

NAVSHIPS 94236

(Non-Registered)

★

TECHNICAL MANUAL

for

AMPLIFIER-
LOUDSPEAKER
AM-2631/U

GIBBS MANUFACTURING
AND RESEARCH CORPORATION
JANESVILLE, WISCONSIN

NEW ENGLAND THERMO TAC INCORPORATED
ROCKY HILL, CONNECTICUT

DEPARTMENT OF THE NAVY
BUREAU OF SHIPS

★

Contract: N126-091912
N126-00814A

Approved by BuShips: 6 November 1961

20665

LIST OF EFFECTIVE PAGES

PAGE NUMBERS	CHANGE IN EFFECT	PAGE NUMBERS	CHANGE IN EFFECT
Title Page	Original	4-1	Original
ii to vii	Original	5-0 to 5-5	Original
1-0 to 1-2	Original	6-0 to 6-5	Original
2-1 to 2-2	Original	7-0 to 7-6	Original
3-1 to 3-2	Original		



DEPARTMENT OF THE NAVY
BUREAU OF SHIPS
WASHINGTON 25, D. C.

IN REPLY REFER TO
Ser 242-100

From: Chief, Bureau of Ships
To: All Activities concerned with the Installation, Operation,
and Maintenance of the Subject Equipment

Subj: Technical Manual for Loud Speaker Amplifier AM-2631/U,
NAVSHIPS 94236

1. This is the Technical Manual for the subject equipment and is in effect upon receipt.
2. When superseded by a later edition, this publication shall be destroyed.
3. Extracts from this publication may be made to facilitate the preparation of other Department of Defense publications.
4. Errors found in this publication (other than obvious typographical errors), which have not been corrected by means of Temporary Corrections or Permanent Changes should be reported. Such report should include the complete title of the publication and the publication number (short title); identify the page and line or figure and location of the error; and be forwarded to the Publications Section of the Bureau of Ships.
5. All Navy requests for Bureau of Ships electronic publications should be directed to the Naval Supply Depot, 5801 Tabor Avenue, Philadelphia, Pennsylvania.

R. K. JAMES
Chief of Bureau

TABLE OF CONTENTS

SECTION 1—GENERAL INFORMATION

<i>Paragraph</i>	<i>Page</i>
1-1. Introduction	1-1
1-2. Functional Description	1-1
1-3. Factory or Field Changes	1-1
1-4. Quick Reference Data	1-1
1-5. Equipment Lists	1-1

SECTION 2—INSTALLATION

2-1. Unpacking and Handling	2-1
2-2. Site Selection	2-1
2-3. Power Requirements	2-1
2-4. Installation Requirements	2-1
2-5. Inspection and Adjustment	2-1
2-6. Preparation for Reshipment	2-1

SECTION 3—OPERATOR'S SECTION

3-1. Functional Operation	3-1
3-2. Operating Procedures	3-1
a. Description of Controls	3-1
b. Sequence of Operation	3-1
3-3. Summary of Operating Procedures	3-1
3-4. Operator's Maintenance	3-1

SECTION 4—PRINCIPLES OF OPERATION

4-1. Overall Functional Description	4-1
a. Power Supply	4-1
b. Amplifier	4-1
4-2. Functional Operation	4-1
a. Power Supply Theory	4-1
b. Amplifier Theory	4-1

SECTION 5—TROUBLE-SHOOTING

<i>Paragraph</i>	<i>Page</i>
5-1. General	5-0
5-2. Preliminary Checks	5-0
5-3. Control Settings	5-1

SECTION 6—SERVICE AND REPAIR

6-1. Failure Report	6-0
6-2. Preventive Maintenance	6-0
a. Introduction	6-0
b. Preventive Maintenance Chart	6-0
6-3. Performance Standards	6-0
a. Introduction	6-0
b. Performance Standard Chart	6-0
6-4. Adjustment	6-1
a. Bias Adjust	6-1
(1) Control Settings	6-1
(2) Test Set-Up	6-1
(3) Tuning Instructions	6-1
6-5. Repair	6-1
a. Removal and Disassembly Procedures	6-1
(1) Printed Circuit Board Assembly	6-1
(2) Chassis Assembly	6-1
(3) Soldering and Unsoldering	6-2
b. Reassembly and Replacement	6-2
(1) Chassis Assembly	6-2
(2) Printed Circuit Board Assembly	6-2
c. Adjustment	6-2

SECTION 7—PARTS LIST

7-1. Introduction	7-0
7-2. Maintenance Parts List	7-0
7-3. Stock Number Identification	7-0
7-4. List of Manufacturers	7-0
7-5. Notes	7-0

LIST OF ILLUSTRATIONS

SECTION 1—GENERAL INFORMATION

<i>Figure</i>		<i>Page</i>
1-1.	Amplifier - Loudspeaker AM-2631/U . .	1-0

SECTION 2—INSTALLATION

2-1.	Installation and Wiring Interconnection Diagram	2-2
------	--	-----

SECTION 3—OPERATOR'S SECTION

3-1.	Speaker Amplifier Operating Controls .	3-1
------	--	-----

SECTION 4—PRINCIPLES OF OPERATION

4-1.	Speaker Amplifier Block Diagram	4-1
------	---	-----

SECTION 5—TROUBLE-SHOOTING

<i>Figure</i>		<i>Page</i>
5-1.	Speaker Amplifier with Cover Open . . .	5-1
5-2.	Chassis Top View with Printed Circuit Board	5-2
5-3.	Chassis Bottom View	5-2
5-4.	Printed Circuit Board	5-3
5-5.	Test Cable	5-4
5-6.	Trouble-Shooting Hook-Up	5-5

SECTION 6—SERVICE AND REPAIR

6-1.	Bias Adjustment	6-1
6-2.	Speaker Amplifier Schematic Diagram .	6-2
6-3.	Speaker Amplifier Wiring Diagram . . .	6-3
6-4.	Speaker Amplifier Waveshapes	6-4

LIST OF TABLES

SECTION 1—GENERAL INFORMATION

<i>Table</i>	<i>Page</i>
1-1. Equipment Supplied with Speaker Amplifier	1-1
1-2. Shipping Data for Speaker Amplifier . . .	1-1
1-3. Speaker Amplifier Transistor Complement	1-2

SECTION 3—OPERATOR'S SECTION

3-1. Function of Controls and Indicators . . .	3-1
3-2. Routine Check Chart	3-2

SECTION 5—TROUBLE-SHOOTING

<i>Table</i>	<i>Page</i>
5-1. Test Equipment Required for Trouble-Shooting	5-0
5-2. Speaker Amplifier Typical Troubles . . .	5-0

SECTION 7—PARTS LIST

7-1. Speaker Amplifier Maintenance Parts List	7-0
7-2. Speaker Amplifier Stock Number Identification	7-3
7-3. Speaker Amplifier List of Manufacturers.	7-5

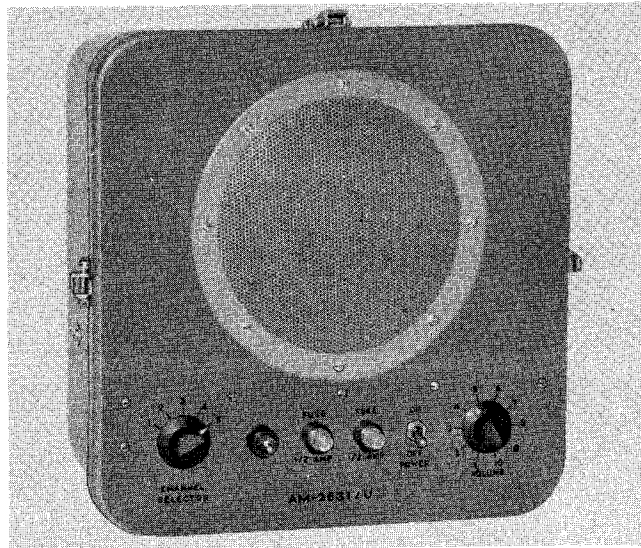


Figure 1-1. Amplifier - Loudspeaker
AM-2631/U

SECTION 1 GENERAL INFORMATION

1-1. INTRODUCTION.

This manual contains installation, operating instructions, operating principles, and maintenance procedures for Amplifier - Loudspeaker AM-2631/U. Throughout this manual the Amplifier - Loudspeaker will be referred to as the speaker amplifier. Refer to figure 1-1.

1-2. FUNCTIONAL DESCRIPTION.

a. The speaker amplifier is a permanent bulkhead mounted installation. It is used in enclosed areas such as wardrooms or messrooms aboard ship. In general the source of program material will be radio receivers or record players designed for ship-board installation.

b. The speaker amplifier consists of two major assemblies, the case and the chassis assembly. The case is flame resistant glass reinforced polyester, and contains all operating controls, two interconnection terminal boards, and an eight inch permanent magnet speaker. The chassis contains the transistorized amplifier with a printed circuit board.

1-3. FACTORY OR FIELD CHANGES.

No field changes have been made on the speaker amplifier.

1-4. QUICK REFERENCE DATA.

Input power requirements 115 v 60 cps
 Operating power 10 watts
 Operating voltage 35 vdc ± 3 vdc
 Number of inputs (channels) 5
 Number of outputs 1
 Power output 5 watts
 Input impedance 6000 ± 600 ohms
 Overall frequency range 100 to 7000 cps
 Operating temperature limits 40° to 131°F
 (4° to 55°C)

1-5. EQUIPMENT LISTS.

- a. All equipment supplied is listed in table 1-1.
- b. No additional equipment or publications is required for proper operation of the speaker amplifier, however, the speaker amplifier is used with remote input equipment and necessary cabling.
- c. All shipping data is listed in table 1-2.
- d. The complete transistor complement is listed in table 1-3.

