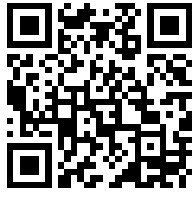
This is a reproduction of a library book that was digitized by Google as part of an ongoing effort to preserve the information in books and make it universally accessible.

Google™ books

https://books.google.com



D101.11:11-2596

TM 11-2596

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

VIBRATOR PACK

PP-31/TIQ-2

DEPARTMENT OF THE ARMY *AUGUST 1948*

Digitized by Google

Digitized by Google

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

TM 11-2596

VIBRATOR PACK

PP-31/TIQ-2

DEPARTMENT OF THE ARMY • *AUGUST 1948*

United States Government Printing Office
Washington : 1948

Digitized by Google

DEPARTMENT OF THE ARMY

Washington 25, D. C., 31 August 1948

TM 11–2596, Vibrator Pack PP–31/TIQ–2, is published for the information and guidance of all concerned.

[AG 300.7 (2 Aug 48)]

BY ORDER OF THE SECRETARY OF THE ARMY:

OFFICIAL:

OMAR N. BRADLEY
Chief of Staff, United States Army

EDWARD F. WITSELL
Major General
The Adjutant General

DISTRIBUTION:

Army:

Tech Sv (2); Arm & Sv Bd (1); AFF Bd (ea Sv Test Sec) (1); AFF (5); OS Maj Comd (5); Base Comd (3); MDW (5); A (ZI) (20), (Overseas) (5); CHQ (2); FC (2); USMA (2); Sch 11 (10); Gen Dep 11 (10); Dep 11 (5) except Baltimore & Sacramento (20); Tng Ctr (2); PE (10); Lab 11 (2); 4th & 5th Ech Maint Shops 11 (2); T/O & E 11-47 (2); 11-107 (2); 11-127 (2); 11-587 (2); 11-592 (2); 11-597 (2); SPECIAL DISTRIBUTION.

Air Force:

USAF (5); USAF Maj Comd (5); USAF Sub Comd (3); Services (ATC) (2); Class III Instls (2); SPECIAL DISTRIBUTION.

For explanation of distribution formula see TM 38–405.

Digitized by Google

CONTENTS

Digitized by Google

DESTRUCTION NOTICE

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

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 units, transformers, sockets, battery clips, switches, panel, chassis, chest, 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. Burn or scatter—All remaining parts of equipment.

DESTROY EVERYTHING

Digitized by Google

SAFETY NOTICE

Voltages as high as 800 volts direct current are present at the output of Vibrator Pack PP–31/TIQ–2 when no load is present. This voltage is dangerous to life.

Do not change vibrator units or make adjustments inside the unit with the ON-OFF switches in 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 when making voltage measurements, always remove the battery clips from the battery terminals. Shorting the storage battery will cause a flash and may result in severe burns.

Digitized by Google

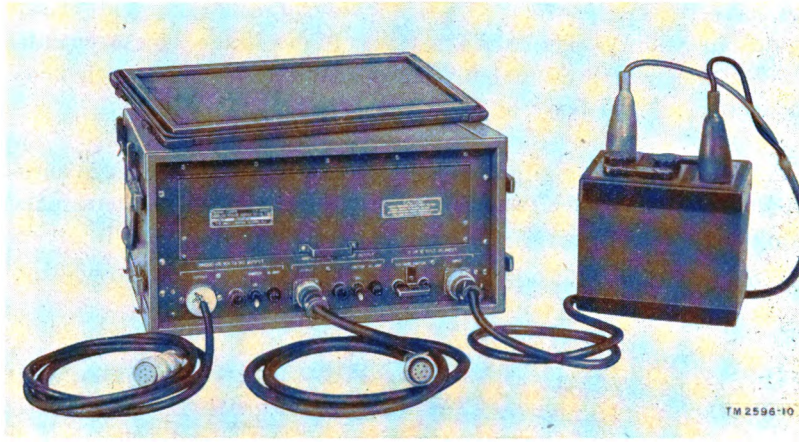


Figure 1. Vibrator Pack PP–31/TIQ–2, connected to 6-volt battery.

Digitized by Google

PART ONE

INTRODUCTION

Section I. DESCRIPTION

1. General

Vibrator Pack PP–31/TIQ–2 (fig. 3) is a transportable, vibrator type power supply unit which operates from a 6- or 12-volt direct-current (d-c) source for the operation of Amplifier AM–20( )/TIQ–2 and Turntable MX–39/TIQ–2. Both of these are components of Public Address Set AN–TIQ/2( ).

2. Technical Characteristics

The following table gives the input voltage, input current, output voltage, and output current of Vibrator Pack PP–31/TIQ–2:

Input voltage (d-c volts)	Input current (d-c amperes)	Output voltage	Output current
7	7.7	115 v ac	0.3 amp ac
7	16.0	400 v dc	0.14 amp dc
14	3.4	115 v ac	0.3 amp ac
14	7.7	400 v dc	0.14 amp dc

NOTE.—Values in above table are based on battery on charge.

3. Components

Vibrator Pack PP–31/TIQ–2 consists of the following:

1 Case Cy–38/TIQ–2.
1 Vibrator pack (bare unit).
1 Cord CX–782/TIQ–2.
1 Cord CX–781/TIQ–2.
1 Cord CX–771/TIQ–2.

1 set of spare parts consisting of—

1 each vibrator (E–1), 120 cycles per second (cps).
1 each vibrator (E–3), 60 cps.
10 each Fuse FU–40.
10 each Fuse FU–23.
10 each Lamp LM–52.
1 each Tube JAN–5U4G.

Digitized by Google

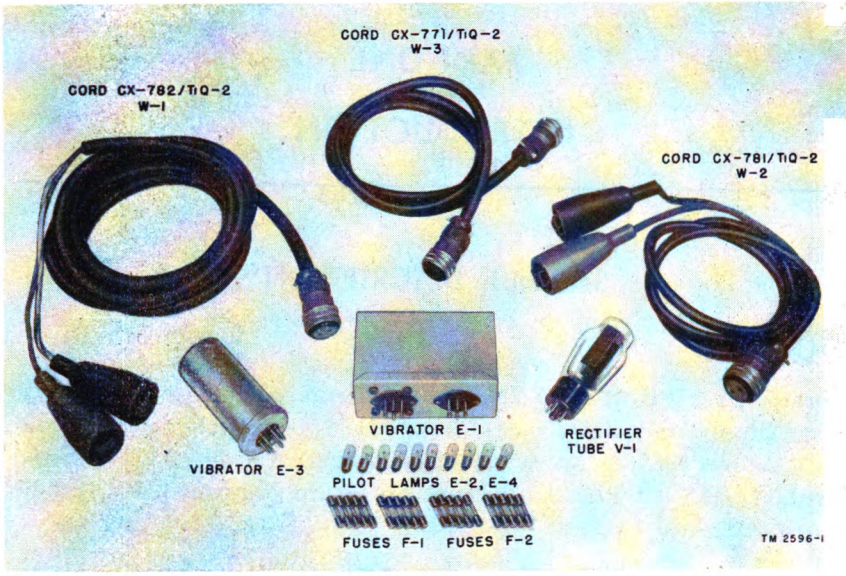


Figure 2. Cords and spare parts.

4. Packaging Data (fig. 6)

Vibrator Pack PP–31/TIQ–2 is packed for export as follows:

a. The equipment and a sufficient quantity of desiccant is placed in a carton which is then sealed.

b. The sealed carton is placed in a metal-lined bag which is heat sealed.

c. The heat-sealed, metal-lined bag is placed in a second carton which is placed in a packing case which has been lined with a bag sealer.

d. The packing case is nailed and then bound with steel straps.

e. When packed for export, the equipment weighs 120 pounds and measures 12½ inches in height, 18 inches in width, and 26 inches in length. The cubic volume is 3.38 cubic feet.

5. Vibrator Pack PP–31/TIQ–2

a. Case. Case CY–38/TIQ–2 is constructed of plywood heavily reinforced with a steel frame and corners. The removable front cover is secured with catch fasteners. A neoprene weatherproof gasket is attached to the front cover to protect the equipment against moisture, but this gasket does not protect the equipment in the event of total immersion. Carrying handles are provided at each end of the case. Catch fasteners are attached to the sides of the case at both top and bottom to permit several cases to be fastened together during storage or transportation.

Digitized by Google

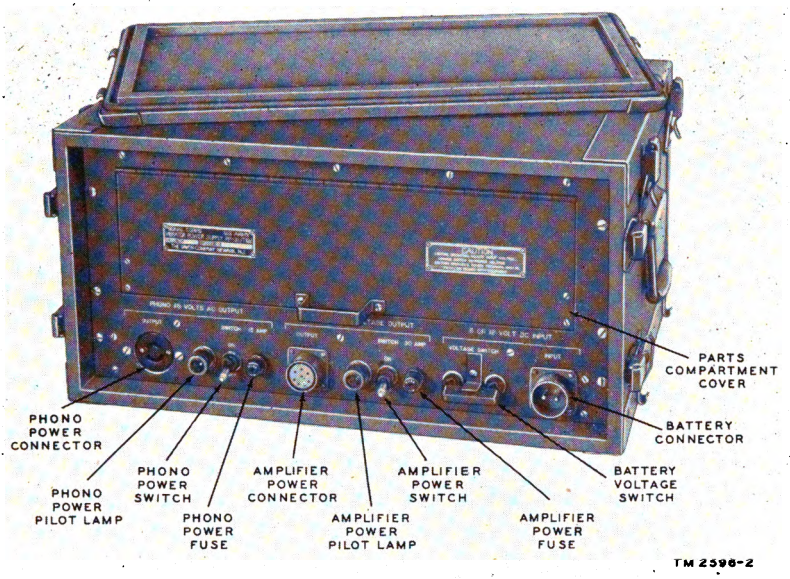


Figure 3. Vibrator Pack PP–31/TIQ–2, front view.

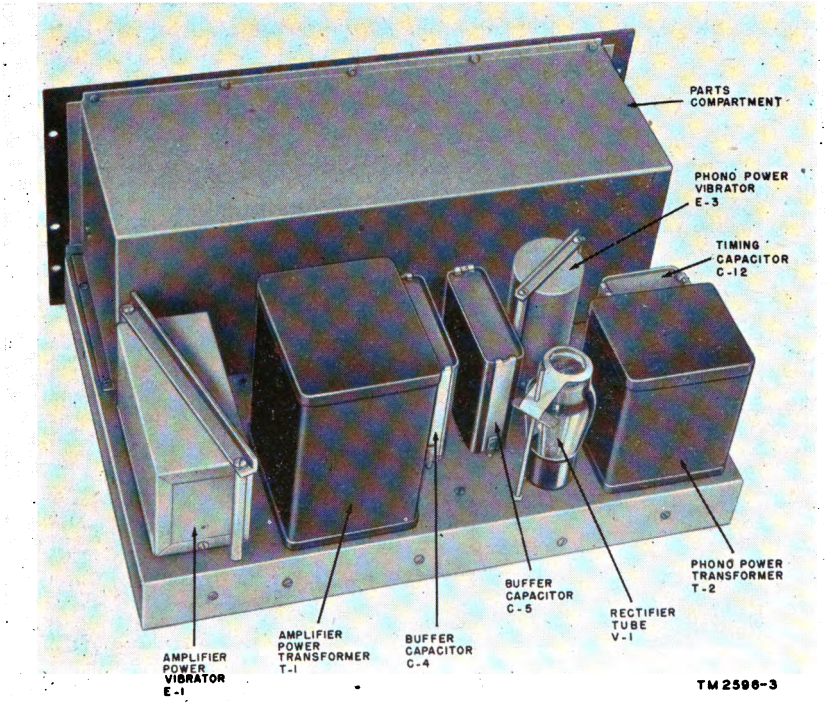


Figure 4. Vibrator Pack PP–31/TIQ–2, chassis, top view.

