DEPARTMENT OF THE ARMY TECHNICAL MANUAL

DEPARTMENT OF THE AIR FORCE TECHNICAL ORDER

TM 11-2099

TO 16-30PTA1-6

AUDIO FREQUENCY MONITOR AN/PTA-1

DEPARTMENTS OF THE ARMY AND THE AIR FORCE

NOVEMBER 1954

TAGO 1551A—Oct. 810468°—54

TECHNICAL MANUAL

AUDIO FREQUENCY MONITOR AN/PTA-1

TM 11-2099
CHANGES No. 1

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON 25, D.C., *1 November 1960*

TM 11-2099, 1 November 1954, is changed as follows:

Page 2, paragraph 2. Add the following subparagraph *g*:

g. Forward DA Form 2028 (Recommended Changes to DA Technical Manual Parts Lists or Supply Manual 7, 8, or 9) direct to the Commanding Officer, U.S. Army Signal Materiel Support Agency, ATTN: SIGMS-MLM, Fort Monmouth, N.J., for comments on parts listings in appendixes I and II.

Page 41.

APPENDIX I

MAINTENANCE ALLOCATION CHART

(Added)

Section I. MAINTENANCE ALLOCATION

1. General

a. This appendix assigns maintenance functions and repair operations to be performed by the lowest appropriate maintenance echelon.

b. Columns in the maintenance allocation chart are as follows:

(1) *Part or component.* This column shows only the nomenclature or standard item name. Additional descriptive data are included only where clarification is necessary to identify the part. Components and parts comprising a major end item are listed alphabetically.

(2) *Maintenance function.* This column indicates the various maintenance functions allocated to the echelon capable of performing the operations.

(*a*) *Service.* To clean, to preserve, and to replenish fuel and lubricants.

(*b*) *Adjust.* To regulate periodically to prevent malfunction.

(*c*) *Inspect.* To verify serviceability and to detect incipient electrical or mechanical failure by scrutiny.

(*d*) *Test.* To verify serviceability and to detect incipient electrical or mechanical failure by use of special equipment such as gages, meters, etc.

(*e*) *Replace.* To substitute serviceable assemblies, subassemblies and parts for unserviceable components.

(*f*) *Rebuild.* To restore an item to a standard as near as possible to original or new condition in appearance, performance, and life expectancy. This is accomplished through the maintenance technique of complete disassembly of the item, inspection of all parts or components, repair or replacement of worn or unserviceable elements using original manufacturing tolerances and/or specifications and subsequent reassembly of the item.

(3) *1st 2d, 3d, 4th, and 5th echelon.* The symbol X indicates the echelon responsible for performing that particular maintenance operation, but does not necessarily indicate that repair parts will be

***These changes supersede so much of Department of the Army Supply Manual SIG 7 & 8 AN/PTA-1, 7 November 1957, as pertains to first echelon items.**

stocked at that level. Echelons higher than the echelon marked by X are authorized to perform the indicated operation.

(4) *Tools required.* This column indicates codes assigned to each individual tool equipment, test equipment, and maintenance equipment referenced. The grouping of codes in this column of the maintenance allocation chart indicates the tool, test, and maintenance equipment required to perform the maintenance function.

(5) *Remarks.* Entries in this column will be utilized when necessary to clarify any of the data cited in the preceding columns.

c. Columns in the allocation of tools for maintenance functions portion are as follows:

(1) *Tools required for maintenance functions.* This column lists tools, test, and maintenance equipment required to perform the maintenance functions.

(2) *1st, 2d, 3d, 4th, and 5th echelon.* A dagget (†) symbol indicates the echelons allocated the facility.

(3) *Tool code.* This column lists the tool code assigned.

(4) *Remarks.* Entries in this column are used to clarify data in the other columns.

2. Maintenance By Using Organizations

When this equipment is used by signal service organizations organic to theater headquarters or communication zones to provide theater communications, those maintenance functions allocated up to and including fourth echelon are authorized to the organization operating this equipment.

3. Mounting Hardware

The basic entries of the maintenance allocation chart do not include mounting hardware such as screws, nuts, bolts, washers, brackets, clamps, etc.

Section II. MAINTENANCE ALLOCATION CHART

(1) PART OR COMPONENT	(2) MAINTENANCE FUNCTION	(3) 1ST ECH	(4) 2ND ECH	(5) 3RD ECH	(6) 4TH ECH	(7) 5TH ECH	(8) TOOLS REQUIRED	(9) REMARKS
MONITOR, AUDIO FREQUENCY AN/PTA-1								
	service	X						Exterior
			X				9	Interior
	adjust			X			10	Switch contacts
	inspect	X						Exterior
			X				9	Interior
	test			X			1, 3, 10, 2, 5, 6	Test Filters and Amplifiers (Sig No. 1 substition) (continuity, resistance voltage C, electron tubes
					X		1, 2, 5, 6, 7, 8, 10	Make all tests
	rebuild					X		
AUDIO FREQUENCY AMPLIFIER AM-558/PTA-1								
ARRESTER, LIGHTNING	replace	X						
ATTENUATOR, FIXED	replace			X			10	
BINDING POST U-106/U	replace			X			10	
CAP, ELECTRICAL	replace		X					
CAPACITORS	replace			X			10	
CONNECTORS	replace			X			10	
ELECTRON TUBES	replace	X						
FILTER ASSEMBLY, ELECTRICAL	replace			X			10	
GASKET	replace			X			10	
JACK, TELEPHONE	replace			X			10	
KNOB	replace			X			10	
PACKING MATERIAL	replace			X			10	
RESISTORS	replace			X			10	
SOCKET, ELECTRON TUBE	replace			X			10	
STRAP, CARRYING	replace		X					
SWITCHES	replace			X			10	
TRANSFORMERS	replace			X			10	
BAG	replace		X					
CATCH, LUGGAGE	replace			X			10	
CLIP, ELECTRICAL	replace		X				10	
CORD ASSEMBLY, ELECTRICAL	replace		X					
REEL, WIRE RL-158/PTA-1	replace		X					
TRANSFORMER, AUDIO FREQUENCY TF-148/PTA-1	replace		X					

Section III. ALLOCATION OF TOOLS FOR MAINTENANCE FUNCTIONS

(1) TOOLS REQUIRED FOR MAINTENANCE FUNCTIONS	(2) 1ST ECH	(3) 2ND ECH.	(4) 3RD ECH.	(5) 4TH ECH.	(6) 5TH ECH.	(7) TOOL CODE	(8) REMARKS
AN/PTA-1 (continued)							
MULTIMETER AN/URM-105			†	†	†	1	If not available use TS-352/U
TEST SET TS-140/PCM			†	†	†	2	
ELECTRONIC TUBE TESTER TV-7/U			†	†		3	
ELECTRONIC TUBE TESTER TV 2/U					†	4	For 5th echelon use only
ATTENUATOR TS-402/U			†	†	†	5	
OSCILLOSCOPE OS-8A/U				†	†	6	
TRANSMISSION MEASURING SET TS-539/FT				†	†	7	
DISTORTION ANALYZER TS-723/U				†	†	8	
TOOL EQUIPMENT TE-33		†				9	
TOOL EQUIPMENT TE-49			†	†	†	10	

APPENDIX II

BASIC ISSUE ITEMS LIST

(Added)

Section I. INTRODUCTION

1. Scope

a. This section lists items supplied for initial operation and for running spares. The list includes accessories, parts, and material issued as *part of* the major end item. The list includes all items authorized for basic operator maintenance of the equipment. End items of equipment are issued on the basis of allowances prescribed in equipment authorization tables and other documents that are a basis for requisitioning.

b. Columns are as follows:

(1) *Source, maintenance, and recoverability code.* Not used.

(2) *Federal stock number.* This column lists the 11-digit Federal stock number.

(3) *Designation by model.* Not used.

(4) *Description.* Nomenclature or the standard item name and brief identifying data for each item are listed in this column. When requisitioning, enter the nomenclature and description on the requisition.

(5) *Unit of issue.* The unit of issue is the supply term by which the individual item is counted for procurement, storage, requisitioning, allowances, and issue purposes.

(6) *Expendability.* Expendable items are indicated by the letter X; nonexpendable items are indicated by NX.

(7) *Quantity authorized.* Under "Items Comprising an Operable Equipment", the column lists the quantity of items supplied for the initial operation of the equipment. Under "Running Spares and Accessory Items", the quantities listed are those issued initially with the equipment as spare parts. The quantities are authorized to be kept on hand by the operator for maintenance of the equipment.

(8) *Illustrations.* Not used.

2. References

Additional instructions concerning maintenance of this equipment are contained in TM 11-5965-231-12P, Operator's Organizational Maintenance Repair Parts and Special Tools List and Maintenance Allocation Chart: Headset, Electrical H-113/U.

Section II. FUNCTIONAL PARTS LIST

(1) SOURCE MAINTENANCE AND RECOVERABILITY CODE	(2) FEDERAL STOCK NUMBER	(3) DESIGNATION BY MODEL	(4) DESCRIPTION	(5) UNIT OF ISSUE	(6) EXPENDABILITY	(7) QUANTITY AUTHORIZED	(8) ILLUSTRATIONS FIGURE NO	(9) ILLUSTRATIONS ITEM NO
			ITEMS COMPRISING AN OPERABLE EQUIPMENT					
			MONITOR, AF AN/PTA-1					
	6625-668-9525		MONITOR, AF AN/PTA-1: 200 to 8000 cyc freq range; 1 channel; hs audible indication; 6 V and 90 v dc					
			MONITOR, AF AN/PTA-1: (Basic Component)	ea	NX	1		
	Ord thru AGC		TECHNICAL MANUAL TM 11-2099	ea	X	2		
	5805-501-3950		AMPLIFIER, AF AM-558/PTA-1: 0.01 u power output; 6 v and 90 v dc; 200 to 8,000 cps normal oper freq range	ea	NX	1		
	5805-301-4656		BAG: f/gn d rods and reel; SigC dwg No. ES-D-66821	ea	X	1		
	5940-518-8333		CLIP, ELECTRICAL: batt style; Mueller Elec part No. 50-C; (Stored in equip cover)	ea	X	2		
	5995-160-0916		CORD ASSEMBLY, ELECTRICAL CD-307A: SigC dwg No. SC-D-2019; (Stored in equip cover)	ea	X	1		
	5975-030-2985		GROUND, ROD CP-106/G: (packed in canvas bag)	ea	X	3		
	5965-504-6370		HEADSET, ELECTRICAL H-113/U: (Stored in equip cover)	ea	NX	1		
	3895-567-2874		REEL, WIRE RL-158/PTA-1: (packed in canvas bag)	ea	NX	1		
	5950-050-2985		TRANSFORMER, AUDIO FREQUENCY TF-148/PTA-1 (Stored in equip cover)	ea	X	1		
			AMPLIFIER, AF AM-558/PTA-1					
	5820-570-6104		STRAP, CARRYING: Davenco part No. 12003, dwg No. A-1380-48	ea	X	1		
			RUNNING SPARES AND ACCESSORY ITEMS					
			MONITOR, AF AN/PTA-1					
	5920-224-4393		ARRESTER, LIGHTNING: Gen Bronze type No. MCD-4 (Installed in equip)	ea	X	2		
	5960-188-3593		ELECTRON TUBE: MIL type 1U4 (Installed in equip)	ea	X	1		
	5960-188-3540		ELECTRON TUBE: MIL type 3Q4; (Installed in equip)	ea	X	1		

By Order of *Wilber M. Brucker*, Secretary of the Army:

G. H. DECKER,
General, United States Army,
Chief of Staff.

Official:

R. V. LEE,
Major General, United States Army,
The Adjutant General.

Distribution:

Active Army: To be distributed in accordance with DA Form 12–7 requirements for TM 11-series (U) plus the following:

USASA (2)	Units organized under following	
CNGB (1)	TOE's (2 each):	11–587
Tech Stf, DA (1) except CSigO	11–7	11–592
(36)	11–16	11–597
Def Atomic Spt Agcy (5)	11–57	30–600 AA–AE
US ARADCOM (2)	11–97	32–57
US ARADCOM Rgn (2)	11–117	32–500
MDW (1)	11–155	33–105
Seventh US Army (2)	11–500 AA–AE	33–106
EUSA (2)	11–557	

NG: State AG (3); units—same as Active Army except allowance is one copy to each unit.
USAR: None.
For explanation of abbreviations used, see AR 320–50.

TECHNICAL MANUAL

AUDIO FREQUENCY MONITOR AN/PTA–1

TM 11–2099
CHANGES No. 2

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON 25, D.C., *28 August 1962*

TM 11–2099, 1 November 1954, is changed as follows:

Page 41, (page 6 of C 1) column 2. Change Federal stock number 5950–050–2985 to 5950–604–8914.

BY ORDER OF THE SECRETARY OF THE ARMY:

G. H. DECKER,
General, United States Army,
Chief of Staff.

Official:

J. C. LAMBERT,
Major General, United States Army,
The Adjutant General.

Distribution:

Active Army:

DASA (6)
USASA (2)
CNGB (1)
Tech Stf, DA (1)
except CSigO (14)
Tech Stf Bd (1)
USCONARC (5)
USAARTYBD (1)
USAARMBD (2)
USAIB (1)
USARADBD (2)
USAAVNBD (1)
USAABELCTBD (1)
USAATBD (1)
ARADCOM (2)
ARADCOM Rgn (2)
OS Maj Comd (3)
OS Base Comd (2)
LOGCOMD (2)
MDW (1)
Armies (2)
Corps (2)
Instl (2) except
Ft Monmouth (63)
USATC AD (2)
USATC Armor (2)
USATC Engr (2)
USATC FA (2)
USATC Inf (2)
USAOMC (3)
Svc Colleges (2)
Br Svc Sch (2)
GENDEP (2) except
Atlanta GENDEP (None)
Sig Sec, GENDEP (5)
Sig Dep (12) except
Sacramento Sig Dep (17)
USA Trans Tml Comd (1)
Army Tml (1)
POE (1)
OSA (1)
USAEPG (2)
AFIP (1)
AMS (1)
Army Pic Cen (2)
EMC (1)
USA Strat Comm Comd (4)
USASSA (25)
USASSAMRO (1)
USARCARIB Sig Agcy (1)
USA Sig Msl Spt Agcy (13)
Sig Fld Maint Shops (3)
USA Corps (3)
Def Log Svc Cen (1)
JBUSMC (2)
WRAMC (1)
Black Hills Ord Dep (5)
Units org under fol TOE:
11–7 (2)
11–16 (2)
11–57 (2)
11–97 (2)
11–98 (2)
11–117 (2)
11–155 (2)
11–157 (2)
11–500 (AA–AE) (4)
11–557 (2)
11–587 (2)
11–592 (2)
11–597 (2)
30–600 (AA–AE) (2)
32–57 (2)
32–500 (2)
33–105 (2)
33–106 (2)

NG: State AG (3).

USAR: None.

For explanation of abbreviations used, see AR 320–50.

☆ U. S. GOVERNMENT PRINTING OFFICE: 1962—650503/6014A

TECHNICAL MANUAL
No. 11-2099
TECHNICAL ORDER
No. 16-30PTA1-6

DEPARTMENTS OF THE ARMY AND
THE AIR FORCE

WASHINGTON 25, D. C., *1 November 1954*

AUDIO FREQUENCY MONITOR AN/PTA-1

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1. Scope

This manual is for the use of all concerned. It contains information on the installation, operation, maintenance, and theory of operation of Audio Frequency Monitor AN/PTA–1. These instructions apply only to Audio Frequency Monitor AN/PTA–1.

2. Forms and Records

The following forms will be used for reporting unsatisfactory conditions of Army material and equipment.

a. DD Form 6, Report of Damaged or Improper Shipment, will be filled out and forwarded as prescribed in SR 745–45–5 (Army); Navy Shipping Guide, Article 1850–4 (Navy); and AFR 71–4 (Air Force).

b. DA Form 468, Unsatisfactory Equipment Report, will be filled out and forwarded to the Office of the Chief Signal Officer, as prescribed in SR 700–45–5.

c. DD Form 535, Unsatisfactory Report, will be filled out and forwarded to Commanding General, Air Materiel Command, Wright-Patterson Air Force Base, Dayton, Ohio, as prescribed in SR 700–45–5 and AFR 65–26.

d. DA Form 11–250, Operator First Echelon Maintenance Check List For Signal Corps Equipment (Public Address, Recorder, Reproducer), will be prepared in accordance with instructions on the back of the form.

e. DA Form 11–251, Second and Third Echelon Maintenance Check List for Signal Corps Equipment (Public Address, Recorder, Reproducer), will be prepared in accordance with instructions on the back of the form.

f. Use other forms and records as authorized.

Section II. DESCRIPTION AND DATA

3. Purpose and Use

Audio Frequency Monitor AN/PTA–1 (fig. 1) is a wire tapping device used to intercept communication signals transmitted over telephone lines and field cables where frequencies in the range of 200 cycles per second (cps) to 8,000 cps are used. The intercepted signal can be picked up in the headset assembly supplied with the equipment or recorded on a sound recorder. Recording equipment is not supplied as a part of Audio Frequency Monitor AN/PTA–1. The set is packed in two units for convenience of transportation and is easily transported by one man.

4. Methods of Interception

There are five ways of connecting Audio Frequency Monitor AN/PTA–1 to a telephone line as outlined in *a* through *e* below. The tactical situation must be considered when determining the method to be used.

a. Direct Connection Method. The direct connection interception method (fig. 7) provides reliable results on any type of line. It has the disadvantage of leaving a visible record of tampering on insulated wires and cables and of being easily discovered by line patrols. Except for the possible disruption of communications during tapping by causing an accidental short or open circuit, the tap, if properly installed, cannot be detected electrically. The bridging loss of the equipment for close installations is only .1 decibel (db) and gradually increases as the equipment is moved away from the line. Output levels of +5 to +10 dbm (decibels referred to 1 milliwatt in 600 ohms) are obtained easily for most applications.

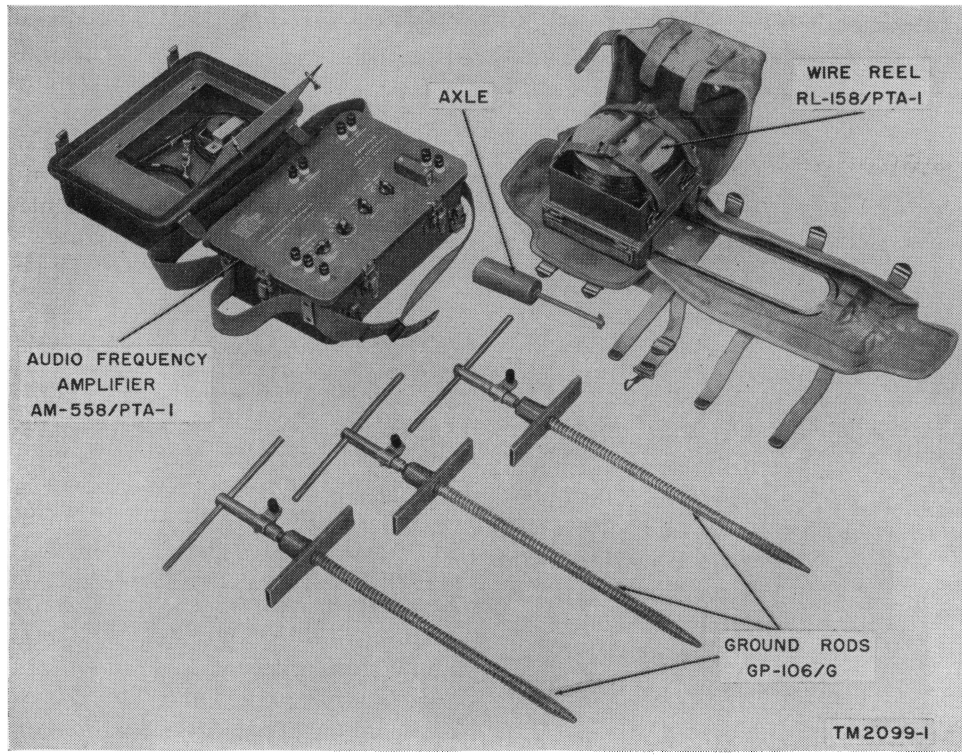


Figure 1. Audio Frequency Monitor AN/PTA-1.

b. Induction Pickup Method. The induction pickup method of interception (fig. 8) provides reliable results on ground-return and two-wire metallic circuits comparable to the results obtained by the direct connection interception method and provides fair results on some small sized cables. The connection to the telephone line is made by a small transformer which is quickly installed and leaves no visible record of tampering except on field wire of overall jacket construction. The method cannot be detected electrically but is easily discovered by line patrols. A decided advantage of this interception method is that the equipment may be placed some distance from the line. For most applications, an output level of −10 dbm to +10 dbm is easily obtained. When used on small unshielded or semishielded cables, the output level depends on the condition and construction of the cable and seldom reaches values higher than −20 dbm.

c. Capacitive Coupling Method. The capacitive coupling method of interception (fig. 9) provides fairly good results on ground-return and two-wire metallic lines, but it is highly susceptible to noise and interference pick-up. Although this method is applied most easily to ground-return circuits, it may be applied to metallic pairs by separating the pairs at the place of coupling. Output levels of 0 dbm can be obtained by careful installation.

d. Ground Loop Method (fig. 10). This method is applicable to ground-return lines. It has the advantages of being impossible to detect electrically, being easily hidden from line patrols, and leaving no record of tampering. The results obtained depend on the conductive property of the interception site and the wire-to-ground leakage condition of the line. Output levels obtained very greatly, and a true prediction of the results is impossible.

e. Ground Rod Method (fig. 11). This interception method is used with ground-return lines only. It has the advantage of being impossible to detect electrically, being easily hidden from line patrols, leaving no permanent record of tampering, and being capable of operation 100 feet or more from the line under favorable conditions. The obtained results depend on the conductive property of the earth at the interception site and the wire-to-ground leakage condition of the line. Output levels vary greatly and a true prediction of results is impossible.

