

DEPARTMENT OF THE ARMY
TECHNICAL MANUAL
DEPARTMENT OF THE AIR
FORCE TECHNICAL ORDER

T.O. 31W1-2U-311
(TM 11-5081)
Basic and Change 2

AUDIO FREQUENCY AMPLIFIER

AM-864/U



DEPARTMENTS OF THE ARMY AND THE AIR FORCE

WARNING

HIGH VOLTAGE

is used in the operation of
this equipment.

DEATH ON CONTACT

may result if operating personnel
fail to observe safety precautions.

AUDIO FREQUENCY AMPLIFIER AM-864/UCHANGE }
No. 2 }HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 11 October 1963

TM 11-5081, 14 July 1954, is changed as follows:

Page 3. Add paragraph 1.1 after paragraph 1.

1.1 Index of Publications

Refer to the latest issue of DA Pam 310-4 to determine whether there are new editions, changes, or additional publications pertaining to the equipment. Department of the Army Pamphlet No. 310-4 is a current index of technical manuals, technical bulletins, supply bulletins, lubrication orders, and modification work orders that are available through publications supply channels. The index lists the individual parts (-10, -20, -35P, etc.) and the latest changes to and revisions of each equipment publication.

Delete paragraph 2 and substitute:

2. Forms and Records

a. Reports of Maintenance and Unsatisfactory Equipment. Use equipment forms and records in accordance with instructions in TM 38-750.

b. Report of Damaged or Improper Shipment. Fill out and forward DD Form 6 (Report of Damaged or Improper Shipment) as prescribed in AR 700-58 (Army), NAVSANDA Publication 378 (Navy), and AFR 71-4 (Air Force).

c. Reporting of Equipment Manual Improvements. The direct reporting by the individual user of errors, omissions, and recommendations for improving this manual is authorized and encouraged. DA Form 2028 (Recommended Changes to DA Technical Manual Parts Lists or Supply Manual 7, 8, or 9) will be used for

*This change supersedes C 1, 23 September 1955.

reporting these improvements. This form will be completed in triplicate using pencil, pen, or typewriter. The original and one copy will be forwarded direct to Commanding Officer, U.S. Army Electronics Materiel Support Agency, ATTN: SELMS-MP, Fort Monmouth, N.J., 07703. One information copy will be furnished to the individual's immediate supervisor (officer, noncommissioned officer, supervisor, etc.).

Page 18. Delete section I and substitute:

23. Scope of Maintenance

The maintenance duties assigned to the operator of the equipment are listed below together with a reference to the paragraphs covering the specific maintenance functions.

- a. Daily preventive maintenance checks and services (par. 26).
- b. Cleaning (par. 27).

24. Preventive Maintenance

Preventive maintenance is the systematic care, servicing, and inspection of equipment to prevent the occurrence of trouble, to reduce downtime, and to assure that the equipment is serviceable.

a. *Systematic Care.* The procedures given in paragraphs 26 and 27 cover routine systematic care and cleaning essential to proper upkeep and operation of the equipment.

b. *Preventive Maintenance Checks and Services.* The preventive maintenance checks and services chart (par. 26) outlines functions to be performed at specific intervals. These checks and services are to maintain Army electronic equipment in a combat serviceable condition; that is, in good general (physical) condition and in good operating condition. To assist operators in maintaining combat serviceability, the charts indicate what to check, how to check, and what the normal conditions are; the references column lists the illustrations, paragraphs, or manuals that contain supplementary information. If the defect cannot be remedied by the operator, higher echelon maintenance or repair is required. Records and reports of these checks and services must be made in accordance with the requirements set forth in TM 38-750.

25. Preventive Maintenance Checks and Services Periods

Preventive maintenance checks and services of the equipment are required daily and under the conditions listed below.

- a. When the equipment is initially installed.

b. When the equipment is reinstalled after removal for any reason.

c. At least once each week if the equipment is maintained in standby condition.

26. Daily Preventive Maintenance Checks and Services Chart

Sequence No.	Item	Procedure	References
1	End item equipment.	Inspect equipment for completeness	Pars. 7 and 9.
2	Exterior surfaces.	Clean exterior surfaces, including panel and meter glass. Check meter glass and indicator lens for cracks.	Par. 27.
3	Connections	Check tightness of all connections to INPUT and OUTPUT terminals.	Fig. 5.
4	Controls and indicators.	While making operating checks (item 5), observe that mechanical action of each knob and switch is smooth and free of external or internal binding, and that there is no excessive looseness. Also, check meter for sticking or bent pointer (fig. 6).	Par. 17.
5	Operation	Operate equipment according to paragraph 17. During operation, be alert for any unusual signs or conditions.	Par. 17.
6	Cords and wires.	Inspect power cord and audio input and output wires for cracked or frayed insulation.	

27. Cleaning

Inspect the exterior of the equipment. The exterior surfaces should be clean and free of dust, dirt, grease, and fungus.

a. Remove dust and loose dirt with a clean soft cloth.

Warning: Cleaning compound is flammable and its fumes are toxic. Provide adequate ventilation. Do not use near a flame.

b. Remove grease, fungus, and ground-in dirt from the equipment; use a cloth dampened (not wet) with cleaning compound.

c. Remove dust or dirt from plugs and jacks with a brush.

Caution: Do not press on the meter face (glass) when cleaning; the meter may become damaged.

d. Clean the front panel, meter, and control knob; use a soft clean cloth. If dirt is difficult to remove, dampen the cloth with water; mild soap may be used for more effective cleaning.

Page 19. Delete figure 7.

Page 20. Delete figure 8.

Page 22. Delete section II and substitute:

Section II. ORGANIZATIONAL MAINTENANCE

29. Scope of Organizational Maintenance

This section contains instructions covering second echelon maintenance of the equipment. Second echelon maintenance of the equipment includes:

- a. Replacement of pluckout items (fuses, lamps, and tubes).
- b. Preventive maintenance checks and services (par. 30.3).
- c. Touchup painting (par. 30.4).

30. Tools, Materials, and Test Equipment Required

The only tool required for second echelon maintenance is a screwdriver. The materials and test equipment required are listed below.

a. *Materials.*

- (1) Cleaning compound (FSN 7930-395-9542).
- (2) Cleaning cloth.
- (3) Lubricating oil, general purpose, preservative (PL-Special).
- (4) Grease, aircraft and instrument (GL).
- (5) Fine sandpaper.

b. Test Equipment.

- (1) Multimeter TS-352/U.
- (2) Test Set, Electron Tube TV-7/U.
- (3) Audio Oscillator TS-382/U.

30.1 Organizational Preventive Maintenance

a. Preventive maintenance is the systematic care, inspection, and servicing of equipment to maintain it in serviceable condition, prevent breakdowns, and assure maximum operational capability. Preventive maintenance is the responsibility of all echelons concerned with the equipment and includes the inspection, testing, and repair or replacement of parts, subassemblies, or units that inspection and tests indicate would probably fail before the next scheduled periodic service. Preventive maintenance checks and services of the equipment at the second echelon level are made at monthly intervals unless otherwise directed by the commanding officer.

b. Maintenance forms and records to be used and maintained on this equipment are specified in TM 38-750.

30.2 Monthly Maintenance

Perform the maintenance functions indicated in the monthly preventive maintenance checks and services chart (par. 30.3). A month is defined as approximately 30 calendar days of 8-hour-per-day operation. If the equipment is operated 16 hours a day, the monthly preventive maintenance checks and services should be performed at 15-day intervals. Adjustment of the maintenance interval must be made to compensate for any unusual operating conditions. Equipment maintained in a standby (ready for immediate operation) condition must have monthly preventive maintenance checks and services performed on it. Equipment in limited storage requires service before operation; it does not require monthly preventive maintenance.

30.3 Monthly Preventive Maintenance Checks and Services Chart

Sequence No.	Item	Procedure	References
1	Pluckout items	Inspect seating of all pluckout items. Make sure that tube clamps grip tube bases tightly.	Fig. 16.

30.3 Monthly Preventive Maintenance Checks and Services Chart—Con't.

Sequence No.	Item	Procedure	References
2	Transformer terminals.	Inspect terminals on power transformer (T3) and interstage transformers (T1 and T2). Connections to terminals must be physically and electrically sound; there should be no evidence of dirt or corrosion.	
3	Terminal blocks	Inspect terminal blocks for loose connections and cracked or broken insulation.	
4	Resistors and capacitors.	Inspect resistors and capacitors for cracks, blistering, or other detrimental defects.	
5	Metal surfaces	Inspect exposed metal surfaces (exterior and interior) for rust and corrosion. Clean and touchup paint as required.	Par. 30.4 and TM 9-213.
6	Operation	Operate the equipment according to paragraph 34. During operation, be alert for unusual signs or conditions.	Par. 34.

30.4 Cleaning and Touchup Painting Instructions

Remove rust and corrosion from metal surfaces by lightly sanding them with fine sandpaper. Brush two thin coats of paint on the bare metal to protect it from further corrosion. Refer to the applicable cleaning and refinishing practices specified in TM 9-213.

Page 30, figure 11. (As changed by C 1, 23 Sep 55). Change the value of resistors R3 and R4 from 47K to: 12K.

Page 50. Add the following appendix after chapter 6.

APPENDIX

REFERENCES

DA Pam 310-4	Index of Technical Manuals, Technical Bulletins, Supply Bulletins, Lubrication Orders, and Modification Work Orders.
SIG 7 & 8 AM-864/U	Amplifier, Audio Frequency AM-864/U.
TM 9-213	Painting Instructions for Field Use.
TM 11-1214	Instruction Book for Oscilloscope OS-8A/U.
TM 11-1214A	Oscilloscope AS-8C/U.
TM 11-2684	Audio Oscillators TS-312/FSM-1, TS-312A/FSM-1, and TS-382/U and Signal Generator TS-312B/FSM-1.
TM 5527	Multimeters TS-352/U, TS-352A/U, and TS-352B/U.
TM 11-5549A	Electronic Multimeter ME-6B/U.
TM 11-5549B	Instruction Book for Electronic Multimeter ME-6C/U.
TM 11-5549C	Electronic Multimeter ME-6D/U.
TM 11-6625-274-12	Operator's and Organizational Maintenance Manual: Test Sets, Electron Tube TV-7/U, TV-7A/U, TV-7B/U and TV-7D/U.
TM 38-750	The Army Equipment Record System and Procedures.

Page 52, figure 23. (As changed by C 1, 23 Sep 55). Change the value of resistors R3 and R4 from 47K to: 12K.

TECHNICAL MANUAL } DEPARTMENTS OF THE ARMY AND
 No. 11-5081 } THE AIR FORCE
 TECHNICAL ORDER }
 No. 16-35AM864-5 } WASHINGTON 25, D. C., 14 July 1954

AUDIO FREQUENCY AMPLIFIER AM-864/U

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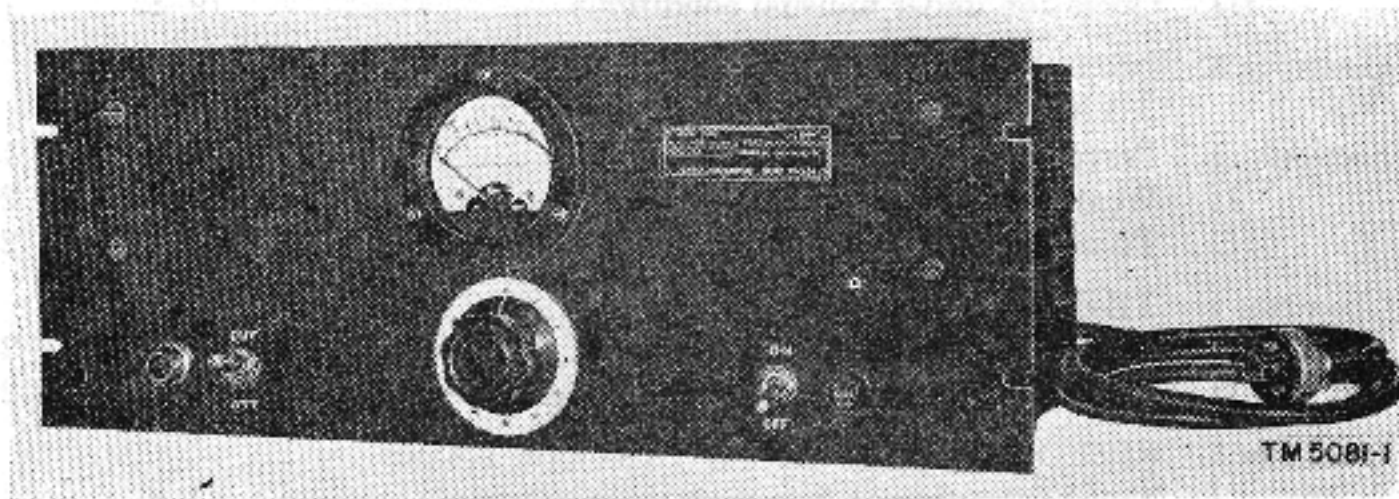


Figure 1. Audio Frequency Amplifier AM-864/U.

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1. Scope

This technical manual is published for the information and guidance of all concerned. It contains instructions for the installation, operation, maintenance, and repair of Audio Frequency Amplifier AM-864/U (fig. 1).

2. Forms and Records

The following forms will be used for reporting unsatisfactory conditions of Army materiel 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, 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, Preparation and Submission of Requisitions for Signal Corps Supplies.

c. DA Form 11-238, Operator First Echelon Maintenance Check List for Signal Corps Equipment (Radio Communication, Direction Finding, Carrier, Radar), will be prepared in accordance with instructions on the back of the form.

d. DA Form 11-239, Second and Third Echelon Maintenance Check List for Signal Corps Equipment (Radio Communication, Direction Finding, Carrier, Radar), will be prepared in accordance with instructions on the back of the form.

e. Use other forms and records as authorized.

Section II. DESCRIPTION AND DATA

3. Purpose and Use

Audio Frequency Amplifier AM-864/U is a peak-limiting, audio-frequency (af) amplifier for use in amplitude-modulated (am.) and frequency-modulated (fm) broadcasting system installations. The amplifier also may be used in conjunction with recording and sound systems that require automatic regulation of the program level.

4. System Application

a. Figure 2 is a simplified block diagram of a typical broadcasting installation that uses a limiting amplifier such as Audio

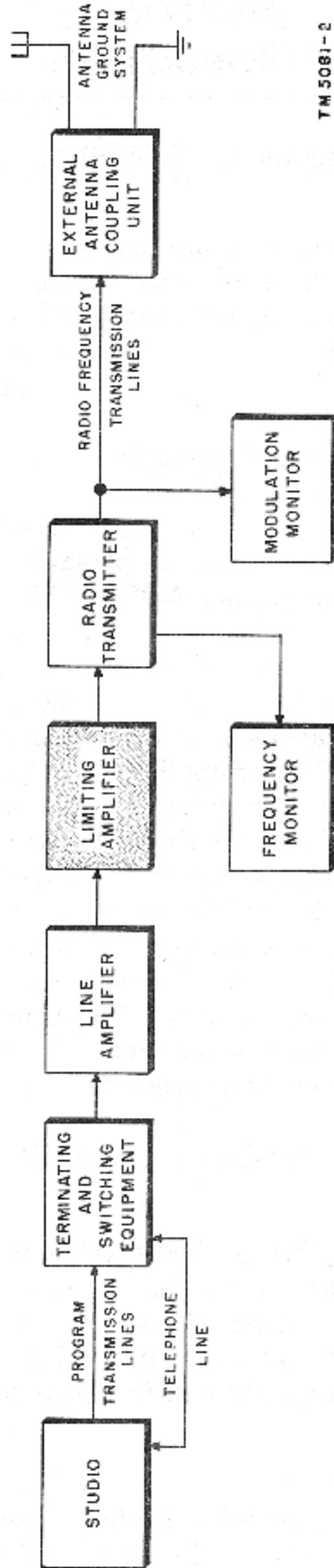


Figure 2. Broadcast installation, simplified block diagram.

Frequency Amplifier AM-864/U. The program originates in the broadcasting studio and is transmitted by transmission line or telephone line or both, depending on the type of installation through the terminating and switching equipment at the broadcasting transmitter location to the line amplifier. The program signal is amplified by the line amplifier and then amplified and limited by the limiting amplifier. The limited audio-frequency signal is fed into the transmitter where it is modulated on to the carrier wave. A frequency monitor taps into the oscillator section of the transmitter to check the carrier frequency for accuracy and stability. A modulation monitor checks the output of the transmitter for satisfactory program signal level and modulation. The output of the radio transmitter is fed through radio-frequency transmission lines to the antenna coupling unit which matches the transmitter impedance to the antenna impedance. The program is fed to the antenna system which broadcasts it into the air.

b. The limiting amplifier immediately precedes the transmitter. At that point in the system, the signal levels fed into the limiting amplifier are sufficiently high, regardless of origin, for the limiting action to be effective. The limiting action of the amplifier consists of reducing the gain of the amplifier when the signal exceeds a predetermined amount and restoring the gain when the signal falls below this amount. This action limits the signal peaks and prevents overmodulation of the transmitter.

c. The limiting amplifier usually is adjusted so that when the studio volume control indicates maximum program level, the transmitter output is being modulated at nearly 100 percent. Since this amplifier compresses those signals which otherwise would cause overmodulation, the quality of the broadcast is not completely dependent on the monitoring operator in the control room. In some installations, the functions of the line amplifier and limiting amplifier can be combined into one unit.

5. Technical Characteristics

Impedance, input	600 ohms (center tapped).
Impedance, output	600 ohms (center tapped).
Gain	Varies with signal input: maximum of 36 db \pm 1 db.
Power output	6 mw into a 600-ohm resistive load.
Rated distortion	Less than 2 percent at 400, 1,000, and 5,000 cps.
Constancy of output	For inputs from -35 to -25 db, output will not vary more than 1 db. (0 db is referenced to 6 mw.)
Speed of automatic gain reduction (attack time)	Approximately .05 second.

Speed of automatic gain increase (recovery time)-----	Approximately 2 seconds.
Noise level -----	40 db below 6 mw.
Frequency response -----	Flat within 1 db of the 1,000 cycle value over the range 100 to 5,000 cycles.
Number of tubes -----	5.
Power input -----	115 volts or 220 volts ac 50 to 60 cycles, 30 watts.
Weight -----	25 lbs.