Digitized by Google

b. Bare Unit. (1) *Front panel.* The front panel contains all the necessary controls and connectors for the operation of the equipment. A hinged opening in the front panel provides access to a compartment for storing cords and spare parts.

(2) *Parts compartment* (fig. 4). The parts compartment consists of a formed steel housing fastened behind the front panel. A hinged section in the front panel provides the cover.

(3) *Chassis assembly* (fig. 4). The chassis consists of a formed steel housing which is fastened to the front panel and which provides a mounting for the various transformers, vibrators, capacitors, etc. A steel cover plate is fastened to the bottom of the chassis with nine screws.

c. Cord CX–782/TIQ–2 (fig. 2). This cord is stored in the parts compartment. The cord consists of 12 feet of No. 10 AWG stranded, two-conductor, rubber-covered cable. One end is terminated by a two-conductor female connector and the other end is terminated by two battery clips protected by rubber insulators. This cord is used to connect Vibrator Pack PP–31/TIQ–2 to a 6- or 12-volt d-c power source.

d. Cord CX–781/TIQ–2 (fig. 2). This cord also is stored in the parts compartment. The cord consists of 6 feet of No. 8 AWG stranded, two-conductor, rubber-covered cable. One end is terminated by a two-conductor female connector and the other end is terminated by two battery

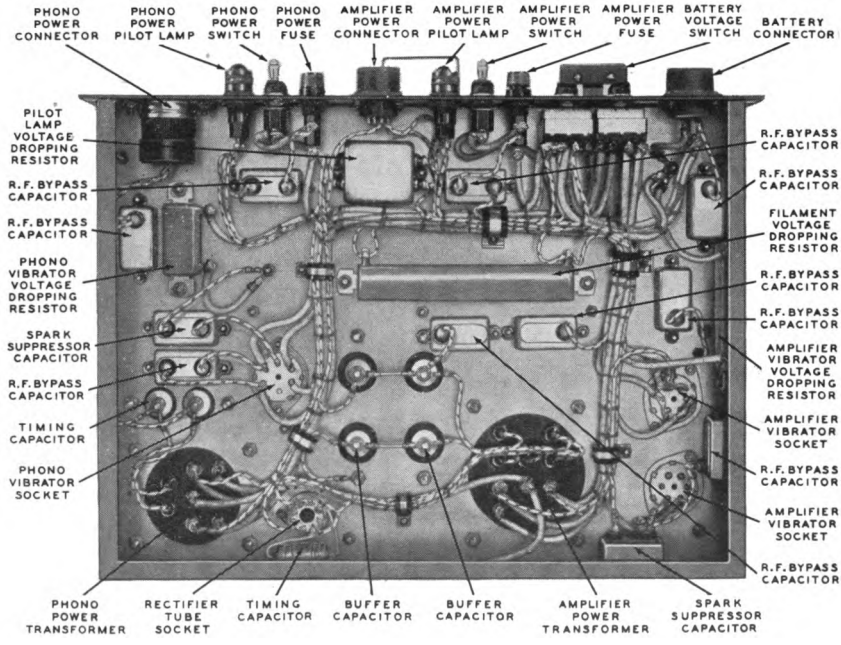


Figure 5. Vibrator Pack PP–31/TIQ–2, chassis, bottom view.

Digitized by Google

clips protected by rubber insulators. This cord is used to connect Vibrator Power Supply PP–31/TIQ–2 to a 6- or 12-volt d-c power source.

e. Cord CX–771/TIQ–2 (fig. 2). Cord CX–771/TIQ–2 is stored in the parts compartment. This cord consists of 6 feet of No. 14 AWG stranded, three-conductor, rubber-covered cable. One end is terminated by an eight-conductor female connector and the other end is terminated by an eight-conductor male connector. This cord is used to connect Vibrator Pack PP–31/TIQ–2 to Amplifier AM–20( )/TIQ–2.

Section II. INSTALLATION

6. Unpacking and Checking

Unpack the equipment (fig. 6) as follows:

a. Cut the steel straps ①.

b. Using a nail puller, remove the nails and remove the top of the packing case ②.

c. Using a nail puller, remove the nails and remove the sides of the packing case ③.

d. Remove all protective wrappings ④, ⑤, ⑥, and ⑦.

e. Remove the equipment from its case ⑧.

f. Unhook the four catch fasteners at the front of Case CY–38/TIQ–2 and remove the front cover.

g. Inspect the equipment for damage and check the components against the master packing slip.

7. Connections (fig. 3)

Before making any connections to the equipment, make sure that the ON-OFF switches on the front panel are in OFF position. Make sure that the VOLTAGE SWITCH is in the correct position for the battery voltage being used. This switch is provided with an angle bracket to lock it in either the 6- or 12-volt position. Remove this lock when it is desired to change voltage but be sure to replace the lock after the switch has been thrown to the desired position.

a. For Use with Amplifier AM–20( )/TIQ–2. Connect the female connector of Cord CX–782/TIQ–2 (W–1) or Cord CX–781/TIQ–2 (W–2) to the battery connector (INPUT receptacle) located at the right-hand end of the front panel. Connect the battery clips of this cord to the terminals of the storage battery. *Connect the clip with the black rubber insulator to the negative battery terminal.* Connect the male connector of Cord CX–771/TIQ–2 (W–3) to the amplifier power connector (AMPLIFIER HIGH VOLTAGE OUTPUT receptacle) located in the center of the front panel. Connect the female connector of this cord to the power receptacle on the amplifier (fig. 3, TM 11–2586).

Digitized by Google

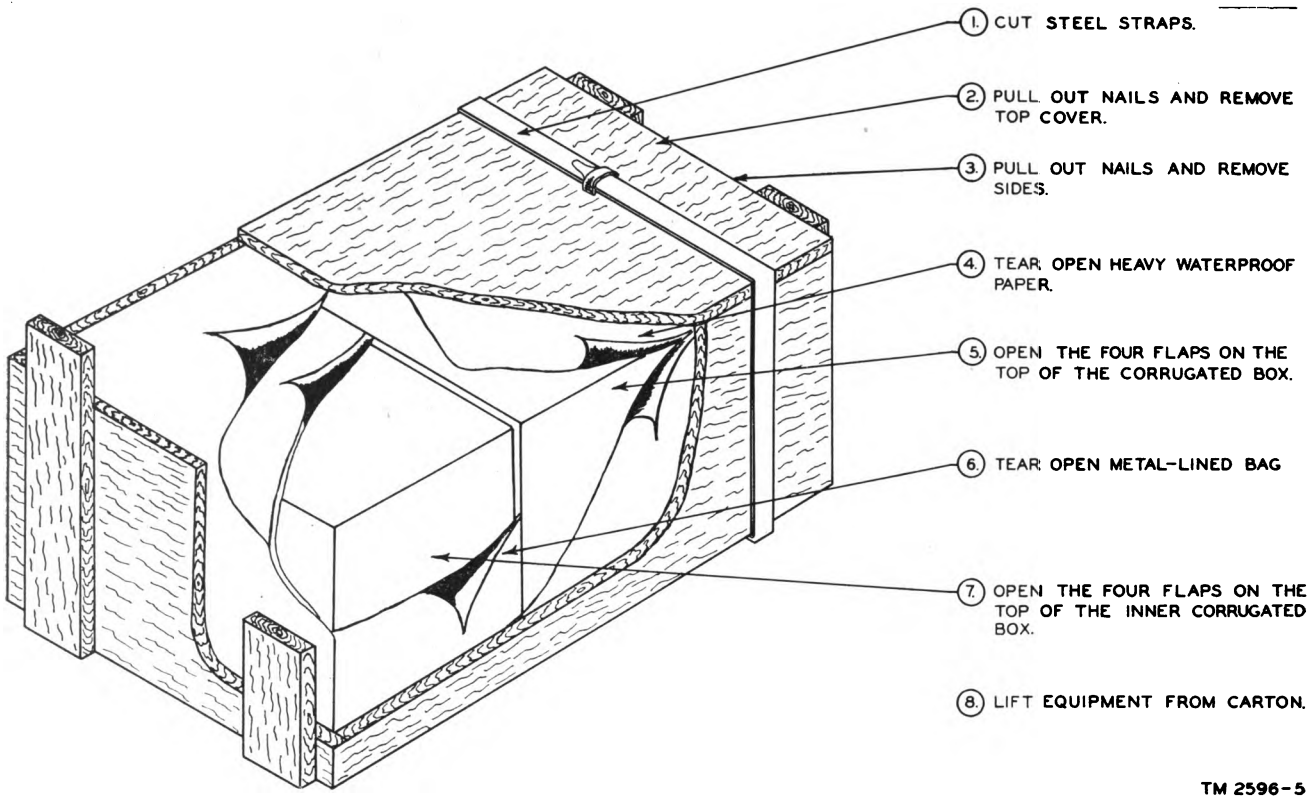


Figure 6. Unpacking sequence.

Digitized by Google

b. For Use with Turntable MX–39/TIQ–2. Connect the female connector of Cord CX–782/TIQ–2. (W–1) or Cord CX–781/TIQ–2 (W–2) to the battery connector (INPUT receptacle) located at the right-hand end of the front panel. Connect the battery clips of this cord to the terminals of the storage battery. *Connect the clip with the black rubber insulator to the negative battery terminal.* Connect the female connector of Cord CX–49/TIQ–2 to the POWER CORD receptacle of Turntable MX–39/TIQ–2 (fig. 6, TM 11–2586). Connect the twist-lock plug of this cord to the phono power connector (PHONO 115 VOLTS AC OUTPUT receptacle) located at the left-hand end of the front panel of the unit. (Cord CX–49/TIQ–2 is furnished with Public Address Set AN/TIQ–2( ) of which Turntable MX–39/TIQ–2 is a component. For further information on this equipment, see TM 11–2586.)

8. Repacking Information

Replace all cords and spare parts in the storage compartment in the front panel. Replace the front cover of Case CY–38/TIQ–2 and fasten the four catch fasteners.

Digitized by Google

PART TWO

OPERATING INSTRUCTIONS

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

Section III. CONTROLS AND THEIR USE

9. Controls and Their Use (fig. 3)

The controls on Vibrator Pack PP–31/TIQ–2 are divided into three groups: One group of controls, marked 6 OR 12 VOLT DC INPUT, is used to select the proper input connections; a second group, marked AMPLIFIER HIGH VOLTAGE OUTPUT, is used when supplying power for Amplifier AM–20( )/TIQ–2. The third group, marked PHONO 115 VOLTS AC OUTPUT, is used when supplying power for Turntable MX–39/TIQ–2.

a. 6 OR 12 VOLT DC INPUT. In this group the battery VOLTAGE SWITCH consists of two toggle switches with a bar connecting the handles for simultaneous operation and a locking device to prevent accidental changing of voltage. In the 6 VOLT position the battery circuit of the vibrator back is arranged for use with a 6-volt battery; in the 12 VOLT position the circuit is arranged for use with a 12-volt battery.

b. AMPLIFIER HIGH VOLTAGE OUTPUT. In this group the ON-OFF toggle switch controls the application of battery voltage to the vibrator in the amplifier power section of the equipment.

c. PHONO 115 VOLTS AC OUTPUT. In this group the ON-OFF toggle switch controls the application of battery voltage to the vibrator in the phono section of the equipment.

