RECTIFIERS
J86264A AND KS-15687 L1, L2, L3, AND L4
(SINGLE-CELL CHARGERS)
OPERATING METHODS

CONTENTS PAGE

1. GENERAL

1.01 This section covers the use of the J86264A and KS-15687 L1, L2, L3, and L4 rectifiers. They are designed for charging one cell, but may be used on two or even three adjacent cells at reduced rates.

1.02 This section is reissued to cover the KS-15687 L2 and L4 rectifiers and to revise Fig. 2, 4, and 5. There is no Equipment Test List for this section.

1.03 The rectifiers operate from ac receptacles on 115±10 volts, 60-Hz power. The J86264A rectifier draws a maximum of 15 amperes, and the KS-15687-type rectifiers draw a maximum of 3 amperes. The J86264A rectifier provides a maximum output of 210 amperes, and the KS-15687-type rectifiers provide a maximum output of 20 amperes.

1.04 If desired, the charge may be supplied to cells in a working string with no change in battery regulator setting and no interference in service. However, charging at high rates with the J86264A rectifier may cause some noise in talking circuits.

1.05 The charge should be discontinued or reduced, if necessary, to prevent the temperature of the electrolyte of the cell from exceeding 110°F.

1.06 Where the rectifier is used for the initial charge of one or more cells added to a charged string, the charge should be in accordance with Section 157-601-201.

1.07 Refer to Sections 157-601-701 and 157-601-702 for general information such as precautions to be taken against explosions and damage from electrolyte, method of taking readings, battery data, etc.

Caution: Avoid creation of sparks, including those from static electricity, or the use of an open flame near batteries, since the gas given off by the battery is explosive.

1.08 ▶Refer to Fig. 1 and 2 for photographs of the J86264A and KS-15687 L1 rectifiers, and Fig. 3, 4, and 5 for the schematic diagrams of all the rectifiers.◀

