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TM 11-965

WAR DEPARTMENT TECHNICAL MANUAL

U.S. Dept. of Army



RECTIFIER POWER UNIT PP-34/MSM

WAR DEPARTMENT *MARCH 1944*

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TECHNICAL MANUAL

RECTIFIER POWER UNIT PP-34/MSM

CHANGES No. 1

WAR DEPARTMENT,
WASHINGTON 25, D. C., 16 October 1944.

TM 11-965, March 1944, is changed as follows:

Section IV

MAINTENANCE

Note. Failure or unsatisfactory performance of equipment will be reported on W. D., A. G. O. Form No. 468. If this form is not available, see TM 38-250.

11. INSPECTIONS. The rectifier should * * * the rectifier disks. Keep the battery * * * to prevent corrosion.

11. 1. LUBRICATION. (Added.) The only parts of Rectifier Power Unit PP-34/MSM which require lubrication are the motor bearings of the ventilating fan.

a. The lubricants required are as follows:

Symbol	*Standard nomenclature*	*Specification*
PS_____	Oil, lubricating preservative, special.	U. S. Army 2-120.
OE 10___	Oil, engine SAE 10_____	U. S. Army 2-104B.
OE 30___	Oil, engine SAE 30_____	U. S. Army 2-104B.

b. Use PS in temperatures below 0° F.; OE 10 in temperatures between 0° F. and 32° F.; and OE 30 in temperatures above 32° F.

c. Apply 4 to 6 drops of oil after every 1,024 hours of operation or every 6 months, whichever occurs first. The oil holes are indicated by the word *oil*, with an arrow pointing to the hole.

Note.—Be sure to remove the fan motor housing to reach the spring cap oiler located at the rear bearing of the motor.

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18. LIST OF MANUFACTURERS. Rescinded.

[A. G. 300.7 (11 Aug 44).]

BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,
Chief of Staff.

OFFICIAL:

J. A. ULIO,
Major General,
The Adjutant General.

DISTRIBUTION:

As prescribed in paragraph 9a, FM 21-6: Armies (Sig) (5); Sv C (Sig) (5); Depts (Sig) (5); Def C (Sig) (2); D (2), IC 11 (5); Tech Sv (2); Arm & Sv Boards (2); Posts, Camps & Stas (2); ROTC (5); Sp Sv Schs (10); T of Opns (5); Base C (5); Sig C Dep (2); Gen Oversea, SOS Dep (Sig Sec) (2); Sig C Labs (2); Sig C Rep Shs (2); PE (Sig) (2).

IC 11: T/O & E 11-7, 11-16, 11-47, 11-57, 11-75, 11-107, 11-127, 11-537S, 11-587, 11-617.

For explanation of symbols, see FM 21-6.

AGO 115C

U. S. GOVERNMENT PRINTING OFFICE: 1944

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WAR DEPARTMENT TECHNICAL MANUAL

TM 11-965

RECTIFIER POWER UNIT PP-34/MSM



WAR DEPARTMENT *MARCH 1944*

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WAR DEPARTMENT,
WASHINGTON 25, D. C., March 1944.

TM 11-965, War Department Technical Manual, Rectifier Power Unit PP-34/MSM, is published for the information and guidance of all concerned.

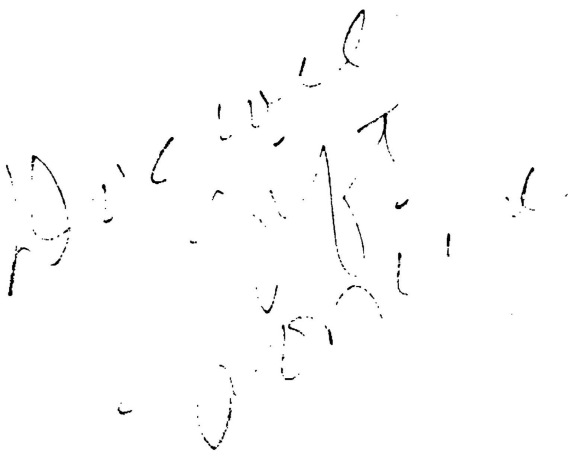
[A.G. 300.7 (11 Jan. 44).]

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G. C. MARSHALL,
Chief of Staff.

OFFICIAL:
J. A. ULIO,
Major General,
The Adjutant General.

