TM 11-2648

WAR DEPARTMENT TECHNICAL MANUAL

VIBRATOR PACK
PP-68/U

RESTRICTED. DISSEMINATION OF RESTRICTED MATTER No person is entitled solely by virtue of his grade or position to knowledge or possession of classified matter. Such matter is entrusted only to those individuals whose official duties require such knowledge or possession. (See also paragraph 23b, AR 380-5, 15 March 1944.)

WAR DEPARTMENT *9 JANUARY 1945*

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WAR DEPARTMENT,
WASHINGTON 25, D. C., 9 January 1945

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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 firearms, grenades, TNT.

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

USE ANYTHING IMMEDIATELY AVAILABLE FOR DESTRUCTION OF THIS EQUIPMENT.

WHAT—1. Smash—Vibrator unit, transformer, sockets, battery clips, switches, panel, chassis, cover, capacitors, resistors, etc.

2. Cut —All wiring in electrical circuits, battery cable, etc.

3. Burn —All instruction books, circuit diagrams, insulation, etc.

4. Bend —Chassis, cover, switch levers, vibrator unit prongs, etc.

5. Bury or scatter—All remaining parts of equipment.

DESTROY EVERYTHING

SAFETY NOTICE

Voltages as high as 142 volts alternating current are present at the output of Vibrator Pack PP-68/U when no load is present. This voltage is dangerous to life.

Do not change vibrator units or make adjustments inside the set with the ON-OFF switch turned to the ON position.

When making voltage checks in the output circuit of this equipment, always have present another person capable of rendering aid. Keep one hand in your pocket while making high-voltage measurements. This precaution will prevent touching the electrical circuit with more than one part of the body at one time.

When servicing the equipment, except in making voltage measurements, always remove the battery clips from the battery terminals. Shorting the storage battery will cause a flash and severe burns.

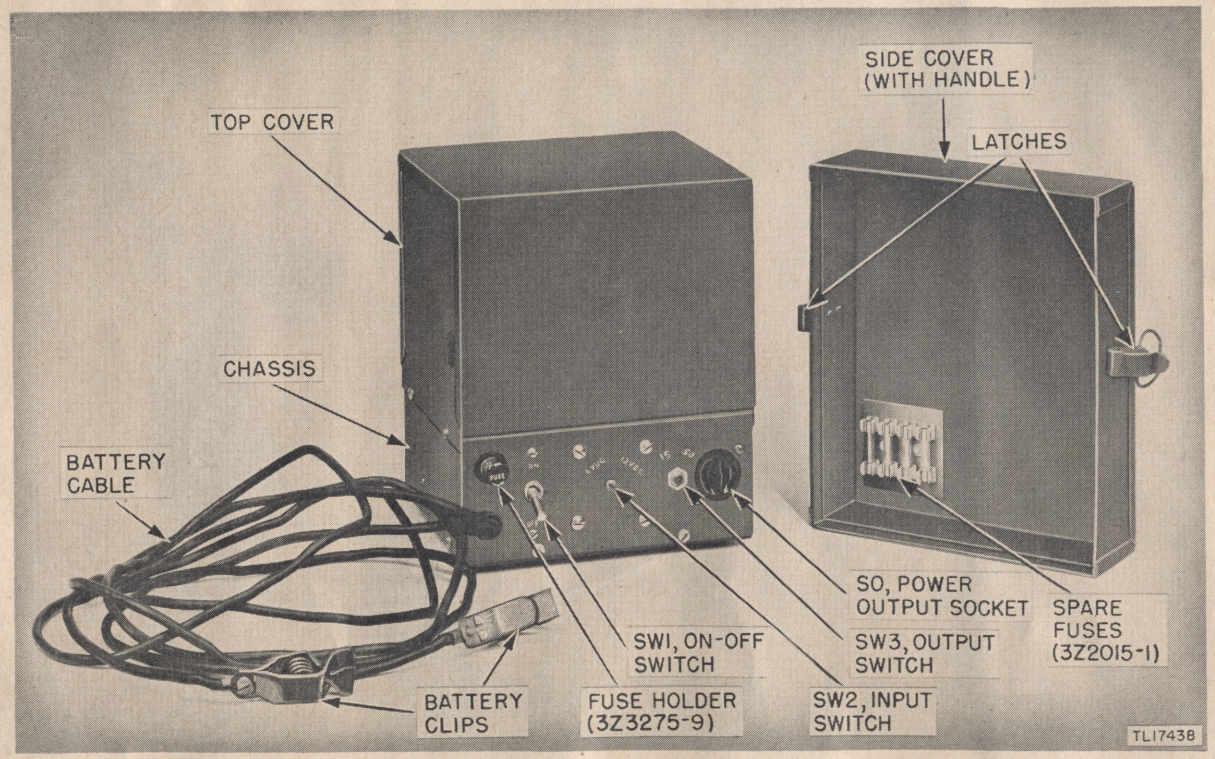

Figure 1. Vibrator Pack PP-68/U, semi-assembled view.

PART ONE
INTRODUCTION

SECTION I

DESCRIPTION OF VIBRATOR PACK PP–68/U

1. GENERAL.

Vibrator Pack PP–68/U (fig. 1) is a portable, vibrator type power supply. It operates with a 6- or 12-volt storage battery source and supplies 110-volt, 60-cycle alternating current to Tube Tester I–177 which is a part of Test Set I–56K. The vibrator pack may be used to supply input power not exceeding 50 watts to other test equipment requiring 110-volt, 60-cycle alternating current.

2. TECHNICAL DATA.

Input to Vibrator Pack PP–68/U is supplied either by a 6-volt or a 12-volt storage battery. Output voltage is 105 to 115 volts for loads of 15 to 50 watts. The following table gives input voltage, input current, output voltage, and output power:

Input voltage (d-c volts)	*Input current (d-c amperes)*	*Output voltage (a-c volts)*	*Output power (watts)*
6	4.0	105	15
6	11.25	105	50
12	2.0	105	15
12	5.25	115	50

3. TABLE OF COMPONENTS.

Vibrator Pack PP–68/U is 8-¾ inches high, 8-⅜ inches wide, 9-⅜ inches deep, and weighs 22 pounds (fig. 4). Major components are:

Component	*Required Number*	*Weight*	
Chassis	1	14 lb	
Bottom plate	1		14 oz
Top cover	1	2 lb	12 oz
Side cover (with handle)	1	2 lb	11 oz
Vibrator	2 (1 spare)	1 lb	8 oz
TM 11–2648	2		

4. PACKAGING DATA.

Each Vibrator Pack PP–68/U is packed in an individual cardboard carton 12-½ inches high, 10 inches wide, and 10 inches deep. The weight of each packed unit is 24-½ pounds. The spare vibrator is wrapped in corrugated cardboard and packed in the same carton. The battery cable is wound in large coils to fit between the vibrator pack and its cover.

