RECTIFIER
INVERTER, REGULATED
KS-15737
OPERATING METHODS

1. GENERAL

1.01 This section covers the operation of a regulated rectifier with a vibrator inverter and a transfer circuit. It is designed to furnish a regulated 130-volt dc, 0.5-ampere output. If the ac power fails, the transfer circuit automatically operates to apply a 48-volt dc battery input to the vibrator inverter which in turn supplies a 115-volt, 60-Hz input for the rectifier. The power required is 115-volt ▶±18 volts,◀ 60-Hz alternating current.

WARNING: Voltages inside the rectifier case are higher than those usually encountered in telephone power plants. Avoid all contact with terminals, as high voltages are present. Do not allow a test pick to touch two metal parts at the same time or destructive and dangerous short circuits may occur. Disconnect ac supply before working on rectifier except as necessary to make tests.

1.02 This section is reissued to add a reference to the replacement for the V1B1 vibrator and to provide an adjustment procedure for resistors R1 and R2. This section does not affect the Equipment Test List.

1.03 Keeping the ventilating passages and rectifier cells clean is especially important to prevent excessive heating.

1.04 Routine checks are intended to detect defects, particularly in infrequently operated parts of the equipment, and insofar as possible, to guard against circuit failures liable to interfere with service. Checks and adjustments, other than those required by trouble conditions, should be made during a period when they will not interfere with service.

1.05 The instructions are based on drawing SD-81298-01, Issue 4B. For detailed description of the operation, see the corresponding circuit description. ▶If this section is to be used with equipment or apparatus relecting later or earlier issue(s) of drawings reference should be made to the SDs and CDs to determine the extent of the change and the manner in which the section may be affected.◀

1.06 Additional information on the operation and maintenance of individual pieces of apparatus, such as relays and switches, is given in other sections and the attendant should be familiar with them. All relays, etc, should be adjusted in accordance with these sections and the circuit requirement tables of the circuit drawings.

2. TOOLS AND GAUGES

CODE OR SPEC NO.	DESCRIPTION
TOOLS	
—	3-Inch Cabinet Screwdriver
GAUGES	
KS-16979	Volt-Ohm-Milliammeter

3. OPERATION

3.01 ***Overall Operation:*** This rectifier is a ferroresonant -type regulated rectifier which is normally operated from ac power service. During power failure or low-voltage service, a transfer circuit shifts the input of the rectifier to the output of a vibrator inverter. Transfer at the instant of low-voltage service or power failure and upon restoration of proper ac power is rapid enough to prevent service or signaling interruptions.

3.02 ***Inverter:*** It consists of a V1B1 vibrator which has C4, C5, and C6 capacitors across T1 transformer for protection of the vibrator contacts. A filter consisting of an L1 coil and a C1 capacitor in the vibrator reed circuit suppresses the noise generated by the vibrator from reaching the battery. Protection for the vibrator driver contacts is provided by R4 resistor and C7 capacitor. ▶The V1B1 vibrator has been replaced by the solid-state Power Oscillator Assembly (4872-501). This assembly consists of two drive transistors Q1 and Q2, saturable transformer T1, power transistors Q3 and Q4, and associated components. A modified Power Oscillator Assembly (4872-507) has been developed to replace the Power Oscillator Assembly (4872-501). This assembly includes the diodes CR5 and CR6, along with capacitor C3 and resistor R12, which serve as a voltage spike suppressor.◀

3.03 ***Rectifier Operation:*** Voltage regulation is obtained by T1 transformer and C3 capacitor. Load changes cause shifts in phase relations and relative magnitudes of the voltages (terminals 4 and 5, 4 and 10, and 5 and 10 of T1 transformer) so that RECT1 rectifier operates as a 3-phase rectifier. At no load the three ac voltages are nearly in phase. As the load increases the phase relations of the three voltages are displaced and the magnitudes varied in such a manner as to maintain the rectifier dc output voltage within the allowable limits.

3.04 ***Transfer Circuit:*** The purpose of this circuit is to transfer the input to the inverter rectifier immediately from ac voltage to 48-volt battery on failure or low ac voltage and to transfer the input from 48-volt battery to ac voltage after the ac voltage has remained above a predetermined minimum value for a period of 15 to 45 seconds. The control or sensing part of the transfer circuit consists of a T2 transformer, a RECT2 rectifier stack, a C relay, a C8 capacitor, and an adjustable R6 resistor. The C relay releases when the ac input voltage drops 16 to 22 percent of the value to which the R6 resistor is adjusted. This adjustment is dependent on the ac voltage supplied to the rectifier and the agreed upon voltage at which the transfer to dc should take place. The C relay released releases time delay B relay which in turn releases the A contactor. This disconnects the ac input and transfers to 48-volt dc battery. When the ac input increases to the previously determined value, C relay operates which will energize the time delay B relay. After 15 to 45 seconds the contacts of the B relay will close and operate the A contactor. This transfers the circuit from dc to ac.