DISTRIBUTION:
IC 11(10).
(For explanation of symbols see FM 21-6.)



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DESTRUCTION NOTICE

WHY —To prevent the enemy from using or salvaging this equipment for his benefit.

WHEN—When ordered by your commander.

HOW —1. Smash—Use sledges, axes, handaxes, pickaxes, hammers, crowbars, heavy tools.

2. Cut—Use axes, handaxes, machetes.

3. Burn—Use gasoline, kerosene, oil, flame throwers, incendiary grenades.

4. Explosives—Use fire arms, grenades, TNT.

5. Disposal—Bury in slit trenches, foxholes, other holes. Throw in streams. Scatter.

USE ANYTHING IMMEDIATELY AVAILABLE FOR DESTRUCTION OF THIS EQUIPMENT.

WHAT—1. Smash—Rectifier stacks, transformers, and all other parts.

2. Burn—Technical manuals.

3. Bury or scatter—Any or all of the above pieces after destroying their usefulness.

DESTROY EVERYTHING.

SAFETY NOTICE

Severe shock may result from contact with voltages within this equipment. Always be sure the a-c circuit-breaker is in the OFF position before removing the top cover. Gas given off by batteries being charged is highly inflammable. Do not come near equipment with matches, flames, lighted cigarettes, or any inflammable material.

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Section I
DESCRIPTION

1. GENERAL. Rectifier Power Unit PP-34/MSM converts 100- to 120-volt, single phase, 50- to 60-cycle, a-c power to 30 volts d-c power for charging lead acid-type storage batteries of one to twelve cells. Two copies of this technical manual are packed with each rectifier.

2. WEIGHT AND DIMENSIONS. The rectifier weighs 160 pounds and is 13½ by 28½ by 16 inches.

3. DESCRIPTION. The rectifier consists of three sections mounted in an angle-iron frame and covered with 16-gauge sheet-steel panels. A front view of the rectifier is shown in figure 1. All controls are mounted on the center panel. The controls consist of an a-c circuit-breaker, a d-c circuit-breaker, and a current throwover switch located in the center of the panel. The switch transfers the load from the internal output connections to the panel output connections located below the tap switches and identified as NEGATIVE OUTPUT (black) and POSITIVE OUTPUT (red) (fig. 1). On the control panel are a pilot light, which indicates when the equipment is in operation, and two tap-changing switches, FINE and COARSE (fig. 1). The rectifier is entirely self-contained and need only be connected to the a-c source by the cord and plug provided.

4. POWER.

a. Input. The maximum power input is approximately 3,000 watts with a full load on the d-c output. The input power source is 100- to 120-volt, single-phase, 50- to 60-cycle alternating current.

b. Output. The maximum power output is 30 volts, 50 amperes direct current at temperature minus 40° C to plus 40° C (104° F), and 40 amperes at 55° C (131° F).