6. Packaging Data

(fig. 3)

When packaged for export shipment, Audio Frequency Amplifier AM-864/U and its spare parts are packed in a wooden crate 13 inches by 28.5 inches by 19 inches. The volume of the crate is 4.5 cubic feet, and the total weight is 50 pounds. Within the wooden crate, the amplifier is protected from shock by two separate cartons, adequate cardboard cells, and other padding. Within the cartons are bags of silica gel. The spare parts are wrapped individually and then sealed within a moisture-vaporproof bag. The carton liner is waterproofed and sealed before the top cover is nailed to the crate. Heavy wire or metal banding then is tightened around the wooden crate to prevent the crate from bulging or splitting if subjected to rough treatment.

Note. Items may be packaged differently from the manner shown, depending on the supply channel.

7. Table of Components

Component	Required No.	Height (in)	Depth (in)	Length (in)	Volume (cu ft)	Unit weight (lb)
Audio Frequency Amplifier AM-864/U.	1	7	8 $\frac{3}{4}$	19	.67	25
Power cable -----	1			72		
Technical manual	2	5 $\frac{7}{8}$		9 $\frac{1}{8}$		

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

8. Description of Audio Frequency Amplifier AM-864/U

a. Audio Frequency Amplifier AM-864/U (fig. 1) is a self-contained unit with its various components mounted directly on a steel chassis. The chassis in turn is fastened to the front panel. A dust cover and bottom plate are used to inclose the unit completely.

b. The amplifier contains five vacuum tubes (including the rectifier). The input and output connections are located on terminal boards at the rear of the amplifier.

c. All controls required for the operation of the amplifier are located on the front panel (fig. 6). These controls consist of two switches (one to turn the amplifier ON and OFF, and the other to transfer the meter on the front panel from ATT to OUT position) and an attenuation control which adjusts the attenuation of the amplifier. The fuse and panel light are located on the front panel.

9. Running Spares

A group of running spares are supplied with Audio Frequency Amplifier AM-864/U. Spares are provided for all normally expendable items such as tubes, pilot lamps, and fuses. The following is a list of running spares:

- 1 tube, type 6SK7.
- 1 tube, type 6SN7GT.
- 1 tube, type 6SQ7.
- 1 tube, type 5Y3GT.
- 5 fuses, 1 ampere.
- 1 lamp, 6-8 volts, 150 ma (milliamperes).

CHAPTER 2

OPERATING INSTRUCTIONS

Section I. SERVICE UPON RECEIPT OF AUDIO FREQUENCY AMPLIFIER AM-864/U

10. Siting

a. Audio Frequency Amplifier AM-864/U is adapted for mounting in a standard 19-inch cabinet rack. It occupies 7 inches of cabinet rack space. The overall depth, measured from the front panel to the rearmost extending component, is 10 inches.

b. Audio Frequency Amplifier AM-864/U must not be placed near magnetic fields such as those which surround voltage regulators, transformers, alternating-current (ac) power supply units, or ac power cords; these fields might induce noise in the amplifier. If any equipment with a self-contained ac power supply is mounted in the same rack, it should be separated from the amplifier front panel by at least 6 inches.

c. Place or mount the amplifier so that air circulates freely around its component. The ambient temperature behind the power transformer never should exceed 140° F.

11. Uncrating, Unpacking, and Checking New Equipment

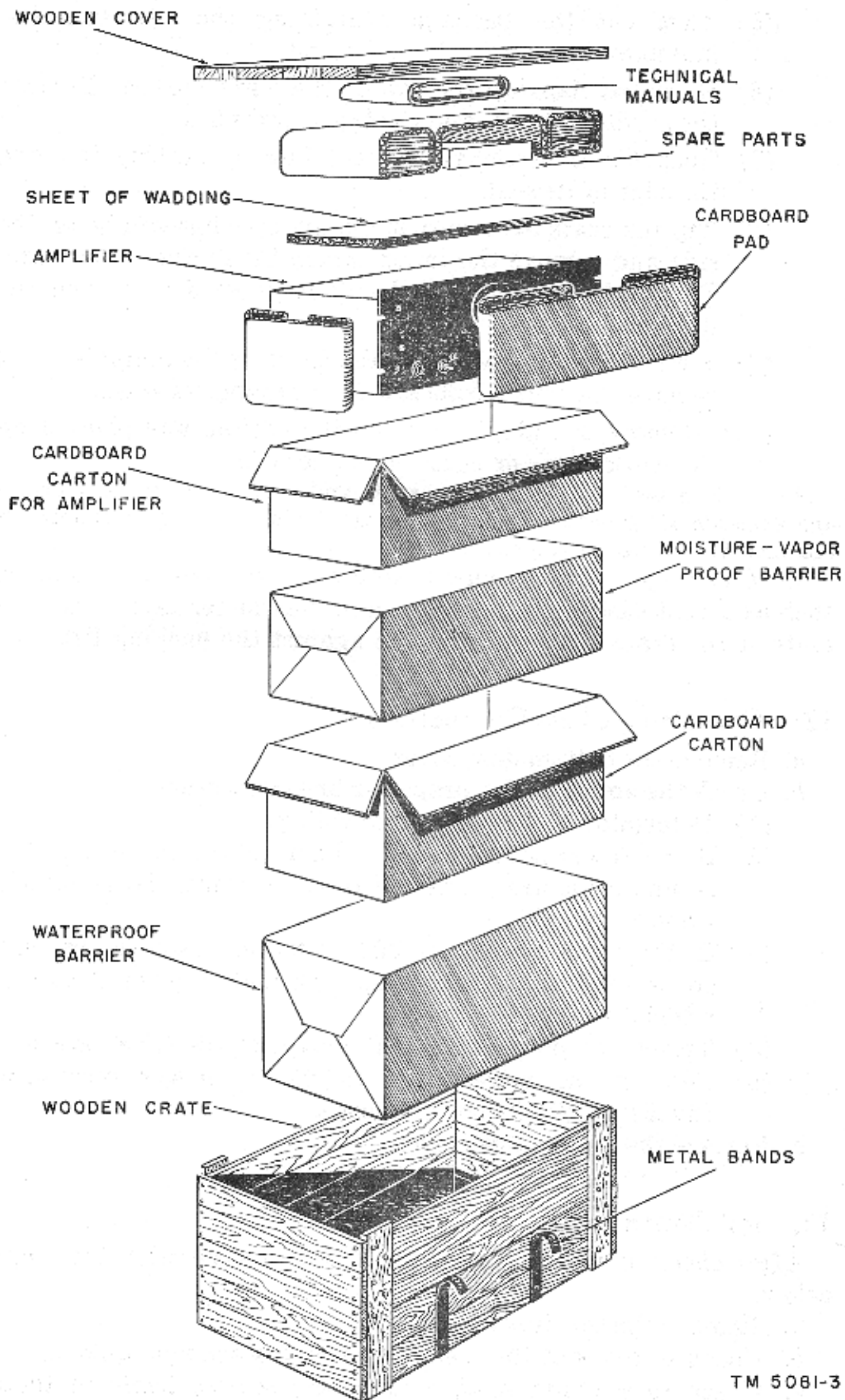
Note. For used or reconditioned equipment, refer to paragraph 15.

a. *General.* The amplifier may be shipped in oversea packing cases (fig. 3) or in domestic packing cases. When new equipment is received, select a location where the amplifier may be unpacked without exposure to the elements; a location that is as near as possible to the permanent or semipermanent installation of the equipment.

Caution: Be careful when uncrating, unpacking, and handling the amplifier; it is damaged easily. If it becomes damaged or exposed, a complete overhaul might be required or the equipment might be rendered useless.

b. *Step-by-step Instructions for Uncrating and Unpacking Export Shipments* (fig. 3).

- (1) Place the packing case as near to the operating position as is convenient.
- (2) Cut and fold back the metal bands.
- (3) Remove the nails with a nail puller. Remove the top of the packing case. Do not attempt to pry off the top; the equipment may be damaged.
- (4) Slit open the waterproof barrier containing the outer carton.



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Figure 3. Audio Frequency Amplifier AM-864/U, packaging diagram.

- (5) Take out the package containing the two technical manuals.
- (6) Open the flaps on the top of the outer carton. Remove the cardboard cells and the spare parts box.
- (7) Open the moisture-vaporproof bag by slitting it along the edge of its seal.
- (8) Tip the crate over so that the top opening will be on the side and remove the inner carton by sliding it outward. Turn this carton with the flaps upward and open the flaps.
- (9) Remove the padding from the cover of the amplifier, and remove the four cardboard cells around its sides.
- (10) Remove the amplifier from the carton, and place it on the work bench or near its final location.

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

c. Checking. Always check equipment for possible damage, such as a bent case, loose knobs, or a broken meter face. The contents of the crate should be checked against the packing list.

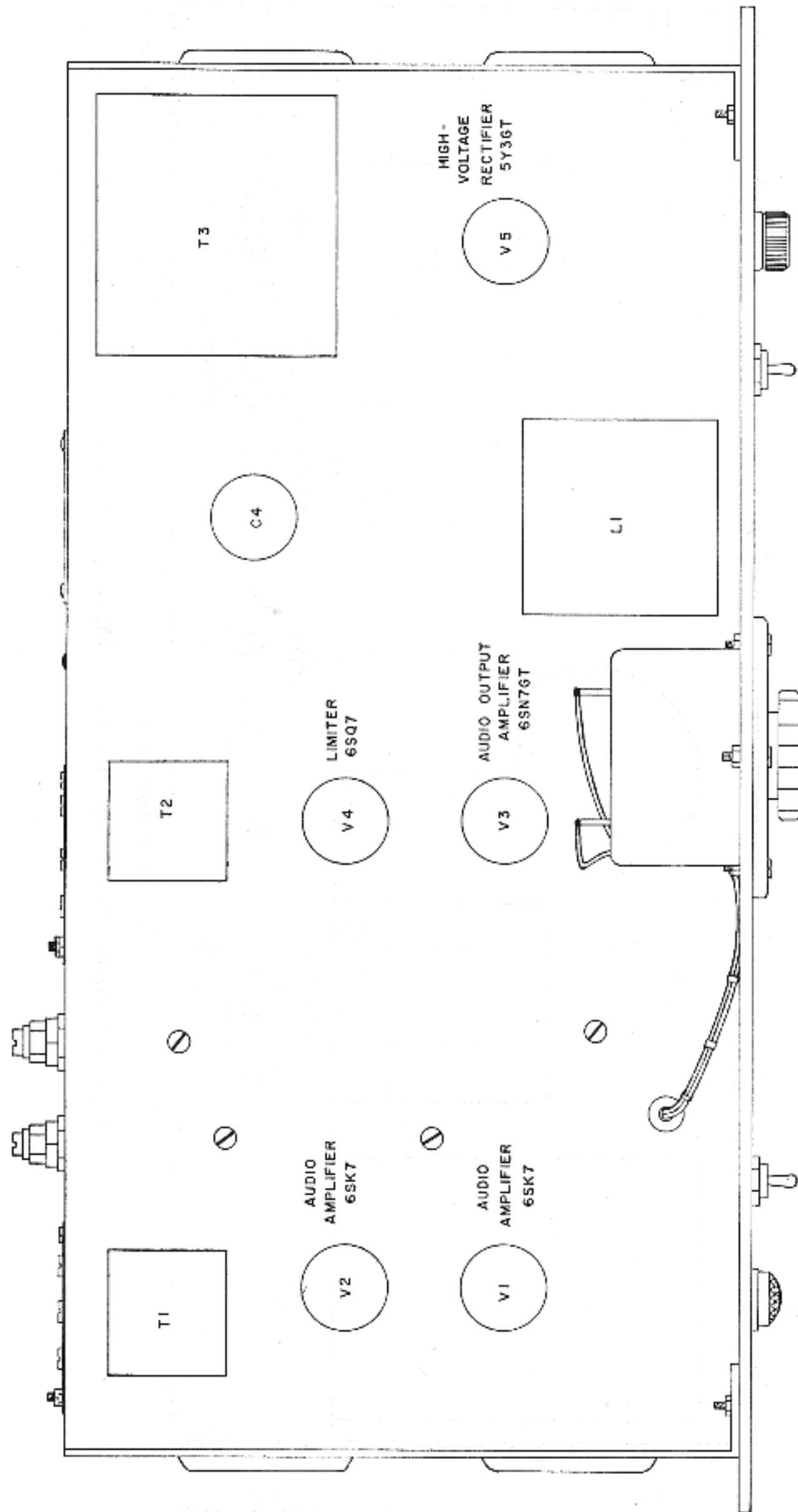
12. Checking Ac Line Connections

- a.* Remove the bottom dust cover.
- b.* Check the amplifier for proper ac line connection.
 - (1) Determine the power source voltage.
 - (2) If the power source is 115 volts ac, check to see that the ac line leads are connected to transformer T3 terminals 1 and 2 (fig. 17).
 - (3) If the power source is 220 volts ac, unsolder the lead on terminal 2 of transformer T3 and resolder it to terminal 3 (fig. 17).
 - (4) Throw the power ON-OFF switch to the OFF position.
 - (5) Connect the power cord to the ac power receptacle (fig. 5) and to the power source.
- c.* Replace the bottom dust cover.

13. Installation

After checking the ac line connections, proceed with the steps below.

- a.* Remove the top dust cover.
- b.* Check to see that the meter connections are not broken.
- c.* Check to see that all five tubes are seated firmly in their proper sockets (fig. 4).
- d.* Replace the top dust cover.



TM 5081-4

Figures 4. Audio Frequency Amplifier AM-864/U, tube location.

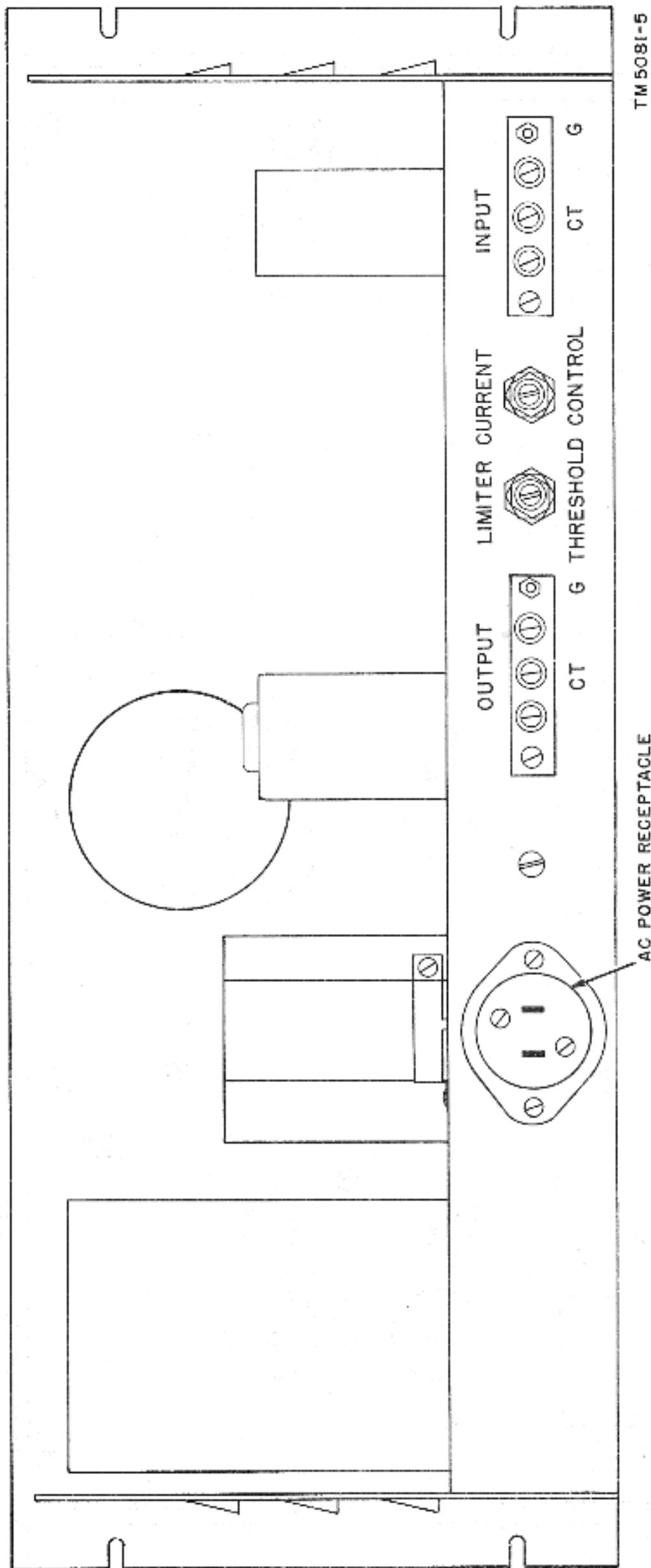


Figure 5. Audio Frequency Amplifier AM-864/U, rear view.

e. Mount the amplifier in the rack using four front panel retaining screws.

f. Check FUSE F1 (fig. 6) for proper value (1 ampere).

Caution: To avoid serious damage to the amplifier, do not use any fuse rated above that specified.

14. Audio Input and Output Connections

(fig. 5)

Caution: Before making connections, be sure to throw the power ON-OFF switch to the OFF position.

a. *Determining the Type of Line.* The 600-ohm INPUT and OUTPUT terminals, located on the back of the amplifier, may be connected to either balanced or unbalanced lines. In order to determine which type of line will be used, the following procedure will be helpful:

- (1) Determine what type of equipment precedes the amplifier. For example, refer to figure 2. Find out what type of line amplifier precedes the limiting amplifier in the system.
- (2) Check the technical manual assigned to the piece of equipment to see whether balanced or unbalanced line connections are specified.
- (3) Determine what type of equipment follows the amplifier. For example, if a transmitter follows the limiting amplifier, as shown in figure 2, find out what type of transmitter it is.
- (4) Check the technical manual as in step 2 above.

b. *Balanced Line.* A balanced line is a two-conductor cable in which the pair of leads may, or may not, be twisted. It is covered by a metallic shield. To connect a balanced line to the INPUT or OUTPUT terminals, connect the center tap (marked CT) to the grounding post (marked G) on the amplifier. Connect the shielded twisted-pair leads to the terminals on either side of the center tap. Connect the shield of the cable used to the grounding post.

c. *Unbalanced Line.* An unbalanced line is almost always one of the following:

- (1) A single conductor cable covered by a metallic shield.
- (2) A two-conductor cable covered by a metallic shield in which one of the two conductors is soldered or otherwise connected to the metallic shield for a ground connection.
- (3) A two-conductor cable covered by a metallic shield in which the two conductors are soldered or otherwise connected together.