TABLE 1-1. EQUIPMENT SUPPLIED WITH SPEAKER AMPLIFIER

QUANT. PER EQUIP.	NOMENCLATURE		OVERALL DIMENSIONS			*VOLUME	*WEIGHT
	NAME	DESIGNATION	HEIGHT	WIDTH	DEPTH		
1	Speaker Amplifier	AM-2631/U	** 14 5/16	** 14 11/16	** 8 3/8		20
2	Technical Manual		11	8 1/2	1/4		1/3

* Unless otherwise stated, dimensions are in inches, volume in cubic feet, and weight in pounds.
 ** Dimensions taken with cover closed.

TABLE 1-2. SHIPPING DATA FOR SPEAKER AMPLIFIER

BOX NO.	NOMENCLATURE		OVERALL DIMENSIONS			*VOLUME	*WEIGHT
	NAME	DESIGNATION	HEIGHT	WIDTH	DEPTH		
1	Speaker Amplifier	AM-2631/U	14 13/16	15	9		24 1/2

* Unless otherwise stated, dimensions are in inches, volume in cubic feet, and weight in pounds, equipment crated and ready for shipment.

TABLE 1-3. SPEAKER AMPLIFIER TRANSISTOR COMPLEMENT

UNIT	TRANSISTOR TYPES	TOTAL PER TYPE
Speaker Amplifier AM-2631/U	2N465	4
	2N647	1
	2N665	2

SECTION 2 INSTALLATION

2-1. UNPACKING AND HANDLING.

Carefully unpack the speaker amplifier, and inspect for evidence of shipping damage. If damage is evident, notify the transportation agency immediately. Packing material must be retained to substantiate damage claims.

2-2. SITE SELECTION.

Make certain there is enough room available to meet the dimensions given in figure 2-1.

Note

Make sure there is adequate space to make necessary cable connections.

2-3. POWER REQUIREMENTS.

The speaker amplifier requires an external power source of 115 v, 60 cps for operation. An installation diagram is included in figure 2-1 to show wiring interconnection.

2-4. INSTALLATION REQUIREMENTS.

When installing the speaker amplifier the following installation pointers must be taken into consideration.

- a. Choose a location to provide the best operating conditions.
- b. The location should be accessible for possible maintenance.
- c. The location selected should prevent interaction between the speaker amplifier and other electronic equipment nearby.
- d. Choose a location where minimum cable length is necessary.
- e. Provide for heat dissipation.

Note

Refer to the applicable ship or station plans to determine cable lengths and type of cable installation since interconnecting cable types may vary among installations.

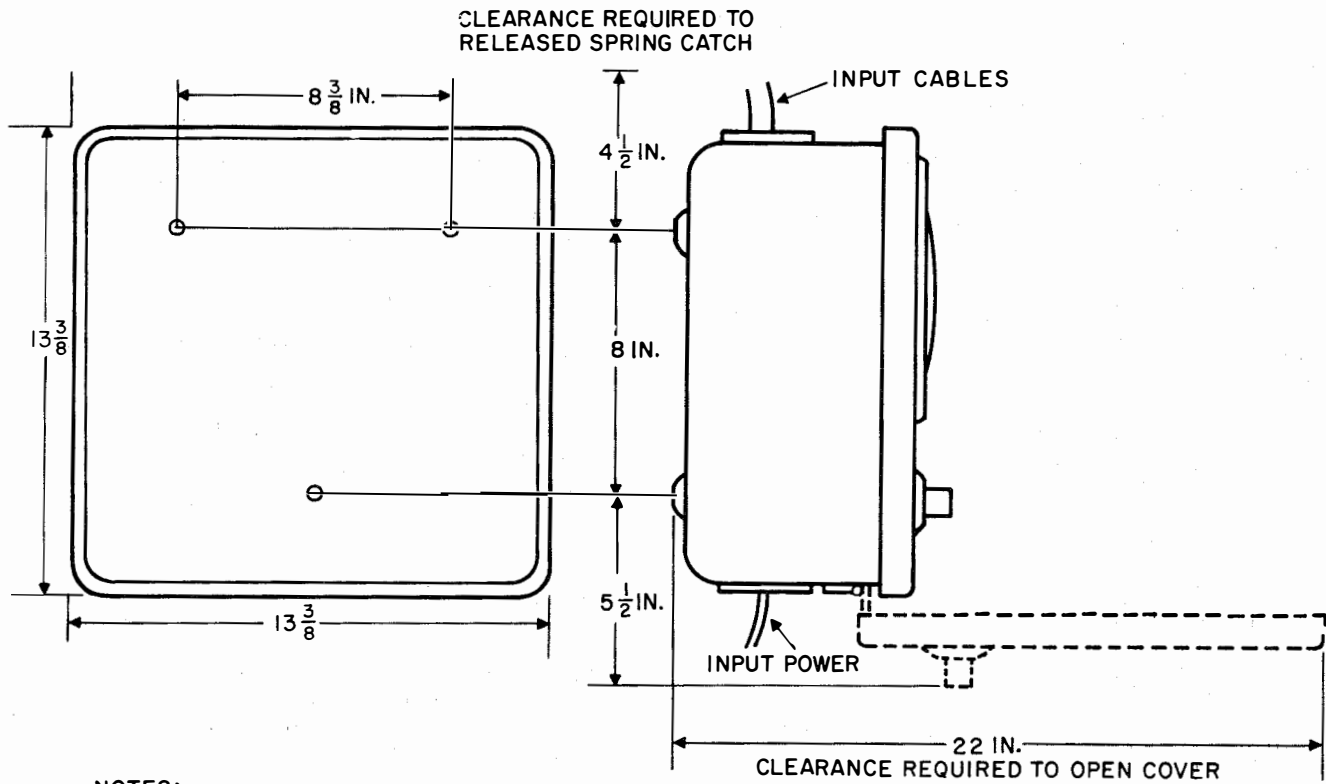
2-5. INSPECTION AND ADJUSTMENT.

- a. Check the physical operation of the controls. Action should be positive and free from binding.
- b. Check fuses for proper rating.
- c. Open the cover by unfastening the spring catches.
- d. Inspect the speaker cone for punctures.
- e. Check all fuses for proper rating.
- f. For operating instructions, refer to Section 3 paragraph 3-2, b.

2-6. PREPARATION FOR RESHIPMENT.

The following instructions are similar to those used to prepare the speaker amplifier for shipment from the factory. These instructions are suitable for overseas shipment and long storage periods. If technical manuals are included in the shipping box, the box must be marked, "TECHNICAL MANUALS INSIDE."

- a. Wrap the speaker amplifier in heavy wrapping paper.
- b. Place the paper wrapped speaker amplifier in a suitable cardboard carton with corner pads for support.
- c. Put a generous amount of desiccant (silica gel) in the carton around the speaker amplifier.
- d. Wrap the cardboard carton in moisture proof paper.
- e. Insert the unit in a heavy moisture proof cardboard carton.
- f. Place the cardboard carton in a suitable wooden box with sufficient corrugated pads for support and cushion.



NOTES:

1. CONNECT SHIELDS FOR INPUT CABLES TO TERMINALS 2, 4, 6, 8, AND 10 OF TBI.

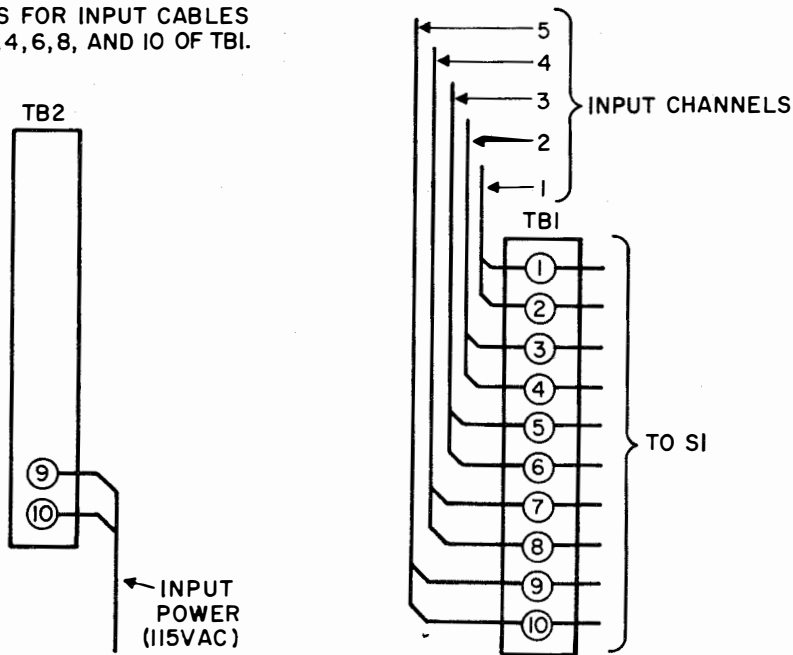


Figure 2-1. Installation and Wiring Interconnection Diagram

SECTION 3 OPERATOR'S SECTION

3-1. FUNCTIONAL OPERATION.

The speaker amplifier is capable of amplifying and producing a speaker output from any one of five channel inputs. This is accomplished by using an outside power source of 115 v, 60 cps to drive the amplifier power supply. The 115 v is stepped down and rectified for transistorized amplifier use. The desired signal is introduced to the speaker amplifier at the appropriate channel position. This signal is amplified and fed to the cover mounted speaker through a push-pull amplifier output stage. Both the desired signal input and the speaker output volume can be controlled from the cover.

3-2. OPERATING PROCEDURES.

a. DESCRIPTION OF CONTROLS.—Table 3-1 describes the function of the indicators and operating controls. Refer to figure 3-1.

b. SEQUENCE OF OPERATION.

- (1) Energize the speaker amplifier by placing the POWER ON-OFF toggle switch to the ON position.
- (2) Observe the power on indicator lamp.
- (3) Turn the CHANNEL SELECTOR switch to the desired channel.
- (4) Turn the VOLUME control to the desired level.
- (5) Turn the POWER ON-OFF switch to the OFF position.
- (6) To secure the speaker amplifier, disconnect the outside power source.

3-3. SUMMARY OF OPERATING PROCEDURES.

- a. Place POWER ON-OFF switch to ON.
- b. Place CHANNEL SELECTOR switch in desired position.
- c. Turn VOLUME control to desired level.
- d. Place POWER ON-OFF switch to OFF.