3.05 ***Filtering:*** A filter consisting of L2 and L3 inductors and C2A, C2B, and C10 capacitors is provided in the rectifier output. The R9 resistor and RECT3 rectifier stack are added in series with C2B and C2A capacitor respectively to prevent instability.

3.06 ***Fusing:*** The ac input, dc input, and dc output are provided with a 1.5-ampere slow-acting F1, a 6-ampere F2, and a 1-ampere F3 fuse respectively.

3.07 ***Alarms:*** The release of D relay when 130-volt output failure occurs provides a ground signal to the output alarm circuit over the D and DF terminals. The release of B relay on an ac input failure provides a ground signal to the transfer alarm signifying operation from the 48-volt battery.

3.08 ***Output Voltage Adjustment:*** The R1 and R2 resistors should be adjusted upon installation and when the rectifier stack RECT1 has aged or when vibrator ▶or the power oscillator is replaced. The procedure is as follows.

(a) Operate from a 48-volt dc source and adjust R1 until the output voltage at 0.5 ampere load is 5 volts less than the output voltage at 0.05 ampere load. In case the output voltage oscillates at this setting, increase the resistance of R1 until oscillation stops.

(b) Operate from a 110-volt ac source and adjust R2 until the output voltage is 3 volts less at 0.5 ampere load than the output voltage at 0.05 ampere load. In case the output voltage oscillates at this setting, increase the resistance of R2 until oscillation stops.◀

3.09 ***Preparing to Start Initially:*** When putting the rectifier into service initially, check the circuit to see that:

(a) Proper fuses are in place.

(b) The T1 transformer taps are connected to correspond with the ac service voltage as measured with a ▶KS-16979◀ voltmeter.

(c) The external loads are disconnected.

3.10 ***Initial Adjustments:*** Proceed as follows.

(a) Connect the external loads.

(b) Connect the ac alarm taps.

(c) Connect the battery.

(d) Connect the ac input taps.

4. ROUTINE CHECKS

4.01 The following should be performed:

(a) Electrolytic capacitors should be maintained in accordance with Section 032-110-701.

(b) Check R1 and R2 to see that proper output voltage is maintained.

5. TROUBLES

5.01 In general, the only items likely to become defective with use are the electrolytic capacitors and the rectifiers which are subject to aging.

5.02 At time troubles may be caused by faulty relay operation.

5.03 If the vibrator or power oscillator is replaced or the RECT1 rectifier stack has aged, R1 and R2 resistors should be readjusted in accordance with 3.08.

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 an aging or drift in the constants of some faulty component. If one of the following possible causes or the use of the point-to-point voltage table does not lead to the location of the trouble, it is advisable to make point-to-point resistance measurements with the circuit completely de-energized, comparing the measurements with the values shown on the SD-81298-01 circuit drawing so that such faults may be found.

TROUBLE	POSSIBLE CAUSE
No dc current	Power Failure
	Blown fuses
	Relays not operated
	Vibrator failure
Low dc current	Low line voltage
	Shorted capacitors
	Incorrect transformer taps used
	Rheostat or resistors out of adjustment
High dc current	High line voltage
	Rheostat or resistors out of adjustment
	Incorrect transformer taps used
Erratic dc current or voltage	Loose connections at rheostats or resistors

6. POINT-TO-POINT VOLTAGES

6.01 As long as the rectifier unit operates satisfactorily, point-to-point voltage values are not needed and are not operating requirements to be checked in routine. In case the rectifier output cannot be obtained, they may be useful in locating defective conditions.

6.02 High voltages to ground are present within the rectifier unit and every precaution should be observed to avoid any contact with exposed metal parts or terminals when the rectifier unit is in operation, or when not in operation but connected to either line or battery.

Caution: When using any portable instrument, the leads should be carefully examined to make sure the insulation is undamaged. The leads should be connected at the instrument before making contact

with the circuit to be tested. If connections are to be changed from one instrument range to another, the alternating current 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.

6.03 Readings should be made with a ▶KS-16979◀ voltmeter. The output of the rectifier will not be appreciably affected by connecting the voltmeter leads to the circuit elements.

6.04 ***Table of Point-to-Point Voltages***

TEST POINT	120 VOLT AC INPUT 0.5 AMP LOAD	48 VOLT DC INPUT 0.5 AMP LOAD
T1 term 4 to 5	134	125
term 7 to 9	90	89
term 21 to 23	410	400

	VOLTAGE
T2 term 4 to RECT 2 (Common term)	10.6 dc