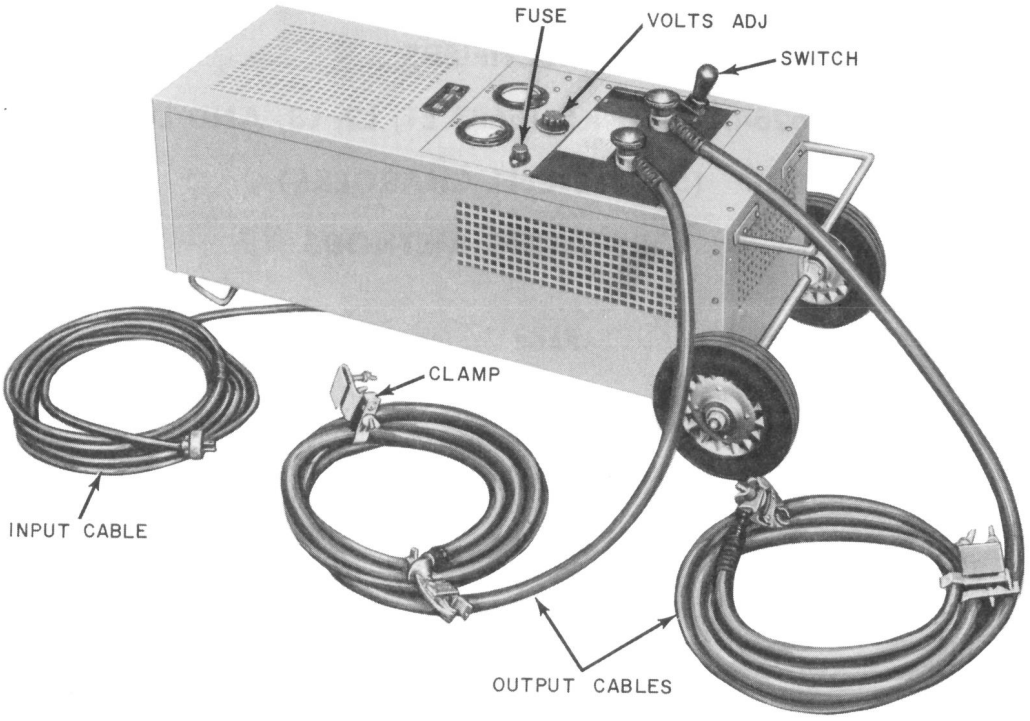

Fig. 1—J86264A Rectifier

Fig. 2—KS-15687 L1 Rectifier

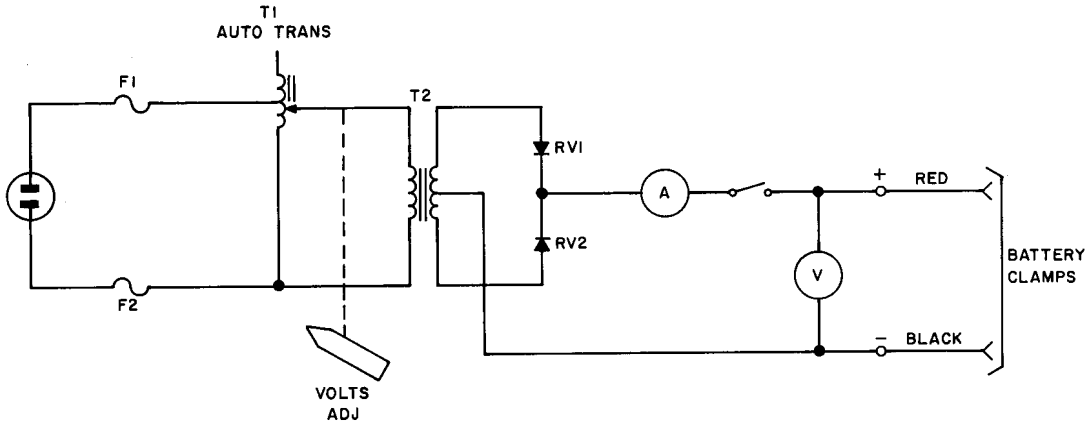

Fig. 3—J86264A Rectifier—Schematic

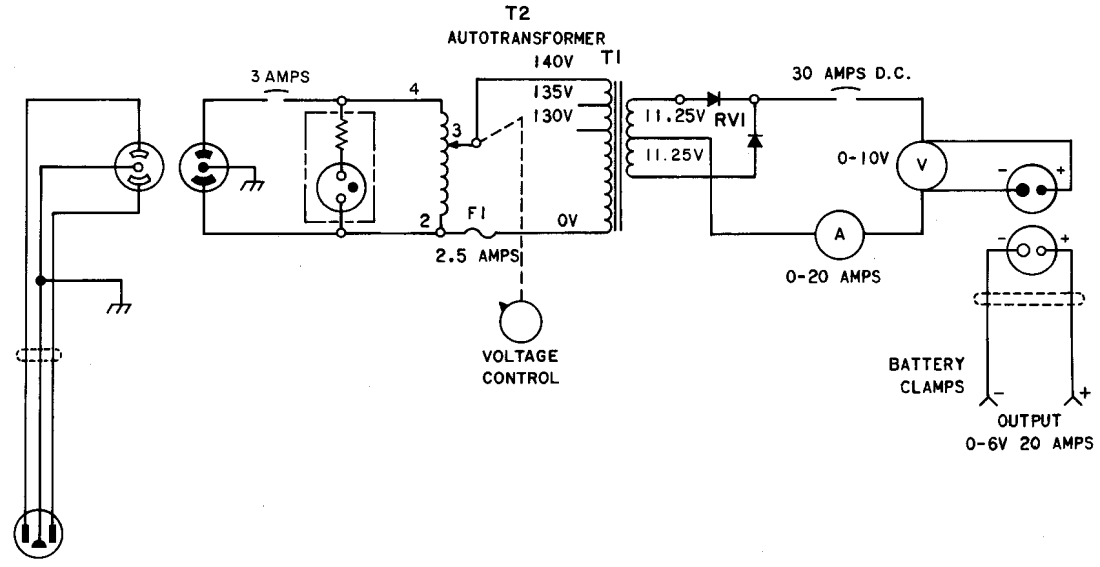

Fig. 4—KS-15687 L1 and L2 Rectifiers—Schematic

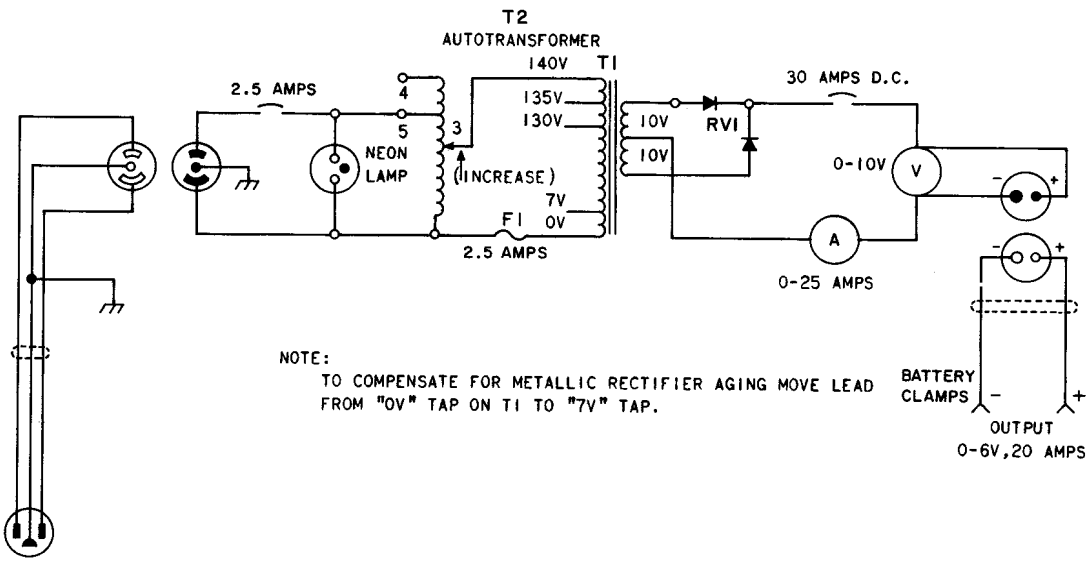

Fig. 5—KS-15687 L3 and L4 Rectifiers—Schematic

2. LIST OF GAUGES

CODE OR SPEC NO.	DESCRIPTION
—	Hydrometer (usually available at battery)
—	Thermometer (usually available at battery)

3. OPERATION

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

(1) If the J86264A rectifier is being used, verify that the rectifier is in the horizontal position with the control panel pointing up to ensure proper cooling.

(2) Verify that the rectifier switch or switches are in the OFF position.

(3) Verify that the autotransformer adjusting knob is rotated fully counterclockwise.

(4) Fasten the rectifier dc output leads somewhere along their length to the battery stand or some other rigid support to prevent the leads from being accidentally disconnected from the battery.

(5) Connect the dc output leads to the rectifier, being careful to observe the proper polarities.

(6) Clamp the rectifier dc output leads to the battery posts, being careful to observe the proper polarities.

Note: A positive reading on the rectifier voltmeter indicates that the proper connections have been made.

3.02 ***Starting:*** To put the rectifiers in service, proceed as follows.

(1) If the KS-15687-type rectifier is being used, connect the ac input leads to the rectifier.

Note: The ac input leads are permanently attached to the J86264A rectifier.

(2) Connect the rectifier ac input leads to the ac receptacle.

(3) Operate the switch of the J86264A rectifier to the ON position, or the INPUT and OUTPUT switches of the KS-15687-type rectifier to the on position.

(4) Adjust the autotransformer until the rectifier produces the desired output voltage and current.

Note: Frequent changes of the autotransformer setting may be necessary during the early stages of the charge to maintain the desired rectifier output voltage and current. The rectifier will maintain a fairly constant output later in the charge with less frequent adjustments.

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

(1) Operate the switch of the J86264A rectifier to the off position, or the INPUT and OUTPUT switches of the KS-15687-type rectifier to the OFF position.

(2) Remove the rectifier ac input leads from the ac receptacle.

(3) Disconnect the rectifier dc output leads from the battery posts.

Note: If further battery charging is not required, disconnect the dc output leads from the rectifier and remove the leads from the battery stand or other rigid support.

