

NAVSHIPS 91254

UNCLASSIFIED

INSTRUCTION BOOK
for
TUBE TESTER
TV-3/U

Manufactured by

THE HICKOK ELECTRICAL INSTRUMENT COMPANY
10514 DuPont Avenue
Cleveland 8, Ohio

for

U. S. NAVY DEPARTMENT

BUREAU OF SHIPS

★
Contract No. #NObsr 42081
and #NObsr 43282

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LIST OF EFFECTIVE PAGES

PAGE NUMBERS	CHANGE IN EFFECT	PAGE NUMBERS	CHANGE IN EFFECT
Title Page	ORIGINAL	6-0 to 6-0	ORIGINAL
A to C	ORIGINAL	7-1 to 7-15	ORIGINAL
i to v	ORIGINAL	8-0 to 8-26	ORIGINAL
1-0 to 1-4	ORIGINAL		
2-1 to 2-7	ORIGINAL		
3-0 to 3-0	ORIGINAL		
4-1 to 4-26	ORIGINAL		
5-1 to 5-1	ORIGINAL		

ADDRESS NAVY DEPARTMENT
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29 September 1949

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

Subj: Instruction Book for Tube Tester
TV-3/U (NAVSHIPS 91254).

1. NAVSHIPS 91254 is the Instruction Book for the subject equipment and is in effect upon receipt.
2. When superseded by a later edition, this publication shall be destroyed.
3. Extracts from this publication may be made to facilitate the preparation of other Navy instruction books and hand-books.
4. All requests for NAVSHIPS Electronics publications should be directed to the nearest District Publications and Printing Office. When changes or revised books are distributed, notice will be included in the applicable maintenance bulletin and the BUSHIPS ELECTRON.

D. H. CLARK
Chief of Bureau

FROM BUREAU OF SHIPS

ORIGINAL

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TABLE OF CONTENTS

SECTION 1—GENERAL DESCRIPTION

<i>Paragraph</i>	<i>Page</i>
1. Purpose	1-1
2. Reference Data	1-1
3. Equipment Lists—Tables 1-1 and 1-2	1-2
4. Vacuum Tube Complement	1-2
5. Accessories—Table 1-3	1-2

SECTION 2—THEORY OF OPERATION

1. Tube Tester Requirements	2-1
2. Theory of Operation of Tube Tester Section	2-1
3. Power Supply	2-2
4. Line Voltage Test	2-2
5. Short Test	2-2
6. Noise Test	2-4
7. Rectifier Test	2-4
8. Mutual Conductance Test	2-4
9. Gas Test	2-5
10. Analyzer Section	2-5
<i>a.</i> Volts A.C. and D.C.	2-5
<i>b.</i> Ohms X1 and X100	2-5
<i>c.</i> Capacity	2-6
<i>d.</i> Milliamperes	2-6

SECTION 3—INSTALLATION AND INITIAL ADJUSTMENTS

1. Tube Tester Section	3-1
2. Analyzer Section	3-1

SECTION 4—OPERATION

1. General	4-1
2. The Controls	4-1
3. Tube Test Data	4-3
4. Operational Procedure	4-3
<i>a.</i> When the Model TV-3/U is used as a Tube Tester	4-3
<i>b.</i> When the TV-3/U is used as a Multimeter	4-24
(1) Volts D.C.	4-24
(2) Volts A.C.	4-24
(3) Ohms	4-24
(4) Capacity	4-24
(5) To Check Small Capacitors (.0001 to .05 Mfd.)	4-25
(6) Milliamperes D.C.	4-26
(7) Inductance	4-26

SECTION 5—OPERATORS MAINTENANCE

<i>Paragraph</i>	<i>Page</i>
1. Line Cord and Plug	5-1
2. Test Leads	5-1
3. Fuse Lamp	5-1
4. Pilot Lamp	5-1
5. Neon Lamp	5-1
6. Tubes	5-1

SECTION 6—PREVENTIVE MAINTENANCE

1. Precautionary Measures	6-1
---------------------------------	-----

SECTION 7—CORRECTIVE MAINTENANCE

0. Failure Reports	7-1
1. Fuse Lamp	7-2
2. Pilot Lamp	7-2
3. Neon Lamp	7-2
4. Tubes	7-2
5. Test Leads	7-2
6. Schematic Wiring Diagram	7-2
7. Voltage and Calibration Check	7-3
<i>a</i> (1) Switch Settings	7-3
<i>a</i> (2) Plate Voltage Check	7-3
<i>a</i> (3) Screen Voltage Check	7-3
<i>a</i> (4) Bias Voltage Check	7-3
<i>a</i> (5) Signal Voltage Check	7-3
<i>a</i> (6) Filament Voltage Check	7-4
8. Resistance Check for Multimeter Section	7-4
9. Copper Oxide Rectifier	7-4

SECTION 8—PARTS LISTS

<i>Table</i>	<i>Page</i>
8-1 Weights and Dimensions of Spare Parts Boxes	8-1
8-2 Shipping Weights and Dimensions of Spare Parts Boxes	8-1
8-3 List of Major Units	8-1
8-4 Combined Parts and Repair Parts List	8-2
8-5 Cross Reference Parts List	8-22
8-6 Applicable Color Codes, Resistors	8-24
8-7 Applicable Color Codes, Capacitors	8-25
8-8 List of Manufacturers	8-26

LIST OF ILLUSTRATIONS

<i>Figure</i>	<i>Title</i>	<i>Page</i>	<i>Figure</i>	<i>Title</i>	<i>Page</i>
1-1	Tube Tester TV-3/U with Cover Removed.....	1-0	2-14	Basic Block Diagram of Tube Tester TV-3/U.....	2-7
1-2	Tube Tester TV-3/U with Cover Closed.....	1-3	4-1	Front View of Tube Tester TV-3/U Showing Controls by Symbol Desig.....	4-2
1-3	Tube Tester TV-3/U Test Leads and Lead Compartment.....	1-3	4-2	Socket Numbering.....	4-6
2-1	Rectifier Diagram Illustrating Theory.....	2-1	4-3	Basing Diagrams for Sub-Miniature Tubes.....	4-7
2-2	Basic Mutual Conductance Circuit Illustrating Theory.....	2-2	4-4	Top View of Socket X-112.....	4-7
2-3	Simplified Power Supply Circuit.....	2-3	4-5	Conversion Chart for Capacity Measurements at Frequencies Other Than 60 Cycles.....	4-25
2-4	Simplified Line Voltage Test Circuit.....	2-2	7-1	Voltage Calibration Check Diagram.....	7-3
2-5	Simplified Short Test Circuit.....	2-2	7-2	Internal View of Tube Tester TV-3/U (Front Left Oblique).....	7-6
2-6	Simplified Rectifier Test Circuit.....	2-4	7-3	Internal View of Tube Tester TV-3/U (Front Right Oblique).....	7-7
2-7	Simplified Mutual Conductance Test Circuit.....	2-4	7-4	Internal View of Tube Tester TV-3/U (Rear Left Oblique).....	7-8
2-8	Simplified Gas Test Circuit.....	2-5	7-5	Internal View of Tube Tester TV-3/U (Rear Right Oblique).....	7-9
2-9	Simplified Voltmeter Circuit.....	2-5	7-6	Schematic Wiring Diagram Tube Tester TV-3/U.....	7-11
2-10	Simplified Ohmmeter Circuit Ohms X1 Range.....	2-6	7-7	Transformer Diagram.....	7-13
2-11	Simplified Ohmmeter Circuit Ohms X100 Range.....	2-6	7-8	Trouble Shooting Chart.....	7-15
2-12	Simplified Capacity Test Circuit.....	2-6			
2-13	Simplified Milliammeter Circuit.....	2-6			

LIST OF TABLES

<i>Table</i>	<i>Title</i>	<i>Page</i>	<i>Table</i>	<i>Title</i>	<i>Page</i>
1-1	Equipment Supplied.....	1-2	7-1	Filament Voltage Chart.....	7-4
1-2	Equipment Required But Not Supplied.....	1-2	7-2	Point to Point Resistance Check for Multimeter Section.....	7-5
1-3	Accessories and Operating Spares Supplied.....	1-2	8-1	Weights and Dimensions of Spare Parts Boxes.....	8-1
4-1	Short Test Chart.....	4-4	8-2	Shipping Weights and Dimensions of Spare Parts Boxes.....	8-1
4-2	RMA Socket Numbering Chart.....	4-7	8-3	List of Major Units.....	8-1
4-3	Tube Test Data Chart.....	4-8	8-4	Combined Parts and Spare Parts List by Symbol Designation.....	8-2
4-4	Test Data for Sub-Miniature Tubes.....	4-19	8-5	Cross Reference Parts List.....	8-22
4-5	Ballast Tube Test Chart.....	4-20	8-6	Applicable Color Codes, Resistors.....	8-24
4-6	Capacity to Voltage Conversion Table for Small Capacitors.....	4-26	8-7	Applicable Color Codes, Capacitors.....	8-25
4-7	Conversion from Capacity Reading to Inductance.....	4-26	8-8	List of Manufacturers.....	8-26

CONTRACTURAL 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 nonconformance shall be given by the Government to the Contractor within one year of the delivery of the defective or nonconforming 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 nonconforming article or part thereof. When such correction or replacement requires transportation of the article or part thereof, shipping costs, not exceeding the 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 redelivery, unless a different period of Guaranty is specified in the schedule. If the Government does not require a correction or replacement of a defective or nonconforming article, the Contractor, if required by the contracting officer, within a reasonable time after the notice of defect or nonconformance, shall repay such portion of the contract price of the article as is equitable in the circumstances.

INSTALLATION RECORD

Contract Number NObsr 42081	Date of Contract 27 January 1948
Contract Number NObsr 43282	Date of Contract 18 May 1949
<i>Serial Number of Equipment</i>	
<i>Date of Acceptance by the Navy</i>	
<i>Date of Delivery to Contract Destination</i>	
<i>Date of Completion of Installation</i>	
<i>Date Placed in Service</i>	

Blank spaces in this table 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. Standard Navy 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.

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.

The use of this equipment involves voltages which are dangerous and may be fatal if contacted by operating personnel. Extreme caution should be exercised when working on equipment employing high voltages.

While every practicable safety precaution has been incorporated in ship and shore electronic equipment, the following rules must be strictly observed:

KEEP AWAY FROM LIVE CIRCUITS.

Operating personnel must at all times observe all safety regulations. Do not change tubes or make adjustment 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 or enter the enclosure for the purpose of servicing or adjusting the equipment without the immediate presence of assistance of another person capable of rendering aid.

DON'T TAMPER WITH INTERLOCKS.

Do not depend upon door switches or interlocks for protection, but always shut down motor generators or other power equipment. Under no circumstances should any access, gate, door, or safety interlock switch be removed, short-circuited, or tampered with in any way, by other than authorized maintenance personnel, nor should reliance be placed upon the interlock switches for removing voltages from the equipment.

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. Tube Tester TV-3/U with Cover Removed

SECTION I

GENERAL DESCRIPTION

1. PURPOSE.

This handbook is intended for use with the Tube Tester TV-3/U (see Figure 1-1) described in the following paragraphs and contains information essential to the operation and maintenance of the equipment.

a. GENERAL.—The TV-3/U is a portable Tube Tester of the Dynamic Mutual Conductance type designed to test and measure the mutual conductance values of electron tubes of the receiving types and many of the smaller transmitting types. A Multimeter section, using the same indicator, is also incorporated in the equipment permitting measurements of ac and dc volts, dc mils, resistance and capacity in the ranges listed in paragraph 2j of this section. The entire equipment is enclosed in an aluminum carrying case with a built-in compartment for accessories and operating or running spare parts. The cover of the case is secured by means of two draw bolts. Two slip hinges permit the removal of the cover if desired. Two Instruction Sheets for the Tube Tester section and the Multimeter section are mounted on the inside surface of the cover for ready reference. A suitable carrying handle is provided.

2. REFERENCE DATA.

- a. Nomenclature:* Tube Tester TV-3/U.
- b. Contract Number:* NObsr-42081 and NObsr-43282.
- c. Contractor:* The Hickok Electrical Instrument Co.
- d. Cognizant Naval Inspector:* Inspector of Naval Material, Cleveland, Ohio.
- e. Number of Packages Involved per Complete Shipment of One Equipment Including Equipment Spare Parts:* One.
- f. Total Cubical Contents Including Equipment Spares:*

Crated:
Uncrated:

g. Total Weight Including Equipment Spares:

Crated:
Uncrated:

b. Characteristics of Power Supply Required for Operation: 105 to 125 Volts ac at 50 to 1600 Cycles, Single Phase. 50 Watts Min. at 60 cycles.

i. Current Drain: 0.33 Amps.

j. Meter Ranges:

(1) Micromhos: 0 to 3000,
0 to 6000,
0 to 15,000.

(2) A.C. and D.C. Volts: 0 to 20,
0 to 200,
0 to 500,
0 to 1000.

Sensitivity on all ranges 1000 ohms per volt.

(3) D.C. Milliamperes: 0 to 20,
0 to 200.

(4) Resistance: 0 to 1 Megohm,
0 to 100 Megohms.

(5) Capacity: 0 to 5 Microfarads,
0 to 50 Microfarads.

k. Accuracy:

(1) D.C. Ranges: Plus-minus 3% of full scale deflection at temperatures between plus 10° and plus 25° C.; Plus-minus 5% of full scale deflection at temperatures between 0 and 50° C.

(2) A.C. Ranges: Plus-minus 5% of full scale deflection between plus 10° and plus 25° C.; Plus-minus 6% of full scale deflection between 0 and 50° C.

(3) Resistance Ranges: Plus-minus 5% at mid scale values at normal room temperatures, approx. 20° C.

(4) Micromhos: Plus or minus 10% on all ranges.

3. EQUIPMENT LISTS.

TABLE 1-1. EQUIPMENT SUPPLIED

QUAN- TITY PER EQUIP- MENT	NAME OF UNIT OR ACCESSORY	Symbol Desig.	NAVY TYPE DESIGNA- TION	OVERALL DIMENSIONS A-UNCRATED B-CRATED			VOLUME A-UNCR. B-CR.	WEIGHT A-UNCR. B-CR.
				H	W	D		
1	1. TUBE TESTER		TV-3/U	A 6 ⁷ / ₈	16 ³ / ₄	10 ⁷ / ₈	A 1125 cu in	A 19 lbs.
				(B — E N P O R T P A C K)				
				13 ¹ / ₈ "	22 ³ / ₄ "	19 ¹ / ₂ "	5850 cu in	52 lbs.
				(B — D O M E S T I C P A C K)				
				10 ¹ / ₂ "	20"	17"	3580 cu in	35 lbs.

TABLE 1-2. EQUIPMENT REQUIRED BUT NOT SUPPLIED.

QUANTITY	NAME OF UNIT	REQUIRED CHARACTERISTICS
1	A.C. Power Source	Capable of supplying 50 to 1600 cycles, 115 Volts p/m 10% A.C., single phase, 50 watts.

4. VACUUM TUBE COMPLEMENT.

The Tube Tester TV-3/U requires one each of the following type vacuum tubes for operation:

ELECTRON TUBE TYPE	QUANTITY
JAN-5Y3GT	1
JAN-83	1

5. ACCESSORIES.

TABLE 1-3. ACCESSORIES AND OPERATING SPARES SUPPLIED

QUANTITY	DESCRIPTION	SYMBOL DESIGNATION
1	LEAD; Grid and Plate, for Lighthouse Tubes	W-101
1	LEAD; Capacity Test	W-102
1	LEAD; Plate Connector	W-103
1	LEAD; Red Test Prod for Multimeter	W-104
1	LEAD; Black Test Prod for Multimeter	W-105
1	LEAD; Grid Connector	W-106
1	PILOT LAMP	E-101
2	FUSE LAMPS	E-102
1	NEON LAMP	E-103