To connect an unbalanced line to the INPUT or OUTPUT terminals, connect one of the terminals on either side of the center

tap to the grounding post. Connect the grounded side of the line to the grounding post. Connect the high side of the line to the ungrounded terminal of the other side of the center tap.

15. Service Upon Receipt of Used or Reconditioned Equipment.

a. Follow the instructions in paragraph 11 for uncrating, unpacking, and checking Audio Frequency Amplifier AM-864/U.

b. Check the used or reconditioned equipment for tags or other indications pertaining to changes in the wiring of the equipment. If any changes in wiring have been made, note the changes in this manual, preferably on the schematic diagram (fig. 23).

c. Check the attenuation control for ease of rotation.

d. Perform the installation and connection procedures given in paragraphs 12, 13, and 14.

Section II. OPERATION UNDER USUAL CONDITIONS

16. Controls and Instruments

(figs. 5 and 6)

The following table lists the controls, meter, and terminations of Audio Frequency Amplifier AM-864/U and gives their functions.

Control	Function
Power OFF-ON switch (SW1)---	In ON position, connects the amplifier to ac power source.
Attenuation control (R5) -----	Adjusts input level of amplifier.
Meter transfer ATT-OUT switch (SW2) and meter (M1).	In the ATT position of SW2, the meter reads the amount of attenuation. In the OUT position of SW2, the meter reads the output level of the amplifier.
Pilot light (I 1) -----	Lights when the power switch is ON and line voltage is applied to the power transformer.
FUSE (F1) -----	Protects power transformer.
CURRENT CONTROL (R8)-----	Determines the input level at which limiting will take place.
LIMITER THRESHOLD control (R10).	Determines the degree of limiting action.
INPUT terminal board (TB1)---	Provides connections for either balanced or unbalanced input.
OUTPUT terminal board (TB2)---	Provides connections for either balanced or unbalanced output.
Ac receptacle (P-1) -----	Provides connection between amplifier and primary power source.

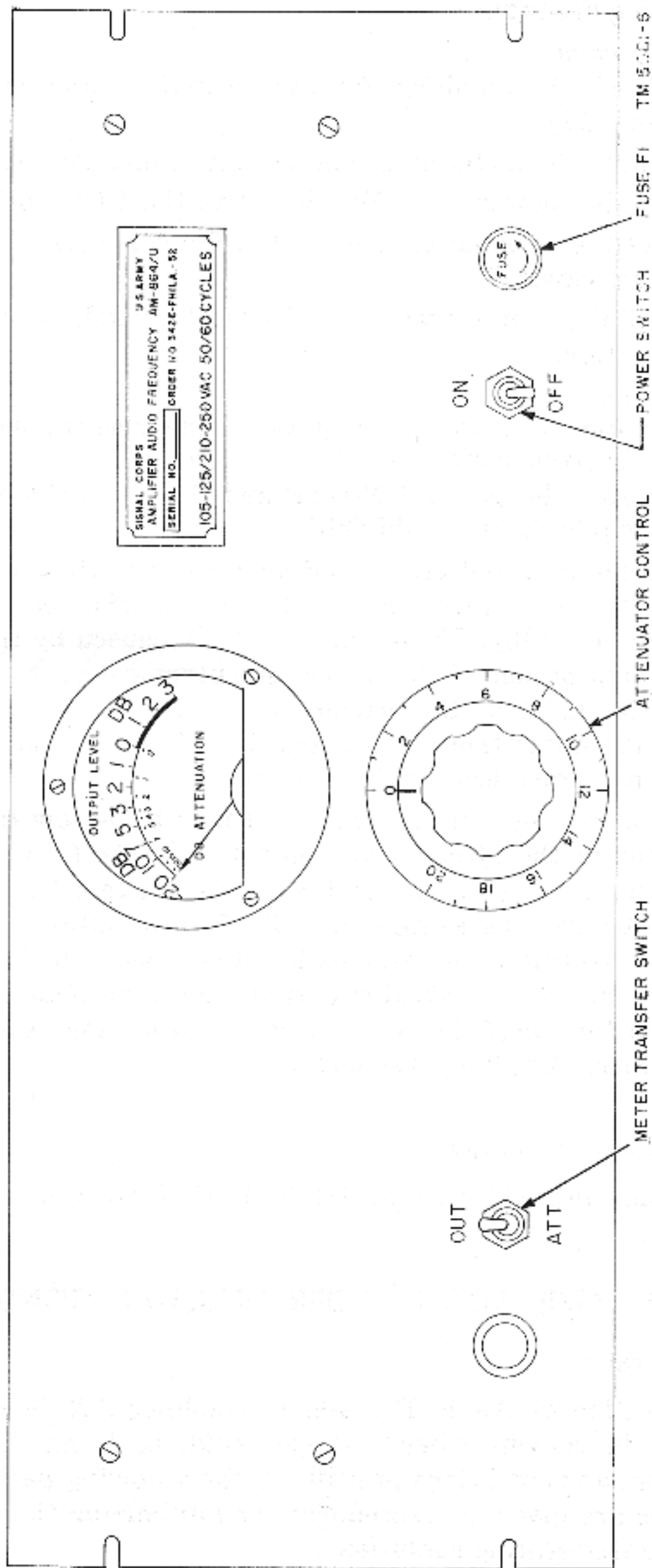


Figure 6. Audio Frequency Amplifier AM-864/U, front panel.

17. Starting Procedure*a. Preliminary.*

- (1) Check the amplifier for the desired ac line connection (par. 12).
- (2) Check the audio input and output connections (par. 14).
- (3) Set the power ON-OFF switch to the OFF position.
- (4) Set the attenuation control (on front panel) fully counterclockwise.
- (5) Set the meter transfer ATT-OUT switch to the OUT position.

b. Starting.

Note. If an abnormal result is obtained while performing the steps below, refer to the equipment performance check list (par. 34).

- (1) Throw the power ON-OFF switch to the ON position. The pilot lamp should light.
- (2) Apply an input signal and advance the attenuation control slowly until the average meter M1 reading is 0 decibels (db). Variations of ± 1 db, caused by the monitoring action of the meter, are permissible. No further adjustment of the attenuation control should be necessary unless there is a marked variation in the average input signal level to the amplifier.
- (3) The average input signal level may be so low that even though the attenuation control is in its fully counterclockwise position, it will be impossible to get an average meter reading as high as 0 db. This situation will occur for average input signals less than .034 volt (-35 db). In this case, a greater output should be obtained from the line amplifier stage (fig. 2) preceding Audio Frequency Amplifier AM-864/U.

18. Stopping Procedure

Throw the power ON-OFF switch to the OFF position.

Section III. OPERATION UNDER UNUSUAL CONDITIONS**19. General**

The operation of Audio Frequency Amplifier AM-864/U may be difficult in regions where extreme cold, heat, humidity and moisture, or sand conditions prevail. In the following paragraphs, instructions are given on procedures for minimizing the effect of these unusual operating conditions.

20. Operation in Arctic Climates

Subzero temperatures and climatic conditions associated with cold weather affect the efficient operation of the equipment. Instructions and precautions for operation under such adverse conditions follow:

- a. Handle the equipment carefully.
- b. Keep the equipment warm and dry.
- c. When this equipment has been exposed to the cold and is brought into a warm room, it will sweat until it reaches room temperature. When the equipment has reached room temperature, dry it thoroughly. This condition also arises when equipment warms up during the day after exposure during a cold night.

21. Operation in Tropical Climates

When operated in tropical climates, this equipment may be installed in tents or huts. When the equipment is installed in swampy areas, moisture conditions are more acute than normal in the tropics. Ventilation is usually very poor, and high relative humidity causes condensation of moisture on the equipment whenever its temperature becomes lower than the ambient air. To minimize this condition, place lighted electric bulbs under the equipment.

22. Operation in Desert Climates

a. Because of the extremely low humidity encountered in desert regions, the measures specified for minimizing condensation in tropical climates are omitted where desert climates are concerned. Otherwise, use the same procedure as that specified for tropical climates (par. 21).

b. The main problem that arises with equipment operation in desert areas is the large amount of sand, dust, and dirt which enters the parts of the equipment. The ideal preventive precaution is to house the equipment in a dustproof shelter. Since, however, such a building is seldom available and would require air conditioning, the next best precaution is to make the building in which the equipment is located as dustproof as possible with available materials. Hang wet sacking over the windows and doors, cover the inside walls with heavy paper, and secure the side walls of the tents with sand to prevent their flapping in the wind.

c. Never tie power cords, signal cords, or other wiring connections to either the inside or outside of tents. Desert areas are subject to sudden wind squalls which may jerk the connections loose or break the lines.

d. Be careful to keep the equipment as free from dust as possible. Make frequent preventive maintenance checks (ch. 3).

CHAPTER 3

ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

Section I. PREVENTIVE MAINTENANCE SERVICES

23. Tools and Materials Used with Audio Frequency Amplifier AM-864/U

Tools and materials used with but not supplied with the amplifier are listed in *a* and *b* below. No special tools are issued with the amplifier. The tools and materials contained in Tool Equipment TE-41 are listed in Department of the Army Supply Manual SIG 6-TE-41.

a. Tools.

Tool Equipment TE-41.

b. Materials.

*Carbon tetrachloride.

*Cheesecloth, bleached, lint-free.

*Paper, sand, flint No. 000.

Solvent, Dry Cleaning (SD) (Fed spec No. P-S-66-a).

24. Definition of Preventive Maintenance

Preventive maintenance is 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 troubles from occurring. Refer to AR 750-5, Maintenance Responsibilities and Shop Operation.

25. General Preventive Maintenance Techniques

a. Use No. 000 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 (SD); then wipe the parts dry with a cloth.

(2) Clean electrical contacts with a cloth moistened with carbon tetrachloride; then wipe them dry with a dry cloth.

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

* Part of Tool Equipment TE-41.

OPERATOR FIRST ECHELON MAINTENANCE CHECK LIST FOR SIGNAL CORPS EQUIPMENT									
RADIO COMMUNICATION, DIRECTION FINDING, CARRIER, RADAR									
EQUIPMENT NOMENCLATURE					EQUIPMENT SERIAL NO.				
INSTRUCTIONS: See other side									
LEGEND FOR MARKING CONDITIONS: ✓ Satisfactory; ✗ Adjustment, repair or replacement required; ⊕ Defect corrected.									
NOTE: Strike out items not applicable.									
DAILY									
NO.	ITEM	CONDITION							
		S	M	T	N	T	P	S	
1	COMPETENCE AND GENERAL CONDITION OF EQUIPMENT (operator, transmitter, receiving cases, wire and cable, microphones, tubes, space parts, technical manuals and accessories). PAR. 27c								
2	LOCATION AND INSTALLATION SUITABLE FOR NORMAL OPERATION. PAR. 27d								
3	CLEAR DIRT AND MOISTURE FROM ANTENNA, MICROPHONE, HEADSETS, INSERTS, KEYS, JACKS, PLUGS, TELEPHONES, CARBINE GAGE, COMPASS PARTS. PAR. 27c								
4	INSPECT SETTING OF READILY ACCESSIBLE "PUSH-IN" ITEMS: TUBES, LAMPS, CRYSTALS, FUSES, CONNECTORS, VIBRATORS, PLUG-IN COILS AND RESISTORS. PAR. 28d								
5	INSPECT CONTROLS FOR BINDING, SCRAPPING, EXCESSIVE LOOSENESS, WORN OR CRIPPED GEARS, MISALIGNMENT, POSITIVE ACTION. PAR. 27c								
6	CHECK FOR NORMAL OPERATION. PAR. 27d								
WEEKLY									
NO.	ITEM	CLASS.	NO.	ITEM	CLASS.				
1	CLEAN AND TIGHTEN EXTERIOR OF COMPONENTS AND CASES, TACK NUTS, SPOCK MOUNTS, ANTENNA MOUNTS, COAXIAL TRANSMISSION LINES, WAVE GUIDES, AND CRABLE CONNECTIONS. PAR. 27f	13	13	INSPECT STORAGE BATTERIES FOR DIRT, LOOSE TERMINALS, FULFILLMENT LEVEL AND SPECIFIC GRAVITY, AND DAMAGED CASES.	13				
2	INSPECT CASES, MOUNTINGS, ANTENNAS, TOWERS, AND EXPOSED METAL SURFACES, FOR RUST, CORROSION, AND MOISTURE. PAR. 27g	14	14	CLEAN AIR FILTERS, BRASS NAME PLATES, DIAL AND METER WINDOWS, JEWEL ASSEMBLIES. PAR. 27k	14				
3	INSPECT COILS, CABLES, WIRES, AND SPOCK MOUNTS FOR CUTS, BREAKS, FRAYING, DETRIORATION, KINKS, AND STRAINS. PAR. 27d	15	15	INSPECT METERS FOR CRACKED GLASS AND CASES. PAR. 27j	15				
4	INSPECT ANTENNAS FOR EFFICIENCIES, CORROSION, LOOSE FIT, DAMAGED INSULATORS AND REFLECTORS.	16	16	INSPECT SHIELDS AND COVERS FOR ABSENCE OF WEATHER-PROOFING.					
5	INSPECT CANVAS ITEMS, LEATHERS, AND CRAWLING FOR WEAR, TEARS, AND FRAYING. PAR. 27i	17	17	CHECK ANTENNA GUY WIRES FOR LOOSENESS AND PROPER TENSION.					
6	INSPECT FOR LOOSENESS OF ACCESSIBLE ITEMS: SWITCHES, FUSES, JACKS, CONNECTORS, ELECTRICAL TRANSDUCERS, POWER-SEATS, PLUGS, FEELERS, MOTORS, RELAYS, CAPACITORS, SCHEMATICS, AND PILOT LIGHT ASSEMBLIES. PAR. 27j	18	18	CHECK TERMINAL BOX COVERS FOR CRACKS, LEAKS, DAMAGED GASKETS, DIRT AND GREASE.					
7	IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION. PAR. 27m								

DA FORM 11-238

REPLACES DA AGO FORM 139, 1 DEC 59, WHICH IS OBSOLETE.

TM 5081-7

Figure 7. DA Form 11-238.

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

d. For further information on preventive maintenance techniques, refer to TB SIG 178, Preventive Maintenance Guide for Radio Communication Equipment.

26. Use of Preventive Maintenance Forms

(figs. 7 and 8)

a. The decision as to which items on DA Forms 11-238 and

SECOND AND THIRD ECHELON MAINTENANCE CHECK LIST FOR SIGNAL CORPS EQUIPMENT				
RADIO COMMUNICATION, DIRECTION FINDING, CARRIER, RADAR				
<i>INSTRUCTIONS: See other side</i>				
EQUIPMENT NOMENCLATURE		EQUIPMENT SERIAL NO.		
LEGEND FOR MARKING CONDITIONS: ✓ Satisfactory; ✕ Adjustment, repair or replacement required; ⊕ Defect corrected. NOTE: Strike out items not applicable.				
NO.	ITEM	COND.	ITEM	COND.
1	COMPLETENESS AND GENERAL CONDITION OF EQUIPMENT (receiver, transmitter, carrying cases, wire and cable, microphones, tubes, spare parts, technical manuals and accessories). PAR. 27 a	27	ELECTRON TUBES - INSPECT FOR LOOSE ENVELOPES, CAP CONNECTIONS, CHOKED SOCKETS; INSUFFICIENT SOCKET SPRING TENSION; CLEAN DUST AND DIRT CAREFULLY; CHECK EMISSION OF RECEIVER TUBE TUBES. PAR. 28 a	
2	LOCATION AND INSTALLATION SUITABLE FOR NORMAL OPERATION. PAR. 27 b	28	INSPECT FILM OUTLETS FOR LOOSE PARTS, DIRT, MISALIGNMENT AND CORROSION.	
3	CLEAN DIRT AND MOISTURE FROM ANTENNA, MICROPHONE, HEADSETS, CRISTSETS, KEYS, JACKS, PLUGS, TELEPHONES, CARRYING BAGS, COMPONENT PANELS. PAR. 27 c	29	INSPECT FIXED CAPACITORS FOR LEAKS, BUBBLES, AND DISCOLORATION. PAR. 28 c	
4	INSPECT SEATING OF READILY ACCESSIBLE "PUSH-OUT" ITEMS: TUBES, LAMPS, CRYSTALS, PLUGS, CONNECTORS, VIBRATORS, PLUG-IN COILS AND RESISTORS. PAR. 28 b	30	INSPECT RELAY AND CIRCUIT BREAKER ASSEMBLIES FOR LOOSE MOUNTINGS; BURNED, PITTED, CORRODED CONTACTS; MISALIGNMENT OF CONTACTS AND SPRINGS; INSUFFICIENT SPRING TENSION; BINDING OF PLUNGERS AND HINGE PARTS.	
5	INSPECT CONTROLS FOR BINDING, SCRAPING, EXCESSIVE LOOSENESS, WORK OR CHIPPED GEARS, MISALIGNMENT, POSITIVE ACTION. PAR. 27 d	31	INSPECT VARIABLE CAPACITORS FOR DIRT, MOISTURE, MISALIGNMENT OF PLATES, AND LOOSE MOUNTINGS.	
6	CHECK FOR NORMAL OPERATION. PAR. 27 e	32	INSPECT RESISTORS, BUSHINGS, AND INSULATORS, FOR CRACKS, CHIPPING, DISINTEGRATING, DISCOLORATION AND MOISTURE. PAR. 28 d	
7	CLEAN AND TIGHTEN EXTERIOR OF COMPONENTS AND CASES, RACK MOUNTS, SHOCK MOUNTS, ANTENNA MOUNTS, COAXIAL TRANSMISSION LINES, WAVE GUIDES, AND CABLE CONNECTIONS. PAR. 27 f	33	INSPECT TERMINALS OF LARGE FIXED CAPACITORS AND RESISTORS FOR CORROSION, DIRT AND LOOSE CONTACTS. PAR. 28 e	
8	INSPECT CASES, MOUNTINGS, ANTENNAS, TOWERS, AND EXPOSED METAL SURFACES, FOR RUST, CORROSION, AND MOISTURE. PAR. 27 g	34	CLEAN AND TIGHTEN SWITCHES, TERMINAL BLOCKS, BURNERS, RELAY CASES, AND INTERIORS OF CHASSIS AND CABINETS NOT READILY ACCESSIBLE. PAR. 28 f	
9	INSPECT CORD, GAIT, WIRE, AND CORD MOUNTS FOR KNOTS, BREAKS, FRAYING, DETERIORATION, KINKS, AND STRAIN. PAR. 27 h	35	INSPECT TERMINAL BLOCKS FOR LOOSE CONNECTIONS, CRACKS AND BREAKS. PAR. 28 g	
10	INSPECT ANTENNA FOR ECCENTRICITIES, CORROSION, LOOSE FIT, DAMAGED INSULATORS AND REFLECTORS.	36	CHECK SETTINGS OF ADJUSTABLE RELAYS.	
11	INSPECT CARRYING ITEMS, LEATHER, AND CABLEING FOR WILDER, TEARS, AND FRAYING. PAR. 27 i	37	LIBRICATE EQUIPMENT IN ACCORDANCE WITH APPLICABLE DEPARTMENT OF THE ARMY LIBRICATION ORDER.	
12	INSPECT FOR LOOSENESS OF ACCESSIBLE ITEMS: SWITCHES, KNAPS, JACKS, CONNECTORS, ELECTRICAL TRANSFORMERS, POTENTIOMETERS, RELAYS, BUSHINGS, MOTORS, VIBRATORS, CAPACITORS, GENERATORS, AND FIELD LIGHT ASSEMBLIES. PAR. 27 j	38	INSPECT GENERATORS, AMPLIFIERS, DYNAMOTORS, FOR BRUSH WEAR, SPRING TENSION, ARCING, AND FITTING OF COMMUTATOR.	
13	INSPECT STORAGE BATTERIES FOR DIRT, LOOSE TERMINALS, ELECTROLYTE LEVEL AND SPECIFIC GRAVITY, AND DAMAGED CASES.	39	CLEAN AND TIGHTEN CONNECTIONS AND MOUNTINGS FOR TRANSFORMERS, CHOKES, POTENTIOMETERS, AND RHEOSTATS. PAR. 28 h	
14	CLEAN AIR FILTERS, BRASS NAME PLATES, DIAL AND METER WINDOW, JEWEL ASSEMBLIES. PAR. 27 k	40	INSPECT TRANSFORMERS, CHOKES, POTENTIOMETERS, AND RHEOSTATS FOR OVERHEATING AND OIL-LEAKAGE. PAR. 28 i	
15	INSPECT METERS FOR DAMAGED GLASS AND CASES. PAR. 27 l	41	BEFORE SHIPPING OR STORING - REMOVE BATTERIES.	
16	INSPECT SHELTERS AND COVERS FOR ADEQUACY OF WEATHERPROOFING.	42	INSPECT CATHODE RAY TUBES FOR BURST SCREEN SPOTS.	
17	CHECK ANTENNA GUY WIRES FOR LOOSENESS AND PROPER TENSION.	43	INSPECT BATTERIES FOR SHORTS AND DEAD CELLS.	
18	CHECK TERMINAL BOX COVERS FOR CRACKS, LEAKS, DAMAGED BASKETS, DIRT AND GRITAGE.	44	INSPECT FOR LEAKING WATERPROOF BAGS, WORK OR LOOSE PARTS, MOISTURE AND FUNGUSPROOF. PAR. 28 j	
19	IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION. PAR. 26 k			