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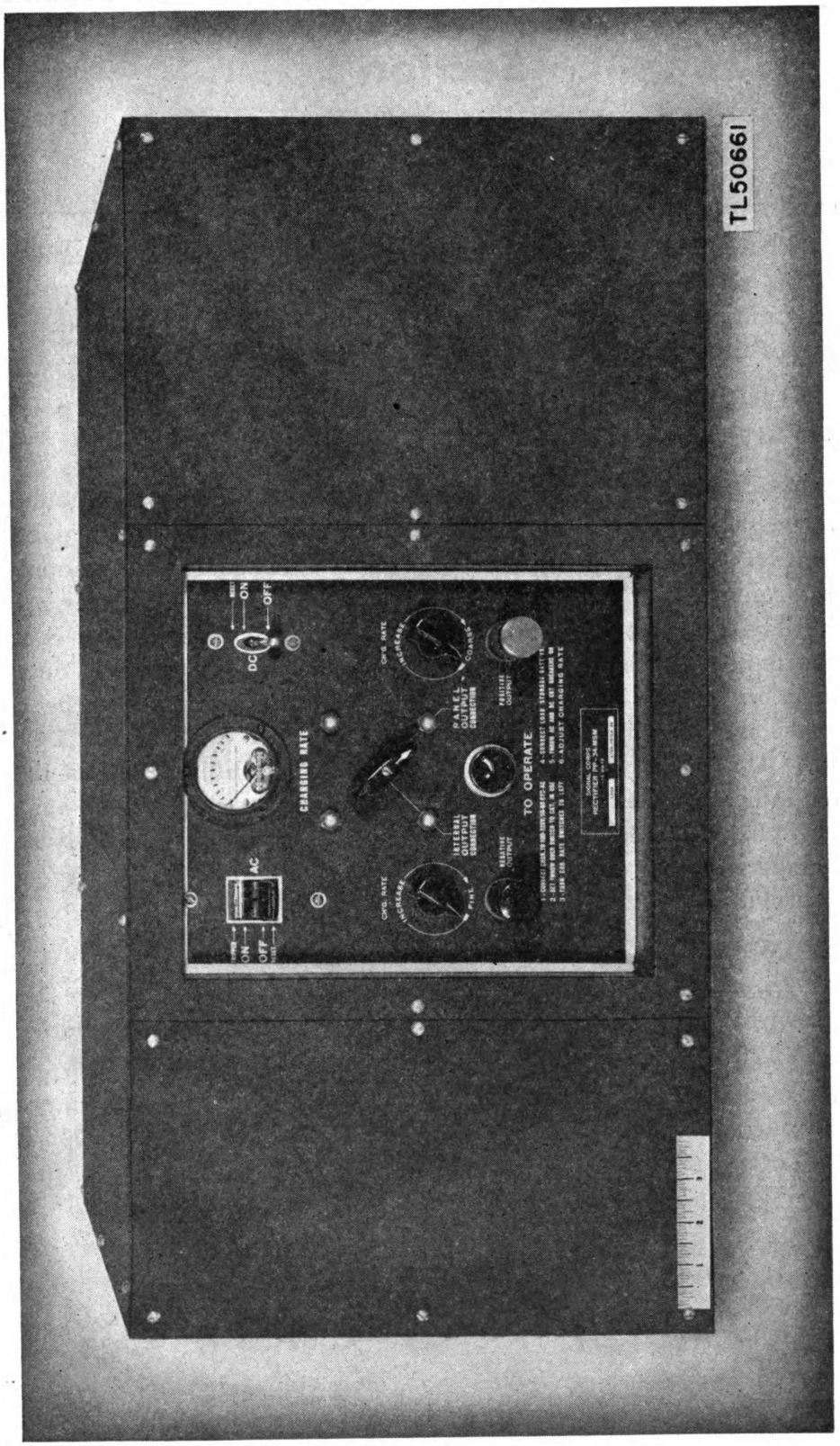


Figure 1. Rectifier Power Unit PP-34/MSM, front view.

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Section II
INSTALLATION AND OPERATION

5. INSTALLATION. The rectifier is ready for operation as soon as it is unpacked. In cases where a permanent installation is to be made, suitable mounting holes may be drilled through the bottom panel and through the 1 by 1 by ⅛-inch angle-iron frame. Air enters at the right-hand end of the equipment. It is drawn through the equipment and expelled at the left-hand end by the ventilating fan. Before connecting the equipment to the a-c source, be sure there are no loose or broken parts.

CAUTION: The rectifier should be placed so that the grillwork on each end will be *at least* 12 inches away from any wall or other fixed object that might impede the flow of air. Do not place rectifier directly over battery. Battery fumes are corrosive.

6. CONNECTIONS.

a. Connect the rectifier first to the a-c source. Make sure the a-c circuit-breaker and the d-c circuit-breaker are in the OFF position.

b. When the rectifier is to be permanently connected to a storage-battery load, it is necessary to bring the d-c cables through the knockout provided in the bottom of the rectifier to the + and — INTERNAL OUTPUT terminals (fig. 2), located on the panel strip on the right-hand side of the transformer section. The current throwover switch, located at the center of the control panel, should be set at INTERNAL OUTPUT CONNECTION (fig. 1).

c. When the rectifier is used as a temporary charging installation, connect the d-c cables to the NEGATIVE OUTPUT binding post (black), and the POSITIVE OUTPUT binding post (red). Be sure the cable with the red insulated clip is connected to the positive binding post, and the cable with the black insulated clip is connected to the negative binding post on the panel of the rectifier. Turn the current throwover switch to PANEL OUTPUT CONNECTION (fig. 1).

7. OPERATION.

a. The rectifier is ready for operation when it is installed and connected as described in paragraphs 5 and 6. The controls perform the same functions when either the permanent internal connections are used or when the panel output connections are used.