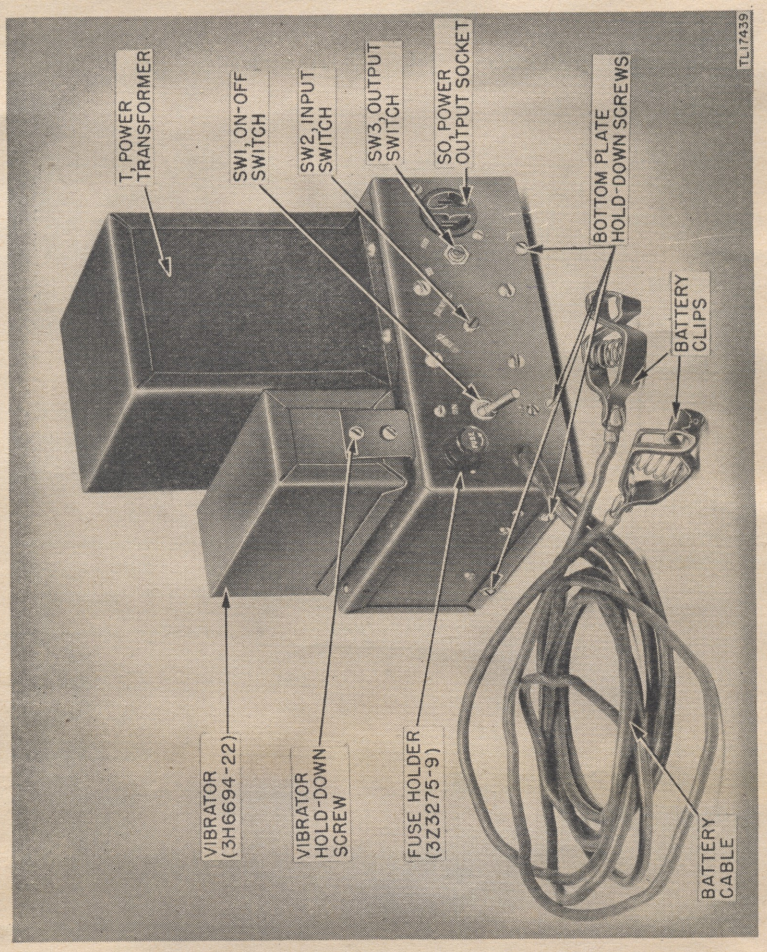

Figure 2. Vibrator Pack PP–68/U, top cover removed.

5. DESCRIPTION OF MAJOR COMPONENTS.

a. Chassis Assembly. The chassis assembly consists of a steel-formed housing. Mounted on top of the housing (fig. 2) are the output transformer T, the vibrator unit, and a six-prong socket for the vibrator unit. The vibrator unit is encased in a metal box which plugs into the socket and is held in place by two screws

which are mounted in steel angles welded to the chassis. Mounted on the front of the chassis assembly are the output receptacle SO, the ON-OFF switch SWI, the input switch SW2, the output switch SW3, the fuse post with a 15-ampere fuse F, and a 6-foot, 2-wire battery cable terminating in two battery clips. Mounted inside the chassis (fig. 3) are a 0.25-mf capacitor C1, a 0.5-mf capacitor C2, a 2.0-mf capacitor C3, a 10-ohm resistor R1, and a 10-ohm resistor R2.

b. Cover Plates. The cover plate on the bottom of the chassis assembly is held in place by eight 6/32 screws. The top cover is a steel housing and it is fastened to the chassis by four 6/32 screws. The side cover is attached to the chassis assembly and top cover by two catch fasteners (fig. 4). It has a steel handle, which is used for carrying the vibrator pack. On the outside of the side cover is the nameplate; inside is a fuse mounting with four spare fuses.

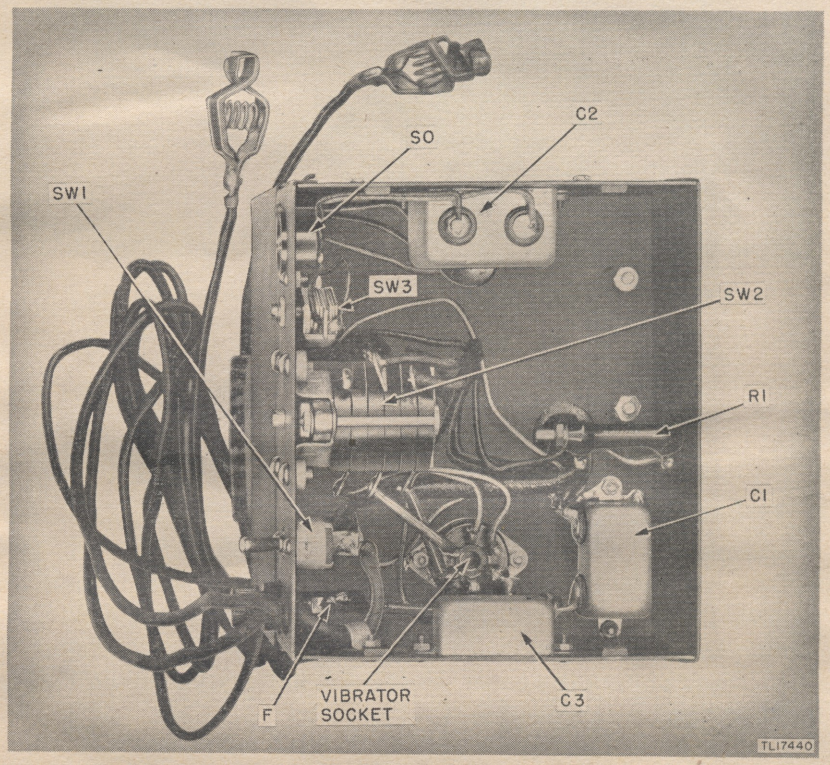

Figure 3. Vibrator Pack PP-68/U, bottom view, cover plate removed.

(Note: C2 and C3 are reversed.)

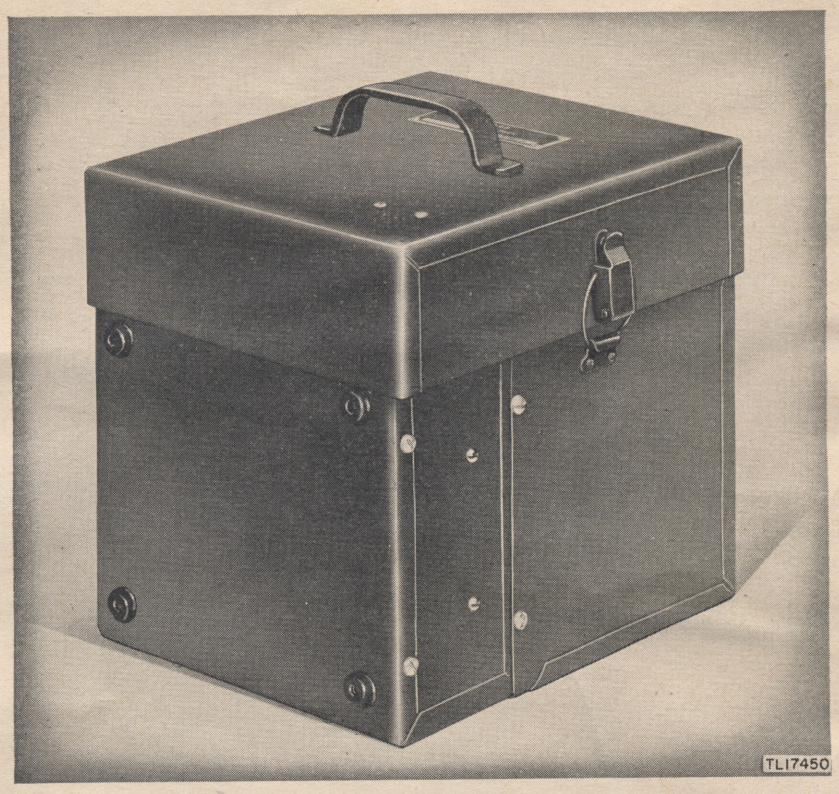

Figure 4. Vibrator Pack PP–68/U, assembled for carrying.

SECTION II

INSTALLATION

6. UNPACKING AND CHECKING.

a. Unpacking. Remove Vibrator Pack PP–68/U from the cardboard carton. Be careful not to scratch the surface or damage protruding parts and controls. Remove the corrugated cardboard protecting the spare vibrator. Remove the side cover by releasing the latches and pulling the cover. Uncoil the battery cable and free the battery clips.

b. Checking. Check the components against the master packing slip. Remove the four 6/32 screws which hold the top cover of the vibrator pack in place and inspect the vibrator. Make sure it is seated firmly in its socket. Replace the top cover and screws. Visually check the condition of the fuse F.