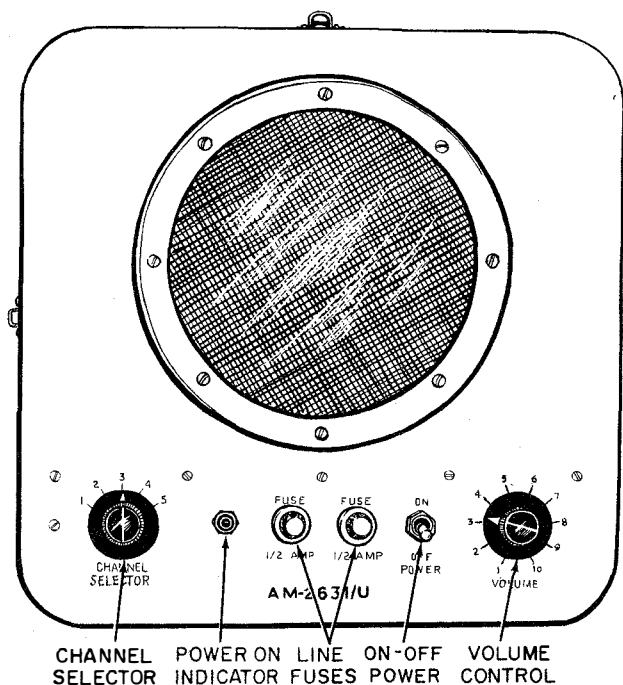


Figure 3-1. Speaker Amplifier
Operating Controls

e. Secure by disconnecting 115 v from speaker amplifier.

3-4. OPERATOR'S MAINTENANCE.

a. Table 3-2 contains operator's routine checks. If any components appear faulty, notify the appropriate personnel.

b. PARTS REPLACEMENT.—Replacement of parts by the operator is limited to fuse and lamp replacement.

TABLE 3-1. FUNCTION OF CONTROLS AND INDICATORS

CONTROL OR INDICATOR	FUNCTION
POWER ON-OFF switch	Supplies 115 v to speaker amplifier.
Power on indicator lamp	Indicates POWER ON-OFF switch is on and 115 v is entering the amplifier.
FUSE 1/2 AMP	Ac line fuses for speaker amplifier protection.
CHANNEL SELECTOR switch	Enables the operator to select any one of five channels inputs.
VOLUME control	Controls speaker volume output.

- (1) To replace the power on indicator lamp, unscrew the jeweled lens.
- (2) To replace either or both line fuses, turn the fuse holder cap counterclockwise.

- (3) To replace the amplifier fuse (glass), unlatch the three top cover fastening spring catches and raise the cover. The glass fuse is located toward the rear of the printed circuit board.

TABLE 3-2. ROUTINE CHECK CHART

WHAT TO CHECK	HOW TO CHECK	CHECK RESULTS
Complete equipment	Visual inspection	Equipment should be properly mounted, knobs and all components should be intact.
CHANNEL SELEC-TOR switch and POWER ON-OFF switch	Operate controls	The switch action should be positive and lock in.
VOLUME control	Operate control	Operation should be smooth.
Power on indicator lamp	Operate and visual	The lamp should light.
Speaker cone	Visual	The cone should be free from tears and cracks or punctures.

SECTION 4 PRINCIPLES OF OPERATION

4-1. OVERALL FUNCTIONAL DESCRIPTION.

The speaker amplifier can be considered as being composed of two subdivisions; namely, the power supply and the amplifier. Refer to figure 4-1.

a. **POWER SUPPLY.**—The power supply is comprised of a step-down transformer, a full wave bridge rectifier circuit, and the necessary filtering and fusing.

b. **AMPLIFIER.**—The amplifier contains seven transistors, a volume (level) control and a bias adjustment.

4-2. FUNCTIONAL OPERATION.

a. **POWER SUPPLY THEORY.**—115 vac 60 cps is introduced to the speaker amplifier and applied to the power transformer T1. Transformer T1 is a step-down transformer - 115 v to 24 vac. 24 vac is impressed across the full wave bridge rectifier composed of diodes CR1 through CR4. The positive half cycles are grounded, while the negative half cycle is fed through diodes CR1 and CR2. The result is a negative pulsating dc voltage. The voltage is then filtered across capacitors C1 and C2 to stabilize the pulsating dc voltage. Fuse F3 is placed in the line to protect the transistor circuits in case of malfunction.

b. **AMPLIFIER THEORY.**—The speaker amplifier uses a transformerless power amplifier. The amplifier input is tapped from any one of the five channel inputs selected by rotary switch S1 wafer A. Wafer B provides the necessary shielding for each channel. The input signal from the selected channel is impressed across VOLUME control potentiometer R4. The desired portion of this signal is impressed across capacitor C9, resistor R5, and is applied to transistor Q1. Transistor Q1 operates as an emitter follower, providing low distortion and input impedance matching. Transistor Q2 receives the signal at its base through capacitor C7 and resistor R12. Transistor Q2 also operates as an emitter follower with a direct coupling to the base of transistor Q3. Transistor Q3 operates as an amplifier (driver) with a feedback circuit through capacitor C10. The output signal from transistor Q3 is applied to the base of transistor Q4 through heat compensating diode CR5. Transistor Q4 also operates as an emitter follower with a direct coupling to the base of transistor Q3. Transistor Q3 output is also directly coupled to transistor Q5 base. Phase inverter transistor Q5 and emitter follower transistor Q4 drive the push-pull stage transistors Q6 and Q7. Resistors R1 and R22 bias the power output (push-pull) circuit. Diode CR5 is used to prevent power transistor runaway. Bias adjust potentiometer R14 is set for one-half of the supply voltage to prevent output distortion.

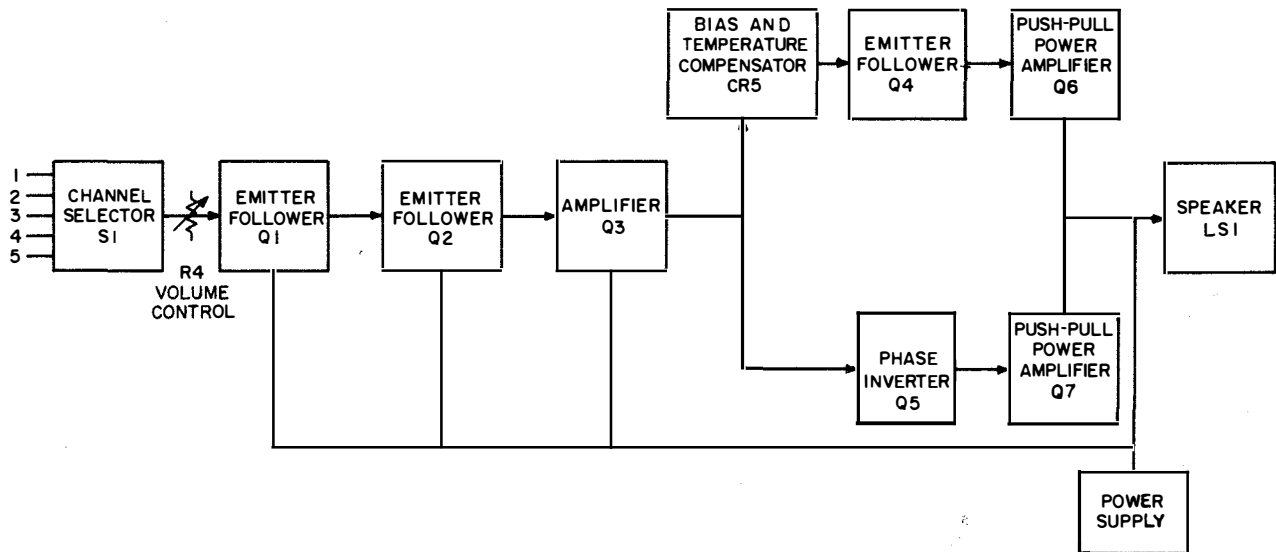


Figure 4-1. Speaker Amplifier Block Diagram

SECTION 5 TROUBLE-SHOOTING

5-1. GENERAL.

Trouble-shooting is the systematic method of recognizing, locating and correcting faulty operation and equipment failure.

a. Trouble-shooting can be applied to any part of the speaker amplifier that is not functioning properly and follows the same pattern:

(1) First confirm the suspected condition before proceeding with any tests.

(2) Next determine and recognize the possible causes.

(3) Isolate the cause (or causes) by performing a series a quick tests.

(4) Table 5-1 is a list of test equipment required for trouble-shooting and service of the speaker amplifier. Equivalent test equipment may be substituted for that listed in table 5-1.

(5) See table 5-2 for a list of troubles, nature of trouble, and their symptoms.

b. Test cable listed in table 5-1 may be used in trouble-shooting speaker amplifier with chassis removed from case. The cable is an extension for terminals 3 through 8 of terminal board TB2 to the chassis wires.

c. Test cable W1 is used for trouble-shooting with the chassis removed from the enclosure. See figure 5-6 for trouble-shooting hook-up.

Note

The test cable listed in table 5-1 is available through on board spare parts and can be ordered from stock.

5-2. PRELIMINARY CHECKS.

Make a visual check of the speaker amplifier to determine possible troubles such as, indicator lamp failure, no outside power source, controls improperly set, blown fuses, loose, charred or broken wires, etc.

TABLE 5-1. TEST EQUIPMENT REQUIRED FOR TROUBLE-SHOOTING

EQUIPMENT	TYPE AND MODEL
Signal Generator (Audio Oscillator)	Hewlett Packard, Model 200B
Oscilloscope	Hewlett Packard, Model 150A
Vacuum Tube Volt Meter (VTVM)	RCA, Model WV-77E
Test Cable (6) Conductor, 10 ft	Part No. 42208

TABLE 5-2. SPEAKER AMPLIFIER TYPICAL TROUBLES

TROUBLE	NATURE OF TROUBLE	SYMPTOMS
Faulty selector switch	Switch contacts dirty, pitted or corroded	Speaker output has crackling noise or no output.
Speaker amplifier inoperative	Defective component in power supply	Overheating of transformer. Leaking filter capacitors.
Shorted transistors Q4 and Q5	Defective capacitor or diode	Blown fuse or fuses.
Shorted transistors Q6 or Q7	Defective transistor Q4 or Q5	Blown fuse or fuses.
Capacitor C5 has low resistance to ground	Defective capacitor	Oscillating output.