Section IV. OPERATION

10. Operation

Before putting this equipment into operation, review technical manual TM 11–2586 covering Public Address Set AN/TIQ–2( ). After reviewing TM 11–2586 and installing the vibrator pack as described in section II, operate it as follows:

Digitized by Google

a. Six-volt Input. (1) Throw the VOLTAGE SWITCH to the 6 VOLT position. (If the VOLTAGE SWITCH is set at the 12 VOLT position when a 6-volt battery is used, there will be no output voltage from the power supply.)

(2) To operate Amplifier AM–20( )/TIQ–2, place the switch in the AMPLIFIER HIGH VOLTAGE OUTPUT section of the vibrator pack and the power switch in Amplifier AM–20( )/TIQ–2 in ON position. The pilot lamp in the amplifier section of the vibrator pack and in the amplifier should light. To stop operation, throw both switches to OFF.

(3) When operation of Amplifier AM–20( )/TIQ–2 is not required momentarily, the switch in the AMPLIFIER section of the power supply should be placed in OFF position. This will remove plate voltage from the amplifier, save the power source from the current drain caused by the operation of vibrator E–1, and keep the cathodes of the amplifier tubes warm so operation can be resumed immediately, if required. In this condition, the pilot lamp in the amplifier will remain lit to indicate that filament voltage is still applied to the tubes.

(4) Normally, when operation of the amplifier is not required for more extended periods of time, the AMPLIFIER section of the power supply and Amplifier AM–20( )/TIQ–2 should be turned off. This will save the power source from the current drain due to operation of the vacuum-tube heaters. Where battery power sources of relatively limited capacity are used it also will be necessary to disconnect Cord CX–771/TIQ–2 from the amplifier in order to prevent current drain through the carbon microphone circuit of Amplifier AM–20( )/TIQ–2 (transformer T–2 and resistor R–34 of Amplifier AM–20( )/TIQ–2).

Caution: If only Amplifier AM–20( )/TIQ–2 is turned off, the output voltage of the AMPLIFIER section of the power supply may rise to an excessive value. If only the AMPLIFIER section of the power supply is turned off, the power source still will be subjected to filament current drain which is approximately 3 amperes. When Amplifier AM–20( )/TIQ–2 is also turned off, the drain will be reduced to approximately 25 ma. The amplifier must be completely disconnected for zero current drain.

NOTE.—Amplifiers AM–20/TIQ–2, serial Nos. 1 to 25 inclusive (Cardwell), furnished on Order No. 8259–Phila–46–04, do not have pin F on power cord connector P–3 connected to the chassis ground. This jumper must be added on these amplifiers before they can be operated from Vibrator Pack PP–31/TIQ–2.

(5) To operate Turntable MX–39/TIQ–2, place the switch in the PHONO 115 VOLTS AC OUTPUT section of the power supply in ON position. The pilot lamp associated with this section will light and, if the switches on Turntable MX–39/TIQ–2 are in the correct positions, the turntable will revolve. To stop operation, turn the PHONO 115 VOLTS AC OUTPUT SWITCH of the vibrator pack off.

Caution: When opearting Turntable MX–39/TIQ–2 from Vibrator

Digitized by Google

Pack PP–31/TIQ–2, always leave the turntable turned on and control its operation with the ON-OFF switch in the TURNTABLE section of the power supply. This will prevent damage to the vibrator unit due to operation at no load, prevent unnecessary battery drain, and prolong the life of the vibrator unit. Accordingly, this section of the power supply should be turned on only when it is needed.

b. Twelve-volt Input. Throw the VOLTAGE SWITCH to the 12 VOLT position and proceed as described in *a* (2) and (3) above.

Caution: If the VOLTAGE SWITCH is set at the 6 VOLT position and a 12-volt battery is used, the fuses will blow out in whichever section of the power supply that is turned on. The circuit supplying power to the heaters of the vacuum tubes in Amplifier AM–20( )/TIQ–2 is not fused and, consequently, THESE TUBES WILL BE DAMAGED IF EXCESSIVE FILAMENT VOLTAGE IS APPLIED.

Section V. EQUIPMENT PERFORMANCE CHECK LIST

11. Purpose and Use

a. General. The equipment performance check list (par. 12) will help the operator to determine whether Vibrator Pack PP–31/TIQ–2 is functioning properly. The check list gives the item to be checked, the conditions under which the item is checked, the normal indications and tolerances 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. Items 7 and 8 on this check list should be checked at least once during a normal operating period or at least four times a day during continuous operation.

b. Action or Condition. For some items the information given in the action or condition column consists of the setting of various switches and controls 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.

Digitized by Google

12. Equipment Performance Check List

	Item No.	Item	Action or condition	Normal indications	Corrective measures
PREPARATORY	1	INPUT connector	Connect female connector of Cord CX–782/TIQ–2 or Cord CX–781/TIQ–2 to INPUT connector.	Connector should be screwed down as far as possible.	Push jacks firmly on plugs and tighten collar securely. Replace connectors if necessary.
	2	Battery clips	Attach clips to battery terminals.	Clips make clean firm contact.	Clean battery clips and terminals.
	3	Storage battery	Check specific gravity of battery.	Battery is fully charged.	Charge or replace battery.
	4	VOLTAGE SWITCH	Throw switch to 6 VOLT position for use with 6-volt battery.		
			Throw switch to 12 VOLT position for use with 12-volt battery.		
			Lock switch in correct position with angle bracket on front panel.		
	5	OUTPUT receptacle	Connect Cord CX–771/TIQ–2 to amplifier output receptacle to operate Amplifier AM–20/TIQ–2.	Connector should be screwed down as far as possible.	Push jacks firmly on plugs and tighten collar securely. Replace connectors if necessary.
			Connect Cord CX–49 / TIQ–2 to phono output receptacle to operate Turntable MX–39/TIQ–2.	Plug is firmly seated.	Push jacks firmly on plugs and tighten collar securely. Replace connectors if necessary.

Digitized by Google

START	6	ON-OFF switches	Throw switch of required section to ON.	Pilot lamp of required section lights. Vibrator hum is heard.	Check connections of battery clips. Check position of VOLTAGE SWITCH. Check fuse. Check pilot lamp shutter position. Check pilot lamp. Replace vibrator. Replace battery.
EQUIPMENT PERFORMANCE	7	Battery clips	Feel clips. Look for arcs between battery clips and terminals.	Clips are not abnormally warm. No arcing is seen.	Throw ON-OFF switches to OFF and clean battery clips and terminals.
	8	Pilot lamps	See if lamps are on.	Lamp for section in operation is lighted.	Vary shutter. Replace lamp. Check fuse. Replace vibrator. Check battery connection. Replace battery.
STOP	9	ON-OFF switches	Throw to OFF.	Pilot lamps go out. Vibrator hum stops.	

Digitized by Google

PART THREE

PREVENTIVE MAINTENANCE

Section VI. PREVENTIVE MAINTENANCE TECHNIQUES

13. Introduction

a. Meaning. Preventive maintenance (PM) is a systematic series of operations performed at regular intervals on equipment to prevent major break-downs, unwanted interruptions in service, and to maintain equipment at top operating efficiency. The purpose of trouble-shooting, on the other hand, is to locate and correct existing faults.

b. Inspection. Inspection is the most important PM operation. Thorough and systematic inspection of equipment at regular intervals often will reveal minor defects which, if corrected promptly, will prevent major break-downs. It is of utmost importance that operating personnel become thoroughly familiar with the equipment so as to enable them to detect abnormal conditions and possible sources of trouble promptly.

c. Tools and Materials. The tools and materials listed below are needed to perform PM on Vibrator Pack PP–31/TIQ–2.

Contact burnishing tool.
Solvent, dry cleaning (SD).
Baking soda.
Clean cloth.
Crocus cloth.
Common hand tools*.

NOTE.—Gasoline will not be used as a cleaning fluid.

14. Routine Maintenance

a. Daily. At the beginning of each day or immediately before operating the equipment, check all fastenings to see that they are secure. Inspect all electrical connections to see that they are tight and all wiring to see that it is in good condition. Check the fuses and pilot lamps to see that they are not burned out. Check the operation of all switches. Wipe all dust and dirt from the exterior of the equipment. Be on the alert to detect any unusual condition. While the equipment is operating, watch for signs of overheating, unusual noise, or other indications of faulty operation.

*Included in the hand tools should be screw drivers, slip-joint pliers, long-nose pliers, and diagonal cutting pliers.

Digitized by Google

b. Weekly. Wipe dust and dirt from connecting cords with a clean damp cloth (do not use cleaning fluid on wires or cables). Clean battery terminals and battery clips with a wire brush and wash them with a solution of baking soda and water. Clean all connector pins. Remove the equipment from its case and remove the bottom chassis plate. Inspect the interior of the equipment for loose connections, corrosion, and damaged parts. Blow out any dust or dirt that may be present.

c. Monthly. Perform all daily and weekly maintenance operations Check all weatherproofing seals and restore any that are broken.

Section VII. LUBRICATION

(Lubrication of this equipment is not required.)

Section VIII. WEATHERPROOFING

15. General

Signal Corps equipment, when operated under severe climatic conditions which prevail in the tropical, Arctic, or desert regions, requires special treatment and maintenance.

16. Tropicalization

a. General. Because fungus growth, insects, corrosion, salt spray, and excessive moisture affect most materials harmfully, a special moistureproofing and fungiproofing treatment has been devised which, if properly applied, provides a reasonable degree of protection. See 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. The following problems may be encountered:

(1) Resistors, capacitors, coils, chokes, transformer windings, etc., fail because of the effects of fungus growth and excessive moisture.

(2) Electrolytic action, often visible in the form of corrosion, takes place in resistors, coils, chokes, transformer windings, etc., causing eventual break-down.

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

(4) Moisture forms electrical paths on terminal boards and insulating strips, causing flash-overs.

Caution: Varnish spray may have a poisonous effect if inhaled. To avoid inhaling spray, use a respirator if available, otherwise fasten cheesecloth or other cloth material over nose and mouth. Never spray varnish or lacquer near an open flame. Do not smoke in a room where varnish or lacquer is being sprayed. The spray may be highly explosive.

Digitized by Google

b. Vibrator Pack PP–31/TIQ–2. This equipment is protected against deterioration under tropical climatic conditions by a moistureproofing and fungiproofing treatment at the time of manufacture. No further treatment should be necessary unless the seal becomes broken through accident or in the course of repair.

c. Moistureproofing and Fungiproofing after Repairs. If the coating of protective varnish has been punctured or broken during repair and if a complete treatment is not needed to reseal the equipment, apply a brush coat to the affected part. Be sure the break is completely sealed.

17. Winterization

a. General. Special precautions are necessary to prevent poor performance or total operational failure of equipment in subzero temperatures. Most signal equipment can be used in winter if difficulties common to low temperatures are anticipated and precautions taken to prevent them. For operation purposes, place equipment in heated rooms whenever possible. Wrap it in blankets when on the march to protect it from winds and freezing temperatures. See TB SIG 66, Winter Maintenance of Signal Equipment, for complete information. The following problems may be encountered:

(1) Steel shrinks and becomes brittle in subzero temperatures.

(2) Glass is especially susceptible to sudden temperature changes. The difference between a low air temperature and the warmth of a man's breath may be sufficient to shatter a lens.

(3) Natural rubber resists cold weather well, but certain types of synthetic rubber are unreliable and become brittle.

b. Vibrator Pack PP–31/TIQ–2. This equipment will perform satisfactorily under low temperature operating conditions. However, in placing this equipment in operation at low temperatures, always allow maximum possible warm-up time prior to operation. If possible, allow the equipment to stand, with power off, in a heated shelter before operation.