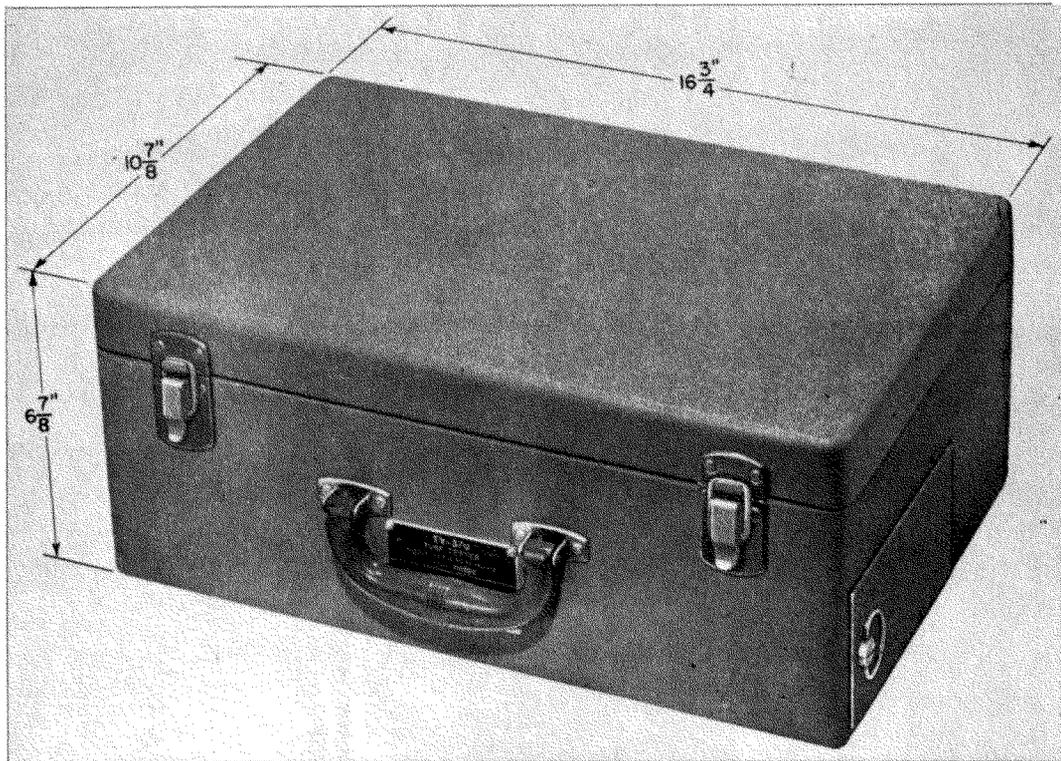
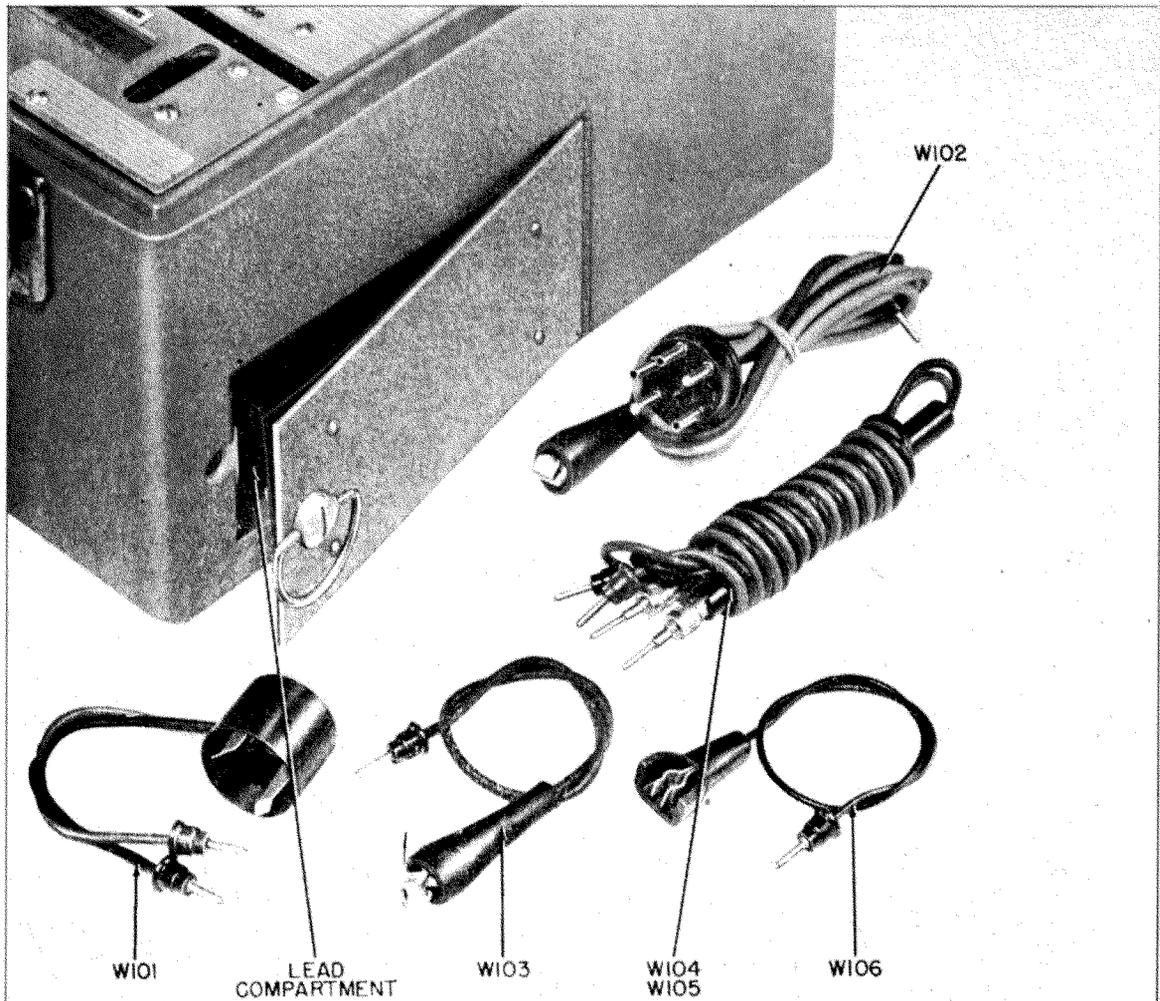


Figure 1-2. Tube Tester TV-3/U with Cover Closed



**READ INSTRUCTIONS
CAREFULLY BEFORE
ATTEMPTING TO
OPERATE THIS
EQUIPMENT**

SECTION 2

THEORY OF OPERATION

1. TUBE TESTER REQUIREMENTS.

a. Electron tubes supplied to the Armed Forces are in nearly all cases procured under either JAN Specifications or other military specifications, which impose rigid controls on the processes of manufacturing, handling, and transportation of the tubes to insure delivery of the highest possible quality tubes to the Services.

b. It is necessary, however, to provide some means of determining the condition of new replacement tubes and also the condition of tubes which have been in service for some time.

c. Of the several methods employed for testing electron tubes, the Dynamic Mutual Conductance or Transconductance test is recognized as the most accurate means available without resorting to the use of complex and cumbersome laboratory equipment. This tube tester, therefore, employs the Dynamic Mutual Conductance test method, and the mutual conductance of the tube under test is indicated on the meter scale directly in micromhos.

Note

The terms mutual conductance and transconductance are used interchangeably. Either term may be defined as the ratio of a small change in plate current to the corresponding change in control grid voltage which produced it. Values of mutual conductance are expressed in Micromhos. The symbol G_m is used to represent mutual conductance or transconductance in various mathematical representations of tube characteristics and their relationships.

d. In addition to the mutual conductance test it is essential that the tube tester provide adequate means of testing for shorted elements and excessive gas content.

e. In the case of tubes of the diode type, tubes having no grid, a straight emission test must be employed rather than the mutual conductance test.

f. Some means of adjusting the voltage input to the Tube tester must be provided to maintain the proper test potentials at all elements under varying conditions of line voltage.

2. THEORY OF OPERATION OF TUBE TESTER SECTION.

(See Figures 2-1 and 2-2)

a. Examine first the simple full-wave rectifier circuit shown in Figure 2-1. The two power transformer secondary windings have their inner ends connected to a direct-current milliammeter. Across the milliammeter is a center-tapped resistor R_M . The load is shown as a resistance R_L , connected between the center tap and the rectifier filament as in any full-wave rectifier circuit.

When rectifier plate P_2 is positive, electron flow is through the upper half of R_M , and the meter tends to deflect in one direction. When P_1 is positive, electron flow is through the lower half of R_M , and the meter tends to deflect in the other direction. With the load resistance fixed and equal forces acting on the meter in both cases, the meter stays at zero because it cannot follow variations at the power line frequency.

b. If the electron tube to be tested is substituted for the fixed load resistance, and a fixed bias E is applied to the tube as in Figure 2-2, the meter will still read zero because an electron tube under steady-state conditions acts like a fixed resistance.

c. If an ac potential is applied to the grid of the tube under test in addition to the dc bias, the circuit becomes equivalent to that employed for quality and mutual conductance tests in Tube Tester TV-3/U. When this ac potential swings the grid positive, the plate current of the tube is increased, and when the plate-cathode resistance is correspondingly lowered, more current flows through R_M and the deflecting force on the meter is greater than before. When the grid swings negative on the other half-cycle, the resistance of the tube under test is increased and the deflecting force on the meter is less. With unbalanced currents on adjacent half-cycles and consequent unequal forces on the meter, the meter reading becomes proportional to the difference in currents. Since this difference is created by the ac grid potential, the meter indicates the plate-current changes produced by the applied grid voltage change, or in other words, the meter indicates mutual conductance.

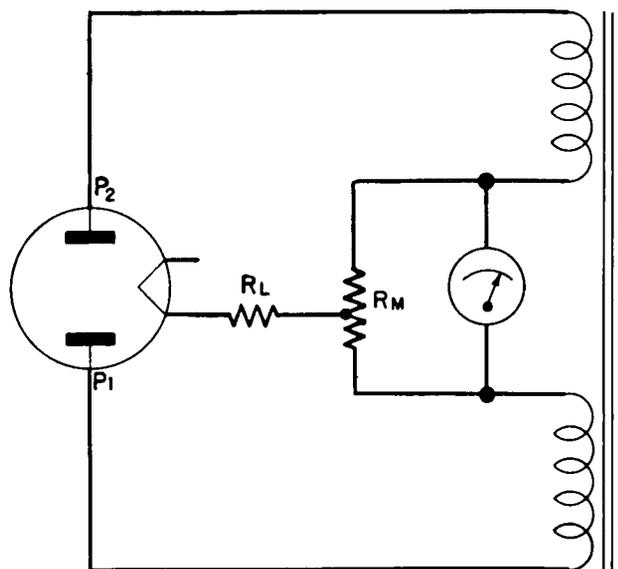


Figure 2-1. Rectifier Diagram
Illustrating Theory

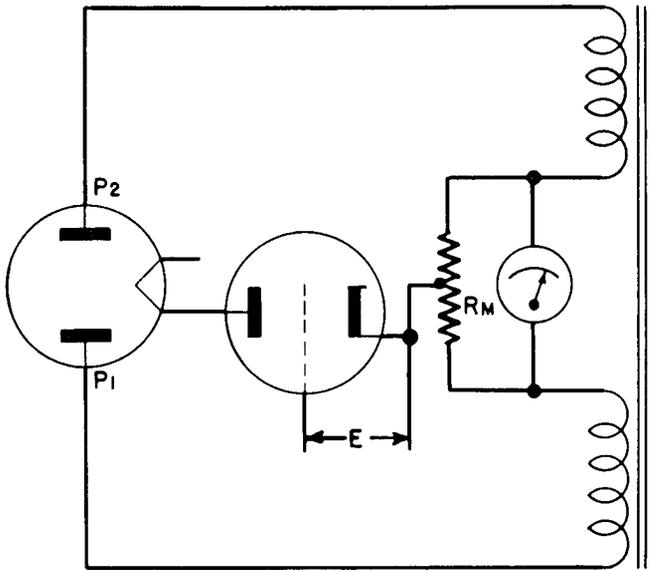


Figure 2-2. Basic Mutual Conductance Circuit Illustrating Theory

3. POWER SUPPLY.

(See Figure 2-3 opposite page)

a. The power transformer, T101, is supplied with primary voltage from a 105 to 125 volt 50 to 1600 cycle line through power ON-OFF switch S106, LINE ADJUST control R113, and FUSE lamp E102. The LINE ADJUST control, when operated in conjunction with the line test circuit, standardizes the voltage across the primary of T101 at 93 volts.

b. Secondary #1 of power transformer T101 consists of a multi-tapped winding designed to supply the various filament or heater voltages for the tubes under test. Voltages shown on Figure 2-3 are measured under load. No load voltages will be somewhat higher. For example; no load voltage measured from point (H) to point (I) will be approximately 124 volts with 93 volts on the primary. Secondary #1 also supplies voltage for rectifier emission tests.

c. Secondaries #2 and #3 supply approximately 170 volts ac to the plates of the type 83 tube V101, which supplies plate voltage to the tube under test. Secondary #2 is also tapped at 20 volts to supply voltage for diode emission tests.

d. Secondary #4, a center tapped 5 volt winding, supplies filament voltage for the type 83 rectifier tube V101.

e. Secondary #5 supplies the signal voltage for mutual conductance tests, 5 volts ac.

f. Secondary #6, 320 volts center tapped, supplies the plates of the screen voltage rectifier V102, a type 5Y3GT tube, a voltage divider system, R113, R114, R115, BIAS control R116, and adjustable resistor R118 across, the output of V102 provides the bias voltage for mutual conductance tests.

g. Secondary #7, 5 volts center tapped, supplies the filament of the type 5Y3 tube, V102.

4. LINE VOLTAGE TEST.

(See Figure 2-4)

a. Pressing the LINE ADJ. push button P7 connects the METER, M101, through resistor R101 and copper oxide rectifier CR 101 to points (H) and (I) of the power supply (Figure 2-3).

b. The values of R101 in series with the meter and R131 and R133 in shunt are such that 124 volts rms across (H) and (I) of the power supply will cause the METER M101 to read 100 volts or LINE TEST.

c. The design of the power transformer T101 is such that 93 volts applied to the primary winding will induce 124 volts across the total secondary #2 winding or across points (H) and (I).

d. Therefore, if, with the LINE ADJ. push button P7 pressed down, the LINE ADJUST CONTROL R113 is turned until the pointer of the METER, M101, is exactly over the LINE TEST mark a standard voltage of 93 volts rms will be established across the primary winding of T101.

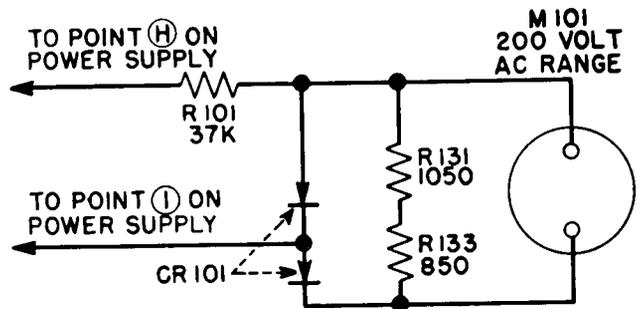


Figure 2-4. Simplified Line Voltage Test Circuit

5. SHORT TEST.

(See Figure 2-5)

a. An ac potential of 93 volts rms from the primary of T101 is applied to the short test circuit through capacitor C105 and resistor R134. The neon lamp, E103, shunted by resistor R129 is connected in series with R134.

b. Turning the SHORTS test switch S113 through position 1, 2, 3, 4, and 5 connects the various elements of the tube under test between the neon lamp E103 and capacitor C105. The SELECTORS must, of course, be set correctly for the particular tube. Any shorts between the elements will complete the circuit from capacitor C105 to the neon lamp E103 causing it to glow.

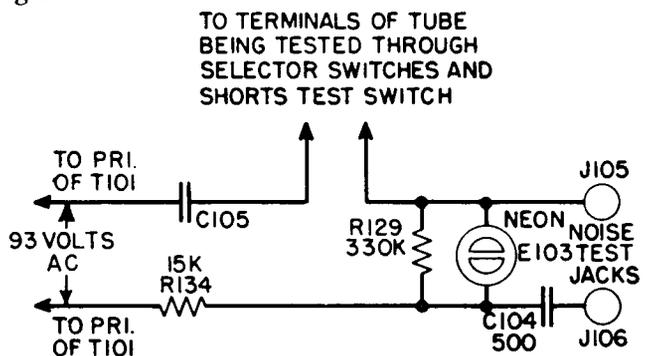


Figure 2-5. Simplified Short Test Circuit

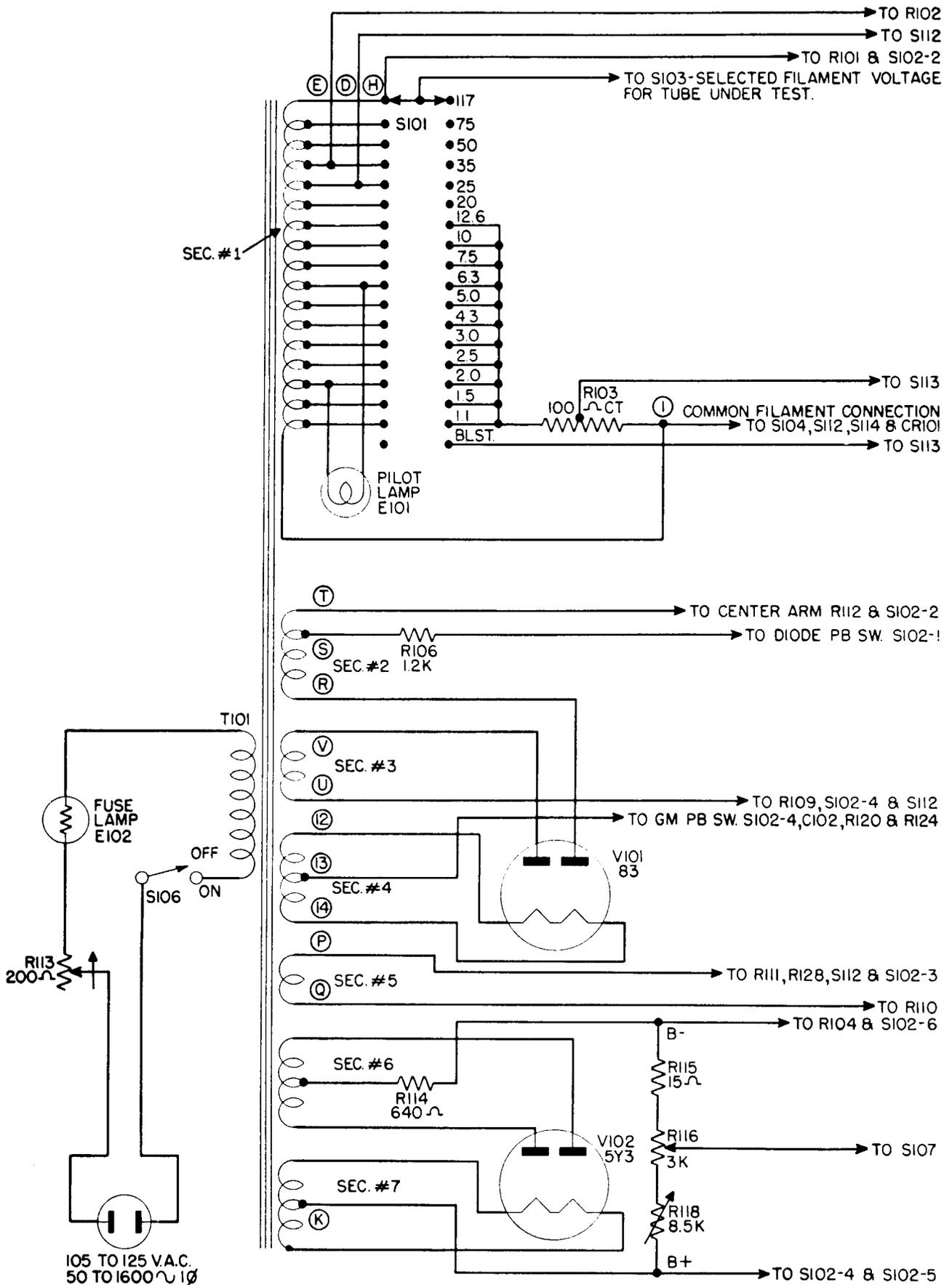


Figure 2-3. Simplified Power Supply Circuit

6. NOISE TEST.

(See Figure 2-5)

- a. The short test circuit may also be used for making a noise test of electron tubes.
- b. Connect the NOISE TEST jacks, J106 and J107, to the antenna and ground posts of any radio receiver.
- c. Turn the SHORTS test switch S113 through positions 1, 2, 3, 4, and 5, meanwhile tapping the tube under test with a finger, or the eraser on a pencil. Intermittent disturbances between the electrodes too brief to register on the neon lamp will cause a momentary short, permitting the alternating voltage from the power supply to be applied to the neon lamp causing a brief oscillation. This oscillation will be reproduced by the loud speaker or headphones as an audible signal similar to static.