5. Technical Characteristics

Audio Frequency Amplifier AM–558/PTA–1.

Impedance, input	20; 150; 600; 1,000; 2,000; 3,500; 5,000; and 500,000 ohms. A ninth impedance position labeled FOR DIRECT CONNECTION TO LINES is provided for wire line bridging use.
Impedance, output	600 ohms.
Input impedance accuracy	±10 percent, FILTER switch B at 200–8000. ±20 percent, FILTER switch B at 200–3000. ±20 percent, FILTER switch B at 300–8000. ±25 percent, FILTER switch B at 300–3000.
Output impedance accuracy	±10 percent at 1000 cps.
Amplifier gain	90 db at 1,000 cps, minimum. 85 db between 200 and 8,000 cps.
Power output	Plus 10 dbm.
Distortion	Maximum 7 percent at maximum power.
Power requirements	6-volt, 50-milliampere maximum filament current. 90-volt, 5-milliampere maximum plate current.

6. Packaging Data

a. When packaged for export shipment, Audio Frequency Amplifier AM–558/PTA–1 and the canvas back pack are placed in individual moisture-vaporproof containers and are packed in a wooden export crate. A cutaway view of Audio Frequency Monitor AN/PTA–1 packed for export is shown in figure 5. The crate is 17½ inches high by 30 inches wide by 25½ inches deep and has a volume of 6⅛ cubic feet. The unit weighs 82 pounds when it is packed for export.

b. The following table lists the contents of the two containers packed in the wooden export crate.

Case dimensions (in.)	Contents	Notes
17 x 13 x 12.5	1 Audio Frequency Amplifier AM–558/PTA–1.	Less Batteries BA–409/U and BA–415/U.
	1 Audio Frequency Transformer TF–148/PTA–1.	Packed inside case cover of amplifier (fig. 3).
	1 headset assembly, Navy type No. 49507	Packed inside amplifier.
	1 extension cord CD–307–A	Packed inside case cover of amplifier.
	2 needle clips	Packed inside amplifier.
25 x 14 x 8½	1 canvas back pack.	
	3 Ground Rods GP–106/G, with three base plates.	Packed inside canvas back pack (figs. 1 and 4).
	1 Wire Reel RL–158/PTA–1 with 500 feet of Wire WD–1/TT and axle.	Packed inside canvas back pack.

7. Table of Components

Components	Required No.	Height (in.)	Depth (in.)	Length (in.)	Volume (cu ft)	Unit weight (lb)
Audio Frequency Amplifier AM–558/PTA–1	1	8¾	10⅝	15⅜	.82	20
Audio Frequency Transformer TF–148/PTA–1	1	1⅝	1⅞	2 15/16	.0051	.5
Needle clips	2	⅜	1/16	2¼		.175
Headset assembly, Navy type 49507	1					.875
Canvas back pack	1	7	8½	24	.631	5
Ground Rod GP–106/G with base plate	3			24		1.75
Wire Reel RL–158/PTA–1 with 500 feet of Wire WD–1/TT and axle	1					
One set of spare parts:						
Electron tube 1U4	1					
Electron tube 3Q4	1					
Electron tube socket and shield	2					
Lightning arrestors	2					

Note. This list is for general information only. See appropriate publications for information pertaining to requisition of spare parts.

8. Description of Major Components

a. Audio Frequency Amplifier AM–558/PTA–1 (figs. 2 and 3). Audio Frequency Amplifier AM–558/PTA–1 is a battery-powered, high-gain amplifier that is mounted in a waterproof metal case. The controls and binding posts are mounted on the top side of the equipment panel. The underside of the equipment panel contains the batteries and the electrical parts of the amplifier. The cover is fastened to the lower portion of the case by six snap-type latches. Two of the latches are permanently connected between the cover and the

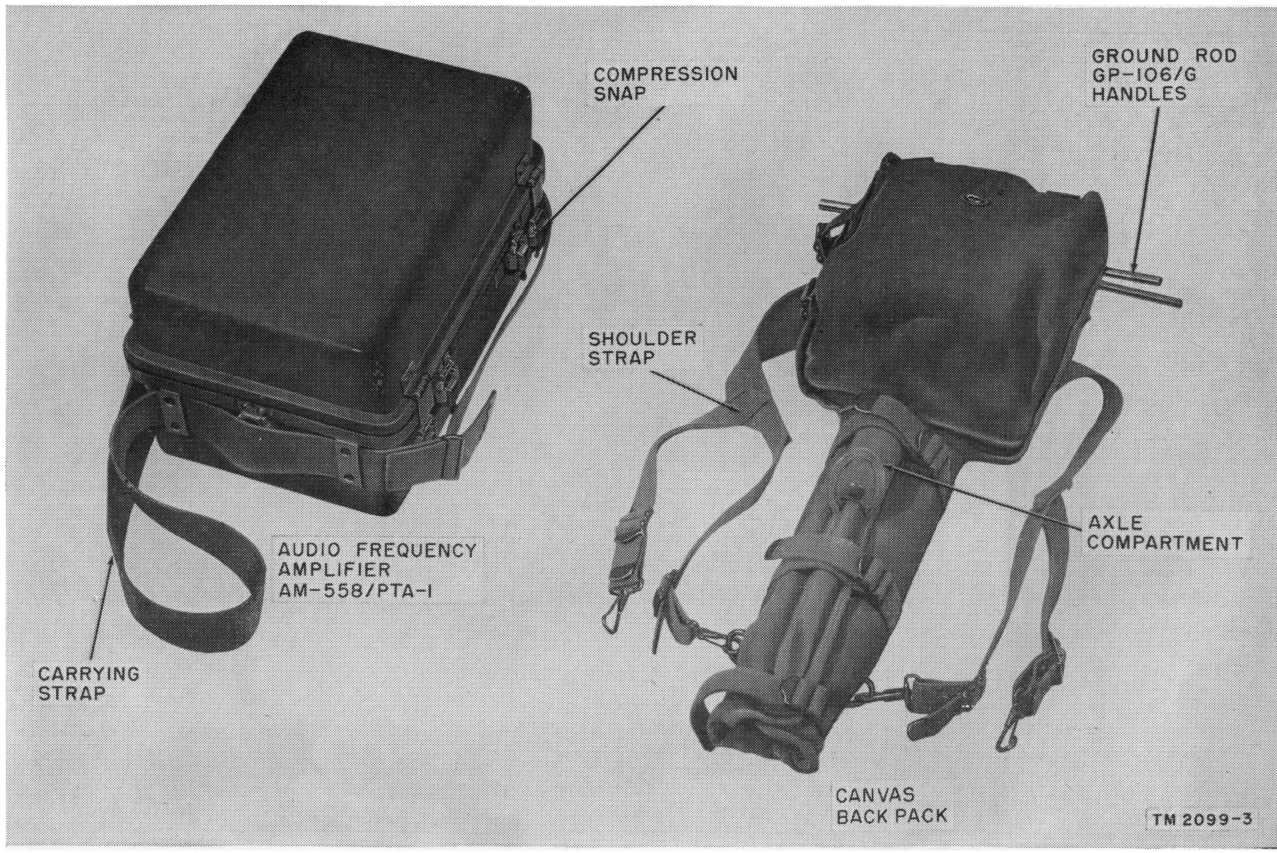


Figure 2. Audio Frequency Amplifier AM–558/PTA–1 and canvas back pack.

base in a hinged arrangement to prevent loss of the cover. The cover contains a compartment for storing the headset, extension cord, Audio Frequency Transformer TF–148/PTA–1, and the two needle clips. The compartment has a hinged cover that prevents the parts stored there from marring or damaging the equipment panel.

b. Canvas Back Pack (figs. 2 and 4). The canvas back pack is a canvas carrying pack provided with standard carrying straps for easy, noiseless, transportation of Ground Rods GP–106/G, Wire Reel RL–158/PTA–1, and the axle. A metal foundation unit, mounted in the carrying case, prevents collapse of the carrying case and contains the mountings for the ground rods, ground rod toe plates, and the wire reel. A separate pocket on the outside of the canvas back pack holds the axle. Access to the ground rods is provided by the spring-latched, hinged cover of the metal foundation unit. The top side of the hinged metal cover holds the mounting for the wire reel. When the flap is closed, 500 feet of Wire WD–1/TT wound on the reel unit can be payed out and recovered through an eyelet in the canvas flap. All parts are snug fitting, cushioned, and strapped to obtain the most noiseless operation possible. With the exception of the well covered ground rods, all metal parts are dark in color to prevent reflection of light.

9. Description of Minor Components

a. Headset (fig. 3). The headset is a dual earpiece with an impedance of 600 ohms. It has an adjustable spring headband and rubber ear cushions.

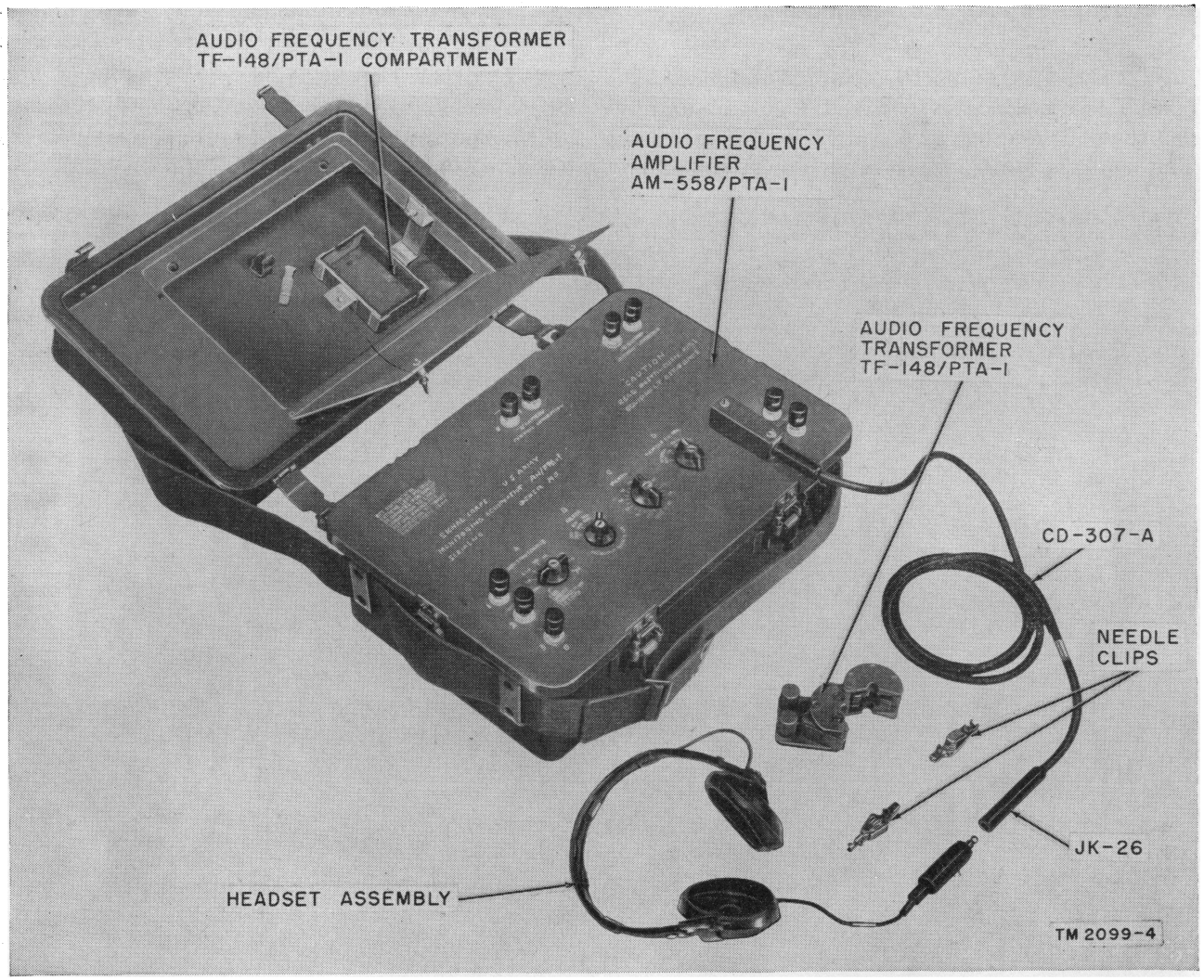


Figure 3. Audio Frequency Amplifier AM–558/PTA–1, case open, showing equipment and accessories.

b. Headset Extension Cord (fig. 3). Cord CD–307–A is a two-conductor, rubber-covered cord. It is approximately 6 feet long with Plug PL55 on one end and Jack JK–26 on the other end.

c. Audio Frequency Transformer TF–148/PTA–1 (fig. 3). This transformer has a secondary winding only. The core is hinged so that it may be opened to allow the insertion of the line wire. The line wire acts as the transformer primary. It is designed for one-hand operation. Binding post connectors are included.

d. Clips (fig. 3). Two needle clips are provided for making connections to lines. These clips have a needle in the jaw for insulation piercing purposes.

e. Ground Rod GP–106/G (figs. 1 and 4). Each ground rod is 2 feet long and is made of ¾-inch diameter aluminum. The rod is threaded from a point approximately 4 inches from the top to the round pointed end at the bottom. A horizontal handle is fastened through a hole in the top of the rod and a plate is provided with a threaded portion to fit the thread on the rod. A binding post is fastened to the top of the rod slightly below the handle.

f. Wire Reel RL–158/PTA–1 (fig. 1). This reel contains 500 feet of Wire WD–1/TT for use in making connections to the amplifier unit. The reel is provided with a handle for rewinding the wire.

g. Axle (fig. 1). An axle is provided for use in paying out and rewinding the wire on the reel. One end of the axle is used as a handle. The other end is the reel mounting and has a movable pin that prevents the reel from coming off the axle while paying out or reeling in wire.

10. Additional Equipment Required

Audio Frequency Monitor AN/PTA–1 requires two batteries: one BA–409/U and one BA–415/U, which are installed in the Audio Frequency Amplifier AM–558/PTA–1. Refer to paragraph 13 for the battery installation procedure. Recording equipment may be used for storing and translating the intercepted information. For information on recording equipment, see TM 11–2569 (Recording Equipment RC–169), TM 11–2542 (Speech Recorder MC–502), or TM 11–2543 (Speech Reproducers MC–503 and MC–503–A).

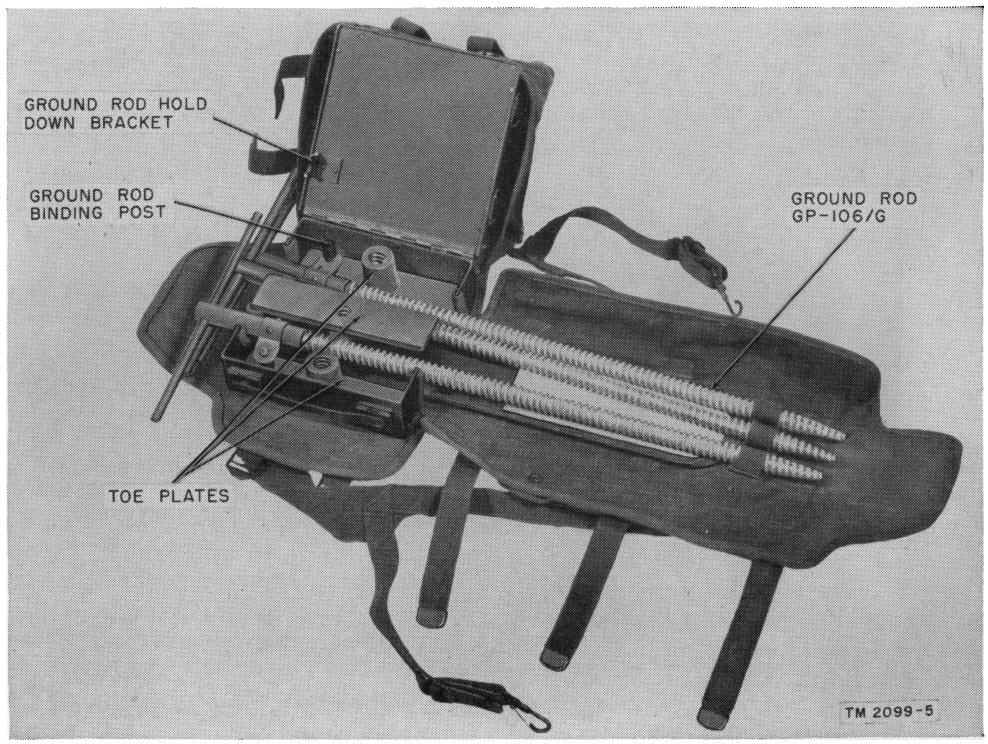


Figure 4. Canvas back pack open, with toe plates and ground rods in position.

CHAPTER 2
OPERATING INSTRUCTIONS

Section I. SERVICE UPON RECEIPT OF MATERIEL

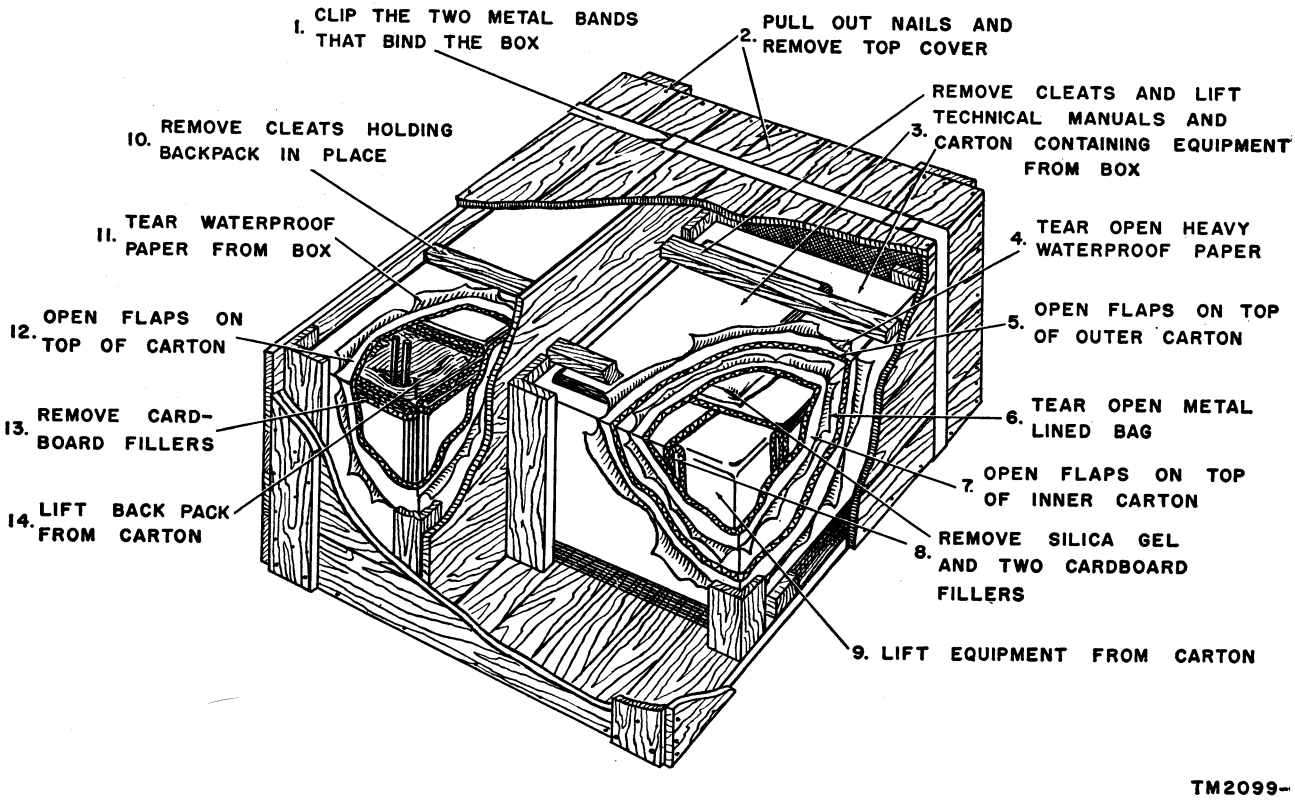


Figure 5. Audio Frequency Monitor AN/PTA–1, packaging diagram.