18. Dustproofing

a. General. Signal Corps equipment operated in desert localities is affected by the extremely high temperatures and the amount of dirt, dust, sand, and other foreign matter in the air. Take care to prevent such elements from filtering into vital parts. Cover the equipment when it is not in use. Thorough cleanliness is imperative. If possible, inspect and clean the equipment daily. See TB SIG 75, Desert Maintenance of Signal Corps Equipment.

b. Vibrator Pack PP–31/TIQ–2. Observe precautions to prevent equipment failure due to dust or dirt infiltration as outlined in TB SIG 75.

Digitized by Google

PART FOUR

AUXILIARY EQUIPMENT

(Not used.)

Digitized by Google

PART FIVE

REPAIR INSTRUCTIONS

Section IX. THEORY OF EQUIPMENT

19. General

Vibrator Pack PP–31/TIQ–2 consists of two output circuits which receive their power from 6- or 12-volt d-c source. Vibrator units E–1 and E–3 rapidly reverse the conceptions from the d-c source to the transformer which results in pulses of dc that alternate in the direction of their flow being applied to the primary of the transformer. This effective a-c current is stepped-up by the action of transformers T–1 and T–2 to the desired voltage. From transformer T–1, the alternating voltage is rectified by vacuum-tube rectifier V–1 to produce the required high-voltage dc. From transformer T–2 the alternating voltage is filtered somewhat to improve its waveform and is available directly as an a-c voltage. The theory of operation of the equipment is divided into a study of the input circuit, a study of the a-c output circuit, and a study of the d-c output circuit. These circuits are shown in figure 8.

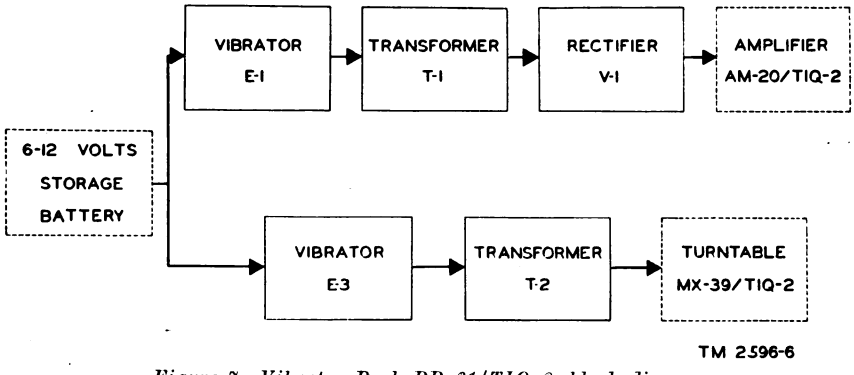


Figure 7. Vibrator Pack PP–31/TIQ–2, block diagram.

20. Input Circuit (fig. 8)

a. Input Circuit for AMPLIFIER HIGH VOLTAGE OUTPUT. The input circuit of this section of the equipment consist of battery connector P–1, amplifier power fuse F–1, amplifier power switch S–3, spark suppressor capacitor C–1, radio-frequency (r-f) bypass capaci-

Digitized by Google

tors C–2, C–7, C–8, C–9, and C–13, amplifier power vibrator E–1, amplifier power pilot lamp E–2, voltage dropping resistors R–1A, R–2, and R–4, battery voltage switch S–1 and S–2, and the tapped primary of amplifier power transformer T–1.

(1) *Battery connector P–1.* Battery connector P–1 has two round male contacts and provides the means for connecting the input of the vibrator pack, through Cord CX–771/TIQ–2 or Cord CX–782/TIQ–2, to either a 6- or 12-volt storage battery.

(2) *Amplifier power fuse F–1.* Fuse F–1 is a 30 ampere, 25-volt primary circuit fuse which protects the amplifier power section of the equipment against short circuits and overloads.

(3) *Amplifier power switch S–3.* Switch S–3 is the ON-OFF switch for the amplifier power section of the equipment. It is a single-pole, single-throw toggle switch and controls the connection of battery voltage to this section.

(4) *Spark suppressor capacitor C–1.* Capacitor C–1 is a 0.5 microfarad (mf), 600-volt, paper-dielectric capacitor which suppresses sparking at the actuating points of vibrator E–1.

(5) *Radio-frequency bypass capacitors C–2, C–7, C–8, and C–9.* These capacitors are 0.5 mf, 600-volt, paper-dielectric capacitors which by-pass to ground any r-f voltages present in the circuit.

(6) *Radio-frequency bypass capacitor C13.* This capacitor is a 0.05 mf, 600-volt, paper-dielectric capacitor which bypasses to ground any r-f voltages present in the circuit.

(7) *Amplifier power vibrator E–1.* Vibrator E–1 is a nonsynchronous type vibrator. The vibrator actuating coil is energized by battery current from a circuit completed through a contact on the vibrating reed. When the energized coil pulls the 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 until the battery is disconnected. A set of contacts on each side of the vibrating reed act the same as a single-pole, double-throw switch which constantly reverses the direction of d-c flow in the primary of amplifier power transformer T–1.

(8) *Pilot lamp E–2 and resistor R–1A.* Amplifier power pilot lamp E–2 is a 6.3 volt, 0.15 ampere, miniature bayonet base Mazda lamp. Voltage-dropping resistor R–1A is a 19-ohm, 1-watt, hermetically sealed resistor. The pilot lamp and resistor are connected in series across part of the primary of amplifier power transformer T–1 to indicate when this section of the equipment is in operation. Resistor R–1A acts as a voltage-dropping resistor to provide the proper voltage for pilot lamp E–2.

(9) *Voltage-dropping resistor R–2.* Resistor R–2 is a 12-ohm, 48-watt resistor which, in 12-volt operation, reduces the voltage across the coil of vibrator E–1.

(10) *Voltage-dropping resistor R–4.* Resistor R–4 is a 2-ohm, 70-watt

Digitized by Google

resistor which, in 12-volt operation, drops the voltage supply for the amplifier filaments to 6 volts.

(11) *Bateery voltage switches S–1 and S–2.* Switches S–1 and S–2 are four-pole, double-throw toggle switches with the handles mechanically connected to operate simultaneously. The battery voltage switch connects half of the total transformer primary turns for 6-volt operation. It also bypasses voltage-dropping resistors R–2 and R–3, and short-circuits resistor R–4, for 6-volt operation, connecting them in the circuit properly for 12-volt operation.

(12) *Amplifier power transformer T–1 primary.* The primary of transformer T–1 is center tapped to permit reversal of pulsating d-c flow. Each half of the center-tapped primary is tapped again, so that all the winding may be used for 12-volt operation or only half of the winding for 6-volt operation.

b. Input Circuit for PHONO 115 VOLTS AC OUTPUT. The input circuit of this section of the equipment consists of battery connector P–1, phono power fuse F–2, r-f bypass capacitors C–10A, C–10B, C–13, and C–14, spark suppressor capacitor C–11 phono power switch S–4, phono power vibrator E–3, battery voltage switches S–1 and S–2, voltage-dropping resistor R–3, phono power pilot lamp E–4, voltage-dropping resistor R–1B, and the primary of phono power transformer T–2.

(1) *Battery connector P–1.* See *a*(1) above.

(2) *Phono power fuse F–2.* Fuse F–2 is a 10-ampere, 25-volt primary circuit fuse which protects the phono power section against shorts and overloads.

(3) *Radio-frequency bypass capacitors C–10A, C–10B, C–13, and C–14.* These paper-dielectric capacitors bypass to ground any r-f voltages present in the circuit. C–10A and C–10B is a dual 0.05 mf, 600-volt capacitor. C–13 is a 0.05 mf, 600-volt capacitor, and C–14 is a 0.5 mf, 600-volt capacitor.

(4) *Spark suppressor capacitor C–11.* This is a 0.5 mf, 600-volt, paper-dielectric capacitor which is used to suppress sparking at the actuating points of vibrator E–3.

(5) *Phono power switch S–4.* Switch S–4 is the ON-OFF switch for the phono power section of the equipment. It is a single-pole, single-throw toggle switch and controls the connection of battery voltage to this section.

(6) *Phono power vibrator E–3.* Vibrator E–3 is a nonsynchronous type vibrator. The vibrator actuating coil is energized by battery current from a circuit completed through a contact on the vibrating reed. When the energized coil pulls the 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 until the battery is disconnected. A

Digitized by Google

set of contacts on each side of the vibrating reed act the same as a single-pole, double-throw switch which constantly reverses the direction of d-c flow in the primary of the phono power transformer T–2.

(7) *Battery voltage switches S–1 and S–2.* See *a*(11) above.

(8) *Voltage-dropping resistor R–3.* Resistor R–3 is a 10-ohm, 31-watt resistor which is used, in 12-volt operation, to reduce the voltage across the coil of vibrator E–3.

(9) *Pilot lamp E–4 and resistor R–1B.* Phono power pilot lamp E–4 is a 6.3-volt, 0.15-ampere, miniature bayonet base Mazda lamp. Voltage-dropping resistor R–1B is a 19-ohm, 1-watt, hermetically sealed resistor. The pilot lamp and resistor are connected in series across part of the primary of the phono power transformer T–2 to indicate when this section of the equipment is in operation. Resistor R–1B acts as a voltage-dropping resistor to provide the proper voltage for pilot lamp E–4.

(10) *Phono power transformer T–2 primary.* See *a*(12) above.

21. Step-by-step Analysis of Input Circuits (fig. 8)

Since the theory of operation is the same for both input circuits, only that for the AMPLIFIER HIGH VOLTAGE OUTPUT section is given below.

a. Vibrator Actuating Circuit. When ON-OFF switch S–3 is thrown to the ON position, current from the battery flows through fuse F–1, through switch S–3, through the single contact on the reed of vibrator E–1, through the coil of vibrator E–1 back to the battery. (When a 12-volt battery is used current flows through the coil vibrator E–1, through resistor R–2 back to the battery.)

b. Transformer Primary Circuit. The input circuit to the transformer (T–1) primary is a separate input circuit in parallel with the vibrator actuating circuit discussed in *a* above.

(1) *First half-cycle.* In the first half-cycle, with the vibrator reed in lower position, current flows from the 12-volt battery through fuse F–1, through switch S–3, through one set of contacts on the vibrator reed, through switch S–1, through the upper half of the primary of transformer T–1 back to the battery. (When a 6-volt battery is used, the arm of switch S–1 is in such a position that it halves the number of transformer primary turns in the circuit and makes use of only part of the upper half of the primary.)

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

Digitized by Google

22. Output Circuit (fig. 8)

a. AMPLIFIER HIGH VOLTAGE OUTPUT. The output circuit of this section consists of the secondary of amplifier power transformer T–1, rectifier tube V–1, timing capacitor C–3, filter capacitors C–4 and C–5, r-f bypass capacitor C–6, and amplifier power connector J–1.

(1) *Amplifier power transformer T–1 secondary.* This transformer has two secondary windings. Winding 9–10 provides 5 volts for the filament of rectifier tube V–1. Winding 1–2–3 is the center-tapped high-voltage winding.

(2) *Rectifier tube V–1.* This rectifier Tube JAN–5UG4 is used to convert the high-voltage ac to dc.

(3) *Timing capacitor C–3.* This 0.02-mf 1,500-volt, paper-dielectric capacitor is used to secure a waveform of such a shape that the vibrator life will be maximum.