7. RECTIFIER TEST.

(See Figure 2-6)

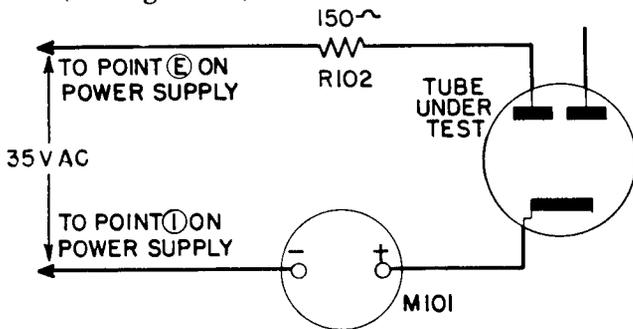


Figure 2-6. Simplified Rectifier Test Circuit

a. Rectifier tubes and diode detector tubes can only be tested for emission. The test circuit is therefore quite simple.

b. Pressing RECTIFIER push button P3 applies an ac potential of 35 volts which is applied between the cathode and plate of the tube under test through resistor R102, and the METER, M101, causing the tube to rectify.

c. The rectifying action of the tube under test will cause a direct current to flow through the meter. Since the current indicated by the meter is proportional to the electron emission of the tube, the meter reading may be taken as a measure of the tube's efficiency.

d. A line on the meter scale marked RECTIFIER OK indicates the point above which rectifier tubes are considered satisfactory. Tubes reading below this line should be rejected.

e. Pressing the OZ4 push button P2 sets up a circuit similar to Figure 2-6, but a higher voltage is applied, 287 volts ac.

f. Pressing the DIODE push button P1 also establishes a circuit similar to Figure 2-6, but a lower voltage, 20 volts ac, is used to protect the delicate cathodes of these tubes.

8. MUTUAL CONDUCTANCE.

(See Figure 2-7)

a. The mutual conductance (g_m) of an amplifier-type vacuum tube, also called the grid-plate transconductance, is an expression representing the efficiency of

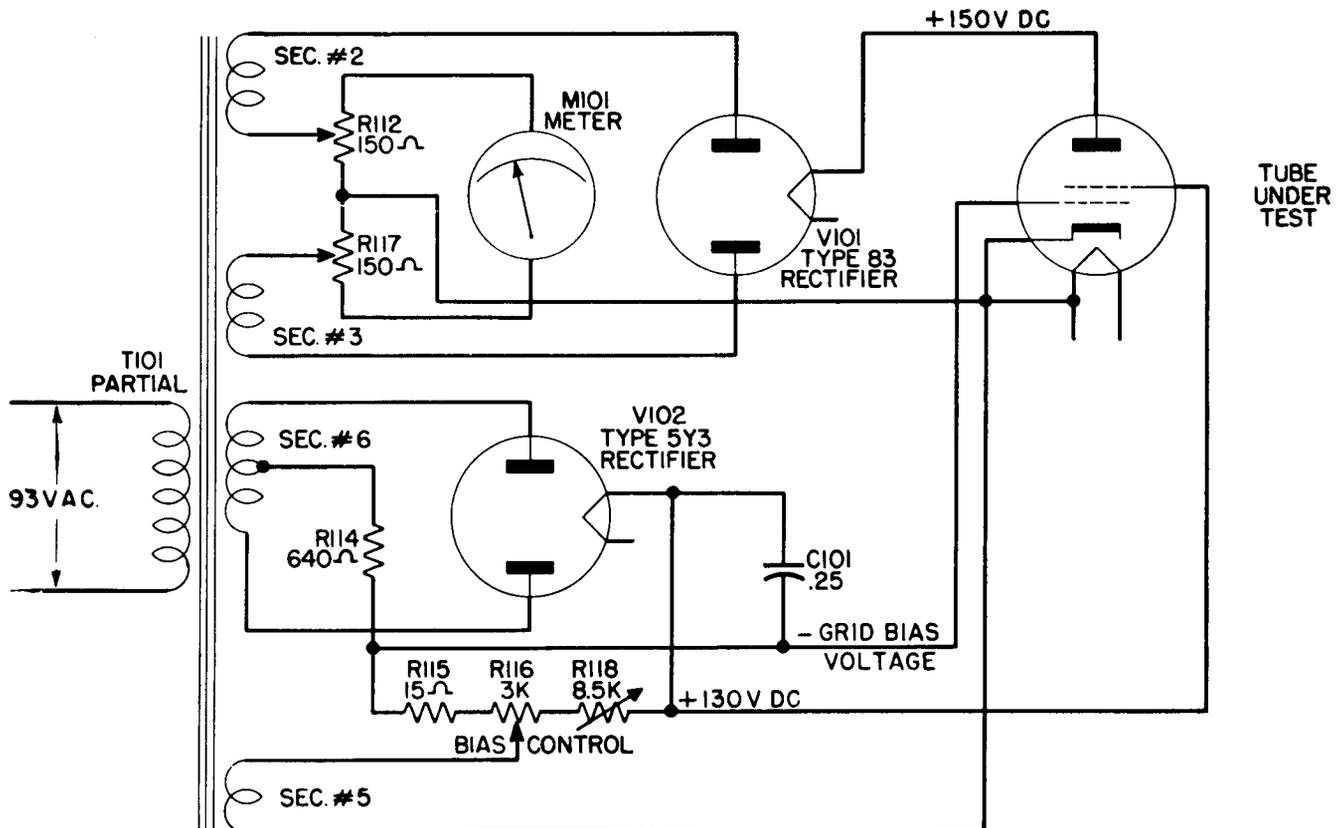


Figure 2-7. Simplified Mutual Conductance Test Circuit

performance of a tube as indicated by the *change in plate current* (ΔI_p) divided by the *change in grid voltage* (ΔE_g). The relation is generally written $G_m = i_p / \Delta E_g$. The value is expressed in micromhos and is a performance indication because it shows how effective a tube is in converting a small change in grid voltage (grid signal) to a large change in plate current.

b. For the measurement of the mutual conductance value directly, the proper dc grid voltage for the tube under test is supplied by a full-wave rectifier circuit using a 5Y3G, V102 tube. Setting BIAS control potentiometer R116 at the value called for on the test data roll chart adjusts this negative bias voltage to the correct value for the particular tube under test.

c. Alternating voltages of 5 volts rms from a separate secondary winding on the power transformer, T101, or 1 volt rms from a voltage divider consisting of R110 and R111, act in series with the grid bias as required for this type of test. This voltage alternately swings the grid in positive and negative directions from the dc bias value, thereby producing the grid-voltage (ΔE_g) required for a dynamic test.

d. The plate voltage for the tube under test is supplied by another full-wave rectifier circuit, using a type 83 tube, V101. The return lead contains the meter circuit which serves to measure the plate-current change (ΔI_p). The meter circuit consists essentially of dual potentiometer R112 and R117 shunted across the METER, M101. Points on the dial I102 of this dual potentiometer serve to adjust the potentiometer for the three ranges of micromhos 3000-6000-15,000 for NORMAL HIGH SIGNAL (5 volts), and two ranges, 6000 and 15,000, for LOW SIGNAL (1 volt).

9. GAS TEST.

(See Figure 2-8)

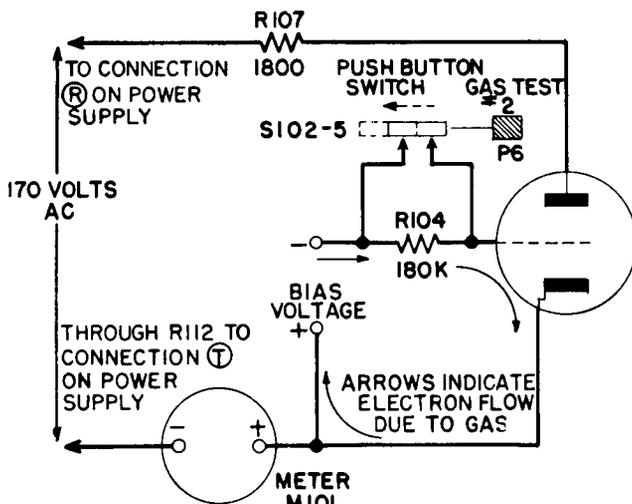


Figure 2-8. Simplified Gas Test Circuit

a. Pressing GAS-1 push button P5 applies definite values of plate voltage and grid bias voltage to the tube under test, causing a definite value of plate current to flow. This current is indicated on the METER, M101.

b. Pressing GAS-2 push button P6 inserts a 180,000 ohms resistor, R104, in the grid circuit. If grid current is flowing from the bias voltage source through the grid circuit to the cathode due to gas in the tube, this current will develop a voltage drop across resistor R104. This voltage drop will reduce the negative bias on the grid, causing a corresponding increase in the plate current being measured by the METER, M101.

c. If the tube contains gas the pointer of the meter will move up scale. This increase in meter reading should not exceed one scale division.

10. ANALYZER SECTION.

a. Volts A.C. and D.C. (See Figure 2-9)

(1) The voltmeter circuit consists of the METER, M101, shunted by resistors R131 and R133, with a

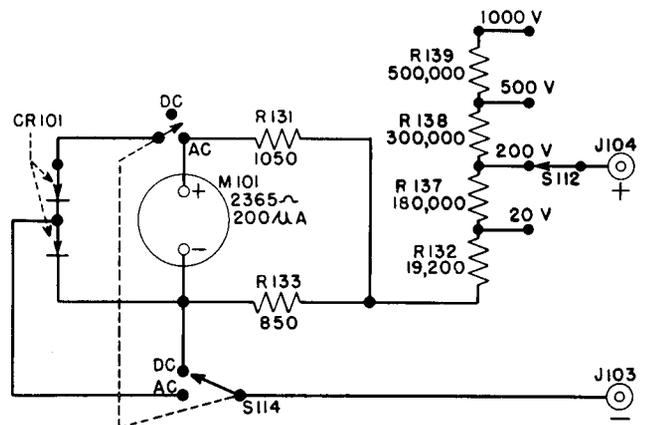


Figure 2-9. Simplified Voltmeter Circuit

network of series resistors R132-R137-R138-R139 connected to the point where R131 and R133 are joined.

(2) The MASTER switch S112 connects the jack J104 to the proper tap of the series resistors for the voltmeter range selected.

(3) For ac volts, the copper oxide rectifier CR101 is connected into the voltmeter circuit, by operating the switch S114 to the proper position.

b. OHMS X1 and X100. (See Figures 2-10 and 2-11)

(1) The ohmmeter section consists of two ranges, ohms X1 and ohms X100. Each has a voltage divider network selected by the MASTER SWITCH S112, which also connects the meter across part of the voltage divider, so that it reads INF. or full scale when a standard voltage is applied by setting LINE ADJUST control R113.

(2) The unknown resistance is connected to the test jacks J103 and J104, which parallels part of the divider network, changing the effective resistance of the divider.

(3) The meter scale indicates ohms directly.

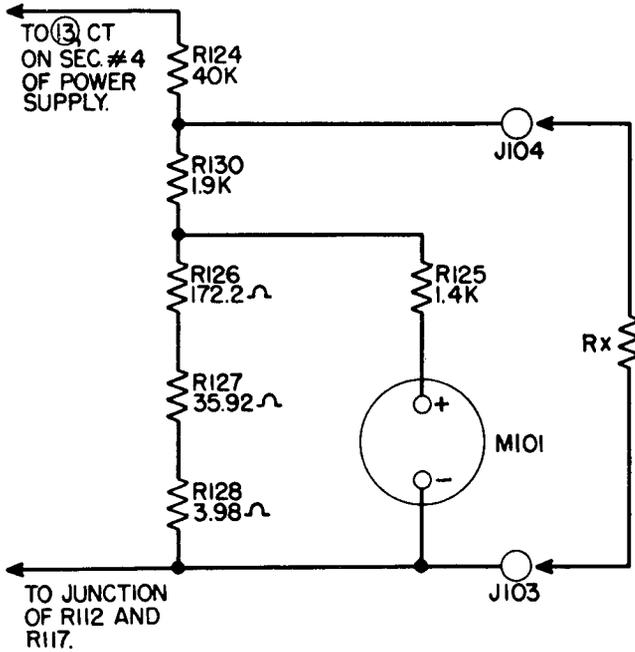


Figure 2-10. Simplified Ohmmeter Circuit for Ohms X1 Range

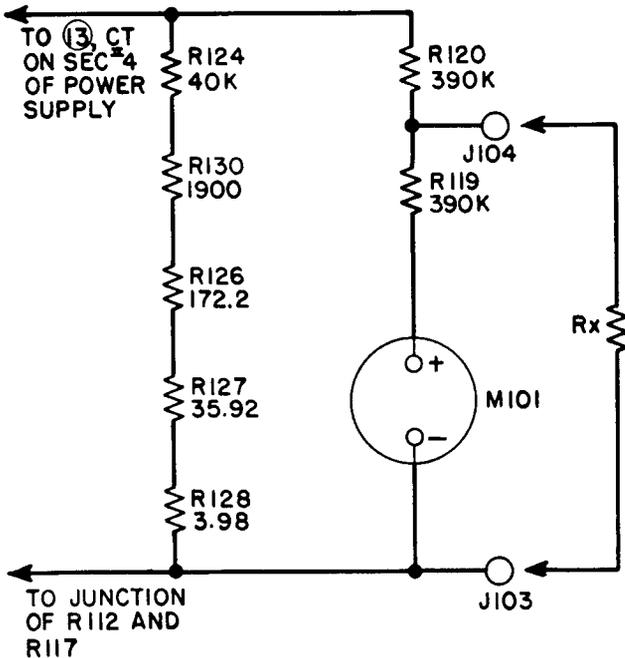


Figure 2-11. Simplified Ohmmeter Circuit for Ohms X100 Range

c. CAPACITY. (See Figure 2-12)

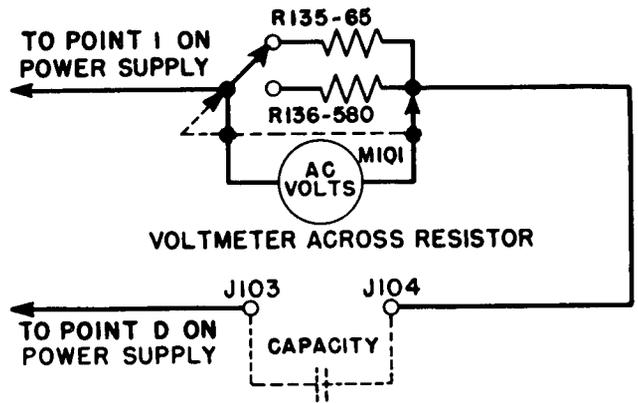


Figure 2-12. Simplified Capacity Test Circuit

(1) A standard ac voltage is applied across the capacitor connected to J103 and J104, through resistor R135 or R136, depending on the range selected by MASTER switch S112.

(2) The voltage drop across the series resistor, either R135 or R136, is measured by the meter, which is calibrated directly in microfarads.

d. MILLIAMPERES. (See Figure 2-13)

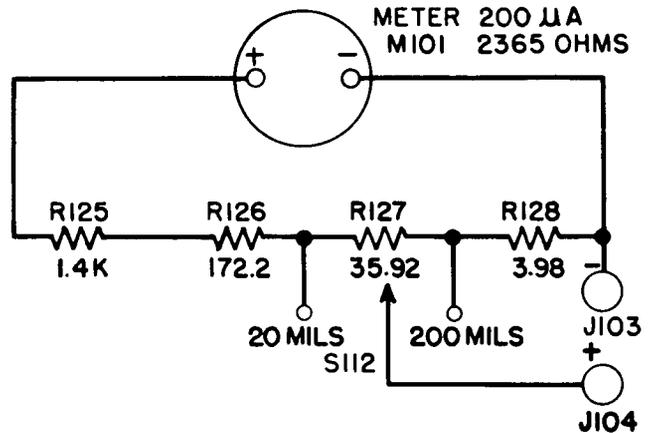


Figure 2-13. Simplified Milliammeter Circuit

(1) The milliammeter, as shown in Figure 2-13 is of the conventional type and will measure up to 200 mils in two ranges, 0-20 and 0-200.

(2) To avoid possible damage to the meter always use the highest range first.