11. Siting

The ideal location of Audio Frequency Monitor AN/PTA–1 with respect to the line to be monitored is about 2 to 4 db away from the midpoint of the line. For field wire, this is approximately 1 mile off center in either direction. This off-center location provides a difference in the near and far end message volumes of approximately 4 to 8 db. Use this volume difference as a source index for interpretation purposes. Greater volume differences may be used for direct operator monitoring but are not recommended for use with the recording equipment. Locate the equipment in a concealed spot. Provide as much shelter as possible even though the equipment will withstand weather abuse. Make all wiring connections as inconspicuous as possible. When equipment is to be unattended, close the top cover.

12. Uncrating, Unpacking, and Checking New Equipment

Note. For used or reconditioned equipment, refer to paragraph 15.

a. General. Equipment may be shipped in an oversea packing case or in a domestic packing case. When new equipment is received, select a

location where the equipment may be unpacked without exposure to the elements.

Caution: Be careful when uncrating, unpacking, and handling the equipment; it is easily damaged. If it becomes damaged or exposed, a complete overhaul may be necessary.

b. Step-by-Step Instructions for Uncrating and Unpacking Export Shipment (fig. 5).

(1) Unpack the equipment as indicated in figure 5.

(2) Remove the equipment from its inner case and place it on the workbench or near its final location.

(3) Inspect the equipment for possible damage incurred during shipment.

(4) Check the contents of the packing case against the master packing slip.

Note. Save the original packing case and containers for both export and domestic shipments. They can be used again when the equipment is repacked for storage or shipment.

13. Preinstallation Procedures

a. Audio Frequency Amplifier AM–558/PTA–1 is shipped with the tubes in their respective sockets, less the two batteries. Perform the following functions before attempting installation.

(1) Remove the front panel from the lower portion of the carrying case by releasing the six compression-type snap catches (fig. 3).

(2) Check to see that all tubes are in their respective sockets. Refer to figure 21 for tube locations.

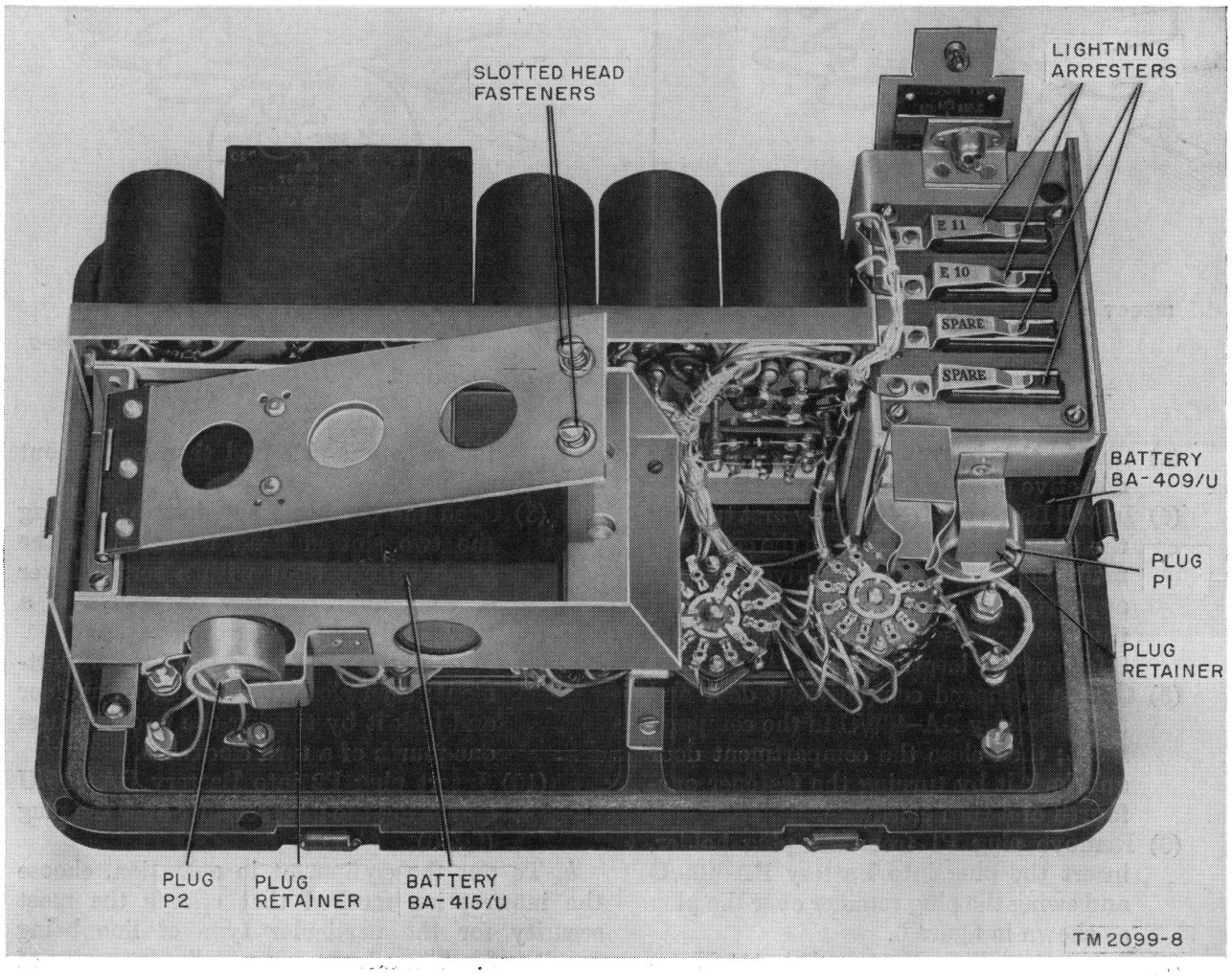


Figure 6. Audio Frequency Amplifier AM–558/PTA–1, batteries and lightning arrestors location.

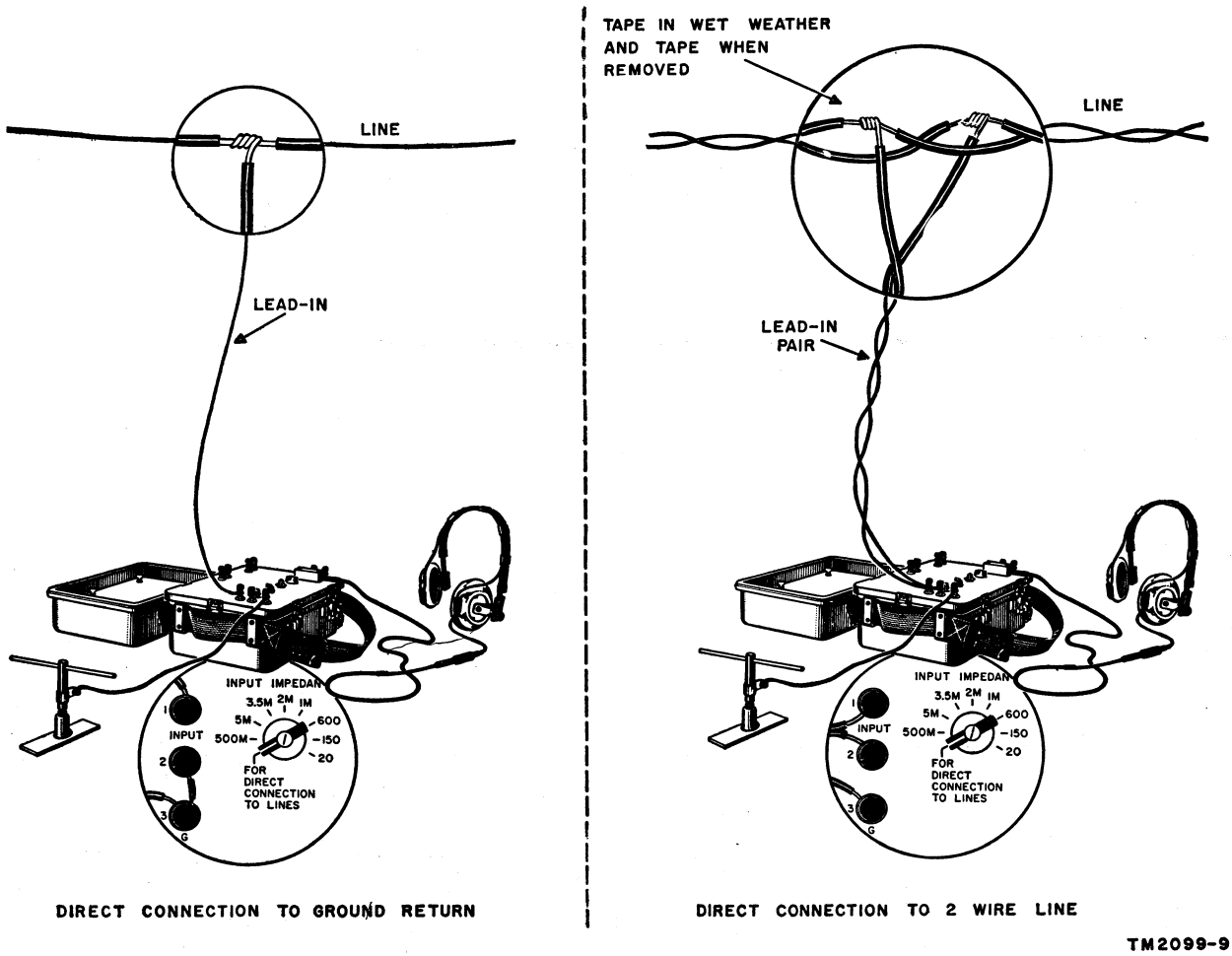


Figure 7. Direct connection interception method.

(3) Check the bottom of the chassis for defective parts and loose wires (fig. 6).

(4) Install Battery BA–409/U by first turning the slotted head fastener on the compartment door with a screw driver or coin, approximately one-fourth of a turn until the fastener disengages. Refer to figure 8 for battery locations.

(5) Open the hinged compartment door and place Battery BA–409/U in the compartment; then close the compartment door and lock it by turning the fastener one-fourth of a turn clockwise.

(6) Remove plug P1 from the plug holder, insert the plug into Battery BA–409/U and swing the plug retainer over the plug as shown in figure 6.

(7) Before installing Battery BA–415/U remove plug P2 by swinging the plug retainer to one side and then pulling out the plug.

(8) Open the compartment door by turning the two slotted head fasteners on the compartment door with a screw driver or coin, approximately one-fourth of a turn until the fastener disengages.

(9) Place Battery BA–415/U in the compartment; then close the compartment door and lock it by turning the two fasteners one-fourth of a turn clockwise.

(10) Insert plug P2 into Battery BA–415/U and swing the plug retainer over the plug (fig. 6).

b. To put the equipment in operation, choose the interception method that affords the most security for the particular type of line being monitored. The advantages and disadvantages of each interception method are listed in par. 4.

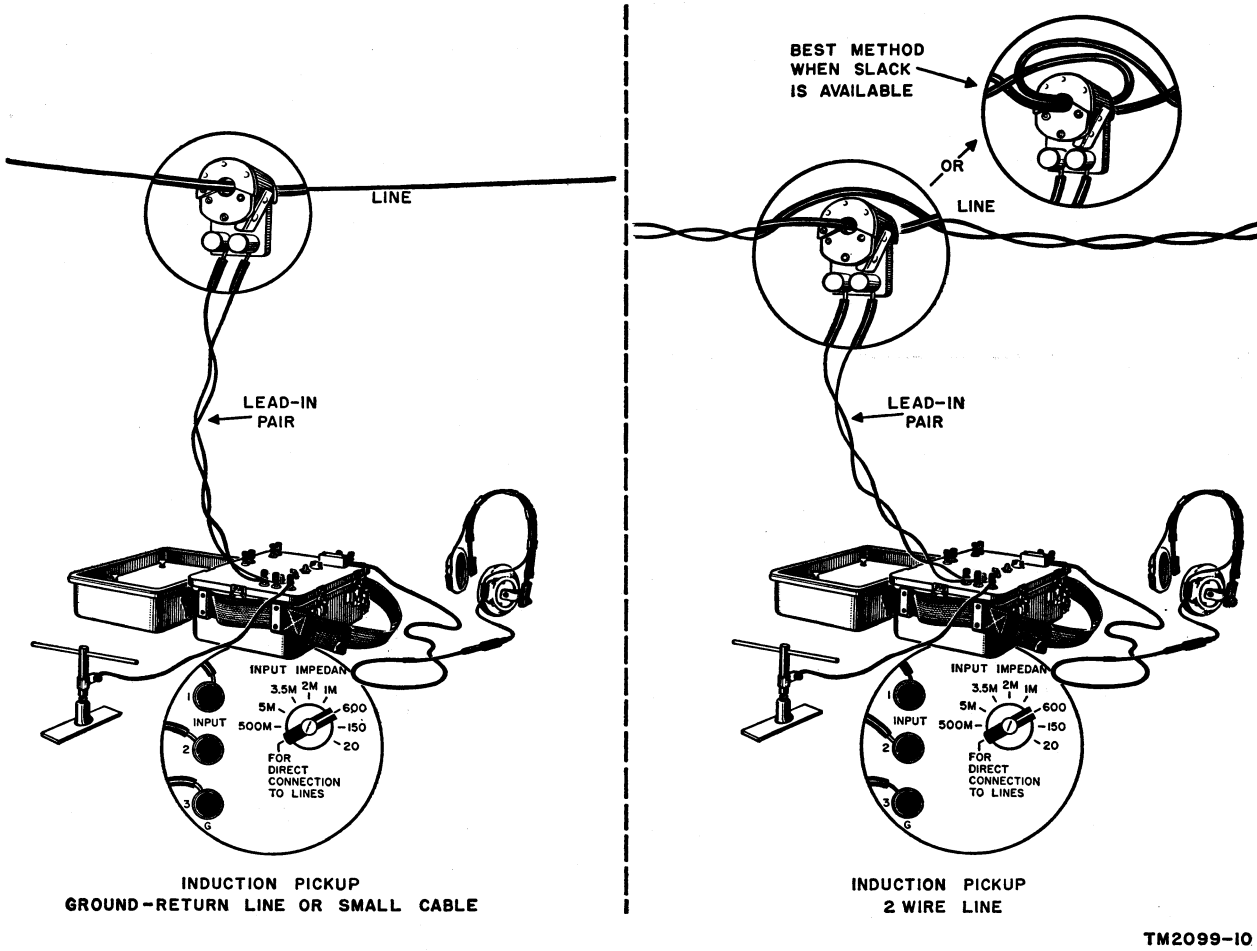


Figure 8. Induction pickup interception method.

14. Installation and Connections

a. Grounding. Audio Frequency Amplifier AM–558/PTA–1 must be grounded for stable operation and to protect the equipment and operating personnel from hazardous shocks caused by lightning and direct current (dc) voltages. Use the best grounding facilities available, such as buried water supply pipes and underground tanks. When such facilities are not available, use Ground Rod GP–106/G. The ground rod is installed as follows:

(1) Place the toe plate on the ground and stand with both feet placed solidly on each edge of the toe plate.

(2) Turn the handle of the ground rod in a clockwise direction to thread it through the toe plate and into the ground.

(3) Connect one end of the ground wire to the terminal at the top of the ground rod. Connect the other end of the ground wire to the G binding post of the Audio Frequency Amplifier AM–558/PTA–1.

Note. Make clean connections and be sure the wire does not contact other binding posts.

b. Batteries. When internal batteries are used, no other battery connections are necessary. To use external batteries, set BATTERY SWITCH D to the OFF position and, observing proper polarity, connect a 6-volt battery to the A BATTERY EXTERNAL CONNECTION binding posts 8 and 9 and a 90-volt battery to the B BATTERY EXTERNAL CONNECTION binding posts 6 and 7. Check the connections for polarity and voltage before operating BATTERY SWITCH D to the ON position.

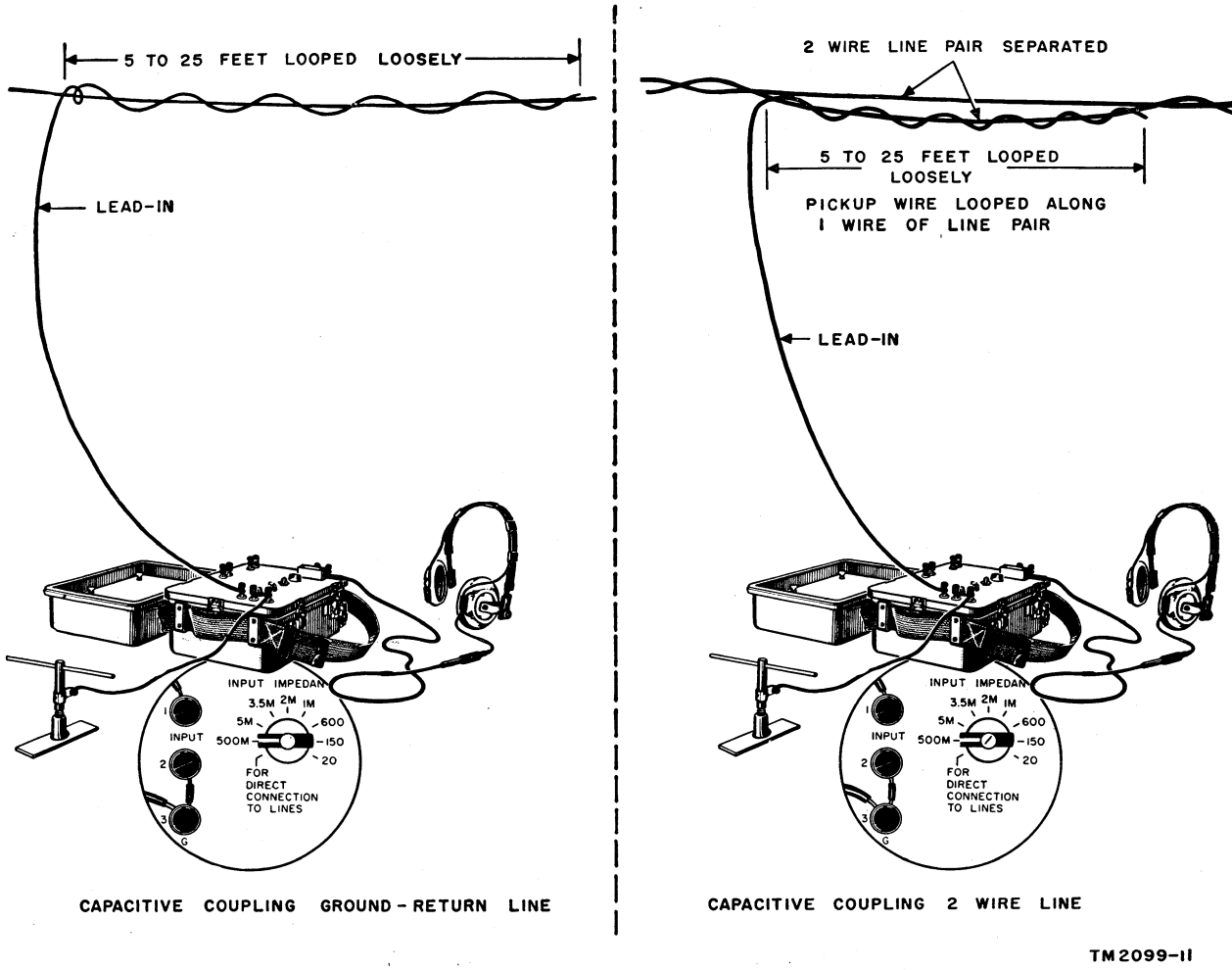


Figure 9. Capacitive coupling interception method.

c. Input. The installation procedure and connections for each method of interception are described below. Connect each wire carefully and correctly. Carelessness may lead to detection.

Caution: Set INPUT IMPEDANCE switch A at the position designated FOR DIRECT CONNECTION TO LINES before making any connection to INPUT binding posts 1 and 2. Do not change the switch position unless specifically directed.

(1) *Direct connection interception method* (fig. 7).

(*a*) Connect ground to binding post 3.

(*b*) For a two-wire line, connect the lead-in pair to INPUT binding posts 1 and 2. For a ground-return line, connect the lead-in wire to INPUT binding post 1 and connect the ground wire to INPUT binding post 2.

(*c*) Pay out the required amount of wire and connect it to the line as shown in figure 7.

(*d*) Use a lead-in wire that is in good condition and limit the length of the lead-in to a maximum of one-half mile. The use of poor wire and longer lengths lead to electrical detection and poor monitoring results.

(2) *Induction pickup interception method* (fig. 8).

(*a*) Connect ground to binding post 3.

(*b*) Connect the lead-in pair to INPUT binding posts 1 and 2, for a two-wire line. For a ground-return line, connect the lead-in wire to binding post 1 and connect the ground wire to INPUT binding post 2.