DA FORM 11-239

REPLACES DA FORM 419, 1 OCT 50, WHICH IS OBSOLETE.

14-48700-1

TM 5061-8

Figure 8. DA Form 11-239.

11-239 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 7 and 8 are partially or totally applicable to the equipment. References in the ITEM block refer to paragraphs in text which contain additional maintenance information.

27. Performing Exterior Preventive Maintenance

Caution: Tighten screws and nuts carefully. Fittings tightened beyond the pressure for which they are designed will be damaged or broken.

a. Check for completeness and satisfactory condition of the amplifier.

b. Check suitability of location and installation for normal operation.

c. Clean dirt and moisture from the amplifier.

d. Inspect panel controls for binding, scraping, excessive looseness, and positive action.

e. Check for normal operation.

Caution: Disconnect power before performing the following operations. Upon completion, reconnect power and check for satisfactory operation.

f. Clean and tighten the panel mountings on the amplifier.

g. Inspect exposed metal surfaces for rust, corrosion, and moisture.

h. Inspect power and audio cables for cuts, breaks, fraying, deterioration, and strain.

i. Inspect manuals for general condition.

j. Inspect switches and knob for looseness.

k. Clean nameplate, dial, meter window, and jewel assembly.

l. Inspect meter for damaged glass and case.

m. If deficiencies noted are not corrected during inspection, indicate action that must be taken to correct them.

28. Performing Interior Preventive Maintenance

Caution: Disconnect power before performing the following operations. Upon completion, reconnect power and check for satisfactory operation.

a. Inspect electron tubes for loose envelopes, cracked sockets, and insufficient socket spring tension. Carefully clean dust and dirt from tubes; check tubes.

- b. Inspect seating of FUSE F1, pilot light, tubes, and cable connections.
- c. Inspect fixed capacitors for leaks, bulges, and discoloration.
- d. Inspect resistors for cracks, blistering, and discoloration.
- e. Inspect terminals of fixed capacitors and resistors for corrosion, dirt, and loose contacts.
- f. Clean and tighten switches, terminal boards, and interior of chassis and cabinet.
- g. Inspect terminal boards for loose connections, cracks, and breaks.
- h. Clean and tighten transformers, choke, and potentiometers.
- i. Inspect transformers, choke, and potentiometers for overheating and leakage.
- j. Check adequacy of moistureproofing and fungiproofing.
- k. If deficiencies noted are not corrected during inspection, indicate action that should be taken to correct them.

Section II. WEATHERPROOFING AND LUBRICATION

29. Weatherproofing and Lubrication

a. *General.* Signal Corps equipment, when operated under severe climatic conditions such as prevail in tropical, 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. The moistureproofing and fungiproofing treatment is necessary only when parts are replaced or repaired, since the equipment is given this treatment at the factory.

c. *Winter Maintenance.* Special precautions necessary to prevent poor performance or total operational failure of equipment in extremely low temperature are explained in TB SIG 66, Winter Maintenance of Signal Equipment, and TB SIG 219, Operation of Signal Equipment at Low Temperature.

d. *Desert Maintenance.* Special precautions 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 the amplifier.

30. 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 No. 00 or No. 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 shorting 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 soften 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

31. General

a. The troubleshooting and repair work that can be performed at the organizational maintenance level (operators and repairmen) is necessarily limited in scope by the tools, test equipment, and replaceable parts issued, and by the existing tactical situation. Accordingly, troubleshooting is based on the performance of the equipment and the use of the senses in determining such trouble as burned-out fuses, tubes, resistors, etc.

b. The following paragraphs help in determining which of the stages is at fault and in localizing the fault to the item involved in that stage, such as a fuse, tube, or resistor.

32. Visual Inspection

a. Failure of this amplifier to operate properly usually will be caused by one or more of the following faults:

- (1) Worn, broken, or disconnected power cord or plug.
- (2) Poor connections at input or output terminals.
- (3) Burned out FUSE F1.
- (4) Defective tubes.
- (5) Defective resistors and capacitors.
- (6) Wires broken from excessive vibration.

b. When a failure is encountered and the cause is not immediately apparent, check as many of the above items as is practicable before starting a detailed examination of the component parts of the amplifier. If possible, obtain information from the operator of the equipment regarding its performance at the time the trouble occurred.

c. Check any item having an abnormal color that may have been caused by overheating or corrosion.

33. Troubleshooting by Using Equipment Performance Checklist

a. *General.* The equipment performance checklist (par. 34) will help the operator locate trouble in the equipment. This list gives the item to be checked, conditions under which the item is checked, the normal indications of correct operation, and the corrective measures the operator may take. *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 under which the item is to be checked. For other items, it represents an action that must be taken to check the normal indication 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 checks the items. If the indications are not normal, the operator should apply recommended corrective measures.

d. *Corrective Measures.* The corrective measures listed are those the operator can make without turning in the equipment for repairs. A paragraph reference in the chart indicates that the trouble cannot be corrected during operation and that troubleshooting by an experienced repairman is necessary. If the amplifier is completely inoperative or if the recommended corrective measures do not yield results, troubleshooting is necessary. However, if the tactical situation requires that the set be maintained and if the set is not completely inoperative, the operator must maintain the set in operation as long as it is possible to do so.

34. Equipment Performance Checklist

Item No.	Item	Action or condition	Normal indication	Corrective measures
1	Power transformer T3 and power cable.	Connected for 115-or 220-volt ac operation.		Connect according to instructions given in paragraph 13. Connect according to instructions given in paragraph 14.
2	Audio input and output cables	Connected properly and securely.		
3	Power ON-OFF switch (SW1).	Set at OFF		
4	Attenuation control (R5).	Fully counterclockwise		
5	Meter transfer ATT-OUT switch (SW2).	Set at ATT		
6	Power ON-OFF switch (SW1).	Throw to ON	Pilot lamp lights.	Check power source. Check FUSE F1 (1 ampere). Check pilot lamp. Refer to paragraph 49, Symptom 1. Check tubes V1, V2, V4, and V5. Refer to paragraphs 17b (3) and 49, Symptom 2.
7	Attenuation control (R5).	Apply signal to the amplifier INPUT terminals.	Variation of attenuation control should make panel meter M1 indicate 0 db.	Refer to paragraph 49, Symptoms 3 and 4. Check tubes V3 and 4.
8	Meter transfer ATT-OUT switch (SW2).	Rotate slowly in a clockwise direction until meter M1 reads -2.5 db on lower scale. Set to OUT Vary input signal from .034 volt to .106 volt (-35 db to -25 db).	Meter M1 indicates -2.5 db on lower scale. Meter indicates 0 db ±1 db. Meter reading will not vary more than 1 db.	
9	Power ON-OFF switch (SW1).	Throw to OFF	Pilot lamp goes out.	Refer to paragraph 49, Symptom 1.

CHAPTER 4

THEORY

Section I. THEORY OF PEAK-LIMITING AMPLIFIERS

35. Program Level

a. The program level determines the percentage modulation of am. signals and the frequency deviation of fm signals. As the program level is increased, percentage modulation (or frequency deviation) is increased and intelligible signals can be received at greater distances. The greatest intelligible range is achieved when 100-percent modulation (or maximum permissible deviation) is employed. When 100-percent modulation is exceeded, distortion and adjacent channel interference result.

b. It is impractical and undesirable to attempt an average modulation level of 100 percent. Aside from the practical difficulties of such an effort, the resulting intelligence would be considerably distorted. In a musical program, for example, the low-level (softer) passages would sound as loud as the high-level (louder) passages. The problem, then, is to obtain as high an average level of modulation as is practical without causing overmodulation and excessive distortion. The speech amplifier is the means of achieving this end.

c. Through the use of a speech amplifier, the original program material is amplified before it is supplied to the modulator. The permissible amplification is limited, however, by the highest signal level present in the original program. Since various portions of the original program may differ greatly in level, it is evident that when the highest level of signal causes 100-percent modulation, the average percentage of modulation still may be low, and some signals may be too low to result in intelligible signals over an appreciable distance.

36. Function of Peak-Limiting Amplifiers

a. General. The function of a peak-limiting amplifier is to obtain maximum average program level without overmodulation. This is accomplished by automatically reducing the gain quickly when the amplified signal exceeds a certain predetermined level and then restoring the gain slowly after the signal decreases below this level. Time constants are placed in the amplifier to determine the time required for reducing the amplifier gain (or attack time) and the time required for restoring the gain (or recovery time). For all signal amplitudes below the predetermined level, the auto-

matically controlled gain is constant. For signal amplitudes above this level, the gain reduction is a function of the peak signal level.

b. Attack Time. The attack time is the minimum time required for the reduction of gain to occur when a high level input signal is applied to the amplifier. The time must be short enough to follow the variations in signal level, but not so short as to follow the variations of the lower frequencies of the program material.

c. Recovery Time. The recovery time is the time required for the gain to return to normal. The time should be long enough to prevent the gain from fluctuating at low audio frequencies. It must be short enough so that no noticeable background noise occurs as the normal gain is restored during a silent period following a high peak signal, but not so short that the restoration of normal gain is noticeable to the listener.

37. Gain Characteristics

A discussion of the gain characteristics illustrates how the peak-limiting amplifier solves the problems discussed in paragraph 36.

a. The load characteristic for a typical peak-limiting amplifier is shown in curve No. 1 of figure 9. The measure of the power ratio in decibels is referred to 6 milliwatts (mw).

b. Assume that the output level at the threshold (point A) will cause the transmitted wave to be modulated at approximately 80 percent and that the output level at point B will produce 100-percent modulation. Below the threshold, an increase of 10 db in the instantaneous value of the input level will cause an increase of approximately 10 db in the output level. Above the threshold, however, a 10-db increase in the input level will cause only a 1-db increase in the output level. Thus, the gain for any program signal that exceeds the threshold input is sharply reduced, and any signal that would produce overmodulation is compressed.

c. Curve No. 2 is the load characteristic of an amplifier (without the peak-limiting feature) which will give the same output at point B when the input level is the same as it was for the amplifier containing the peak-limiting feature. A comparison of curves No. 1 and No. 2 reveals that the use of the peak-limiting amplifier makes possible an approximate 5-db increase in average input level without overmodulation.

Section II. THEORY OF AUDIO FREQUENCY AMPLIFIER AM-864/U

38. Block Diagram (fig. 10)

Audio Frequency Amplifier AM-864/U is a peak-limiting ampli-

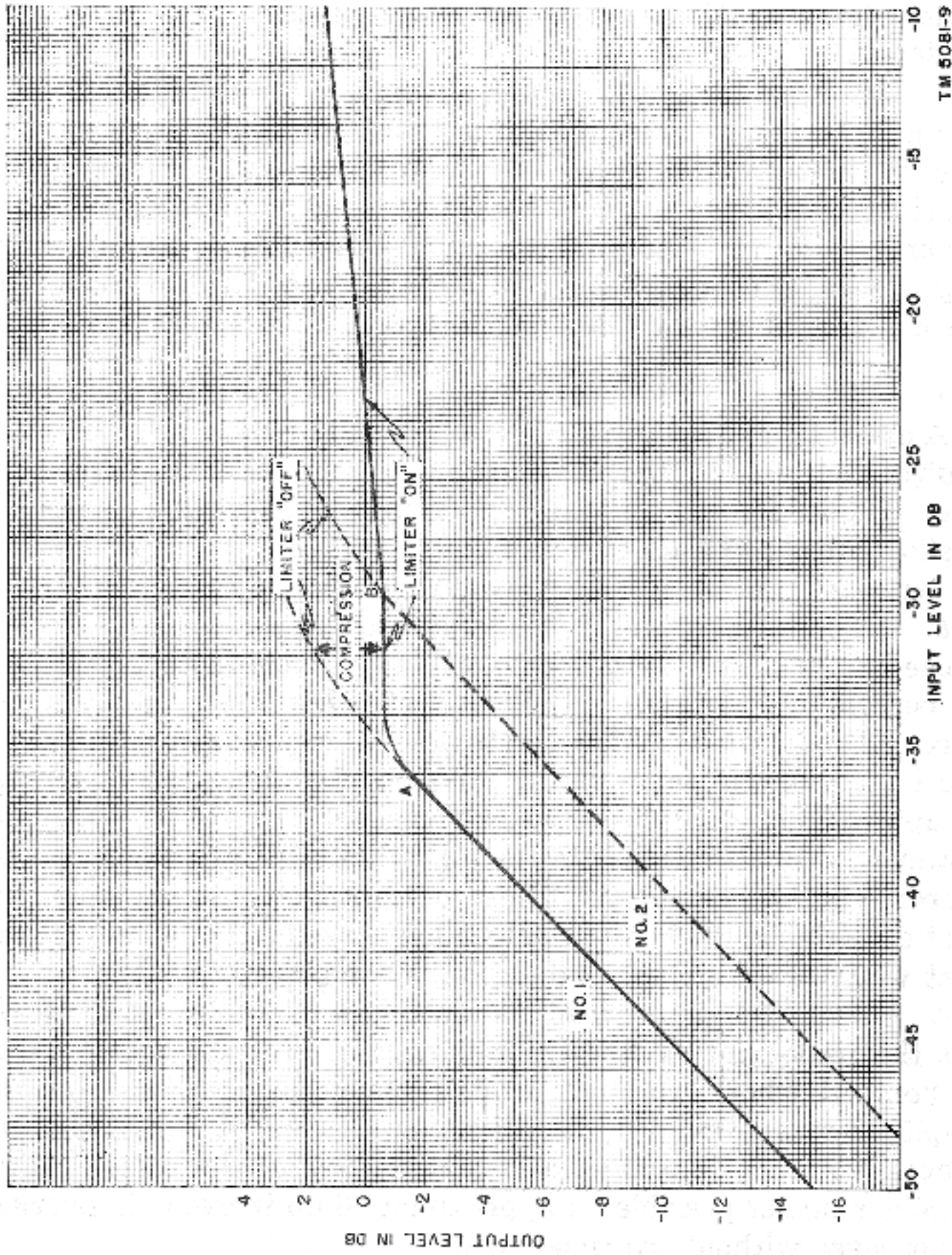


Figure 9. Pre-limiting amplifier, typical gain characteristic.

fier of the type discussed in paragraphs 35 through 37. A complete schematic diagram of the amplifier is shown in figure 23.

a. *Audio Amplifier Stage (V1 and V2).* The audio input signal is fed into this stage through the attenuation control which allows the adjustment of the input signal level. From the attenuator, the signal is fed to the control grids of push-pull audio amplifier V1 and V2.

