

NAVSHIPS 91078

RESTRICTED

INSTRUCTION BOOK
for
A. F. AMPLIFIER
AM-215A/U

HOFFMAN RADIO CORPORATION

LOS ANGELES 7, CALIFORNIA

BUREAU OF SHIPS

NAVY DEPARTMENT

Contract: NObsr-39405

Approved by BuShips: 6 April 1948

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NAVY DEPARTMENT

BUREAU OF SHIPS
WASHINGTON 25, D. C.

6 April 1948

To: All Activities Concerned with the Installation
Operation and Maintenance of the Subject Equipment.

Subj: Instruction Book for A. F. Amplifier, AM-215A/U
NAVSHIPS 91078.

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ORIGINAL

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GUARANTEE

The Contractor guarantees that at the time of delivery thereof the articles provided for under this contract will be free from any defects in material or workmanship and will conform to the requirements of this contract. Notice of any such defect or non-conformance shall be given by the Government to the Contractor within one year of the delivery of the defective or non-conforming article, unless a different period of Guaranty is specified in the schedule. If required by the Government within a reasonable time after such notice, the Contractor shall with all possible speed correct or replace the defective or non-conforming article or part thereof. When such correction or replacement requires transportation of the article or part thereof, shipping costs, not exceeding usual charges, from the delivery point to the Contractor's plant and return, shall be borne by the Contractor; the Government shall bear all other shipping costs. This Guaranty shall then continue as to corrected or replacing articles or, if only parts of such articles are corrected or replaced, to such corrected or replacing parts, until one year after the date of re-delivery, unless a different period of Guaranty is specified in the schedule. If the Government does not require correction or replacement of a defective or non-conforming article, the Contractor, if required by the contracting officer within a reasonable time after the notice of the defect or non-conformance, shall repay such portion of the contract price of the article as is equitable in the circumstances.

INSTALLATION RECORD

Contract Number NObsr-39405

Date of Contract, 30 June 1947

Serial Number of equipment.....*Date of acceptance by the Navy*.....*Date of delivery to contract destination*.....*Date of completion of installation*.....*Date placed in service*.....

Blank spaces on this page shall be filled in at time of installation.

REPORT OF FAILURE

Report of failure of any part of this equipment, during its entire service life, shall be made to the Bureau of Ships in accordance with current regulations using form NAVSHIPS NBS 383 (revised) except for Marine Corps equipment, in which case the "Signal Equipment Failure Report" form shall be used and distributed in accordance with instructions pertaining thereto. The report shall cover all details of the failure and give the date of installation of the equipment. For procedure in reporting failures see Chapter 67 of the *Bureau of Ships Manual* or superseding instructions.

ORDERING PARTS

All requests or requisitions for replacement material should include the following data:

1. Federal stock number or, when ordering from a Marine Corps or Signal Corps supply depot, the Signal Corps stock number.

2. Name and short description of part.

If the appropriate stock number is not available the following shall be specified:

1. Equipment model or type designation, circuit symbol, and item number.
2. Name of part and complete description.
3. Manufacturer's designation.
4. Contractor's drawing and part number.
5. JAN or Navy type number.

DESTRUCTION OF ABANDONED MATERIAL IN THE COMBAT ZONE

In case it should become necessary to prevent the capture of this equipment, and when ordered to do so, DESTROY IT SO THAT NO PART OF IT CAN BE SALVAGED, RECOGNIZED, OR USED BY THE ENEMY. BURN ALL PAPERS AND BOOKS.

Means:

1. Explosives, when provided.
2. Hammers, axes, sledges, machetes, or whatever heavy object is readily available.
3. Burning by means of incendiaries such as gasoline, oil, paper or wood.
4. Grenades and shots from available firearms.
5. Burying all debris, where possible and when time permits.
6. Throwing overboard or disposing of in streams or other bodies of water.

Procedure:

1. Obliterate all identifying marks. Destroy nameplates and circuit labels.
2. Demolish all panels, castings, switch and instrument boards.
3. Destroy all controls, switches, relays, connections and meters.
4. Rip out all wiring and cut interconnections of electrical equipment. Smash gas, oil, and water cooling systems in gas engine generators, etc.
5. Smash every electrical or mechanical part, whether rotating, moving or fixed.
6. Break up all operating instruments such as keys, phones, microphones, etc.
7. Destroy all classes of carrying cases, straps, containers, etc.
8. Bury or scatter all debris.

DESTROY EVERYTHING!

SAFETY NOTICE

The attention of officers and operating personnel is directed to Chapter 67 of the *Bureau of Ships Manual* or superseding instructions on the subject of radio-safety precautions to be observed.

This equipment employs voltages which are dangerous and may be fatal if contacted by operating personnel. Extreme caution should be exercised when working with the equipment.

While every practicable safety precaution has been incorporated in this equipment, the following rules must be strictly observed:

KEEP AWAY FROM LIVE CIRCUITS:

Operating personnel must at all time observe all

safety regulations. Do not change tubes or make adjustments inside equipment with high voltage supply on. Under certain conditions dangerous potentials may exist in circuits with power controls in the off position due to charges retained by capacitors. To avoid casualties always remove power and discharge and ground circuits prior to touching them.

DON'T SERVICE OR ADJUST ALONE:

Under no circumstances should any person reach within the enclosure for the purpose of servicing or adjusting the equipment without the immediate presence or assistance of another person capable of rendering aid.

RESUSCITATION

AN APPROVED POSTER ILLUSTRATING THE RULES FOR RESUSCITATION BY THE PRONE PRESSURE METHOD SHALL BE PROMINENTLY DISPLAYED IN EACH RADIO, RADAR, OR SONAR ENCLOSURE. POSTERS MAY BE OBTAINED UPON REQUEST TO THE BUREAU OF MEDICINE AND SURGERY.



Figure 1-1. AF Amplifier AM-215A/U

SECTION 1

GENERAL DESCRIPTION

1. PURPOSE OF EQUIPMENT.

The AF Amplifier AM-215A/U, Figure 1-1, is a multiple input audio frequency amplifier designed for general communication work in conjunction with Naval electronic receiving equipment and associated loud-speaker units.

2. DESCRIPTION OF UNIT.

The AM-215A/U is a five tube, three stage audio frequency amplifier with push-pull output, incorporating inverse feedback. The power supply and amplifier are included in one compact unit.

a. CONTROLS.—The three controls for the unit are mounted on the front panel along with a shutter type pilot light. They are respectively: a POWER ON-OFF switch, S102, a VOLUME control, R107, and a CHANNEL SELECTOR switch, S101. The CHANNEL SELECTOR switch has five positions and is used to select one of the five input channels as the source of sound for the amplifier.

b. INPUTS.—Five 600 ohm input circuits are provided for connecting to sources of audio, such as radio receivers, microphones or phono preamplifiers, etc. One input circuit at a time is connected to the input transformer, T101, by the input selector switch, S101, as desired. The other input circuits are each terminated in a 620 ohm resistor.

A maximum of two watts continuous power may be fed into each input. A minimum of approximately six milliwatts is required to produce full output.

c. OUTPUT.—The maximum output of the amplifier is 10 watts with less than 10% total harmonic distortion at nominal voltage rating. Two output impedances are provided, 600 ohms and 15 ohms, for feeding a conventional 600 ohm line or a standard speaker voice coil.

d. POWER SUPPLY.—The power supply is built on the same chassis with the amplifier. It operates from a 110/115/120 volt AC power source, of 50 or 60 cycles, and supplies all filament and plate power required by the amplifier.

e. CASE.—The complete equipment is housed in a die cast aluminum case which is made up of two pieces riveted together. The front panel of the amplifier serves as the cover for the case. The chassis is mounted to the rear side of front panel, extending back from the panel at 90 degrees. The panel and chassis are also die cast aluminum. A neoprene gasket is placed around the grooved edge of the panel so that when the case is

closed the unit is sealed and made "drip proof." The two Dzus fasteners at the top of the panel are used to secure the panel shut. The panel is hinged at the bottom so that it and the chassis will swing out of the case for adjusting and servicing. The tubes are accessible when the panel is opened approximately 60 degrees. When the panel is opened 180 degrees the chassis will be outside the case, be upside down and completely accessible for servicing, see Figure 5-2, page 5-2.

The exterior of the case and panel are finished with a smooth Navy grey enamel. The chassis and interior of the case are painted grey.

The unit may be mounted from the rear, top, or bottom surface of the case as described in Section 3, Installation.

3. REFERENCE DATA.

a. NOMENCLATURE. — AF AMPLIFIER AM-215A/U.

b. CONTRACT NUMBER AND DATE.—NObsr-39405, 30 June 1947.

c. CONTRACTOR.—Hoffman Radio Corp., 3761 So. Hill Street, Los Angeles 7, California.

d. COGNIZANT NAVAL INSPECTOR.—Inspector of Naval Material, Los Angeles District, 1206 So. Santee Street, Los Angeles 15, California.

e. NUMBER OF PACKAGES PER COMPLETE SHIPMENT OF EQUIPMENT.—Two: one package—Equipment; one package—Equipment Spare Parts.

f. TOTAL CUBICAL CONTENTS.—Equipment and Equipment Spare Parts; crated 1.26 cubic feet, uncrated 0.79 cubic feet.

g. TOTAL WEIGHT.—Equipment and Equipment Spare Parts: crated 51.8 pounds, uncrated 45.5 pounds.

h. FREQUENCY RANGE.—250 to 4000 cps, ± 3 db.

i. POWER OUTPUT.—10 watts maximum at 10% total harmonic distortion, or less, at nominal voltage rating.

j. OUTPUT IMPEDANCE.—600 ohms center tapped and 15 ohms.

k. POWER GAIN.—32.2 db.

l. AUDIO INPUT POWER.—2 watts maximum into each input; 6 milliwatts minimum for full power output.

m. INPUT IMPEDANCE.—600 ohms each input.

n. POWER SOURCE REQUIRED FOR EQUIPMENT.—110/115/120 volts A.C., 50/60 cps, single phase, .57 amperes, 55 watts.

1 Section
Paragraph 3

NAVSHIPS 91078
AM-215A/U

GENERAL
DESCRIPTION

- o.* POWER FACTOR OF EQUIPMENT.—84%. equipment supplied and the equipment required but not
p. EQUIPMENT LISTS.—Tables 1-1 and 1-2 list the supplied on the contract.

TABLE 1-1. EQUIPMENT SUPPLIED

QUAN- TITY PER EQUIP- MENT	NAME OF UNIT	NAVY TYPE DESIGNATION	OVER-ALL DIMENSIONS			VOLUME	WEIGHT
			HEIGHT	WIDTH	DEPTH		
1	AF AMPLIFIER	AM-215A/U	8 $\frac{3}{8}$	12	7	0.41	23.5
1	SET OF EQUIPMENT SPARE PARTS		6-3/16	13 $\frac{1}{4}$	7 $\frac{1}{4}$	0.34	22
2	INSTRUCTION BOOKS	NAVSHIPS 91078	11	8 $\frac{1}{2}$	—	—	—

Dimensions are inches, volume cubic feet, weight pounds.

