VOLTAGE REGULATOR AND RECTIFIER J86246A AND J86246B OPERATING METHODS

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1. GENERAL

1.01 This section covers the operation of the J86246A electronic-type voltage regulator and the J86246B unregulated semiconductor-type rectifier.

1.02 This section is reissued to revise Tables A and B and to bring the section up to date. Since this reissue covers a general revision, arrows ordinarily used to indicate changes have been omitted.

1.03 The J86246A voltage regulator and the J86246B rectifier were intended to be used together to regulate the 20-cycle output voltage of a motor generator set such as that used in the 804C ringing power plant.

1.04 The regulator and rectifier units are adaptable for connection to a 200-, 210-, 220-, 230-, 240-, or 250-volt, 60-cycle, single-phase power source.

Caution: Voltages inside the units are higher than 200 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 ac power supply before doing any work inside the units.

1.05 Keeping the ventilating passages clean is especially important to avoid excessive heating.

1.06 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.

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

SD-81123-01 for the J86246A

SD-81124-01 for the J86246B

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

2. TOOLS AND TEST APPARATUS

CODE OR SPEC NO.	DESCRIPTION
TOOLS	
—	3-Inch C Screwdriver (or the replaced 3-inch cabinet screwdriver)
TEST APPARATUS	
KS-14510 L1	Volt-Ohm-Milliammeter

3. OPERATION (see Fig. 1)

Preparing to Start Initially

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

(a) The load is disconnected from the line-driven ringing machine by removing fuses or by transferring the load to the battery-driven ringing machine as covered in Section 167-722-311.

(b) The correct electron tubes are in the sockets.

(c) The correct primary taps on T and T2 transformers are selected, as covered on the SD drawings, for the ac supply voltage. Use the KS-14510 meter to measure the voltage.

(d) The following potentiometer and rheostat controls are in the positions listed below.

POTENTIOMETER OR RHEOSTAT	POSITION
ADJ VOLTS	maximum counterclockwise
GC	maximum clockwise
AH	approximate midpoint

(e) All external connections are made in accordance with the SD drawings covering the associated circuit of which the units are a part.

(f) The proper ac power supply fuses are in place.

Initial Adjustments

3.02 Operate the controls in the associated plant to allow the line-driven ringing machine to run without carrying the load.

3.03 ***J86246A Voltage Regulator***

(a) Adjust the ADJ VOLTS potentiometer control clockwise until the 20-cycle output voltage of the ringing machine is 86 volts measured across terminals 1 and 2 of T1 transformer. Use the KS-14510 meter to measure the voltage.

Note: Operation of the VM ± G1 key on the control panel in the associated plant will cause the voltmeter on the panel to indicate the output voltage. See Section 167-722-311.

(b) On the secondary side of T1 transformer, select the proper taps (3 to 6) to obtain 160 ±5 volts dc measured across J7 and J8 jacks. Use the KS-14510 meter to measure the voltage.

3.04 ***J86246B Rectifier***

(a) With the ringing machine 20-cycle output at 86 volts, adjust the taps (6 to 9) on the secondary side of T transformer. Select the proper taps to obtain 125 ±5 volts dc across terminals 1 and 3 on TS1 terminal strip. Use the KS-14510 meter to measure the voltage.

(b) Readjust the ADJ VOLTS potentiometer control on the J86246A, if necessary, to secure the ringing machine output of 86 volts.

(c) ***R1, R2, and R3 Strapping:*** With the ringing machine output at 86 volts, strap R1, R2, and R3 resistors in such a way that the PLT CUR milliammeter on the J86246A indicates between 80 and 120 milliamperes.

3.05 Operate the controls in the associated plant to connect the office load to the 20-cycle output of the ringing machine. To use test loads, see Section 171-123-101.

(a) Adjust the ADJ VOLTS potentiometer control to secure the output of the ringing machine at 86 volts.