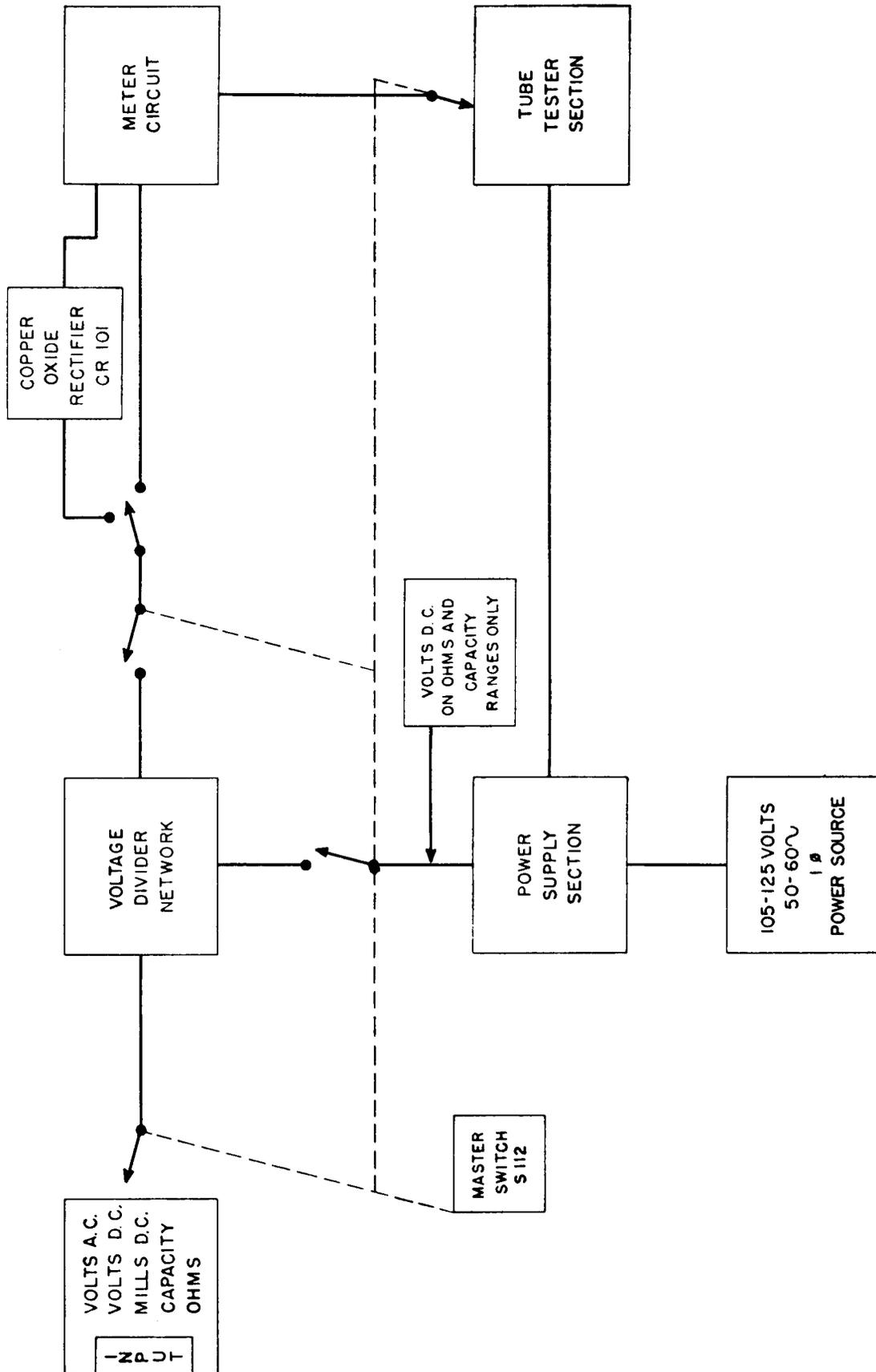


Figure 2-14. Basic Block Diagram of Tube Tester TV-3/U

SECTION 3 INSTALLATION AND INITIAL ADJUSTMENTS

1. TUBE TESTER SECTION.

a. After carefully removing the Tube Tester TV-3 U from its shipping container, set the Tester up near a 105 to 125 volt 50-60 cycle ac outlet.

b. Open the cover and uncoil the line cord. Check the FUSE lamp E102 and the neon lamp E103 to make sure they are properly seated in their sockets.

c. Open the lead compartment in the end of the case and check the lead complement using Table 1-3 and Figure 1-3. In addition to the leads, a set of operating spares consisting of two FUSE lamps, one neon lamp, and one pilot lamp is also housed in this compartment.

d. Plug the line cord into a 105 to 125 volt 50-60 cycle ac outlet, and throw the line switch S106 to the ON position. The red panel indicator I101 should light. If it does not, unscrew the red jewel cover of indicator I101 and make sure that the pilot lamp E102 is properly seated in its socket. Should the indicator still fail to light, check pilot lamp E102 and the FUSE lamp E101 for open filaments; and, if necessary, replace from operating spares which will be found in the lead compartment.

e. Press the LINE ADJ. button P7 and be sure that the pointer of meter M101 can be set to LINE TEST

by turning the LINE ADJUST knob. If this adjustment can be accomplished, the tube tester section is ready for operation.

2. ANALYZER SECTION.

a. With the line cord connected to a 105 to 125 volt 50 to 1600 cycle ac source and the line switch S106 in the ON position, turn the master switch S112 to the OHMS X1 position.

b. The pointer of the meter M101 will move up scale to the right.

c. Turn LINE ADJUST knob of R113 until the pointer rests exactly over the end of the scale marked INF. (infinity).

d. Insert the red and black Test leads W104 and W105 in the VOLTS-MILS-OHMS-CAP. jacks at the upper right hand corner of the panel.

e. Short the ends of the test leads together. This should cause the pointer of the meter to return to zero.

f. Repeat the steps outlined in paragraphs 2a through 2e above for OHMS X100, CAP. 5 MFD and CAP. 50 MFD settings of master switch S112.

g. If proper meter indications and adjustments, as in steps "a" through "e" above, are obtained on these four ranges, the analyzer section is ready for operation.

SECTION 4

OPERATION

IMPORTANT: Read these instructions thoroughly before attempting to operate the Tube Tester TV-3/U.

1. GENERAL.

a. Refer to the photograph of the Model TV-3/U, Figure 4-1, or preferably to the *tester itself*.

(1) The tube sockets are grouped along the top edge and in the upper left hand section of the panel as follows. Along the top edge reading from left to right are standard sockets for 4-5-6 pin tubes, a dual socket for large and small radius 7 pin tubes, which also provides a pilot lamp test receptacle, an 8 pin octal socket, and an 8 pin loctal socket. A 7 pin miniature socket and a 9 pin, or noval miniature, are located directly below the 4 and 5 pin standard sockets respectively. An acorn tube socket designed to accommodate all tubes of this type now in use is located directly below the 6 pin socket. An 8 contact subminiature socket is located to the left of the 7 pin miniature socket.

(2) For tubes having top grid connections, top plate connections, or both, use grid and plate leads, W106 and W103, Figure 1-3. For lighthouse type tubes use W101, Figure 1-3.

(3) Leads supplied for use with the analyzer section are also illustrated in Figure 1-3. They are red and black test leads 48" long, W104 and W105 for VOLTS-MILS-OHMS and capacity measurements, and W102, a special lead for checking small capacitors from .0001 to .05 M.F.

(4) All leads referred to in the preceding paragraphs are kept in the lead compartment in the end of the case.

(5) The FUSE lamp serves both as a protective fuse and an overload indicator. This lamp will flash brightly when an overload is placed on the tube tester or the tube under test. When this occurs turn off the equipment immediately. A continued or excessive overload will, of course, burn out the FUSE lamp, and a replacement will be necessary. The red pilot lamp serves only as an ON-OFF indicator for the equipment.

2. THE CONTROLS.

a. Power input to the TV-3/U is controlled by the ON-OFF switch, S106.

b. The master switch S112, located in the upper right hand section of the panel, sets up the proper internal circuit connections for using the TV-3/U equipment for TUBE TEST, or for testing OHMS VOLTS (A.C. or D.C.) CAPACITY or MILS in the ranges provided.

c. The LINE ADJUST, R113, controls the input voltage to the power transformer, T101, for proper standardization of the tube tester section, and also the ohms and capacity circuits.

d. The FILAMENT *voltage* switch, S101, provides a selection of filament or heater voltages from 1.1 through 117 volts ac in seventeen steps. Another position on this switch, marked BLST., also provides for testing ballast tubes.

e. SELECTORS; FILAMENT S103, FILAMENT S104, GRID S105, PLATE S108, SCREEN S109, CATHODE S110, and SUPPRESSOR S115 provide proper switching of the internal circuits to apply correct test voltages to the various pins of the tube under test.

f. BIAS control R116 is used to adjust the bias voltage applied to the tube under test to the proper value.

g. SHUNT control, a dual potentiometer R112 and R117, controls the sensitivity of the meter circuit to the proper level for the tube under test.

b. SHORTS switch S113 has five short test positions which connect the various elements of the tube under test to the short test circuit containing the neon indicator lamp E103. A sixth switch position TUBE TEST connects the tube to the tube test circuits after short test is completed.

i. NORMAL—LOW SIGNAL switch S107 provides a selection of either 5 volts or 1 volt ac for exciting the grid of the tube to be tested.

j. Push button switches located in the center of the panel actuate the final circuit selector switches for the type of test to be made as follows:

(1) P1 DIODE, test button for low power diodes such as type 6H6.

(2) P2 OZ4, test button for cold cathode rectifiers such as type OZ4.

(3) P3 RECT., test button for rectifiers such as types 5Y3, 6X4, 83, etc.

(4) P4, RED test button. G_m or mutual conductance test button for testing amplifier tubes only. NEVER USE THIS BUTTON WHEN TESTING RECTIFIER TUBES.

(5) P5 and P6, No. 1 and No. 2 Gas test buttons.

(6) P7, test button for Line Adjust.

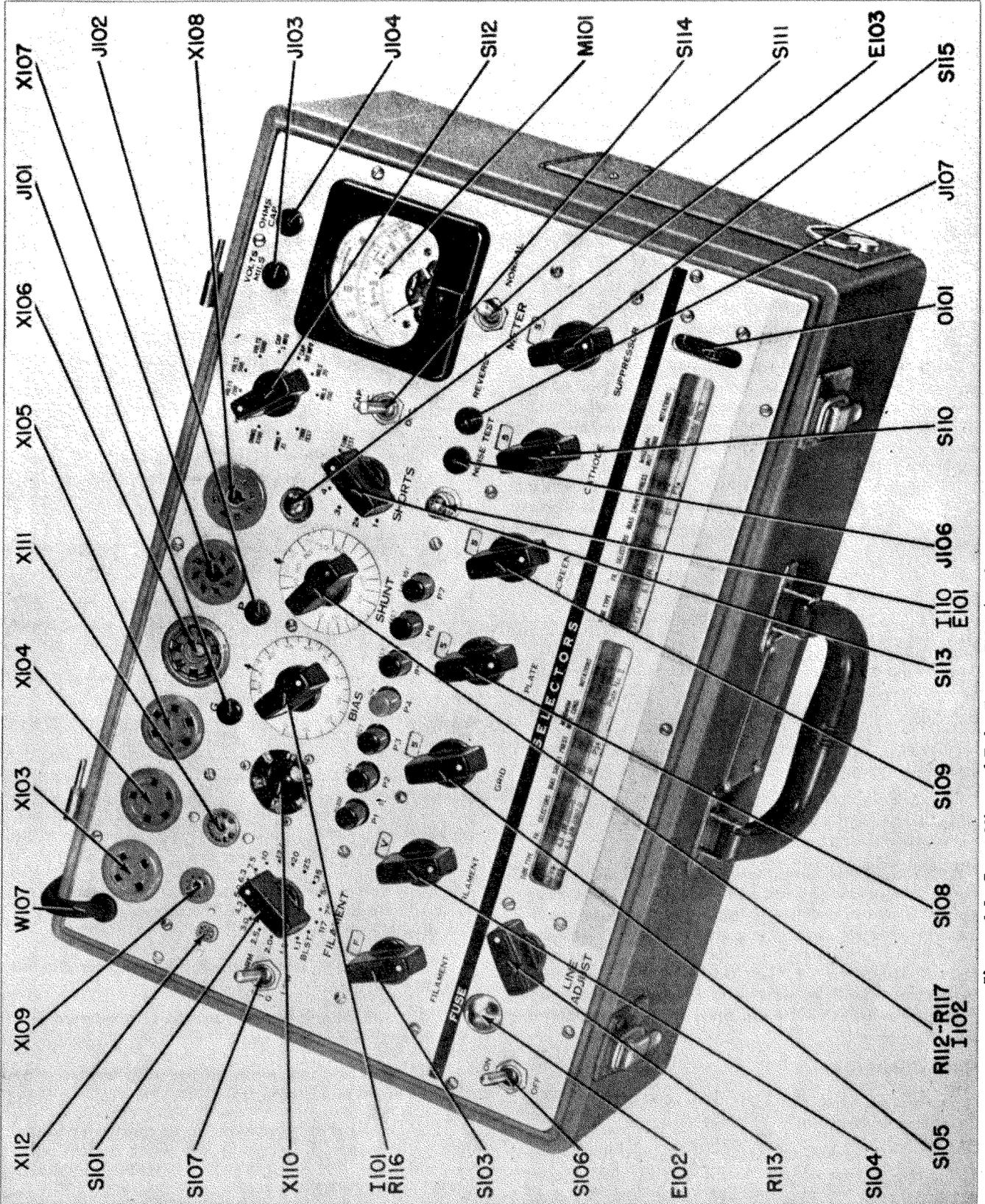


Figure 4-1. Front View of Tube Tester TV-3/U Showing Controls By Symbol Designation

k. CAP. A.C.-D.C. switch S114 connects copper oxide rectifier in analyzer circuit for A.C. volts and CAPACITY measurements only.

l. METER—REVERSE—NORMAL switch reverses polarity of voltage applied to meter when testing certain types of tubes.

m. Roller Index Chart I101, located at the bottom of the panel, is operated by a phenolic gear which protrudes through the panel in the lower right hand corner. Appropriate column headings on the panel just above the index window provide easy reference to tube test data printed on the roll chart.

3. TUBE TEST DATA.

a. All information necessary for properly setting the tube test controls for the various tube types is tabulated on the roll chart in eight columns under the following headings, reading from left to right:

- (1) **TUBE TYPE:** All currently available type numbers which the TV-3/U is designed to test are listed numerically in this column starting with type 00A and continuing through type 38142. Tubes having type letters only instead of numbers, such as XXB, are listed at the end of the numerical listing.
- (2) **FILAMENT:** Correct filament or heater voltages for the tube types listed are shown in this column. FILAMENT voltage switch S101 must be adjusted accordingly BEFORE inserting a tube in any of the test sockets.
- (3) **SELECTORS:** In this column are listed the correct settings for the two FILAMENT selector switches, S103 and S104, GRID selector switch S105, PLATE selector S108, SCREEN selector S109, CATHODE selector S110, and SUPPRESSOR S115.

The settings follow the same order in which the switches appear on the panel reading from left to right.

- (4) **BIAS:** This column lists the proper settings for the BIAS dial I101.
- (5) **SHUNT:** This column lists special settings for SHUNT dial I102, and NORMAL—LOW SIGNAL switch S107. When no numerical setting is listed for this control on the Roll Chart, the dial should be set to the red dot marker for the micromhos range to be used.
- (6) **PRESS:** Under this heading are listed the correct test PUSH BUTTONS to be used for the various tube types and their individual sections in the case of certain multipurpose tubes.
- (7) **MUT. CON.:** In this column are the MINIMUM, not average, mutual conductance values for amplifier tubes and amplifier sections of multipurpose tubes. Any tube showing a G_m or mutual conductance reading less than the value indicated in this column should be discarded.

(8) **NOTATIONS:** Under this heading is listed special information pertaining to particular tube types.

b. The roll chart is divided into left and right hand sections. The left hand section covering the tube type numbers from 00A through 12AT6, and the right hand section covering type numbers from 12AT7 through type XXL.

c. All data shown on the roll chart is also contained in TABLE 4-2 of this section.

4. OPERATIONAL PROCEDURE.

a. When the TV-3/U is to be used as a Tube Tester—

- (1) Plug the line cord W107 into an outlet supplying 105 to 125 volts ac at 50 to 1600 cycles.
- (2) Throw the line toggle switch S106 to the ON position. The panel indicator I110 should light.
- (3) Turn the MASTER SWITCH S112 to the position marked TUBE TEST.
- (4) Press the LINE ADJ. Push Button, P7, which will cause the pointer of the METER, M101, to move up scale to the right.
- (5) While still holding down Push Button P7, turn the knob of LINE ADJUST control R113 until the meter pointer rests exactly on the LINE TEST mark at the center of the meter scale. This establishes standard voltages for the tube tester.

Caution

DO NOT INSERT TUBE IN TEST SOCKET UNTIL CORRECT SETTINGS OF ALL CONTROLS HAVE BEEN MADE IN ACCORDANCE WITH THE FOLLOWING STEPS:

- (6) Turn SHORTS switch S113 to position No. 1.
- (7) Operate the phenolic gear which turns the roll chart mechanism until the type number of tube to be tested appears just above the red index line.
- (8) Turn the knob of FILAMENT *voltage* switch S101 to the voltage indicated on the chart under FIL.
- (9) Insert the tube to be tested in the proper test socket, and recheck line voltage adjustment as in paragraph (4) and (5) above.
- (10) The SELECTORS: The operation of setting these seven dials is somewhat similar to dialing a telephone number. On the roll chart, below the word SELECTORS, are listed the dialing numbers. These numbers consist of two letters and five figures. It is only necessary to turn the knobs of the seven SELECTOR switches, FILAMENT, S103; FILAMENT, S104; GRID, S105; PLATE, S108; SCREEN, S109; CATHODE, S110; and SUPPRESSOR, S115, until the letters and numbers appearing in the small windows above the knobs are the same, reading from left to right, as those indicated on the roll chart.

EXAMPLE: The roll chart indicates JR-6237-5 under SELECTORS.

Starting at the left, turn the knob of the first FILAMENT SELECTOR switch S103 until the letter J appears in the window. Turn the second FILAMENT SELECTOR switch until the letter R appears in the window. Turn the GRID SELECTOR until the number 6 appears, the PLATE SELECTOR to number 2, SCREEN to number 3, CATHODE to number 7, and SUPPRESSOR to number 5.

The sequence of letters and numbers appearing in the windows should now be identical with those indicated on the roll chart. (JR-6237-5)

The seven SELECTORS are electrically interlocked in such a way that it is impossible to connect two different voltages to the same tube pin at the same time. Accidental shorts are thus avoided.

(11) Set the BIAS dial I101 to the point indicated on the roll chart under BIAS.

(12) Set the SHUNT dial I102, or the NORMAL-LOW switch S107, to the position indicated on the roll chart under SHUNT. If LOW SIGNAL is not indicated on the roll chart, the switch should be kept in the NORMAL position.

(13) IF THE TUBE IS OF THE HEATER CATHODE TYPE, ALLOW ENOUGH TIME FOR THE CATHODE TO REACH OPERATING TEMPERATURE BEFORE PROCEEDING.

(14) Turn the SHORTS switch S113 from position number 1 through position number 5, meanwhile watching the neon short indicator lamp E103 on each switch position. Tubes having shorted elements will cause the lamp to glow. Tubes may be tested either hot or cold. A short is indicated by a steady glow on both plates of the neon lamp. A momentary glow when the switch is turned from one position to another should be disregarded, as this flashing is caused by the charging of a condenser in the short test circuit.

Tubes having more than one section such as the 6J6 should be tested for shorts on each section.

A shorted tube should be discarded without further test.

(15) LOCATING SHORTED ELEMENTS. In the Table 4-1 (X) under any SHORT switch position indicates that the neon lamp glows in that position.

(16) If the tube passes the short test, turn the SHORTS switch S113 to the TUBE TEST position.

(17) Press the test push button indicated on the Roll Chart in the column headed PRESS.