4. TROUBLES

4.01 Some of the possible causes of trouble in the rectifier are given as follows. Should any of the possible troubles develop, it is suggested that the possible causes be checked in the order given. ▶If the trouble is not found, check for loose or open connections or short circuits due to foreign matter lying across wiring terminals.◀

TROUBLE	POSSIBLE CAUSE
(a) Rectifier voltmeter does not indicate positive voltage when rectifier is connected to battery (ac input not connected to rectifier).	Battery connections reversed. Loose connection. Open connection. Defective voltmeter.
(b) Rectifier voltmeter indicates low dc output voltage when rectifier is connected to battery and ac input.	Rectifier switch or switches in the off position. Fuse blown. No ac input power. Autotransformer not set properly. Rectifier stack open. T1 or T2 transformers open.
(c) Rectifier dc output voltage very erratic.	Loose connections.
(d) Rectifier overheating.	Output overloaded. Rectifier stack shorted. J86264A rectifier not operating in a horizontal position.

5. CHARGING

5.01 Recharge may be on an ampere-hour basis, in which case it should be 110 percent of the discharge for lead-acid cells. If the amount of discharge is not known, use 100 percent of the 8-hour rated capacity of the cell. Charging should be done in accordance with one of the following methods.

(a) Hold the current approximately constant by making adjustments of the autotransformer for the period of time necessary to give the desired ampere-hour charge.

(b) Charge for a convenient length of time at one rate, calculating the ampere-hours for that charge period; charge at a different rate for a time and calculate the ampere-hours for that period, and so on as convenient. See 5.02.

(c) Leave the autotransformer at a fixed setting and take current readings at 15-minute intervals throughout the charge. Use the average of these readings as the current value when calculating the total ampere-hours. Readings at longer intervals are satisfactory for all or part of the charge if experience indicates that the current changes little between readings. Readings at 15-minute intervals should not be averaged with those taken at longer intervals.

5.02 Reconditioning or the curative charging rate should not exceed the finish rate (see Section 157-601-701) for the battery. On recharge after discharge, charging for the entire period may be at the finish rate or less, but to save time [see 5.01(b)], it may be at a higher rate for the first part of the charge, as described below.

Step 1—Charge at the highest rate (in amperes) of the rectifier, until the ampere-hours yet to be replaced equals the charge rate of the rectifier.

Step 2—Charge for half-hour periods. The rate of the charge during each half-hour period should be two-thirds of the ampere hours yet to be replaced at the start of that period. Continue these half-hour charge periods until the calculated charge rate drops to the finish rate or less.

Step 3—Complete the remainder of the charge at the finish rate.

J86264A Rectifier (210 amperes)

Example 1

The finish rate for a KS-5553 L505 cell is 110 amperes. If the discharge was 655 ampere-hours, the required recharge would be 1.10 X 655 = 720 ampere-hours. This could be 6.55 hours (6 hours and 33 minutes) at the finish rate, but higher rates as covered in 5.01(b) would reduce charging time to 4.21 hours (4 hours and 13 minutes).

720 required

Step 1
720 − 210 = 510, 510 = 210 amps for 2.43 hrs
210 yet required

Step 2
$\frac{210 \times 2}{3} = 140$, 70 = 140 amps for .50 hr
140 yet required

Step 3
$\frac{140 \times 2}{3} = 93$, 140 = 110 amps for 1.28 hrs
0

Total 4.21 hrs
or 4 hrs and 13 mins

Note: This example used on all three steps.

Example 2

The finish rate for a KS-5553 L508 cell is 140 amperes. Recharge for an 835 ampere-hour discharge is 919 ampere-hours.

919 required

Step 1
919 − 210 = 709, 709 = 210 amps for 3.37 hrs
210 yet required

Step 3
$\frac{210 \times 2}{3} = 140$, 210 = 140 amps for 1.50 hrs
0

Total 4.86 hrs
or 4 hrs and 52 mins

Note: Finish rate was reached without using Step 2.

Example 3

The finish rate for a KS-5553 L402 cell is 24 amperes. Recharge for a 120 ampere-hour discharge is 132 ampere-hours.

132 required

Step 2
$\frac{132 \times 2}{3} = 88$, 44 = 88 amps for .50 hr
88 yet required

Step 2
$\frac{88 \times 2}{3} = 58$, 29 = 58 amps for .50 hr
59 yet required

Step 2
$\frac{59 \times 2}{3} = 39$, 19.5 = 39 amps for .50 hr
39.5 yet required

Step 2
$\frac{39.5 \times 2}{3} = 26$, 13 = 26 amps for .50 hr
26.5 yet required

Step 3
$\frac{26.5 \times 2}{3} = 18$, 26.5 = 24 amps for 1.11 hrs
0

Total 3.11 hrs
or 3 hrs and 7 mins

Note: Step 1 could not be used and Step 2 was required four times.