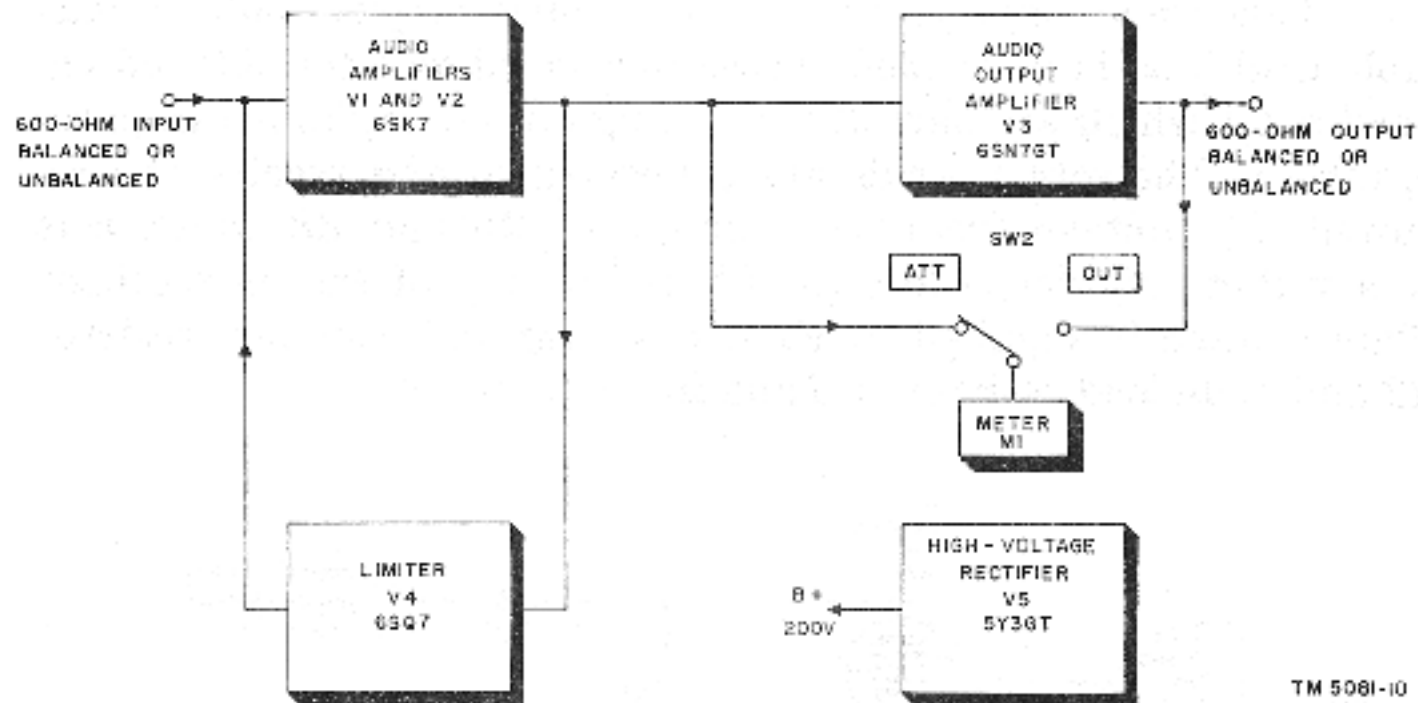


Figure 10. Audio Frequency Amplifier AM-864/U, block diagram.

b. *Audio Output Amplifier V3.* The push-pull output of the audio amplifier stage then is resistance-capacitance coupled to the control grids of push-pull stage V3.

c. *Limiter V4.* A small portion of the signal from the output of tube V2 is fed to the triode section of V4, where it is amplified. The amplified signal from the output of the triode section of tube V4 is capacitance-coupled to the self-contained diodes of V4. The rectified output voltage of the diodes varies the bias on the audio amplifier stage (V1 and V2) in accordance with the strength of the signal voltage received from the triode portion of V4. The output circuit of the diodes has a resistor-capacitor time constant to provide the proper attack and recovery times.

d. *Metering Circuit.* The metering circuit provides a means of reading the attenuation and the power output of the amplifier. By placing meter transfer switch SW2 in the OUT position, the meter indicates the power, output of the amplifier. Place the meter transfer switch in the ATT position to connect the meter to the common plate circuit of the audio amplifier stage (V1 and V2). These readings indicate the amount of attenuation.

e. *Power Supply.* The power transformer (T3) provides the necessary filament voltages for Audio Frequency Amplifier

AM-864/U by stepping down the ac line voltage. T3 also increases the line voltage for the plates of tube V5. V5 is used as the high-voltage (hv) rectifier to supply the B+ voltage required for the amplifier.

39. Audio Amplifier Stage

(fig. 11)

a. This stage employs two pentode tubes in push-pull. A variable grid bias is developed across paralleled resistor R1 and capacitor C1 which are part of the timing circuit explained in paragraph 41. The screen grids are connected to and receive the required B+ voltage from the junction of R6 and R8 which acts as a voltage divider across the filtered output of the hv rectifier. Plate voltage is supplied to V1 and V2 through common resistor R2 and plate load resistors R3 and R4, respectively.

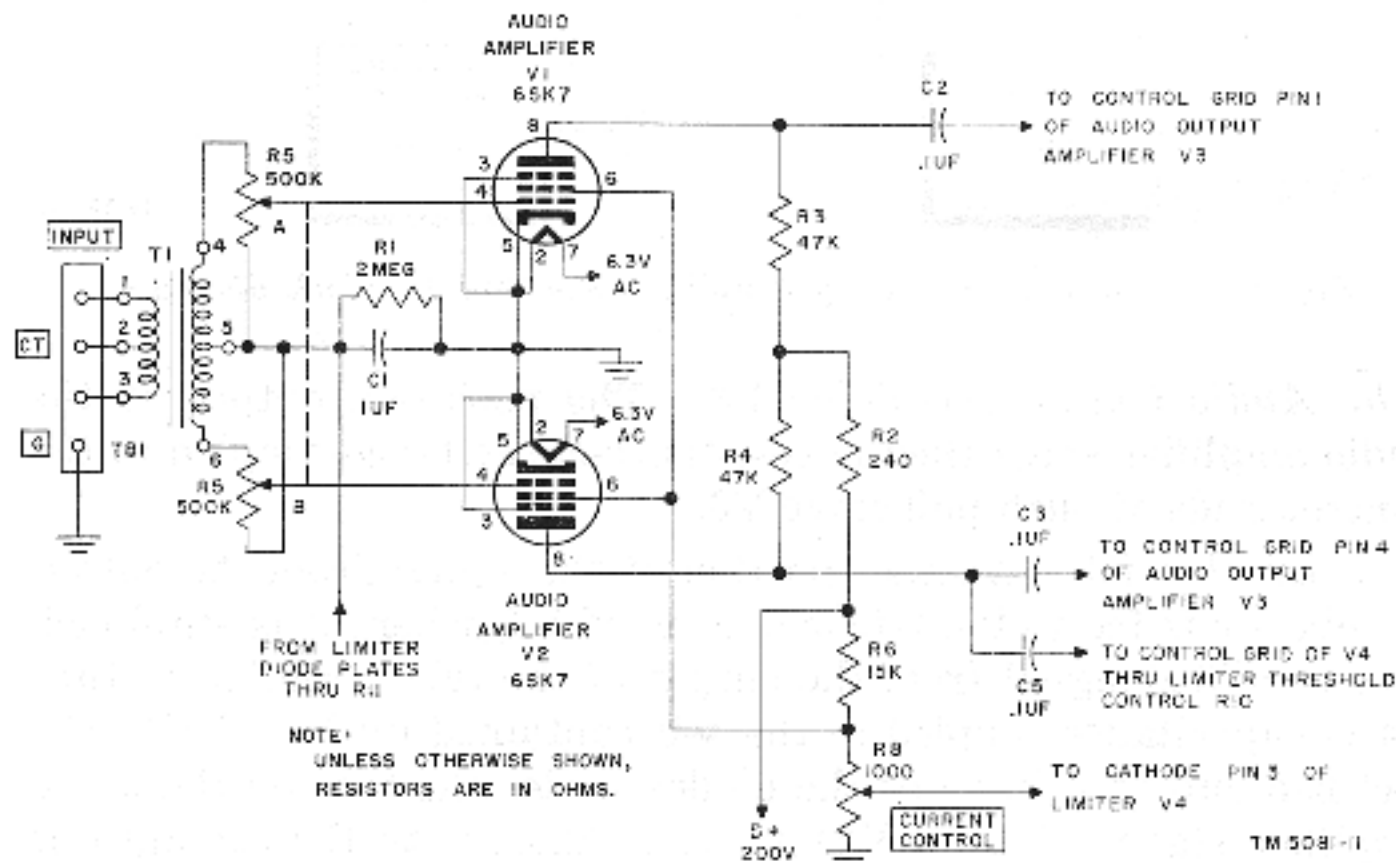


Figure 11. Audio amplifier stage, V1 and V2, schematic diagram.

b. The INPUT terminal board (TB1) provides a means for connecting a 600-ohm balanced or unbalanced input to the primary winding of transformer T1. The primary winding of T1 is not internally grounded; an auxiliary grounding post (marked G) is provided on the terminal board for external grounding of the primary winding (par. 14). The signal voltage appearing across the high-impedance secondary winding of T1 is connected across the dual attenuator potentiometer R5. A portion of the signal voltage (depending on R5 setting) is coupled directly to the control grids of V1 and V2.

c. The plate current wave forms of each tube are combined in the plate load circuit, and the amplified output of this stage is coupled capacitively through C2 and C3 to the grids, pins 1 and 4, respectively, of audio output amplifier V3. A small portion of the output signal from the plate of V2 is fed to the control grid of limiter tube V4 through C5 and LIMITER THRESHOLD control R10.

40. Audio Output Amplifier V3 (fig. 12)

a. Tube V3 is a dual triode connected to operate as a conventional push-pull amplifier. Grid bias is developed across unby-passed cathode resistor R9. The omission of the bypass capacitor reduces distortion and improves the overall frequency response of the amplifier. R13 and R14 are the grid dc return resistors for V3. B+ voltage is supplied to the plates of V3 from the output of the hv rectifier through the center tap and each half of the primary winding of transformer T2.

b. The push-pull output from the audio amplifiers is applied through capacitors C2 and C3 to the control grids of V3. The amplified outputs of the triode sections of V3 are combined across the primary of transformer T2 which matches the plate circuit to the 600-ohm impedance of the load.

c. The OUTPUT terminal board (TB2) provides a means for connecting a balanced or unbalanced load to the secondary winding of transformer T2. The secondary winding of T2 is not internally grounded; an auxiliary grounding post (marked G) is provided on the terminal board for external grounding of the secondary winding (par. 14).

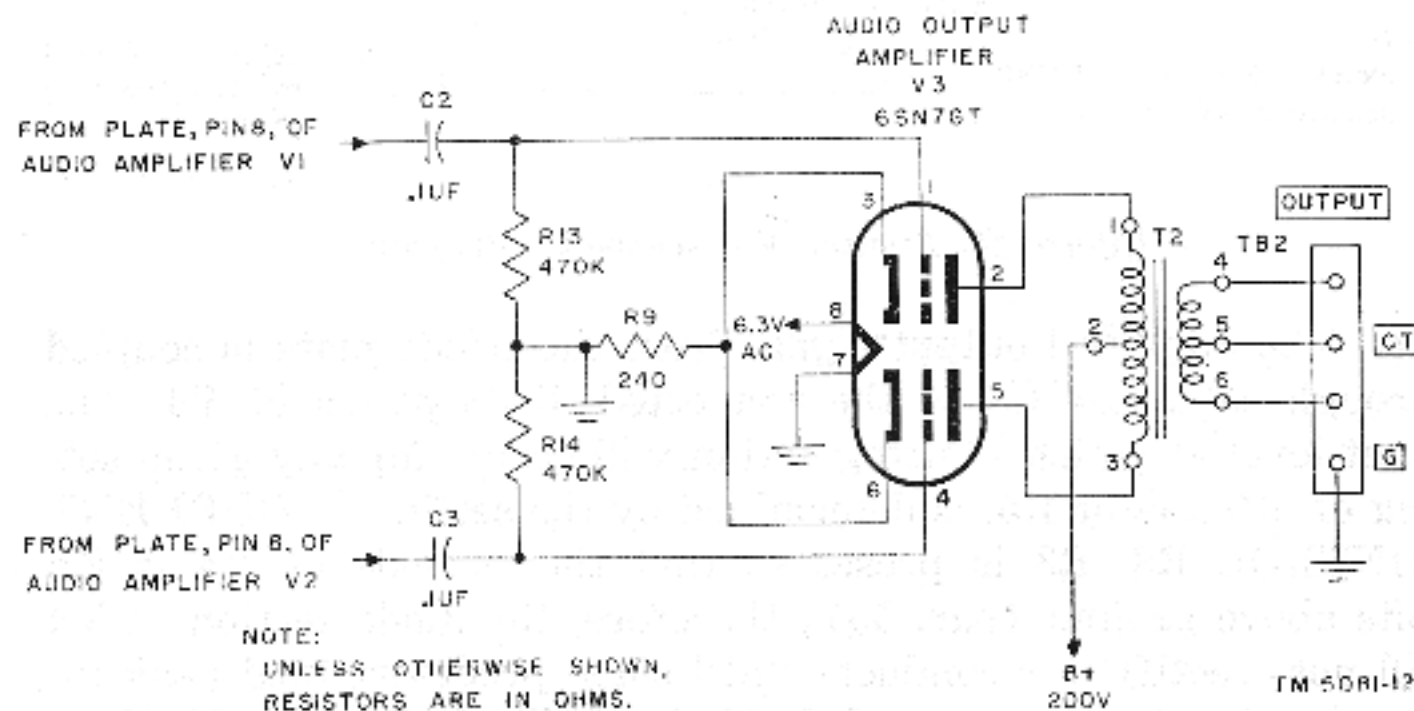


Figure 12. Audio output amplifier V3, schematic diagram.

41. Limiter V4

(fig. 13)

a. The limiter tube is a duplex-diode triode. The triode portion is used as an amplifier, and the diode plates are connected together to operate as a half-wave rectifier. B+ voltage for the plate of the triode is supplied through plate load resistor R7.

b. A small portion of the output signal from the plate of V2 is coupled to the control grid of limiter tube V4 through capacitor C5 and LIMITER THRESHOLD control R10. The LIMITER THRESHOLD control determines the degree of limiting which will take place for any predetermined increase of signal level. This control is preset so that a 10-db increase in the input signal level would produce a 1-db increase in the signal output level of the amplifier (par. 55). If this control is rotated counterclockwise (toward the cathode), the limiting action of the amplifier will be reduced, and the output of the amplifier will increase by more than 1 db for a 10-db increase in input signal. If this control is advanced too far in a clockwise direction (toward capacitor C5), the output level of the amplifier actually will decrease with an increase of input signal level.

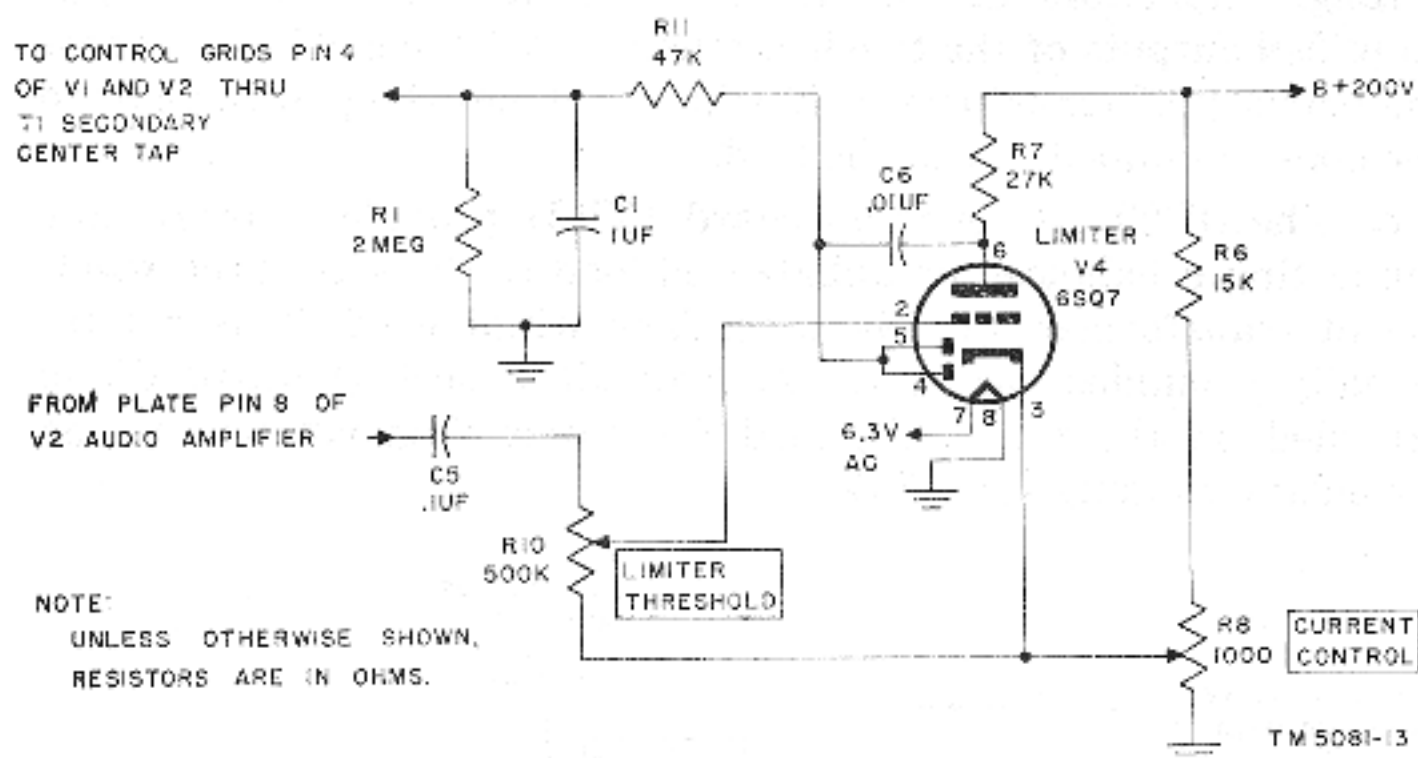


Figure 13. Limiter V4, schematic diagram.

c. The amplified output signal from the triode plate is coupled through capacitor C6 to the connected diode plates of V4. The input level at which limiting action will occur, for any given setting of attenuator R5, is determined by the setting of CURRENT CONTROL R8. R8 is preset so that the cathode of V4 is 2.5 volts above ground (par. 55); therefore, the diode section of V4 will not rectify (or conduct) until some predetermined peak input signal voltage is exceeded. If the CURRENT CONTROL is

set at its maximum counterclockwise position (toward ground), limiting action will occur at very low input levels. Rotation in a clockwise direction (toward resistor R6) will increase the cathode bias to a point high enough to prevent rectification and limiting action, until a relatively high input signal level is attained.

d. The resultant pulsating direct-current (dc) voltage from the diode of tube V4 is filtered by resistor R11 and capacitor C1 and applied as a variable bias voltage across resistor R1. This voltage then is fed to the control grids of V1 and V2 through the center tap and each half of the secondary winding of T1. It is readily noted that when the input signal to the amplifier increases, the bias voltage on the control grids of V1 and V2 increases, thus reducing the gain of V1 and V2.

e. Resistors R1 and R11 and capacitor C1 also determine the proper *attack* and *recovery* time constants of the amplifier. When the diode plate voltage exceeds the cathode voltage, current flows through the diode load and causes capacitor C1 to charge; the ungrounded terminal of C1 becomes negative with respect to ground. The charging time (attack time) of C1 is determined by the values of R11 and C1, and is fixed at .05 second (par. 36b). The discharge time (recovery time) of C1 is fixed at 2 seconds (par. 36c) by R1 and C1.