5-3. CONTROL SETTINGS.

- a. Place POWER ON-OFF switch (S2) in ON position.
- b. Turn CHANNEL SELECTOR switch (S1) to the desired channel.
- c. Set VOLUME control potentiometer (R4) to the desired level.

CAUTION

Do not use a volt ohm meter (VOM) to measure resistances in the speaker amplifier. Serious damage may be incurred to transistors.

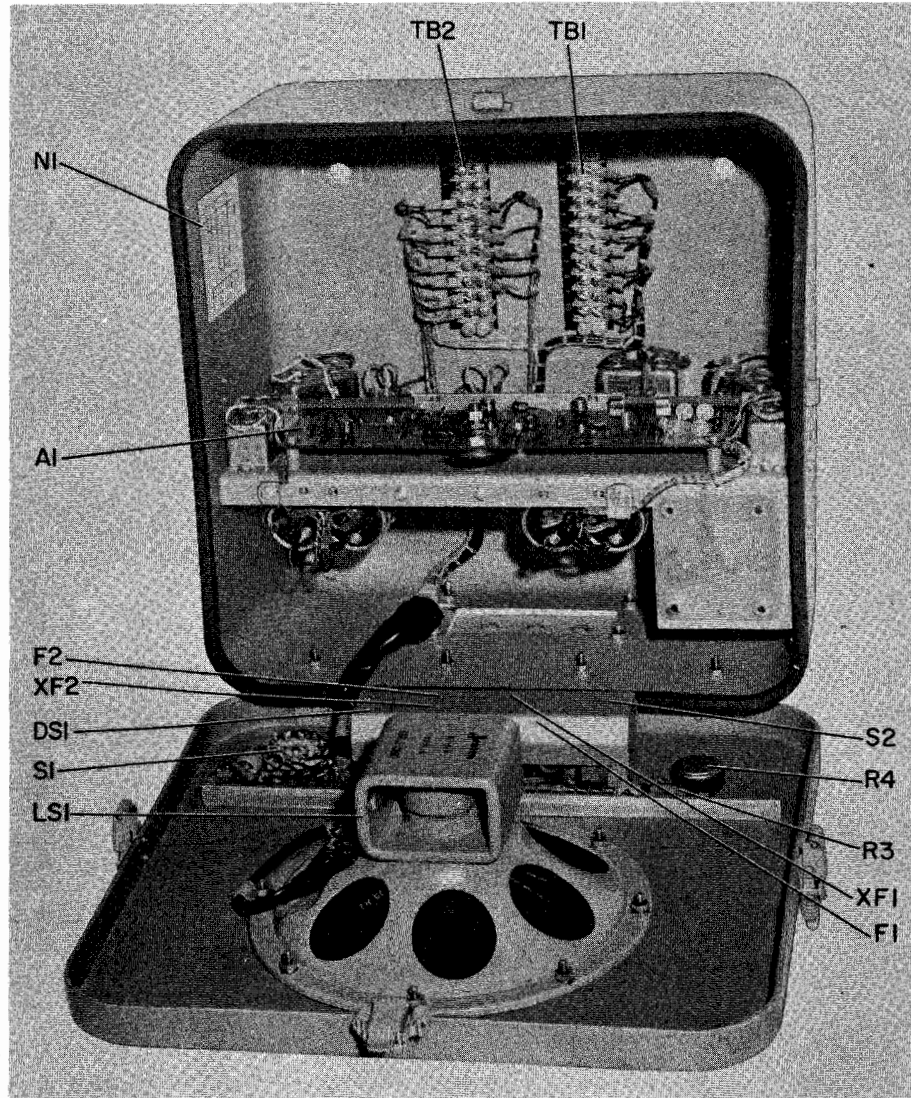


Figure 5-1. Speaker Amplifier with Cover Open