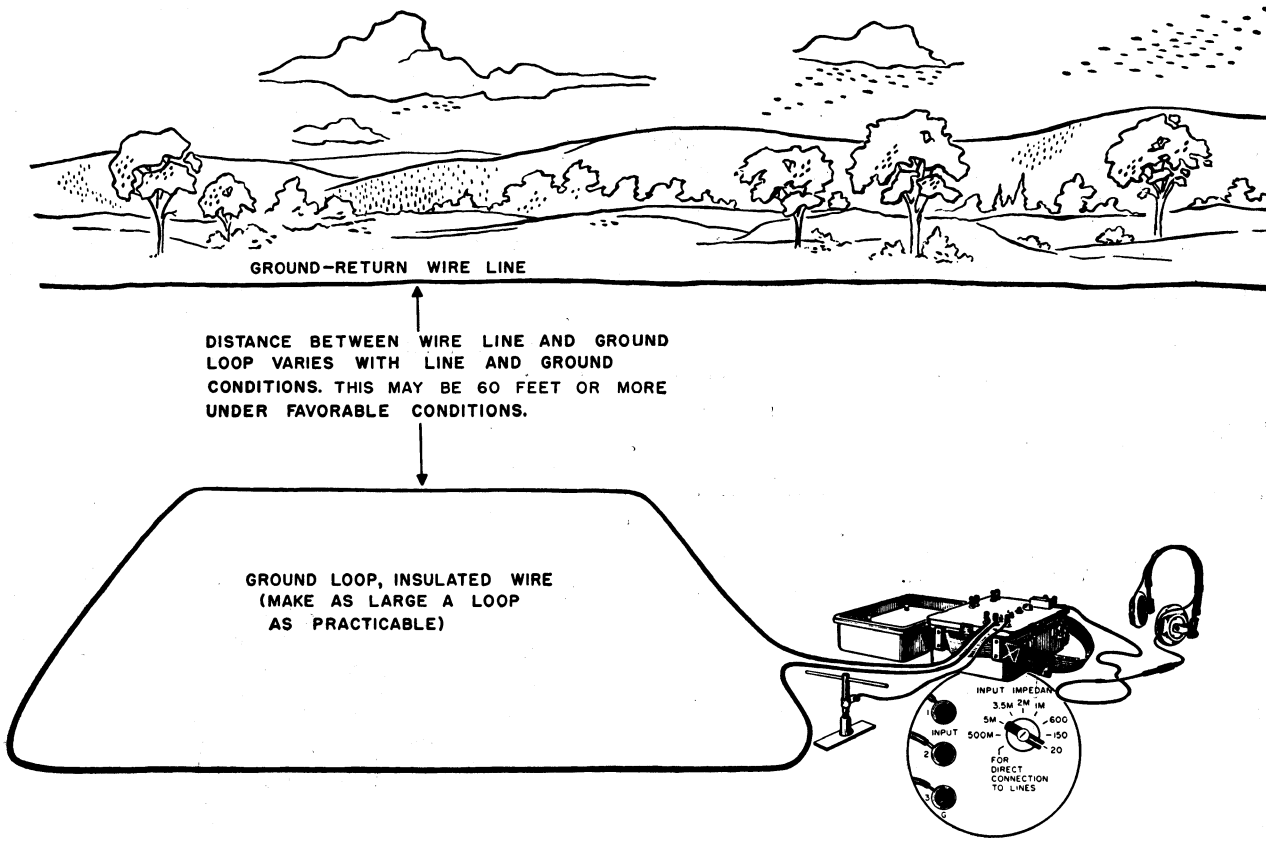


Figure 10. Ground loop interception method.

(*c*) Pay out the amount of wire necessary and connect it to the binding posts on the Audio Frequency Transformer TF–148/PTA–1.

(*d*) Open the core of the pickup transformer and lay the wire or cable to be monitored inside of the core.

(*e*) Close and secure the core over the wire or cable.

(*f*) Limit the length of the lead-in wire to a maximum of 500 feet.

(3) *Capacitive coupling interception method* (fig. 9).

(*a*) Connect INPUT binding posts 2 and 3 to ground.

(*b*) Connect the lead-in wire to INPUT binding post 1.

(*c*) Lay out the lead-in wire to the line to be monitored.

(*d*) Loop the lead-in wire along the line wire as shown in figure 9.

(4) *Ground loop interception method* (fig. 10).

(*a*) Connect binding post 3 to ground.

(*b*) Connect one end of the loop wire to INPUT binding post 1.

(*c*) Form the loop, which should be as long as possible, in a rectangular shape with the long side parallel to and as close as possible to one side of the line that is being monitored. Keep the insulated loop wire on the ground.

(*d*) Connect the other end of the loop wire to INPUT binding post 2.

(5) *Ground rod interception method* (fig. 11).

(*a*) Choose a ground rod baseline parallel to the line to be monitored and as close to it as security conditions permit.

(*b*) Install two ground rods on the rod baseline as far apart as possible. The rods must not be less than 300 feet apart.

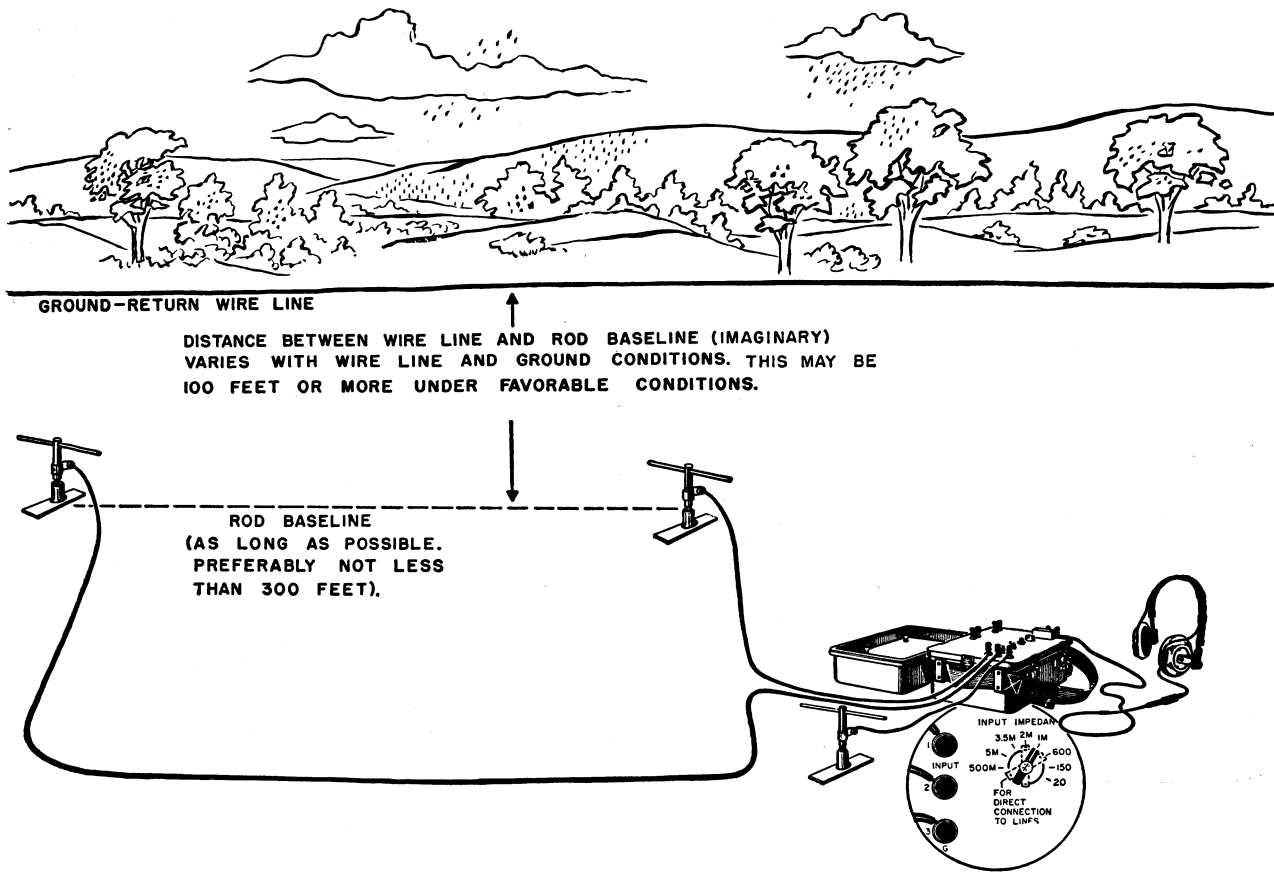


Figure 11. Ground rod interception method.

(*c*) Connect the furthest baseline ground rod to INPUT binding post No. 2.

(*d*) Connect the near baseline ground rod to INPUT binding post No. 1.

(*e*) When the Audio Frequency Amplifier AM–558/PTA–1 is located at one of the baseline ground rods, strap binding post 1 to binding post 3 to provide an equipment ground. If it is not possible to locate the equipment at one of the baseline ground rods, install a third ground rod for use as the equipment ground.

d. Output (figs. 3 and 12). Facilities for connecting the output of Audio Frequency Amplifier AM–558/PTA–1 are provided on the lower right side of the equipment panel. A phone jack, marked PL55, is used to connect a headset for operator monitoring. OUTPUT binding posts 4 and 5 are used when connecting to recording equipment. These connections are outlined below.

(1) *Operator monitoring connections.*

(*a*) Insert the plug of Extension Cord CD–307–A into the jack marked PL55 on the equipment panel of the amplifier.

(*b*) Insert the plug from the headset assembly into the Jack JK–26 of the Extension Cord CD–307–A.

(2) *Recording connections.* Connect Wire WD–1/TT from the input terminals of the distant recorder to OUTPUT binding posts 4 and 5 of the audio frequency amplifier.

15. Service Upon Receipt of Used or Reconditioned Equipment

a. Refer to the instructions given in paragraph 12 when unpacking used or reconditioned equipment. When information is available to indicate that the equipment is operating satisfactorily, it may be placed in operation.

b. If used equipment is received for service, look for tags or other sources of information pertaining to the condition of the equipment. When the condition is doubtful and no information is available, subject the equipment to the final testing procedures (pars. 53 through 60). These final testing procedures will indicate whether the equipment is functioning as designed. A thoroughly reconditioned piece of equipment can be considered to be in the same condition as new equipment.

Section II. CONTROLS AND INSTRUMENTS

Note. This section describes, locates, illustrates, and furnishes the operator sufficient information pertaining to the various controls and instruments provided for the proper operation of the equipment.

16. General

Improper setting of the controls can cause damage to electronic equipment. For this reason, it is important to know the function of every control. The actual operation of the equipment is discussed in paragraphs 18 through 25.

17. Controls and Their Uses

(fig. 12)

The following table lists the controls and their functions for Audio Frequency Amplifier AM–558/PTA–1. The controls are located on the front panel of Audio Frequency Amplifier AM–558/PTA–1.

Control	Function
INPUT binding posts 1, 2, and 3.	Binding posts 1 and 2 are used to connect pickup leads; 3 is used for ground connection.
OUTPUT binding posts 4 and 5.	Used to connect to recorder or other monitoring device.
B BATTERY EXTERNAL CONNECTION binding posts.	Used to connect external 90-volt plate battery.
A BATTERY EXTERNAL CONNECTION binding posts 8 and 9.	Used to connect external 6-volt filament battery.
Jack PL55	Used to connect headset for direct operator monitoring.
INPUT IMPEDANCE switch A.	Provides for selection of most favorable impedance for interception methods in use. Does not vary from FOR DIRECT CONNECTION TO LINES position except as directed in paragraph 20.
FILTER switch B	Provides for proper filter circuit to reduce noise and interference to a minimum. Position 200–8000 provides high fidelity response for use on quiet lines. Position 200–3000 provides voice frequency response only with high frequency static rejected. Position 300–8000 provides high fidelity response with 60 cycle power line fundamental and harmonic pickup rejected. Position 300–3000 provides vf response only with hf static and power line pickup rejected.
VOLUME control C	Used as audio gain control. Connected so that all steps provide added attenuation of 3 db except as follows: first two steps from counter-clockwise end provide 10 db and last step at clockwise end provide 5 db added gain. A TEST position is provided to determine general overall operating condition of batteries and vacuum tubes.
BATTERY SWITCH D	Provides for selection of either internal or external batteries and provides common OFF position for equipment.

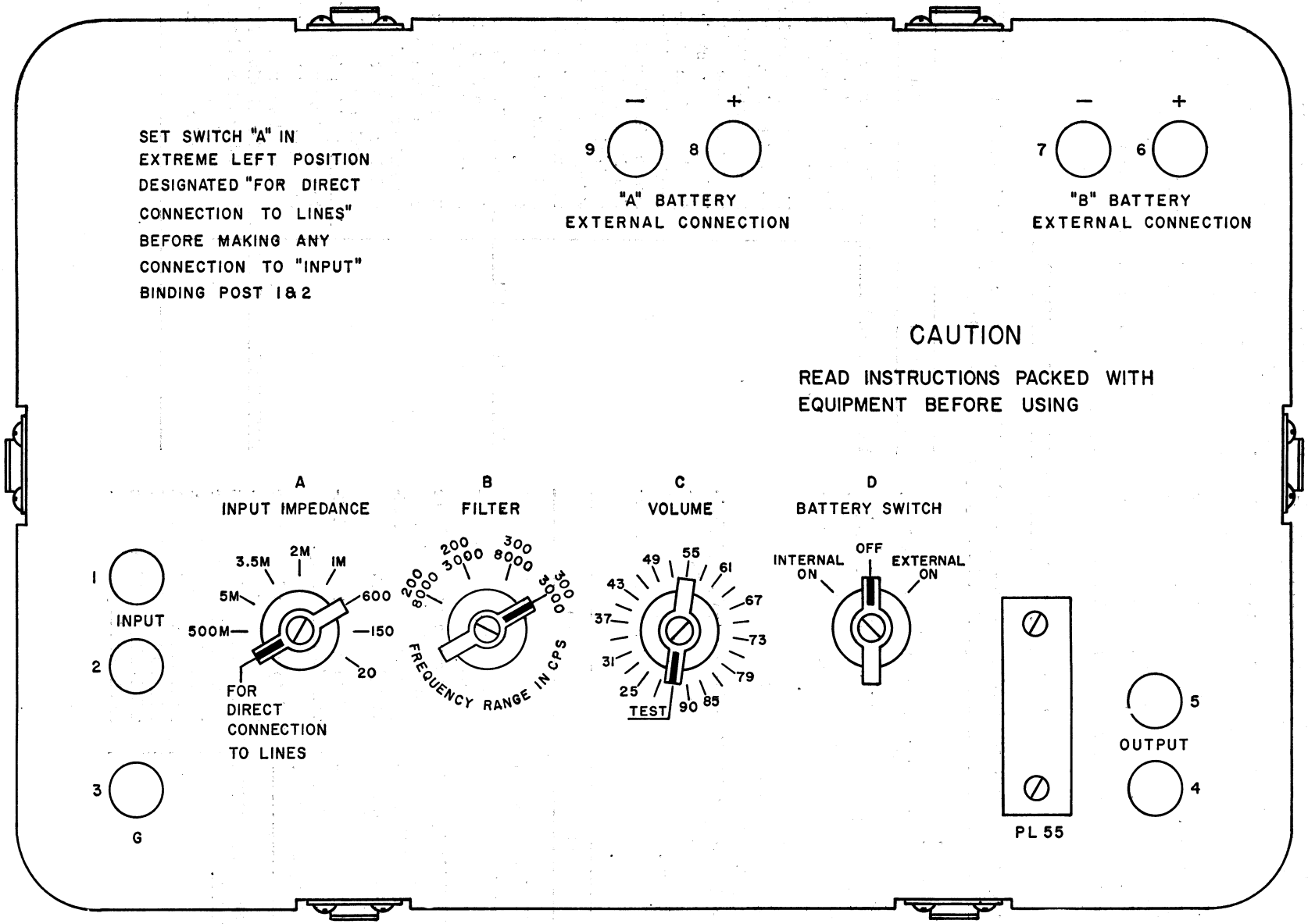


Figure 12. Audio Frequency Amplifier AM–558/PTA–1, front panel.

Section III. OPERATION UNDER USUAL CONDITIONS

18. Preliminary Starting Procedures

a. Check all connections to be sure they are properly terminated.

b. Check installation to be sure security is obtained.

c. Make certain that connections have not been made to both PL55 and OUTPUT terminals 4 and 5.

d. Set VOLUME control knob C at position between 20 and 49.

19. Starting Procedure

Turn BATTERY SWITCH D to the INTERNAL ON position if the internal batteries are used, or to the EXTERNAL ON position if the external batteries are used. Signals or line noise may or may not be heard in the hea set, depending on the efficiency of the interception method used. Refer to the equipment performance checklist (par. 36) if any abnormal indication is obtained.

20. Types of Operation

a. Direct Connection Interception Method (fig. 7).

Control	Position
INPUT IMPEDANCE switch A.	Do not readjust. It must remain on FOR DIRECT CONNECTION TO LINES position.
VOLUME control C____	Adjust until signal reception is best. Setting will vary with line and other conditions.
FILTER control B_____	Adjust until signal is clear and free from hum and noise. After adjusting FILTER control B, it may be necessary to readjust VOLUME control C for most satisfactory output.

b. Induction Pickup Interception Method (fig. 8).

Contro	Position
INPUT IMPEDANCE switch A.	Readjust for greatest volume. In general, best results will be obtained at position 600.
VOLUME control C____	Adjust until signal reception is most satisfactory.
FILTER control B_____	Adjust for best signal clarity and least hum and noise. After adjusting FILTER control B, it may be necessary to readjust VOLUME control C for most satisfactory output.

c. Capacitive Coupling Interception Method (fig. 9).

Contro	Position
INPUT IMPEDANCE switch A.	Readjust for greatest volume. Generally 500M position will be best.
VOLUME control C____	Adjust for most satisfactory signal volume.
FILTER control B_____	Adjust for best signal clarity and least hum and noise. Readjustment of VOLUME control C may be necessary for most satisfactory reception.

d. Ground Loop Interception Method (fig. 10).

Contro	Position
INPUT IMPEDANCE switch A.	Readjust for greatest volume. Generally position 20 will be best.
VOLUME control C____	Adjust for most satisfactory signal strength.
FILTER control B_____	Adjust for best signal clarity and least hum and noise. Readjustment of VOLUME control C may be necessary for most satisfactory reception.

e. Ground Rod Interception Method (fig. 11).

Control	Position
INPUT IMPEDANCE switch A.	Readjust for greatest volume. Best position depends on ground impedance at selected location.
VOLUME control C_____	Adjust for most satisfactory signal strength.
FILTER control B_____	Adjust for best signal clarity and least hum and noise. Readjustment of VOLUME control C may be necessary for satisfactory reception.

21. Stopping Procedure

To stop the operation of the equipment, turn BATTERY SWITCH D to the OFF position. Disconnect the lead-in wires from the line carefully so as not to short-circuit, ground, or break the line wires.

Section IV. OPERATION UNDER UNUSUAL CONDITIONS

22. General

Audio Frequency Monitor AN/PTA–1 is designed to operate unattended under all conditions so that only normal precautions have to be taken for satisfactory operation. In the following paragraphs, instructions are given on procedures for minimizing the effects of unusual operating conditions.

23. Operation in Arctic Climates

In arctic areas, the ground rod interception method may not be practicable because of the difficulty of inserting the rods in frozen ground. The other methods of interception mentioned are practicable (pars. 4 and 14).

a. Handle the equipment carefully.

b. Wear a knitted woolen cap over the earphones when operating in the open air with headsets that do not have rubber earpieces. Frequently, when headsets without rubber earpieces are worn, the edges of the ears may freeze, without the operator being conscious of this condition. Never flex rubber earcaps, because this action may render them useless. If water gets into the equipment, or if moisture condenses within the case and chassis, it may freeze and impede the switches. When this happens, dry the equipment thoroughly in a warm, dry room.

c. When equipment that has been exposed to the cold is brought into a warm room, it will sweat until it reaches room temperature. When it has reached room temperature, dry it thoroughly. This condition also occurs when equipment warms up during the day after exposure during a cold night.

24. Operation in Tropical Climates

In tropic areas, fungiproofing and moistureproofing must be done more often. The case must be closed tightly and the wires from the binding post must be inspected more often for electrical leakage caused by moisture.

25. Operation in Desert Climates

The main problem with equipment in desert areas is the large amount of sand or dust that enters the moving parts of dials, switches, and rheostats. To prevent the entrance of sand or dust into the equipment, keep the cover tightly closed and cover the equipment with canvas or other suitable material. Frequent cleaning of the equipment is necessary to remove dust and sand.

CHAPTER 3

ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

Section I. PREVENTIVE MAINTENANCE SERVICES

26. Definition of Preventive Maintenance

Preventive maintenance is scheduled, systematic work performed on equipment (usually when the equipment is not in use) to keep it in good working condition so that breakdowns and needless interruptions in service will be kept to a minimum. Preventive maintenance differs from trouble-shooting and repair since its object is to prevent certain troubles from occurring. See AR 750–5 (Maintenance Responsibilities and Shop Operation).

27. Tools Required for Audio Frequency Monitor AN/PTA–1

Tool Equipment TE–33 is used but is not supplied with Audio Frequency Monitor AN/PTA–1. It contains all the hand tools necessary for organizational maintenance personnel.

28. General Preventive Maintenance Techniques

Most preventive maintenance techniques pertain to specific areas of preventive maintenance, such as inspecting of specific parts, and are thoroughly covered in later sections. However, the following general instructions should be helpful.

a. Use #0000 sandpaper to remove corrosion.

b. Use a clean, dry, lint-free cloth, or a dry brush for cleaning.