TABLE 1-2. EQUIPMENT REQUIRED BUT NOT SUPPLIED

QUANTITY PER EQUIPMENT	NAME OF UNIT	NAVY TYPE DESIGNATION	REQUIRED USE	REQUIRED CHARACTERISTICS
1 to 5	SOURCE OF AUDIO FREQUENCY, SUCH AS NAVY RADIO RECEIVER, MICROPHONE OR PHONO PRE- AMPLIFIER, ETC.		TO SUPPLY A DESIRED SOUND SIGNAL TO THE AMPLIFIER INPUT	OUTPUT IMPEDANCE 600 ohms. OUTPUT POWER: 6 milliwatts minimum, 2 watts maximum.
1 or more	REPRODUCERS, SUCH AS LOUD SPEAKERS, HEADSETS, ETC.		A.F. REPRODUCTION	MUST MATCH AMPLIFIER 600 ohm or 15 ohm OUTPUT

q. SHIPPING DATA.—Table 1-3 gives information on the equipment and equipment spare parts as packed for shipment.

r. EQUIPMENT SIMILARITIES.—The A.F. Amplifier AM-215A/U is similar to the AM-215/U Ampli-

fier mechanically and electrically, and the units are interchangeable. Both are designed for 5 input channels and a 600 ohm and a 15 ohm output.

s. VACUUM TUBE COMPLEMENT.—The tubes used in the equipment are listed in Table 1-4.

TABLE 1-3. SHIPPING DATA

SHIPPING BOX NO.	CONTENTS		OVER-ALL DIMENSIONS			VOLUME	WEIGHT
	NAME	DESIGNATION	HEIGHT	WIDTH	DEPTH		
1	AF AMPLIFIER	AM-215A/U	10 $\frac{3}{4}$	14 $\frac{3}{8}$	9 $\frac{1}{2}$	0.85	28.3
2	EQUIPMENT SPARE PARTS		7	13 $\frac{3}{4}$	8	0.45	23.5

Dimensions are inches, volume cubic feet, weight pounds.

TABLE 1-4. VACUUM TUBE COMPLEMENT

SYMBOL	TYPE	FUNCTION
V101	JAN 12AU7	ONE TRIODE AS VOLTAGE AMPLIFIER ONE TRIODE AS PHASE INVERTER
V102	JAN 6AQ5	POWER AMPLIFIER
V103	JAN 6AQ5	POWER AMPLIFIER
V104	JAN6X4	RECTIFIER
V105	JAN6X4	RECTIFIER

SECTION 2

THEORY OF OPERATION

1. GENERAL.

A complete schematic of the AF amplifier AM-215A/U is given in Figure 5-5 and is referred to in the following text.

The AM-215A/U is a straightforward amplifier of advanced design incorporating a direct coupled stage, phase inversion, inverse feedback and push-pull output.

2. INPUTS.

Terminals are provided for connecting five pairs of 600 ohm lines to the input of the amplifier. These are numbered 1 to 5 and respectively correspond to the numbering on the CHANNEL SELECTOR switch S101 as shown in Figure 1-1.

The circuits of the channel selector switch S101 are arranged to connect one pair of input terminals at a time, respectively, to the primary of the input transformer T101; at the same time each of the other inputs is connected to a 620 ohm loading resistor to properly terminate the lines not connected to T101.

The secondary of T101 is loaded by R106 and R107, and this load is reflected to the input line by the primary as 600 ohms. The center tap on the primary is brought out to a terminal to provide for grounding, if required, when used with balanced input lines. There is a static shield between primary and secondary to eliminate electrostatic coupling and reduce spurious input noise.

R107 is the amplifier gain or volume control.

3. DIRECT COUPLING.

V101 is a double triode used as a voltage amplifier and phase inverter. The plate of the voltage amplifier (pin 1) is directly connected to the grid of the phase inverter (pin 7), using R110 as a common plate-grid resistor. R110, being 470,000 ohms, produces a large voltage drop due to the plate current through it, and this puts the grid of the phase inverter at a low positive voltage with respect to ground. The cathode current of the phase inverter flowing through the 51,000 ohm cathode resistor R108 results in a positive voltage on the cathode more positive than that on the grid, thus

giving the triode its proper negative grid bias. The circuit is self equalizing and produces a satisfactory grid bias on the phase inverter through every normal variation of operating voltage and tube condition.

4. PHASE INVERTER.

The phase inverter is of the divided load type. R112 in the plate circuit and R111 in the cathode circuit are equal and each produce the same amount of signal voltage drop, but the voltage across one is 180° out of phase with the voltage across the other. This produces input for the push-pull stage that follows.

5. OUTPUT.

The push-pull output stage, V102 and V103, is conventional. Two output impedances are provided on T102: 15 ohms for a standard speaker voice coil and 600 ohms for a regular 600 ohm line. The 600 ohm output has a center tap brought out to a terminal for grounding when required in connection with a balanced output line. C104 is connected from V103 grid to ground to stabilize the amplifier by eliminating the generation of high frequencies when the amplifier is driven to maximum or near maximum output.

Inverse feedback from the plate of V102 to the cathode of the voltage amplifier is fed through R109. The inverse feedback reduces distortion and improves output voltage regulation with respect to load. A change of 2 to 1 from the normal output load will cause a change in output voltage no greater than 2 db. However this reduces the power output. Full power output can be obtained only by use of a correctly matching output load. Section 3, Installation discusses matching the output load impedance in paragraph 4.

6. POWER SUPPLY.

The power supply is conventional, furnishing all plate and filament power for the amplifier from a regular AC power source as specified. The rectifiers V104 and V105 are connected in a full wave rectifier circuit with T103. Two tubes are used to handle the current required by the amplifier. The filtering is done by C106, C107 and L101.

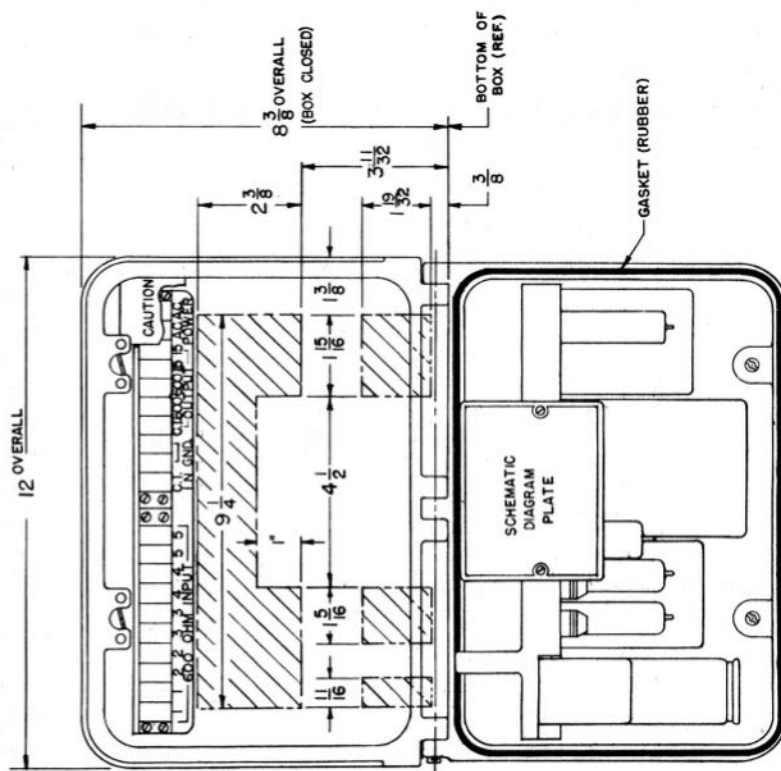
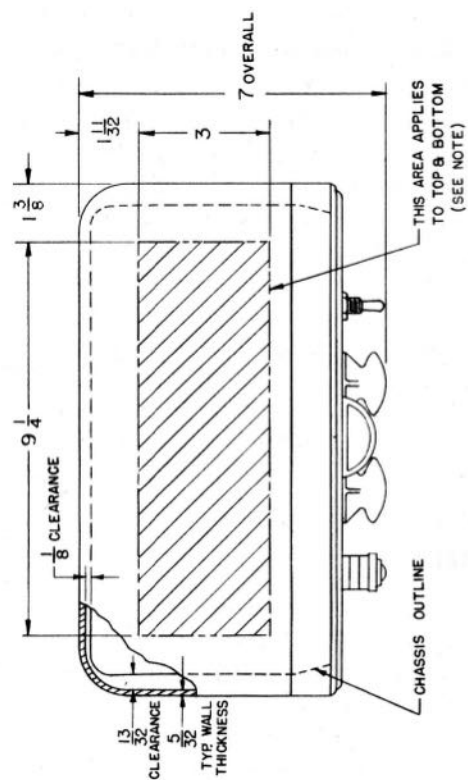
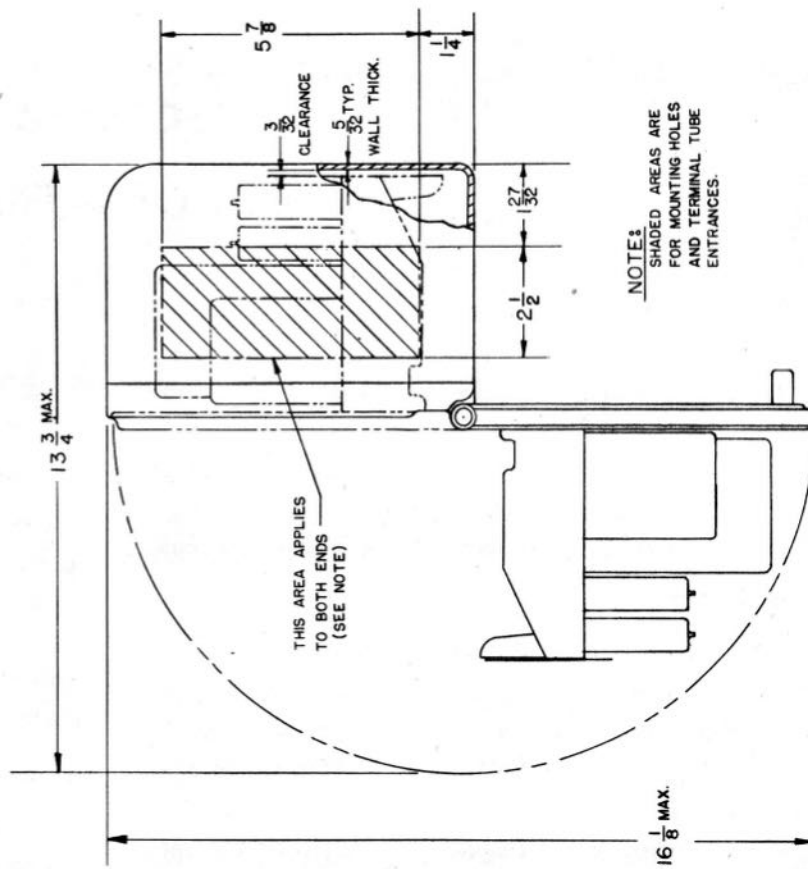
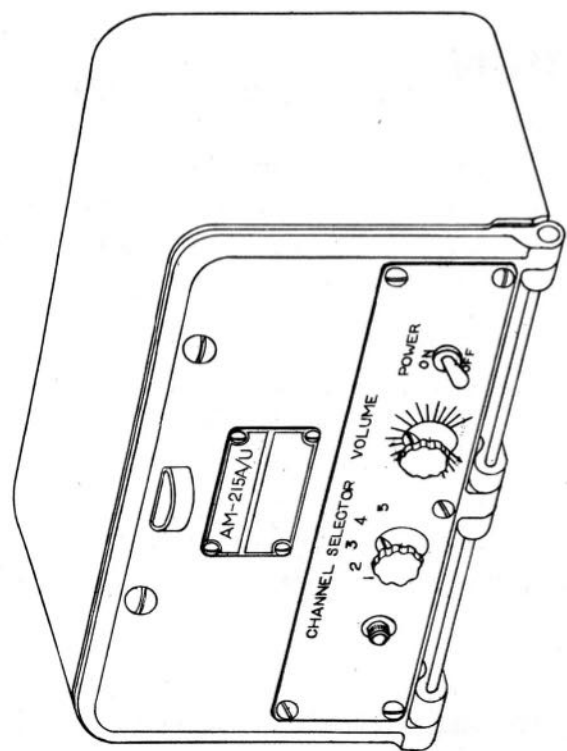


Figure 3-1. Outline and Installation Drawing

SECTION 3 INSTALLATION

1. UNPACKING.

The AF Amplifier AM-215A/U is packed for domestic shipment in a fiberboard shipping box (Box 1). The box should be opened at the top by cutting the tape that binds down the flaps and raising the flaps. Remove the packing list and the two instruction books from the packing above the unit. Pull out packing from around the unit to loosen it and lift from the box. Tear off the paper wrapping.