7. CONNECTIONS.

Before making any connections make sure that ON-OFF switch SW1 on the front of the chassis assembly is turned to OFF *and switch SW2 is in the 6- or 12-volt position depending on the battery voltage being used.* Connect the battery clips on the end of the battery cable to the terminals of the storage battery. Make sure the clips make good contact. Plug the a-c power cord of Tube Tester I–177 into the output receptacle SO on the front of the chassis assembly of the vibrator pack.

PART TWO
OPERATING INSTRUCTIONS

NOTE: For information on destroying the equipment to prevent enemy use, refer to the destruction notice at the front of the manual.

SECTION III

CONTROLS AND THEIR USE

8. CONTROLS AND THEIR USE (fig. 2).

The functions of the three switches which constitute the controls of Vibrator Pack PP–68/U are:

a. ON-OFF Switch. The ON-OFF switch SW1 controls the application of battery voltage to the vibrator pack.

b. Input Switch. The input switch SW2 makes the proper circuit changes in the vibrator pack to permit use of either a 6-volt or a 12-volt storage battery as a source of power. *The switch must be in the 6VDC position when a 6-volt storage battery is used, and in the 12VDC position when a 12-volt battery is used.*

c. Output Switch. The output switch SW3 controls the power output of the vibrator pack. This switch is turned to the 15-watt position when the vibrator powers low-wattage test equipment; to the 50-watt position when the vibrator powers high-wattage test equipment.

SECTION IV

OPERATION

9. OPERATION.

After the vibrator pack has been installed as described in section II, put it into operation by following the procedure below:

a. 6-volt Input. (1) INPUT SWITCH SW2. Using a screwdriver, turn input switch SW2 to the left, until the groove points to the 6VDC mark on the panel.
(2) POWER OUTPUT SWITCH SW3. Use a screwdriver to turn output switch SW3 to the 15-watt position if low-wattage output is required, or to the 50-watt position if more than 15 watts output is required. Turn the output switch to the 50-watt position when power is supplied to Tube Tester I–177.

(3) ON-OFF SWITCH SW1. To start Vibrator Pack PP–68/U throw ON-OFF switch SW1 to ON. To stop the vibrator pack, throw the switch to OFF.

> **CAUTION:** When Vibrator Pack PP–68/U is not in use, always throw ON-OFF switch SW1 to OFF position to prevent unnecessary drain on the battery.

b. 12-volt Input. Using a screwdriver, turn the input switch to the right, until the groove points to the 12VDC mark on the panel. Proceed as in subparagraph a(2) and (3) above.

> **CAUTION:** If input switch SW2 is set at 12VDC and a 6-volt battery is used, there will be no vibrator action. If the input switch is set at 6VDC and a 12-volt battery is used, the fuse will burn out.

SECTION V

EQUIPMENT PERFORMANCE CHECK LIST

10. PURPOSE AND USE OF CHECK LIST.

a. General. The equipment performance check list (par. 11) will help the operator to determine whether Vibrator Pack PP–68/U is functioning properly. The check list gives the item to be checked, the conditions under which the item is checked, the normal indications of correct operation, and the corrective measures that the operator can take. Items 1 to 5 are checked before starting, item 6 when starting, items 7 and 8 during operation, and item 9 when stopping.

b. Action or Condition. For some items the information given in the action or condition column consists of the settings of switches under which the item is to be checked. For other items it represents an action that must be taken in order to check the normal indication given in the normal indication column.

c. Normal Indications. The normal indications listed include the visible and audible signs that the operator will perceive when he checks the items. If the indications are not normal, the operator should apply the recommended corrective measures.

d. Corrective Measures. The corrective measures listed are those that the operator can make without turning the equipment in for repairs. If the equipment is completely inoperative or if the recommended corrective measures do not yield results, trouble shooting must be done by a qualified repairman.

11. EQUIPMENT PERFORMANCE CHECK LIST.

	Item No.	*Item*	*Action or condition*	*Normal indications*	*Corrective measures*
PREPARATORY	1	Battery clips.	Attach clips to battery terminals.	Clips make clean, firm contact.	Clean battery clips and terminals.
	2	Input switch SW2.	*a.* Throw switch to 6VDC position for use with 6-volt battery.		
			b. Throw switch to 12VDC position for use with 12-volt battery.		
	3	Storage battery.	Check specific gravity of battery.	Battery is fully charged.	Charge or replace battery.
	4.	Output receptacle SO.	Insert a-c input plug of test equipment into receptacle.	Plug is firmly seated in receptacle.	
	5	Output switch SW3.	*a.* Throw switch to 15-watt position for use with low-wattage test equipment.		
			b. Throw switch to 50-watt position for use with high-wattage test equipment.		
START	6	ON-OFF switch SW1.	Throw switch to ON.	Vibrator hum is heard.	*a.* Check connections of battery clips. *b.* Check position of input switch. *c.* Check fuse. *d.* Replace vibrator. *e.* Replace battery.

11. EQUIPMENT PERFORMANCE CHECK LIST (contd).

	Item No.	*Item*	*Action or condition*	*Normal indications*	*Corrective measures*
EQUIPMENT PERFORMANCE	7	Battery clips.	*a.* Feel clips. *b.* Look for arcs between battery clips and terminals.	*a.* Clips are not hot. *b.* No arcs are seen.	Throw ON-OFF switch to OFF and clean battery clips and terminals.
	8	Vibrator.	Listen for hum.	Steady hum is heard.	*a.* Check battery connections. *b.* Replace battery. *c.* Replace vibrator.
STOP	9	ON-OFF switch SW1.	Throw to OFF.	Vibrator hum stops.	

PART THREE

PREVENTIVE MAINTENANCE

SECTION VI

PREVENTIVE MAINTENANCE TECHNIQUES

12. MEANING OF PREVENTIVE MAINTENANCE.

Preventive maintenance is a systematic series of operations performed at regular intervals on equipment, when turned off, to eliminate major break-downs and unwanted interruptions in service, and to keep the equipment operating at top efficiency. To understand what is meant by preventive maintenance, it is necessary to distinguish between preventive maintenance, trouble shooting, and repair. The prime function of preventive maintenance is to *prevent* break-downs and, therefore, the need for repair. On the other hand, the prime function of trouble shooting and repair is to locate and correct *existing* defects. The importance of preventive maintenance cannot be overestimated. The entire system of radio communication depends upon each set being *on the air* when it is needed and upon its *operating efficiency*. It is vitally important that radio operators and repairmen maintain their radio sets and test equipment properly.

NOTE: The operations in sections VI and VII are considered user maintenance.

13. DESCRIPTION OF PREVENTIVE MAINTENANCE TECHNIQUES.

a. General. Most of the electrical parts used in Vibrator Pack PP–68/U require routine preventive maintenance. Those requiring maintenance differ in the amount and kind required. Because hit-or-miss maintenance techniques cannot be applied, definite and specific instructions are needed. This section of the manual contains these specific instructions and serves as a guide for personnel assigned to perform the six basic maintenance operations namely: Feel, Inspect, Tighten, Clean, Adjust, and Lubricate. Throughout this manual the letter system for the six operations will be as follows:

F—Feel.
I —Inspect.

T—Tighten.
C—Clean.
A—Adjust.
L—Lubricate.

The first two operations establish the need for the other four. The selection of operations is based on a general knowledge of field needs. For example, the dust encountered on dirt roads during cross-country travel filters into the equipment no matter how much care is taken to prevent it. Rapid changes in weather (such as heavy rain followed by blistering heat), excessive dampness, snow, and ice tend to cause corrosion of exposed surfaces and parts. Without frequent inspections and the necessary performance of tightening, cleaning, and lubricating operations, equipment becomes undependable and subject to break-down when it is most needed.

b. Feel. The feel operation is used most often to check rotating machinery, such as blower motors, drive motors, etc., and to determine if electrical connections, bushings, etc., are overheated. Feeling indicates the need for lubrication or the existence of similar types of defects requiring correction. The maintenance man must become familiar with the normal operating temperatures of motors, etc., in order to recognize signs of overheating.