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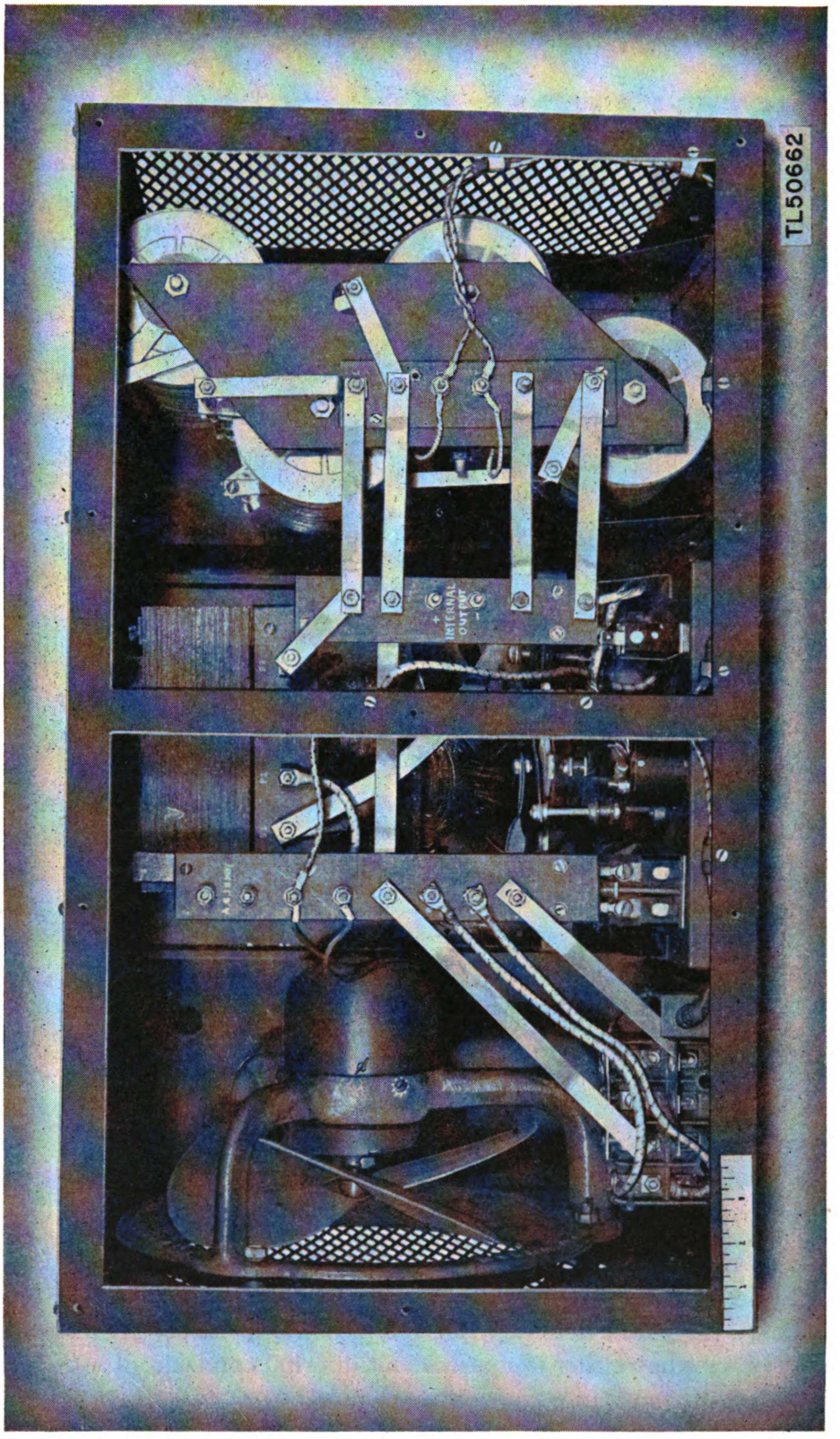


Figure 2. Rectifier Power Unit PP-34/MSM, top view, cover removed.