The equipment spares are similarly packed in a fiberboard box (Box 2). Open it in the same manner and remove the metal spare parts box and packing list.

2. GENERAL.

The AF Amplifier may be mounted by means of bolts through the top, back or bottom of the case in the areas shown cross-hatched in Figure 3-1 Outline and Installation Drawing. Input, output and power circuits may be brought into the case by means of terminal tubes in any of these shaded areas when the clearance from the chassis is sufficient, preferably at the top or near the top close to the connecting terminals.

All holes required for mounting bolts and terminal tubes are to be drilled in the case by the installing activity to fit the needs of the particular installation. An example

of a possible installation is shown in Figure 3-3 Typical Tubes and Cables.

3. INSTALLATION PROCEDURE.

a. Before drilling mounting holes in the case remove the unit from the case as follows:

1. Release the two fasteners at the top of the panel by turning them counterclockwise and tip the unit out of the case.

2. Take off the "CAUTION 110-120V" plate and disconnect the wires from the lower edge of the terminal strips, in the back of the case, by loosening the screws which hold the spade lugs.

3. Remove the screws that hold the two cable clamps at each side of the case.

4. Remove the cotter pin from the end of the hinge pin and take out the hinge pin.

5. Remove the unit from the case. See Figure 3-2.

b. Drill the required holes in the area shown cross-hatched in figure 3-1, taking into consideration the clearance between the chassis and the case. Be careful not to damage the terminal strips. Four $\frac{1}{4}$ " or $\frac{3}{8}$ " steel bolts should be used for mounting, placed as far apart as the cross-hatched area and other conditions will permit.

c. Mount the case and connect the terminal tubes.

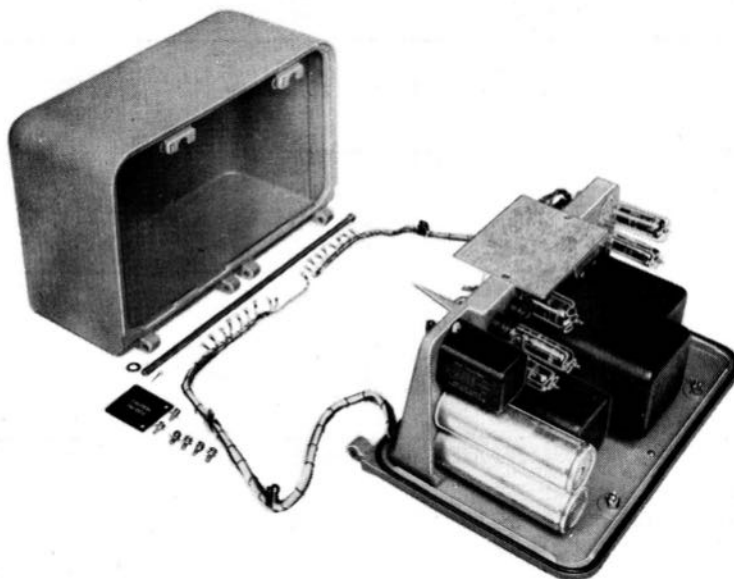


Figure 3-2. Amplifier Removed from Case

d. Pass the required leads through the terminal tubes and connect them to the top of the proper terminals, as marked, by soldering or by using the top screws.

CAUTION

Do not handle any wires that are carrying power or signal voltages. Be sure all circuits are off.

e. Reassemble the hinge by inserting the hinge pin from either side, screw the cable clamps in place and reconnect the amplifier wires to their corresponding terminals as marked. Replace "CAUTION 110-120V" plate.

f. Close the case and engage panel fasteners.

g. Complete all connections to power source, signal sources and reproducers, or line load. The signal sources must be adjusted to deliver average power in the range of 6 milliwatts to 2 watts. Over two watts may damage the amplifier and less than 6 milliwatts may not give full output when required.

4. MATCHING IMPEDANCES.

Each source of audio frequency should have a 600 ohm output impedance. Sources not having 600 ohm output must have their output adjusted to properly match the 600 ohm amplifier input, if they are to operate properly.

Full power output from the amplifier can be obtained only when the impedance of the load matches the amplifier output to which it is connected. The following table gives numerous combinations for correctly loading

the amplifier.

Considerable mismatching can be tolerated without excessive distortion, due to the action of the inverse feedback, but improper matching causes a loss in power output approximately proportional to the ratio of mismatch.

When two or more equal loads are connected the power will divide equally between them. When both the 600 and 15 ohm outputs are used simultaneously each should be connected to a load which is twice the impedance of the winding. This will properly load the amplifier and each load will receive half the power output.

5. ADJUSTING FOR HIGH OR LOW LINE VOLTAGE.

It is important that the taps on the power transformer T103 be properly connected for the line voltage supplied to the amplifier. Excessive voltage will shorten tube and component life, and low voltage will reduce the maximum undistorted output. Primary terminals are provided on the bottom of T103 for primary voltages as follows:

terminals 1 and 2—110 volts

terminals 1 and 3—115 volts

terminals 1 and 4—120 volts

The amplifier is wired at the factory for 115 volts.

Measure the line voltage and make certain that the primary leads are soldered to the terminals most nearly corresponding to the actual line voltage.

TABLE 3-1. OUTPUT LOAD MATCHING CHART

OUTPUT WINDING	SINGLE LOAD	SERIES LOADS	PARALLEL LOADS	SERIES PARALLEL LOADS
600	600	Two 300 Three 200 or Four 150	Two 1200 Three 1800 or Four 2400	Four 600
15	15	Two 7.5 Three 5 Four 3.75 or Five 3	Two 30 Three 45 Four 60 or Five 75	Four 15
600 and 15 Combination	1200 and 30 Respectively	Two 600 and Two 15 Respectively	Two 2400 and Two 60 Respectively	Two 2400 in parallel and Two 15 in series — or — Two 600 in series and Two 60 in parallel

All values are in ohms.

6. INSTALLATION CHECK.

With power source on, throw the POWER switch S102 to ON. The pilot light I101 should glow; turn the lens housing counterclockwise to make certain the

shutter is open.

Operate all signal sources and turn the CHANNEL SELECTOR switch S101 to each of the five positions noting whether each signal is reproduced normally. Check the operation of the volume control, R107.

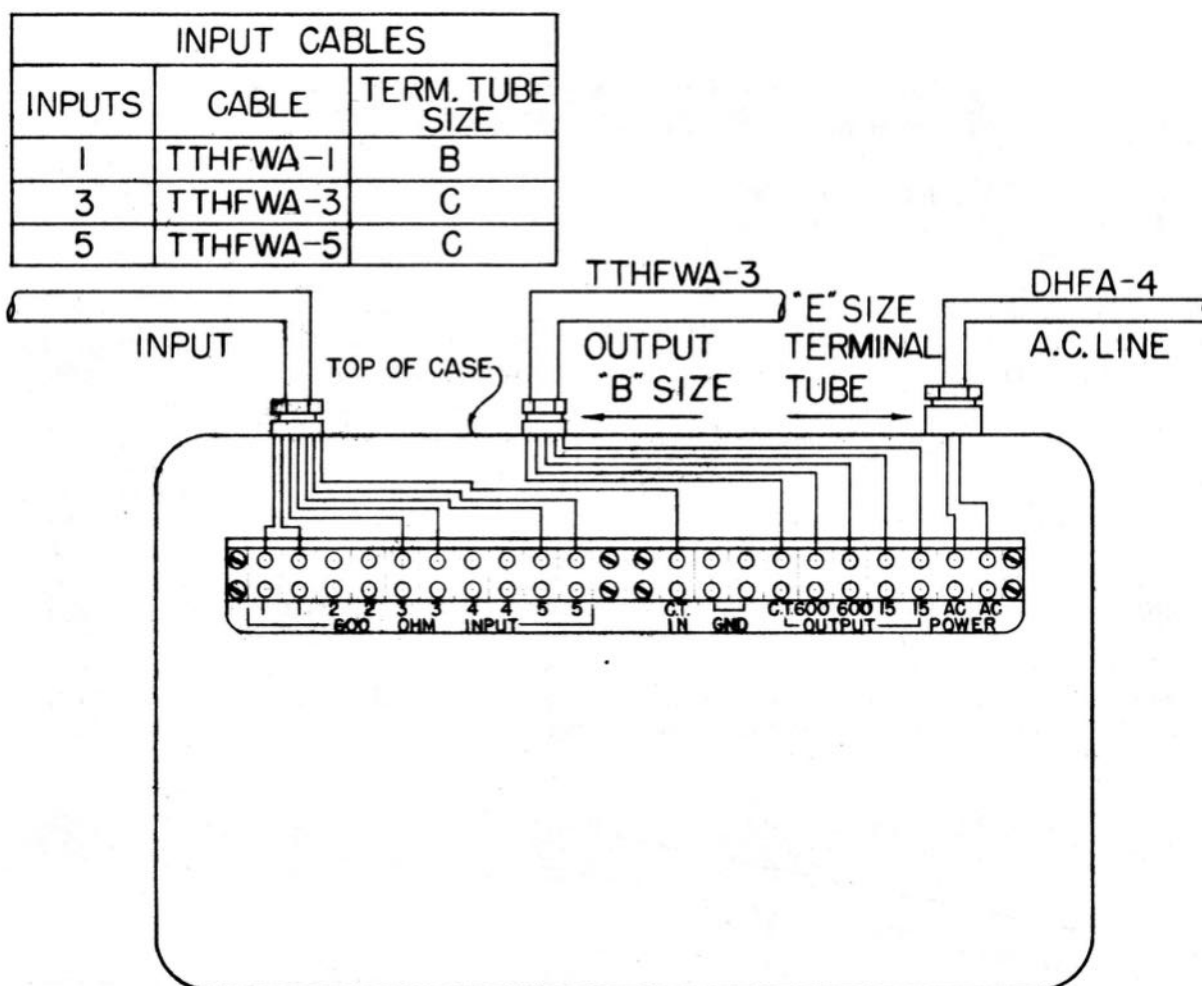


Figure 3-3. Typical Tubes and Cables

SECTION 4

OPERATION

1. GENERAL.

The operating controls are illustrated in Figure 1-1. Turn the VOLUME CONTROL R107 to 1 or 2, and throw the POWER switch S102 to ON. Illumination of the pilot light I101 indicates the power is on when the

shutter is open. Rotate the lens housing of the pilot light to adjust the shutter for the desired brilliance. Turn the CHANNEL SELECTOR S101 to the desired input channel and adjust the VOLUME CONTROL R107 for the desired volume. To turn the equipment off first decrease volume to 0 and then throw the POWER switch to OFF.

FAILURE REPORTS

A FAILURE REPORT must be filled out for the failure of any part of the equipment whether caused by defective or worn parts, improper operation, or external influences. It should be made on Failure Report, form NBS-383, which has been designed to simplify this requirement. The card must be filled out and forwarded to BUSHIPS in the franked envelope which is provided. Full instructions are to be found on each card.