NOTE: It is important that the feel operation be performed as soon as possible after shut-down and always before any other maintenance is done.

c. Inspect. Inspection is the most important operation in the preventive maintenance program. A careless observer will overlook the evidences of minor trouble. Although these defects may not interfere with the performance of the equipment, valuable time and effort can be saved if they are corrected before they lead to major break-downs. Make every effort to become thoroughly familiar with the indications of normal functioning, in order to be able to recognize the signs of a defective set. Inspection consists of carefully observing all parts of the equipment, noticing their color, placement, state of cleanliness, etc.

Inspect for the following conditions:

(1) Overheating, as indicated by discoloration, blistering, or bulging of the parts or surface of the container; leakage of insulating compounds; and oxidation of metal contact surfaces.

(2) Placement, by observing that all leads and cabling are in their original positions.

(3) Cleanliness, by carefully observing all recesses in units for accumulation of dust, especially between connecting terminals. Parts, connections, and joints should be free of dust, corrosion, and other foreign matter. In tropical and high-humidity locations, look for fungus growth and mildew.

(4) Tightness, by testing any connection or mounting which appears to be loose.

d. Tighten, Clean, and Adjust. These operations are self-explanatory. Specific procedures to be followed in performing them are given wherever necessary throughout part three.

> **CAUTION:** Screws, bolts, and nuts should not be tightened carelessly. Fittings tightened beyond the pressure for which they are designed will be damaged or broken.

Whenever a loose connection is tightened, it should be moistureproofed and fungiproofed again by applying the varnish with a small brush. See section IX for details of moistureproofing and fungiproofing.

e. Lubricate. Lubrication of Vibrator Pack PP–68/U is not required.

SECTION VII

ITEMIZED PREVENTIVE MAINTENANCE

14. INTRODUCTION.

For ease and efficiency, it is suggested that preventive maintenance on Vibrator Pack PP–68/U be broken down into operations that can be performed at different time intervals. In this section the preventive maintenance work to be performed on the vibrator pack at specified time intervals is broken down into units of work called items. The general techniques involved and the application of the FITCAL operations in performing preventive maintenance on individual parts are discussed in section VI. These general instructions are not repeated in this section. When performing preventive maintenance, refer to section VI if more information is required for the following items. All work is to be performed with the power removed from the equipment. After preventive maintenance has been performed on a given day, the equipment should be put into operation and checked for satisfactory performance. (See paragraph 11, Equipment Performance Check List.)

15. COMMON MATERIALS NEEDED.

The following materials will be needed in performing preventive maintenance:

Common hand tools (TE–41 or equivalent).
Clean cloth.
Solvent, Dry-cleaning, Federal Specification P–S–661a.
Baking soda.

NOTE: Leaded gasoline will not be used as a cleaning fluid for any purpose. Solvent, Dry-cleaning, Federal Specification P–S–661a, is available as a cleaning fluid, through established supply channels. Oil, Fuel, Diesel, U.S. Army Specification 2–102B, may be used for cleaning purposes when dry-cleaning solvent is not at hand. Since unleaded gasoline is available only in limited quantities, and only in certain locations, it should be used for cleaning purposes only when no other agent is suitable. Carbon tetrachloride, or fire-extinguishing liquid (carbon tetrachloride base), will be used, if necessary, *only on contact parts of electronic equipment.*

16. ITEM 1, EXTERIOR OF VIBRATOR PACK PP-68/U (fig. 1).

a. Inspect. Inspect the exterior of the vibrator pack for damage to the finish. Check the controls, input switch, output switch, and ON-OFF switch for ease of operation. Check the condition of the output receptacle.

b. Clean. Clean the exterior of the vibrator pack with a dry cloth. If necessary, use dry-cleaning solvent to remove dirt and grease.

17. ITEM 2, BATTERY CABLE AND BATTERY CLIPS.

a. Inspect. Inspect the battery cable for cracks or tears in the insulation and for tightness of connection to the battery clips. Give special attention to the cable at the point where it enters the vibrator unit. Replace the cable if necessary. Inspect the battery clips for corrosion and wear.

b. Tighten. Tighten connections between the battery cable and battery clips if necessary.

c. Clean. Clean the battery cable with a clean, damp cloth. Scrape the corrosion from the battery clips with a knife or screwdriver. Clean the battery clips with a solution of baking soda and water. Wipe them dry.

d. Adjust. Adjust the position of the battery clips so they will make a clean, firm contact with the battery terminals. Bend the battery clips carefully with pliers if necessary.

18. ITEM 3, INTERIOR OF CASE (figs. 2 and 3).

a. Inspect. Remove the cover plates from the vibrator pack, and inspect the top and bottom of the chassis. Look for scratches or corrosion on the metal, for loose connections in the wiring, and for discolored resistors under the chassis.

b. Tighten. See that the vibrator is tightly seated in its socket. Tighten the screws which hold it in place in the socket.

c. Clean. Clean the metal part of the chassis with a dry cloth. If necessary use dry-cleaning solvent to remove dirt and grease from the top and sides of the chassis. Blow dust from the bottom of the chassis.

19. PREVENTIVE MAINTENANCE CHECK LIST.

The following check list is a summary of the preventive maintenance to be performed on Vibrator Pack PP–68/U. The suggested time intervals shown on the check list may be varied at any time by the local commander. However, for best performance of the equipment, it is recommended that the operations be performed at least as frequently as called for in the check list. The operations are considered user maintenance.

Item No.	*Operations*	*Item*	*When performed*		
			Daily	*Weekly*	*Monthly*
1	IC	Exterior of vibrator pack.		X	
2	ITCA	Battery cable and battery clips.	X		
3	ITC	Interior of case.			X

SECTION VIII

LUBRICATION

20. LUBRICATION.

No War Department Lubrication Order has been issued for Vibrator Pack PP–68/U as no lubrication is required.

SECTION IX

MOISTUREPROOFING AND FUNGIPROOFING

21. PROBLEMS ENCOUNTERED.

The operation of Signal Corps equipment in tropical areas where temperature and relative humidity are extremely high requires special attention. The following items represent problems which may be encountered in operation:

a. Resistors, capacitors, coils, chokes, transformer windings, etc., fail.

b. Electrolytic action takes place in resistors, coils, chokes, transformer windings, etc., causing eventual break-down.

c. Hook-up wire and cable insulation break down. Fungus growth accelerates deterioration.

d. Moisture forms electrical leakage paths on terminal boards and insulating strips.

22. TREATMENT.

A moistureproofing and fungiproofing treatment has been devised which if properly applied provides a reasonable degree of protection against fungi, insects, corrosion, salt spray, and moisture. The treatment involves the use of a moisture- and fungi-resistant varnish applied with a spray gun or brush. Refer to TB SIG 13, Moistureproofing and Fungiproofing Signal Corps Equipment, for a detailed description of the varnish-spray method of moistureproofing and fungiproofing and the supplies and equipment required in this treatment.

> **CAUTION:** Varnish spray may have toxic effects if inhaled. To avoid inhaling spray, use respirator if available; otherwise, fasten cheesecloth or other cloth material over nose and mouth.

23. STEP-BY-STEP INSTRUCTIONS FOR TREATING VIBRATOR PACK PP-68/U.

a. Preparation. Make all repairs and adjustments necessary for the proper operation of the vibrator pack.

b. Disassembly.

(1) Disconnect the battery clips from the storage battery.

(2) Disconnect the test equipment powered by the vibrator pack by removing the a-c line plug from the vibrator pack output receptacle.