(4) *Filter capacitors C–4 and C–5.* Capacitors C–4 and C–5 are 4-mf, 1,000-volt paper-dielectric capacitors. They are used to smooth any a-c ripple present in the d-c voltage.

(5) *Radio-frequency bypass capacitor C–6.* Capacitor C–6 is a 0.05-mf, 1,000-volt, paper-dielectric capacitor which bypasses to ground any r-f voltages which may be present in the circuit.

(6) *Amplifier power connector J–1.* Amplifier power connector J–1 has eight female contacts which provide the means for connecting the plate and filament voltages to the amplifier.

b. PHONO 115 VOLTS AC OUTPUT. The output circuit of this section consists of the secondary of phono power transformer T–2, timing capacitor C–12, r-f bypass capacitor C–15, and phono power connector J–2.

(1) *Phono power transformer T–2 secondary.* The secondary of phono power transformer T–2 is a single winding designed to supply 115 volts ac to operate Turntable MX–39/TIQ–2.

(2) *Timing capacitor C–12.* This 4-mf, 600-volt, paper-dielectric capacitor compensates for phono motor factor and secures a waveform of such a shape that the vibrator life will be maximum.

(3) *Radio-frequency bypass capacitor C–15.* Capacitor C–15 is a 0.05-mf, 600-volt, paper-dielectric capacitor which bypasses to ground any r-f voltages which may be present in the circuit.

(4) *Phono power connector J–2.* This is a twist-lock type female-contact connector into which a twist-lock plug may be inserted for use in operating. Turntable MX–39/TIQ–2.

23. Analysis of Output Circuit

a. AMPLIFIER HIGH VOLTAGE OUTPUT. Interrupted dc, 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,

Digitized by Google

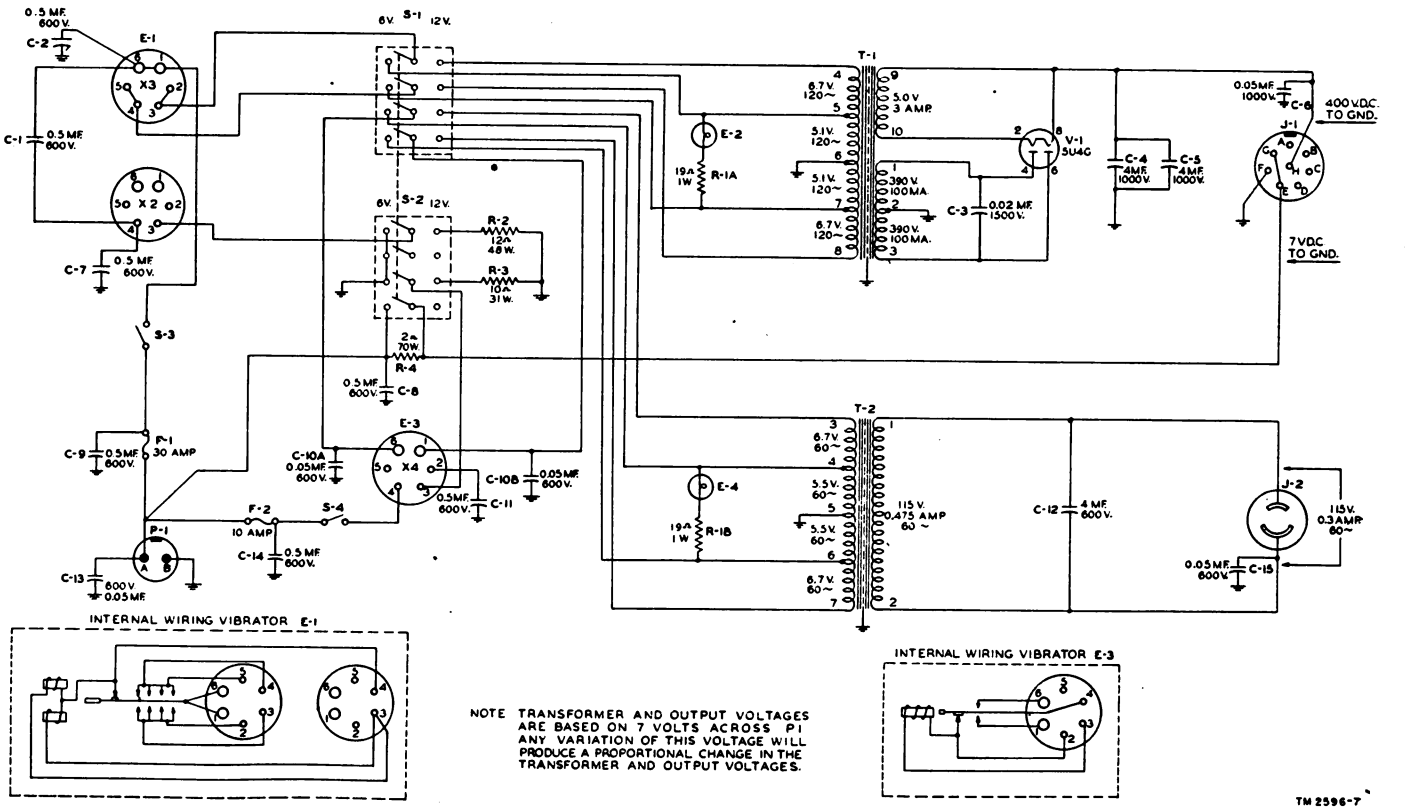


Figure 8. Vibrator Pack PP-31/TIQ-2, schematic diagram.

Digitized by Google

produces alternating magnetic flux in the transformer core. This alternating flux in the core produces alternating voltages in the secondary windings of the transformer. The 5-volt secondary winding of the transformer supplies filament current for rectifier Tube JAN–5U4G. The ends of the high-voltage windings are connected to the plates of the rectifier tube. The rectifier tube allows current to pass in one direction only. Thus, when terminal No. 1 of the transformer is positive, current will pass through plate (4) of the tube and, since terminal No. 3 is negative, no current will pass through plate (6). As the current reverses and terminal No. 3 of the transformer becomes positive, current passes through plate (6) and, since terminal No. 1 is now negative, no current will pass through plate (4).

b. PHONO 115 VOLTS AC OUTPUT. Interrupted dc, 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 C–12 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 X. TROUBLE-SHOOTING

24. Introduction

a. General. No matter how well equipment is designed and manufactured, faults occur in service. When such faults occur, the repairman must locate and correct them as rapidly as possible. This section contains information designed to aid those engaged in the important duty of trouble-shooting.

b. Trouble-shooting Data. The following material will help the repairman locate the trouble more quickly:

(1) Illustrations showing the location of parts and their reference symbols (figs. 4 and 9).

(2) Diagrams and voltage and resistance data (fig. 8).

(3) The symptoms, probable causes, and remedies given in the trouble-shooting chart (par. 32).

c. Trouble-shooting Steps. The first step in servicing the power supply is to sectionalize the trouble (if possible) through inspection. *Sectionalization* means tracing the fault to the component responsible for the trouble. The second step is to localize the fault. *Localization*

Digitized by Google

means tracing the fault to the defective part in the component suspected of being responsible for the trouble.

25. Trouble-shooting by Inspection

Before starting an elaborate test procedure, attempt to locate the cause of the trouble by inspecting the power supply and cords. Turn off the power and check the equipment immediately so that odors, abnormal signs (which may disappear when the equipment cools off), and other temporary indications may be readily detected. Look for the following:

a. Overheated Parts. Excessive heat may cause oil to drip from the paper capacitors. Check for a nearby resistor or any part showing signs of excessive heating. Metal parts will usually discolor; resistors also will change in color if subjected to the passage of excessive current over a long period of time. Look for burned insulation on the hook-up wires. The acrid odor of burning insulation or enamel may lead the trouble-shooter to the defective part. Smoke rising from any part may indicate the presence of a short circuit.

b. Mechanical Faults. Mechanical faults usually reveal themselves through noise other than the usual noises heard during normal operation. If the offending part is not immediately indicated, stop the set and start again. Listen carefully to the sounds coming from each vibrator. Consult the normal indication column in the equipment performance check list (par. 12).

(1) The noise resulting from loosened parts and mountings sometimes may be tracked down by feeling the suspected parts. Pressing down on a suspected part may stop the vibration and eliminate the sounds. This type of trouble is not likely to occur if the equipment is inspected and serviced as instructed in section VI.

(2) The condition of connectors, cables, switches, terminals, and other parts which are subjected to mechanical wear and tear is usually determined by examination. If any of the above parts are suspected, examine them for loose screws, mountings, corrosion, etc.

c. Summary. An experienced trouble-shooter always will inspect the equipment for visible signs of trouble. The majority of troubles in vibrator packs usually result from defective tubes, vibrators, or batteries. Loose cable clamps or screws, corrision at critical points, poorly soldered joints, and many other similar visible defects usually can be seen or felt during inspection. The use of test equipment may not be necessary when making such an inspection. Familiarity with the normal signs, conditions, sounds, smells, etc., help the trouble-shooter. Study the diagrams (figs. 7 and 8) and know the exact location of the parts by using the illustrations (figs. 4 and 9) and the reference symbols thereon. Learn to trouble-shoot by inspection and use the test equipment to confirm the findings, if necessary.

Digitized by Google

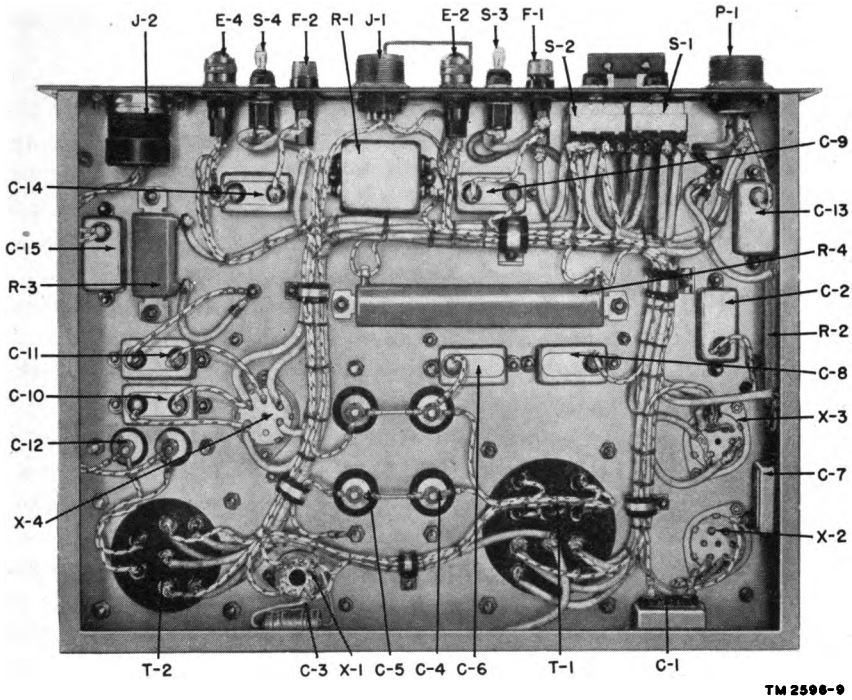


Figure 9. Under chassis parts.

26. Voltage Measurements

a. General. Voltage measurements aid the repairman because many troubles either result from abnormal voltages or produce abnormal voltages. Since voltage measurements are made between two points in a circuit, the circuit need not be interrupted.

(1) Operating voltages (fig. 8) are measured between the adjacent terminals or between terminals otherwise indicated. The indicated voltags should be obtained with the power supply connected as given in paragraph 12. The indicated voltages are based on a voltage of 7 or 14 volts at the terminals of receptacle P–1. Any deviation from this voltage will result in an approximately proportional change in the voltages indicated on the diagram.