42. Metering Circuit (fig. 14)

The metering circuit provides a means of reading the attenuation and the power output of the amplifier.

a. Meter transfer switch SW2 is employed to switch meter M1 into the proper circuit for the above readings. When SW2 is in the ATT position, the voltage drop across resistor R2, in the common plate return circuit of tubes V1 and V2, is measured. When SW2 is in the OUT position, the full-wave rectified output voltage of CR1 is read.

b. When the gain of the push-pull input audio stage is auto-

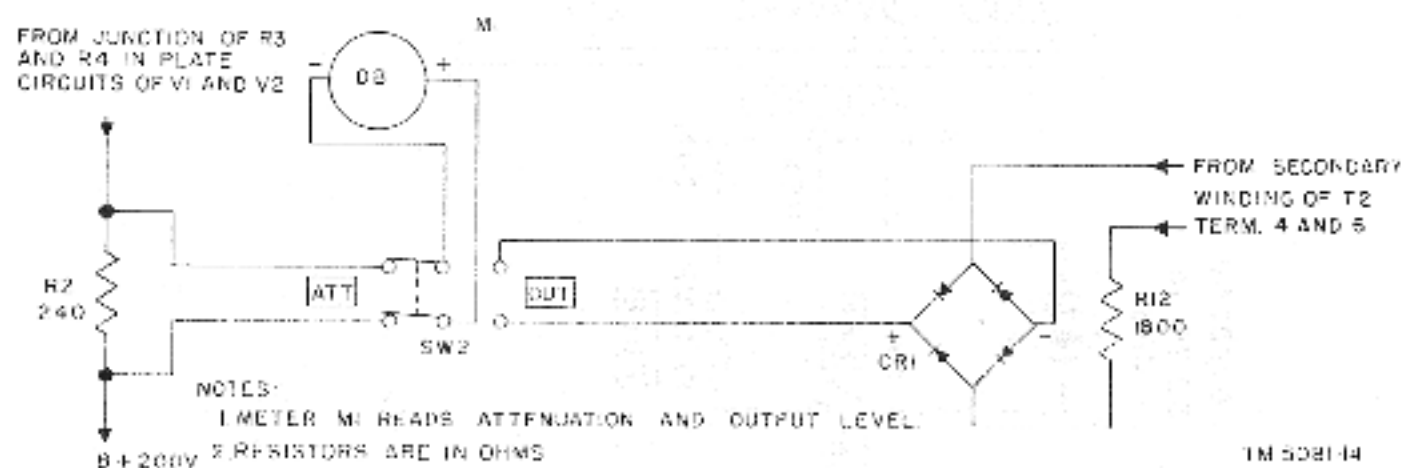
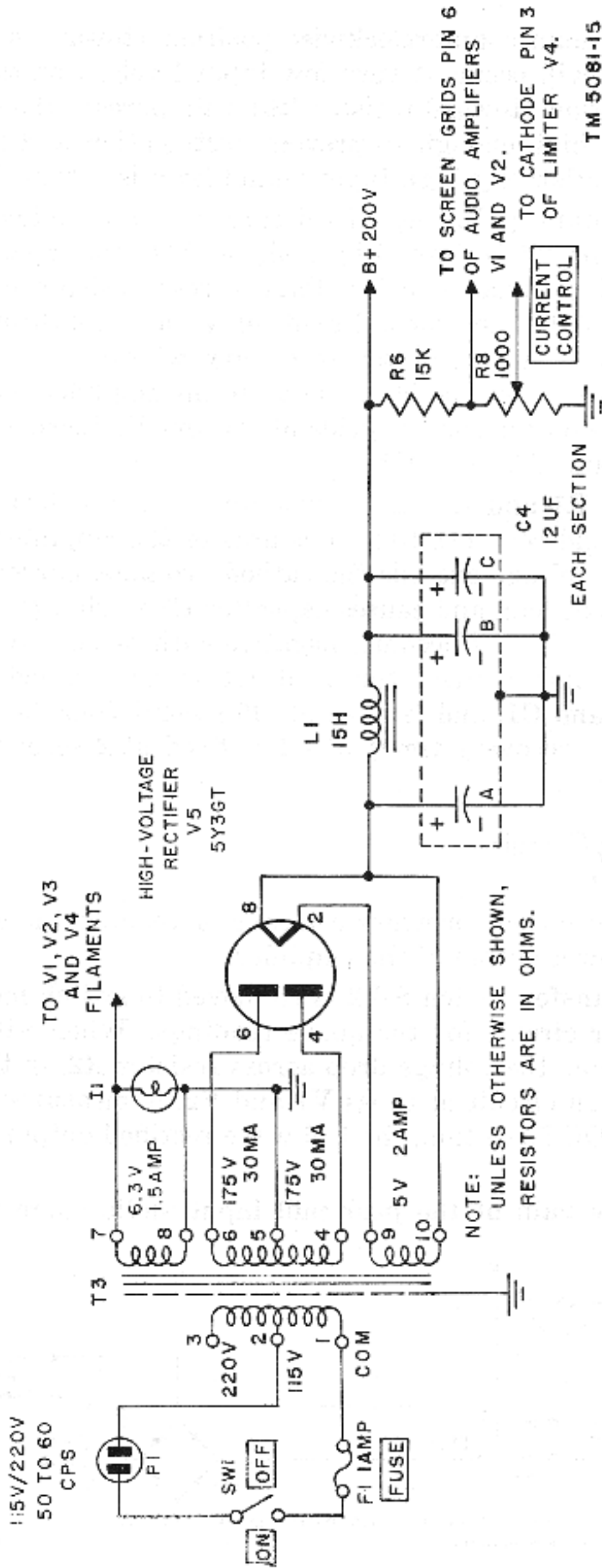


Figure 14. Metering circuit, schematic diagram.



TM 5081-15

Figure 15. Power supply, schematic diagram.

matically lowered by an increase in bias voltage on the grids of V1 and V2 (par. 41*d*), the plate current decreases; this results in a lower voltage drop across resistor R2. This reduced voltage is an indication of the gain reduction of the amplifier. The meter is calibrated to evaluate this gain reduction in db.

c. The output of the amplifier appearing across a 600-ohm load is fed through voltage-dropping resistor R12 to full-wave rectifier CR1. The value of R12 is chosen so that the output of CR1, as read by meter M1, indicates the power output of the amplifier in db. A reading of zero db represents 6 milliwatts of power in a 600-ohm load.

43. Power Supply (fig. 15)

The power supply furnishes the amplifier with the required operating voltages, (and may be connected to either a 115- or a 220-volt ac source (par. 12)).

a. The ac input is connected to the primary of transformer T3 through power ON-OFF switch SW1 and FUSE F1. The hv secondary winding of T3 delivers 350 volts ac at 30 ma to the plates of V5 and is center tapped for full-wave operation. The secondary also has two filament windings with outputs of 5 volts ac for the filament of hv rectifier tube V5, and 6.3 volts ac for the filaments of all the other tubes and the pilot light (I 1) in the amplifier.

b. The power supply uses a type 5Y3GT tube as a conventional full-wave rectifier. The pulsating dc output of the rectifier is filtered by capacitor C4 and choke L1. C4 is a three-section capacitor; one section is connected as the input capacitor to the filter, and the other two sections are connected in parallel across the bleeder. Resistor R6 and potentiometer R8 form the bleeder for the filtered output of the hv rectifier.

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 repairmen.

Section I. TROUBLESHOOTING AT FIELD MAINTENANCE LEVEL

Warning: When servicing Audio Frequency Amplifier AM-864/U be extremely careful of any high voltages exposed. Always disconnect the power cable before performing any resistance measurements. Keep one hand in pocket when measuring socket voltages with the probe. Before touching any part after the voltage is shut off, short the part to ground.

44. Troubleshooting Procedures

a. General. The tests listed below will aid in isolating the source of trouble. Follow the procedures in the order given. Remember that servicing procedures should cause no further damage to the amplifier.

b. Component Sectionalization and Localization. The first step in servicing a defective amplifier is to sectionalize the fault. This means tracing the fault to the *stage or circuit* responsible for the abnormal operation of the equipment. The second step is to localize the fault to the defective part in that circuit. Some faults such as burned-out resistors and shorted transformers often can be located by sight and smell. The majority of faults, however, must be localized by *checking voltages and resistances*. The service procedure is summarized as follows:

- (1) *Visual inspection.* Visual inspection (par. 32) frequently reveals the stage in which the trouble exists. This inspection is valuable in avoiding additional damage to the amplifier through improper servicing methods, and in forestalling future failures.
- (2) *Checking B+ circuits for shorts.* These resistance measurements (par. 47) prevent further damage to the amplifier from possible short circuits. Since this test gives an indication of the condition of the filter circuits, its function is more than preventive.
- (3) *Operational test.* The operational test (par. 48) is important because it frequently indicates the general location of trouble and often determines the exact nature of

the fault. All symptoms must be interpreted in relation to one another.

- (4) *Troubleshooting chart.* The trouble symptoms listed in this chart (par. 49) will aid greatly in localizing trouble.
- (5) *Signal tracing.* The principal advantage of the signal tracing method (par. 51) is that it usually enables the repairman to sectionalize the trouble accurately and quickly to a given stage when the general location of the the trouble is not immediately evident from the above tests.
- (6) *Intermittents.* In all these tests, the possibility of intermittents should not be overlooked. If present, this type of trouble often can be made to appear by tapping or jarring the set. It is possible that the trouble is not in the amplifier itself but in the installation. Trouble also may be due to external conditions. In this event, test the installation, if possible.

45. Troubleshooting Data

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

Fig.	Par.	Description
4		Audio Frequency Amplifier AM-864/U, tube location.
16		Audio Frequency Amplifier AM-864/U, top view of chassis.
17		Audio Frequency Amplifier AM-864/U, bottom view of chassis.
18		Tube sockets and terminal board, voltage and resistance diagram.
23		Audio Frequency Amplifier AM-864/U, schematic diagram.
50		Dc resistances of choke and transformers.

46. Test Equipment Required for Troubleshooting

Test equipment required for troubleshooting Audio Frequency Amplifier AM-864/U is listed below. The technical manuals associated with the test equipment are also listed.

Test equipment	Technical manual
Tube Tester I-177, I-177-A, or equal	TM 11-2627
Electronic Multimeter ME-6A/U (vacuum-tube voltmeter), or equal.	TM 11-5549
Multimeter TS-382A/U, or equal	TM 11-5527
Audio oscillator TS-382A/U, or equal	TM 11-2684A
Oscilloscope OS-8A/U, or equal	TM 11-1214

47. Checking B+ Circuits for Shorts

Trouble within the amplifier often may be detected by checking the resistance of the B+ circuits before applying power to the equipment, thereby preventing damage to the power supply. Disconnect the power cable, and make the following checks:

a. Measure the resistance between pin 8 of V5 and ground; the resistance should agree with that given in figure 18. If the resistance reading is abnormally low, check for shorted or leaky filter capacitor C4 (fig. 23). If the resistance reading is higher than normal, either resistor R6, potentiometer R8, or choke L1 is open.

b. If the capacitor is in good condition, remove the lead from the junction of C4 and R6 and check through the amplifier for shorts; use the voltage and resistance diagram (fig. 18).

48. Operational Test

Operate Audio Frequency Amplifier AM-864/U as described in equipment performance checklist in paragraph 34. This checklist is important because it frequently indicates the general location of trouble.

49. Troubleshooting Chart

The following chart is supplied as an aid in locating trouble in the amplifier. This chart lists the symptoms which the repairman observes, either visually or audibly, while making a few simple tests. *The chart also indicates how to sectionalize trouble quickly to the particular stage or circuit in the unit.* The signal tracing test outlined in paragraph 51 then can be used to supplement this procedure and to determine the defective stage. Once the trouble has been sectionalized, a tube check and voltage and resistance measurements of this stage or circuit ordinarily should be sufficient to localize the defective part. Normal voltage and resistance measurements are given in figure 18.

Symptom	Probable trouble	Correction
1. P o w e r ON-OFF switch SW1 in ON position. Pilot lamp and tubes do not light.	No power to amplifier... Blown FUSE F1..... Break in power cord... Connecting leads to fuse-holder or s w i t c h broken. Transformer not connected properly.	Check power source. Replace fuse. If it blows again, check for shorts (par. 47). Check tube V5. Repair or replace. Repair or replace. C h e c k connections (par. 12).

Symptom	Probable trouble	Correction
2. No meter reading when a .06-volt (-30 db) signal is applied to the input terminals, meter transfer switch SW2 is in the ATT position, and attenuation control is in fully counter-clockwise position.	Defective tube V1, V2, or V5.	Check tubes.
	Faulty power supply---	Check filter circuit components.
	Defective meter -----	Replace.
	Defective switch -----	Replace.
3. Attenuation is greater than -2.75 db on lower scale under conditions stated in 2 above with attenuation control fully clockwise.	Defective amplifier stage.	Check tubes V1, V2 and V4. Check stage using voltage and resistance measurements. (fig. 18).
	LIMITER THRESHOLD control not adjusted properly.	Readjust (par. 55).
4. No meter reading when SW2 is in the OUT position, a .06-volt (-30 db) signal is applied to the input terminals, and the attenuation control (R5) is set to give a -2.5 db (lower scale) reading on the meter when SW2 is in the ATT position.	Faulty audio output stage.	Check tube V3. Check stage using voltage and resistance measurements (fig. 18).
	Defective meter rectifier CRI.	Replace.
5. Meter reading less than -1 db on upper scale under conditions stated in 4 above.	Faulty audio output stage.	Check tube V3. Check stage using voltage and resistance measurements (fig. 18).
6. Weak or distorted output.	Incorrect input or output impedance match.	Check audio input and output connections (par. 14).
	Leaky dc blocking capacitor C2 or C3.	Replace.

Symptom	Probable trouble	Correction
7. Excessive hum.	Defective h-v rectifier. Defective section of filter capacitor C4.	Check tube V5. Replace.
8. No limiting.	Defective limiter stage. LIMITER TRESHOLD or CURRENT CONTROL not adjusted properly.	Check tube V4. Readjust (par. 55).
9. Output level decreases with increase in signal input level.	LIMITER TRESHOLD potentiometer not adjusted properly.	Readjust (par. 55).
10. Intermittent noise.	Defective tube, resistor, capacitor, or loose connection.	With amplifier in operation, using an insulated prod, gently tap and slightly move all tubes, resistors, capacitors, and soldered connections to locate loose elements in tubes or loose connections to any component. Replace or repair.