(3) Remove the chassis bottom plate by removing the eight 6/32 screws which hold it to the bottom of the chassis.

(4) Remove the top cover by removing the four 6/32 screws which hold it to the chassis.

(5) Remove the two screws which hold the vibrator unit, and pull the unit out of its socket.

(6) Remove the fuse from its mounting on the front panel.

(7) Remove the spare fuses from their mountings.

c. Masking. Cover the following components with masking tape:

(1) Top and bottom of vibrator socket.

(2) Front and back of output receptacle SO.

(3) Fuse clips.

(4) Battery clips.

(5) Front and back of input switch SW2, and output switch SW3.

(6) Prongs of vibrator units.

d. Drying. Place the vibrator pack in a baking oven and bake 2 to 3 hours at 160° F.

> **CAUTION:** Do not exceed 160° F. If wax should begin to melt in any of the components, decrease the temperature and increase the baking time approximately 1 hour for each decrease of 10° F in temperature.

e. Varnishing.

(1) Apply three coats of moistureproofing and fungiproofing varnish (Lacquer, Fungus-resistant, Spec No. 71–2202 (Stock No. 6G1005.3) or equal), with spray gun on all components except fuses, allowing a 15- to 20-minute drying period after each coat.

(2) Use a brush to varnish those components not reached by the spray. Make sure that all components are adequately protected by varnish.

f. Reassembly.

(1) After the varnish is dry, remove the masking tape from all components.

(2) Reassemble the vibrator pack and test its operation.

g. Marking. Mark the vibrator pack with "MFP" and the date of treatment near the nameplate.

EXAMPLE: MFP—5 Dec 1944.

PART FOUR
AUXILIARY EQUIPMENT

NOT USED

PART FIVE
REPAIR INSTRUCTIONS

NOTE: Failure or unsatisfactory performance of equipment used by Army Ground Forces and Army Service Forces will be reported on W.D., A.G.O. Form No. 468 (Unsatisfactory Equipment Report). For particular see paragraph 33. If Form No. 468 is not available, see TM 38–250. Failure or unsatisfactory performance of equipment used by Army Air Forces will be reported on Army Air Forces Form No. 54 (unsatisfactory report).

SECTION X

THEORY OF EQUIPMENT

24. GENERAL.

Vibrator Pack PP–68/U converts 6- or 12-volt direct current into 110-volt, 60-cycle alternating current by using a vibrator and a transformer. The vibrator changes steady direct current into pulsating direct current. The transformer action then changes the pulsating direct current into an alternating current. Contact points on the vibrating reed in the vibrator unit automatically and rapidly reverse the direction of current flow, producing a pulsating direct current through the transformer primary. This fast changing current in the primary produces the alternating-current output. The theory of operation of the vibrator pack is divided into a study of the input circuit, and a study of the output circuit.

25. INPUT CIRCUIT (fig. 5).

The input circuit consists of the vibrator, tapped primary of transformer T, input switch SW2, ON-OFF switch SW1, fuse F, capacitor C1, vibrator coil series resistor R1, resistor R2, capacitor C2, and the 6- or 12-volt storage battery.

a. Vibrator Unit. Although the vibrator unit is a synchronous type, it is operated as a nonsynchronous vibrator by wiring together the two metal contact points found on each side of the vibrating reed. The vibrator actuating coil L (fig. 6) is energized by battery current from a circuit completed through the single contact on the vibrating reed. When the energized coil L pulls the vibrating reed toward it, the energizing circuit is broken. The

reed then springs back and the coil is again energized. Thus the reed continues to vibrate. The vibrator circuit is much like the ordinary door buzzer circuit. The set of double contacts on the vibrator reed constitute a single-pole, double-throw switch which is constantly reversing the direction of direct current flow through the primary of transformer T.

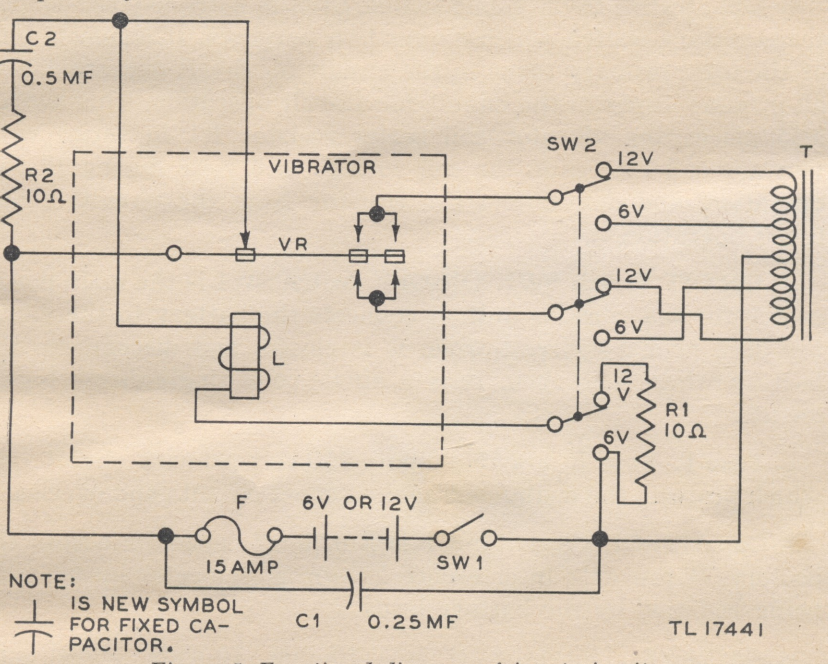

Figure 5. Functional diagram of input circuit.

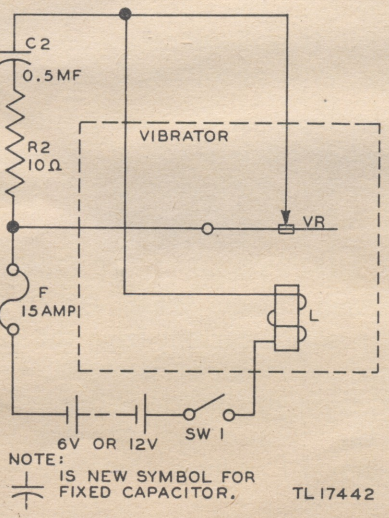

Figure 6. Functional diagram of vibrator actuating circuit.

b. Transformer Primary. The transformer primary is center-tapped to permit reversal of pulsating direct current flow. Each half of the center-tapped primary is tapped again, so that all of the winding may be used for 12-volt operation, or only half for 6-volt operation.

c. Input Switch SW2. Input switch SW2 is a triple-pole, double-throw rotary switch which serves two purposes. It connects half of the total primary turns in the circuit for 6-volt operation, and all primary turns in the circuit for 12-volt operation. This switch also places the vibrator coil series resistor R1 in series with vibrator coil L to drop the coil voltage to 6 volts during 12-volt operation, and disconnects the resistor from the circuit during 6-volt operation.

d. ON-OFF Switch SW1. ON-OFF switch SW1 is the main power switch for the vibrator unit. It connects the battery to the vibrator pack primary circuit when it is closed, and disconnects the battery when it is open. It is a single-pole, single-throw toggle switch.

e. Fuse F. Fuse F is a 15-ampere, 250-volt primary circuit fuse which protects the equipment against short circuits and overloads.

f. Capacitor C1. Capacitor C1 is a 0.25-mf capacitor across the battery. It prevents interference known as "vibrator hash" from being radiated by the battery leads.

g. Resistor R1. Resistor R1 is a 10-ohm, 10-watt, wire-wound resistor which is switched in series with the vibrator actuating coil L in order to decrease the voltage across coil L to 6 volts during 12-volt operation. It is disconnected from the circuit by input switch SW2 during 6-volt operation.

h. Resistor R2 and Capacitor C2. Resistor R2 is a 10-ohm ½-watt resistor, and capacitor C2 is a 0.5-mf, 400-volt paper capacitor. Together they form a filter which quenches the arc caused by the opening of the vibrator actuating point.