(2) Set the voltmeter on the highest range so that the voltmeter will not be overloaded. Then if it is necessary to obtain increased pointer deflection, set the voltmeter to a lower range.

b. Precautions against High Voltage. Certain precautions must be taken when measuring voltage above a few hundred volts. High voltages are dangerous and under certain conditions can be fatal. When it is necessary to measure high voltages, observe the following rules:

(1) Make a secure connection to one of the test points with one of the voltmeter leads.

Digitized by Google

(2) Connect the voltmeter test prod to the other test point. Do not touch the metal prod.

27. Resistance Measurements

a. Normal Resistance Values. When a fault develops in a circuit, its effect very often will be apparent as a change in the resistance values. To assist in the localization of such faults, trouble-shooting data, including normal resistance values, have been provided. The normal resistance values are shown in the schematic diagram (fig. 8).

b. Precautions. (1) Before making any resistance measurements, turn off the power. *If the ohmmeter is connected to a circuit which already has voltages in it, the needle may be thrown off scale and the meter movement may be damaged.*

(2) Capacitors must always be discharged before resistance measurements are made. This is very important when checking power supplies that are disconnected from their load. The discharge of a capacitor through the meter may damage the meter movement.

c. Correct Use of High and Low Ranges. Make certain when to use the low-resistance range and when to use the high-resistance range of an ohmmeter. When checking circuit continuity, the ohmmeter should be set on the lowest range. If a medium or high range is used, the pointer may indicate 0 ohms, even if the resistance is as high as 500 ohms. When checking high resistances or measuring the leakage resistance of capacitors or cables, the highest range should be used. If a low range is used, the pointer will indicate *infinite* ohms, even though the actual resistance is less than a megohm.

d. Parallel Resistance Connections. (1) In a parallel circuit the total resistance is less than the lowest resistance in the circuit. Remember this when trouble-shooting with the aid of a schematic diagram.

(2) When a resistance is measured and the value is found to be less than expected, study the schematic diagram carefully to be certain that there are no resistances in parallel with the one that has been measured. Before replacing a resistor because its resistance measures too low, disconnect one terminal from the circuit and measure its resistance again to make sure that the low reading does not occur because some part of the circuit is in parallel with the resistor.

(3) In checking resistors R–1A and R–1B, remove pilot lamps E–2 and E–4 from their sockets to prevent measuring transformer windings in parallel with these resistors.

e. Tolerance Values for Resistance Measurements. Tolerance value is the normal difference that is expected between the rated value of the resistor and its actual value. All resistors used in the vibrator pack have a tolerance of 5 percent. For example, a resistor might have a rated value of 100 ohms. If the resistor were measured and found to have a value between 95 and 105 ohms, it would be considered normal.

Digitized by Google

28. Capacitor Checks

a. Capacitor Defects. It is often necessary and desirable to check capacitors for leakage and open or short circuits. The usual trouble in capacitors is a short circuit or leakage caused by the break-down of the dielectric between the plates. However, open circuits sometimes occur in paper-type capacitors because of the metal tab (terminal) pulling away from the tinfoil plates, but this trouble is unusual.

b. Open Capacitor. A capacitor suspected of being open can be checked best by shunting a good capacitor across it. In the vibrator pack the test capacitor lead length will not affect the operation of the circuit.

c. Kick Indication. Any good high-resistance voltohmmeter may be used to check for leakage in a paper or mica capacitor. Tests for an open or short circuit may be made with the same instrument. (Test Unit I–176 is generally available in the field and is recommended for checking capacitors, using the kick-indication method.) The ohmmeter circuit of the test unit is used to make the check. Proceed as follows:

(1) Disconnect one end of the capacitor from its shunting circuit.

(2) Set the ohmmeter to read on its highest range and place the ohmmeter leads across the capacitor.

(3) A good capacitor should cause the meter needle to kick up the scale and fall back to infinity (zero).

(4) A leaky capacitor will cause the pointer to remain at some point on the scale other than infinity.

(5) An open capacitor will cause no deflection of the meter needle.

(6) The lower the capacitance, the lesser will be the degree of deflection which occurs on the ohmmeter scale. The higher the capacitance, the greater will be the deflection which appears on the ohmmeter scale (if the capacitor is normal). Usually, capacitors lower than 0.05 mf do not indicate a measurable kick. Replace defective capacitors.

d. Replacement. In general, the replacement of capacitors in this equipment is not too critical with respect to the value of the capacitor but only with respect to its working voltage. This should be equal to or greater than the working voltage rating of the capacitor being replaced. In the case of capacitors C–3 and C–12, however, their value has been selected with particular regard to the vibrator and load circuit with which they are used. Therefore, whenever either capacitor C–3 or C–12 is replaced, capacitors of the same value (within the 10-percent tolerance allowed) should be used.

29. Current Measurements

a. Current measurements are not ordinarily required in trouble-shooting the unit. However, if current measurements are desired, the

Digitized by Google

circuit may be opened and the meter connected in series with the circuit. Observe polarity to keep the meter needle on the meter scale. *An ammeter must always be connected in series with the circuit under check.*

b. A meter is least protected against damage when it is used to measure current; therefore, always set the current range to the highest value. Then, if necessary, decrease the range to give a more accurate reading. Avoid working close to full-scale reading, because this increases the danger of overload.

c. Usually the current to be measured flows through a resistance which is known or which can be measured with an ohmmeter. The current flowing in the circuit can be determined by dividing the voltage drop across the resistor by its resistance value.

30. Tube Checking

a. The trouble-shooter is concerned most with the emission of a vacuum tube. Hand-tapping of the tube envelope usually reveals shorted or poorly welded elements inside the tube. A faulty rectifier tube, when tapped while under operation, usually will show arcs inside the tube. Experience in tapping tube envelopes will teach the trouble-shooter how to determine a mechanically defective tube.

b. Results obtained from a tube checker are not always conclusive because the test conditions are not the same as those under which the tube actually operates in the power supply. The final test of a tube may have to be its replacement with a tube known to be good. It is often quicker and more reliable to replace a suspected tube with a good one than to check it with the tube checker.

c. Tube checkers usually are available in the field. Technical manuals are packed with the instruments and they cover the tube-checker panel settings.

31. Parts Replacement

Careless replacement of parts often creates new faults. Observe the following precautions.

a. Before a part is unsoldered, note the position of the leads. If the part has a large number of leads, tag each lead.

b. Do not damage other leads by pulling or pushing them out of the way.

c. Do not allow drops of solder to fall into the set; they may cause short circuits. It is very important to make well-soldered joints. A poorly soldered joint (cold-soldered) is one of the most difficult faults to locate.

d. Place the replaced part in the exact position occupied by the origi-

Digitized by Google

nal part. A part which has the same electrical value but a different physical size may cause trouble.

e. Pay attention to proper grounding when replacing a part. Use the same ground point as in the original wiring.

32. Trouble-shooting Chart

The following trouble-shooting chart, if properly used, should facilitate trouble-shooting. Most troubles will manifest themselves by the appearance of symptoms. These symptoms appear in the first column. The second column of the chart lists the probable source of the trouble. The corrections are listed in the third column. If trouble with the equipment develops, inspect the component believed to be at fault. Look for symptoms. Inspect the first column of the trouble-shooting chart for a symptom that resembles the one found by inspection. Proceed with steps as outlined in the third column.

Symptoms	Probable cause	Correction
1. Vibrator unit does not operate.	1. Poor battery contacts.	1. Clean battery clips and terminals.
	Fuse burned out.	Replace fuse.
	Vibrator unit defective.	Replace vibrator.
2. Fuses burn out.	2. VOLTAGE SWITCH S-1 set at 6 VOLT when 12-volt battery is used.	2. Throw VOLTAGE SWITCH to 12 VOLT position.
	Vibrator unit defective.	Replace vibrator.
	Capacitor shorted.	Replace capacitor.
3. D-c output voltage low.	3. Battery not fully charged.	3. Replace or recharge battery.
	Bad tube V-1.	Replace tube.
4. Vibrator operates, but output voltage is zero.	4. Switch S-1 defective.	4. Repair or replace switch.
	Output receptacle defective.	Repair or replace output receptacle.
	Secondary of transformer shorted.	Replace transformer.
	Tube burned out.	Replace tube.

Section XI. REPAIRS

33. Repair Procedures

a. General. Repairs consist mainly of the following operations: making parts replacements; tightening loose mountings of transformers, capacitors, and resistors; splicing and repairing defective cables and cords; straightening bent pins on connectors and plugs; removing and inserting fuses, tubes, and panel indicator lamps; removing and inserting vibrators; removing corrosion from those points in the circuit

Digitized by Google

which, if corroded, would interfere with normal operation (connector pins, tube socket contacts, battery clips, etc.); and numerous other operations which result in continuous high quality equipment performance.

b. Repairing Vibrator Pack PP–31/TIQ–2. Power supply parts likely to cause trouble are untreated (varnish-free) socket contacts. When cleaning socket contacts, avoid spreading the contact fingers excessively. A good way to clean the contacts is to pull and push the vacuum tube or vibrator in and out of the socket so that the pins act as a burnisher.

c. Parts Replacement. Mounting screws for transformers, sockets, capacitors, connectors, etc., are accessible and easily removed. Colors of wires should be noted and identification tags attached to the free ends of wires or terminals. Always use identical replacement parts and always be sure to use the same ground lug for the ground connection. Avoid heating wires or adjacent parts with the soldering iron. Avoid dropping solder on the chassis by keeping the tip of the iron well tinned and away from the chassis when the iron is loaded with melted solder.

d. Replacement of Vibrator Units. (1) Remove the two 10/32 screws holding vibrator unit E–1 in its socket. Remove the angle bracket and lift the vibrator unit directly away from the chassis.

(2) Remove the two 8/32 screws holding vibrator unit E–3 in its socket. Remove the angle bracket and lift the vibrator unit directly away from the chassis.

(3) Before inserting a new vibrator unit in its socket, note the indexing of the socket. Place the new vibrator in the socket so that the large prongs on the vibrator unit fit into the large socket holes.

e. Replacement of Rectifier Tube. (1) Squeeze the two portions of the spring clip together where the rod goes through the clip. Lift the clip off the rod. Lift the tube from the socket. Before inserting a new tube, note the indexing of the socket.

(2) *Parts replacement.* Always reinstall parts and wires in their original positions. Return cable clips and rubber insulators to their respective places. Collect all wire strands and cut them off or place them alongside the main body of wire; solder securely.

(3) *Varnish film.* Restore the varnish film to the treated areas after repairs are completed (sec. VIII). This operation is especially important in damp, hot climates.

34. Unsatisfactory Equipment Report

a. WD AGO Form 468 (War Department Unsatisfactory Equipment Report) for Equipment Used by the Army. WD AGO Form 468 will

Digitized by Google

be filled out and forwarded through channels to the Office of the Chief Signal Officer, Washington 25, D. C., when trouble occurs more often than is normal, as determined by qualified repair personnel.

b. AF Form 54 (Unsatisfactory Report) for Equipment Used by the Air Force. AF Form 54 will be filled out and forwarded to Commanding General, Air Materiel Command, Wright-Patterson Air Force Base, Dayton, Ohio, in accordance with AF Regulation 15–54.

Digitized by Google

APPENDIX I

REFERENCES

NOTE.—For availability of items listed, check FM 21–6 and Department of the Army Supply Catalog SIG 1 & 2; also see FM 21–6 for applicable technical bulletins, supply bulletins, modification work orders, and changes.