Use great care in filling the card out to make certain it carries adequate information. For example, under "Circuit Symbol" use the proper circuit identification taken from the schematic drawings, such as T-803, in the case of a transformer, or R-207, for a resistor. Do not substitute brevity for clarity. Use the back of the card to completely describe the cause

of failure and attach an extra piece of paper if necessary.

The purpose of this report is to inform BUSHIPS of the cause and rate of failures. The information is used by the Bureau in the design of future equipment and in the maintenance of adequate supplies to keep the present equipment going. The cards you send in, together with those from hundreds of other ships, furnish a store of information permitting the Bureau to keep in touch with the performance of the equipment of your ship and all other ships of the Navy.

This report is not a requisition. You must request the replacement of parts through your Officer-in-Charge in the usual manner.

Make certain you have a supply of Failure Report cards, and envelopes on board. They may be obtained from any Electronics Officer.

FAILURE REPORT—ELECTRONIC EQUIPMENT
NAVSHIPS (NBS) 383 (REV. 8-45)
(FORMERLY NAVSHIPS (NBS) 383 AND NAVSHIPS (NBS) 384)
SHIP NUMBER AND NAME OR STATION

CHECK ONE: ☐ RADIO
EQUIPMENT MODEL DESIGNATION
TYPE NUMBER AND NAME OF MAJOR UNIT INVOLVED
THIS
TUBE TYPE, INCLUDING PREFIX LETTERS
TUBE MANUFACTURER
FAILURE OCCURRED IN:
☐ STORAGE ☐ OPERATIVE
☐ HANDLING ☐ OTHER (SPECIFY)
☐ INSTALLING
NATURE OF FAILURE AND REMARKS

NOTICE—Read notes on reverse side. Additional forms and envelopes may be obtained from nearest BMO.

NAME OF PERSON MAKING REPORT
DATE

ELECTRONIC EQUIPMENT FAILURE REPORT (SIG)
NAVSHIPS (NBS) 383 (REV. 11-45)

NOTICE—Read notes on cover prior to preparing this form.

*REPORT NO. _____
DATE _____

ORGANIZATION PERFORMING MAINTENANCE
NAME AND RANK OF OFFICER ACCOUNTABLE FOR MAINTENANCE

EQUIPMENT INVOLVED:
☐ Navy ☐ Army ☐ USMC ☐ JAG ☐ Commercial ☐ Other (Specify)
☐ Radio ☐ Radar ☐ Sonar ☐ Wire ☐ Test ☐ Test ☐ Power ☐ Sound ☐ Other (Specify)

EQUIPMENT MODEL DESIGNATION
SERIAL NUMBER OF EQUIPMENT
NAME OF CONTRACTOR
CONTRACT NO.

TYPE NUMBER AND NAME OF MAJOR UNIT INVOLVED
SERIAL NUMBER OF UNIT
CONTRACT OR PO DATA OF UNIT
DATE EQUIPMENT RECEIVED

ITEM WHICH FAILED

THIS SIDE FOR TUBES
TUBE TYPE, INCLUDING PREFIX LETTERS
SERIAL NO. (NOTE 4)
NAME OF PART
CIRCUIT SYMBOL (e.g. R-134)
NAVY TYPE NO.

TUBE MANUFACTURER
CONTRACT NO. (NOTE 4)
SERIAL NO.
*CONTRACT DATA
*DATE RECD.
*ARMY STOCK NO.

FAILURE OCCURRED IN
☐ Storage ☐ Operation
☐ Handling ☐ Other (Specify in remarks)
☐ Installing

GUARANTEED HOURS (NOTE 4)
ACTUAL HOURS
DATE OF ACCEPTANCE (NOTE 4)
DATE OF FAILURE
TYPE OF FAILURE (NOTE 7)
TUBE CIRCUIT SYMBOL (V-)

*CHECK-OFF OR TAG DATA (NOTE 4)
*MANUFACTURER'S DATA (NOTE 4)

BRIEF DESCRIPTION AND CAUSE OF FAILURE, INCLUDING APPROXIMATE LIFE (CONTINUE ON BACK)

NATURE OF FAILURE AND REMARKS (NOTE 4) (CONTINUE ON BACK)

CONCLUSION:
☐ Normal replacement ☐ Shortage ☐ Modification ☐ Failure ☐ Transportation damage ☐ Other (Specify)

*NOT REQUIRED FOR REPORTS SUBMITTED BY NAVAL ACTIVITIES.

10-66651-1 U. S. GOVERNMENT PRINTING OFFICE

Figure 5-1. Failure Report, Sample Form

SECTION 5

MAINTENANCE

1. OPERATORS MAINTENANCE.

a. GENERAL.—To insure proper operation of the AM-215A/U Amplifier, the equipment should be given a daily operational check. Turn on the amplifier, supply input signal and check the loudspeaker output, or other reproducer output, for general quality and volume. Rotate the volume control to check for normal, quiet, control of amplifier output. Adjust the pilot light for desired brilliance by rotating the lens housing. Check each active input for normal operation.

b. EMERGENCY MAINTENANCE.—

NOTICE TO OPERATORS

Operators shall not perform any of the following emergency maintenance procedures without proper authorization.

CAUTION

Be sure the POWER switch is in OFF position while replacing tubes or fuses or doing work inside the case.

TABLE 5-1. OPERATORS EMERGENCY MAINTENANCE

TROUBLE SYMPTOM	PROBABLE CAUSE	CORRECTION
Power switch on Pilot Light off.	Pilot lamp I101, burned out.	Replace pilot lamp from spares. See Pilot Lamp Replacement paragraph.
	Fuse, F101 or F102, blown.	Replace with fuse or fuses from spares in unit or from spare parts kit. See Warning below, and Fuse Replacement paragraph.
	AC power source not on.	Turn on power source; report power failure.
Power on, pilot glows, no signal output, or unsatisfactory output.	No input, or unsatisfactory input signal.	Try other inputs; check unsatisfactory input source; check input connections on terminal strips.
	Defective tubes.	Replace any tubes that do not light and then, if necessary, replace each of the other tubes one by one. See Tube Replacement paragraph.

WARNING

Do not replace either fuse with one of greater than 1 ampere rating unless continued operation is more important than probable damage. If a fuse burns out immediately after replacement, do not replace it a second time until the cause has been corrected.

(1.) PILOT LAMP REPLACEMENT.—To replace the pilot lamp, unscrew the lens-shutter assembly, counterclockwise, from the front of the panel. Release the lamp by pressing it in and turning counterclockwise. Insert the new lamp (Mazda 44) and lock it in place. Replace the lens-shutter assembly.

(2.) FUSE REPLACEMENT.—Open the case by releasing the fasteners at the top of the panel with a quarter turn counterclockwise. Tip the panel out so that the top of the chassis is accessible. The fuses are plainly marked F101 and F102. Extract the fuse by turning the knurled fuse holder cap approximately an eighth turn counterclockwise and lifting both the cap and the fuse out of the holder. Pull the fuse out of the cap. Insert a new fuse in the cap and replace in holder. Use the SPARE FUSES which are held in clips on the chassis,

and replenish from spare parts.

(3.) TUBE REPLACEMENT.—To replace tubes, open the case the same as for fuse replacement. Before removing a tube, snap the wire tube clip off the top of the tube by pressing on the two outside loops while steadying the tube with the thumb or a finger. Grasp the tube and pull straight up from the socket with a very slight rocking motion. Use only a slight rocking motion, if any; excessive rocking will break off tube pins or damage the socket. The tube types are plainly marked on the chassis besides the socket. When the tube is out of the socket, align the tube clip, by bending if necessary, so that the center loop is straight above the center of the socket.

When putting a tube into the socket, align the pins of the tube to correspond with the holes in the socket; hold the tube straight above the socket, pressing it against the tube clip; and push the tube straight into the socket. Snap the tube clip over the top of the tube by pressing on the center loop with thumb or finger while steadying the tube.

After replacing tubes, make certain that all tube clips are in place on top of the tubes before closing the case.

NOTE

ALL TUBES OF A GIVEN TYPE SUPPLIED WITH THE EQUIPMENT SHALL BE CONSUMED PRIOR TO EMPLOYMENT OF TUBES FROM GENERAL STOCK.

(4.) A #8 ALLEN WRENCH, held in a clip on the chassis, is provided for tightening the knob set screws.

NOTE

THE ATTENTION OF MAINTENANCE PERSONNEL IS INVITED TO THE REQUIREMENTS OF CHAPTER 67 OF THE BUREAU OF SHIPS MANUAL OF THE LATEST ISSUE.

2. PREVENTIVE MAINTENANCE.

a. After each 500 hours of operation, all tubes should be removed from the amplifier and tested. See paragraph 1.b.(3.) above. Replace all defective tubes.

b. When the tubes are tested, the amplifier chassis and terminal connection strips should be given a thorough visual inspection for loose, broken or corroded connections and for damaged components.

c. Make certain that the power supply is properly adjusted for high or low line voltage (Sec. 3, Para. 5). Excessive voltage will shorten tube life.

3. CORRECTIVE MAINTENANCE.

a. FAILURE REPORTS.—Make failure reports as instructed on page 5-0.

b. GENERAL.—The AF Amplifier AM-215A/U is described in Section 1 where various ratings are listed; its operating principles are discussed in Section 2 and Section 6 lists parts data and color codes that will be helpful in maintenance.

Figures 5-1 through 5-6 and Table 5-2 will assist in corrective maintenance. Other data is included in this section.

The following discussion is intended to aid in locating and correcting sources of trouble in the most direct, efficient manner. When a trouble is not obvious, start first with simple tests and then proceed with the purpose of localizing the trouble to one section or one stage of the amplifier, where a more detailed test can locate the exact component which is at fault. Analyze symptoms and try to select the tests that will most quickly reveal the cause of the trouble.

c. TROUBLE SHOOTING CHART.—Table 5-2 is a complete listing in block form of possible symptoms of trouble and the probable causes. Points of inspection or test are in the right hand blocks and trouble symptoms are listed on the lines leading to the left, with blocks of possible causes at the ends of these lines. The chart progresses from simple troubles and tests to the more complex, including signal tracing steps on the bottom half of the page.

d. SIMPLE TESTS.—Simple tests include Operators Maintenance and the upper blocks on the trouble shooting chart. Such tests as visual inspection, replacing of fuses and tubes, and trying other input channels can be made without instruments and will often correct the trouble or indicate its cause.