P1 for DIODES.

P2 for OZ4 and similar rectifiers.

P3 for standard RECTIFIERS.

P4 for G_m , Mutual conductance, of amplifier tubes.

Table 4-1. Short Test Chart

KIND OF SHORT		1	2	3	4	5
FIL	—CATHODE			X		
FIL	—GRID	X	X			X
FIL	—PLATE	X	X		X	X
FIL	—SCREEN	X		X	X	X
FIL	—SUP		X			
GRID	—CATHODE	X	X	X		X
GRID	—PLATE				X	
GRID	—SCREEN		X	X	X	
GRID	—SUP	X				X
PLATE	—SCREEN		X	X		
PLATE	—SUP	X			X	X
SCREEN	—SUP	X	X	X	X	X

(18) With the proper test push switch depressed, the METER M101 will indicate the condition of the tube.

(19) RECTIFIER TUBE TEST: Rectifier tubes, including diode tubes and diode sections of multi-purpose tubes, are tested for emission only since they have no mutual conductance characteristic.

Caution

NEVER press the RED G_m , mutual conductance push button P4 when testing rectifier tubes.

(a) The push button P1 is used when testing detector DIODES. It applies a low voltage which will not injure the delicate cathode. Good diodes will cause the pointer of METER M101 to indicate above the point marked DIODES OK.

(b) The push button P2 is used when checking cold cathode rectifiers such as the OZ4. This applies a voltage sufficiently high to ionize the tube and start conduction. Good tubes will cause the pointer of METER M101 to indicate above the point in the center of the scale marked RECTIFIERS OK.

(c) The push button P3 is used when testing regular power rectifiers such as the 5Y3. Depressing this button applies a medium voltage which is best suited to reveal defects in this type of tube. Good tubes will read above the point at the center of the scale marked RECTIFIERS OK.

(d) For multi-section tubes having more than one diode section, or for full wave power rectifiers, each section must be tested separately as indicated on the Roll Chart.

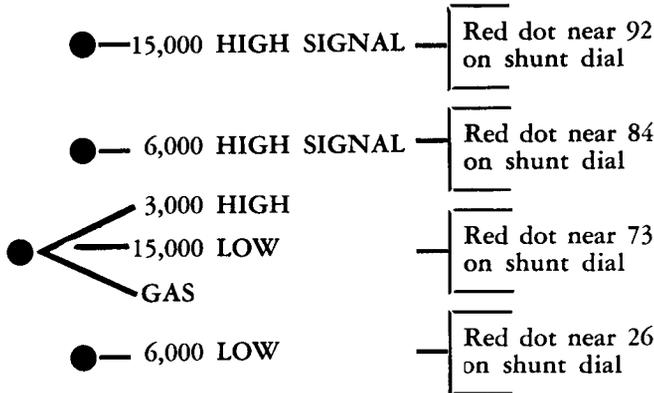
(20) MUTUAL CONDUCTANCE TEST: In the case of amplifier tubes an emission test is not sufficient, and a mutual conductance test must be employed. Be sure that the controls are properly set in accordance with the Roll Chart as outlined in paragraphs 4a (6)

through 4a (12) of this section, and also that the tube has been checked for shorts in accordance with paragraphs 4a (13)-(14) of this section. Then turn the SHORTS switch S113 to the TUBE TEST position.

(a) The mutual conductance is measured in micromhos in five ranges:

- 0 to 3,000 with NORMAL HIGH SIGNAL voltage
- 0 to 6,000 with NORMAL HIGH SIGNAL voltage
- 0 to 15,000 with NORMAL HIGH SIGNAL voltage
- 0 to 6,000 with LOW SIGNAL voltage
- 0 to 15,000 with LOW SIGNAL voltage

(b) Four small red dots on the edge of the SHUNT dial indicate the proper setting for this dial to obtain proper readings in micromhos for the various ranges, also shown on the dial.



(c) The column headed SHUNT on the Roll Chart indicates the tubes for which the SIGNAL switch S107 should be set to the LOW position. On all other tubes it should be set to the NORMAL HIGH position.

(d) The LOW SIGNAL voltage is used with certain tubes having low bias and sharp cutoff characteristics to prevent swinging the grid from positive to cutoff. This results in a more accurate test.

(e) With the NORMAL-LOW SIGNAL switch in the proper position, determined as above, set the SHUNT dial I102 to the range which most closely agrees with the minimum mutual conductance value shown under G_m on the Roll Chart for the tube under test. Correct settings for the ranges are indicated by four red marker dots.

(f) Check the line adjustment as in paragraph 4a (4) and 4a (5) of this section, and reset LINE ADJUST R113 if necessary.

(g) Press G_m push button P4. The METER M101 will indicate the mutual conductance or G_m of the tube directly in micromhos on the scale corresponding to the range selected when setting the SHUNT dial I102. That is, 0 to 3,000, 0 to 6,000, or 0 to 15,000 for

NORMAL HIGH SIGNAL; and 0 to 6,000, or 0 to 15,000 for LOW SIGNAL.

(h) Check the mutual conductance in micromhos as indicated on the METER M101 with the value shown on the Roll Chart. Since the chart values are MINIMUM any tube which reads below this value should be discarded or replaced.

(21) GAS TEST. The push switches P5 and P6 are used to test an amplifier tube for gas content.

(a) Set the SHUNT dial at RED DOT, NEAR 73 MARKED GAS.

(b) The push button P5 is pressed and held down while the BIAS dial is turned to cause the pointer of the meter to indicate 100 micromhos on the 0-3000 scale.

(c) Hold down the P5 and press P6.

(d) If the tube contains gas the pointer of the meter will move UP the scale. If the pointer movement is not more than one division of the scale, the gas content is satisfactory.

Note

With some tubes, such as the type 45, the micromhos reading cannot be brought down to 100 mhos by turning the BIAS dial. In such case turn the BIAS dial to 100 and test for gas.

(e) Some tubes develop gas after being heated for a period of time. If a tube is suspected, allow it to heat for a few minutes.

(22) METER REVERSE. Directly below the indicating meter is a switch S111 marked REVERSE-NORMAL. With certain tubes, such as the 117N7, the meter, when this switch is set on NORMAL, will deflect backwards (to the left) when push switch P3 is pressed for rectifier test. In such case turn the meter switch to REVERSE, which will cause the pointer of the meter to move up the scale. The TUBE TEST DATA CHART indicates when S111 should be set in reverse by a note "REVERSE METER" in the column headed "NOTATIONS." After the test has been made return the switch to NORMAL.

(23) TOP CAPS. There are two jacks in the upper center of the control panel marked G(grid) J101 and P(plate) J102. These are used when making connection to the top cap of the tube being tested. On the data chart in the NOTATIONS columns, opposite tube types having top caps, is the notation CAP = G or CAP = P. G means that the top cap is connected to the G jack, and P that it is connected to the P jack. Test leads W103 and W106 are used in making these connections.

(24) NOISE TEST. The short test circuit is also used in making noise tests on electron tubes. Connections are made from the noise test jacks J105 and J106 to the antenna and ground posts of any radio receiver. The tube under test is tapped with the finger as the

SHORTS switch S113 is turned through positions 1-2-3-4-5. Intermittent disturbances, which are too brief to register on the neon lamp, will be reproduced by the loud speaker as static.

(25) PILOT LAMP TEST. The center of the large 7-pin socket is used to check pilot lamps. Set the filament selector switches on JR. Set the filament voltage switch to the proper voltage for the lamp being tested.

(26) SOCKET NUMBERING. In order to reduce dialing to a minimum the socket contacts are numbered as shown on Figure 4-2 which shows the bottom views. The numerical values of the lettered dials are as shown in Table 4-2.

The letter I was omitted because of its resemblance to the figure 1. The letter Q was omitted because of its resemblance to the figure 0.

Note

This numbering system is for use in simplifying the operation of the selector switches of the TV-3/U, and should not be confused with the RMA tube and socket numbering system.

(27) SPECIAL NOTES. Power line voltage varies in different localities, and may also vary somewhat aboard ship.

While a national survey indicates that the average voltage for the U. S. A. is about 117 volts, it does not

mean that every locality maintains a constant voltage at that level.

Occasionally there is the complaint that a used tube will test GOOD, but will not work in the radio receiver; but when a NEW tube is substituted, the receiver will operate correctly. The answer may be this: Tubes are built to specifications. Tube Tester TV-3/U is designed to test tubes in conformity with these specifications. The used tube that would not perform in a certain receiver may not be receiving its specified filament voltage. The new tube performed because of its initial reserve capacity. The used tube may have performed if it had received its specified filament voltage. Also the tube may be depending on characteristics other than its mutual conductance for satisfactory operation.

Tube failure frequently occurs in ac-dc sets where several tubes are connected with their heaters or filaments in series. Sometimes, even though the power line voltage is normal, a series tube with abnormally high filament resistance will rob its companion tube of its normal filament voltage. The robbed tube apparently fails; but when tested under specified conditions, the tube will test GOOD.

(28) TESTING SUB-MINIATURE TUBES.

(a) Sub-miniature tubes having wire leads in place of pins are tested in the TV-3/U by means of a special socket X112.

SOCKET NUMBERING
BOTTOM VIEWS

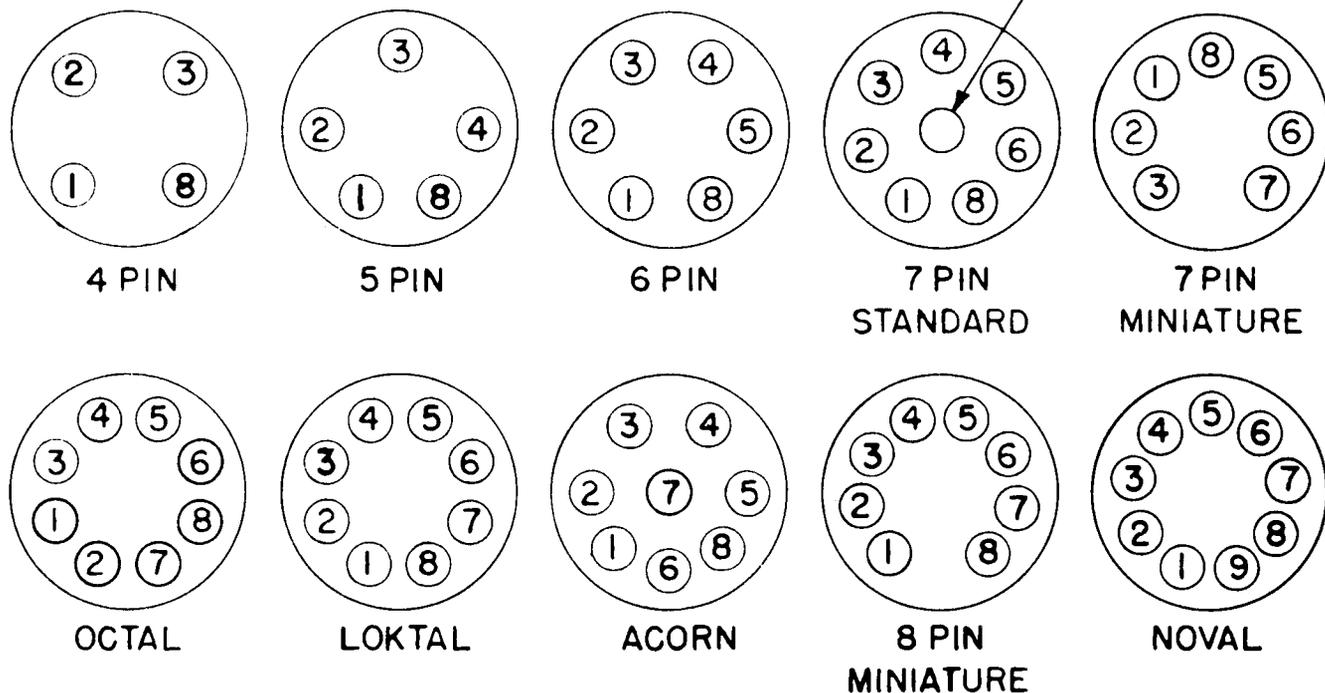


Figure 4-2. Socket Numbering

(b) There are several basings used for sub-miniature tubes and they are shown in Figure 4-3, and are all bottom views of the tubes, with leads numbered.

(c) A small 8 contact socket X112 is mounted on the panel for testing sub-miniature tubes. A top view is shown in Figure 4-4, with contacts numbered.

(d) The numbered leads of the tubes are inserted in the corresponding contacts of the socket. A good way to handle the leads is to grasp each lead about 1/8" from its end with the tips of a pair of long nose pliers, and insert the leads in their proper socket contact.

(e) Table 4-4 shows the proper tube test data for these sub-miniature types.

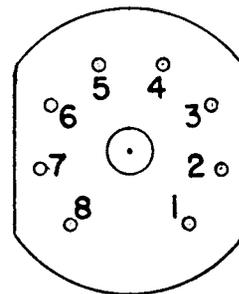


Figure 4-4. Top View of Socket X112

BASING DIAGRAMS FOR
SUB MINIATURE TUBES

TUBES HAVING LESS THAN 8 LEADS HAVE AN ARROW ON THE SIDE OF TUBE INDICATING NO. 1 LEAD

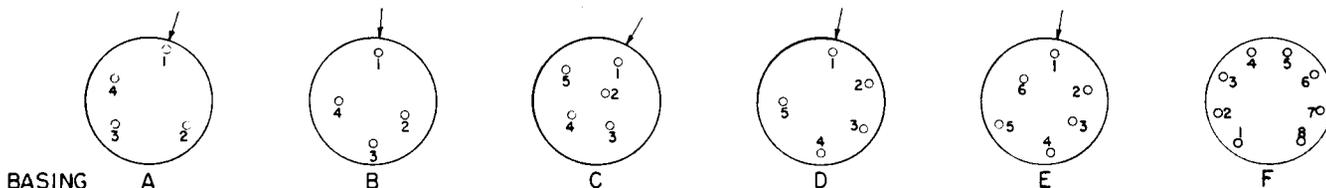


FIG. 4-3

BOTTOM VIEW OF TUBES

RMA NUMBERING

NUMERICAL VALUE OF LETTERED DIAL TV-3/U			4 PIN	5 PIN	6 PIN	7 PIN	OCTAL	LOKTAL	7 PIN MINIA-TURE	9 PIN MINIA-TURE	SUB MINIA-TURE	ACORN
0	A	P										
1	B	R	1	1	1	1	2	1	3	1	1	1
2	C	S	2	2	2	2	1	2	2	2	2	2
3	D	T	3	3	3	3	3	3	1	3	3	3
4	E	U		4	4	4	4	4		4	4	4
5	F	V			5	5	5	5	5	5	5	5
6	G	W				6	6	6	6	6	6	
7	H	X					8	7	7	7	7	7
8	J	Y	4	5	6	7	7	8	4	8	8	6
9	K	Z								9		