1. Supply Publications

SIG 1 & 2	Introduction and Index.
SIG 3	List of Items for Troop Issue.
SIG 4–1	Allowances of Expendable Supplies.
SIG 5	Stock List of All Items.
SB 11–17	Electron Tube Supply and Reference Data.
SB 11–76	Signal Corps Kit and Materials for Moisture- and Fungi-Resistant Treatment.

2. Technical Manuals on Test Equipment

TM 11–472	Repair and Calibration of Electrical Measuring Instruments.
TM 11–2613	Voltohmmeter I–166.
TM 11–2626	Test Unit I–176.
TM 11–2627	Tube Tester I–177.

3. Shipping Instructions

U. S. Army Specification No. 100–14A	Army–Navy General Specification for Packaging and Packing for Oversea Shipment.

4. Decontamination

TM 3–220	Decontamination.

5. Demolition

FM 5–25	Explosives and Demolitions.

Digitized by Google

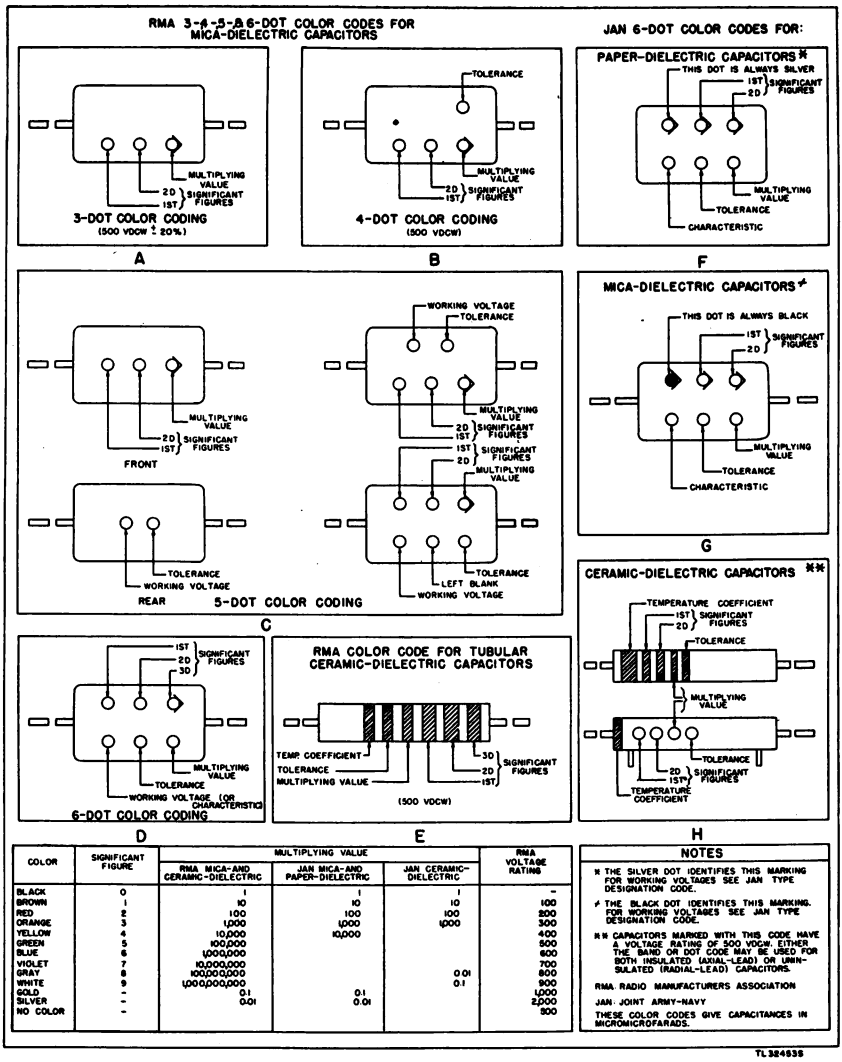
6. Other Publications

TB SIG 13	Moistureproofing and Fungiproofing Signal Corps Equipment.
TB SIG 66	Winter Maintenance of Signal Equipment.
TB SIG 7	Tropical Maintenance of Ground Signal Equipment.
TB SIG 75	Desert Maintenance of Ground Signal Equipment.
TM 1–455	Electrical Fundamentals.
TM 11–453	Shop Work.
TM 11–462	Signal Corps Reference Data.
TM 11–2586	Public Address Sets AN/TIQ–2 and AN/TIQ–2A.

7. Abbreviations

ac	alternating current (noun)
a-c	alternating current (adjective)
amp	ampere(s)
AWG	American Wire Gauge
cps	cycles per second
dc	direct current (noun)
d-c	direct current (adjective)
JAN	joint Army-Navy
lb.	pound(s)
ma	milliampere(s)
mf	microfarad(s)
par.	paragraph(s)
PM	preventive maintenance
rf	radio frequency
v.	volt(s)

Digitized by Google



COLOR	SIGNIFICANT FIGURE	MULTIPLYING VALUE			RMA VOLTAGE RATING
		RMA MICA-AND CERAMIC-DIELECTRIC	JAN MICA-AND PAPER-DIELECTRIC	JAN CERAMIC-DIELECTRIC	
BLACK	0	1	1	1	-
BROWN	1	10	10	10	100
RED	2	100	100	100	200
ORANGE	3	1,000	1,000	1,000	300
YELLOW	4	10,000	10,000		400
GREEN	5	100,000			500
BLUE	6	1,000,000			600
VIOLET	7	10,000,000			700
GRAY	8	100,000,000		0.01	800
WHITE	9	1,000,000,000		0.1	900
GOLD	-	0.1	0.1		1,000
SILVER	-	0.01	0.01		2,000
NO COLOR	-				500

NOTES

* THE SILVER DOT IDENTIFIES THIS MARKING FOR WORKING VOLTAGES SEE JAN TYPE DESIGNATION CODE.

THE BLACK DOT IDENTIFIES THIS MARKING. FOR WORKING VOLTAGES SEE JAN TYPE DESIGNATION CODE.

** CAPACITORS MARKED WITH THIS CODE HAVE A VOLTAGE RATING OF 500 VDCW. EITHER THE BAND OR DOT CODE MAY BE USED FOR BOTH INSULATED (AXIAL-LEAD) OR UNINSULATED (RADIAL-LEAD) CAPACITORS.

RMA RADIO MANUFACTURERS ASSOCIATION

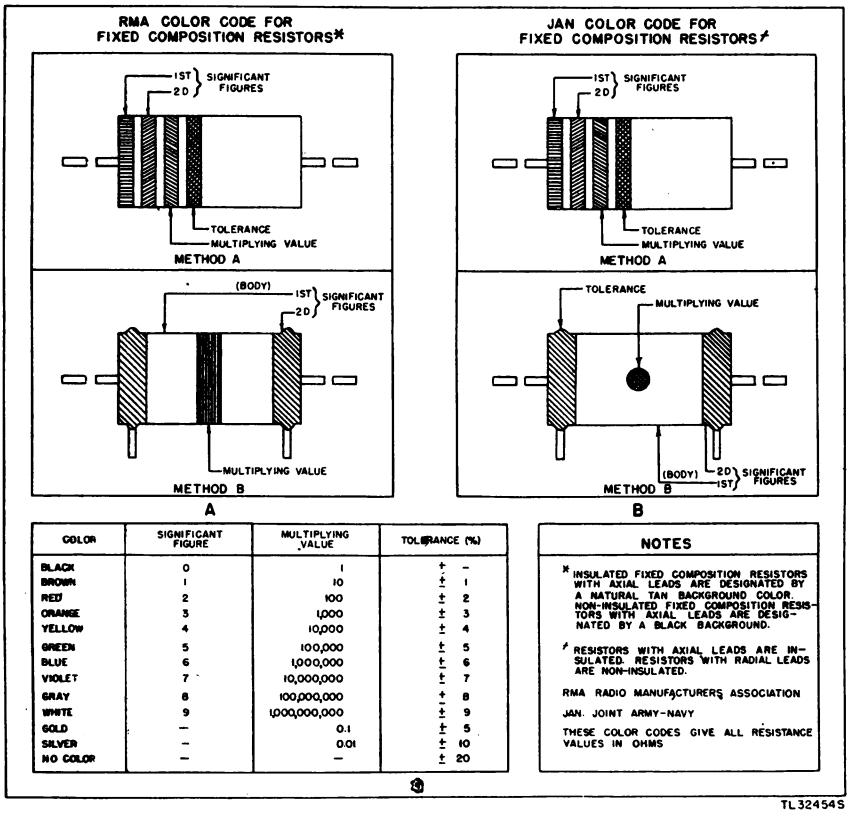
JAN: JOINT ARMY-NAVY

THESE COLOR CODES GIVE CAPACITANCES IN MICROMICROFARADS.

TL 324838

Figure 10. Capacitor color codes.

Digitized by Google



COLOR	SIGNIFICANT FIGURE	MULTIPLYING VALUE	TOLERANCE (%)
BLACK	0	1	+ –
BROWN	1	10	± 1
RED	2	100	± 2
ORANGE	3	1,000	± 3
YELLOW	4	10,000	± 4
GREEN	5	100,000	± 5
BLUE	6	1,000,000	± 6
VIOLET	7	10,000,000	± 7
GRAY	8	100,000,000	± 8
WHITE	9	1,000,000,000	± 9
GOLD	–	0.1	± 5
SILVER	–	0.01	± 10
NO COLOR	–	–	± 20

NOTES

* INSULATED FIXED COMPOSITION RESISTORS WITH AXIAL LEADS ARE DESIGNATED BY A NATURAL TAN BACKGROUND COLOR. NON-INSULATED FIXED COMPOSITION RESISTORS WITH AXIAL LEADS ARE DESIGNATED BY A BLACK BACKGROUND.

/ RESISTORS WITH AXIAL LEADS ARE INSULATED. RESISTORS WITH RADIAL LEADS ARE NON-INSULATED.

RMA RADIO MANUFACTURERS ASSOCIATION

JAN. JOINT ARMY-NAVY

THESE COLOR CODES GIVE ALL RESISTANCE VALUES IN OHMS

Figure 11. Resistor color codes.

Digitized by Google

APPENDIX II

IDENTIFICATION TABLE OF REPLACEABLE PARTS

NOTE.—The fact that an item appears in this technical manual is not sufficient basis for requisitioning the item. Requisitions must cite an authorized basis, such as TO/&E, TE, TA, T/BA, SIG 6, SIG 7&8, SIG 7–8–10, SIG 10, list of allowances of exendable material, or other authorized supply basis. For an index of available catalog pamphlets, see the latest issue of War Department Supply Catalog SIG 1 & 2.