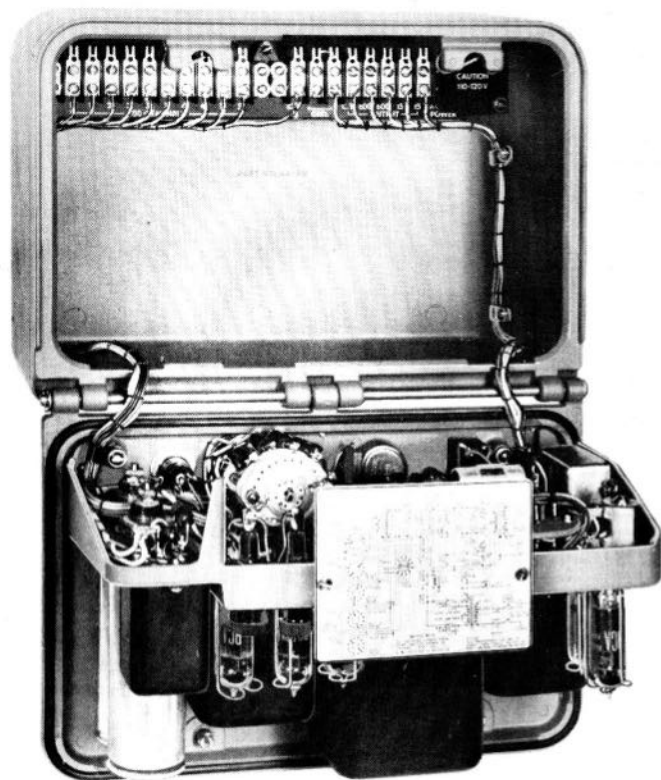


Figure 5-2. Amplifier Open for Maintenance

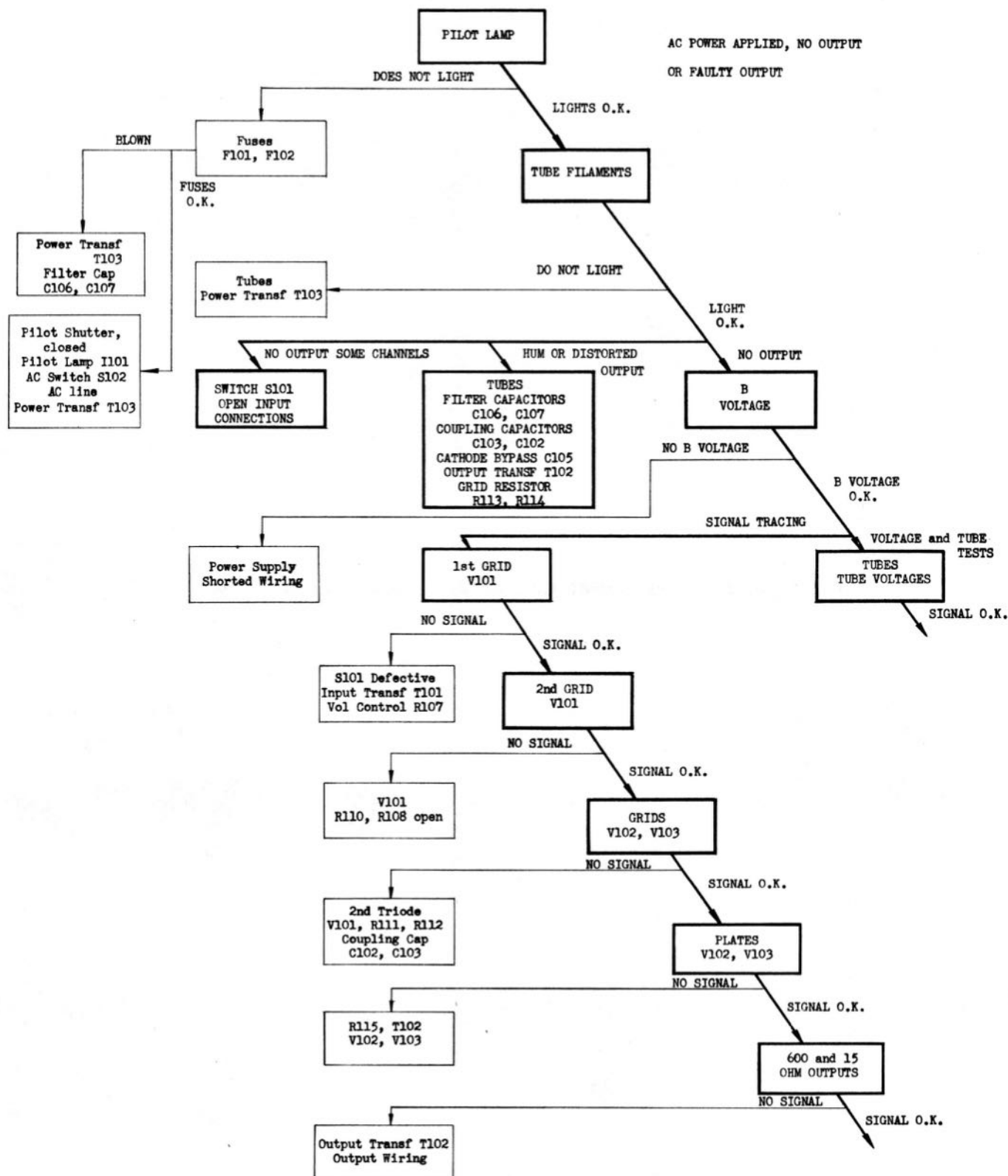


TABLE 5-2. TROUBLE SHOOTING CHART

NAVSHIPS 91078
AM-215A/U

MAINTENANCE

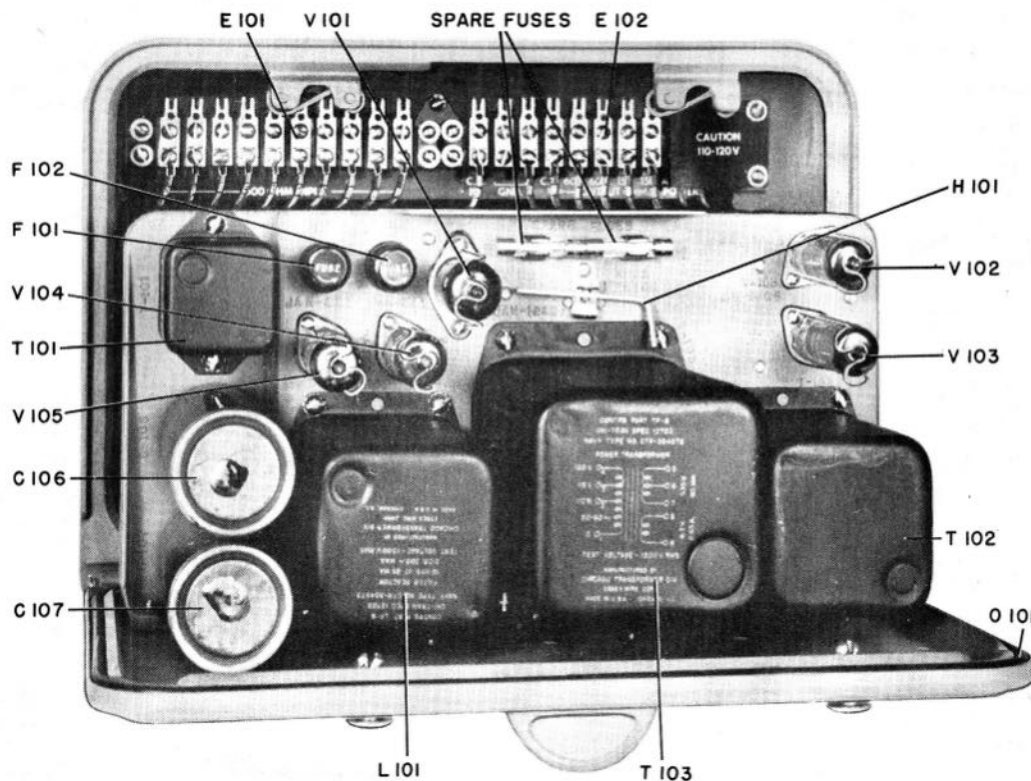


Figure 5-3. AF Amplifier AM-215A/U Components, Top View

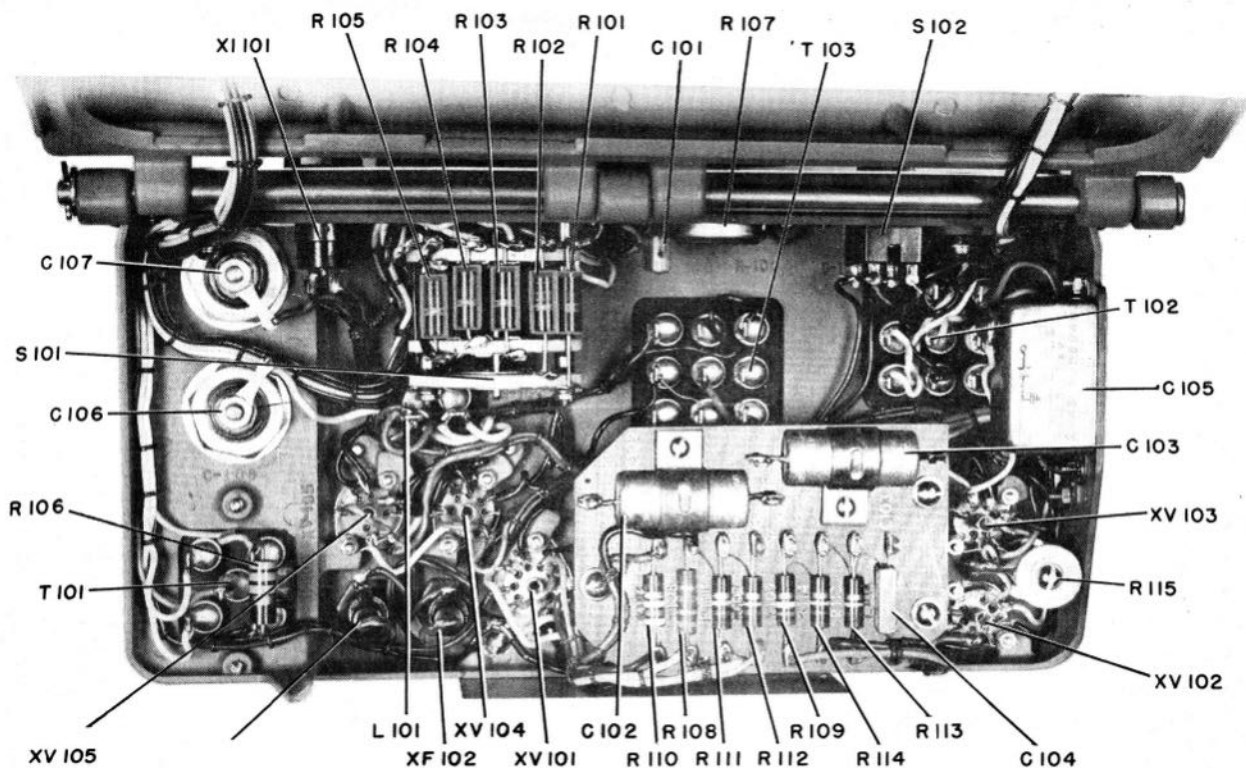


Figure 5-4. AF Amplifier AM-215A/U Components, Bottom View

e. VOLT-OHMMETER TESTS.

Equipment required.

Volt-ohm-milliammeter—such Model OE series or equivalent.

If simple tests do not correct the trouble or reveal its cause much can be learned with voltage or/and resistance tests. Data for these tests is given at the bottom of the Schematic Diagram, Figure 5-5. For these tests open the case as shown in Figure 5-2.

CAUTION

DO NOT CONTACT ANY TERMINALS OR WIRES WHILE THE UNIT IS TURNED ON, WITH ANYTHING EXCEPT PROPERLY INSULATED TEST PRODS.

One of the principal voltages in the amplifier is the "B" voltage measured at the screen (pin 6) of V102, or V103, the power output tubes, or at C107.

If this voltage is normal and the amplifier still is inoperative or operates improperly, proceed with a complete stage by stage voltage and resistance test; or use signal tracing methods.

CAUTION

BE SURE AMPLIFIER IS TURNED OFF AND ALL CONDENSERS ARE DISCHARGED BEFORE USING OHMMETER TESTS.

f. SIGNAL TRACING.—

(1) Equipment Required

1. Audio oscillator, such as Model LO or LAJ series or equivalent.
2. Oscilloscope, such as OBL series or equivalent.
3. Volt-Ohm-Milliammeter such as Model OE series or equivalent.