(b) Vary the load and note the effect on the output voltage. If the output voltage does not stay within the limits of 84 to 88 volts, adjust the GC rheostat control on the J86246A to bring it within the limits. Clockwise rotation increases and counterclockwise rotation decreases the regulated voltage so that a readjustment of the ADJ VOLTS control is required whenever an appreciable change in the GC control is made. Manipulate the GC and ADJ VOLTS controls until the output voltage stays within the prescribed limits for the plant load.

Note: The GC rheostat controls the gain of the amplifier and, consequently, the sensitiveness of the voltage regulation. At maximum gain, the speed of response of the generator is greatest, as the regulator applies the greatest field voltage change for a given instantaneous change in the output voltage.

3.06 ***Hunting:*** If hunting should result from the adjustments in 3.05, adjust the AH rheostat control clockwise or counterclockwise until the hunting disappears.

Note: With the AH antihunt control in the midpoint position, the adjustment will probably be nearly correct. If the AH control is turned to the maximum clockwise position with the GC control at or near its maximum clockwise position (maximum gain), a low-frequency hunt will occur. As the AH control is turned counterclockwise from the extreme position, this hunt will disappear. If the AH control is turned to the maximum counterclockwise position, a high-frequency hunt may be started. At some position between these two extreme positions, the best operation will be obtained. This position will usually be slightly counterclockwise from the point at which the low-frequency hunt disappears. At low gain there is less tendency to hunt and the setting of the AH control is not critical; in fact, it may not be possible to start a hunting condition with the AH control in any position.

Routine Adjustments

3.07 The operation of the voltage regulator and rectifier is entirely automatic and should not require frequent checks after the first few weeks of operation.

4. ROUTINE CHECKS

4.01 The following should be performed.

(a) Periodically check that the 20-cycle output voltage of the ringing machine is within the prescribed limits.

Note: Operation of the VM ± G1 key on the control panel in the associated plant will cause the voltmeter on the panel to indicate the output voltage. See Section 167-722-311.

(b) Periodically check the output current reading on the PLT CUR milliammeter and, on the J86246B, adjust the strapping of R1, R2, and R3 resistors, as required, in accordance with 3.04(c).

Note: A change in the minimum ringing load or in the number of PBX feeders connected to the ringing generator will affect the reading of the PLT CUR milliammeter and the ringing machine output voltage.

(c) Periodically check that the voltages on T and T1 transformer secondary windings are within the limits as covered in 3.03 and 3.04.

Note: Aging of the selenium rectifying elements may require changing the transformer taps.

(d) Periodically check the condition of the electron tubes, using whatever electron tube tester is available, in accordance with the information for the tester.

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

5. TROUBLES

5.01 The replacement of any electron tube, particularly V1 or V2, may require a readjustment of the ADJ VOLTS control. Replacement of the V2 voltage amplifier tube will probably also necessitate a readjustment of the GC gain control. It is probable that tube changes will not require the readjustment of the AH antihunt control, providing the gain is readjusted to give approximately the same accuracy of regulation as previously obtained.

5.02 The J86246A is equipped with J1 through J5 jacks to facilitate the measurement of the voltage drops across the R12, R13, R14, and R15 cathode resistors for determining the division of current among the sections of the V3 and V4 tubes. While the regulator will operate with only one of these tubes (that is, two good sections), greater overload margin and faster response is obtained by the use of the two power tubes. On this basis, it is recommended that a tube be replaced when the voltage drop readings indicate that any one section is carrying less than 50 per cent of the average of all four sections of the two tubes. To determine the average voltage, add the four voltage readings of the sections and divide the sum by 8. If this number is greater than any one of the measured voltages, replace the associated tube.

5.03 Where more than one electron tube may cause a trouble, replace tubes with new ones until the trouble is corrected. Then put back the used electron tubes one at a time until the defective electron tube or tubes have been located. Replace the defective tube or tubes with new ones.

5.04 Control rheostats and potentiometers are totally enclosed and should be replaced if they become defective in any respect.