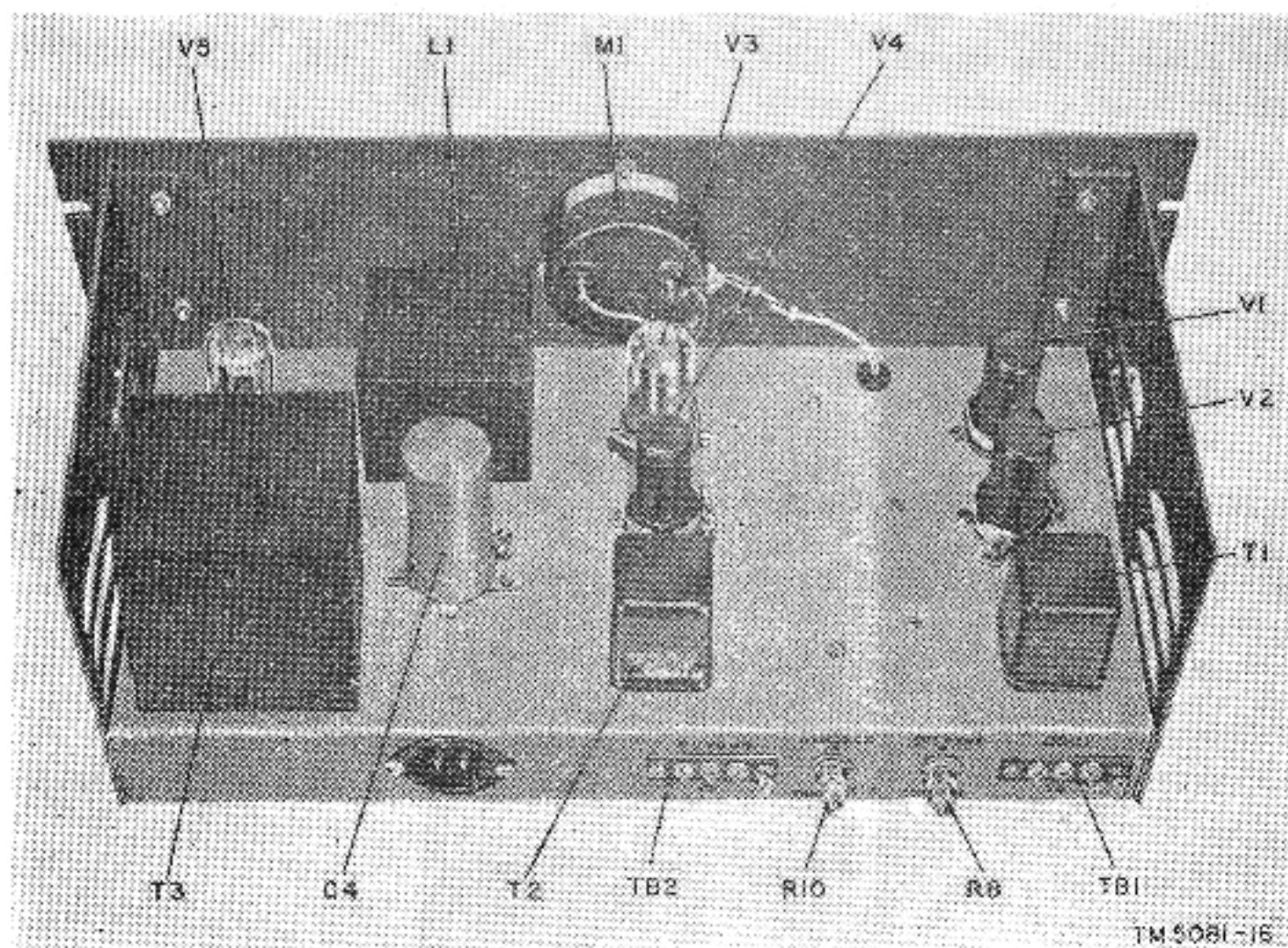
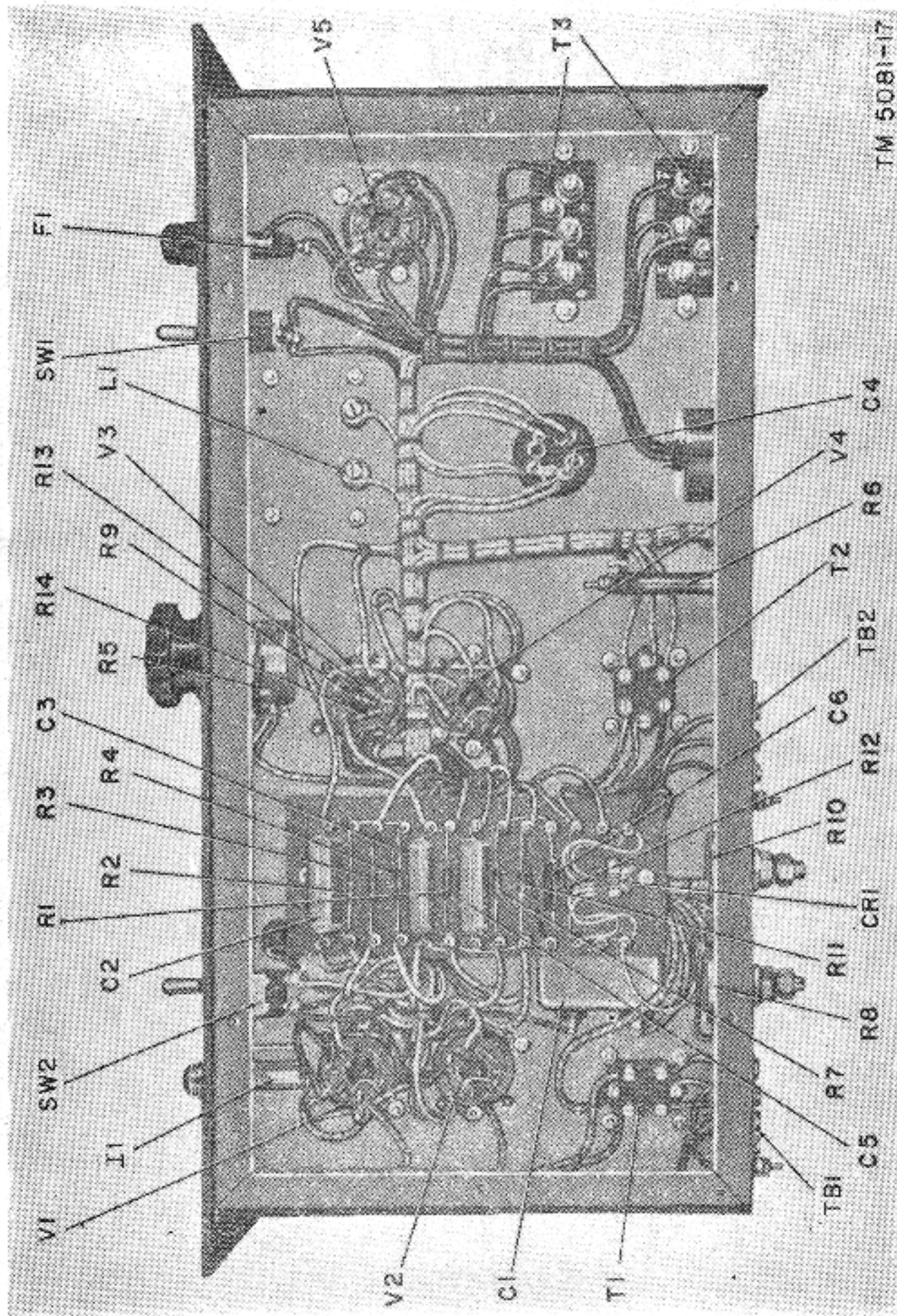


Figure 16. Audio Frequency Amplifier AM-864/U, top view of chassis.



TM 5081-17

Figure 17. Audio Frequency Amplifier AM-864/U, bottom view of chassis.

50. Dc Resistances of Choke and Transformers

The dc resistances of transformer and choke windings in the amplifier are listed below:

Transformer or choke	Terminals	Ohms
L1	1-2	300
T1	1-2	28
	2-3	28
	4-5	260
	5-6	260
T2	1-2	500
	2-3	500
	4-5	20
	5-6	20
T3	1-2	17
	2-3	32
	4-5	200
	5-6	200
	7-8	Less than 1
	9-10	Less than 1

51. Signal Tracing Notes

a. Signal tracing requires a source of af signal. Apply an average signal of .06 volt (-30db) to the amplifier INPUT terminals. Refer to paragraph 17b(1) and (2).

b. An oscilloscope such as Oscilloscope OS-8A/U is required to check the signal at the various tube grids and plates. Check the signal on the grids of V1 and V2; then check the signal on the plates of V1 and V2 for amplification and distortion. Scope indications should be equal at the grids of the same push-pull stage. Progress from audio amplifier stage V1 and V2 to audio output amplifier V3 until the defective stage is found.

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

d. Check the wiring and soldering in each stage during the procedure.

e. When trouble is sectionalized to a given stage, first test the tube, then measure the tube voltages, and finally measure the resistances at the tube socket of that stage (fig. 18).

f. Remove only *one* tube at a time when testing. Checking the number of the tube; test the tube and, if it is not defective, return it to the proper socket before another tube is removed.

g. At each step it is assumed that all previous steps were com-

pleted satisfactorily. Isolate and clear any trouble located before proceeding with any succeeding steps. Refer to paragraph 52 for replacement of parts procedure.

Section II. REPAIRS

52. Replacement of Parts

a. The parts of Audio Frequency Amplifier AM-864/U are easily accessible and easily replaced if found to be defective. Be careful whenever the amplifier is serviced. Dangerous voltages are exposed.

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

- (1) Before a part is unsoldered, note the position of the leads. If the part, such as a transformer, has a number of connections, tag each of the leads to it; this insures proper reconnection.
- (2) Be careful not to damage other leads by pulling or pushing them out of the way.
- (3) Do not allow drops of solder to fall into the unit. They may cause short circuits.
- (4) A carelessly soldered connection may create a new fault. It is very important to make well-soldered joints, since a poorly soldered joint is one of the most difficult faults to find.
- (5) When a part is replaced, it must be placed in the same position as the original one. Give particular attention to proper grounding when replacing a part. Use the same ground as in the original wiring. Failure to observe these precautions may result in decreased gain, or possible oscillation of the circuit.
- (6) Be sure to double-check new connections involving power supply wiring in order to avoid misconnections which would cause additional damage to the equipment.

53. Refinishing

Instructions for refinishing are given in paragraph 30. If the equipment is worn and the panel is badly marred, the exterior should be refinished in accordance with instructions in TM 9-2851, Painting Instructions for Field Use, before it is returned to use.

Section III. ADJUSTMENT PROCEDURES

54. Test Equipment

The multimeter, vacuum-tube voltmeter, and audio oscillator required for adjusting Audio Frequency Amplifier AM-864/U are

listed in paragraph 46. Two 600-ohm 1-watt resistors also are required.

55. Adjustment Procedures

Any changes from the original settings of the LIMITER THRESHOLD (R10) and the CURRENT CONTROL (R8) will be relatively small. Be careful when making readjustments. The LIMITER THRESHOLD control should not be disturbed unless the limiting action definitely is known *not* to be normal. *Do not manipulate these controls unnecessarily.* The average setting of both controls is indicated by matched markings on the chassis and on the shafts. When these markings are aligned, the setting will coincide with the original factory adjustments.

a. CURRENT CONTROL (R8).

- (1) Remove the bottom dust cover.
- (2) Connect Multimeter TS-352/U between the center arm of R8 and ground.
- (3) Adjust R8 so that the center arm is 2.5 volts dc above ground.
- (4) Replace bottom cover.

b. LIMITER THRESHOLD Control (R10).

- (1) Connect the equipment as shown in figure 19 with the exception of the distortion meter.
- (2) Turn attenuation control R5 to its maximum clockwise position.
- (3) Turn LIMITER THRESHOLD control R10 to its maximum counterclockwise position.

Note. The db reading in the parentheses after each voltage reading below is the signal level at the amplifier terminals based on 0 db referenced to 6 mw.

- (4) Place Electronic Multimeter ME-6A/U across the output of the Audio Oscillator TS-382A/U.
- (5) Set the frequency of the audio oscillator to 1,000 cycles and the output level to .066 volt. (This oscillator output provides a -35 db input to the amplifier terminals.)
- (6) Place the electronic multimeter across the output of the amplifier, using the SPDT switch (fig. 19).
- (7) Turn LIMITER THRESHOLD control R10 slowly clockwise until the output level, as indicated on Electronic Multimeter ME-6A/U, reads 1.9 volts (0 db).
- (8) Increase the input signal to .21 volt. (This provides a -25 db input to the amplifier.) The output level of the amplifier should not be more than 2.13 volts (1-db increase over 1.9 volts).

- (9) If the output level increases more than 1 db, perform the procedures outlined in *a* above and repeat the procedures outlined in *b* (3) through (8) above.
- (10) If the output level increases by more than 1 db, tube V4 or its associated circuit is not operating properly; check tube V4 and make resistance and voltage measurements (fig. 18).

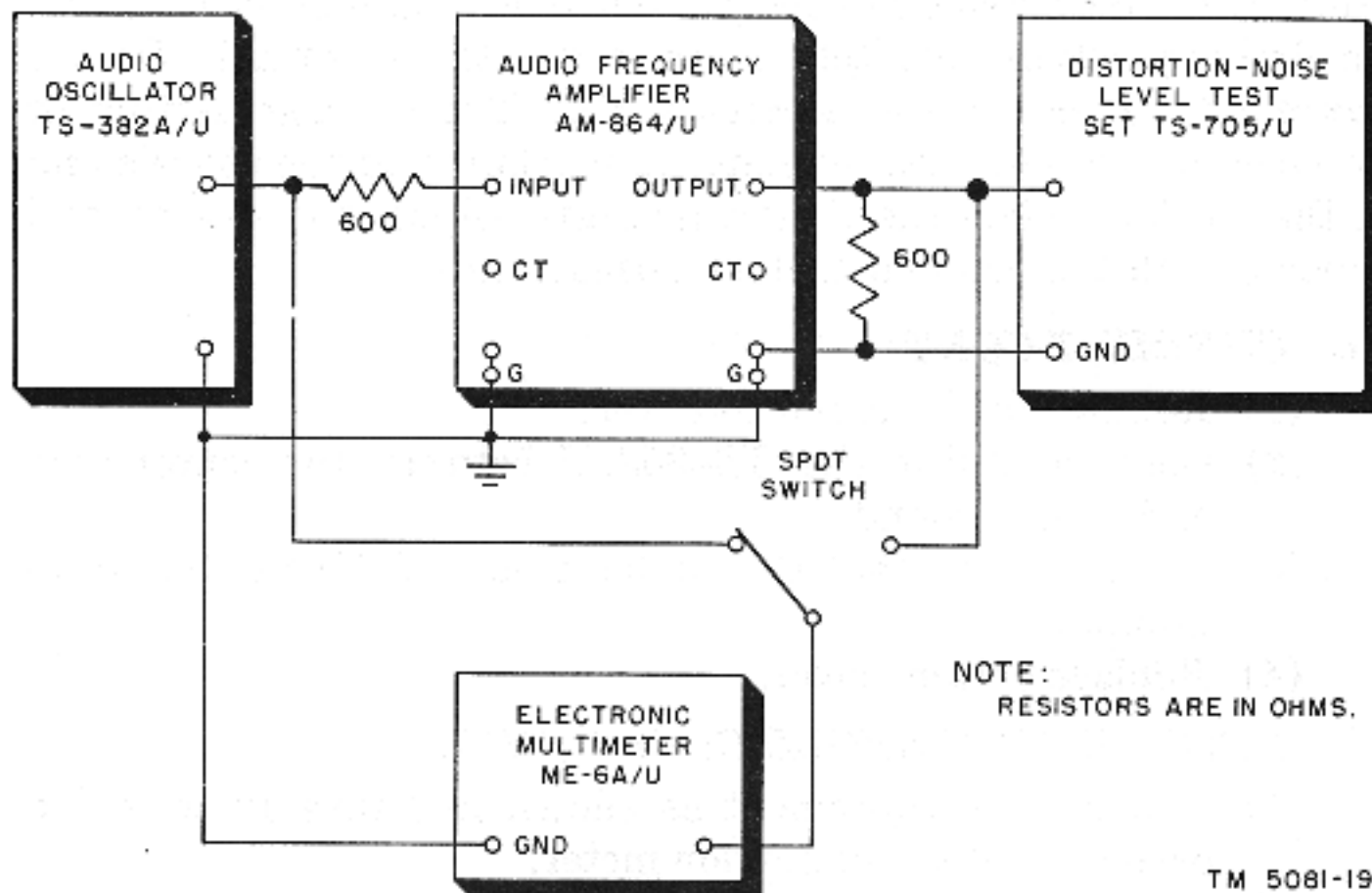


Figure 19. Final test set-up.

Section IV. FINAL TESTING

56. General

This section is intended as a guide to be used in determining the quality of a repaired Audio Frequency Amplifier AM-864/U. The tests outlined in paragraphs 58 through 62 may be performed by maintenance personnel with adequate test equipment and the necessary skills. Repaired equipment meeting the minimum requirements will give uniformly satisfactory operation. The db reading in the parentheses after each voltage reading below is the signal level at the amplifier terminals based on 0 db referenced to 6 mw in 600 ohms.

57. Test Equipment

The instruments mentioned below are listed in paragraphs 46 and 54. A Distortion-Noise Level Test Set TS-705/U, or equal, is also needed.

58. Gain and Power Output

- a. Connect the equipment as shown in figure 19 with the exception of the distortion meter.
- b. Turn attenuation control R5 to its maximum clockwise position.
- c. Place Electronic Multimeter ME-6A/U across the output of the Audio Oscillator TS-382A/U.
- d. Set the frequency of the audio oscillator to 1,000 cycles and the output level to .066 volt (-35 db input to the amplifier).
- e. Place the electronic multimeter across the output of the amplifier. Meter reading should be not less than 1.9 volts (0 db).

59. Constant Output

- a. Follow the procedure outlined in paragraph 58.
- b. Increase the output of the audio oscillator to .21 volt. (-25 db input to the amplifier). The output as indicated on the meter should be not greater than 2.13 volts (1-db increase over 1.9 volts).

60. Frequency Response

- a. Follow the procedure outlined in paragraph 58.
Caution: Check to see that the output of the audio oscillator remains constant throughout this test.
- b. Vary the frequency of the audio oscillator. Take readings of the amplifier output at 100, 500, 1,000, 3,000 and 5,000 cycles. The resulting data should indicate a flat response within ± 1 db of the 1,000-cycle value. See figure 20.

61. Distortion

- a. Follow the procedure outlined in paragraph 58.
- b. Connect the distortion meter as shown in figure 19. The distortion should not exceed 2 percent.
- c. Repeat the above steps for 400 and 5,000 cycles. The distortion should not exceed 2 percent.

62. Noise Level

- a. Connect the equipment as shown in figure 19 with the exception of the audio oscillator and the distortion test set.
- b. Connect a 600-ohm resistor to the two terminals on either side of the terminal marked CT on the INPUT terminal board.
- c. Place Electronic Multimeter ME-6A/U across the output of the amplifier.
- d. Set attenuation control R5 to its maximum clockwise position. The maximum reading permissible on the multimeter is .019 volt (-40 db).