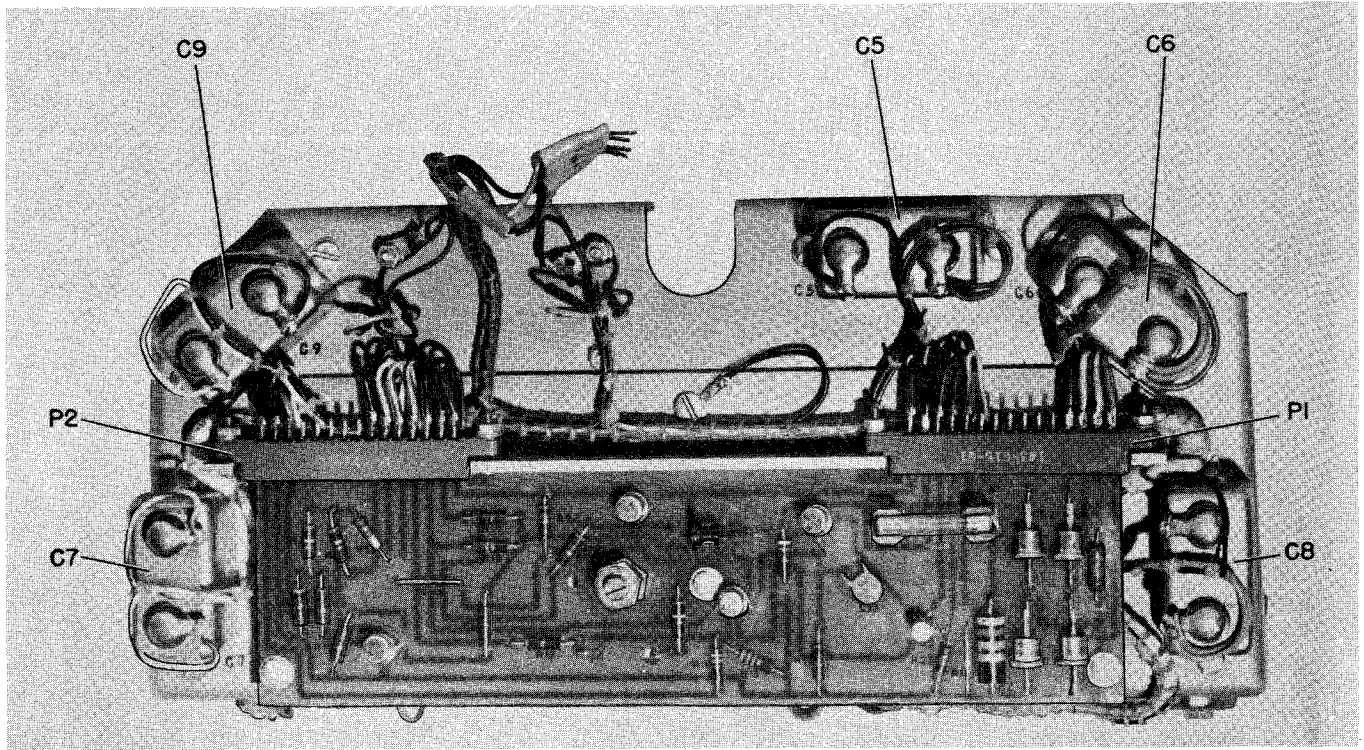


Figure 5-2. Chassis Top View with Printed Circuit Board

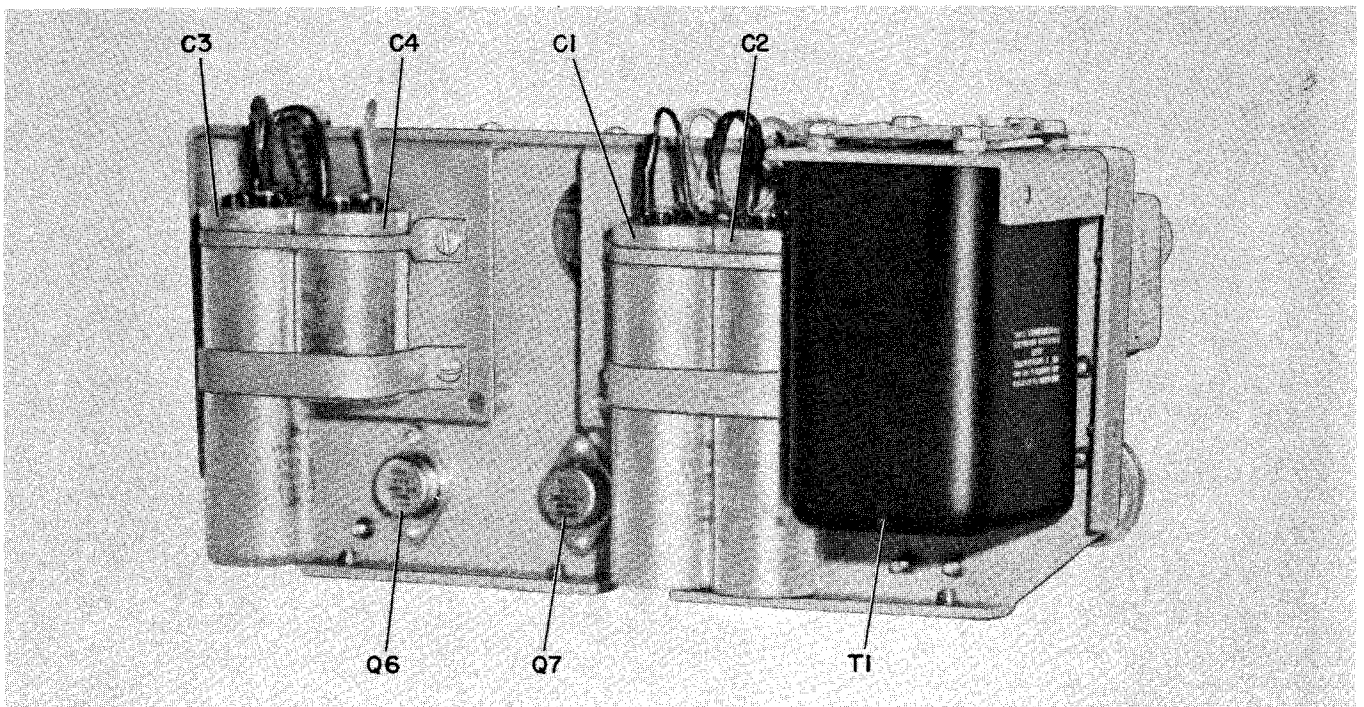


Figure 5-3. Chassis Bottom View

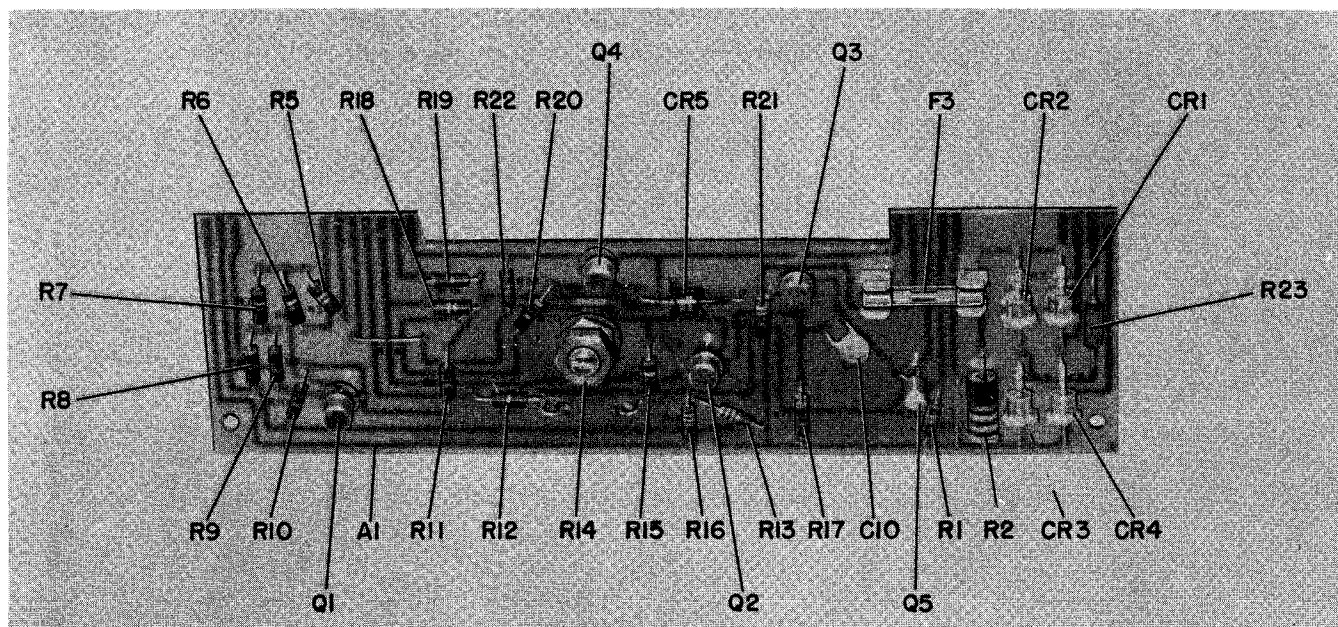


Figure 5-4. Printed Circuit Board

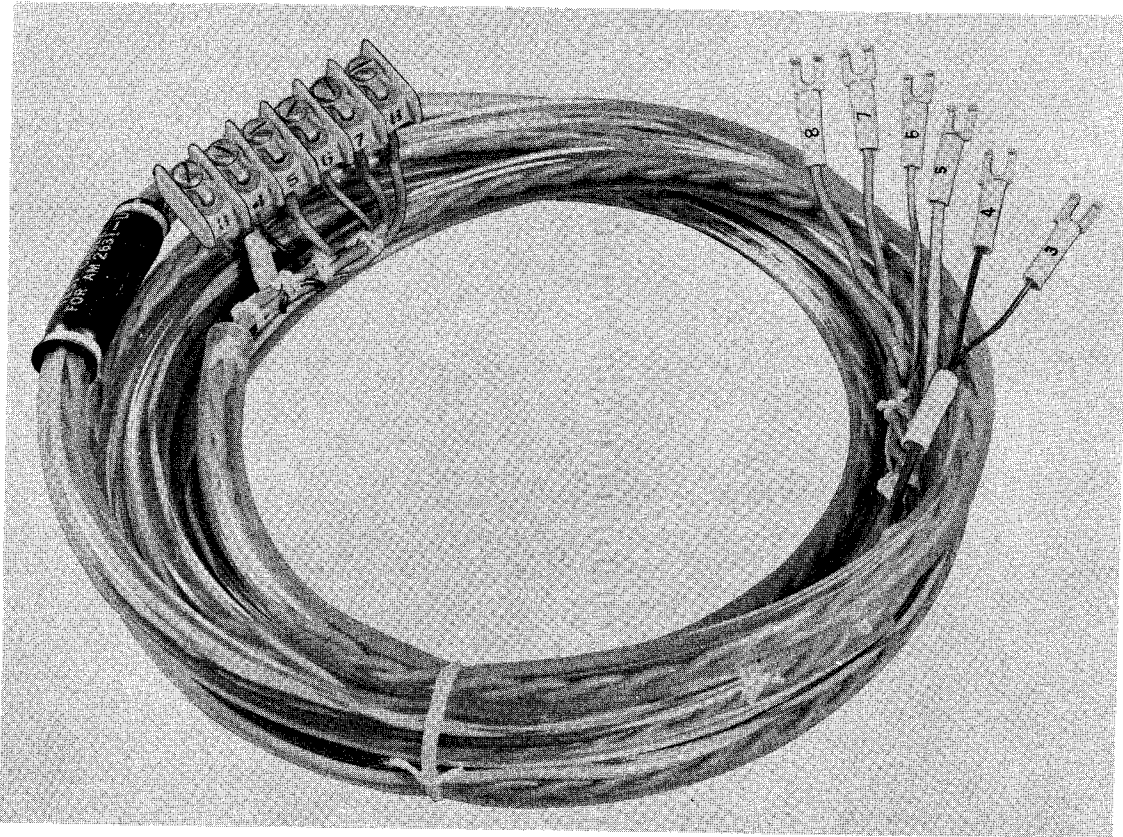


Figure 5-5. Test Cable

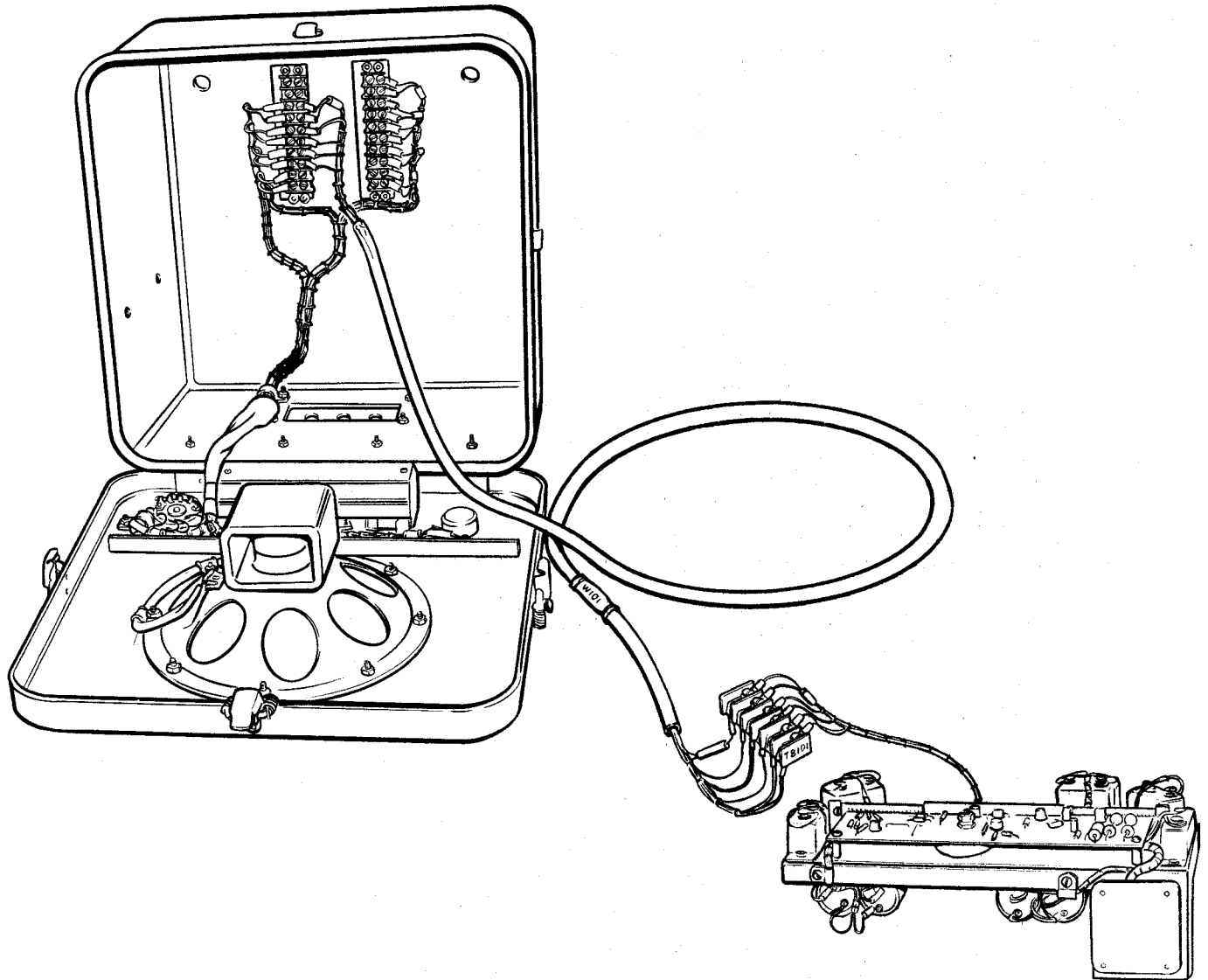


Figure 5-6. Trouble-Shooting Hook-Up

SECTION 6

SERVICE AND REPAIR

6-1. FAILURE REPORT.