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CAUTION: Be sure the charge rate tap switches are turned as far as possible to the left.

b. Connect the battery, or batteries, to the d-c cables. Observe the correct polarity. The a-c circuit-breaker should be turned to ON. Then turn the d-c circuit-breaker to ON. The charging rate can then be adjusted by turning the CH'G. RATE COARSE tap switch (fig. 1) to the right. This will give the coarse adjustment of the charging rate, which should be a few amperes lower than the final rate desired. The fine adjustment can then be made by the CH'G. RATE FINE tap switch (fig. 1). The charging rate ammeter (fig. 1) indicates the amount of direct current supplied to the storage battery load by the rectifier.

CAUTION: Do not exceed the range of the ammeter.

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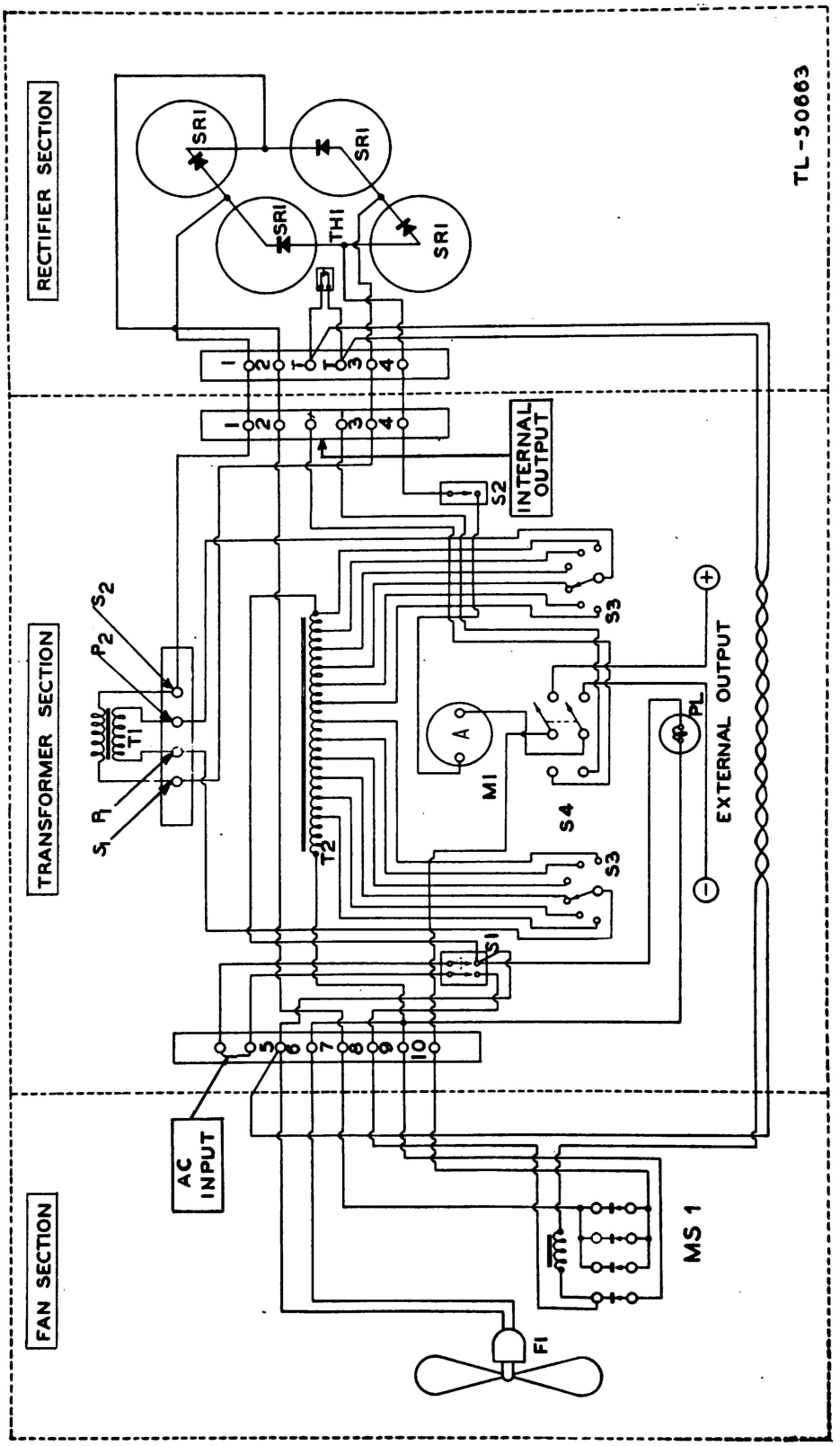


Figure 3. Rectifier Power Unit PP-34/MSM, schematic diagram.