Identification Table of Replaceable Parts for Vibrator Pack PP–31/TIQ–2

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
	VIBRATOR PACK PP–31/TIQ–2: vibrator type, nonsynchronous; supplies 110 v AC, 0.3 amp, 60 cycles to Turntable MX–39/TIQ/2; 400 v DC, 140 ma plate voltage and 6 v DC filament voltage to Amplifier AM–20/TIQ–2; operates from 6 or 12 volt storage battery; approx 17″ lg x 13″ wd x 8″ d overall; Sig C spec #71–3212; u/w Public Address Set AN/TIQ–2.	Provides power source for Public Address Set AN/TIQ–2( ).	3H4698–31
W–2	CORD CX–781/TIQ–2, power: consists of Sig C Cordage CO–212, 6 ft lg; AN–3106–22–IS connector and AN–3057–12 cable clamp on one end; rubber insulated and jacketed; 2 Mueller type #21 battery clips w/Mueller type #23 insulators on other end; end w/battery clips has outer insulating jacket stripped back 12″; Sig S spec #71–3212.	Provides power connection from battery power source.	3E6000–781

Digitized by Google

W–1	CORD CX–782/TIQ–2, power: consists of 2 cond #10 AWG cordage; rubber insulated and jacketed; w/AN–3106–22–IS connector one end; 12 ft lg excluding terminals; 2 Mueller type #21 battery clips w/Mueller type #23 insulators on other end; Sig C spec #71–3212.	Provides power connection from battery power source.	3E6000–782
W–3	CORD CX–771/TIQ–2, power: consists of 6 ft lg, 3 cond #14 AWG type S cordage; rubber insulated and jacketed; w/AN–3106–20–7S connector one end and AN–3057–12 cable clamp on other end; Sig C spec # 71–3212.	Provides power connection from Vibrator Pack PP–31/TIQ–2 to Amplifier AM–20( )/TIQ–2.	3E6000–771
C–1, C–2, C–7, C–8, C–9, C–11, C–14	CAPACITOR, fixed: paper dielectric; 500,000 mmf ± 10%; 600 vdcw; 1 13/16" lg x 1" wd x 7/8" h; JAN type CP54B1EF504K.	C–1—Suppresses spark at contacts of vibrator E–1. C–2, C–7—Bypasses undesirable r-f voltages from vibrator E–1 to ground. C–8—Bypasses r-f voltages from filament line to ground. C–9—Bypasses r-f voltages from 6–12 volt power lead to ground. C–11—Suppresses spark at contacts of vibrator E–3. C–14—Bypasses r-f voltages from 6–12 volt power lead to ground.	3DA500–560
C–3	CAPACITOR, fixed: paper dielectric; 20,000 mmf ± 10%; 1,500 vdcw; 1 5/8" lg x 1" diam; JAN type CP29A1EH203K.	C–3—Improves waveform and stabilizes vibrator action.	3DA20–196
C–4, C–5	CAPACITOR, fixed: paper dielectric; 4 mf ± 10%; 1,000 vdcw; 3 7/8" lg x 3 3/4" wd x 1 1/4" thk; JAN type CP70E1EG405K; mounts with bracket JAN type CP07SC2.	C–4, C–5—Smooths out ripples from rectified dc.	3DB4–280

Digitized by Google

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
C–6, C–13, C–15	CAPACITOR, fixed: paper dielectric; 50,000 mmf ± 10%; 1,000 vdcw; 1 1/8" lg x 1" wd x 3/4" h; JAN type CP54B1EG503K.	C–6, C–13, C–15—Provides low reactance path to ground for hash (r-f).	3DA50–326
C–10	CAPACITOR, fixed: paper dielectric 50,000 mmf ± 15%; 600 vdcw; 1 1/8" lg x 1" wd x 7/8" h; JAN type CP54B4EF503L.	Suppresses arcing between contacts of vibrator E–3.	3DA50–327
C–12	CAPACITOR, fixed: paper dielectric; 4 mf ± 10%; 600 vdcw; 3 7/8" lg x 2 1/2" wd x 1 3/16" thk; JAN type CP70E1EF405K.	Improves waveform of a-c output of transformer T–2.	3DB4–221
J–1	CONNECTOR, female contact: 8 round polarized female contacts; straight; 1 1/2" x 1 1/2" x 1 5/16" overall; 1 1/8" diam body; Amphenol AN–3102–20–7S; cylindrical aluminum body with square mtg flange; molded bakelite insert; mounts in 1 1/8" diam hole; 4 mtg holes; 1 5/32" mtg/c.	Provides means for connecting Cord CX–771/TIQ–2 to vibrator pack.	2Z8678.68
J–2	CONNECTOR, female contact: 2 curved twist-lock female contacts; straight; 1 5/8" diam x 1 3/4" lg overall; 20 amp, 250 v; cylindrical molded bakelite body; w/metal mtg flange; mounts in 1 5/8" diam hole; 2 mtg holes 3/16" diam; 2 1/16" mtg/c; Hubbell part No. 8809.	Provides means for connecting Cord CX–781/TIQ–2 to vibrator pack.	6Z7588.1
P–1	CONNECTOR, male contact: 2 round polarized contacts; straight; 1 5/8" x 1 5/8" x 1 5/16" overall; 1 1/4" diam body; cylindrical aluminum body with square mtg flange; molded bakelite insert; mounts in 1 1/4" diam hole; 4 mtg holes; 1 1/4" mtg center; Amphenol AN–3102–22–11P.	Provides means for connecting Cord CX–781/TIQ–2 or Cord CX–782/TIQ–2 to vibrator pack.	2Z8672.1
	COVER ASSEMBLY: rubber; w/threaded mtg bushing; 1/2" lg x 9/16" diam x 1/32" thk wall (includes 1 rubber and 1 metal washer and 1 spcl nut; 1/8" diam hole in top); C–H #8916K615.	Weatherproofs toggle switch.	3Z9849.39–1/B1

Digitized by Google

F–1	FUSE FU–40: cartridge; 30 amp, 25 v; glass body; ferrule term; 1¼" lg x $\frac{3}{32}$" diam overall.	Protects vibrator E–1 from overload damage.	3Z1940
F–2	FUSE FU–23: cartridge; 10 amp, 25 v; glass body; ferrule term; 1¼" lg x $\frac{3}{32}$" diam overall.	Protects vibrator E–3 from overload damage.	3Z1923
E–5, E–6	HOLDER, fuse: extractor post; for one type 4 AG fuse; bakelite body $\frac{5}{8}$"–18 thd x ½" lg; approx $2\frac{15}{16}$" lg overall including term; fits $\frac{5}{8}$" diam mtg hole; includes $\frac{5}{8}$"–18 hex nut for mtg; one solder lug term on end; one term on side of body; knurled, tapered, finger-operated knob; engraved "fuse"; Buss #HCN.	Provide receptacles for fuses F–1 and F–2.	3Z1939.1
E–2, E–4	LAMP LM–52: incandescent; 6–8 v, 0.15 amp; Mazda #47, bulb T–3¼ clear; 1⅛" lg overall; miniature bayonet base.	E–2—Indicates when amplifier power circuit is energized. E–4—Indicates when phone power circuit is energized.	2Z5952
J–3, J–4	LAMPHOLDER: miniature bayonet; brass body; black nickel pl; $2\frac{5}{16}$" lg x ⅞" diam including term; mts in $\frac{1}{8}$" diam hole; red faceted jewel; mechanical shutter type; Dialco #98410–431.	Provide receptacles for lamps E–2 and E–4.	2Z5991–93
R–1	RESISTOR, fixed: wire wound; 20 ohms ± 5%; 1 w; max body dimen $1\frac{3}{32}$" lg x $\frac{3}{32}$" diam; JAN type RU4C200J.	Voltage-dropping resistor for pilot lamp.	3RU18801
R–2	RESISTOR, fixed: wire wound; 12 ohms ± 5%; 48 w; max body dimen 3½" lg x $1\frac{3}{16}$" wd x ⅝" thk; JAN type RW22G120.	Voltage-dropping resistor for vibrator E–1.	3RW12906
R–3	RESISTOR, fixed: wire wound; 10 ohms ± 5%; 31 w; max body dimen 2" lg x $1\frac{3}{16}$" diam; JAN type RW21G100.	Voltage-dropping resistor for vibrator E–3.	3RW12326
R–4	RESISTOR, fixed: wire wound; 2 ohms ± 5%; 70 w; max body dimen 6" lg x $1\frac{3}{16}$" wd x ⅝" thk; JAN type RW24G2RO.	Voltage-dropping resistor for amplifier filament circuit.	3RW8107

Digitized by Google

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
X–1	SOCKET, tube: octal; one piece saddle mtg; two $\frac{5}{32}$" diam holes on 1½" mtg/c; ceramic body $1\frac{1}{16}$" diam x $\frac{7}{16}$" h excluding term; phosphor bronze silver plated contacts; Ucinite 115001/1A.	Provides support for tube V–1 and a means of circuit connections to the tube.	2Z8678.195
X–2, X–3, X–4	SOCKET, tube: medium; six contacts; one piece saddle mtg; two 0.152" diam holes on $1\frac{27}{32}$" mtg/c; round ceramic body $1\frac{11}{32}$" diam x $\frac{3}{4}$" h excluding term; mounts in $1\frac{7}{32}$" diam hole; phosphor bronze silver plated contacts; National Co #CIR–6.	X–2, X–3—Provides support for vibrator E–1 and means of circuit connections to vibrator. X–4—Provides support for vibrator E–3 and means of circuit connections to vibrator.	2Z8676.36
S–3, S–4	SWITCH, toggle: SPST; 6/15 amp, 250/125 v; $1\frac{1}{16}$" lg x ½" w x $1\frac{9}{64}$" h; bat handle $\frac{1}{16}$" lg; JAN type ST–42A.	S–3—Provides control of current to amplifier power circuit vibrator E–1. S–4—Provides control of current to phono power circuit vibrator E–3.	3Z9863–42A
S–1, S–2	SWITCH, toggle: 4PDT; 29 amp; 24 v DC; phenolic body; $1\frac{21}{64}$" lg x $1\frac{7}{16}$" wd x 1¼" d; $\frac{11}{16}$" lg bat type handle; position 1—normally closed; position 2—normally open; solder lug term; single hole mtg bushing $\frac{15}{32}$"-32, $\frac{15}{32}$" lg; C–H part #7665K3.	S–1, S–2—Dual-operated switch which permits selection of 6- or 12-volt input power from battery.	3Z9849.218
T–1	TRANSFORMER, power: vibrator; input 6 v DC, 16.7 amp or 12 v DC, 8 amp; output 5 v, 3 amp, 400 v, 0.14 amp; 120 cyc output; varnish impregnated; hermetically sealed metal case; 4¾" lg x $3\frac{15}{16}$" wd x 6" h excluding term; 10 solder lug term on bottom four ¼"–20 mtg studs ⅝" lg; 3" x 3¾" mtg/c; Red Arrow Elec spec 1035.	Provides means of stepping down current for filament supply and stepping up voltage for plate supply for amplifier.	2Z9625–56

Digitized by Google

T–2	TRANSFORMER, power: vibrator; input 6 v DC, 11.1 amp or 12 v DC, 5.1 amp; output 110 v 475 ma; 60 cyc output; varnish impregnated; hermetically sealed metal case; 4" lg x 3⅜" wd x 4⅝" h excluding term; 7 solder lug term on bottom; four #10–32 mtg studs ⅝" x 3¼" mtg/c; Red Arrow Elec spec 1034.	Provides means of stepping up voltage for phono operation.	2Z9625–55
V–1	TUBE, electron: JAN 5U4G.	Converts ac to dc for amplifier power supply.	2J5U4G
E–1	VIBRATOR, nonsynchronous: input 6 v DC; dual-reed 120 cps; 5⅝" lg x 2⅝" wd x 3 $\frac{5}{16}$" h excluding prongs; base connection F3; Electronic Labs type LTE–1420.	Changes battery current to interrupted dc.	3H6691–37
E–3	VIBRATOR, nonsynchronous: input 6 v DC; dual-reed 60 cps; 4 $\frac{11}{16}$" h x 2 $\frac{3}{16}$" diam; excluding prongs; Electron Labs type 427.	Changes battery current to interrupted dc.	3H6691–36

☆ U. S. GOVERNMENT PRINTING OFFICE: 1948—804184

Digitized by Google

Digitized by Google

Stanford University Libraries
3 6105 211 234 211

Digitized by Google

Digitized by Google