Report each failure, whether caused by a defective part, wear, improper operation, or an external cause. Use ELECTRONIC FAILURE REPORT form DD787. Each pad of forms includes full instructions for filling out the forms and forwarding them to the Bureau of Ships. However, the importance of providing complete information cannot be emphasized too much. Be sure to include the model designation and complete serial number of the speaker amplifier (from the identification plate), and the type number and reference designation of the defective part. Describe the cause of the failure completely, continuing on the back of the form if necessary. Do not substitute brevity for clarity.

a. YOUR SIDE.—Every FAILURE REPORT is a boost for you:

- (1) It shows that you are doing your job.
- (2) It helps make your job easier.
- (3) It insures available replacements.
- (4) It gives you a chance to pass your knowledge to every man on the team.

b. BUREAU SIDE.—The Bureau of Ships uses the information to:

- (1) Evaluate present equipment.
- (2) Improve future equipment.

- (3) Order replacements for stock.
- (4) Prepare field changes.
- (5) Publish maintenance data.

Note

Always keep a supply of failure report forms on board. You can get them from the nearest District Publications and Printing Office.

6-2. PREVENTIVE MAINTENANCE.

a. INTRODUCTION.—Preventive maintenance information consists of mechanical and electrical performance tests. Performance test provide a means of evaluating the relative performance of the speaker amplifier. These tests may be performed while the equipment is in use. When the results of these tests indicate the speaker amplifier is not functioning properly, refer to Section 5 for trouble analysis.

b. PREVENTIVE MAINTENANCE CHART.—Preventive maintenance procedures are given in a chart form. At the top-right of the chart page is a list of test equipment, if any, required to perform the procedure. At the top-left of the chart is a list of operating conditions and control settings. These apply to the entire page unless other conditions and settings are given for some of the steps.

Operating conditions and control settings:

Power ON-OFF switch S2 in OFF position

Test equipment required:

None

STEP NO.	ACTION REQUIRED	PROCEDURE
1	Speaker amplifier inspection	<p>Unfasten the three spring catches securing the cover to the case. Raise the cover. Inspect the exposed interior for dust and foreign particles. The interior should be clean and free of any dust.</p> <p>Check the rubber cover seal. It must be free of cracks and signs of deterioration.</p>

6-3. PERFORMANCE STANDARDS.

a. INTRODUCTION.—Performance standards provide a means of testing the performance of the speaker amplifier against design standards. The results of these tests will show the maximum performance capabilities of the speaker amplifier. If the results of these tests indicate the speaker amplifier is not functioning properly, refer to Section 5 for trouble analysis.

b. PERFORMANCE STANDARD CHART.—The procedures for obtaining the performance standard test indications is given in chart form. At the top-right of the chart page is a list of test equipment, if any, required to perform the procedure on that page. At the top-left of the chart page is a list of operating conditions and control settings. These apply to the entire page unless other conditions and settings are given for some of the steps.

Operating conditions and control settings:

Test equipment required:

POWER ON-OFF switch S2 in OFF position

Audio Oscillator - 200B VTVM - WV - 77E

STEP NO.	ACTION REQUIRED	PRELIMINARY ACTION	READ INDICATION ON	REFERENCE STANDARD
1	Test set-up for power output check.	Disconnect the two speaker leads at terminal board TB2, terminals 5 and 6. Connect an eight ohm, plus or minus one ohm noninductive (carbon) resistor across the speaker wires at terminals 5 and 6. Select 1000 cps at 1/2 v on the signal generator. Connect the signal generator to any channel input-terminal board TB1 terminal 1, 3, 5, 7, or 9. Select the channel to which the input signal is connected.		
2	Determine power output.	Turn the POWER ON-OFF switch S2 to ON. Connect the VTVM across the eight ohm resistor. Increase volume until 6.4 vac is read across the resistor. The 6.4 vac reading represents 5 watts output.	VTVM	5 watts speaker output

6-4. ADJUSTMENT.

a. BIAS ADJUST.

(1) CONTROL SETTINGS.

- (a) Place POWER ON-OFF switch (S2) to ON.
- (b) Place CHANNEL SELECTOR switch (S1) in desired position.
- (c) Turn VOLUME control potentiometer (R4) to desired position.

(2) TEST SET-UP.

- (a) Allow the speaker amplifier to warm up for approximately one half hour.
- (b) Unlatch the three spring catches securing the cover.
- (c) Lift the cover.

(3) TUNING INSTRUCTIONS.

- (a) Locate bias adjust potentiometer R14, see figure 6-1.
- (b) Loosen the locknut on potentiometer R14.
- (c) Use a VTVM as prescribed in table 5-1 or suitable substitute. Connect the VTVM leads across capacitor C1 or C2 (the positive, red lead is ground; the negative, black lead is B- or approximately -35 vdc \pm 3 vdc).
- (d) Check the voltage at the negative (black) lead of capacitor C3.
- (e) The voltage from the negative side of capacitor C3 to ground must be one-half of the B- supply (-17-1/2 vdc).
- (f) If the voltage measured in step (e) is not exactly one-half of B-, adjust bias adjust potentiometer R14 for one-half of the B- supply voltage.
- (g) Repeat steps (c) through (f) and readjust if necessary.
- (h) Tighten the locknut on potentiometer R14.
- (i) Lower the cover and secure the spring catches.

6-5. REPAIR.

a. REMOVAL AND DISASSEMBLY PROCEDURES.

(1) PRINTED CIRCUIT BOARD ASSEMBLY.

- (a) Loosen and remove three screws and washers securing the printed circuit board to the chassis.
- (b) Pull the printed circuit board straight out and away from connectors P1 and P2.

Note

Any component can be removed from the speaker amplifier without complete disassembly, therefore, no detailed disassembly procedure is required.

(2) CHASSIS ASSEMBLY.

- (a) Loosen terminal screws 3 through 8 on terminal board TB2.

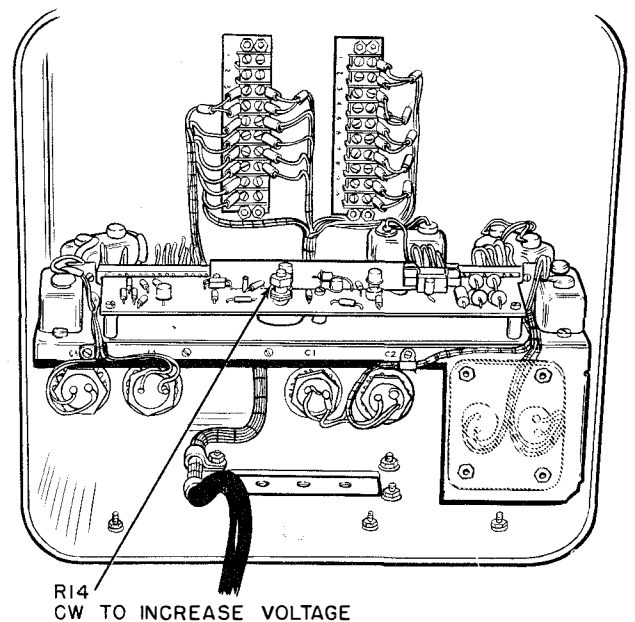


Figure 6-1. Bias Adjustment

- (b) Remove wire leads from terminals 3 through 8.
- (c) Remove the 10 screws and washers securing the chassis to the case.

Note

Removal and replacement of component parts is obvious after determining the physical location of the defective part, therefore, detailed removal and replacement instructions are not necessary.

(3) SOLDERING AND UNSOLDERING.

- (a) Make sure the soldering iron or gun is at soldering temperature.
- (b) Never apply heat longer than necessary.
- (c) Use a heat absorbing device (heat sink) on the wire lead between the source of heat and the

component being soldered. This prevents damaging effects to transistors, diodes, etc.

b. REASSEMBLY AND REPLACEMENT.

- (1) **CHASSIS ASSEMBLY.**
 - (a) Align holes in chassis and case.
 - (b) Replace and tighten 10 screws and washers.
 - (c) Insert and tighten the wire leads to terminal board TB2 - terminals 3 through 8.
- (2) **PRINTED CIRCUIT BOARD ASSEMBLY.**
 - (a) Insert printed circuit board into connectors P1 and P2.
 - (b) Replace three screws and washers into stand-offs mounted on the chassis.

c. ADJUSTMENT.

- (1) Perform the adjustment procedure in paragraph 6-4.