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Section III
FUNCTIONING OF PARTS

8. CIRCUIT. The schematic diagram of Rectifier Power Unit PP-34/MSM is shown in figure 3.

9. TRANSFORMER AND AUTOTRANSFORMER. Autotransformer T2 is connected to the a-c source through the a-c circuit-breaker S1 and through tap switches S3. The winding of the autotransformer is tapped at 20 points, providing 10 coarse and 10 fine adjustments for regulating the charging rate. Transformer T1 provides the power at the correct voltage for the selenium rectifier.

10. RECTIFIER. Rectifier SR1 consists of four rectifier stacks, made up of selenium rectifying disks. They are assembled so that current can flow readily in one direction, but practically not at all in the other direction. The rectifier stacks are connected together in the form of a diamond, commonly called a bridge circuit, giving full-wave rectification. The rectifier changes the alternating current to pulsating direct current for charging storage batteries. The rectifier stacks are protected against overheating by a thermal switch TH1 (fig. 3) which opens the circuit-breaker.

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Section IV
MAINTENANCE

11. INSPECTIONS. The rectifier should give little trouble when installed and checked as directed. Remove the accumulated dust and dirt frequently. Use dry compressed air or a soft, long-bristled brush to remove the foreign matter from the rectifier disks. The only moving part of the rectifier is the ventilating fan, which should be lubricated once a month at the points indicated on the fan motor housing. Be sure to remove the fan motor housing to reach the spring cap oiler located at the rear bearing of the motor. Keep the battery clips on the d-c cables clean. Apply a light coating of grease or oil to the jaws of the clips to prevent corrosion.

12. REMOVAL OF PARTS. In case of failure of any of the parts, throw the a-c switch and the d-c switch to OFF. Disconnect the rectifier from the power source and the battery or batteries being charged; then remove the top cover. Disconnect the bus-bar connecting the three sections of the rectifier from the terminal strips (fig. 2). The fasteners holding the center panel may then be removed and the entire transformer and control assembly removed from the rectifier frame as a drawer. The entire unit can be replaced from the spare parts group, or any component part which has failed can be replaced by itself. The rectifier, or right-hand section, can also be removed as a drawer, by removing the front panel fasteners. The magnetic contactor is mounted on the left-hand panel, which may be removed in case it is necessary. Fuses are not used in the Rectifier Power Unit PP-34/MSM, since the a-c and d-c circuit-breakers furnish the necessary protection against overloads.

13. PROCEDURE IN CASE OF FAILURE. Be sure the power cord is connected to the a-c source and the pilot lamp is lighted. Check all bus-bar connections to be sure they are securely fastened.

Check the following:

a. Be sure the a-c circuit-breaker is reset to ON.

b. The d-c circuit-breaker must be reset to ON.

c. Be sure the current throwover switch is set at the proper position for internal output or panel output connections.

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14. TESTING PROCEDURE.

a. An ohmmeter may be employed for continuity testing. When using an ohmmeter, it is important that all sources of power be disconnected from the equipment to be tested. Resistance values across transformer T1 and autotransformer T2 (fig. 3) are small, ranging from a fraction of an ohm to 2 or 3 ohms. Resistance values across the selenium rectifier stacks will be a few ohms or several thousand ohms, depending on the polarity of the test leads from the ohmmeter, as applied to the terminals of the rectifier stack.

b. The following data is useful in checking the rectifier circuits. All measurements were taken at the secondary winding, S_1 and S_2, of power transformer T1 (fig. 3). Voltage readings in the following table were taken with a 115-volt input and no load on the equipment. Tap switches S3 (fig. 3) are set at extreme counterclockwise position for initial reading, and are rotated clockwise for successive readings.