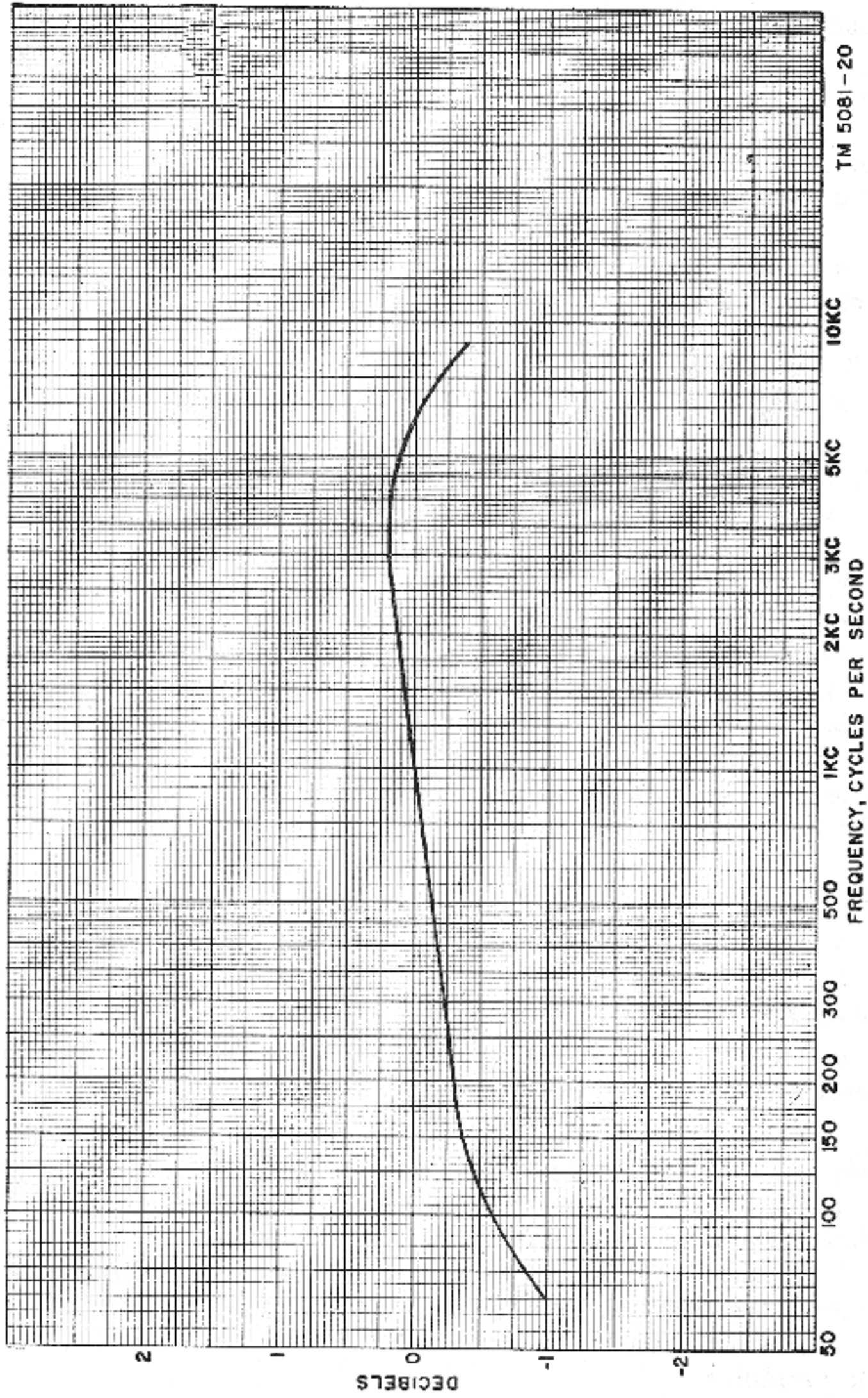


Figure 20. Audio Frequency Amplifier AM-864/U, frequency response curve.

CHAPTER 6

SHIPMENT AND LIMITED STORAGE AND DEMOLITION TO PREVENT ENEMY USE

Section I. SHIPMENT AND LIMITED STORAGE

63. Disassembly

The following instructions are recommended as a guide for preparing the amplifier for transportation and storage.

- a. Disconnect input and output circuits and ac power line.
- b. Remove the unit from its rack installation.

64. Repacking for Shipment or Limited Storage

a. The exact procedure for repacking for shipment or limited storage depends on the material available and the conditions under which the equipment is to be shipped or stored. Refer to paragraph 11 and reverse the instructions given in that paragraph.

b. Whenever practicable, place a dehydrating agent such as silica gel inside the chest. Protect the chest with a waterproof paper barrier. Seal the seams of the paper barrier with a waterproof sealing compound or tape. Pack the protected chest 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

65. General

The demolition procedures outlined in paragraph 66 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.

66. Methods of Destruction

a. *Smash.* Smash the tubes, switches, meter, controls, capacitors, and transformers; use sledges, axes, handaxes, pickaxes, crowbars, or heavy tools.

b. *Cut.* Cut internal and external wires and cables; use axes, knives, or machetes.

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

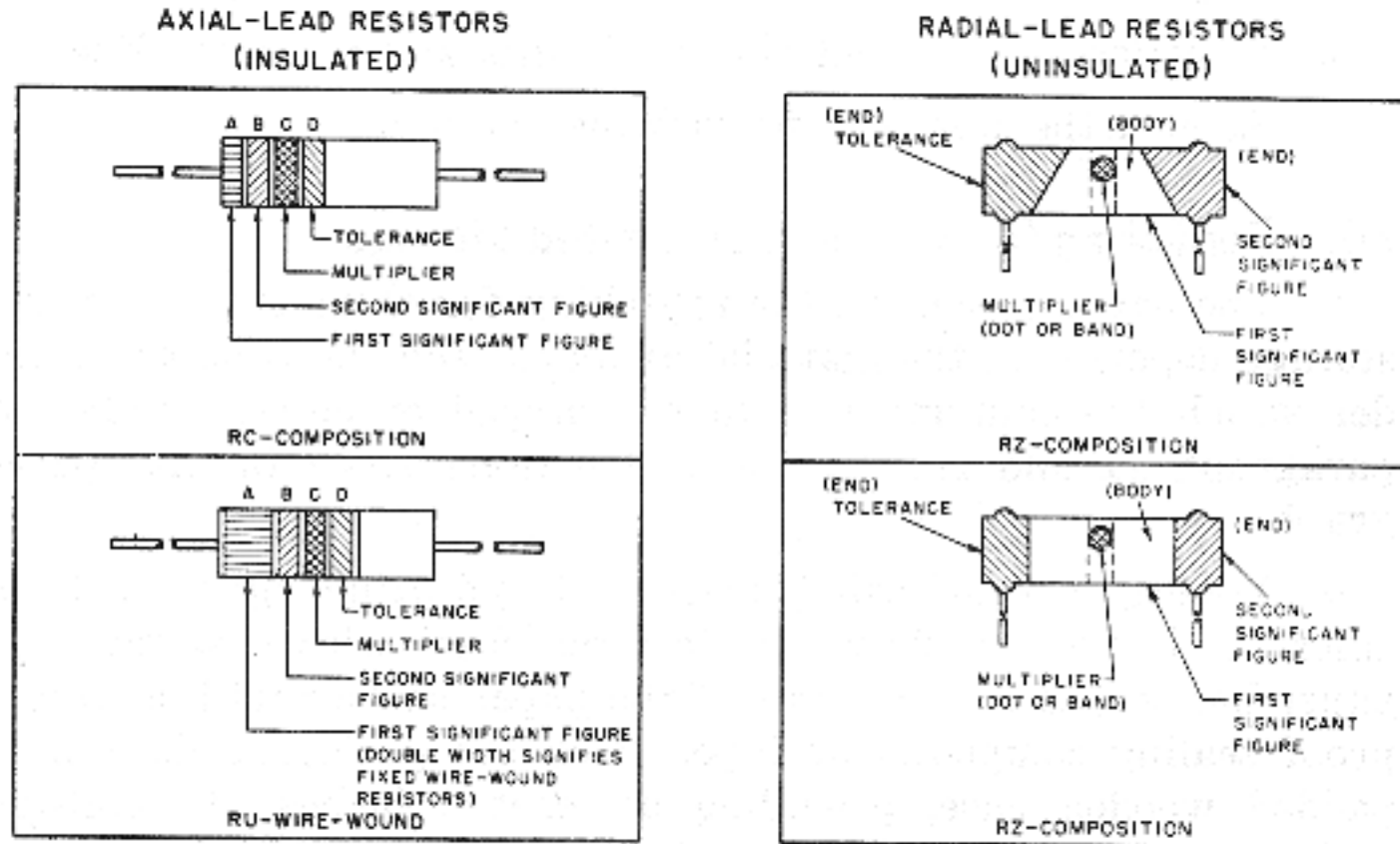
d. *Bend.* Bend panel, cabinet, and chassis.

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

f. *Disposal.* Bury or scatter the destroyed parts in slit trenches, foxholes, or throw them into streams.

g. *Destroy.* Destroy everything.

RESISTOR COLOR CODE MARKING
(MIL-STD RESISTORS)



RESISTOR COLOR CODE

BAND A OR BODY*		BAND B OR END*		BAND C OR DOT OR BAND*		BAND D OR END*	
COLOR	FIRST SIGNIFICANT FIGURE	COLOR	SECOND SIGNIFICANT FIGURE	COLOR	MULTIPLIER	COLOR	RESISTANCE TOLERANCE (PERCENT)
BLACK	0	BLACK	0	BLACK	1	BODY	± 20
BROWN	1	BROWN	1	BROWN	10	SILVER	± 10
RED	2	RED	2	RED	100	GOLD	± 5
ORANGE	3	ORANGE	3	ORANGE	1,000		
YELLOW	4	YELLOW	4	YELLOW	10,000		
GREEN	5	GREEN	5	GREEN	100,000		
BLUE	6	BLUE	6	BLUE	1,000,000		
PURPLE (VIOLET)	7	PURPLE (VIOLET)	7				
GRAY	8	GRAY	8	GOLD	0.1		
WHITE	9	WHITE	9	SILVER	0.01		

* FOR WIRE-WOUND-TYPE RESISTORS, BAND A SHALL BE DOUBLE-WIDTH. WHEN BODY COLOR IS THE SAME AS THE DOT (OR BAND) OR END COLOR, THE COLORS ARE DIFFERENTIATED BY SHADE, GLOSS, OR OTHER MEANS.

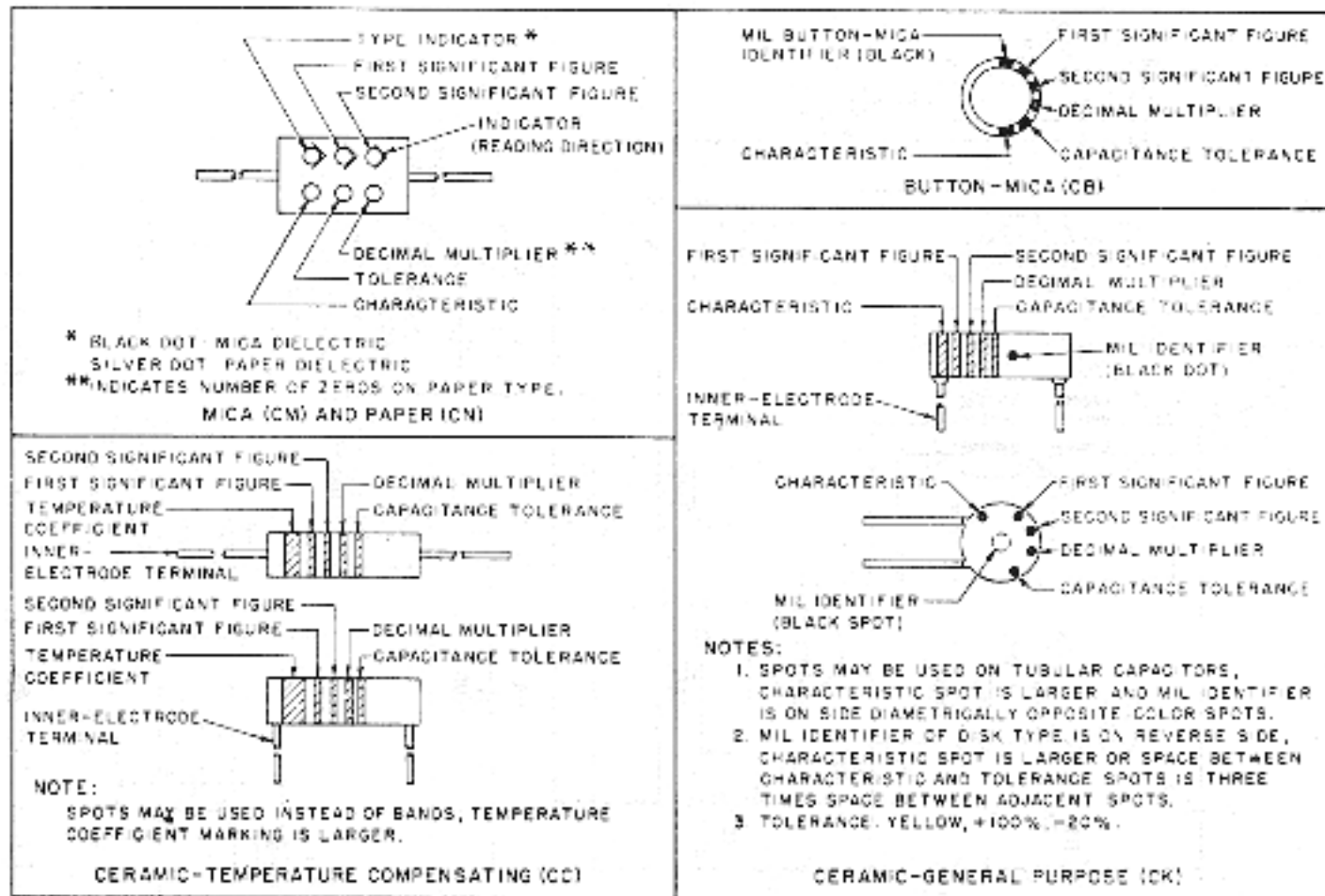
EXAMPLES (BAND MARKING):
 10 OHMS ± 20 PERCENT: BROWN BAND A, BLACK BAND B, BLACK BAND C, NO BAND D.
 4.7 OHMS ± 5 PERCENT: YELLOW BAND A, PURPLE BAND B, GOLD BAND C, GOLD BAND D.

EXAMPLES (BODY MARKING):
 10 OHMS ± 20 PERCENT: BROWN BODY, BLACK END, BLACK DOT OR BAND, BODY GOLD OR ON TOLERANCE END.
 3,000 OHMS ± 10 PERCENT: ORANGE BODY, BLACK END, RED DOT OR BAND, SILVER END.

STD-R1

Figure 21. Resistor color and letter code.

CAPACITOR COLOR CODE MARKING
(MIL-STD CAPACITORS)



CAPACITOR COLOR CODE

COLOR	SIG FIG.	MULTIPLIER		CHARACTERISTIC ¹				TOLERANCE ²					TEMPERATURE COEFFICIENT ³ (ULF/UF/°C)
		DECIMAL	NUMBER OF ZEROS	CM	CN	CB	CK	CM	CN	CB	CC		
											OVER 10UF	10UF OR LESS	
BLACK	0	1	NONE		A			20	20	20	20	2	ZERO
BROWN	1	10	1	B	E	B	W					1	-30
RED	2	100	2	C	H		X	2		2	2		-50
ORANGE	3	1,000	3	D	J	D			30				-150
YELLOW	4	10,000	4	E	P								-220
GREEN	5		5	F	R						5	0.5	-330
BLUE	6		6		S								-470
PURPLE (VIOLET)	7		7		T	W							-750
GRAY	8		8			X						0.25	+50
WHITE	9		9								10	1	-330 (+500) ³
GOLD		0.1						5		5			+50
SILVER		0.01						10	10	10			

1. LETTERS ARE IN TYPE DESIGNATIONS GIVEN IN MIL-C SPECIFICATIONS.
2. IN PERCENT, EXCEPT IN UUF FOR CC-TYPE CAPACITORS OF 10 UUF OR LESS.
3. INTENDED FOR USE IN CIRCUITS NOT REQUIRING COMPENSATION

STD-01

Figure 22. Capacitor color and letter code.

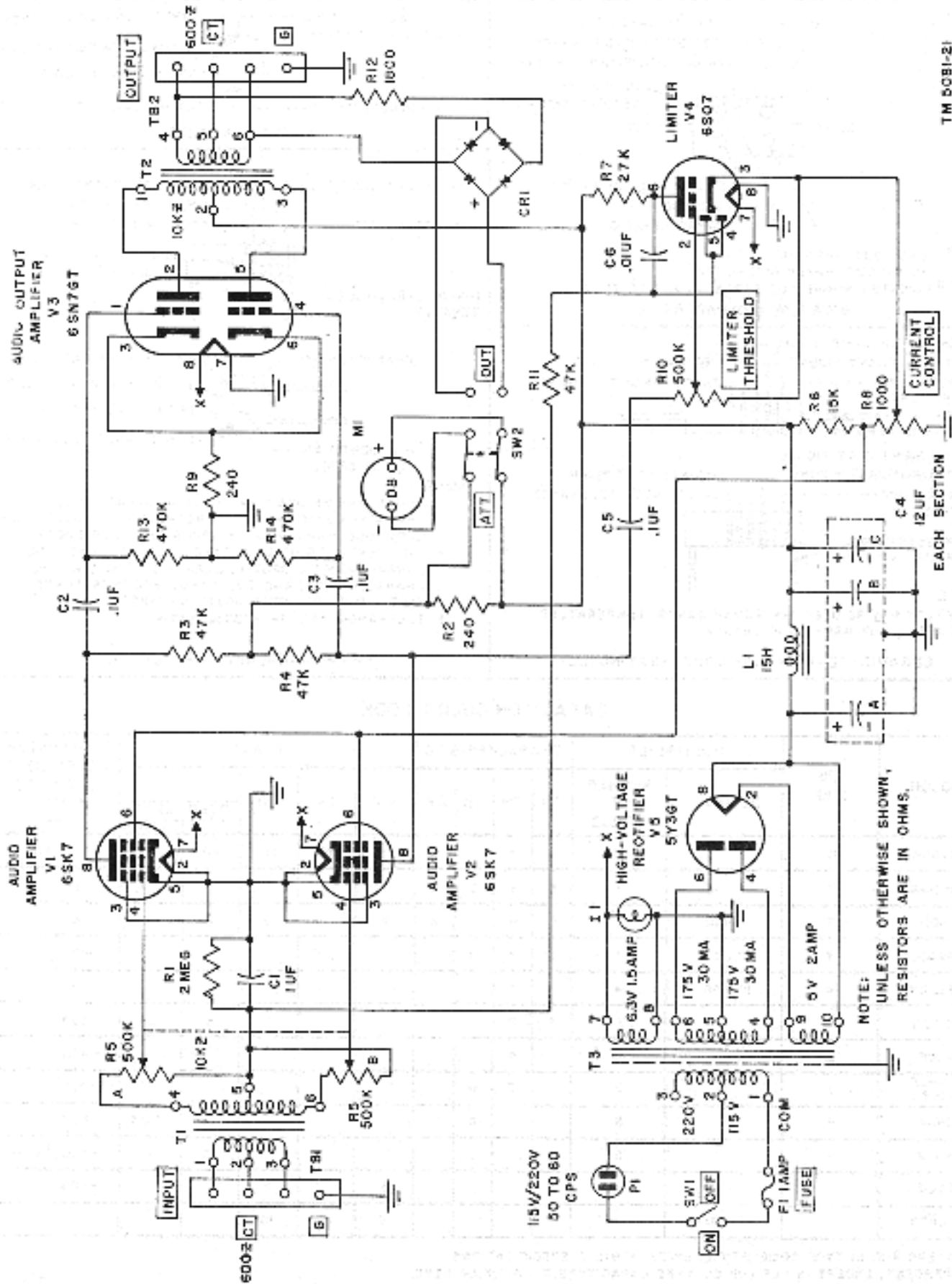


Figure 23. Audio Frequency Amplifier AM-864/U, schematic diagram.

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