26. STEP-BY-STEP ANALYSIS OF INPUT CIRCUIT.

a. Vibrator Actuating Circuit. When ON-OFF switch SW1 is thrown to the ON position, current from the 12-volt battery flows through this switch, through resistor R1, through one arm of input switch SW2, through vibrator actuating coil L, through the single contact of the vibrator reed, through fuse F, and back to the battery. Resistor R1 reduces the voltage across the coil to

6 volts. (When a 6-volt battery is used, resistor R1 is eliminated from this series circuit.)

b. Transformer Primary Circuit. The input circuit to the primary of transformer T is a separate input circuit in parallel with the vibrator actuating circuit discussed in subparagraph **a** above.

(1) FIRST HALF-CYCLE (fig. 7). On the first half-cycle, with the vibrator reed in the lower position, current flows from the 12-volt battery through ON-OFF switch SW1 to the center-tap of the primary of transformer T, through the lower half of the primary, through one arm of input switch SW2, through the lower set of double contacts to the vibrator reed, through the reed, and through fuse F back to the battery. (When a 6-volt battery is used, the arm of input switch SW2 is in such position that it halves the number of transformer primary turns in the circuit, and makes use of only part of the lower half of the primary.)

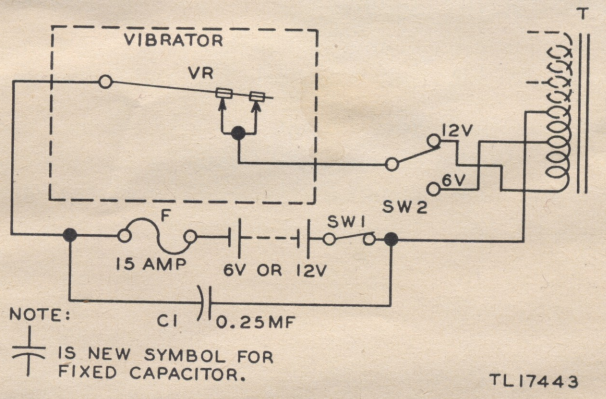

Figure 7. Functional diagram of vibrator, first half-cycle.

(2) SECOND HALF-CYCLE (fig. 8). On the second half-cycle the circuit is similar to that of the first half-cycle except that the vibrating reed is in the upper position, and the upper windings of the transformer primary are in the circuit instead of the lower windings. It will be noted that this reverses the direction of current flow through the primary.

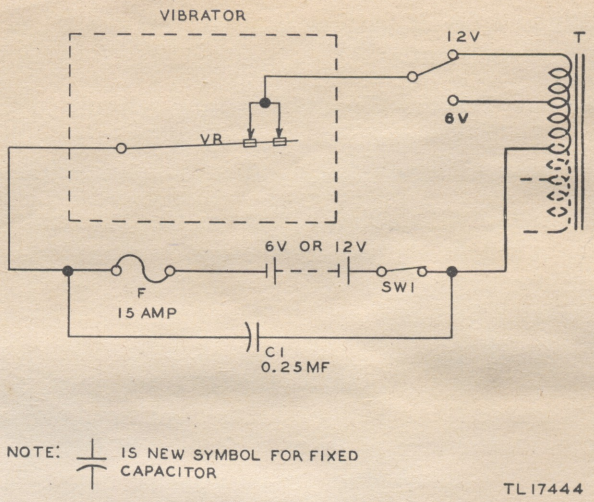

Figure 8. Functional diagram of vibrator, second half-cycle.

27. OUTPUT CIRCUIT (fig. 9).

The output circuit consists of the secondary of transformer T, output switch SW3, output receptacle SO, and buffer capacitor C3.

a. Transformer Secondary Circuit. The transformer secondary is tapped so that all the turns may be used to provide the greatest possible output when output switch SW3 is in the 50-watt position; fewer turns may be selected when switch SW3 is in the 15-watt position.

b. Output Switch SW3. Output switch SW3 is a single-pole, double-throw rotary switch which is used to select either the 15-watt or the 50-watt output tap on the transformer secondary.

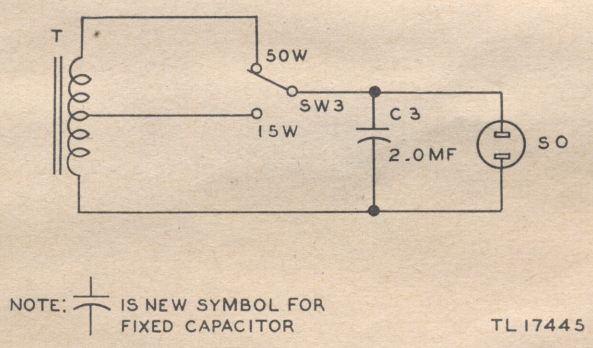

Figure 9. Functional diagram of output circuit.

c. Output Receptacle SO. Output receptacle SO is a female-contact receptacle into which the ordinary line cord plug of a-c operated test equipment may be plugged.

28. ANALYSIS OF OUTPUT CIRCUIT (fig. 9).

Interrupted direct current, flowing first in one direction in one half of the transformer primary, then in the opposite direction in the other half of the transformer primary, produces alternating magnetic flux in the transformer core. This alternating flux in the core produces an alternating voltage in the secondary winding of the transformer. Buffer capacitor C3 determines how the magnetic flux in the transformer core decays when the primary circuit is opened by the vibrator. This capacitor prevents extreme peak voltage in the secondary.

SECTION XI

TROUBLE SHOOTING

29. GENERAL.

Trouble shooting in Vibrator Pack PP–68/U will consist largely of making continuity checks, resistance measurements, and voltage measurements. The circuit is simple and there are few parts likely to give trouble. The vibrator unit, a possible source of trouble, may be replaced quickly and easily.

30. TEST EQUIPMENT.

Recommended test equipment includes basic components of Test Set I–56–K such as Test Unit I–176 and Voltohmmeter I–166. Test Unit I–176 can be used for measuring the a-c voltages and d-c voltages present as well as the resistance readings for Vibrator Pack PP–68/U. However, any test equipment available to the repairman may be used provided the ranges cover the voltage and resistance values shown in the test tables in this manual.

31. CIRCUIT TESTING.

a. Voltage Checks. Connect the vibrator pack to a 6-volt storage battery by securing the battery clips to the battery terminals. Disconnect the test equipment a-c input plug from the vibrator pack output receptacle SO. Throw input switch SW2 to the 6-volt position, output switch SW3 to the 50-watt position, and the ON-OFF switch to ON. Refer to figure 10. The following point-to-point voltages should be measured:

Points of measurement	*Voltage readings (v)*
A to B	142.0 ac
A to G	0.0
C to D	12.5 ac
C to E	6.25 ac
D to E	6.25 ac
E to G	6.2 dc

NOTE: The above readings are approximate and will vary slightly with the condition of the storage battery used.

b. Resistance Checks. Throw the ON-OFF switch to OFF. Disconnect the battery clips from the storage battery. Use a low-resistance ohmmeter. Refer to figure 10. The following approximate point-to-point readings should be obtained:

Points of measurement	*Resistance readings (ohms)*
A to B	6.25
A to G	Infinity
C to D	0.1
C to E	0.05
D to E	0.05
E to F	6.0
E to G	6.0

32. TROUBLE CHART.

The accompanying chart lists in tabular form the most common troubles that may interfere with the normal operation of Vibrator Pack PP–68/U.