Set up the signal tracing test by first connecting a 600 ohm resistor of 20 watts rating or higher to the 600 ohm output terminals—all other output loads disconnected. Connect the output of the audio oscillator to a vacant pair of input terminals. If all inputs are in use, disconnect one pair of input leads for this test. Turn the Channel Selector switch to the corresponding number. Adjust the audio oscillator to a frequency of 1000 cps and to an output that will produce 1.9 volts at the amplifier input, as measured by the AC part of the volt-ohm-milliammeter. Set the volume control to maximum.

Follow the signal through the amplifier, stage by stage, as indicated in Table 5-2; using the oscilloscope to indicate the presence or absence of signal and/or the character of the signal. Proper interpretation of the oscilloscope pattern will indicate the type and source of trouble. If necessary, follow the signal tracing by voltage and/or ohmmeter testing of the individual stage or component suspected.

(2.) Gain and Power Output.

A normal amplifier will give full output with 1.9 volts or less applied to the input. Full output is indicated by 77.5 volts across the 600 ohm output load. With a sine wave input, the normal full output as viewed on the oscilloscope will approximate a sine wave with the peaks slightly flattened.

g. HUM.—Common causes of hum are defective tubes, open or shorted capacitors or defective input grounding. Interchanging the output tubes, or replacing and interchanging, will frequently reduce hum originating in this stage. Hum sources can be readily located by signal tracing.

b. DISTORTION.—The cause of distortion is most easily isolated by signal tracing, while defective tubes, incorrect voltages, leaky condensers, etc. are causes that can be found by voltage or resistance tests or by the substitution of parts. Do not replace major parts unless sufficient testing has been done to prove that other parts are not at fault.

TABLE 5-3. TUBE OPERATING VOLTAGES AND CURRENTS

TUBE TYPE	FUNCTION	PLATE (E)	PLATE (MA)	SCREEN (E)	SCREEN (MA)	CATH (E)	GRID (E)	HEATER AC (E)
12AU7	Voltage Amplifier	77	.5	—	—	4.9	0	6.3
	Phase Inverter	192	1.6	—	—	85	77	6.3
6AQ5	Power Amplifier	275	*36	280	*2.5	15	0	6.3
6X4	H V Rectifier	270 AC	*85	—	—	300	0	6.3

Note: All voltages measured to ground; 20,000 ohms per volt dc meter; 1000 ohms per volt ac meter; zero signal; *each tube.

TABLE 5-4. TUBE CHARACTERISTICS

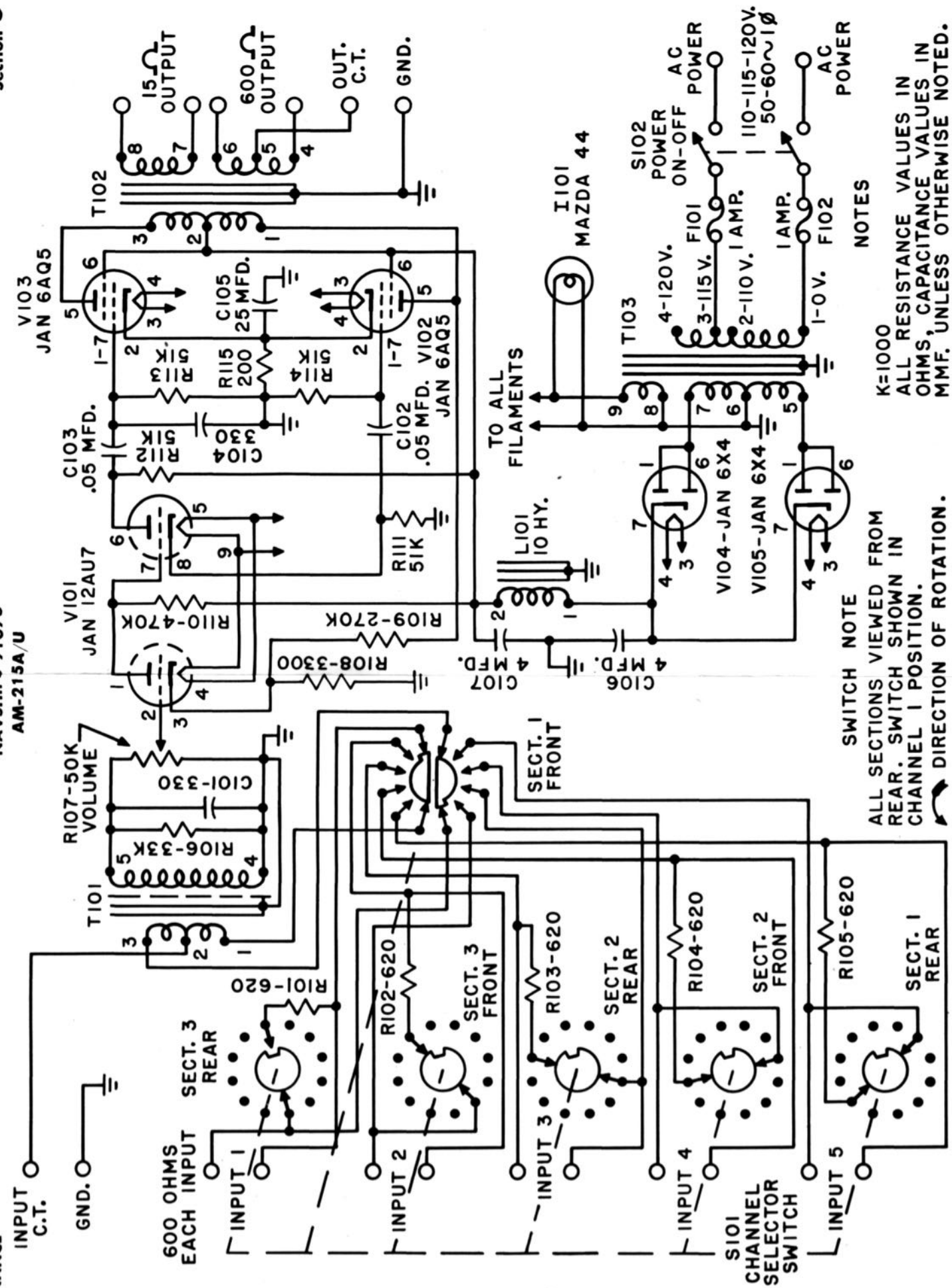
TUBE TYPE	FILAMENT VOLTAGE (V) AC	FILAMENT CURRENT (A) AC	PLATE VOLTAGE (V)	GRID BIAS (V)	SCREEN VOLTAGE (V)	PLATE CURRENT (MA)	SCREEN CURRENT (MA)	AC PLATE RESISTANCE (OHMS)	VOLTAGE AMPLIFICATION FACTOR (MU)	TRANSCONDUCTANCE (MICROMHOS)		EMISSION	
										NOR-MAL	MINI-MUM	IS (MA)	TEST VOLT
12AU7	12.6 6.3	.15 .30	¹ 250	— ¹ 8.5	—	¹ 10.5	—	¹ 7700	¹ 17	¹ 2200	¹ 1750	70	30
6AQ5	6.3	.45	250	—12.5	250	47	7	52,000	—	4100	3000	100	30
6X4	6.3	.60	—	—	—	—	—	—	—	—	—	² 140	² 50

For condenser-input filter; A-C plate voltage per plate (rms) 325 volts; D-C output current 70 ma. ¹Each triode ²Each diode

TABLE 5-5. WINDING DATA

NOTE: Refer to Fig. 5-5 for schematic diagrams

SYMBOL DESIGNATION	CHICAGO TRANSF NUMBER	WINDING	WIRE SIZE	TURNS	D-C RESISTANCE OHMS	IMPEDANCE RATIO	HIPOT A-C VOLTS	REMARKS
T101	12700 7A-SPL	Primary Term 1-3 CT Term 2	#37PE	788 CT	150	1. to 33.3	750	600 Ohms CT
		Secondary Term 4-5	#41PE	5312	1600		750	20,000 Ohms Electrostatic shield between primary and secondary; vacuum impregnated with Irvington #100 varnish.
T102	12701 7F-DO	Primary Term 1-3 CT Term 2	#36PE	2052	290	16.7 to 1 667 to 1	1750	10,000 Ohms Impedance
		Secondary Term 4-6 CT Term 5	#33PE	536 CT	34		1750	600 Ohms Impedance
		Secondary Term 7-8	#23PE	86	0		1750	15 Ohms Impedance 50 ma pri DC current; vacuum impregnated with Irvington #100 varnish.
T103	12702 K2C4-130-1 1/4"	Primary Term 1-4 taps at 2 and 3	#24PE	445 taps at 426, 407	10		1750	0, 110, 115, 120 V; 50/60 cycles.
		Secondary HV-Term 5-7 CT Term 6	#32PE	2112 CT	190		1750	535 V @ 85 ma
		6.3V-Term 8-9	#17PE	25 1/2	0		1750	6.3 V @ 2.65 amps Vacuum impregnated with Irvington #100 varnish.
L101	12703 K8A-BO-1"	Single	#32PE	3519	270	—	1750	10 hy, 85 ma Vacuum impregnated with Irvington #100 varnish.



NOTES

K=1000

ALL RESISTANCE VALUES IN OHMS, CAPACITANCE VALUES IN MMF. UNLESS OTHERWISE NOTED.

RESISTANCES OF TRANSFORMER AND CHOKE WINDINGS

SYMBOL	PRIMARY	SECONDARY
T101	150 Ohms Term 1-3	1600 Ohms Term 4-5
T102	290 Ohms Term 1-3	34 Ohms Term 4-6
T103	10 Ohms Term 1-4	190 Ohms Term 5-7
L101	270 Ohms Term 1-2	

Figure 5-5. AF Amplifier AM-215A/U, Schematic Diagram

TUBE TYPE	OPERATING VOLTAGE DATA AND NON-OPERATING RESISTANCE DATA									
	SOCKET PIN NUMBER									
	1	2	3	4	5	6	7	8	9	
V101 12AU7	740K DC	77 DC	1600 DC	0 DC	3300 DC	4.9 DC	0 DC	0 DC	0 DC	6.3 AC
V102 6AQ5	*51K DC	0 DC	200 DC	15 DC	0 DC	0 DC	0 DC	0 DC	0 DC	0 AC
V103 6AQ5	51K DC	0 DC	200 DC	15 DC	0 DC	0 DC	0 DC	0 DC	0 DC	0 AC
V104 6X4	100 AC	270 AC	0 AC	0 AC	0 AC	0 AC	0 AC	0 AC	0 AC	0 AC
V105 6X4	100 AC	270 AC	0 AC	0 AC	0 AC	0 AC	0 AC	0 AC	0 AC	0 AC

RESISTANCE DATA: AC power and input and output circuits disconnected; volume control at maximum; all resistances are normal values measured to ground except where noted.

K = 1000

*Measures infinity with tube out of socket.

VOLTAGE DATA: Equipment in normal operating condition, with no input; the voltages are normal values with a 20,000 ohm per volt DC meter or a 1,000 ohm per volt AC meter, all measured to ground; scale selected to give a reading of not less than 1/3 full scale.