5.05 Broken wires, particularly at terminals, may cause failures.

Rectifier Stack Replacement

5.06 ***Selenium Rectifier Stacks:*** Selenium rectifier cells may fail due to aging, which is an increase in the resistance of the cells. The replacement of only the defective stack in rectifying elements that consist of more than one stack may result in an unbalanced condition in the rectifying element. To avoid unbalance, replace the stacks as follows.

Note: Burned-out rectifier stacks will show scorched spots or raised bumps on the disc and will emit an obnoxious odor.

(a) When replacing a defective stack or stacks in a multiple stack element, replace all other stacks in the element that have been in service 2 years or longer.

(b) Do not combine stacks of different list numbers or different manufacturers.

(c) Do not attempt to replace part of the rectifier cells in a stack or bolt assembly. Always replace the entire stack.

Trouble Chart

5.07 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. If one of the possible causes listed 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 circuit drawing so that such faults may be found.

TROUBLE	POSSIBLE CAUSE
(a) No ringing voltage	Failure or disconnection of the input power
	Blown ac supply fuse or ringing fuse.
	Ringing machine not operating (field open, open brush)
	Failure of ac control relay in ringing control circuit
	Failure of J86246B unit
(b) High or low ringing voltage	Unusually high or low ac service voltage
	ADJ VOLTS and/or GC controls out of adjustment
	Failure of V2, V3 and/or V4 electron tubes
	Failure of rectifying elements
	Failure of R1, R2, and/or R3 resistors in the J86246B unit
	Heavy overload on the plant
	Large PBX feeder loads in absence of other loads at light load periods
(c) Output voltage varying more than ±2 volts	GC and/or AH controls out of adjustment

6. POINT-TO-POINT VOLTAGES

6.01 Point-to-point voltage values are not operating requirements to be checked on a routine basis. In case the output voltage cannot be obtained, they will be useful in locating defects or trouble conditions.

6.02 ***Caution: High voltages to ground are present within the units. Every precaution should be observed to avoid any bodily contact with exposed metal parts or terminals when the units are in operation or not in operation but connected to the input power source or load.***

6.03 ***Table of Point-to-Point Voltages*** (see notes): The readings given in Tables A and B for the J86246A and J86246B, respectively, are typical for the units under no-load and full-load conditions with nominal 250-volt ac input power. The readings are measured with a KS-14510 meter. Connecting the meter to observe readings, except as noted in the tables, does not appreciably affect the ringing machine output.

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. The values shown in the table are for typical units in good working condition. A defect in the units may leave a high-voltage charge on a capacitor and other parts of the circuit with the power off. A defective unit with the power connected may have quite different voltages than those shown; therefore, it may be desirable to use a higher voltage scale until readings indicate the proper scale to use for the defective condition.

TABLE A — VOLTAGES FOR J86246A VOLTAGE REGULATOR

MEASUREMENT MADE				KS-14510 METER				
FROM		TO (see note 1)		SCALE AC OR DC	RANGE (volts)	TYPICAL READING (volts)		NOTES
APP	TERM.	APP	TERM.			NO LOAD PLT CUR 95 MA	FULL LOAD PLT CUR 330 MA	
T1	1	T1	2	AC	300	86	79	
T2	1	T2	5	AC	300	245	243	
TS1	1	TS1	2	DC	300	103	80	
TS1	3	TS1	4	AC	12	6.1	6.1	
J1	—	J5	—	DC	12	1.1	3.9	
J2	—	J5	—	DC	12	1.2	4.1	
J3	—	J5	—	DC	12	1.1	3.8	
J4	—	J5	—	DC	12	1.1	3.9	
J7	—	J5	—	DC	60	35	54	
J7	—	J6	—	DC	300	100	100	
J6	—	J8	—	DC	300	60	61	
J7	—	J8	—	DC	300	162	162	
RV1,RV2	Y	RV1,RV2	Y	AC	300	157	157	2
RV1,RV2	R	RV1,RV2	BK	DC	300	180	180	2
V1	7,8	V1	2,3	DC	300	101	101	
V2	1	V2	6	AC	12	9.5	9.5	
V2	2	V2	5	DC	300	65	45	
V2	3	V2	5	DC	60	44	41.5	
V2	4	V2	5	—	—	—	—	3
V2	CAP	V2	5	DC	12	2.35	1.8	4
V3	7	V3	8	AC	12	6.3	6.3	
V3	1	V3	3	DC	60	20	6.6	
V3	2	V3	3	DC	300	102	83	