(1) If necessary, except for electrical contacts, moisten the cloth or brush with Solvent, Dry Cleaning (SD); then wipe the parts with a cloth.

(2) Do not use carbon tetrachloride to clean the switch contacts in Audio Frequency Amplifier AM–558/PTA–1. This fluid will leave a deposit on the contacts which is extremely difficult to remove because of the location and construction of the contacts. To eliminate noise in switches, rotate them until the noise decreases.

Caution: Repeated contact of carbon tetrachloride with the body or prolonged breathing of the fumes is dangerous. Be sure adequate ventilation is provided.

c. If available, dry compressed air may be used at a line pressure not exceeding 60 pounds per square inch (psi) to remove dust from inaccessible places; be careful, however, or mechanical damage from the air blast may result.

29. Use of Preventive Maintenance Forms (figs. 13 and 14)

a. The decision as to which items on DA Forms 11–250 and 11–251 are applicable to this equipment is a tactical decision to be made in the case of first echelon maintenance by the communication officer/chief or his designated representative, and in the case of second and third echelon maintenance, by the individual making the inspection. Instructions for the use of each form appear on the reverse side of the form.

b. Circled items in figures 13 and 14 are partially or totally applicable to Audio Frequency Monitor AN/PTA–1. References in the ITEM block refer to paragraphs in text which contain additional maintenance information.

OPERATOR FIRST ECHELON MAINTENANCE CHECK LIST FOR SIGNAL CORPS EQUIPMENT
PUBLIC ADDRESS, RECORDER, REPRODUCER

INSTRUCTIONS: See other side

EQUIPMENT NOMENCLATURE	EQUIPMENT SERIAL NO.
AUDIO FREQUENCY MONITOR AN/PTA-1	

LEGEND FOR MARKING CONDITIONS: ✓ Satisfactory; X Adjustment, repair or replacement required; (X) Defect corrected.
NOTE: Strike out items not applicable.

DAILY

NO.	ITEM	CONDITION S	M	T	W	T	F	S
1	INSPECT UNIT FOR COMPLETENESS - MICROPHONE, HEADSET, CORDS, CABLES, ACCESSORIES, RUNNING SPARES. PAR.7,30 a(1)							
2	CLEAN EXTERIOR OF COMPONENTS OF DIRT, GREASE, GRIME, CORROSION, OIL. PAR.28,30a(2)							
3	CLEAN PLUGS AND ELECTRICAL CONNECTIONS OF CORROSION, TARNISH, DIRT, DUST, GREASE, OIL. PAR.28,30a(3)							

WEEKLY

NO.	ITEM	CONDITION	NO.	ITEM	CONDITION
4	INSPECT EXTERIOR OF COMPONENTS FOR RUST, CORROSION, LOOSE OR MISSING SCREWS, CHIPPED PAINT, CRACKS. PAR.30b(1)		7	INSPECT ELECTRICAL CONNECTIONS FOR FIRMNESS OF SEATING, PROPER CONTACT, TIGHTNESS, CORROSION, GREASE, OIL, DIRT. PAR.30b(4)	
5	INSPECT CORDS AND CABLES FOR LOOSE TERMINALS, FRAYED, CUT OR GOUGED INSULATION OR JACKETING, BROKEN CONDUCTORS. PAR.30b(2)		8	INSPECT PLUGS FOR CHIPS, CRACKS, CORROSION, TARNISH, ROUGHNESS, BENDS. PAR.30b(5)	
6	TIGHTEN - LOOSE EXTERIOR SCREWS, BOLTS, FASTENINGS, MOUNTINGS. PAR.30b(3)		9	OPERATE UNIT AND CHECK FOR SMOOTHNESS, UNUSUAL NOISES, SQUEAKS, VIBRATIONS, CORRECT OPERATION. PAR.30b (6)	

10 IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION.

DA FORM 1 MAY 51 11-250 REPLACES DA AGO FORM 419, 1 DEC 50, WHICH IS OBSOLETE.

Figure 13. DA Form 11-250.

SECOND AND THIRD ECHELON MAINTENANCE CHECK LIST FOR SIGNAL CORPS EQUIPMENT
PUBLIC ADDRESS, RECORDER, REPRODUCER

INSTRUCTIONS: See other side

EQUIPMENT NOMENCLATURE: AUDIO FREQUENCY MONITOR AN/PTA-1

EQUIPMENT SERIAL NO.

LEGEND FOR MARKING CONDITIONS: ✓ Satisfactory; X Adjustment, repair or replacement required; (X) Defect corrected.
NOTE: Strike out items not applicable.

NO.	ITEM	CONDITION	NO.	ITEM	CONDITION
1	INSPECT UNIT FOR COMPLETENESS - MICROPHONE, HEADSET, CORDS, CABLES, ACCESSORIES, RUNNING SPARES. PAR. 7, 30 a(1)		13	SOLDER ANY BROKEN OR LOOSE SOLDERED CONNECTIONS. PAR. 30 c(4)	
2	CLEAN EXTERIOR OF COMPONENTS OF DIRT, GREASE, GRIME, CORROSION, OIL. PAR. 28, 30 a(2)		14	INSPECT INTERNAL WIRING AND CABLING, WHERE ACCESSIBLE FOR LOOSE TERMINALS, FRAYED, CUT, OR GOUGED INSULATION OR JACKETING, BROKEN CONDUCTORS. PAR. 30 c(5)	
3	CLEAN PLUGS AND ELECTRICAL CONNECTIONS OF CORROSION, TARNISH, DIRT, DUST, GREASE, OIL. PAR. 28, 30 a(3)		15	INSPECT MOTORS FOR CONDITION OF BRUSHES, EVIDENCES OF OVERHEATING, END PLAY, SIDE PLAY.	
4	INSPECT EXTERIOR OF COMPONENTS FOR RUST, CORROSION, LOOSE OR MISSING SCREWS, CHIPPED PAINT, CRACKS. PAR. 30b(1), 32		16	INSPECT REPRODUCER AND/OR RECORDER HEADS FOR GENERAL CONDITION.	
5	INSPECT CORDS AND CABLES FOR LOOSE TERMINALS, FRAYED, CUT OR GOUGED INSULATION OR JACKETING, BROKEN CONDUCTORS. PAR. 30b(2)		17	CLEAN CIRCUIT ELEMENTS, LOUD-SPEAKERS, TURNTABLES, REELS, MOTORS OF DIRT, DUST, GREASE, OIL, GRIME, WHERE ACCESSIBLE.	
6	TIGHTEN - LOOSE EXTERIOR SCREWS, BOLTS, FASTENINGS, MOUNTINGS. PAR. 30b(3)		18	INSPECT CAPACITORS, POTENTIOMETERS, AND RESISTORS FOR LOOSE TERMINALS, CORROSION, LEAKS, BULGES, BLISTERING, DISCOLORATION. PAR. 30c(6), 30c(7)	
7	INSPECT ELECTRICAL CONNECTIONS FOR FIRMNESS OF SEATING, PROPER CONTACT, TIGHTNESS, CORROSION, GREASE, OIL, DIRT. PAR. 30b(4)		19	INSPECT INKING UNITS FOR CLOGGING, GUMMY DEPOSITS, DIRT, GREASE.	
8	INSPECT PLUGS FOR CHIPS, CRACKS, CORROSION, TARNISH, ROUGHNESS, BENDS. PAR. 30b(5)		20	INSPECT ALL LABELS, ENGRAVINGS, PLATES FOR LEGIBILITY. PAR. 30 c(8)	
9	OPERATE UNIT AND CHECK FOR SMOOTHNESS; UNUSUAL NOISES, SQUEAKS, VIBRATIONS; CORRECT OPERATION. PAR. 30b(6)		21	CLEAN, TIGHTEN, AND WHERE APPLICABLE, LUBRICATE AIR FILTER.	
10	INSPECT ALL VISIBLE MOVING PARTS FOR BINDING, SCRAPING, SQUEAKING, EVIDENCES OF WORN BEARINGS, SHAFTS, GEARS. PAR. 30 c(1)		22	LUBRICATE UNIT IN ACCORDANCE WITH LATEST DEPARTMENT OF THE ARMY LUBRICATION ORDER OR INFORMATION PUBLISHED IN APPROPRIATE TECHNICAL MANUAL.	
11	INSPECT TUBE SOCKETS FOR CRACKS, CHIPS, LOOSE SOLDER CONNECTIONS. PAR. 30 c(2)		23	INSPECT MOISTURE AND FUNGUS PROOFING. PAR. 30 c(9)	
12	INSPECT TUBES FOR SEATING, LOOSE ENVELOPES. PAR. 30c(3)		24	INSPECT FOR PROPER SEASONAL MAINTENANCE WHERE APPLICABLE.	
			25	INSPECT CONTROLS FOR BINDING, SCRAPING, POSITIVE ACTION PAR. 30C(1), 30C(11)	

26 IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION.

DA FORM 1 MAY 51 11-251 REPLACES DA AGO FORM 419, 1 DEC 50, WHICH IS OBSOLETE.

TM 2099-16

Figure 14. DA Form 11–251.

30. Performing Preventive Maintenance

(figs. 13 and 14)

The following subparagraphs are a suggested schedule of preventive maintenance for Audio Frequency Monitor AN/PTA–1. The operations indicated should be performed by organizational personnel at the intervals indicated, unless these intervals are changed by the local commander.

Caution: Screws, bolts, and nuts should not be tightened beyond the pressure for which they are designed or they will be damaged or broken.

a. Daily.

(1) Check the equipment for completeness and satisfactory condition. Components of this equipment are listed in paragraph 7.

(2) Clean dirt, grease, and grime from the exterior of the components of Audio Frequency Monitor AN/PTA–1.

(3) Clean corrosion, tarnish, dirt and dust from plugs and electrical connections.

(4) Check the connections of batteries BT1 and BT2 for corrosion and proper contact.

b. Weekly.

(1) Check the exterior condition of the components for rust, corrosion, missing screws, and marred surfaces. The components of the AN/PTA–1 are listed in paragraph 7.

(2) Check the cords and lead-in wire for loose connections, frayed insulation, and broken conductors.

(3) Check the exterior screws, compression snaps, and toe plates for looseness.

(4) Check the binding post connections of Audio Frequency Amplifier AM–558/PTA–1 and Ground Rod GP–106/G for tightness, corrosion, and proper seating.

(5) Check the plug for chips, cracks, corrosion, and tarnish.

(6) Connect the equipment as shown in figure 15 and examine it for unusual noises and correct operation.

c. Monthly.

(1) Check the switches and controls for binding, squeaking, and scraping.

(2) Check the tube sockets for cracks, chips, and corrosion. Clean dust and dirt from the tube sockets.

(3) Check the tubes for cracked sockets and proper seating.

(4) Check the interior of Audio Frequency Amplifier AM–558/PTA–1 for loose or poorly soldered connections.

(5) Check the interior of Audio Frequency Amplifier AM–558/PTA–1 for loose terminals, dirty switch contacts, and broken conductors.

(6) Check the capacitors, coils, resistors, and switches for corrosion, bulging, dirt, loose terminals, and discoloration.

(7) Check the batteries for corrosion and proper voltages.

(8) Check the labels and panel markings for legibility.

(9) Check adequacy of moistureproofing and fungiproofing.

(10) Clean and tighten connections for transformers, filters, and switches.

(11) Check the switches for binding, scraping, and positive action.

(12) Check the carrying straps for dirt, dust, and frayed edges.

Section II. WEATHERPROOFING

31. Weatherproofing and Lubrication

a. General. Signal Corps equipment, when operated under severe climatic conditions such as prevail in tropic, arctic, and desert regions, requires special treatment and maintenance. Fungus growth, insects, dust, corrosion, salt spray, excessive moisture, and extreme temperatures are harmful to most materials.

b. Tropical Maintenance. A special moistureproofing and fungiproofing treatment has been devised, which, if properly applied, provides a reasonable degree of protection. This treatment is explained in TB SIG 13 (Moistureproofing and Fungiproofing Signal Corps Equipment) and TB SIG 72 (Tropical Maintenance of Ground Signal Equipment).

c. Winter Maintenance. The special precautions necessary to prevent poor performance or total operational failure of equipment in extremely low temperatures are explained in TB SIG 66 (Winter Maintenance of Signal Equipment) and TB SIG 219 (Operation of Signal Equipment at Low Temperatures).

d. Desert Maintenance. The special precau-

tions necessary to prevent equipment failure in areas subject to extremely high temperatures, low humidity, and excessive sand and dust are explained in TB SIG 75 (Desert Maintenance of Ground Signal Equipment).

e. Lubrication. No lubrication is necessary for this equipment.

32. Rustproofing and Painting

a. When the finish on the case has been badly scarred or damaged, rust and corrosion can be prevented by touching up bared surfaces. Use #00 or #000 sandpaper to clean the surface down to the bare metal; obtain a bright smooth finish.

Caution: Do not use steel wool. Minute particles frequently enter the case and cause harmful internal short-circuiting or grounding of circuits.

b. When a touch-up job is necessary, apply paint with a small brush. Remove rust from the case by cleaning corroded metal with solvent (SD). In severe cases it may be necessary to use solvent (SD) to loosen the rust and to use sandpaper to complete the preparation for painting. Paint used will be authorized and consistent with existing regulations.

Section III. TROUBLESHOOTING AT ORGANIZATIONAL MAINTENANCE LEVEL

33. General

The troubleshooting and repair work that can be performed at the organizational maintenance level (operators and repairmen) is limited in scope by the tools, test equipment, replaceable parts issued, and by the existing tactical situation. Accordingly, troubleshooting is based upon performance of the equipment and the use of the senses in determining trouble such as burned-out tubes, resistors, etc. The following paragraphs will help in determining the stages at fault and the faulty component.

34. Visual Inspection

a. Equipment troubles may be caused by one or more of the following conditions:

(1) Loose or unconnected battery plugs (P1 and P2).
(2) Poor connections at input or output terminals.
(3) Defective tubes (V1 through V3).
(4) Broken or loose wires.
(5) Improper position of operating controls.

b. When a failure is encountered and the cause is not immediately apparent, examine as many of the above items as is practicable. Examine anything that seems to have an abnormal color which may have been caused by overheating or corrosion.

35. Troubleshooting by Using Equipment Performance Checklist

a. General. The equipment performance checklist (par. 36) will help to locate trouble in Audio Frequency Amplifier AM–558/PTA–1. The list gives the items to be checked, the normal indications and tolerances of correct operation, and the corrective measures that can be taken by the operator. *To use this list, follow the items in numerical sequence.*

b. Action or Condition. For some items, the information given in the *action or condition* column consists of various switch and control settings. For other items, follow the instructions given in the *normal indications* column.

c. Normal Indications. The normal indications listed include the visible and audible signs that the operator should perceive when he examines 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 which the operator can make without turning in the equipment for repairs. A reference to the table in chapter 5 indicates that troubleshooting by an experienced repairman is necessary. If the set is completely inoperative or if the recommended corrective measures do not yield results, troubleshooting is necessary. However, if the tactical situation requires that monitoring be maintained, and if the set is not completely inoperative, the operator must keep the set in operation as long as it is possible.

36. Equipment Performance Checklist

	Item No.	Item	Action or condition	Normal indications	Corrective measures
PREPARATORY	1	INPUT IMPEDANCE switch A.	Set at position designated FOR DIRECT CONNECTION TO LINES.		
	2	External batteries_____	If external batteries are to be used, make connections as described in paragraph 14*b*.	Binding posts should make tight connection on bared wire.	Clean wire ends.
	3	Interception method___	Select interception method (par. 4).		
	4	INPUT connection____	Connect selected interception method (par. 14).	Binding posts should make tight connection on bared wire.	Clean wire ends.
	5	Output jack PL55_____	Insert headset plug into jack marked PL55.	Good electrical connection on tip and sleeve of plug.	Remove jack cover and clean springs.
	6	VOLUME control C___	Set at position between 20 and 49.		
START	7	BATTERY SWITCH D.	When using internal batteries, set at INTERNAL ON. When using external batteries, set at EXTERNAL ON.	Signals or line noise may or may not be heard in headset depending on efficiency of the pickup method used.	See items 8 and 9.
EQUIPMENT PERFORMANCE	8	INPUT IMPEDANCE switch A.	Reset at position described in paragraph 14 for selected interception method.	Signals or line noise may or may not be heard in headset depending on efficiency of pickup method used.	
	9	VOLUME control C___	Reset for most favorable volume position.	Signals or line noise should be heard in headset.	Check batteries, replace if necessary. Check tubes. replace if necessary. Check headset connection.
	10	FILTER switch B____	Adjust for most favorable signal-to-noise ratio.	A position of greatest signal and least hum and noise should be selected.	
	11	OUTPUT binding posts 4 and 5.	Connect recorder if required	Sound level in headset will drop.	Remove headset.
STOP	12	BATTERY SWITCH D.	Place in OFF position_____	Signals or line noise stops.	

CHAPTER 4
THEORY

37. General

This chapter contains detailed information for the electrical circuits in Audio Frequency Amplifier AM–558/PTA–1. Figure 15 is a block diagram illustrating Audio Frequency Monitor AN/PTA–1 connected for monitoring a telephone line using the induction pickup interception method. The audio signal from the line induces a signal into Audio Frequency Transformer TF–148/PTA–1. The signal is passed to the audio frequency amplifier where it is amplified to an audio level that is easily heard in the headset. To aid the repairman in understanding the circuit, a paragraph is devoted to each stage of the audio amplifier. Schematic diagrams illustrating the circuits are provided.

38. Block Diagram of Audio Frequency Amplifier AM–558/PTA–1

The block diagram of Audio Frequency Amplifier AM–558/PTA–1 is shown in figure 16. For more detailed overall information refer to the complete schematic diagram in figure 26. The signal paths through this equipment are described briefly in *a* through *c* below.

a. Input to Amplifier. Audio Frequency Amplifier AM–558/PTA–1 has a special input circuit which provides a method of adjusting the input impedance of the amplifier to the impedance of the line to be intercepted. The amplifier is provided with an adjustable filter for reducing unwanted hum and noise.

b. First and Second Voltage Amplifiers and Output Amplifier. The three-stage amplifier has an output impedance of 600 ohms to match the impedance of the headset, local lines, or recording equipment. The intercepted signal is presented at the output of the amplifier in its original form.

c. Battery Power Supply. The power supply includes internal batteries which will power the equipment unattended for periods as long as 72 hours. For longer periods of operation external batteries may be connected. Two batteries are required, one BA–409/U and one BA–415/U.

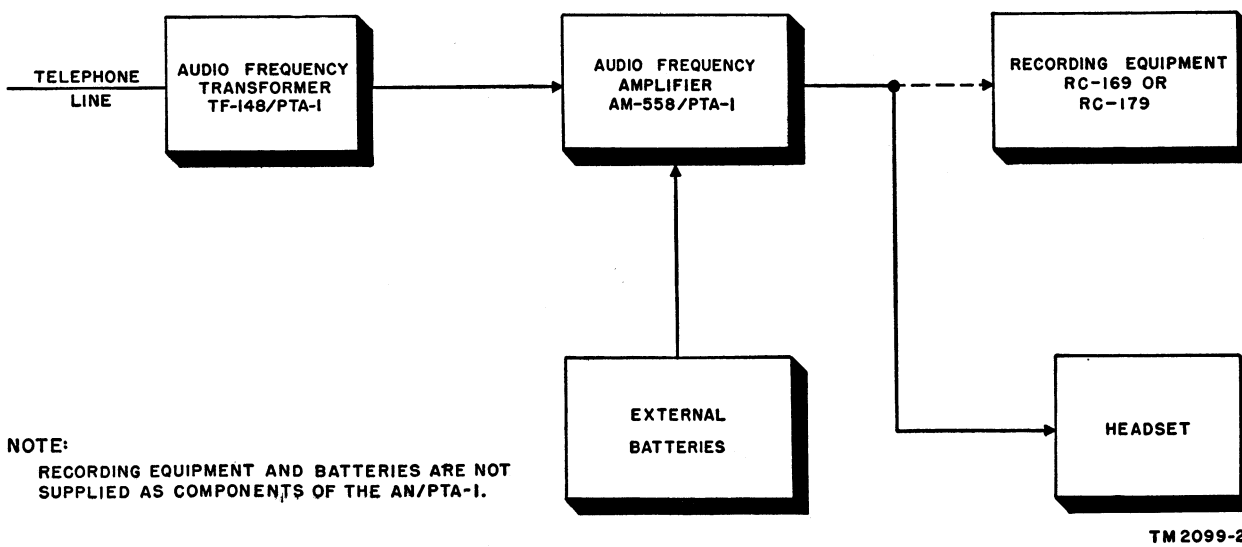


Figure 15. Audio Frequency Monitor AN/PTA–1, block diagram.