Symptoms	*Probable trouble*	*Corrections*
1. Vibrator unit does not operate.	1. Poor battery contacts.	1. Clean battery clips and battery terminals.
	Input switch SW2 set at 12VDC when 6-volt battery is used.	Throw input switch SW2 to 6 VDC position.
	Fuse burned out (see symptom 2).	Replace fuse.
	Vibrator loose in socket.	Seat vibrator unit firmly in socket.
	Vibrator unit defective.	Replace vibrator unit.
2. Fuses burn out.	2. Input switch SW2 set at 6VDC when 12-volt battery is used.	2. Throw input switch SW2 to 12 VDC position.
	Vibrator unit defective.	Replace vibrator unit.
	Capacitor C1, C2, or C3 shorted.	Replace shorted capacitor.
3. Output voltage low.	3. Output switch SW3 set for 15 watts when load is more than 15 watts.	3. Throw output switch SW3 to 50-watt position.
	Battery not fully charged.	Charge or replace battery.
4. Vibrator operates, but output voltage is zero.	4. Switch SW2 or SW3 or connections defective.	4. Repair switch connections.
		Replace switch SW2 or SW3.
	Output receptacle SO or connections defective.	Repair output receptacle connections.
		Replace output receptacle.
	Secondary of transformer T burned out.	Replace transformer.

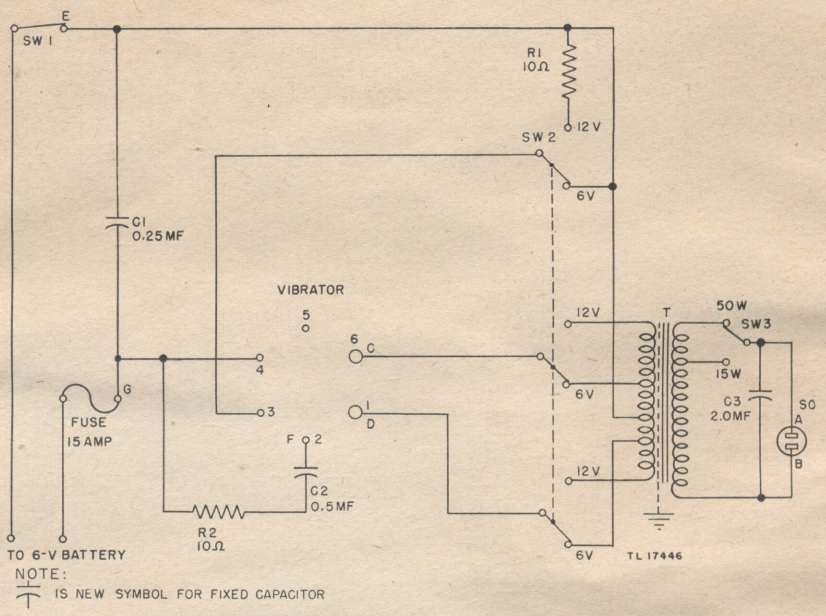

Figure 10. Vibrator Pack PP–68/U, test circuit.

SECTION XII

REPAIRS

33. REPLACEMENT OF PARTS.

Few parts replacements should be necessary in Vibrator Pack PP–68/U. To gain access to the chassis top and bottom, remove the 6/32 screws which hold the bottom plate and top cover.

a. Replacement of Vibrator Unit. Remove the two 6/32 screws holding the vibrator unit in its socket. Spread the vibrator unit holding posts slightly and pull the vibrator unit directly away from the chassis until the prongs on the base of the vibrator unit are out of the socket. Before inserting a new vibrator unit, note the indexing of the socket. Place the new vibrator in the socket so that the two large prongs on the vibrator unit plug fit into the corresponding holes marked No. 1 and No. 6 in the socket.

b. Replacement of Other Components. Check the schematic diagram (fig. 11) before replacing any defective components. Make sure that all soldered joints to a replacement component are clean and secure. See that the chassis and wiring are cleaned thoroughly and free from superfluous particles of solder. Touch up exposed surfaces with moistureproofing and fungiproofing lacquer (see section IX).

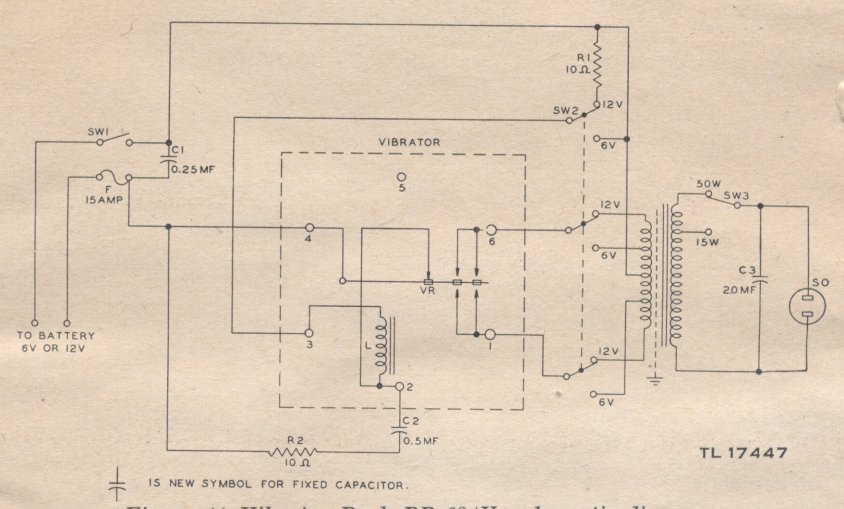

Figure 11. Vibrator Pack PP–68/U, schematic diagram.

34. WAR DEPARTMENT UNSATISFACTORY EQUIPMENT REPORT.

a. When trouble in equipment used by Army Ground Forces or Army Service Forces occurs more often than repair personnel feel is normal, War Department Unsatisfactory Equipment Report, W.D., A.G.O. Form No. 468 (fig. 12) should be filled out and forwarded through channels to the Office of the Chief Signal Officer, Washington 25, D. C. Refer to TM 38–250 for complete instructions on the handling of this report.

b. When trouble in equipment used by Army Air Forces occurs more often than repair personnel feel is normal, Army Air Forces Form No. 54 should be filled out and forwarded through channels.

WAR DEPARTMENT

UNSATISFACTORY EQUIPMENT REPORT

FOR (Technical service) Signal Corps — MATERIEL — DATE: 15 May 44

FROM (Organization) 579 Sig. Repair Co. — (Station) APO 101 — (Technical service) New York City

TO (Next superior headquarters) Signal Officer — (Station) Army

COMPLETE MAJOR ITEM

NOMENCLATURE: Receiver & Transmitter, BC-1000-A — TYPE: Man-Pack

MODEL: A — MANUFACTURER: Philco Corp.

U. S. A. REG. NO.: Order No. 10185-Phila-44 — SERIAL NO.: 1619 — DATE RECEIVED: 2 Feb. 1944

EQUIPMENT WITH WHICH USED (IF APPLICABLE): SCR-300-A

NOMENCLATURE OF DEFECTIVE COMPONENT

PART NO.: AN-130-A No. 2R275-130-A — TYPE: 2 Section, 33" Flexible tubing near base.

MANUFACTURER: Philco Corp. — DATE INSTALLED: 14 Feb. 44

LENGTH OF SERVICE

DATE OF INITIAL TROUBLE: 18 Feb. 44

TOTAL TIME INSTALLED: YEARS — MONTHS 1 Mo. — DAYS

TOTAL PERIOD OF OPERATION BEFORE FAILURE (FILL IN WHERE APPLICABLE)

YEARS	MONTHS	DAYS	HOURS	MILES	ROUNDS
—	—	4	20 hrs Operating Time		

DESCRIPTION OF TROUBLE AND PROBABLE CAUSE

GIVE TYPE OF FAILURE, MECHANICAL, ELECTRICAL, WORKMANSHIP, MATERIAL, DESIGN

Breaks bakelite shell at base of Antenna

UNUSUAL SERVICE CONDITIONS

GIVE BRIEF DESCRIPTION

Operating temperatures low, average 14°

TRAINING OR SKILL OF USING PERSONNEL (CHECK ONE) — POOR — FAIR — GOOD

DESCRIPTION OF ANY REMEDIAL ACTION TAKEN

Car in changing the angle of Antenna

RECOMMENDATIONS

A less brittle insulation for low operating temperatures

1ST IND.