WIRE COLOR CODE (#20 SHR, JAN-C-76)		SYM COLOR	
49	YELLOW	25	BROWN
50	BLACK	26	RED
51	BLACK	27	ORANGE
52	BLUE	28	YELLOW
53	BLACK	29	ORANGE
54	YELLOW	30	GREEN
55	BROWN	31	BLACK
56	ORANGE	32	GREY
57	YELLOW	33	GREY
58	BLACK	34	BLACK
59	BLACK	35	BROWN
60	BROWN	36	RED
61	BROWN	37	GREY
62	YELLOW	38	GREY
63	YELLOW	39	BLACK
64	YELLOW	40	BLUE
65	RED	41	BLUE
66	YELLOW	42	BLACK
67	BLUE	43	BLACK
68	GREEN	44	BROWN
69	YELLOW	45	BROWN
70	BLACK	46	BLUE
71	GREEN	47	ORANGE
72	GREEN	48	RED
73	BLUE		

WIRE COLOR CODE (#20 SHR, JAN-C-76)		SYM COLOR	
1	BROWN	11	BLACK
2	BROWN	12	BLUE
3	RED	13	BLACK
4	RED	14	BLACK
5	ORANGE	15	GREEN
6	ORANGE	16	GREEN
7	YELLOW	17	GREEN
8	YELLOW	18	WHITE
9	GREEN	19	WHITE
10	GREEN	20	GREY
11	BLACK	21	GREY
12	BLUE	22	WHITE
13	BLACK	23	WHITE
14	BLACK	24	GREEN

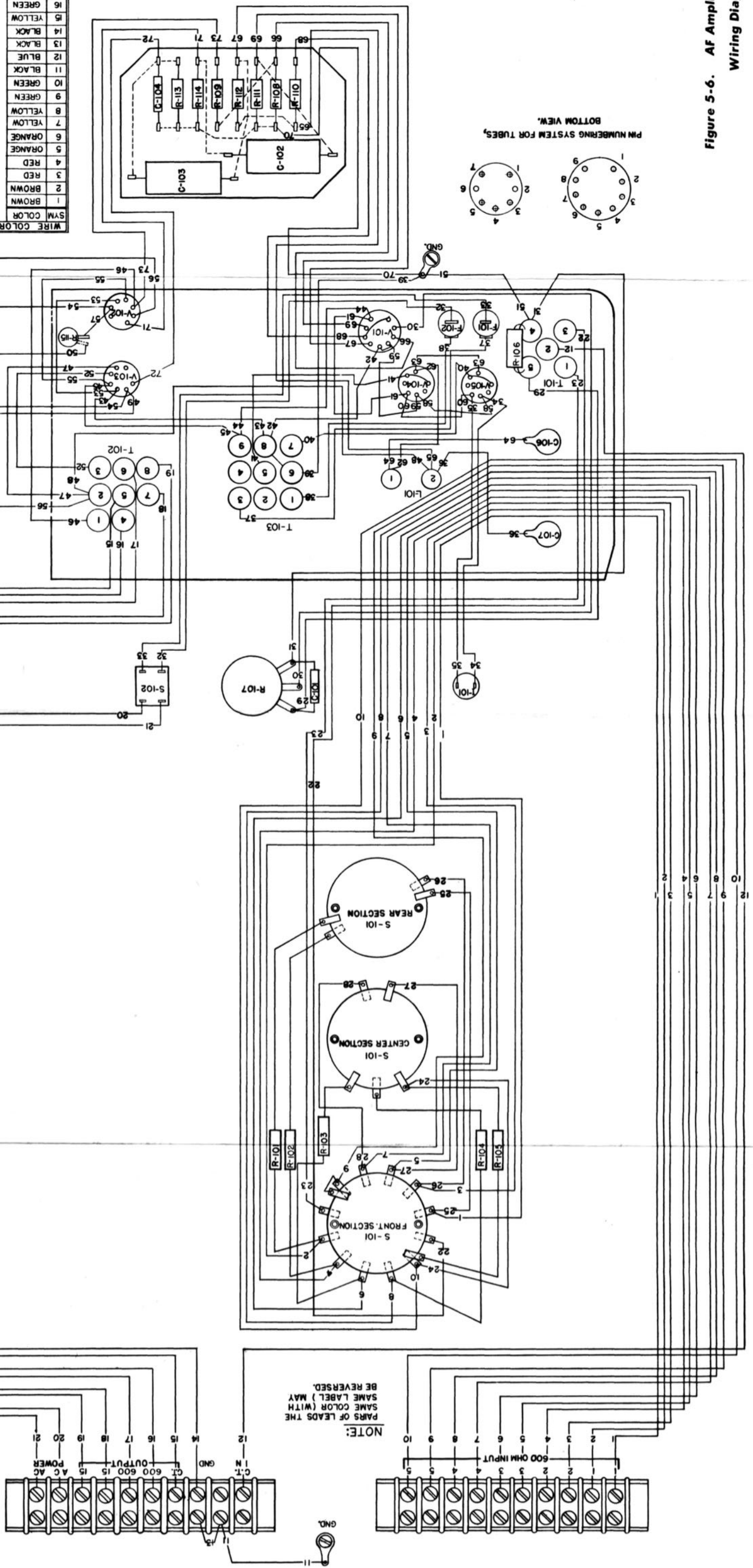


Figure 5-6. AF Amplifier AM-215A/U,
Wiring Diagram

SECTION 6
PARTS LIST

TABLE 6-1. WEIGHT AND DIMENSIONS OF SPARE PARTS BOX*

EQUIPMENT SPARES					
SPARE PARTS BOX	OVERALL DIMENSIONS			VOLUME	WEIGHT
	HEIGHT	WIDTH	DEPTH		
One Only	6 $\frac{3}{16}$	13 $\frac{1}{4}$	7 $\frac{1}{4}$	0.34	22

TABLE 6-2. SHIPPING WEIGHT AND DIMENSIONS OF SPARE PARTS BOX*

EQUIPMENT SPARES						
SHIPPING BOX NUMBER	SPARE PARTS BOX	OVERALL DIMENSIONS			VOLUME	WEIGHT
		HEIGHT	WIDTH	DEPTH		
2	One Only	7	13 $\frac{3}{4}$	8	0.45	23.5

*Dimensions are in inches; volume, cubic feet; weight, pounds.

NOTE: The Tender and Stock Spare Parts are shipped in bulk and therefore are not shown in the spare parts list.

TABLE 6-3. MAJOR UNIT

SYMBOL GROUP	NAME OF MAJOR UNIT	DESIGNATION
101-199	AF AMPLIFIER	AM-215A/U

TABLE 6-4. COMBINED PARTS AND SPARE PARTS LIST

SYMBOL DESIG- NATION	NAME OF PART AND DESCRIPTION	FUNCTION	JAN AND (NAVY TYPE) NO.	MFR. & MFR'S DESIG.	CON- TRACTOR DWG. & PART NO.	ALL SYMBOL DESIG. INVOLVED	EQUIP- MENT SPARE PARTS	
							BOX NO.	QUAN.
C101	CAPACITOR, fixed; mica, 330 mmf $\pm$ 20%, 500 vdcw. Spec. JAN-C-5	Hi Freq. Bypass	CM20B331M	JAN No.	CM-22	C101 C104	1	1
C102	CAPACITOR, fixed; paper, .05 mfd $\pm$ 20%, 600 vdcw. Spec. JAN-C-25	Coupling	CP29A1DF503M	JAN No.	CP-22	C102 C103	1	1
C103	Same as C102	Coupling						
C104	Same as C101	Spurious Freq. Bypass						
C105	CAPACITOR, fixed; electrolytic, 25 mfd, 50 vdcw. Spec. JAN-C-62	Cathode Bypass	CE62C250G	JAN No.	CE-1	C105	1	1
C106	CAPACITOR, fixed; paper, 4 mfd, 600 vdcw. Spec. JAN-C-25	1st Filter	CP40C2DF405V	JAN No.	CP-18	C106 C107	1	1
C107	Same as C106	2nd Filter						
E101	BOARD, terminal; general purposes; 10 terms, brass nickel pl, 2 screws each; term 7/16" between centers, barriers; molded bakelite; 5/8" lg x 1-11/32" wd x 1/2" thk overall; four 11/64" diam mtg holes on 4-13/16" x 27/64" centers	Input Connector Board		6 10-141-3/4W	EL-45	E101 E102		0
E102	Same as E101	Output Connector Board						
E103	KNOB, round; 8 indents equal spaced around top; skirted bottom; pointer 3/8" rad; black phenolic; for 1/4" diam shaft; double #8-32 Allen head set screws; white line on pointer; 1-7/16" diam x 3/8" h; brass insert; hole depth 9/16"; counterbored under skirt 11/16" diam x 1/8" d. Navy Dwg. RE10F-479A Type B	Volume Control		8 Navy No.	EK-7	E103		0
E104	Same as E103	Selector Switch						
F101	FUSE, cartridge; glass enclosed, non-renewable fuse, ferrule type, 1 1/4" lg, 1/4" diam ferrule; rated 250 v, continuous 110% rating; blowing time 60 minutes for 135% load (1 amp) Navy Dwg. RE28F120	Line Fuse	(28032-1)	2 3AG	FU-8	F101 F102	1	40
F102	Same as F101	Line Fuse						
H101	WRENCH, angle; 5/64" hex; for #8 Allen socket head screw; steel; cad plate; 2" x 3/4" overall	Knob Wrench		10 Descr.	VW-2	H101	1	1
I101	LAMP, incandescent; 6-8 V, .25 amp; clear bulb; miniature bayonet base; 1-3/16" lg x 7/16" diam; Mazda 44	Pilot Lamp		11 44	IL-3	I101	1	2

PARTS LIST

NAVSHIPS 91078
AM-215A/USection 6
L-101-R110

L101	REACTOR, filter choke: 10 hv, 85 ma; 300 ohms DC resistance; 1750 v RMS test; HS metal case 2.49" lg x 2.37" wd x 3.29" h excl term and mtg fl; term 13/16" h; six 0.187" diam mtg holes four of which are on 2.690" x 1.750" mtg/c, remaining two holes in ctr of 1.750" dimension; two solder lug term on bottom. Spec. JAN-T-27	Filter	(304573)	3 Spec. #12703 K8A-BO-1	LF-6	L101	1	1
O101	GASKET: panel (cover); neoprene tubing, 3/16" diam; rectangular when mtd, 10-5/32" lg x 6-23/32" wd; circular when fabricated, 35/32" circum, ends butted together and vulcanized	Drip Proof Seal		5 PK-21	PK-21	O101	1	1
O102	CLIP, tube: for holding tube in socket; coated stainless steel spring wire, full hard; 1-9/16" h x 1 1/4" wd x 5/8" d; loops at ends provide for mounting with #4-40 screws which hold socket, 1 1/8" mtg/c	Holds V101		5 OM-205	OM-205	O102	1	1
O103	CLIP, tube: for holding tube in socket; coated stainless steel spring wire, full hard; 1-15/16" h x 1 1/8" wd x 9/16" d; loops at ends provide for mounting with #4-40 screws which hold socket, 3/8" mtg/c	Holds V102		5 OM-206	OM-206	O103 O104 O105 O106	1	1
O104	Same as O103	Holds V103						
O105	Same as O103	Holds V104						
O106	Same as O103	Holds V105						
R101	RESISTOR, fixed: comp, 620 ohms $\pm$ 5%, 2 watts. Spec. JAN-R-11	Input 1 Dummy Load	RC40BF621J	JAN No.	RC-18	R101 R102 R103 R104 R105	1	3
R102	Same as R101	Input 2 Dummy Load						
R103	Same as R101	Input 3 Dummy Load						
R104	Same as R101	Input 4 Dummy Load						
R105	Same as R101	Input 5 Dummy Load						
R106	RESISTOR, fixed: comp, 33K ohms $\pm$ 5%, 2 watts. Spec. JAN-R-11	T101 Secondary Load	RC40BF333J	JAN No.	RC-41	R106	1	1
R107	RESISTOR, VARIABLE: composition; 50,000 ohm; 2 watt, 70° C max operating; 3 solder lug term; enclosed metal case 1-1/16" diam x 9/16" d; type 1 round metal shaft, 0.250" diam; clockwise log taper: 3/32" x 3/32" lg mtg bushing; resistant to salt spray; same as 636061 except 636061 has counterclockwise log taper, ($\pm$ 10% tol; 7/8" lg shaft.)	Volume Control	(636060-N10)	1 JA5031-P3056	RV-19	R107	1	1
R108	RESISTOR, fixed: comp, 3300 ohms $\pm$ 5%, 1 watt. Spec. JAN-R-11	Cathode Bias & Feedback	RC30BF332J	JAN No.	RC-40	R108	1	1
R109	RESISTOR, fixed: comp, 270K ohms $\pm$ 5%, 1 watt. Spec. JAN-R-11	Inverse Feedback	RC30BF274J	JAN No.	RC-22	R109	1	1
R110	RESISTOR, fixed: comp, 470K ohms $\pm$ 10%, 1 watt. Spec. JAN-R-11	Plate-grid, Common Coupling	RC30BF474K	JAN No.	RC-24	R110	1	1