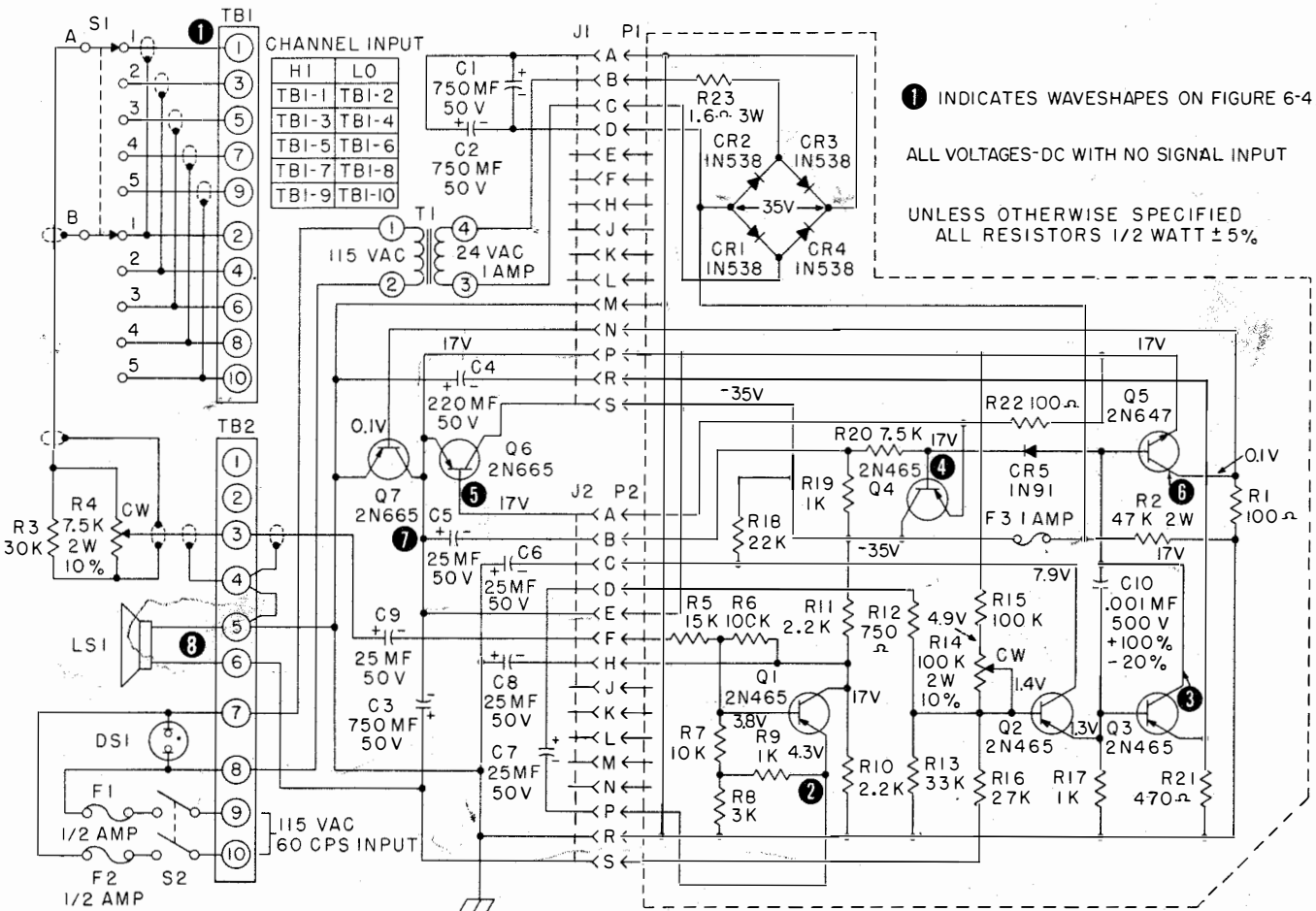


Figure 6-2. Speaker Amplifier Schematic Diagram

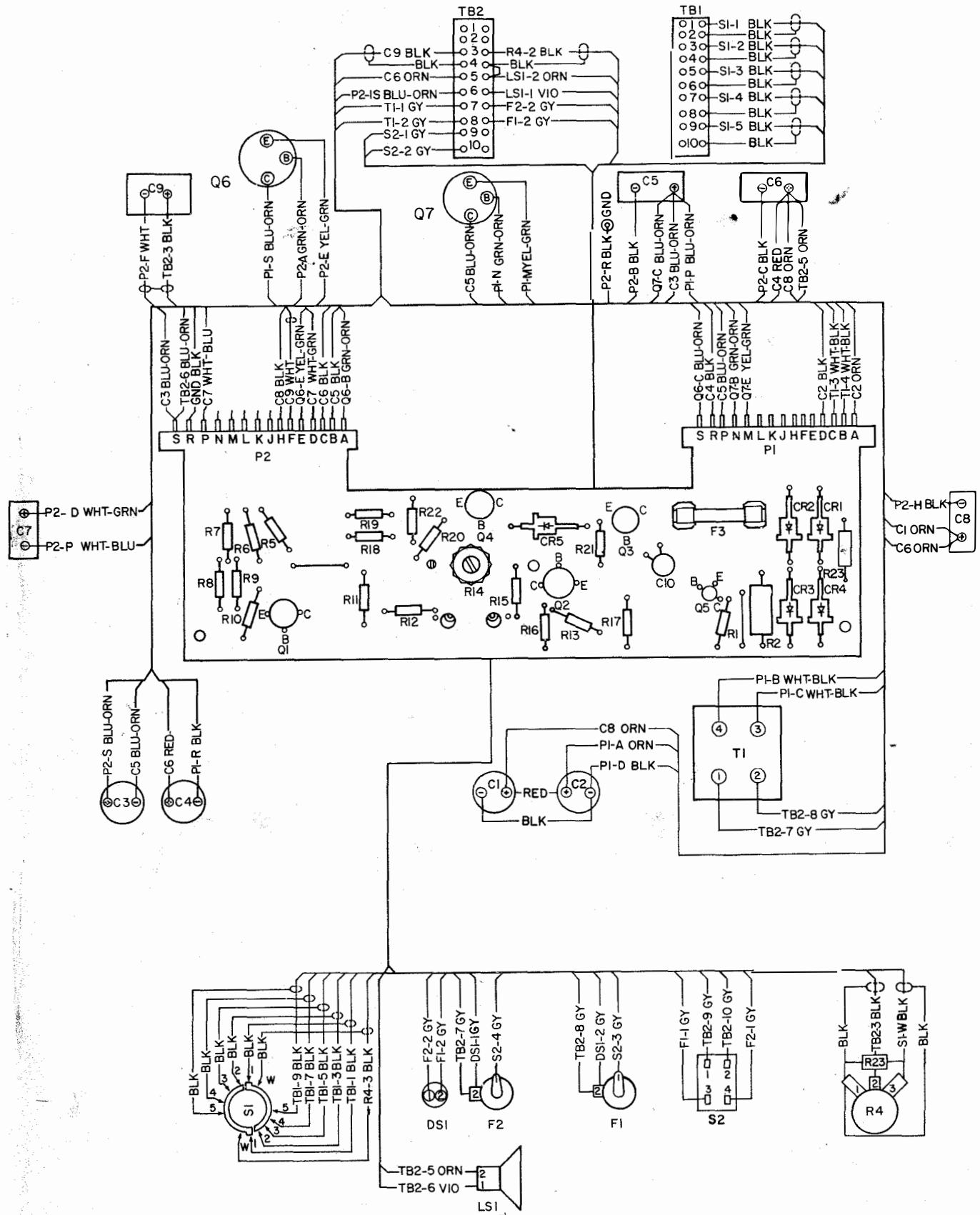


Figure 6-3. Speaker Amplifier Wiring Diagram

Test Equipment: Audio Oscillator - Hewlett Packard, Model 200B.
Oscilloscope - Hewlett Packard, Model 150A.

- Test Set-up:
1. Select 1000 cps at 2.0 v,pp on the audio oscillator.
 2. Connect the oscillator output to terminals 1 and 2 of terminal board TB1 (terminal 2 is chassis ground).
 3. Select channel 1 on CHANNEL SELECTOR switch S1.

Waveshape Check:

Oscilloscope Connection

Waveshape

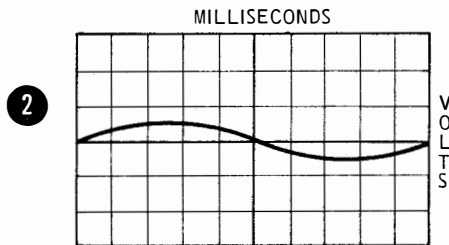
Volts Peak to Peak

Terminal board TB1
terminal 1. 1 volt per CM.



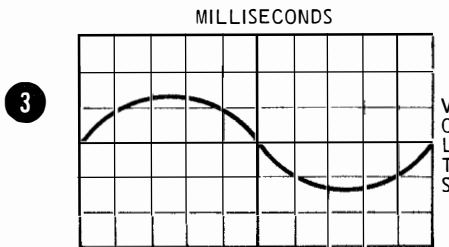
2 v,pp

Emitter of transistor
Q1. 0.5 volt per CM.



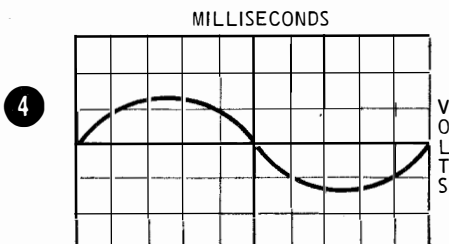
0.5 v,pp

Collector of transistor
Q3. 5 volts per CM.



12.5 v,pp

Base of transistor Q4
5 volts per CM.



12.5 v,pp

Figure 6-4. Speaker Amplifier Waveshapes (Sheet 1 of 2)

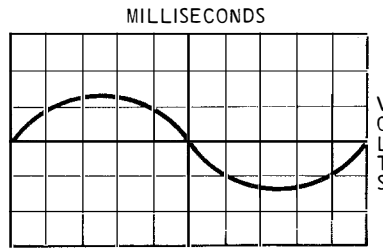
Oscilloscope Connection

Waveshape

Volts Peak to Peak

Emitter of transistor
Q4. 5 volts per CM.

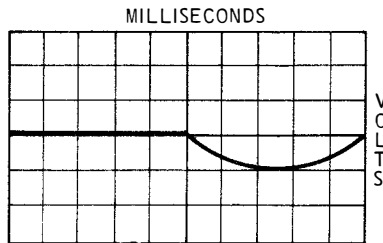
5



12.5 v,pp

Collector of transistor
Q5. 0.5 volt per CM.

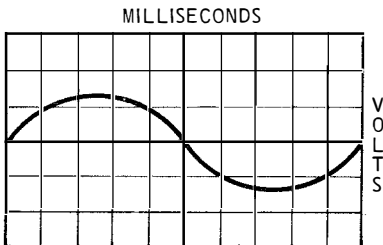
6



0.5 v,pp

Negative (black) terminal
of capacitor C3. 5 volts
per CM.