OFFICE — STATION — DATE

(Technical service) TO CHIEF Signal Officer Washington 25 D.C.

NAME — RANK — STATION

ORIGINATING OFFICER

SIGNATURE: E. A. Malcomb

NAME: E. A. MALCOMB

RANK AND TITLE: Capt., Sig C

ORGANIZATION: 579 Sig Repair Co.

INSTRUCTIONS

1. It is imperative that the Chief of Technical Service concerned be advised at the earliest practical moment of any constructional, design, or operational defect in materiel. This form is designed to facilitate such reports and to provide a uniform method of submitting the required data.

2. This form will be used for reporting manufacturing, design or operational defects in materiel with a view to improving and correcting such defects, and for use in recommending modifications of materiel.

3. This form will not be used for reporting failures, isolated material defects or malfunctions of materiel resulting from fair-wear-and-tear or accidental damage nor for the replacement, repair, or the issue of parts and equipment. It does not replace currently authorized operational or performance records.

4. Reports of malfunctions and accidents involving ammunition will continue to be submitted as directed in the manner described in AR 750-10 (Change No. 3).

5. It will not be practicable or desirable in all cases to fill all blank spaces of the report. However, the report should be as complete as possible in order to expedite necessary corrective action. Additional pertinent information not provided for in the blank spaces should be submitted as inclosures to the form. Photographs, sketches or other illustrative material are highly desirable.

6. When cases arise, where it is necessary to communicate with a chief of service in order to assure safety to personnel, more expeditious means of communication are authorized. This form should be used to confirm reports made by more expeditious means.

7. This form will be made out by using or service organizations and forwarded in duplicate through command channels to the chief of technical service. The office of the chief of technical service receiving the report will forward an information copy to the Commanding General, Army Ground Forces or Army Air Forces, whichever is applicable, and to the Commanding General, Army Service Forces.

8. Necessity for using this form will be determined by the using or service troops.

W. D., A. G. O. Form No. 468
1 December 1943

TL 14114

Figure 12. Sample War Department Unsatisfactory Equipment Report.

APPENDIX

SECTION XIII
MAINTENANCE PARTS LIST

35. MAINTENANCE PARTS LIST FOR VIBRATOR PACK PP-68/U.

Ref symbol	*Signal Corps stock No.*	*Name of part and description*	*Quan per unit*	*Running spares*	*Orgn stock*	*3d ech*	*4th ech*	*5th ech*	*Depot stock*
C1	3DA250-178	**CAPACITOR, fixed:** paper; 250,000-mmf; 600 v dc (working); 1-11/16″ x ¾″ x 15/16″; Potter No. 3402; (metal case; hermetically sealed; oil impregnation; 2 insulated solder lug terminals on side space; 2 mtg feet with 3/16″ holes on 2⅛″ mtg centers).	1			*		*	*
C2	3D177A	**CAPACITOR, fixed:** paper; 500,000-mmf; 400 v dc (working); 1-11/16″ x ¾″ x 15/16″; Potter No. CA-277; (metal case; hermetically sealed; oil impregnation; 2 insulated solder lug terminals on side space; 2 mtg feet with 3/16″ holes on 2⅛″ mtg center); vibrator point suppression.	1			*		*	*
C3	3DB2-34	**CAPACITOR, fixed:** paper; 2-mf; 600 v dc (working); 2″ x 1″ x 1⅞″; Potter No. 3405; (metal case; hermetically sealed; oil impregnation; 2 insulated solder lug terminals on side space; 2 mtg feet with 3/16″ holes on 2-7/16″ mtg center); output smoothing capacitor.	1			*		*	*

*Indicates stock available.

35. MAINTENANCE PARTS LIST FOR VIBRATOR PACK PP-68/U (contd).

Ref symbol	*Signal Corps stock No.*	*Name of part and description*	*Quan per unit*	*Running spares*	*Orgn stock*	*3d ech*	*4th ech*	*5th ech*	*Depot stock*
	3Z1086B-1	**CLIP, battery:** steel, lead-plated; 2″ lg x ½″ wd; Mueller Elec Corp No. 24A; (uninsulated; 25-amp; 220-v; one screw and wire clamping ear for connection to wire; 1¼″ max jaw opening); battery connector.	2			*		*	*
SO	6Z8367-2	**CONNECTOR, female-contact:** (receptacle); 2 rectangular parallel contacts; straight; 1-9/32″ x 1⅞″ with 2 holes 5/32″ diam; 1½″ mtg center; Amphenol No. MIP-61F; (output voltage connections).	1			*		*	*
F	3Z2015-1	**FUSE, cartridge:** 15-amp; 250-v; one time; glass body; ferrule ¼″ diam x 7/32″ lg; Littelfuse No. 3AG; (input ckt).	1	4	*	*		*	*
	3Z3275-9	**HOLDER, fuse:** extractor post; for single 3AG fuse; molded black bakelite body with extractor knob; 15-amp; 250-v; length 1¾″ from front of panel; 2⅛″ over-all; Littelfuse No. 1075F.	1		*	*		*	*
	3Z3282-25	**HOLDER, fuse:** block; for four 3AG fuses; bakelite with copper clips; 2⅛″ x 2″ x 1/16″; Silman No. 804.	1			*		*	*
R1	3Z6001-60	**RESISTOR, fixed:** wire-wound; 10 ohms ±10%; 10-w; 1¾″ x 5/16″; IRC type AB.	1			*		*	*
R2	3Z6001-3	**RESISTOR, fixed:** wire-wound; 10 ohms ±10%; ½-w; ⅝″ x 3/16″; IRC BW ½.	1			*		*	*

	2Z8659-7	**SOCKET, tube:** 6-prong wafer; bakelite; Amphenol type MIP-6; (vibrator).	1			*		*	*
SW1	3Z9858-8.141	**SWITCH, toggle:** SPST; bakelite body; 2″ lg x ¾″ wd x 1″ high; AH&H No. 81402; (input voltage).	1			*		*	*
SW2	3Z9858-24	**SWITCH, rotary:** SPDT; 6 unmatched layers molded phenolic each ¼″ thk x 1⅝″ diam; 3″ lg x 2½″ wd; Arc-Less Switch Co type WP; (¼″ slotted shaft screwdriver operated); for 6- or 12-volt input.	1			*		*	*
SW3	3Z9826-5.11	**SWITCH, rotary:** SPDT; bakelite body; 1½″ lg x ¾″ wd x ⅝″ high; AH&H No. 26565; (⅜″ slotted shaft for screwdriver operation); output voltage control.	1			*		*	*
T	2Z9625-39	**TRANSFORMER, power:** vibrator; fully inclosed steel case; pri 6 v, 12 v; sec 110 v, 60 cps, 15 w; 110 v, 60 cps, 50 w; 4½″ x 4¼″ x 5½″ high ATR; type T-612-A.	1			*		*	*
	3H6694-22	**VIBRATOR, synchronous:** input 6 v dc, 12.6 v dc; 5½″ lg x 1¾″ wd x 1″ thk; 8-contact; 6 wire leads; Kurman type 860v.	1		*	*		*	*
	1B810.28	**WIRE, insulated:** copper; tinned; two No. 10 AWC stranded convd; seven No. 18 AWG strands; 0.116″ OD; rubber insulation; cotton braid each conductor, double cotton braid over-all; (input connector cable).	6			*		*	*

* Indicates stock available.

32 Order No. 21360-Phila-44-10; 14182 copies; 12 Jan 45.