TABLE 4-2

TABLE 4-3. TUBE TEST DATA CHART

Tube Type	Fill Volts	Selectors	Bias	Shunt	Press	Mut. Cond.	Notations	Tube Type	Fill Volts	Selectors	Bias	Shunt	Press	Mut. Cond.	Notations
00A	5.0	JR-3200-0	33	...	P4	420		1F6	2.0	JR-0230-0	26	...	P4	410	Pent. Sect. Cap=G {Diode No. 1, OK over 500
01A	5.0	JR-3200-0	48	...	P4	460		1F6	2.0	JR-0530-0	0	0	P1	...	{Diode No. 2, OK over 500
0A2	.....	JP-0502-0	0	37	P5	.....		1F6	2.0	JR-0430-0	0	0	P1	.....	Pent. Sect. Cap=G Diode No. 1
0A3	.....	JP-0501-0	0	37	P5	.....		1F7	2.0	JR-0360-0	26	...	P4	410	Diode No. 2
0A4G	.....	KS-0581-0	100	85	P5	.....		1G4	1.5	JR-5300-0	49	.....	P4	520	
0B2	.....	JP-0502-0	0	20	P5	.....		1G5	2.0	JR-5340-0	37	.....	P4	950	
0B3	.....	JP-0501-0	0	37	P5	.....		1G6	1.5	JR-5600-0	16	.....	P4	420	Plate No. 1
0C3	.....	JP-0501-0	0	37	P5	.....		1H4	1.5	JR-4300-0	16	.....	P4	420	Plate No. 2
0D3	.....	JP-0501-0	0	37	P5	.....		1H5	2.0	JR-5300-0	40	.....	P4	570	
0Y4	BLST	JX-3502-0	0	40	P2	.....		1H5	1.5	JR-0300-0	16	.....	P4	175	Triode Sect. Cap=G Diode Sect.
0Z4	.....	JR-0507-0	0	60	P2	.....		1H6	2.0	JR-0500-0	24	Low Sig.	P4	365	Triode Sect. Diode No. 1
0Z4	.....	JR-0307-0	0	60	P2	.....		1H6	2.0	JR-6500-0	0	0	P1	.....	Diode No. 2
1A3	1.5	HT-0201-0	0	0	P1	470	Cap=G	1H6	2.0	JR-6400-0	0	0	P1	.....
1A4	2.0	JR-0230-0	29	.....	P4	500		1J5	2.0	JR-5340-0	45	.....	P4	600	
1A5	1.5	JR-5340-0	43	.....	P4	470	Pent. Sect. Cap=G	1J6	2.0	JR-5600-0	15	.....	P4	630	
1A6	2.0	JR-0250-4	35	.....	P4	100		1J6	2.0	JR-4300-0	15	.....	P4	630	
1A6	2.0	JR-4350-2	35	.....	P4	250	Pent. Sect. Cap=G	1L4	1.5	HT-6210-0	19	.....	P4	650	
1A7G	1.5	JR-5340-0	30	.....	P4	200	Osc. Sect.	1LA4	1.5	JR-6230-0	43	.....	P4	500	
1A7G	1.5	JR-5643-0	46	.....	P4	900		1LA6	1.5	JR-6253-4	24	.....	P4	500	
1AB5	1.1	JR-6230-0	0	.....	P4	.....		1LA6	1.5	JR-4352-6	46	.....	P4	190	Pent. Sect. Osc. Sect.
1B3	1.1	JR-0000-0	0	60	P5	.....	Cap=P	1LA6	1.5	JR-6230-0	51	.....	P4	580	
1B4	2.0	JR-0230-0	35	.....	P4	400	Cap=G	1LB4	1.5	JR-6230-0	51	.....	P4	250	Heptode Sect. Osc. Sect.
1B5	2.0	JR-5200-0	24	Low Sig.	P4	360	Triode Sect.	1LB6	1.5	JR-6243-7	0	.....	P4	480	
1B5	2.0	JR-5400-0	0	0	P1	.....	Diode No. 1	1LB6	1.5	JR-6357-4	20	.....	P4	630	Pent. Sect. Osc. Sect.
1B5	2.0	JR-5300-0	0	0	P1	.....	Diode No. 2	1LC5	1.5	JR-6234-0	29	.....	P4	350	Pent. Sect. Diode Sect.
1B7	1.5	JR-0340-5	24	.....	P4	500	Pent. Sect. Cap=G	1LC6	1.5	JR-6253-4	30	.....	P4	380	
1B7	1.5	JR-5640-3	46	.....	P4	200		1LC6	1.5	JR-4352-6	30	.....	P4	820	
1C5	1.5	JR-5340-0	44	.....	P4	1000		1LD5	1.5	JR-6230-0	28	.....	P1	.....
1C6	2.0	JR-0253-4	29	.....	P4	410	Ampl. Sect. Cap=G	1LD5	1.5	JR-6430-0	0	0	P4	660	
1C6	2.0	JR-4352-0	50	.....	P4	200		1LE3	1.5	JR-6205-0	0	.....	P4	175	Triode Sect. Diode Sect.
1C7	2.0	JR-0346-5	29	.....	P4	410	Pent. Sect. Cap=G	1LG5	1.5	JR-6234-0	25	.....	P4	480	
1C7	2.0	JR-5643-0	50	.....	P4	200	Cap=G	1LH4	1.5	JR-6400-0	16	.....	P4	480	Cap=G
1D5	2.0	JR-0340-0	29	.....	P4	470	Pent. Sect.	1LH4	1.5	JR-6234-0	11	.....	P4	500	Pent. Sect. Diode Sect.
1D7	2.0	JR-0346-5	35	.....	P4	470	Pent. Sect. Cap=G	1LN5	1.5	JR-6234-0	11	.....	P4	500	Cap=G
1D7	2.0	JR-5643-0	35	.....	P4	100		1N5	1.5	JR-5340-0	43	.....	P4	1320	Diode No. 1 Grid No. 2 Grid
1D8	1.5	JR-5346-0	50	.....	P4	580	Pent. Sect.	1N6	1.5	JR-0600-0	43	0	P1	.....
1D8	1.5	JR-5643-0	11	.....	P4	360	Triode Sect. Cap=G	1N6	1.5	JR-0340-0	11	.....	P4	500	Cap=G
1D8	1.5	JR-5743-0	0	0	P1	.....	Diode Sect.	1P5	1.5	JR-0340-0	11	.....	P4	500	
1E4	1.5	JR-5300-0	37	.....	P4	520	Cap=G	1Q5	1.5	JR-5340-0	37	.....	P4	1320	Diode
1E5	2.0	JR-0340-0	35	.....	P4	400	Cap=G	1R4	1.5	JR-0407-0	0	0	P1	.....
1E7	2.0	JR-5673-4	10	Low Sig.	P4	900	No. 1 Plate	1R5	1.5	DX-8216-0	33	.....	P4	380	No. 1 Grid
1E7	2.0	JR-4376-5	10	Low Sig.	P4	900	No. 2 Plate	1R5	1.5	DX-6218-0	33	.....	P4	315	No. 2 Grid
1F4	2.0	JR-3240-0	23	.....	P4	880		1S4	1.5	DX-1280-0	43	.....	P4	950	
1F5	2.0	JR-5340-0	23	.....	P4	880		1S5	1.5	DX-6580-0	34	.....	P4	330	Pent. Sect.

TABLE 4-3 (Continued)

Tube Type	Fill Volts	Selectors	Bias	Shunt	Press	Mar. Cond.	Notations
1S5	1.5	DX-0180-0	0	0	P1	600	Diode Sect.
1SA6	1.5	JR-4763-0	23	.....	P4	410	Pent. Sect.
1SB6	1.5	JR-7340-0	27	.....	P4	470	Diode Sect.
1SB6	1.5	JR-7500-0	27	0	P1	725	
1T4	1.5	DX-6210-0	34	.....	P4	565	
1T5	1.5	JR-5340-0	45	.....	P4	330	Pent. Sect.
1U4	1.5	DX-6210-0	14	.....	P4	.....	Diode Sect.
1U5	1.5	DX-6210-0	34	.....	P4	.....
1U5	1.5	DX-6810-0	34	0	P1	.....
1V	6.3	JR-0203-0	0	49	P3	.....	Cap=P
1Z2	1.5	DS-0000-0	0	70	P5	1900	
2A3	2.5	JR-3200-0	67	.....	P4	.....
2A4	2.5	JR-5300-0	61	73	P3	1260	Triode Sect. Cap=G
2A5	2.5	JR-4235-0	29	.....	P4	700	Diode No. 1
2A6	2.5	JR-0205-0	11	Low Sig.	P4	.....	Diode No. 2
2A6	2.5	JR-0405-0	11	0	P1	.....	Pent. Sect. Cap=G
2A6	2.5	JR-0305-0	11	0	P1	250	Osc. Sect.
2A7	2.5	JR-0236-5	22	.....	P4	950	
2A7	2.5	JR-5436-0	30	.....	P4	630	
2B4	2.5	JR-3204-0	72	91	P5	.....
2B6	2.5	JR-4236-0	15	.....	P4	.....
2B7	2.5	JR-0236-0	30	.....	P4	.....
2B7	2.5	JR-0536-0	0	0	P1	.....
2B7	2.5	JR-0436-0	0	0	P1	860	Diode No. 1
2C21	6.3	JR-4506-0	17	.....	P4	860	Diode No. 2
2C21	6.3	JR-0302-0	17	.....	P4	1900	Triode No. 2, Cap=G
2C22	6.3	JR-0007-0	13	.....	P4	.....	Upper Cap=G, Lower Cap=P
2C26	6.3	JR-0007-0	18	.....	P4	950	Upper Cap=P Lower Cap=G
2C45	7.5	JR-3200-0	37	.....	P4	1380	
2C51	6.3	KR-3402-8	17	Low Sig.	P4	3300	Triode No. 1
2C51	6.3	KR-7608-2	17	Low Sig.	P4	3300	Triode No. 2
2C52	12.6	JX-4506-1	9	Low Sig.	P4	950	Triode No. 1
2C52	12.6	JX-2103-5	9	Low Sig.	P4	950	Triode No. 2
2C53	6.3	JR-5007-0	0	.....	P4	250	Cap=P
2D21	6.3	JR-3602-5	#	80	P3	.....	Strikes at approx. 75
2E5	2.5	JR-5403-0	.....	.....	P4	.....	Eye Open
2E5	2.5	JR-5423-0	.....	.....	P4	.....	Eye Closed
2E22	6.3	JR-3024-0	0	.....	P4	2500	Cap=P
2E24	6.3	JR-5030-0	35	.....	P4	2000	Short on 3, Cap=P
2E25	6.3	JR-5040-7	0	.....	P4	1900	Cap=P
2E26	6.3	JR-5032-7	37	.....	P4	2200	Cap=P
2E30	6.3	JR-3560-2	20	.....	P4	1900	
2V3	2.5	JR-0000-0	0	50	P5	.....	Cap=P
2W3	2.5	HR-0400-0	0	30	P3	.....
2X2A	2.5	JR-0000-0	0	73	P5	.....	Cap=P
2Z2	2.5	JR-0200-0	0	15	P3	.....
3A4	2.5	DX-8210-0	33	.....	P4	1260	Triode No. 1
3A5	3.0	DX-5600-0	32	.....	P4	1260	Triode No. 2
3A5	3.0	DX-1200-0	22	.....	P4	470	Pent. Sect. Cap=G
3A8	2.5	JR-0340-0	12	.....	P4	315	Triode Sect.
3A8	2.5	JR-5640-0	12	.....	P4	.....	Diode Sect.
3A8	2.5	JR-0740-0	0	0	P1	.....	Short on 3
3B4	2.5	JV-1730-0	55	.....	P4	1070	
3B5	2.5	JR-5340-0	60	.....	P4	950	
3B7	2.5	JR-6700-0	31	Low Sig.	P4	1200	Triode No. 1
3B7	2.5	JR-3200-0	31	Low Sig.	P4	1200	Triode No. 2
3B29	3.0	JR-0000-0	0	87	P5	.....	Cap=P
3C6	2.5	BY-5600-0	10	.....	P4	700	Triode No. 1
3C6	2.5	JR-4300-0	10	.....	P4	700	Triode No. 2
3D6	2.5	JR-6230-0	37	.....	P4	1320	
3E6	3.0	JR-6234-0	15	Low Sig.	P4	1100	
3LE4	2.5	JR-6237-4	55	.....	P4	700	
3LF4	2.5	JR-6230-0	30	.....	P4	1200	
3Q4	3.0	HT-1280-0	24	.....	P4	1340	
3Q5	2.5	JR-5340-0	38	.....	P4	1130	
3S4	2.5	HT-1280-0	43	.....	P4	820	
3V4	3.0	DX-6210-0	31	.....	P4	1040	
4A6	3.0	JR-5600-0	20	Low Sig.	P4	630	Triode No. 1
4A6	3.0	JR-4300-0	20	Low Sig.	P4	630	Triode No. 2
5A24	5.0	JS-0400-6	0	18	P3	.....
5A24	5.0	JS-0600-4	0	22	P3	.....
5R4	5.0	HR-0600-0	0	24	P3	.....
5R4	5.0	HR-0400-0	0	18	P3	.....	Plate No. 1
5T4	5.0	HR-0600-0	0	55	P3	.....	Plate No. 2
5T4	5.0	HR-0400-0	0	49	P3	.....	Plate No. 1
5U4	5.0	HR-0600-0	0	35	P3	.....	Plate No. 2
5U4	5.0	HR-0400-0	0	30	P3	.....	Plate No. 1
5V4	5.0	HR-0600-0	0	60	P3	.....	Plate No. 2
5V4	5.0	HR-0400-0	0	60	P3	.....	Plate No. 1
5W4	5.0	HR-0600-0	0	20	P3	.....	Plate No. 2
5W4	5.0	HR-0400-0	0	15	P3	.....	Plate No. 1
5X4	5.0	JX-0500-0	0	43	P3	.....	Plate No. 2
5X4	5.0	JX-0300-0	0	39	P3	.....	Plate No. 1
5Y3	5.0	HR-0600-0	0	22	P3	.....	Plate No. 2
5Y3	5.0	HR-0400-0	0	18	P3	.....	Plate No. 1
5Y4	5.0	JX-0500-0	0	16	P3	.....	Plate No. 2
5Y4	5.0	JX-0300-0	0	12	P3	.....	Plate No. 1
5Z3	5.0	JR-0300-0	0	49	P3	.....	Plate No. 2
5Z3	5.0	JR-0200-0	0	43	P3	.....	Plate No. 1
5Z4	5.0	HR-0600-0	0	73	P3	.....	Plate No. 2
5Z4	5.0	HR-0400-0	0	73	P3	.....	Plate No. 1
6A3	6.3	JR-3200-0	67	.....	P4	1900	
6A4	6.3	JR-3240-0	28	.....	P4	1260	
6A5	6.3	JR-5300-0	67	.....	P4	1900	

TABLE 4-3 (Continued)

Tube Type	Fill Volts	Selectors	Bias	Shunt	Press	Mut. Cond.	Notations
6A6	6.3	JR-5604-0	12	.....	P4	950	Triode No. 1
6A6	6.3	JR-3204-0	12	.....	P4	950	Triode No. 2
6A7	6.3	JR-0236-5	22	.....	P4	630	Pent. Sect., Cap=G
6A7	6.3	JR-5436-2	30	.....	P4	190	Osc. Sect.
6A8	6.3	JR-0347-5	22	.....	P4	630	Pent. Sect., Cap=G
6A8	6.3	JR-5647-3	30	.....	P4	190	Osc. Sect.
6AB4	6.3	JR-6307-0	14	Low Sig.	P4	2500	
6AB5	6.3	JR-5403-0	.....	.....	P4	.....	Eye Open
6AB5	6.3	JR-5423-0	.....	.....	P4	.....	Eye Closed
6AB6	6.3	JR-5347-0	0	.....	P4	920	
6AB7	6.3	JR-5347-3	0	.....	P4	2200	
6AC5	6.3	JR-5307-0	0	.....	P4	530	
6AC6	6.3	JR-5347-0	0	.....	P4	1500	
6AC7	6.3	JR-4765-3	10	Low Sig.	P4	3800	
6AD6	6.3	JR-4357-0	.....	.....	P4	.....	{ Eye 1 Open { Eye 2 Closed
6AD6	6.3	JR-3457-0	.....	.....	P4	.....	{ Eye 2 Open { Eye 1 Closed
6AD7	6.3	JR-5347-6	29	.....	P4	1260	Pent. Sect.
6AD7	6.3	JR-2607-3	0	.....	P4	380	Triode Sect.
6AE5	6.3	JR-5307-0	68	.....	P4	750	
6AE6	6.3	JR-5407-3	0	.....	P4	540	Triode No. 2
6AE6	6.3	JR-5307-4	0	.....	P4	470	Triode No. 1
6AE7	6.3	JR-6307-4	33	.....	P4	950	Triode No. 1
6AE7	6.3	JR-4305-6	33	.....	P4	950	Triode No. 2
6AF5	6.3	JR-5307-0	51	.....	P4	950	
6AF6	6.3	JR-4357-0	.....	.....	P4	.....	{ Eye 1 Open, { Eye 2 Closed
6AF6	6.3	JR-3457-0	.....	.....	P4	.....	{ Eye 2 Open, { Eye 1 Closed
6AG5	6.3	JR-3562-0	10	Low Sig.	P4	2500	
6AG7	6.3	JR-4765-2	10	Low Sig.	P4	3800	
6AH5	6.3	JR-6418-0	23	.....	P4	3150	
6AH6	6.3	JR-3567-2	10	Low Sig.	P4	3800	
6AH7	6.3	JX-5604-0	20	Low Sig.	P4	1510	Triode No. 1
6AH7	6.3	JX-2301-0	20	Low Sig.	P4	1510	Triode No. 2
6AJ5	6.3	JR-3562-0	27	.....	P4	1730	
6AJ7	6.3	JR-4765-3	10	Low Sig.	P4	3800	
6AK5	6.3	JR-3562-0	10	Low Sig.	P4	2780	
6AK6	6.3	JR-3567-2	23	.....	P4	1320	
6AK7	6.3	JR-4765-2	10	Low Sig.	P4	3800	
6AL5	6.3	JR-0703-0	0	61	P1	.....	Diode No. 1
6AL5	6.3	JR-0205-0	0	61	P1	.....	Diode No. 2
6AL6	6.3	JR-5047-0	23	.....	P4	3150	Cap=P
6AL7	6.3	JR-6357-0	Vary	100	P4	.....	{ Bias Controls { Left Pattern
6AL7	6.3	JR-5347-0	Vary	100	P4	.....	{ Bias Controls { Both Patterns
6AL7	6.3	JR-4357-0	Vary	100	P4	.....
6AN5	6.3	JR-3567-0	11	.....	P4	5000	
6AQ5	6.3	JR-3562-0	21	.....	P4	2320	
6AQ6	6.3	JR-3702-0	6	.....	P4	725	Triode Sect.
6AQ6	6.3	JR-0602-0	0	0	P1	.....	Diode No. 1
6AQ6	6.3	JR-0502-0	0	0	P1	.....	Diode No. 2
6AQ7	6.3	JX-4501-6	13	.....	P1	630	Triode Sect.
6AQ7	6.3	JX-4201-6	0	0	P1	.....	Diode No. 1
6AQ7	6.3	JX-4301-6	0	0	P1	.....	Diode No. 2
6AR5	6.3	JR-3562-0	34	.....	P4	1000	
6AR6	6.3	GX-8352-0	34	.....	P4	3400	
6AS5	6.3	JR-2763-0	26	.....	P4	3530	
6AS6	6.3	JR-3562-7	10	Low Sig.	P4	1540	
6AS7	6.3	JX-4506-1	100	.....	P4	1800	Triode No. 1
6AS7	6.3	JX-2103-5	100	.....	P4	1800	Triode No. 2
6AT6	6.3	JR-3702-0	18	.....	P4	750	Triode Sect.
6AT6	6.3	JR-3602-0	0	0	P1	.....	Diode No. 1
6AT6	6.3	JR-3502-0	0	0	P1	.....	Diode No. 2
6AV6	6.3	JR-3567-2	10	Low Sig.	P4	2050	
6AV6	6.3	JR-3702-5	12	.....	P4	800	Triode Sect.
6AV6	6.3	JR-3602-5	0	0	P1	.....	Diode No. 1
6AV6	6.3	JR-3502-7	0	0	P1	.....	Diode No. 2
6AW7	6.3	JX-1602-0	8	Low Sig.	P4	750	Triode Sect.
6AW7	6.3	JX-1305-0	0	50	P1	.....	Diode No. 1
6AW7	6.3	JX-1402-0	0	50	P1	.....	Diode No. 2
6B4	6.3	JR-5300-0	67	.....	P4	1900	
6B5	6.3	JR-4235-0	0	.....	P4	950	
6B6	6.3	JR-0307-0	10	Low Sig.	P4	700	Triode Sect., Cap=G
6B6	6.3	JR-0507-0	0	0	P1	.....	Diode No. 1
6B6	6.3	JR-0407-0	0	0	P1	.....	Diode No. 2
6B7	6.3	JR-0236-0	30	.....	P4	630	Pent. Sect.
6B7	6.3	JR-0536-0	0	0	P1	.....	Diode No. 1
6B7	6.3	JR-0436-0	0	0	P1	.....	Diode No. 2
6B8	6.3	JR-0367-2	24	.....	P4	720	Pent. Sect., Cap=G
6B8	6.3	JR-0567-2	0	0	P1	.....	Diode No. 1
6B8	6.3	JR-0467-2	0	0	P1	.....	Diode No. 2
6BA6	6.3	JR-3567-2	9	.....	P4	2700	
6BA7	6.3	EV-7913-2	17	.....	P4	470	Ampl. Sect.
6BA7	6.3	EV-2913-7	25	.....	P4	470	Osc. Sect.
6BD6	6.3	JR-3567-2	13	Low Sig.	P4	1260	
6BE6	6.3	JR-7562-3	11	.....	P4	900	Ampl. Sect.
6BE6	6.3	JR-3562-7	0	.....	P4	1000	Osc. Sect.
6BF6	6.3	JR-3702-0	18	.....	P4	1200	Triode Sect.
6BF6	6.3	JR-3602-0	0	0	P1	.....	Diode No. 1
6BF6	6.3	JR-3502-0	0	0	P1	.....	Diode No. 2
6BG6	6.3	JR-5073-0	20	.....	P4	3800	Cap=P
6BH6	6.3	JR-3562-7	15	.....	P4	1260	