TABLE A — VOLTAGES FOR J86246A VOLTAGE REGULATOR (cont)

MEASUREMENT MADE					KS-14510 METER			
FROM		TO (see note 1)		SCALE AC OR DC	RANGE (volts)	TYPICAL READING (volts)		NOTES
APP	TERM.	APP	TERM.			NO LOAD PLT CUR 95 MA	FULL LOAD PLT CUR 330 MA	
V3	4	V3	6	DC	60	20	7.0	
V3	5	V3	6	DC	300	102	77	
V4	7	V4	8	AC	12	6.3	6.3	
V4	1	V4	3	DC	60	20	6.6	
V4	2	V4	3	DC	300	102	83	
V4	4	V4	6	DC	60	20	6.8	
V4	5	V4	6	DC	300	102	77	
P1	2	P1	1	DC	300	64	64	
P1	3	P1	1	DC	60	29	29.5	
P1	2	P1	3	DC	60	35	34.0	
AH	2	AH	1	DC	3	0	0	
AH	1	AH	3	—	—	—	—	3
AH	2	AH	3	DC	3	0	0	
GC	2	GC	1	DC	3	0	0	
GC	1	GC	3	—	—	—	—	3
GC	2	GC	3	DC	3	0	0	
C4,C5	R5	C4,C5	AH-2	DC	12	2.3	1.8	4,5
C6	R5	C6	AH-2	DC	12	2.3	1.8	4,5
R1	RV1	R1	C1	DC	60	17.5	17.5	5
R3	R1	R3	P1-2	DC	300	68	68	5
R4	P1-1	R4	R2	DC	60	29	29	5
R5	P1-3	R5	C6	DC	3	0	0	5
R6	R16	R6	R7	DC	60	54	56	5
R7	R6	R7	R4	DC	300	107	105	5
R8	R6	R8	V3-1	DC	3	0	0	5
R9	R8	R9	V3-4	DC	3	0	0	5
R10	R9	R10	V4-1	DC	3	0	0	5
R11	R10	R11	V4-4	DC	3	0	0	5

TABLE B — VOLTAGES FOR J86246B RECTIFIER

MEASUREMENT MADE					KS-14510 METER			
FROM		TO (see note 1)		SCALE AC OR DC	RANGE (volts)	TYPICAL READING (volts)		NOTES
APP	TERM.	APP	TERM.			NO LOAD PLT CUR 95 MA	FULL LOAD PLT CUR 330 MA	
T	1	T	5	AC	300	242	242	
RV1,RV2	2	RV1,RV2	2	AC	300	155	152	2
RV1,RV2	1	RV1,RV2	3	DC	300	130	125	2
TS1	1	TS1	2	DC	60	24	42	
TS1	2	TS1	3	DC	300	104	80	
TS1	1	TS1	3	DC	300	128	122	
C1,C2	+	C1,C2	—	DC	300	128	122	5
R1	R2	R1	TS1-3	DC	60	27	21	5
R2	R3	R2	R1	DC	300	75	58	5
R3	TS1-2	R3	R2	DC	3	0	0	5
L	RV1-1	L	TS1-1	DC	3	1.5	2.6	5

Notes for Tables A and B

1. "TO" terminal should be connected to the negative jack of the meter.
2. AC and dc voltage measurements are made across RV1, RV2 rectifier input and output, respectively.
3. The terminals are strapped together.
4. The 12-volt range should be used for these readings. Using the 3-volt range will disturb the circuit and cause the 20-cycle ringing maching output to increase to approximately 90 volts.
5. DC voltage measurements are made across the component apparatus.