39. Input Circuit
(fig. 17)

a. The audio signal from the intercepted circuit is fed to INPUT binding posts 1 and 2, and the ground connection is made on binding post 3. Lightning arrestors E10 and E11, connected from the input binding posts to ground, are the gas-filled type that will ionize when high voltages, such as lightning charges, are fed to the amplifier. When the protectors ionize, they provide a low dc resistance path to ground, protecting the equipment and personnel from lightning and other high voltage surges.

b. The audio signal is fed to the impedance-matching circuit of the input circuit which consists of transformers T1 and T2, resistors R1 and R2, capacitor C1, and INPUT IMPEDANCE switch S1. Switch S1 is shown in position FOR DIRECT CONNECTION TO LINES. The switch consists of three sections. Section 3 selects the proper tap on transformers T1 and T2 as required. Section 2, connected across terminals 3 and 4 of transformer T1, short-circuits terminals 3 and 4 on all positions except the FOR DIRECT CONNECTION TO LINES position. Resistors R1 and R2 and capacitor C1 reduce the direct connection bridging loss, thereby reducing the possibilities of enemy detection. Section 1 selects the secondary of the transformer in use, either T1 or T2. The output of either T1 or T2, depending on the position of switch S1, is connected through attenuator AT1 and switch S2 to filter network FL1. Attenuator AT1 is a 4,000-ohm T-type attenuator that acts as isolation between transformers T1 and T2 and filter network FL1. This isolation helps to keep the overall input impedance more constant with a varying frequency.

c. FILTER switch S2 controls the type of filter in the circuit. The 200- to 8,000-cycle frequency range represents the nominal frequency limits not normally exceeded by the equipment. In the 200–3,000 cycle position, frequencies above 3,000 cycles are cut off by the introduction of the low-pass section of filter FL1. In the 300–8,000 cycle position, frequencies below 300 cycles are cut off by the high-pass section of filter FL1. In the 300–3,000 cycle position, both sections of filter FL1 are in the circuit and the frequencies below 300 cycles and above 3,000 cycles are cut off. The cutting off of frequencies below 300 cycles minimizes interference from low-frequency noise sources such as power lines and electric motors. The cutting off of frequencies above 3,000 cycles minimizes hf interference such as radio, code, and static. The output of filter FL1 is connected to the primary of transformer T3. The function of T3 is to match the impedance of the input circuits to the control grid of the first voltage amplifier.

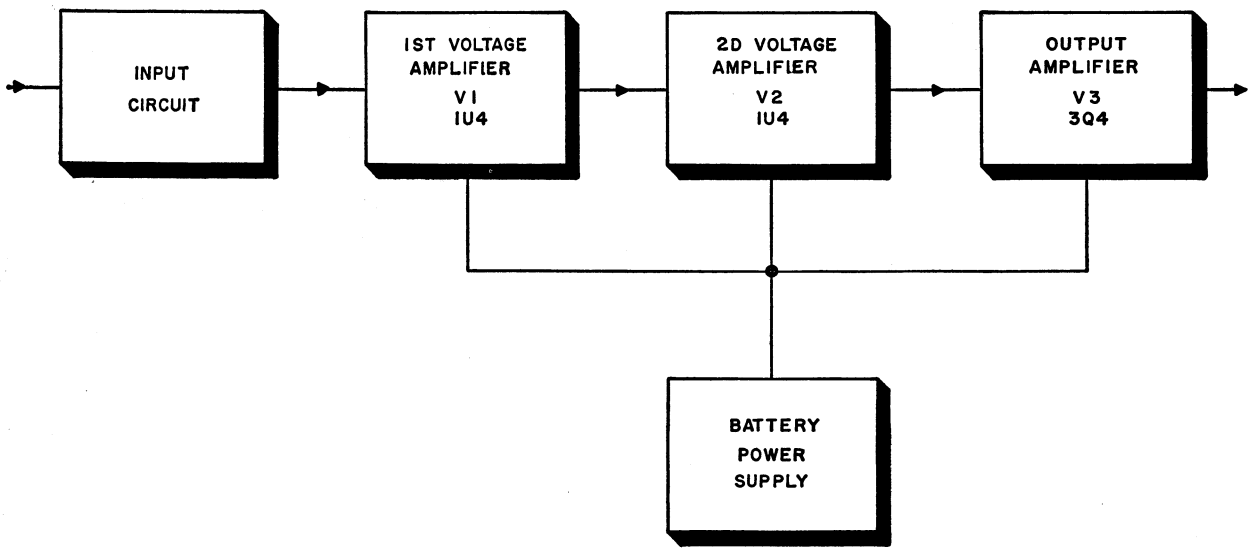


Figure 16. Audio Frequency Amplifier AM–558/PTA–1, block diagram.

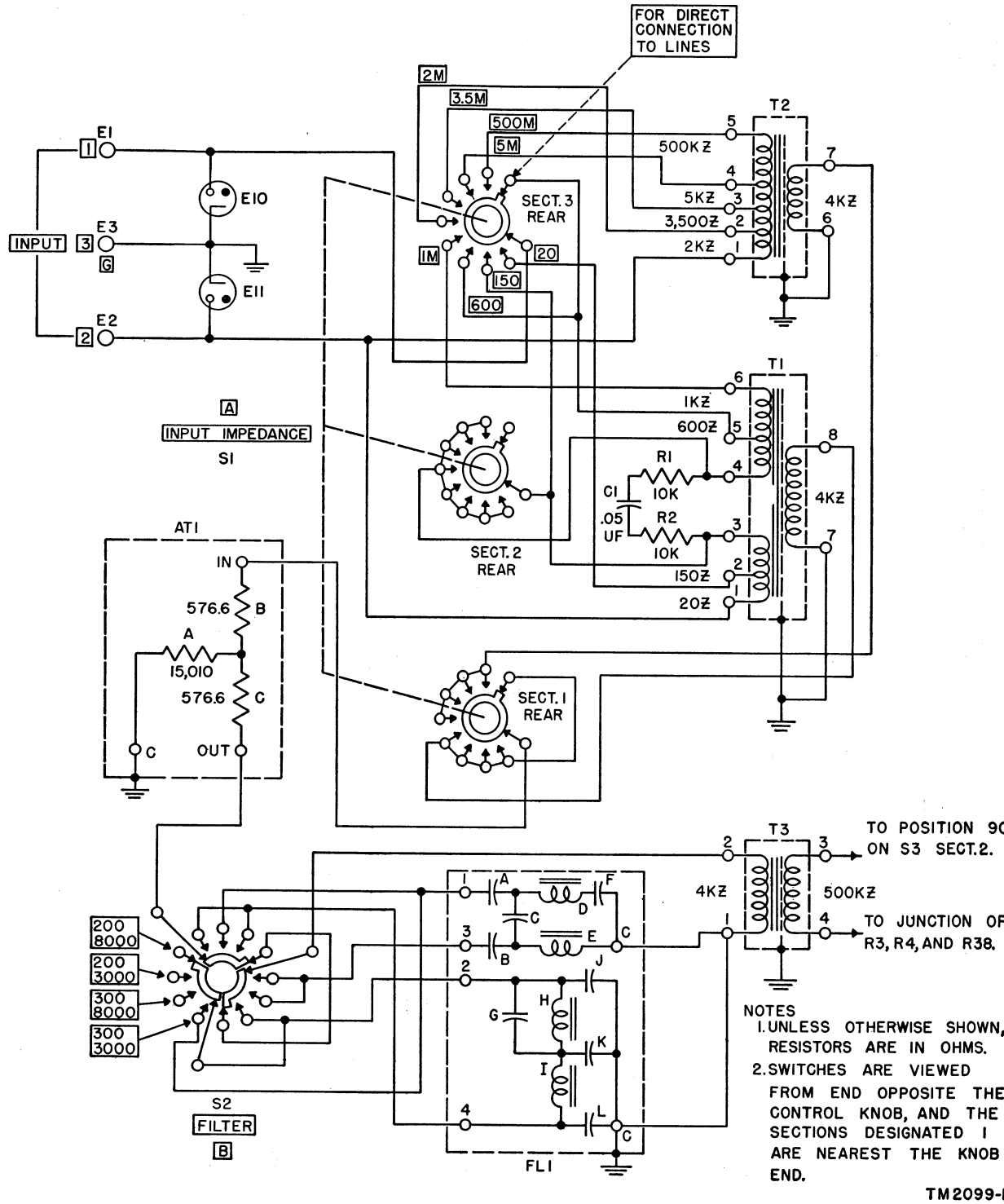


Figure 17. Input circuit, simplified schematic.

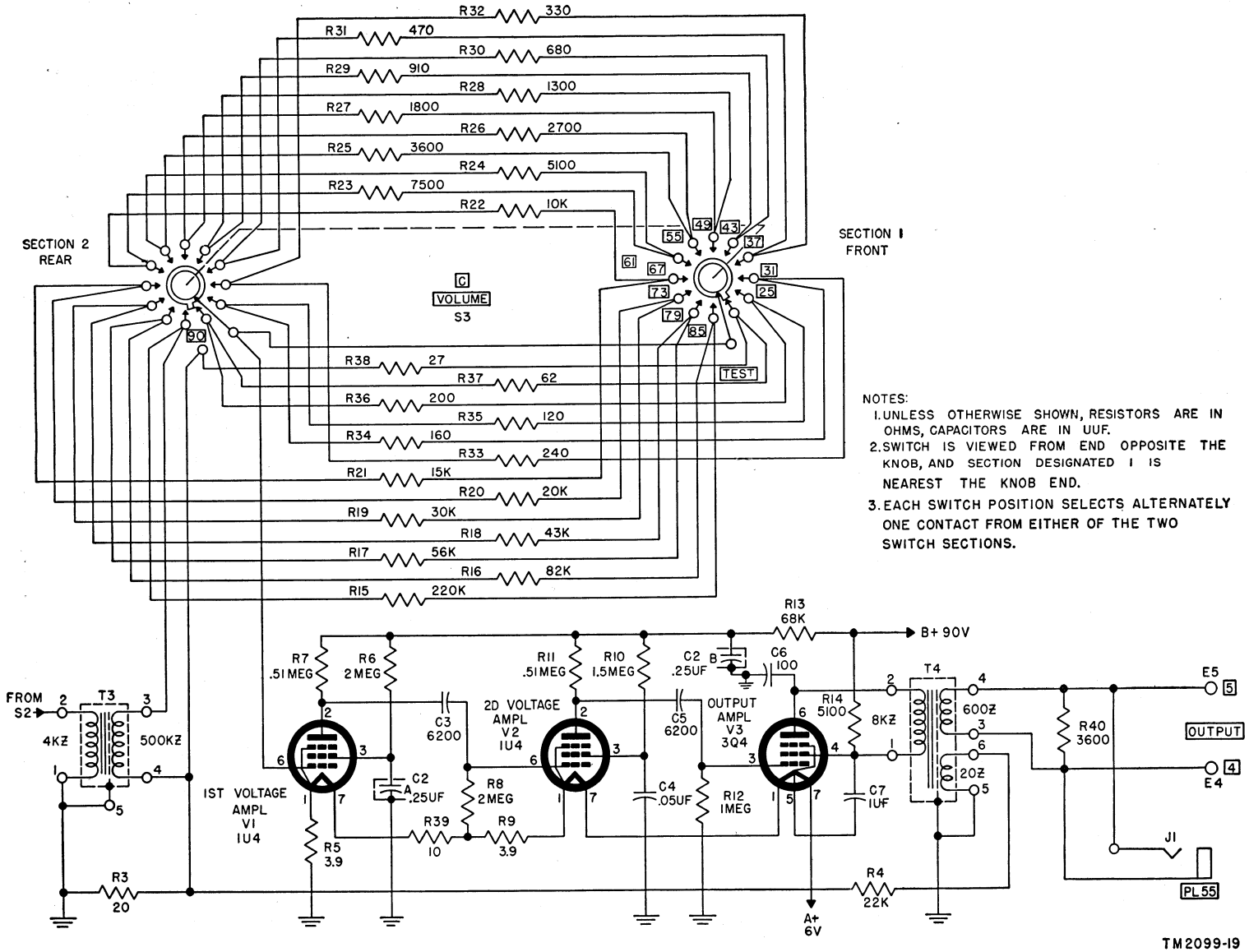


Figure 18. Audio amplifier stages, simplified schematic.

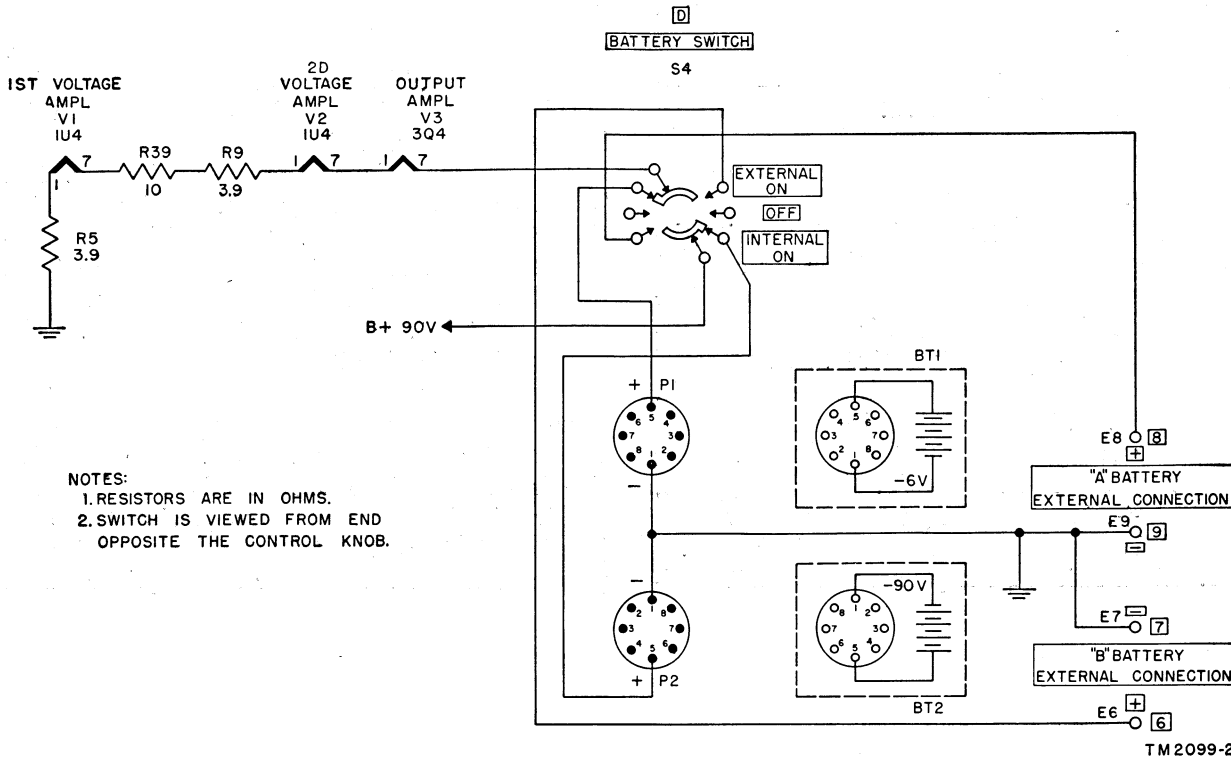


Figure 19. Power supply and filament circuit, simplified schematic.

40. Audio Amplifier Stages

(fig. 18)

a. The audio signal from output transformer T3 is applied across VOLUME control C (switch S3). Switch S3 and resistors R15 through R38 control the level of the audio signal that is applied by transformer T3 to the control grid (pin 6) of the first voltage amplifier V1. The control grid of V1 is stabilized by the dc path through VOLUME control C and resistor R3 to ground. The first voltage amplifier V1 is connected to operate as a high gain pentode tube. Resistor R6 is the screen grid (pin 3) voltage-dropping resistor, and the screen grid is bypassed to ground by capacitor C2A. Resistor R7 is the plate (pin 2) load resistor. The amplified voltage is coupled to the control grid (pin 6) of second voltage amplifier tube V2 by capacitor C3.

b. The second voltage amplifier also is connected to operate as a high gain pentode tube. The control grid (pin 6) of V2 is stabilized by the dc path through resistor R8. Resistor R10 is the screen-grid (pin 3) voltage-dropping resistor, and the screen grid is bypassed to ground by capacitor C4. Resistor R11 is the plate (pin 2) load resistor. The amplified voltage is coupled to the control grid (pin 3) of output amplifier V3 by capacitor C5.

c. Output amplifier V3 is connected to operate as a power amplifier pentode. The control grid (pin 3) of tube V3 is stabilized by the dc path through resistor R12 to ground. Tube V3 uses the full biasing voltage obtained by its position in the filament voltage distribution circuit. Screen-grid (pin 4) voltage is supplied to the tube through dropping resistor R14. The screen grid is bypassed by capacitor C7 to the center tap of the filament of V3 (pin 5). Transformer T4 couples the plate (pin 6) of V3 to OUTPUT binding posts E4 and E5 and to headset receptacle J1. R40 is connected across the secondary of transformer T4 and serves to stabilize the output impedance. Capacitor C6, connected from the plate (pin 6) of V3 to ground, bypasses high frequencies to ground, thus providing further amplifier stabilization. A third winding is provided on transformer T4 (terminals 5 and 6) which, together with resistors R3 and R4, provides negative voltage feedback to flatten out the overall gain characteristics of the amplifier and to make the gain less dependent on battery voltage variation.

Resistor R13 and capacitor C2B form a decoupling network to prevent audio frequency (af) coupling between voltage amplification stages V1 and V2 and output amplifier stage V3.

41. Power Supply

(fig. 19)

a. BATTERY SWITCH D (S4) permits the amplifier to be operated from either the external or internal batteries, and also turns the amplifier on and off. When switch S4 is in the EXTERNAL ON position, the positive A BATTERY binding post 8 is connected to the filament circuit, the negative binding post 9 is connected permanently to ground and to the negative binding post 7 of the B BATTERY. Binding post 6, marked +, is connected to supply the various plate and screen voltages to the amplifier tubes.

b. When switch S4 is placed in the OFF position, both internal and external batteries, whichever are in use, are disconnected from the amplifier. Placing switch S4 in the INTERNAL ON position permits the amplifier to be operated from its internal batteries, and disconnects the external batteries from their respective circuits (fig. 19). The A or filament battery BT1 has its negative side connected to ground. The positive side connects through switch S4 to the filaments of V3, through V2, through resistors R9 and R39, to the filament of V1, through R5 to ground. The resistors in this circuit drop the battery voltage and also supply the necessary bias voltages. The B or plate battery BT2 provides plate and screen voltages for the vacuum tubes. The negative side is connected to the chassis ground. The positive side is connected through switch S4 to the junction of R13 and R14 (fig. 26) and supplies the plate and screen voltages for the amplifier tubes.

CHAPTER 5

FIELD MAINTENANCE INSTRUCTIONS

Note. This chapter contains information for field maintenance. The amount of repair that can be performed by units having field maintenance responsibility is limited only by the tools and test equipment available and by the skill of the repairman.

Section I. TROUBLESHOOTING AT FIELD MAINTENANCE LEVEL

42. Troubleshooting Procedures

The first step in servicing defective equipment is to sectionalize the fault. Sectionalizing means tracing the fault to the major component or circuit responsible for abnormal operation of the equipment. The second step is to localize the fault. Localization means tracing the fault to the defective *part* responsible for the abnormal condition. Some faults such as burned-out resistors and shorted transformers often can be located by sight, smell, and hearing. The majority of faults, however, must be localized by checking voltages and resistance.

43. Troubleshooting Data

The material supplied in this manual will help in the rapid location of faults. Consult the following troubleshooting data:

Figure No.	Paragraph No.	Description
20		Audio Frequency Amplifier AM–558/PTA–1, voltage and resistance diagram.
21		Audio Frequency Amplifier AM–558/PTA–1, top view of chassis.
22		Audio Frequency Amplifier AM–558/PTA–1, bottom view of chassis.
26		Audio Frequency Amplifier AM–558/PTA–1, schematic diagram.
	48	Troubleshooting chart.
	36	Equipment Performance Checklist.

44. Test Equipment Required for Troubleshooting

The test equipment required for troubleshooting the AM–558/PTA–1 is listed below. Technical manuals associated with the test equipment also are listed.

Test equipment	Technical manual
Test Set TS–140/PCM	
Attenuator TS–402/U or TS–402A/U	TM 11–2044
Multimeter TS–352/U	TM 11–5527
Tube Tester I–177–A	TM 11–2627
Battery Tester TS–183/U, TS–183A/U, or TS–183B/U.	TM 11–2571

45. General Precautions

Whenever the equipment is being serviced, observe the following precautions carefully. Failure to observe these precautions may result in decreased gain, sensitivity, or possible oscillation.

a. Do not leave the equipment on longer than is necessary. This will shorten the life of the batteries.

b. Careless replacement of parts often makes new faults inevitable. Note the following points carefully.

(1) Before a part is unsoldered, note the position of the leads connected to it. If the part, such as a transformer, has a number of leads and terminals, tag each of them so that they may be replaced correctly.

(2) Be careful not to damage other leads by pulling or pushing them out of the way. This is particularly important in used or old equipment, since the insulation deteriorates with age.

(3) Do not allow drops of solder to fall into the equipment. This may cause short circuits.

(4) A carelessly soldered connection may create a new fault. It is very important to make well-soldered joints. A poorly soldered joint may cause trouble that is difficult to locate.