TABLE 4-3 (Continued)

Tube Type	File Volts	Selectors	Bias	Shunt	Press	Mur. Cond.	Notations	Tube Type	File Volts	Selectors	Bias	Shunt	Press	Mur. Cond.	Notations
6BJ6	6.3	JR-3562-7	0	.....	P4	2400		6L5	6.3	JR-5307-0	27	.....	P4	950	
6C4	6.3	JR-6307-0	24	.....	P4	1380		6L6	6.3	JR-5347-2	23	.....	P4	3150	
6C5	6.3	JR-5307-0	21	.....	P4	1260		6L7	6.3	JR-0347-5	23	.....	P4	410	Cap Grid, Cap = G
6C6	6.3	JR-0235-4	21	.....	P4	770	Cap = G	6L7	6.3	JR-5347-2	27	.....	P4	410	Pin Grid
6C7	6.3	JR-0206-0	29	.....	P4	780	Triode Sect., Cap = G	6N4	6.3	JR-3502-0	18	Low Sig.	P4	3800	
6C7	6.3	JR-0506-0	0	0	P1	.....	Diode No. 1	6N5	6.3	JR-5403-0	.....	.....	P4	.....	Eye Open
6C7	6.3	JR-0406-0	0	0	P1	.....	Diode No. 2	6N5	6.3	JR-5423-0	.....	.....	P4	.....	Eye Closed
6C8	6.3	JR-5607-0	17	.....	P4	630	Triode No. 1	6N6	6.3	JR-5347-0	.....	.....	P4	950	Triode No. 1
6C8	6.3	JR-0304-0	17	.....	P4	630	Triode No. 2	6N7	6.3	JR-5607-3	12	.....	P4	950	Triode No. 2
6D4	6.3	JR-3705-0	100	55	P3	.....	{ Tube Strikes at approx. 75	6N7	6.3	JR-4307-6	12	.....	P4	910	
6D5	6.3	JR-5307-0	57	.....	P4	1260	Cap = G	6P5	6.3	JR-5307-0	29	.....	P4	700	Pent. Sect., Cap = G
6D6	6.3	JR-0235-4	21	.....	P4	1000	Cap = G	6P7	6.3	BT-0457-6	28	.....	P4	315	Triode Sect.
6D7	6.3	JR-0236-4	24	.....	P4	770	Cap = G	6P7	6.3	BT-8607-4	28	.....	P4	.....	Strikes at Approx. 60
6D8	6.3	JR-0347-5	22	.....	P4	630	Pent. Sect., Cap = G	6Q5	6.3	JR-5307-0	60	91	P5	630	Triode Sect., Cap = G
6D8	6.3	JR-5647-3	30	.....	P4	190	Triode Sect., Cap = G	6Q6	6.3	JR-0307-0	17	.....	P1	.....	Diode No. 1
6E5	6.3	JR-5403-0	.....	.....	P4	.....	Eye Open	6Q6	6.3	JR-0507-0	0	0	P1	.....	Diode No. 2
6E5	6.3	JR-5423-0	.....	.....	P4	.....	Eye Closed	6Q7	6.3	JR-0407-0	0	0	P1	.....	Triode Sect., Cap = G
6E6	6.3	JR-5604-0	28	.....	P4	880	Triode No. 1	6Q7	6.3	JR-0307-2	17	.....	P4	500	Diode No. 1
6E6	6.3	JR-3204-0	28	.....	P4	880	Triode No. 2	6Q7	6.3	JR-0507-3	0	0	P1	.....	Diode No. 2
6E7	6.3	JR-0236-4	24	.....	P4	950	Cap = G	6R7	6.3	JR-0407-3	0	0	P1	1200	Triode Sect., Cap = G
6F4	6.3	JR-2306-0	30	.....	P4	3800	Cap = G	6R7	6.3	JR-0507-3	0	0	P1	.....	Diode No. 1
6F5	6.3	JR-0407-2	10	Low Sig.	P4	950	Cap = G	6R7	6.3	JR-0407-3	0	0	P1	.....	Diode No. 2
6F6	6.3	JR-5347-2	29	.....	P4	1260	Cap = G	6S7	6.3	JR-0347-5	27	.....	P4	1100	Cap = G
6F7	6.3	JR-0236-5	28	.....	P4	700	Pent. Sect., Cap = G	6S8	6.3	JX-0601-0	10	.....	P4	570	Triode Sect., Cap = G
6F7	6.3	JR-5436-2	28	.....	P4	315	Triode Sect.	6S8	6.3	JX-0401-0	0	0	P1	.....	Diode No. 1
6F8	6.3	JR-5607-0	23	.....	P4	1260	Triode No. 1	6S8	6.3	JX-0201-0	0	0	P1	.....	Diode No. 2
6G5	6.3	JR-0304-0	23	.....	P4	1260	Triode No. 2, Cap = G	6S8	6.3	JX-0305-0	0	0	P1	.....	Diode No. 3
6G5	6.3	JR-5403-0	.....	.....	P4	.....	Eye Open	6SA7	6.3	JR-7346-5	21	.....	P4	470	Ampl. Sect.
6G5	6.3	JR-5423-0	.....	.....	P4	.....	Eye Closed	6SA7	6.3	JR-5346-7	21	.....	P4	470	Osc. Sect.
6G6	6.3	JR-5347-0	12	Low Sig.	P4	1450	Diode	6SB7	6.3	JR-7346-5	16	.....	P4	470	Ampl. Sect.
6H4	6.3	JR-0407-0	0	61	P1	.....	Diode	6SB7	6.3	JR-5346-7	40	.....	P4	190	Osc. Sect.
6H5	6.3	JR-5403-0	.....	.....	P4	.....	Eye Open	6SB7	6.3	JR-5346-7	40	Low Sig.	P4	830	Triode No. 1
6H5	6.3	JR-5423-0	.....	.....	P4	.....	Eye closed	6SC7	6.3	JX-4506-1	10	Low Sig.	P4	830	Triode No. 2
6H6	6.3	JR-0507-0	0	61	P1	.....	Diode No. 1	6SC7	6.3	JX-3106-5	10	Low Sig.	P4	1900	
6H6	6.3	JR-0304-0	0	61	P1	.....	Diode No. 2	6SF5	6.3	JR-4765-3	10	Low Sig.	P4	950	
6J4	6.3	JR-3702-0	15	Low Sig.	P4	5700	Cap = G	6SF7	6.3	JX-1643-2	0	.....	P4	1260	Pent. Sect.
6J5	6.3	JR-5207-0	22	Low Sig.	P4	1640	Triode No. 1	6SF7	6.3	JX-0543-6	0	0	P1	.....	Diode Sect.
6J6	6.3	JR-5307-0	15	Low Sig.	P4	2800	Triode No. 2	6SG7	6.3	JR-4765-2	0	.....	P4	2100	
6J6	6.3	JR-6307-0	15	Low Sig.	P4	2800	Cap = G	6SH7	6.3	JR-4765-2	0	.....	P4	2150	
6J7	6.3	JR-0347-5	22	.....	P4	770	Heptode Sect. Cap = G	6SJ7	6.3	JR-4765-3	20	Low Sig.	P4	1040	
6J8	6.3	JR-5347-6	18	.....	P4	630	Triode Sect.	6SK7	6.3	JR-4765-3	10	Low Sig.	P4	1260	
6K5	6.3	JR-5647-3	30	.....	P4	315	Cap = G	6SL7	6.3	JX-4506-1	7	Low Sig.	P4	1000	Triode No. 1
6K6	6.3	JR-0307-0	17	Low Sig.	P4	840	Cap = G	6SL7	6.3	JX-2103-5	7	Low Sig.	P4	1000	Triode No. 2
6K6	6.3	JR-5347-0	34	.....	P4	1000	Hexode Sect. Cap = G	6SN7	6.3	JX-4506-1	22	Low Sig.	P4	1650	Triode No. 1
6K7	6.3	JR-0347-5	19	.....	P4	910	Cap = G	6SN7	6.3	JX-2103-5	22	Low Sig.	P4	1650	Triode No. 2
6K8	6.3	JR-5347-6	11	.....	P4	630	Triode Sect.	6SO7	6.3	JX-1603-2	11	Low Sig.	P4	700	Triode Sect.
6K8	6.3	JR-5647-3	0	.....	P4	1500	Triode Sect.	6SQ7	6.3	JX-0503-6	0	0	P1	.....	Diode No. 1

TABLE 4-3 (Continued)

Tube Type	File Volts	Selectors	Bias	Shunt	Press	Mut. Cond.	Notations	Tube Type	File Volts	Selectors	Bias	Shunt	Press	Mut. Cond.	Notations
6SO7	6.3	JX-0403-6	0	0	P1	1200	Diode No. 2	6Z4	6.3	JR-0204-0	0	35	P3	760	Plate No. 2
6SR7	6.3	JX-1603-2	18	0	P4	1200	Triode Sect.	6Z5	6.3	JS-0504-0	0	49	P3	760	Plate No. 1
6SR7	6.3	JX-0503-6	0	0	P1	1160	Diode No. 1	6Z5	6.3	JS-0304-0	0	49	P3	760	Plate No. 2
6SR7	6.3	JX-0403-6	0	0	P1	1200	Diode No. 2	6Z7	6.3	JR-5607-0	0	0	P4	760	Triode No. 1
6SS7	6.3	JR-4765-3	19	0	P4	1200	Triode Sect.	6Z7	6.3	JR-4307-0	0	0	P4	760	Triode No. 2
6ST7	6.3	JX-1603-2	15	0	P4	1000	Diode No. 1	6ZY5	6.3	JR-0507-0	0	30	P3	1640	Plate No. 1
6ST7	6.3	JX-0503-6	0	0	P1	1000	Diode No. 2	6ZY5	6.3	JR-0307-0	0	30	P3	3800	Plate No. 2
6ST7	6.3	JX-0403-6	0	0	P1	1000	Triode No. 1	7A4	6.3	JR-6207-0	22	Low Sig.	P4	1100	Diode No. 1
6SU7	6.3	JX-4506-1	7	Low Sig.	P4	1000	Triode No. 2	7A5	6.3	JR-6237-0	28	0	P4	630	Diode No. 2
6SU7	6.3	JX-2103-5	7	Low Sig.	P4	1320	Pent. Sect.	7A6	6.3	JR-0607-5	0	49	P1	315	Ampl. Sect.
6SV7	6.3	JX-1643-0	12	0	P4	760	Diode Sect.	7A6	6.3	JR-0302-5	0	49	P1	315	Osc. Sect.
6SV7	6.3	JX-1543-0	0	0	P1	760	Triode Sect.	7A7	6.3	JR-6237-4	27	0	P4	1140	Triode No. 1
6SZ7	6.3	JX-1603-2	10	0	P4	760	Triode Sect.	7A8	6.3	JR-6257-4	24	0	P4	1640	Triode No. 2
6SZ7	6.3	JX-0503-2	0	0	P1	760	Diode No. 1	7A8	6.3	JR-4357-6	26	0	P4	1900	Ampl. Sect.
6T5	6.3	JR-5403-2	0	0	P1	630	Diode No. 2	7AB7	6.3	HS-5314-0	10	0	P4	1140	Osc. Sect.
6T5	6.3	JR-5423-0	0	0	P4	630	Eye Open	7AD7	6.3	JR-6237-4	0	Low Sig.	P4	3900	Triode No. 1
6T7	6.3	JR-0307-0	17	0	P4	630	Eye Closed	7AF7	6.3	JR-5607-0	21	0	P4	1640	Triode No. 2
6T7	6.3	JR-0507-0	0	0	P1	760	Triode Sect., Cap = G	7AF7	6.3	JR-4302-0	21	0	P4	1640	Triode No. 2
6T7	6.3	JR-0407-0	0	0	P1	760	Diode No. 1	7AG7	6.3	JR-6237-4	0	0	P4	2100	Triode No. 1
6T8	6.3	EV-8907-6	11	0	P4	760	Diode No. 2	7AH7	6.3	JR-6237-4	0	0	P4	1430	Triode No. 1
6T8	6.3	EV-0607-1	0	50	P1	760	Triode Sect.	7AJ7	6.3	JR-6237-4	0	Low Sig.	P4	2500	Triode No. 2
6T8	6.3	EV-0203-7	0	50	P1	760	Diode No. 1	7AK7	6.3	JR-6237-4	0	0	P4	1000	Triode Sect.
6U5	6.3	EV-0107-8	0	50	P1	3900	Diode No. 2	7B4	6.3	JR-6207-0	10	Low Sig.	P4	700	Diode No. 1
6U5	6.3	JR-5403-0	0	0	P4	3900	Eye Open	7B5	6.3	JR-6237-0	34	0	P4	700	Diode No. 2
6U6	6.3	JR-5423-0	33	0	P4	1000	Eye Closed	7B6	6.3	JR-3207-0	11	Low Sig.	P1	1070	Triode Sect.
6U6	6.3	JR-5347-5	21	0	P4	2600	Cap = G	7B6	6.3	JR-0607-2	0	0	P1	410	Pent. Sect.
6V5	6.3	JX-5340-0	31	0	P4	2320	Triode Sect., Cap = G	7B7	6.3	JR-6237-4	27	0	P4	950	Osc. Sect.
6V6	6.3	JR-5347-2	21	0	P4	610	Diode No. 1	7B8	6.3	JR-6257-4	18	0	P4	410	Triode Sect.
6V7	6.3	JR-0307-0	39	0	P4	1900	Diode No. 2	7B8	6.3	JR-4357-6	18	0	P4	1900	Triode Sect.
6V7	6.3	JR-0507-0	39	0	P1	770	Plate No. 1	7C4	6.3	JR-0407-0	0	30	P1	820	Diode No. 2
6V7	6.3	JR-0407-0	39	0	P1	770	Plate No. 2	7C6	6.3	JR-6237-0	30	0	P4	1200	Triode Sect.
6W4	6.3	JX-0503-0	56	72	P3	1900	Cap = G	7C6	6.3	JR-0607-2	10	0	P1	820	Diode No. 2
6W5	6.3	JR-0507-0	0	33	P3	770	Plate No. 1	7E5	6.3	JR-0507-2	0	0	P1	820	Triode Sect.
6W5	6.3	JR-0300-0	0	33	P3	770	Plate No. 2	7E5	6.3	JR-6237-4	22	0	P4	820	Diode No. 1
6W6	6.3	JR-5347-0	56	0	P4	1900	Cap = G	7E6	6.3	JS-1304-0	15	0	P4	1900	Diode No. 2
6W7	6.3	JR-0347-5	22	0	P3	770	Plate No. 1	7E6	6.3	JR-3207-0	18	0	P1	1200	Pent. Sect.
6X4	6.3	JR-0607-0	0	20	P3	770	Plate No. 2	7E6	6.3	JR-0607-2	0	0	P1	820	Diode No. 1
6X4	6.3	JR-0307-0	0	20	P3	770	Plate No. 1	7E7	6.3	JR-0507-2	22	0	P1	820	Diode No. 2
6X5	6.3	JR-0507-2	0	33	P3	770	Plate No. 2	7E7	6.3	JR-6257-0	22	0	P4	820	Pent. Sect.
6X5	6.3	JR-0307-2	0	33	P3	770	Plate No. 1	7E7	6.3	JR-0407-2	22	0	P1	820	Diode No. 1
6Y5	6.3	JR-0504-0	0	30	P3	770	Plate No. 2	7E7	6.3	JR-0307-2	22	0	P1	820	Diode No. 2
6Y5	6.3	JR-0304-0	0	30	P3	3800	Triode No. 1	7F7	6.3	JR-5607-3	0	0	P4	820	Triode No. 1
6Y6	6.3	JR-5347-0	44	0	P4	630	Triode No. 2	7F7	6.3	JR-4302-6	0	0	P4	820	Triode No. 2
6Y7	6.3	JR-5607-3	15	0	P4	630	Triode No. 1	7F8	6.3	HS-8605-0	10	Low Sig.	P4	3150	Triode No. 1
6Y7	6.3	JR-4307-6	15	0	P4	630	Triode No. 2	7F8	6.3	HS-1304-0	10	Low Sig.	P4	3150	Triode No. 2
6Z4	6.3	JR-0304-0	0	35	P3	1260	Plate No. 1	7G7	6.3	JR-6237-4	18	0	P4	1260	Triode No. 2

TABLE 4-3 (Continued)