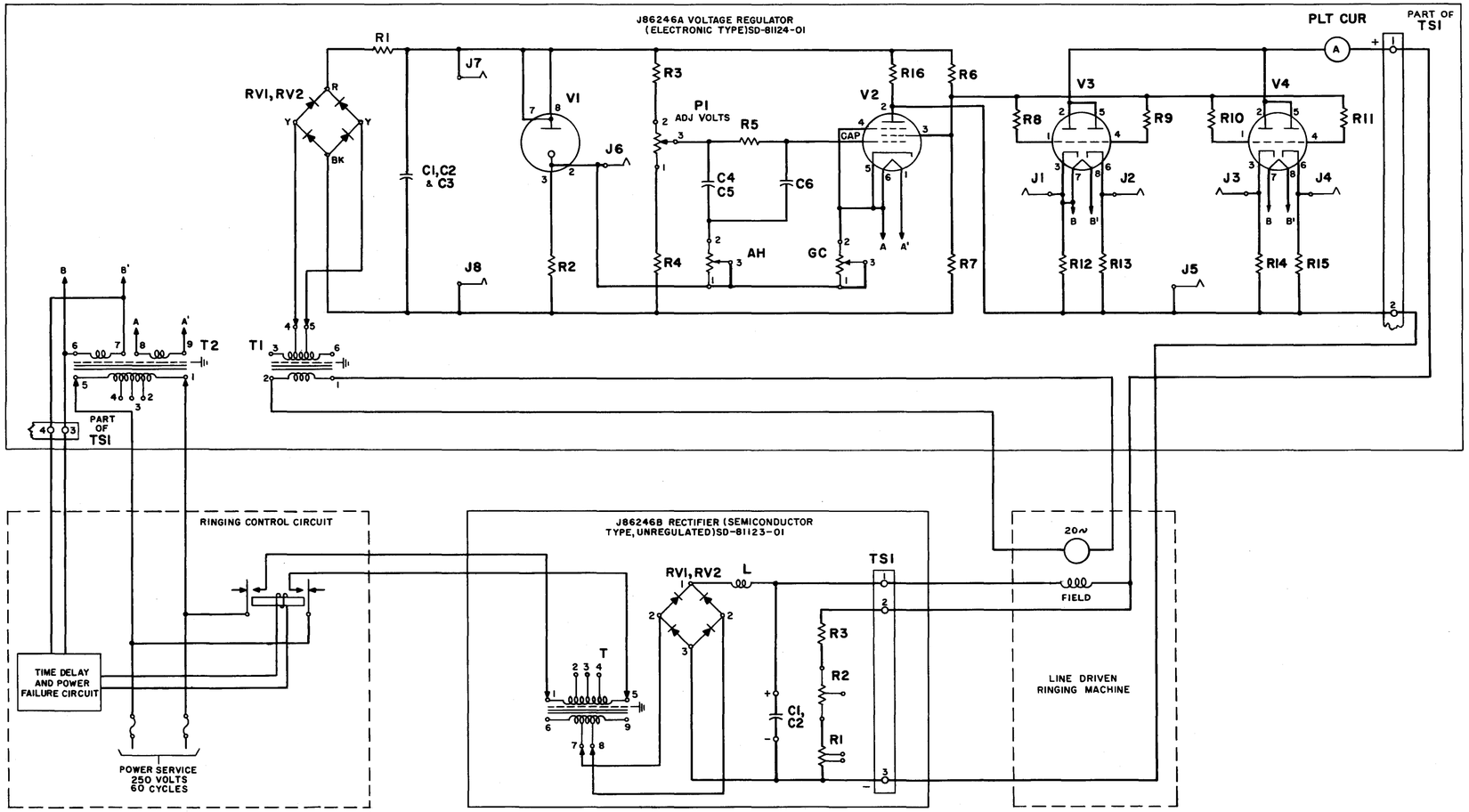

Fig. 1 – J86246 Voltage Regulator and Rectifier