KS-15687 Rectifier (20 amperes)

Example 1

The finish rate for a KS-5361 L150A cell is 10.5 amperes. If the discharge was 90 ampere-hours, the required recharge would be 1.10 X 90 = 99 ampere-hours. This could be 9.43 hours (9 hours and 30 minutes) at the finish rate, but higher rates as covered in 5.01(b) would reduce charging time to 5.73 hours (5 hours and 44 minutes).

99 required

Step 1
99 − 20 = 79, 79 = 20 amps for 3.95 hrs
20 yet required

Step 2
$\frac{20 \times 2}{3} = 13.3$, 6.6 = 13.3 amps for .5 hr
13.4 yet required

Step 3
$\frac{13.3 \times 2}{3} = 8.8$, 13.4 = 10.5 amps for 1.28 hrs
0

Total 5.73 hrs
or 5 hrs and 44 mins

Note: This example used all three steps.

Example 2

The finish rate for a KS-15577 L9 Gould cell is 19 amperes. Recharge for a 160 ampere-hour discharge is 176 ampere-hours.

176 required

Step 1
176 − 20 = 156, 156 = 20 amps for 7.8 hrs
20 yet required

Step 3
$\frac{20 \times 2}{3} = 13.3$, 20 = 19 amps for 1.05 hrs
0

Total 8.85 hrs
or 8 hrs and 51 mins

Note: Finish rate was reached without using Step 2.

5.03 Recharge of cells may, if desired, be on a voltage basis instead of the ampere-hour basis described in 5.01. In such a case, charge until current and specific gravity are constant for three consecutive hourly readings. Then give a boost charge for the number of hours shown in Table A for that voltage. ***Example:*** If cell charging voltage is 2.49, the length of boost should be from 2.4 hours to 3.3 hours. At temperatures above 95°F, the minimum length of boost charge is preferable; at temperatures below 65°F, the maximum length of boost charge is preferable.

5.04 Conditioning charges may be by the ampere-hour method described in 5.01 or by the voltage method described in 5.03. Since the required amount of reconditioning depends on the condition of the cell, the supervisor may wish to modify these charges to either increase or decrease the amount of charge. The use of this charger for small special charges on two cells should be made in accordance with local instructions.

6. CHARGE RECORDS

6.01 Record float or open-circuit voltage and corrected specific gravity readings before and after each charge. After charge, specific gravity readings should be taken 2 weeks after completion of the charge for lead-antimony cells and 6 weeks after completion of the charge for lead-calcium cells.

TABLE A

BOOST CHARGE TIME

VOLTS PER CELL	HOURS	
	MAX	MIN
2.50	2.7	2.1
2.49	3.3	2.4
2.48	3.6	2.7
2.47	4.2	3.3
2.46	4.8	3.6
2.45	5.7	4.2
2.44	6.6	5.1
2.43	7.5	5.7
2.42	8.7	6.6
2.41	10.2	7.8
2.40	11.7	9.0
2.39	13.5	10.5
2.38	15.6	12.0
2.37	18.0	14.1
2.36	20.7	16.5
2.35	24.0	19.2
2.34	27.6	22.2
2.33	32.1	25.8
2.32	37.2	29.7
2.31	43.2	34.5
2.30	49.2	39.6
2.29	57.5	46.5
2.28	67.2	54.0
2.27	77.4	61.2
2.26	90.0	72.3
2.25	104.0	84.0
2.24	122.0	97.0
2.23	141.0	113.0
2.22	162.0	132.0
2.21	187.0	152.0
2.20	216.0	176.0

Note: Where lead-calcium cells are equipped with electrolyte sampling tubes, readings of specific gravity may be taken 2 days after the charge.

6.02 When charging on an ampere-hour basis, as described in 5.01 and 5.02, record all time and current readings that are taken so that the amount of charge may be determined in ampere-hours. If known, the amount of discharge should also be recorded in ampere-hours.

6.03 When charging on a voltage basis, as described in 5.03, record the time required for the voltage to stabilize, the value of the stabilized voltage, the amount of current being drawn, and the length of the boost charge given after voltage stabilization.

6.04 Form E-2006 or E-3591 is suggested for these charge records but the use of blank space on any available battery form is acceptable.