(5) When a part is replaced in the equipment, it must be replaced exactly as the original. Give particular attention to the proper grounding when parts are replaced. Use the same ground as the original wiring.

46. Checking Filament and B+ Circuits for Shorts

Trouble within the amplifier often may be detected by checking the resistance of the filament and high-voltage circuits. These checks are made before connecting the batteries to the AM–558/PTA–1. In this way, possible damage to the batteries, the test equipment, or to the amplifier may be averted.

a. Check the resistance from the junction of resistors R13 and R14 to chassis ground. The resistance should check with that value given on the voltage and resistance chart (fig. 20).

b. If the resistance value is lower than normal, remove the wire from the junction of R13 and R14 that connects to BATTERY SWITCH D and check the resistance from this wire to ground. The reading given should be a very high or infinite resistance. If not, proceed to check BATTERY SWITCH D and the associated wiring.

c. If normal readings are obtained (*b* above), reconnect the wire to the junction of R13 and R14. Remove R13 and C2B and check the resistance from C2B to ground. If this value is low, continue checking the B+ circuit from C2B to tubes V1 and V2.

d. If normal measurements are made (*c* above), reconnect R13 to C2B, disconnect R13 from R14, and proceed to check the B+ circuit from R14 through T4 and to the plate of V3.

e. To check the resistance measurements of the filament circuit refer to the power supply and filament circuit simplified schematic (fig. 19) and the voltage and resistance diagram (fig. 20).

47. Operational Test

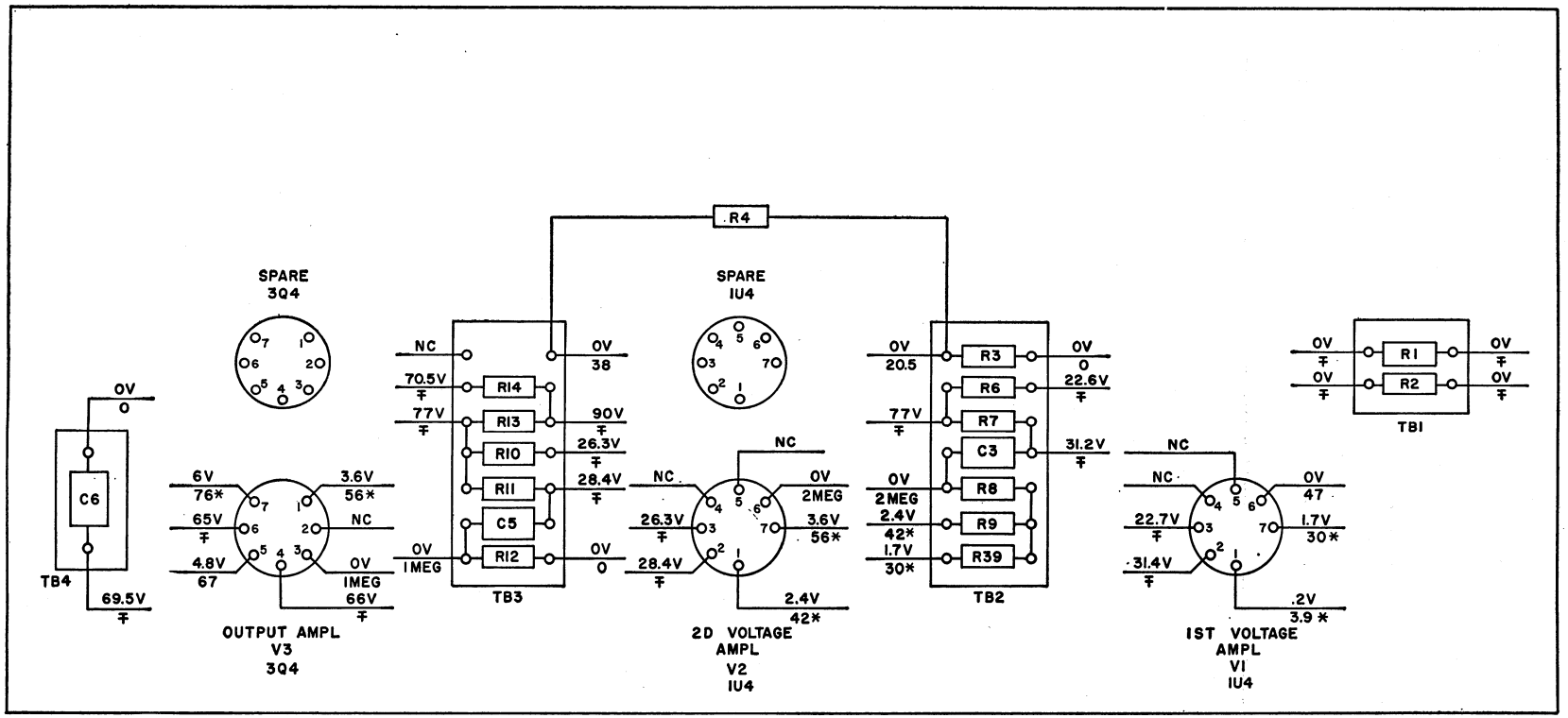
Operate Audio Frequency Monitor AN/PTA–1 as described in the equipment performance checklist (par. 36). This checklist is important because it indicates the general location of the trouble. Also listen for cracking or hissing noises which indicate hv arcing. Check the equipment for smoke and the odor of burned or overheated parts.

48. Troubleshooting Chart

The following chart is supplied as an aid in locating trouble in the equipment. This chart lists the symptoms which the repairman observes, either visually or audibly, while making a few simple tests. *It also indicates how to localize trouble quickly to a particular stage.* The signal substitution test outlined in paragraph 50 then can be used to supplement this procedure and to determine the defective stage. When the trouble has been localized to a stage or circuit, a tube check and voltage and resistance measurement of this stage or circuit should be sufficient to isolate the defective part. Normal voltage and resistance measurements are given in figure 20.

Symptom	Probable trouble	Correction
Connect binding post G to ground. Connect INPUT binding posts 1 and 2 to OUTPUT binding posts 4 and 5. Connect headset to output PL55 Jack. Set INPUT IMPEDANCE control A at 600, FILTER control B at 200–8000, VOLUME control C at TEST, and BATTERY SWITCH D at INTERNAL ON position. Absence of tone with equipment setup as shown above.	Defective Battery BA–409/U or BA–415/U. Defective tube V1, V2, or V3. Defective protector E10 or E11.	Check protectors E10 and E11. Check Batteries BA–409/U and BA–415/U and test tubes V1, V2, and V3. If necessary, make voltage and resistance measurements to locate defective part. An alternate method is to use signal substitution (par. 50).
Remove connections to binding posts 1, 2, 4, and 5. Turn VOLUME control C clockwise toward maximum gain. Low-frequency oscillation (motorboating) with equipment setup as shown above.	Internal resistance of Battery BA–415/U too high. Resistor R13 shorted.	Replace Battery BA–415/U. Check and remove short from R13.

Symptom	Probable trouble	Correction
With equipment setup as in step 2, singing (audio tone) is heard.	Weak batteries. Wiring associated with high level end of amplifier too close to the low level end.	Replace batteries. Dress wires so that wiring associated with high level end of amplifier is isolated from that of low level end.
With equipment setup as in step 2 and VOLUME control C at position 90, microphonic noise is heard when control panel is tapped gently.	Noisy tube V1	Replace tube V1; if spare tube is not available, interchange tubes V1 and V2.
No change in level when VOLUME control C is varied.	Defective switch S3	Replace switch S3.
No change in signal quality when FILTER switch is varied.	Defective switch S2. Defective filter network FL1.	Replace switch S2. Replace filter network FL1.



NOTES:

1. READINGS TAKEN TO GROUND WITH 20,000 OHMS-PER-VOLT MULTIMETER.
2. NC INDICATES NO CONNECTION.
3. ∓ INDICATES VERY HIGH (INFINITE) RESISTANCE READING ON METER.
4. * INDICATES RESISTANCE MEASURMENT BETWEEN PIN AND CHASSIS GROUND.
5. FOR VOLTAGE MEASUREMENTS USE EXTERNAL BATTERIES.
6. INPUT IMPEDANCE SWITCH A S1 SET AT ANY POSITION.
7. FILTER SWITCH B S2 SET AT 200-8000.
8. VOLUME SWITCH C S3 SET AT TEST.
9. BATTERY SWITCH D S4 SET AT EXTERNAL ON FOR VOLTAGE MEASUREMENTS, AND SET AT OFF FOR RESISTANCE MEASUREMENTS.
10. UNLESS OTHERWISE SHOWN, RESISTANCE IS IN OHMS.

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Figure 20. Audio Frequency Amplifier AM-558/PTA-1, voltage and resistance diagram.

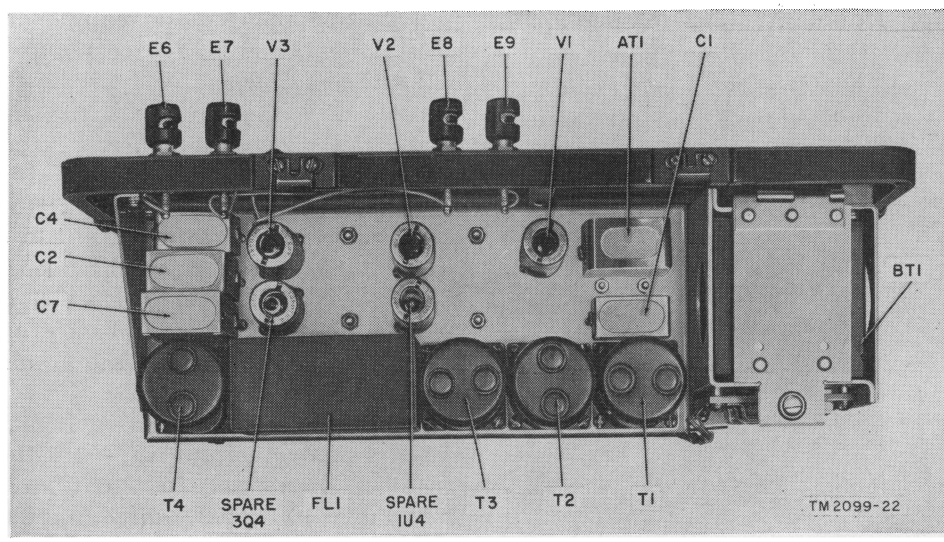


Figure 21. Audio Frequency Amplifier AM–558/PTA–1, top view of chassis.

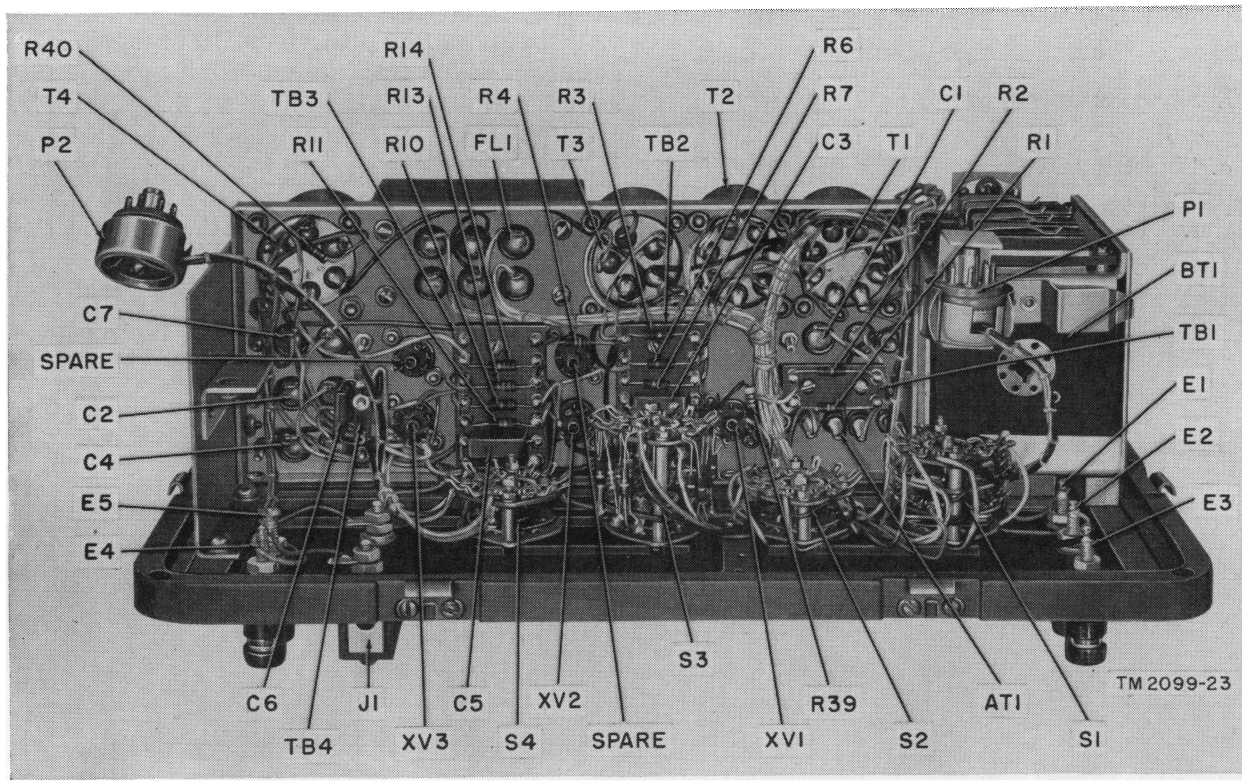


Figure 22. Audio Frequency Amplifier AM–558/PTA–1, bottom view of chassis.

49. Additional Troubleshooting Information

For additional troubleshooting information, consult the charts listed below. The following charts list the dc resistance of the transformer windings in the AM–558/PTA–1.

Transformer	Terminals	Ohms
T1	1–2	2
	2–3	4
	4–5	6
	5–6	8
	7–8	50
T2	1–2	55
	2–3	20
	3–4	16
	4–5	2, 990
	6–7	68
T3	1–2	111
	3–4	2, 160
T4	1–2	550
	3–4	54
	5–6	39
Audio Frequency Transformer TF–148/PTA–1.		8

50. Signal Substitution Notes

(fig. 23)

a. Signal substitution requires a source of af signal with a variable output level and a decibel meter. The equipment supplied with Test Set TS–140/PCM fulfill these requirements. Attenuator TS–402/U is needed to reduce the output of the af signal generator. Oscilloscope OS–8/U or equal is needed to check the signal at the various stages in the amplifier.

b. Connect Signal Generator SG–15/PCM (part of Test Set TS–140/PCM) to Attenuator TS–402/U, and the attenuator output to the INPUT terminals 1 and 2 of Audio Frequency Amplifier AM–558/PTA–1. Connect Decibel Meter ME–22/PCM to OUTPUT terminals 4 and 5 of the AM–558/PTA–1. Connect the grounds between all equipments.

c. Apply power to all the equipment. Set the signal generator output to —10 dbm at 1,000 cps. Set Attenuator TS–402/U to 80. Place INPUT IMPEDANCE switch A at 600, FILTER switch B at 200–8000, and VOLUME switch C at 90. Measure the output signal at OUTPUT terminals 4 and 5 with Decibel Meter ME–22/PCM (part of Test Set TS–140/PCM). Adjust Attenuator TS–402/U until Decibel Meter ME–22/PCM indicates 0 dbm. Add 10 to the attenuator settings and this will indicate the gain of the amplifier, which should be near 90 db.

d. If the gain of the amplifier is low or if there is no amplifier output, use Oscilloscope OS–8/U or equal to check the signal at the various grids and plates of the tubes. Check the signal at the

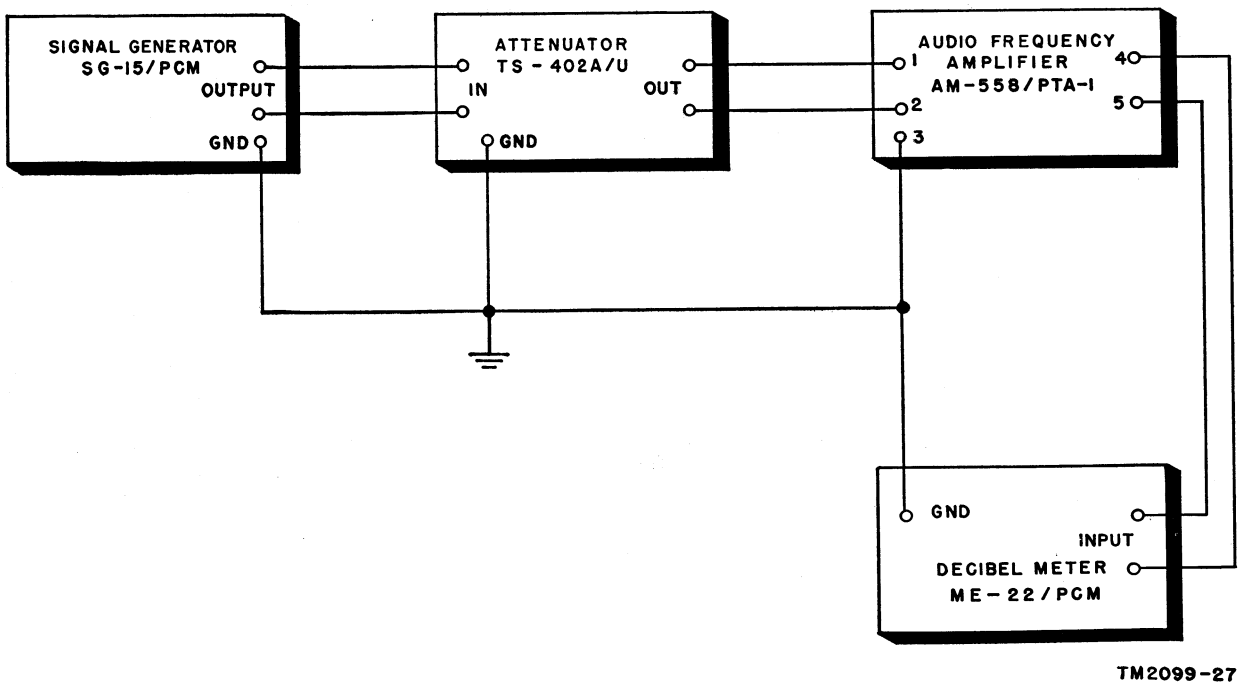


Figure 23. Test equipment setup for trouble sectionalization.

control grid (pin 6) of V1, then check it for amplification at the plate (pin 2 of V1). Progress from the low level stages to the higher level stages until the defective stage is found.

e. When the faulty stage has been found by this method, use Multimeter TS–352/U and Tube Tester I–177–A, or equal, to isolate the defective part.

f. Check the wiring and soldering in each stage.

g. When a trouble is sectionalized to a given stage or circuit, first test the tube, then measure the voltage, and finally measure the resistance at the tube socket of that stage.

h. Remove only one tube at a time when testing. Check the number of the tube, test the tube and, if not defective, return it to the proper socket before removing another tube. The proper operation of some circuits depend on the particular tube being used. In the case of Audio Frequency Amplifier AM–558/PTA–1 where extremely high-gain stages are used, trouble caused by microphonic tubes may be corrected by interchanging tubes of the same type.

i. If a very low voltage (not shown on the voltage chart) is indicated, immediately turn off the power to the amplifier and check for shorted capacitors. A faulty capacitor may cause excessive current to flow through a resistor which would cause the resistor to burn out.

j. Trouble in a circuit or stage is not always indicated by an incorrect voltage or resistance measurement at the tube socket. An open bypass or coupling capacitor could cause trouble which would not show up in ordinary measurements.

k. At each stage, it is assumed that tests of the previous stages were completed satisfactorily. Isolate and clear all trouble before proceeding with any succeeding steps. It is possible that trouble in a component may cause trouble in other components of the amplifier; therefore, putting one circuit back in operation may not return the amplifier to its proper working condition.

Section II. REPAIRS

51. Replacement of Parts

a. The front panel of Audio Frequency Amplifier AM–558/PTA–1 mounts all controls, binding posts, chassis, components, and batteries as a single unit. To replace batteries, tubes, or any of the replacement parts use the following procedure:

(1) Release the six compression-type snap catches.

(2) Lift the front panel out of the carrying case.

b. When replacing any of the switches, such as the INPUT IMPEDANCE switch, FILTER switch, VOLUME control, or BATTERY SWITCH first tag or mark each wire connected to the switch. This will insure proper wiring of the new switch when it is installed.

c. To replace lightning arrestors E10 and E11, grasp the end of the lightning arrestor which is not covered by the spring clip and lift the end of the lightning arrestor until it clears the composition spacer plate.

(1) Slide out the lightning arrestor from under the spring.

(2) Replace the lightning arrestors by reversing the above procedure.

52. Refinishing

Instructions for refinishing badly marred panels on exterior cabinets are given in TM 9–2851 (Painting Instructions for Field Use). Use only authorized paint.

Section III. FINAL TESTING

53. General

This section is intended as a guide to be used in determining the quality of a repaired Audio Frequency Amplifier AM–558/PTA–1. The minimum test requirements outlined in paragraphs 57 through 62 may be performed by maintenance personnel with adequate test equipment and the necessary skills. Repaired equipment meeting these requirements will furnish uniformly satisfactory operation.