TABLE I — VOLTAGE READINGS

Condition		Output	Condition		Output
COARSE switch step No.	Input voltage	a-c (volts)	FINE switch step No.	Input voltage	a-c (volts)
1	115	3	1	115	0.25
2	115	6	2	115	0.5
3	115	9	3	115	0.75
4	115	12	4	115	1.0
5	115	15	5	115	1.25
6	115	18	6	115	1.5
7	115	21	7	115	1.75
8	115	24	8	115	2.0
9	115	28	9	115	2.25
10	115	31.5	10	115	2.5

15. REPLACING PARTS. Be sure that all solder connections are secure. Be sure that no solder has dropped on any of the electrical components. Hot solder on the selenium rectifier disks will damage the disks, and cause failure of the rectifier. *All bus-bar connections must be tight.*

16. MOISTUREPROOFING AND FUNGIPROOFING.

a. General. Communication failures commonly occur when Signal Corps equipment is operated in tropical areas where temperature

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and relative humidity are extremely high. The following problems are typical.

(1) Resistors and capacitors fail.

(2) Electrolytic action takes place in coils, chokes, transformer windings, etc., causing eventual break-down.

(3) Hook-up wire and cable insulation break-down. Fungus growth accelerates deterioration.

(4) Moisture forms electrical leakage paths on terminal boards and insulating strips, causing flashovers and crosstalk.

(5) Moisture provides leakage paths between battery terminals.

b. Treatment. A moistureproofing and fungiproofing treatment has been devised which, if properly applied, provides a reasonable degree of protection against fungus growth, insects, corrosion, salt spray, and moisture. The treatment involves the use of a moisture- and fungi-resistant varnish applied by means of a spray gun. A brief description of the method of application follows.

(1) All repairs and adjustments necessary for the proper operation of the equipment are made.

(2) Equipment to be processed is thoroughly cleaned of all dirt, dust, rust, fungus, oil, grease, etc.

(3) Equipment is partially disassembled and certain points, such as relay contacts, open switches, air capacitors, sockets, bearings, etc., are covered with masking tape.

(4) Equipment is thoroughly dried by heat to expel moisture which the circuit elements have absorbed.

(5) All circuit elements and all parts of the equipment are sprayed or painted with three coats of moistureproofing and fungiproofing varnish.

(6) The equipment is given a final operational check. Radio sets receive a 24- to 36-hour aging period, when time permits, before alignment.

c. Step by Step Instructions.

(1) DISASSEMBLY.

(a) Remove 11 screws from top of unit to remove cover.

(b) Remove all bus-bar and leads by removing the hexagonal nuts from positions 1, 2, 3, 4, 5, 6, 7, 8, 9, and 10 on bakelite strip.

1. When installed in radio repair trucks, remove the battery leads connected to the panel output connections. Remove a-c input leads from bakelite strip.

(c) Remove 8 screws from center panel and 6 screws from right-hand panel.

(d) Loosen hexagonal nuts on positions 1, 2, 3, and 4 of strip in recti-

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fier section and remove bus-bar from transformer section. Remove transformer section and rectifier section.

(2) MASKING.

(a) Mask nuts and bolts on bakelite terminal strips.

(b) Mask silver-plated portions of bus-bar and terminals on leads.

(c) Mask terminal and silver-soldered portion of bus-bar connected to transformer section.

(d) Mask contactor and silver-soldered portion of bus-bar in fan section.

(3) DRYING. The unit is now ready for baking. Place unit in oven and bake for approximately 2 to 3 hours. DO NOT EXCEED 160° F.

(4) VARNISHING. Upon completion of baking, remove unit and use spray method. Spray inside of whole cabinet, transformer section and rectifier section. Apply three coats of moistureproofing and fungiproofing varnish. When varnish has dried (if varnish is tacky it is not dry), remove masking tape.

(5) REASSEMBLY. Reassemble the unit and test operation.

(6) MARKING. Mark MFP and date of treatment with paint or other means not easily removed.

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Section V
SUPPLEMENTARY DATA

17. TABLE OF REPLACEMENT PARTS.

Ref. Symbol	Quantity in equipment	Signal Corps stock No.	Name of part and description	Function	Mfr's code and type No.	Contr's drawing or part No.
	1		TRANSFORMER AND INSTRUMENT SUB-ASSEMBLY: to fit into housing complete and ready for operation consists of the following parts: 1 Ammeter, M1. 1 A-c circuit-breaker, S1. 1 D-c circuit-breaker, S2. 1 Pilot lamp, PL. 1 Transformer unit, T1 and T2. 1 Current throwover switch, S4. 2 Tap switches, S3. 1 Terminal, output, positive. 1 Terminal, output, negative.	Voltage transformation and circuit control.	1	RCP-24
F1	1		FAN: Motor-driven, single-phase, 110-120-v, 50-60-cycles.	Forced ventilation for cooling rectifier stacks.	2 Model 41	RCP-F-1
M1	1		AMMETER: d-c, 0-50-amp, 2", flush mounting.	Indicates charging rate.	3 Model 17-3	RCP-M1
	1		METER GLASS: 2", for above meter.	Replacement for meter glass in case of breakage.	3	

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17. TABLE OF REPLACEMENT PARTS—(cont'd).

