch 12-Point Box Wrench
—	3-Inch C Screwdriver
TEST APPARATUS	
1W13B	Cord (each end equipped with a KS-6278 connecting clip)
KS-14510 L1	Volt-Ohm Milliammeter
—	Weston Model 931 DC Voltmeter or equivalent
—	One Blown Type 70 Alarm Fuse

3. OPERATION

Preparing to Start

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

(a) The following fuses are removed:

AC power supply fuses (in power service cabinet)

CHARGE, charge alarm, F1, and F2 fuses (in rectifier)

Regulation fuse (in connecting plant).

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

(c) The correct taps on the T1 transformer are selected (as covered on the SD- drawing) for the ac service voltage. Use the KS-14510 meter to measure the voltage.

Caution: 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.

(d) The wiring (positive or negative ground) is correct for the charging service to be used.

Note: The OUTPUT current meter is in the ground lead.

(e) The VOLT ADJ and CC potentiometer controls are in the maximum counterclockwise positions.

Note 1: The CC and BIAS screwdriver controls are on the front of the unit and under the cabinet door. These controls are provided with adjustment locknuts. The BIAS control is adjusted and locked at the factory, and for normal maintenance, no additional adjustment should be required.

Note 2: Use the R-2698 wrench for the adjustment locknut on the controls.

(f) In units equipped with manual control, the MAN CONT AUTO potentiometer and switch control is in the AUTO position.

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

(h) An adequate office load or an artificial load of like capacity is available.

Note: The following expedients may be desirable in obtaining specified loads.

(1) Change output of another rectifier in the connecting plant.

(2) Discharge of battery.

(3) Use of test load (see Section 171-123-101).

Starting

3.02 To start the rectifier proceed as follows.

(1) Insert the following proper size fuses to connect the input power and the load: AC power supply, CHARGE, charge alarm, F1, F2, and regulation fuses.

(2) Apply the input power by operating the ON-OFF key to the ON position.

(3) Adjust the VOLT ADJ control clockwise until the output voltage of the rectifier is equal to the battery float voltage requirement. (See Section 157-601-301.)

Note: The output voltage is indicated on the voltmeter in the connecting plant. To measure the output voltage where the rectifier is used to supply a resistance load, use the Weston Model 931 dc voltmeter connected across the output terminals 1 and 2 on the TSS-terminal strip.

(4) Increase the load until the output current is 33 amperes as indicated on the OUTPUT meter.

(5) Adjust the CC control clockwise until the output current is 32 amperes as indicated on the OUTPUT meter. Lock the control in this position with the adjustment locknut, using the R-2698 wrench.

Stopping

3.03 For routine starting and stopping, it is only necessary to operate the ON-OFF key.

4. ROUTINE CHECKS

4.01 The rectifier should be checked periodically in accordance with the Equipment Test List, after any trouble condition has been corrected, or if it has been out of service.

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

4.03 Circuit packs and semiconductor devices should be maintained in accordance with Section 032-173-301.

4.04 ***Contactor and Relays:*** As often as local experience demands, the contactor and relays should be inspected for adjustment and condition of contacts, making sure that they are in accordance with the circuit requirement table and the Bell System Practices which apply.

4.05 ***Manual Operation Check:*** In units equipped with manual control, check the manual operation of the rectifier as follows.

(1) Operate the MAN CONT AUTO control to the MAN position.

(2) Rotate the MAN CONT AUTO control clockwise and check the indication on the OUTPUT meter to see that the output current increases.

4.06 ***RECT FAIL Alarm Check:***

(1) Decrease the load until the output current is approximately ▶15◀ amperes as indicated on the OUTPUT meter.

Note: See Note under 3.01(h) for expedients in obtaining specified loads.

(2) Unfasten and open the hinged meter panel.

(3) Using the 1W13B cord, connect battery or ground to terminal 3 on the TSS-terminal strip of the rectifier. See following Note.

Requirement: The RF relay operates to shut down the rectifier and the RECT FAIL lamp lights.

Note: The option wiring ("U" or "V") in the rectifier circuit will determine whether battery or ground is applied to terminal 3. (See SD-81396-01.)

(4) Remove the 1W13B cord.

(5) Close and fasten the hinged panel.

(6) Decrease the load to a minimum. To restart the rectifier, operate the ON-OFF key to the OFF position and then to the ON position.

4.07 In units equipped with manual control, the output current may be controlled by the MAN CONT AUTO potentiometer. Operate the control to the MAN position and adjust the control clockwise to obtain the specified output current. After completing the alarm checks covered in 4.05 and 4.06, decrease the load to a minimum and return the control to the AUTO position. To restart the rectifier, operate the ON-OFF key to the OFF position and then to the ON position.

4.08 ***Charge Fuse Alarm Check:***

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

(2) Remove the F1 charge fuse.

(3) Temporarily replace the F1 fuse with an operated alarm fuse.

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

Requirement: The RF relay operates and the rectifier shuts down.

(5) Remove the operated alarm fuse and replace with the original F1 fuse.

(6) Operate the ON-OFF switch to OFF, then ON to restart the rectifier.

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

(8) Remove the F2 charge fuse.

(9) Temporarily replace the F2 fuse with an operated alarm fuse.

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

Requirement: The RF relay operates and the rectifier shuts down.

(11) Remove the operated alarm fuse and replace with the original F2 fuse.

(12) Operate the ON-OFF switch to OFF, then ON to restart the rectifier.

5. TROUBLES

General

5.01 In general, the only items likely to become defective with use are the electrolytic capacitors and semiconductor stacks or diodes.

Rectifying Element Replacement

5.02 To avoid unbalance, only the complete CR1-CR4 rectifying element (stack) should be replaced. In no case should any attempt be made to replace part of the rectifier cells in the stack or bolt assembly which is part of the rectifying element.

Printed Circuit Board Replacement (CPS-1, CPS-2, CPS-3)

5.03 When any one of the three printed circuit boards becomes defective, all three boards should be replaced as they are matched at the factory.

Caution: The rectifier should never be operated with the R2 resistor disconnected from across the T2 transformer, as a high voltage may appear across terminals 3 and 4 of the transformer, should the printed circuit board (CPS-1) be removed for any reason.

Trouble Chart

5.04 Should any of the following troubles develop, it is suggested that the possible causes listed be checked. If the trouble is not found, look for loose or open connections or short circuits due to foreign matter lying across wiring terminals. A loose connection generally causes heating. Any one of the following troubles may be caused by an open or short circuit or by aging or drift in the constants of some faulty component.

TROUBLE	POSSIBLE CAUSE
(a) No output voltage	Failure or disconnection of the input power
	Blown or missing ac supply fuses or other fuses in the rectifier
	CT contactor open
	Open rectifying diodes
	Open Q3 transistor in regulator
	Shorted filter capacitors
	Defective T1 transformer
(b) Low output voltage	Low input voltage
	Defective filter capacitors
	Incorrect transformer taps used
	Defective CR1-CR4 rectifying element
	Defective printed circuit boards (CPS-1, CPS-2, CPS-3)
	Defective T1 transformer
	Potentiometers out of adjustment
(c) High output voltage	Defective T1 transformer
	High input voltage
	Potentiometers out of adjustment
	Incorrect transformer taps used
	Defective printed circuit boards (CPS-1, CPS-2, CPS-3)
	Open filter capacitors
(d) Erratic dc current or voltage	Loose connections at any component
	Intermittent open or short in any component