54. Test Equipment Required for Final Testing

a. Transmission Measuring Set TS–559/FT is used to measure the noise level of Audio Frequency Amplifier AM–558/PTA–1. The noise level is indicated visually by the deflection of a meter needle. The range of the TS–559/FT is 10 to 85 db above reference noise.

b. Test Set TS–140/PCM consists of Signal Generator SG–15/PCM and Decibel Meter ME–22/PCM. The equipment has an output of

−50 to +26 dbm, a measuring range of −45 to +25 dbm, ±.5 dbm, and a frequency range of .2 to 35 kilocycles (kc).

c. Analyzer Spectrum TS–723/U is used to measure distortion in the amplifier and has a frequency range of 20 to 20,000 cps ±3 percent accuracy.

d. Attenuator TS–402/U has an attenuation range of 0 to 81 db when inserted between 600-ohm impedances over a frequency range of 0 to 100 kc.

e. One 600-ohm ±1 percent, 1-watt composition resistor is required.

55. Output Noise Test

The output noise test requires the use of Transmission Measuring Set TS–559/FT and a 600-ohm ±1 percent, 1-watt composition resistor.

a. Connect the 600-ohm resistor across INPUT terminals 1 and 2 of the AM–558/PTA–1.

b. Connect Transmission Measuring Set TS–559/FT to OUTPUT terminals 4 and 5, and connect the grounds between the equipment.

c. This test must be made with normal line weighting (TM 11–2094, Transmission Measuring Set TS–559A/FT).

d. Set INPUT IMPEDANCE switch A at 600, FILTER switch B at 200–8000 and VOLUME control C at 90.

e. Apply power to all equipment. The noise output level of the amplifier should not be more than 44 db above reference noise as indicated by Transmission Measuring Set TS–559/FT.

56. Induction Pickup Transformer Test (fig. 24)

The measurements of the transmission performance of the induction pickup transformer (Audio Frequency Transformer TF–148/PTA–1) require the use of a good Audio Frequency Amplifier AM–558/PTA–1 and a dummy transmission line.

a. Connect the equipment as shown in figure 24.

b. Clamp the induction pickup transformer over one wire of the two-wire line (fig. 24).

c. Set INPUT IMPEDANCE switch A to 600, FILTER switch B to 200–8000, and VOLUME control C to 85.

d. Apply power to all equipment. Set Signal Generator SG–15/PCM to 1,000 cps and adjust its output level to −30 dbm.

e. Decibel Meter ME–22/PCM should indicate 0 dbm.

f. Check the frequency response of the induction pickup transformer by varying the frequency of the SG–15/PCM from 300 to 3,000 cps and keeping the output level of the SG–15/PCM constant.

g. The output of the AM–558/PTA–1 should not vary more than ±10 db from the 1,000 cps value.

57. Gain-Frequency Test

Gain-frequency measurements are required to determine the overall transmission and filter condition of Audio Frequency Amplifier AM–558/PTA–1. Figure 25 shows the gain-frequency characteristics of a typical AM–558/PTA–1.

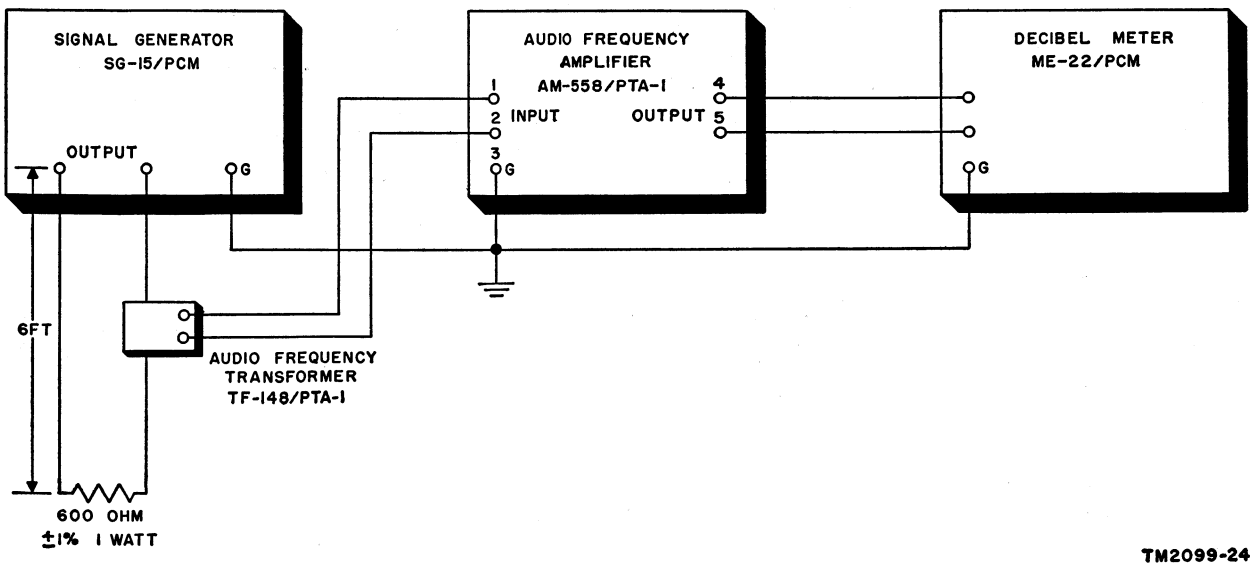


Figure 24. Induction pickup transformer test setup.

a. Connect Signal Generator SG–15/PCM to the input of Attenuator TS–402/U, and connect the TS–402/U output to INPUT terminals 1 and 2 of the AM–558/PTA–1. Connect Decibel Meter ME–22/PCM to OUTPUT terminals 4 and 5 of the AM–558/PTA–1. Connect grounds between the equipment.

b. Set INPUT IMPEDANCE switch A at 600, FILTER switch B at 200–8000, and VOLUME control C at 90.

c. Apply power to all equipment. Set Signal Generator SG–15/PCM to 1,000 cps and the output level to —90 dbm, by using the controls on Signal Generator SG–15/PCM and Attenuator TS–402/U.

d. Measure the output from the AM–558/PTA–1 with Decibel Meter ME–22/PCM and adjust it to 0 dbm (.775 volt) or as near thereto as possible by varying the TS–402/U settings. This total attenuation setting is equal to the gain of the AM–558/PTA–1.

e. Make similar measurements for several frequencies spotted throughout the 200- to 8,000-cps frequency range. Repeat the above procedure for each of the remaining three FILTER switch B settings. Plot the four gain-frequency curves and compare them with figure 25. The significance of the curves with respect to filter FL1 action is as follows:

Curve	*Filter action*
200–8000	None.
200–3000	Low-pass section.
300–8000	High-pass section.
300–3000	Band pass (high- and low-pass sections in series).

58. Test for Output Power

Audio Frequency Amplifier AM–558/PTA–1 is designed to provide 90-db gain at 1,000 cps and at least an 85-db gain throughout the frequency range from 200 to 8,000 cps with FILTER switch B on position 200–8000. The high-pass filter (300–8000) offers a loss of 30 db or more at frequencies below 300 cps, and 3 db or less at 500 cps. The low-pass filter (200–3000) offers a loss of 30

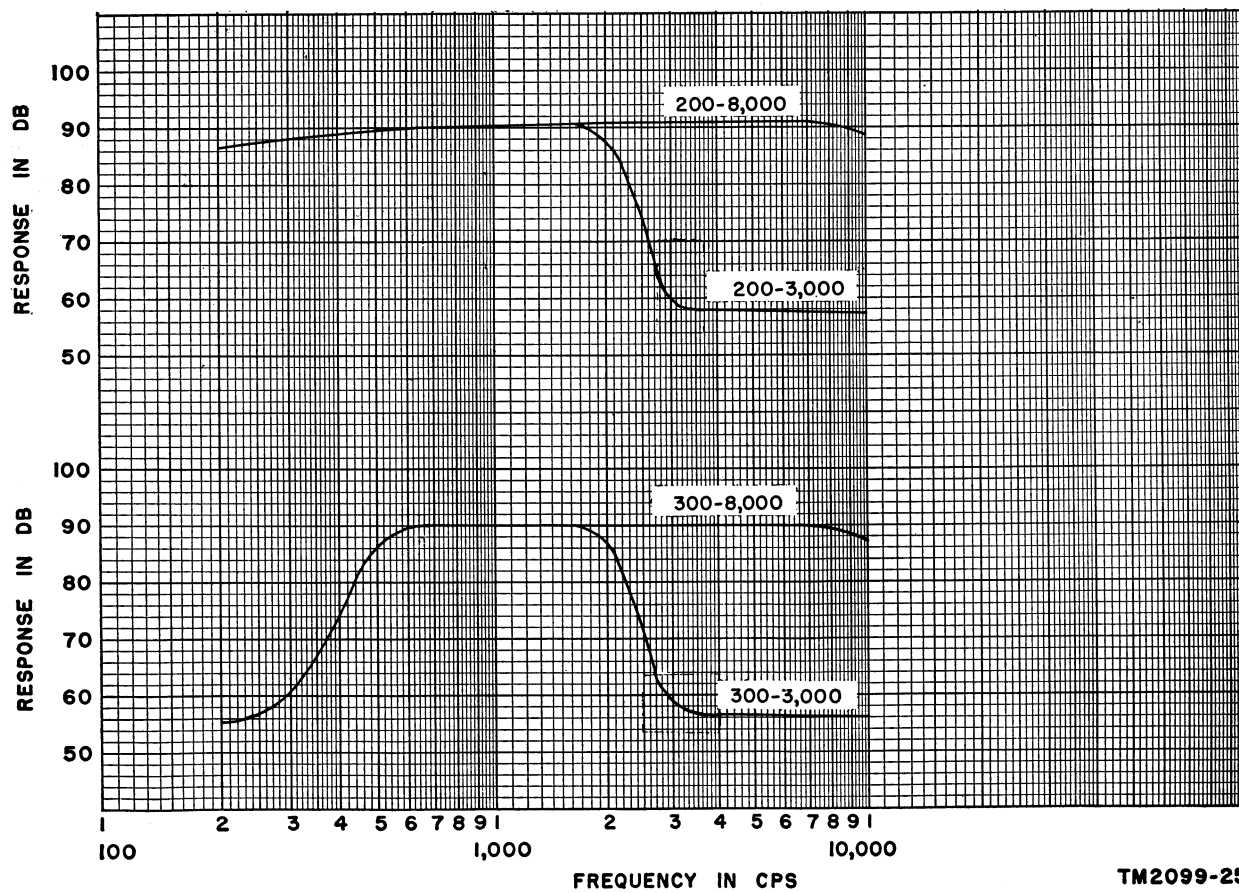


Figure 25. Audio Frequency Amplifier AM–558/PTA–1, gain-frequency characteristics.

db or more at frequencies above 3,000 cps and 3 db or less at 2,000 cps. The amplifier is designed to be capable of producing an output power of +10 dbm in a 600-ohm load at any frequency between 200 cps and 8,000 cps.

a. Connect the output of Signal Generator SG–15/PCM to the input of Attenuator TS–402/U.

b. Connect the output of TS–402/U to the input of Audio Frequency Amplifier AM–558/PTA–1.

c. Connect the output of AM–558/PTA–1 to Decibel Meter ME–22/PCM.

d. Connect the ground connections on the equipments above.

e. Set INPUT IMPEDANCE switch A of the AM–558/PTA–1 to 600.

f. Set FILTER switch B of the AM–558/PTA–1 to 200–8000.

g. Set VOLUME control C of the AM–558/PTA–1 to 90.

h. Set the attenuation of the TS–402/U to 80.

i. Apply power to all equipment.

j. Set the Signal Generator SG–15/PCM to −10 db at 1,000 cps. Decibel Meter ME–22/PCM should indicate 0 dbm (.775 volt). Vary the frequency of the SG–15/PCM throughout the 200–8000 cps frequency range; the ME–22/PCM should indicate at least −5 dbm (.436 volt).

k. Set Signal Generator SG–15/PCM to −10 db at 1,000 cps and Attenuator TS–402/U to 70 db. Vary the frequency of the SG–15/PCM throughout the 200–8000 cps frequency range; the ME–22/PCM should read 10 dbm.

l. Set FILTER switch B to the 200–3000 position. Set Attenuator TS–402/U to 50 db and Signal Generator SG–15/PCM to −10 db at 1,000 cps. At frequencies above 3,000 cps, Decibel Meter ME–22/PCM should read 0 dbm or less. Change the setting of Attenuator TS–402/U to 77 db and Signal Generator SG–15/PCM to 2,000 cps. Decibel Meter ME–22/PCM should read 0 dbm or more.

m. Set FILTER switch B to the 300–8000 cps position. Set Attenuator TS–402/U to 50 db and Signal Generator SG–15/PCM to −10 db at 1,000 cps. At frequencies below 300 cps, Decibel Meter ME–22/PCM should read 0 dbm or less. Change Attenuator TS–402/U setting to 86 db and Signal Generator SG–15/PCM to 500 cps. Decibel Meter ME–22/PCM should read 0 dbm or more.

59. Output Distortion Test

Audio Frequency Amplifier AM–558/PTA–1 is designed to be capable of producing an output power of +10 dbm in a 600-ohm load at any frequency between 200 and 8,000 cps. At this power output, the harmonic distortion should not exceed 7 percent.

a. To connect the equipment, refer to paragraph 58 *a* through *g*.

b. Apply power to all equipment.

c. Set Signal Generator SG–15/PCM to 200 cps.

d. Adjust Signal Generator SG–15/PCM output and Attenuator TS–402/U until Decibel Meter ME–22/PCM indicates plug 10 dbm.

e. Remove power from all of the equipments.

f. Remove Decibel Meter ME–22/PCM from the output terminals of Audio Frequency Amplifier AM–558/PTA–1, and connect a 600-ohm resistor in place of the ME–22/PCM.

g. Connect Analyzer Spectrum TS–723/U to the output terminals of the AM–558/PTA–1.

h. Apply power to all equipments.

i. The harmonic distortion, as indicated by Analyzer Spectrum TS–723/U should not exceed 7 percent.

j. Repeat the procedures above outlined in the subparagraphs for 1,000 and 8,000 cps. The harmonic distortion should not exceed 7 percent for these frequencies.

60. Input Circuit Test

INPUT IMPEDANCE switch A should indicate continuity for each position except the one marked FOR DIRECT CONNECTION TO LINES. Follow *a* to *f* below for this test.

a. Remove all power from the AN/PTA–1.

b. Set INPUT IMPEDANCE switch A of the AM–558/PTA–1 to the FOR DIRECT CONNECTION TO LINES position.

c. Set Multimeter TS–352/U to read in ohms.

d. Connect Multimeter TS–352/U across binding posts 1 and 2 of the AM–558/PTA–1.

e. The needle of Multimeter TS–352/U should register a capacitance kick and then slowly return to the end of the scale marked INFINITY.

f. Strap capacitor C1 and repeat the test above. Multimeter TS–352/U should indicate 20,000 ohms ±5 percent.

CHAPTER 6

SHIPMENT AND LIMITED STORAGE AND DEMOLITION TO PREVENT ENEMY USE

Section I. SHIPMENT AND LIMITED STORAGE

61. Disassembly

Audio Frequency Monitor AN/PTA–1 can be disassembled by reversing the directions for uncrating and unpacking (par. 12). Follow all necessary precautions to prevent damage to the equipment.

62. Repacking for Shipment or Limited Storage

a. The exact procedure for repacking for shipment or limited storage depends on the material available and the condition under which the equipment is to be shipped or stored. Disassemble the equipment.

b. The AM–558/PTA–1 should not be shipped or stored with internal batteries. Remove the batteries. Place plug P1 in the holder mounted on the battery compartment (fig. 6). Place plug P2 in the smaller of the two holes located on the side of the battery compartment for BT2; then swing the spring around and over the plug.

c. Whenever practicable, place a dehydrating agent such as silica gel inside the inner carton. Protect the equipment with a waterproof paper barrier. Seal the seams of the paper barrier with a waterproof sealing compound or tape. Pack the protected equipment in a padded wooden case, providing at least 3 inches of excelsior padding or some similar material between the paper barrier and the packing case.

Section II. DEMOLITION OF MATERIEL TO PREVENT ENEMY USE

63. General

The demolition procedure outlined in paragraph 64 will be used to prevent the enemy from using or salvaging this equipment. Demolition of the equipment will be accomplished only upon order of the commander.

64. Methods of Destruction

a. Smash. Smash tubes, switches, controls, capacitors, and transformers; use sledges, axes, pickaxes, hammers, crowbars, or other heavy tools.

b. Cut. Cut all cords, cables, and wiring; use axes, handaxes, or machetes.

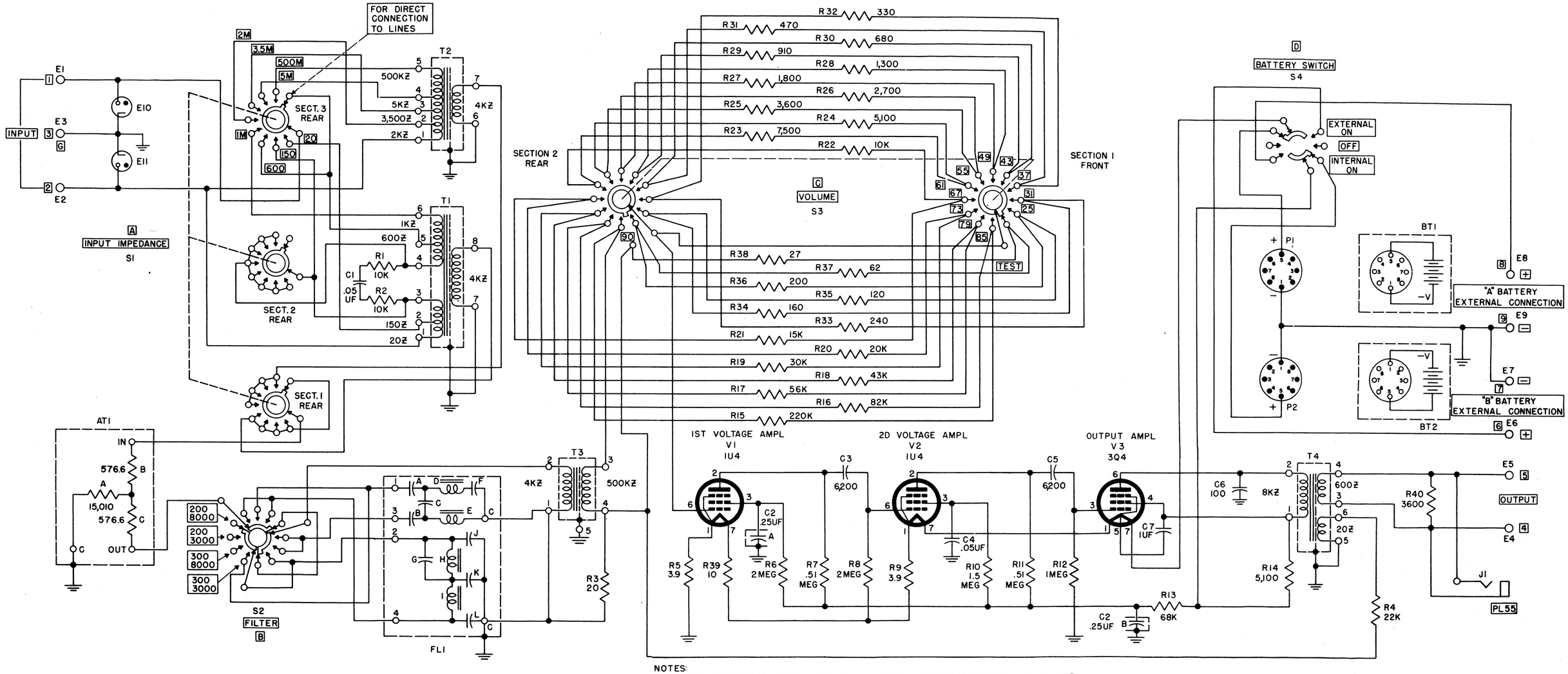
c. Burn. Burn cords, resistors, capacitors, wiring, and technical manuals; use gasoline, kerosene, oil, flame throwers, or incendiary grenades.

d. Bend. Bend panel, cabinet, and chassis.

e. Explode. If explosives are necessary, use firearms, grenades, or TNT.

f. Dispose. Bury or scatter the destroyed parts in slit trenches, foxholes or other holes, or throw them into streams.

g. Destroy. Destroy everything.



NOTES:
1. UNLESS OTHERWISE SHOWN, RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.
2. SWITCHES ARE VIEWED FROM END OPPOSITE THE CONTROL KNOB, AND SECTIONS DESIGNATED 1 ARE NEAREST THE KNOB END.
3. EACH POSITION OF SWITCH S3 SELECTS ALTERNATELY ONE CONTACT FROM EITHER OF THE TWO SWITCH SECTIONS.

TM 2099-26

Figure 26. Audio Frequency Amplifier AM-558/PTA-1, schematic diagram.

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[AG 413.47 (18 Aug 54)]

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