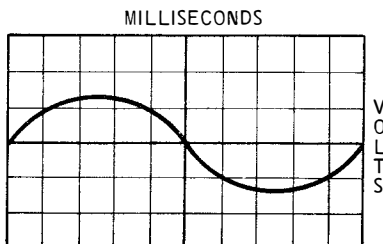
7



12.5 v,pp

Terminals 5 and 6 of
terminal board TB2
with eight ohm resistive
load in place of speaker.
5 volts per CM.

5



12.5 v,pp

See figure 6-2 for connection points on schematic diagram

Figure 6-4. Speaker Amplifier Waveshapes (Sheet 2 of 2)

SECTION 7 PARTS LIST

7-1. INTRODUCTION.

Reference designations (such as circuit symbols, reference symbols, etc.) have been assigned to identify all maintenance parts of the speaker amplifier. They are included on drawings, diagrams, and the parts list. The letters of reference designation indicate the kind of part (generic group), such as resistor, capacitor, transistor, etc. The number differentiates between parts of the same generic group.

Sockets associated with a particular plug-in device such as a fuse are identified by a reference designation which includes the reference designation of the plug-in device preceded with the prefix X. For example, the X prefix identifies the socket for fuse F3 and is designated XF3.

7-2. MAINTENANCE PARTS LIST.

Table 7-1 lists all replaceable maintenance parts. Column one, REF. DES. lists reference designations of various parts in alphabetical and numerical order. Column two, NOTES, refers to the explanatory notes that appear in paragraph 7-5. Column three, NAME AND DESCRIPTION, gives the name and describes the various parts. Complete information is given for all

key parts (parts differing from any part previously listed in this table). The name and description is omitted for other parts. However, reference is made to the key part for the descriptive data. Column four, LOCATING FUNCTION, indicates how the part is used and gives its functional location in the equipment.

7-3. STOCK NUMBER IDENTIFICATION.

Table 7-2 is arranged by key designations in alpha-numerical order. The STOCK NUMBERS column lists all available stock numbers for key parts. If the reference designation for a part is known, find its key designation from table 7-1 before using this table.

7-4. LIST OF MANUFACTURERS.

Table 7-3 lists manufacturers of maintenance parts used in the speaker amplifier. The first column includes the abbreviations used in table 7-1 to identify manufacturers.

7-5. NOTES.

No notes are used or required in table 7-1.

TABLE 7-1. SPEAKER AMPLIFIER MAINTENANCE PARTS LIST (SHEET 1 OF 4)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	LOCATING FUNCTION
A1		PRINTED CIRCUIT BOARD ASSEMBLY	
C1		CAPACITOR, FIXED, ELECTROLYTIC, 750 uf 50 vdc CE31C751G	B- Filter
C2		Same as C1	
C3		Same as C1	Coupling output from Q6 and Q7
C4		CAPACITOR, FIXED, ELECTROLYTIC, 220 uf 50 vdc	Q3 emitter circuit
C5		CAPACITOR, FIXED, ELECTROLYTIC, 25 uf 50 vdc CE64C250G	Q4 base circuit
C6		Same as C5	Q2 collector circuit
C7		Same as C5	Q2 coupling
C8		Same as C5	Q1 collector, filter

TABLE 7-1. SPEAKER AMPLIFIER MAINTENANCE PARTS LIST (SHEET 2 OF 4)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	LOCATING FUNCTION
C9		Same as C5	Input coupling
C10		CAPACITOR, FIXED, 0.001 uf 500 vdc +100% -20% (CE)	Q3 feedback
CR1		SEMICONDUCTOR DEVICE DIODE Type 1N538, (GE)	Power supply rectifier
CR2		Same as CR1	
CR3		Same as CR1	
CR4		Same as CR1	
CR5		SEMICONDUCTOR DEVICE DIODE, Type 1N91 (GE)	Temperature com- pensating
DS1		LAMP GLOW, NEON Type NE-51 (GEC)	Power on indicator
F1		FUSE, 3AG, 1/2 amp	AC line fuse
F2		Same as F1	
F3		FUSE 3AG, 1 amp	DC fuse
LS1		LOUDSPEAKER	Output production
MP1		KNOB, control	CHANNEL SELECTOR
MP2		Same as MP1	VOLUME
N1		PLATE, INFORMATION, schematic diagram	
N2		PLATE, IDENTIFICATION	
P1		CONNECTOR, 15 CONTACT (ABE)	Circuit board to chassis
P2		Same as P1	
Q1		TRANSISTOR, TYPE 2N465 (MSD)	Emitter follower
Q2		Same as Q1	
Q3		Same as Q1	Amplifier
Q4		Same as Q1	
Q5		TRANSISTOR, TYPE 2N647 (RCA)	Phase inverter
Q6		TRANSISTOR, TYPE 2N665 (DRD)	Push-pull output
Q7		Same as Q6	
R1		RESISTOR, FIXED, 100 ohms 1/2w ± 5%	Q7 base

TABLE 7-1. SPEAKER AMPLIFIER MAINTENANCE PARTS LIST (SHEET 3 OF 4)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	LOCATING FUNCTION
R2		RESISTOR, FIXED, 47 K 2w ± 10%	Power supply, load
R3		RESISTOR FIXED, 30 K 1/2w ± 5%	Input voltage dropping
R4		RESISTOR, VARIABLE, 7.5 K 2w ± 10% RV4NAYS752A	Volume control
R5		RESISTOR, FIXED, 15 K 1/2w ± 5%	Q1 impedance match- ing
R6		RESISTOR, FIXED, 100 K 1/2w ± 5%	
R7		RESISTOR, FIXED, 10 K 1/2w ± 5%	Q1 base bias
R8		RESISTOR, FIXED, 3 K 1/2w ± 5%	Q1 impedance match- ing
R9		RESISTOR, FIXED, 1 K 1/2w ± 5%	Q1 emitter
R10		RESISTOR, FIXED, 2.2 K 1/2w ± 5%	Q1 collector
R11		Same as R10	
R12		RESISTOR, FIXED, 750 ohms 1/2w ± 5%	
R13		RESISTOR, FIXED, 33 K 1/2w ± 5%	Voltage dropping
R14		RESISTOR, VARIABLE 100 K 2w ± 10% RV4LAYS104A	Bias control
R15		Same as R6	Q2 base bias
R16		RESISTOR, FIXED, 27 K 1/2w ± 5%	Q2 bias
R17		Same as R9	Q3 base bias
R18		RESISTOR, FIXED, 22 K 1/2w ± 5%	Q2 collector
R19		Same as R9	Q4 base bias
R20		RESISTOR, FIXED, 7.5 K 1/2w ± 5%	Q4 base
R21		RESISTOR, FIXED, 470 ohms 1/2w ± 5%	Q3 base
R22		Same as R1	Q6 base bias
R23		RESISTOR, FIXED, 1.6 ohms 3w ± 5% RW59V1R6	Load

TABLE 7-1. SPEAKER AMPLIFIER MAINTENANCE PARTS LIST (SHEET 4 OF 4)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	LOCATING FUNCTION
S1		SWITCH, ROTARY, 2 sections, 5 positions	CHANNEL SELECTOR
S2		SWITCH, TOGGLE, DPST	POWER ON-OFF
TB1		BOARD, TERMINAL, 20 post (CJ)	Interconnection
TB2		Same as TB1	
T1		TRANSFORMER, STEP-DOWN, 115 v to 24 v	Power
W101		CABLE, TEST, 6 conductor 10 ft	Trouble-shooting
XDS1		SOCKET, LAMP, dc	
XF1		FUSE HOLDER (BUSS)	
XF2		Same as XF1	

TABLE 7-2. SPEAKER AMPLIFIER STOCK NUMBER IDENTIFICATION (SHEET 1 OF 2)

REF. DESIG.	STOCK NUMBERS			
	NAVY FEDERAL	STANDARD NAVY	SIGNAL CORPS	USAF
A1				
C1	N5910-284-5023			
C4	N5910-227-0282			
C5				
C10				
CR1	N5960-519-6977			
CR5				
DS1				
F1	N5920-281-0224			
F3				
LS1				
MP1				
N1				
N2				
P1	N5935-615-4360			
Q1	N5960-681-9889			

TABLE 7-2. SPEAKER AMPLIFIER STOCK NUMBER IDENTIFICATION (SHEET 2 OF 2)

REF. DESIG.	STOCK NUMBERS			
	NAVY FEDERAL	STANDARD NAVY	SIGNAL CORPS	USAF
Q5				
Q6	<i>5961-892-3474</i>			
R1	N5905-190-8889			
R2	N5905-195-6754			
R3	N5905-192-3978			
R4	N5905-578-4471			
R5	N5905-279-2616			
R6	N5905-195-6761			
R7	N5905-185-8510			
R8	N5905-279-1751			
R9	N5905-192-6806			
R10	N5905-279-1876			
R12	N5905-195-9481			
R13	N5905-171-1998			
R14	N5905-665-4992			
R16	N5905-195-9482			
R18	N5905-171-2004			
R20	N5905-249-4195			
R21	N5905-192-3973			
R23	N5905-542-7896			
S1				
S2	N5930-050-2704			
TB1	N5940-229-9669			
T1				
W101				
XDS1				
XF1	N5920-578-9333			

TABLE 7-3. SPEAKER AMPLIFIER LIST OF MANUFACTURERS

ABBREVIATION	NAME	ADDRESS
ABE	Amphenol-Borg Electronics Corp	Broadview, Illinois
BUSS	Bussmann Mfg Co	St. Louis 7, Missouri
CE	Centralab	Milwaukee 1, Wisconsin
CJ	Cinch Jones Mfg Co	Chicago 24, Illinois
DC	Dialight Corp	Brooklyn 37, New York
DRD	Delco Radio Division	Kokomo, Indiana
GE	General Electric	Syracuse 1, New York
GEC	General Electric Corp	Schenectady 5, New York
MSD	Motorola Semiconductor Division	Phoenix, Arizona
RCA	Radio Corp of America	Somerville, New Jersey

57

2
2
4
2
4
3
3
2
2
19

~~61750A (7)~~

40-39