TABLE 6-4. COMBINED PARTS AND SPARE PARTS LIST (Continued)

SYMBOL DESIG- NATION	NAME OF PART AND DESCRIPTION	FUNCTION	JAN AND (NAVY TYPE) NO.	MFR. & MFR'S DESIG.	CON- TRACTOR DWG. & PART NO.	ALL SYMBOL DESIG. INVOLVED	EQUIP- MENT SPARE PARTS	
							ON	XOB
R111	RESISTOR, fixed: comp, 51K ohms $\pm$ 5%, 1 watt. Spec. JAN-R-11	Cathode Load	RC30BF513J	JAN No.	RC-17	R111 R112 R113 R114	1	2
R112	Same as R111	Plate Load						
R113	Same as R111	Grid Return						
R114	Same as R111	Grid Return						
R115	RESISTOR, fixed: wire wound, 200 ohms $\pm$ 5%, 7 watts. Spec. JAN-R-26	Cathode Bias	RW30F201	JAN No.	RW-23	R115	1	1
S101	SWITCH, rotary: 7 pole 5 position; 3 cer- amic sections; elkonium 18-spring silver alloy contacts and rotor segments; 2% 2% diam x 2% d; two poles are non- shorting 5 pos selector; 5 poles are closed circuits so arranged that one pole is opened for each switch position, respectively; solder lug terminals, mtg bushing $\frac{1}{8}$ " lg x $\frac{1}{8}$ "-32; $\frac{1}{8}$ " lg x $\frac{1}{4}$ " diam metal shaft; Navy Spec. 16S19(RE)	Channel Selector		7 RS-33	SW-11	S101	1	1
S102	SWITCH, toggle: DPST. Spec. JAN-S-23	AC Power	ST22K	JAN No.	SW-10	S102	1	1
T101	TRANSFORMER, AF: input type; pri im- pedance 600 ohms, CT, sec'd impedance 20,000 ohms, 750 v test; HS steel case, laminated 29 gauge Armco Radio 6 core; case 1.500" sq x 2.13" h excl term and mtg fl; 2 watts max oper level; turns ratio pri to sec'd 1:6.5; freq response 250 to 4000 cps $\pm$ 1% db; electrostatic shield between pri and sec'd; five 13/16" h solder lug term on bottom of case; two 0.187" diam mtg holes 1.875" c to c. Spec. JAN-T-27	Input Line to Grid	(304574)	3 Spec. #12700 7A-SPL	TA-10	T101	1	1
T102	TRANSFORMER, AF: plate coupling type; pri 10,000 ohms impedance CT, sec'd #1- 600 ohms impedance, CT, sec'd #2- 15 ohms im- pedance, 50 ma pri, DC current; HS steel case; laminated 29 gauge Armco radio 6 core; 2.49" lg x 2.375" wd x 3.04" h excl mtg fl and term; seven 13/16" h solder lug term on bottom of case; 10 watts max oper level; turns ratio pri to sec'd #1 is 3.83 to 1, to sec'd #2- 23.9:1; freq response 100 to 6,000 cps $\pm$ 1 db; two rows 2.690" apart having three 0.187" diam mtg holes 0.875" c to c. Spec. JAN-T-27	Output to Line or Voice Coil	(304575)	3 Spec. #12701 7F-DO	TA-11	T102	1	1

PARTS LIST

NAVSHIPS 91078
AM-215A/USection 6
T103-XV105

T103	(304576)	3 Spec. #12702 K2C4-130 -1 1/4"	TP-8	T103	1	1
V101	12AU7	JAN No.		V101	1	3
V102	6AQ5	JAN No.		V102 V103	1	6
V103						
V104	6X4	JAN No.		V104 V105	1	6
V105						
XF101		2 HKP	FH-4	XF101 XF102	1	1
XF102						
XI101		4 122210- 621	IM-10	XI101	1	1
XV101	(491844)	9 X0AC-9	XT-7	XV101	1	1
XV102	(491675)	9 X0A	XT-6	XV102 XV103 XV104 XV105	1	2
XV103						
XV104						
XV105						

ORIGINAL

RESTRICTED

6-5

TABLE 6-5. CROSS REFERENCE PARTS LIST

JAN (or AWS) DESIGNATION	KEY SYMBOL	NAVY TYPE	KEY SYMBOL
CE62C250G	C105	28032-1	F101
CM20B331M	C101	304573	L101
CP29A1DF503M	C102	304574	T101
CP40C2DF405V	C106	304575	T102
RC30BF274J	R109	304576	T103
RC30BF332J	R108	491675	XV102
RC30BF474K	R110	491844	XV101
RC30BF513J	R111	636060-N10	R107
RC40BF333J	R106		
RC40BF621J	R101		
RW30F201	R115		
ST22K	S102		
6AQ5	V102		
6X4	V104		
12AU7	V101		

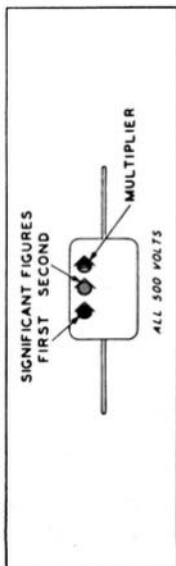
TABLE 6-6. LIST OF MANUFACTURERS

CODE NO.	PREFIX	NAME	ADDRESS
1	CBZ	Allen - Bradley Co.	136 W. Greenfield Avenue Milwaukee 2, Wisconsin
2	CFA	Bussmann Mfg. Co.	University at Jefferson St. Louis 7, Missouri
3	CTR	Chicago Transformer Division Essex Wire Corp.	3501 W. Addison Street Chicago 18, Illinois
4	CAYZ	Dial Light Co. of America, Inc.	900 Broadway New York 3, New York
5	CKB	Hoffman Radio Corp.	3761 S. Hill Street Los Angeles 7, California
6	CJC	Howard B. Jones Division Cinch Mfg. Co.	2460 W. George Street Chicago 18, Illinois
7	CMA	P. R. Mallory & Co., Inc.	Indianapolis 6, Indiana
8		Molded Insulation Co.	335 E. Price Street Philadelphia 44, Pennsylvania
9	CNA	National Company, Inc.	Malden, Massachusetts
10		Quality Screw Products	112 South 6th Street Montebello, California
11	CTL	Tungsol Lamp Works, Inc.	95 8th Avenue Newark 4, New Jersey

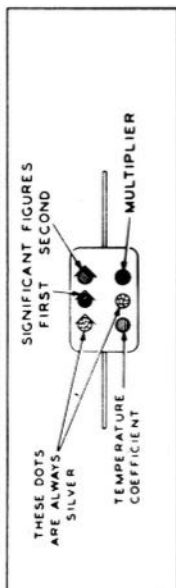
TABLE 6-6. APPLICABLE COLOR CODES AND MISCELLANEOUS DATA

CAPACITOR COLOR CODES

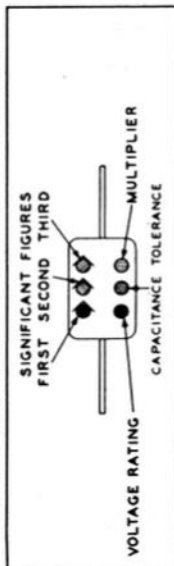
RMA 3-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS



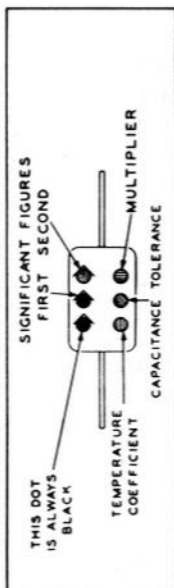
JAN 6-DOT COLOR CODE FOR PAPER-DIELECTRIC CAPACITORS



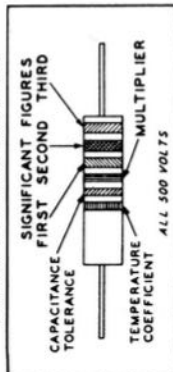
RMA 6-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS



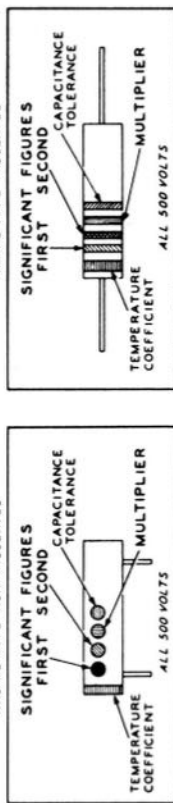
JAN 6-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS



**RMA COLOR CODE FOR TUBULAR
CERAMIC-DIELECTRIC CAPACITORS**

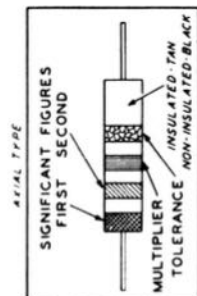


JAN COLOR CODE FOR FIXED CERAMIC-DIELECTRIC CAPACITORS

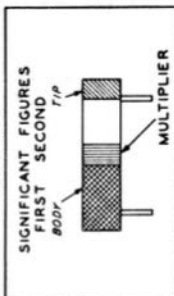


RESISTOR COLOR CODES

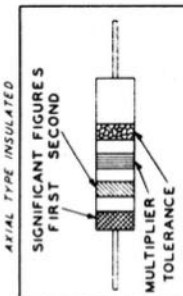
RMA COLOR CODE FOR
FIXED COMPOSITION RESISTORS



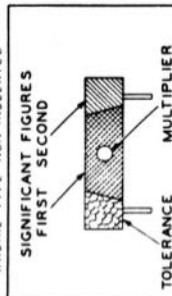
RADIAL TYPE



JAN COLOR CODE FOR
FIXED COMPOSITION RESISTORS



RADIAL TYPE NON-INSULATED



RESISTORS			CAPACITORS					TEMPERATURE COEFFICIENT
TOLERANCE	MULTIPLIER	SIGNIFICANT FIGURE	COLOR	MULTIPLIER			VOLTAGE RATING	
				RNA MICA AND CERAMIC DIELECTRIC	JAN MICA AND PAPER DIELECTRIC	JAN CERAMIC DIELECTRIC		
	1	0	BLACK	1	1	1		A
	10	1	BROWN	10	10	10	100	B
	100	2	RED	100	100	100	200	C
	1000	3	ORANGE	1000	1000	1000	300	D
	10000	4	YELLOW	10000	10000	10000	400	E
	100000	5	GREEN	100000			500	F
	1000000	6	BLUE	10000000			600	G
	10000000	7	VIOLET	1000000000			700	
	100000000	8	GRAY	10000000000		0.01	800	
	1000000000	9	WHITE	100000000000		0.1	900	
5	0.1		GOLD	0.01	0.1		1000	
10	0.01		SILVER	0.01	0.01		2000	
20			NO COLOR				5000	

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