Ref. Symbol	Quantity in equipment	Signal Corps stock No.	Name of part and description	Function	Mfr's code and type No.	Contr's drawing or part No.
	1		CABLE: charging, 12' long, No. 6 AWG, complete with No. 21 clip and No. 23 insulator, red.	Connection from panel to positive terminal of battery.	1, 4	
	1		CABLE: charging, 12' long, No. 6 AWG, complete with No. 21 clip and No. 23 insulator, black.	Connection from panel to negative terminal at battery.	1, 4	
	1		CABLE: a-c power, 6' long, No. 10 AWG, complete with No. 7436 plug.	Connects rectifier with a-c source.	1, 5	
MS1	1		MAGNETIC CONTACTOR: Bulletin 702.	Opens and closes a-c and d-c circuits when equipment is turned on and off.	6	RCP-24 MS1
S1	1		CIRCUIT-BREAKER: a-c, 110-v, 25-amp. SK-3375.	Protects a-c circuit and acts as ON-OFF control.	7	RCP-24 S1
S2	1		CIRCUIT-BREAKER: d-c, 32-v, 50-amp. Class 9300-50B.	Protects d-c circuit.	7	RCP-24 S2
PL	1		LAMP: pilot, candelabra base, 110-v.	When lighted indicates equipment is turned on.		RCP-24 PL
TH1	1		THERMOSTAT: 150-v, 15-amp., a-c.	Thermal protection for rectifier elements.	8	RCP-24 TH1

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17. TABLE OF REPLACEMENT PARTS—(cont'd).

Ref. Symbol	Quantity in equipment	Signal Corps stock No.	Name of part and description	Function	Mfr's code and type No.	Contr's drawing or part No.
T1 and T2	1		TRANSFORMER UNIT: consisting of tapped autotransformer, 110-120-v, single-phase, 50-60-cycles, and power transformer.	Furnishes a-c voltage in correct values for selenium rectifier.	9 7116A, 7116B	RCP-24 T1 and T2
S3	2		TAP SWITCHES: 150-v, 15-amp, a-c, 212-10.	Adjusts fine and coarse charging rate.	10	RCP-24 S3
S4	1		CURRENT THROWOVER SWITCH.	Transfers charging connections from internal to panel output.	11 Type P.	RCP-24 S4
SR1	4		SELENIUM RECTIFIER STACK.	Changes a-c current to d-c current.	12 6RS-13H10	RCP-24 SR1
	1		*Rectifier subassembly:* consists of the following: 4 selenium rectifier stacks, SR1. 1 Thermostat, TH1.	Changes a-c current to d-c current. Fits into cabinet, complete and ready for operation.	1	RCP-24
	54		10/32 x ¼" SEMS: fasteners.	Holds sheet-steel panels to angle-iron frame.	13	
	1		BATTERY CLIP: positive No. 21.	Connects d-c cable to battery.	4	
	1		BATTERY CLIP: negative No. 21.	Connects d-c cable to battery.	4	

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18. LIST OF MANUFACTURERS.

Code	*Name*	*Address*
1	Radio Controls, Inc.	New York, N. Y.
2	Ilg Electric Ventilating Co.	Chicago, Ill.
3	Burton Rogers Co.	Boston, Mass.
4	Mueller Electric Co.	Cleveland, Ohio
5	Harvey Hubbell, Inc.	Bridgeport, Conn.
6	Allen Bradley Co.	Milwaukee, Wis.
7	Square D Company	Detroit, Mich.
8	Curtiss Development & Mfg. Co.	Milwaukee, Wis.
9	New York Transformer Co.	New York, N. Y.
10	Ohmite Mfg. Co.	Chicago, Ill.
11	Bruno H. Ahlers	Woodhaven, L. I., N. Y.
12	General Electric Co.	Bridgeport, Conn.
13	Shakeproof, Inc.	Chicago, Ill.

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