Tube Type	Fit Volts	Selectors	Bias	Shunt	Press	Mut. Cond.	Notations	Tube Type	Fill Volts	Selectors	Bias	Shunt	Press	Mut. Condl.	Notations
7G8	6.3	JR-5736-2	10	.....	P4	1320	Tetrode No. 1	12AU7	12.6	EV-7608-0	24	.....	P4	1400	Triode No. 1
7G8	6.3	JR-4236-7	10	.....	P4	1320	Tetrode No. 2	12AU7	12.6	EV-2103-0	24	.....	P4	1400	Triode No. 2
7H7	6.3	JR-6237-4	10	Low Sig.	P4	2400	.....	12AV6	12.6	JR-3702-5	12	.....	P4	790	Triode Sect.
7J7	6.3	JR-6257-4	18	.....	P4	500	Heptode Sect.	12AV6	12.6	JR-3602-5	0	0	P1	.....	Diode No. 1
7J7	6.3	JR-4357-6	18	.....	P4	630	Triode Sect.	12AV6	12.6	JR-3502-6	0	0	P1	.....	Diode No. 2
7K7	6.3	JR-4302-0	10	Low Sig.	P4	1000	Triode Sect.	12AW6	12.6	JR-3562-7	10	Low Sig.	P4	2500	.....
7K7	6.3	JR-0507-0	10	0	P1	.....	Diode No. 1	12AX7	12.6	EV-7608-0	8	Low Sig.	P4	950	Triode No. 1
7K7	6.3	JR-0607-0	10	0	P1	.....	Diode No. 2	12AX7	12.6	EV-2103-0	8	Low Sig.	P4	950	Triode No. 2
7L7	6.3	JR-6237-4	12	.....	P4	1260	.....	12AY7	12.6	EV-7608-0	15	Low Sig.	P4	1100	Triode No. 1
7N7	6.3	JR-5607-3	29	.....	P4	1260	Triode No. 1	12AY7	12.6	EV-2103-0	15	Low Sig.	P4	1100	Triode No. 2
7N7	6.3	JR-4302-6	29	.....	P4	1260	Triode No. 2	12B7	12.6	JR-6237-4	22	.....	P4	1200	.....
7Q7	6.3	JR-6237-4	21	.....	P4	500	Ampl. Sect.	12B8	12.6	JR-0342-0	22	.....	P4	1140	Pent. Sect., Cap = G
7Q7	6.3	JR-4237-6	21	.....	P4	500	Osc. Sect.	12B8	12.6	JR-7506-0	0	.....	P4	1260	Triode Sect.
7R7	6.3	JR-6257-0	10	.....	P4	1900	Pent. Sect.	12BA6	12.6	JR-3567-2	9	.....	P4	2700	.....
7R7	6.3	JR-0407-2	10	0	P1	.....	Diode No. 1	12BA7	12.6	EV-7913-2	17	.....	P4	470	Ampl. Sect.
7R7	6.3	JR-0307-2	10	0	P1	.....	Diode No. 2	12BA7	12.6	EV-2913-7	25	.....	P4	470	Osc. Sect.
7S7	6.3	JR-6257-4	18	.....	P4	950	Heptode Sect.	12BD6	12.6	JR-3567-2	18	.....	P4	1260	.....
7S7	6.3	JR-4357-6	9	.....	P4	1900	Triode Sect.	12BE6	12.6	JR-7562-3	11	.....	P4	900	Ampl. Sect.
7T7	6.3	JR-6237-4	9	.....	P4	2500	.....	12BE6	12.6	JR-3562-7	0	.....	P4	1000	Osc. Sect.
7V7	6.3	JR-6237-4	6	.....	P4	2200	.....	12BF6	12.6	JR-3702-0	14	.....	P4	1200	Triode Sect.
7W7	6.3	JR-6237-5	10	Low Sig.	P4	570	Triode Sect.	12BF6	12.6	JR-3602-0	0	0	P1	.....	Diode No. 1
7X7	6.3	JR-3204-0	0	.....	P1	.....	Diode No. 1	12BF6	12.6	JR-3502-0	0	0	P1	.....	Diode No. 2
7X7	6.3	JR-0504-0	0	61	P1	.....	Plate No. 1	12C8	12.6	JR-0367-2	24	.....	P4	725	Pent. Sect., Cap = G
7Y4	6.3	JR-0607-0	0	61	P1	.....	Plate No. 2	12C8	12.6	JR-0507-3	24	0	P1	.....	Diode No. 1
7Y4	6.3	JR-0607-0	0	33	P3	.....	Plate No. 1	12C8	12.6	JR-0407-3	24	0	P1	.....	Diode No. 2
7Y4	6.3	JR-0307-0	0	33	P3	.....	Plate No. 2	12F5	12.6	JR-0407-0	10	Low Sig.	P4	950	Cap = G
7Z4	6.3	JR-0607-0	0	24	P3	.....	Plate No. 1	12H6	12.6	JR-0507-2	0	61	P1	.....	Diode No. 1
7Z4	6.3	JR-0307-0	0	24	P3	.....	Plate No. 2	12H6	12.6	JR-0304-2	0	61	P1	.....	Diode No. 2
10Y	7.5	JR-3200-0	39	.....	P4	790	.....	12J5	12.6	JR-5307-2	22	Low Sig.	P4	1640	.....
12A	5.0	JR-3200-0	44	.....	P4	950	.....	12J7	12.6	JR-0347-5	22	.....	P4	770	Cap = G
12A5	12.6	JR-4235-0	51	.....	P4	1040	.....	12K7	12.6	JR-0347-5	19	.....	P4	920	Cap = G
12A6	12.6	JR-5347-2	12	.....	P4	1130	.....	12K8	12.6	JR-5347-6	11	.....	P4	630	Heptode Sect., Cap = G
12A7	12.6	JR-0236-5	48	.....	P4	1900	.....	12K8	12.6	JR-5647-3	0	.....	P4	1500	Triode Sect.
12A7	12.6	JR-0504-2	0	40	P3	610	Pent. Sect., Cap = G	12L8	12.6	JW-2751-3	10	.....	P4	1340	Pentode No. 1
12A8	12.6	JR-0347-5	22	.....	P4	630	Rect. Sect.	12L8	12.6	JW-3451-2	10	.....	P4	1340	Pentode No. 2
12A8	12.6	JR-5647-3	37	.....	P4	190	Cap = G	12Q7	12.6	JR-0307-0	17	.....	P4	500	Triode Sect., Cap = G
12AH7	12.6	JX-5504-3	20	.....	P4	1260	Osc. Sect.	12Q7	12.6	JR-0507-3	17	0	P1	.....	Diode No. 1
12AH7	12.6	JX-2301-6	20	.....	P4	1260	Triode No. 1	12Q7	12.6	JR-0407-3	17	0	P1	.....	Diode No. 2
12AL5	12.6	JR-0703-0	0	61	P1	.....	Triode No. 2	12S8	12.6	JX-0601-0	10	.....	P4	570	Triode Sect., Cap = G
12AL5	12.6	JR-0205-0	0	61	P1	.....	Plate No. 1	12S8	12.6	JX-0305-0	0	0	P1	.....	Diode No. 1
12AT6	12.6	JR-3702-0	18	.....	P4	750	Plate No. 2	12S8	12.6	JX-0401-0	0	0	P1	.....	Diode No. 2
12AT6	12.6	JR-3602-0	18	0	P1	.....	Triode Sect.	12SA7	12.6	JX-0201-0	0	0	P1	.....	Diode No. 3
12AT6	12.6	JR-3502-0	18	0	P1	.....	Diode No. 1	12SA7	12.6	JR-7346-5	21	.....	P4	470	Ampl. Sect.
12AT7	12.6	EV-7608-0	14	Low Sig.	P4	2500	Diode No. 2	12SA7	12.6	JR-5346-7	21	.....	P4	470	Osc. Sect.
12AT7	12.6	EV-2103-0	14	Low Sig.	P4	2500	Triode No. 1	12SC7	12.6	JX-4506-1	10	Low Sig.	P4	840	Triode No. 1
12AU6	12.6	JR-3557-2	10	Low Sig.	P4	2050	Triode No. 2	12SC7	12.6	JX-3106-5	10	Low Sig.	P4	840	Triode No. 2
								12SF5	12.6	JX-3501-0	10	Low Sig.	P4	950	.....

TABLE 4-3 (Continued)

Tube Type	Fill Volts	Selectors	Bias	Shunt	Press	Mut. Cond.	Notations	Tube Type	Fill Volts	Selectors	Bias	Shunt	Press	Mut. Cond.	Notations
12SF7	12.6	JX-1643-2	0	...	P4	1260	Pent. Sect.	14H7	12.6	JR-6237-4	10	Low Sig.	P4	2400	Heptode Sect.
12SF7	12.6	JX-0503-6	0	0	P1	...	Diode Sect.	14J7	12.6	JR-6257-4	18	...	P4	500	Triode Sect.
12SG7	12.6	JR-4765-2	0	...	P4	2100	...	14J7	12.6	JR-4357-6	18	...	P4	630	Triode No. 1
12SH7	12.6	JR-4765-2	0	...	P4	2150	...	14N7	12.6	JR-5607-3	20	Low Sig.	P4	1640	Triode No. 2
12SJ7	12.6	JR-4765-3	20	Low Sig.	P4	1050	...	14N7	12.6	JR-4302-6	20	Low Sig.	P4	1640	Pent. Sect.
12SK7	12.6	JR-4765-3	10	Low Sig.	P4	1260	...	14Q4	12.6	JR-6237-4	21	...	P4	500	Osc. Sect.
12SL7	12.6	JX-4506-1	7	Low Sig.	P4	1000	Triode No. 1	14Q4	12.6	JR-4237-6	21	...	P4	500	Pent. Sect.
12SL7	12.6	JX-2103-5	7	Low Sig.	P4	1000	Triode No. 2	14R7	12.6	JR-6257-0	10	...	P4	1900	Diode No. 1
12SN7	12.6	JX-4506-1	22	Low Sig.	P4	1640	Triode No. 1	14R7	12.6	JR-0407-2	10	0	P1	...	Diode No. 2
12SN7	12.6	JX-2103-5	22	Low Sig.	P4	1640	Triode No. 2	14R7	12.6	JR-0307-2	10	0	P1	...	Heptode Sect.
12SO7	12.6	JX-1603-2	11	Low Sig.	P4	700	Triode Sect.	14S7	12.6	JR-6257-4	18	...	P4	950	Triode Sect.
12SQ7	12.6	JX-0503-6	0	0	P1	...	Diode No. 1	14S7	12.6	JR-4357-6	0	...	P4	950	Triode Sect.
12SQ7	12.6	JX-0403-6	0	0	P1	...	Diode No. 2	14V7	12.6	JR-6237-4	6	...	P4	2500	Triode Sect.
12SR7	12.6	JX-1603-2	18	...	P4	1200	Triode Sect.	14W7	12.6	JR-6237-5	10	Low Sig.	P4	2200	Triode Sect.
12SR7	12.6	JX-0503-6	0	0	P1	...	Diode No. 1	14X7	12.6	JR-3204-0	0	0	P1	570	Diode No. 1
12SR7	12.6	JX-0403-6	0	0	P1	...	Diode No. 2	14X7	12.6	JR-0504-0	0	0	P1	...	Diode No. 2
12SW7	12.6	JX-1603-2	14	...	P4	1200	Triode Sect.	14X7	12.6	JR-0607-0	0	0	P1	...	Plate No. 1
12SW7	12.6	JX-0503-6	0	0	P1	...	Diode No. 1	14Y4	12.6	JR-0607-0	0	33	P3	...	Plate No. 2
12SW7	12.6	JX-0403-6	0	0	P1	...	Diode No. 2	14Y4	12.6	JR-0307-0	0	33	P3	...	Plate No. 1
12SX7	12.6	JX-4506-1	21	Low Sig.	P4	1640	Triode No. 1	14Z3	12.6	JR-0203-0	0	43	P3	...	Plate No. 2
12SX7	12.6	JX-2103-5	21	Low Sig.	P4	1640	Triode No. 2	15	2.0	JR-0234-0	22	...	P4	390	Cap=G
12SY7	12.6	JX-7346-5	21	...	P4	470	Ampl. Sect.	19	2.0	JR-4500-0	15	...	P4	630	Triode No. 1
12SY7	12.6	JX-5346-7	21	...	P4	470	Osc. Sect.	19	2.0	JR-3200-0	15	...	P4	630	Triode No. 2
12Z3	12.6	JR-0203-0	0	35	P3	...	...	19BG6	20.0	JR-5073-0	24	...	P4	3800	Cap=P
12Z5	12.6	JR-0605-0	0	40	P3	...	Plate No. 1	19J6	20.0	JR-5207-6	17	Low Sig.	P4	3350	Plate No. 1
12Z5	12.6	JR-0203-0	0	40	P3	...	Plate No. 2	19J6	20.0	JR-6307-5	17	Low Sig.	P4	3350	Plate No. 2
14A4	12.6	JR-6207-0	17	...	P4	1650	...	19T8	20.0	EV-8907-6	13	Low Sig.	P4	750	Triode Sect.
14A5	12.6	JR-6207-0	12	...	P4	1900	...	19T8	20.0	EV-0607-1	0	50	P1	...	Diode No. 1
14A7	12.6	JR-6237-4	22	...	P4	1200	...	19T8	20.0	EV-0203-7	0	50	P1	...	Diode No. 2
14AF7	12.6	JR-5607-0	0	...	P4	1570	...	19T8	20.0	EV-0107-8	0	50	P1	...	Diode No. 3
14AF7	12.6	JR-4302-0	0	...	P4	1570	...	RK20A	7.5	JR-3024-0	0	...	P4	1600	Cap=P
14B6	12.6	JR-3207-0	0	...	P4	700	Triode Sect.	22	3.0	JR-0230-0	45	...	P4	315	Cap=G
14B6	12.6	JR-0607-2	0	0	P1	...	Diode No. 1	24A	2.5	JR-0234-0	12	...	P4	630	Cap=G
14B6	12.6	JR-0507-2	0	0	P1	...	Diode No. 2	VT25A	7.5	JR-3200-0	30	...	P4	1260	Cap=G
14B8	12.6	JR-6257-4	27	...	P4	630	Pent. Sect.	25A6	25.0	JR-5347-0	43	...	P4	1450	Pent. Sect.
14B8	12.6	JR-4357-6	18	...	P4	315	Osc. Sect.	25A7	25.0	JR-5347-6	50	...	P4	1130	Rect. Sect.
14C5	12.6	JR-6237-0	23	...	P4	2325	...	25A7	25.0	JR-0602-3	0	50	P3	...	...
14C7	12.6	JR-6237-4	20	Low Sig.	P4	990	Triode Sect.	25AC5	25.0	JR-5307-0	0	...	P4	950	...
14E6	12.6	JR-3207-0	12	...	P4	1130	Diode No. 1	25B5	25.0	JR-4235-0	0	...	P4	1570	...
14E6	12.6	JR-0607-2	12	0	P1	...	Diode No. 2	25B6	25.0	JR-5347-0	52	...	P4	2500	...
14E6	12.6	JR-0507-2	12	0	P1	...	Pent. Sect.	25B8	25.0	JR-0342-0	22	...	P4	1260	Pent. Sect., Cap=G
14E7	12.6	JR-6257-0	24	...	P4	820	Triode Sect.	25B8	25.0	JR-7506-0	10	...	P4	950	Triode Sect.
14E7	12.6	JR-0407-2	24	0	P1	...	Diode No. 1	25C6	25.0	JR-5347-0	37	...	P4	4400	...
14E7	12.6	JR-0307-2	24	0	P1	...	Diode No. 2	25D8	25.0	JR-0342-0	18	...	P4	1200	Pent. Sect., Cap=G
14F7	12.6	JR-5607-3	0	...	P4	1000	Triode No. 1	25D8	25.0	JR-5602-0	0	...	P4	700	Triode Sect.
14F7	12.6	JR-4302-6	0	...	P4	1000	Triode No. 2	25D8	25.0	JR-5702-0	0	0	P1	...	Diode Sect.
14F8	12.6	HS-8605-0	10	Low Sig.	P4	3150	Triode No. 1	25L6	25.0	JR-5347-2	30	...	P4	4100	...
14F8	12.6	HS-1304-0	10	Low Sig.	P4	3150	Triode No. 2	25N6	25.0	JR-5347-0	0	...	P4	1570	...

TABLE 4-3 (Continued)

Tube Type	Tube Type	Fill Volts	Selectors	Bias	Shunt	Press	Mut. Cond.	Notations	Mut. Cond.	Press	Shunt	Bias	Selectors	Fill Volts	Tube Type	Fill Volts	Selectors	Bias	Shunt	Press	Mut. Cond.	Notations	
25T	38	6.3	JR-3000-0	0	...	P4	630	Cap = P	660	P4	...	39	JR-0234-0	6.3	38	6.3	JR-0234-0	0	...	P4	660	Cap = G	
25W4	39-44	25.0	JX-0503-0	0	72	P3	...	Plate No. 1	630	P3	...	28	JR-0234-0	6.3	39-44	6.3	JR-0234-0	0	...	P4	630	Cap = G	
25Y5	40	25.0	JR-0504-0	0	40	P3	...	Plate No. 2	...	P3	...	32	JR-3200-0	5.0	40	5.0	JR-3200-0	0	...	P4	...	Short on 1-2-3-4-5	
25Z5	40Z5	25.0	JR-0203-0	0	40	P3	...	Plate No. 1	...	P3	60	...	JR-0537-0	BLST	40Z5	BLST	JR-0537-0	0	...	P3	...	Rect. Sect.	
25Z5	40Z5	25.0	JR-0504-0	0	40	P3	...	Plate No. 2	...	P3	...	0	JR-0507-0	50.0	40Z5	50.0	JR-0507-0	0	...	P3	...	Short on 1-2-3-4-5	
25Z5	41	25.0	JR-0203-0	0	40	P3	...	Plate No. 1	1000	P3	...	34	JR-4235-0	6.3	41	6.3	JR-4235-0	34	...	P4	1000	...	
25Z5	42	25.0	JR-0507-0	0	40	P3	...	Plate No. 1	1260	P3	...	29	JR-4235-0	6.3	42	6.3	JR-4235-0	29	...	P4	1260	...	
25Z5	43	25.0	JR-0304-0	0	40	P3	...	Plate No. 2	1450	P3	...	43	JR-4235-0	25.0	43	25.0	JR-4235-0	43	...	P4	1450	...	
25Z6	45	25.0	JR-0507-2	0	40	P3	...	Plate No. 1	1170	P3	...	61	JR-3200-0	2.5	45	2.5	JR-3200-0	61	...	P4	1170	...	
25Z6	45Z3	25.0	JR-0304-2	0	40	P3	...	Plate No. 2	...	P3	50	...	HT-0208-0	50.0	45Z3	50.0	HT-0208-0	0	...	P3	...	Short on 1-2-3-4-5	
26	45Z5	1.5	JR-3200-0	43	...	P4	725	...	...	P4	60	...	JR-0537-0	BLST	45Z5	BLST	JR-0537-0	...	...	P3	...	Rect. Sect.
26A6	45Z5	25.0	JR-3567-2	9	...	P4	2500	...	...	P4	...	0	JR-0507-0	50.0	45Z5	50.0	JR-0507-0	0	...	P3	...	Short on 1-2-3-4-5
26A7	46	25.0	JW-2701-0	10	67	P5	...	Triode No. 1	1260	P5	...	30	JR-3240-0	2.5	46	2.5	JR-3240-0	30	...	P4	1260	...	
26A7	47	25.0	JW-3401-0	10	67	P5	...	Triode No. 2	1260	P5	...	22	JR-3240-0	2.5	47	2.5	JR-3240-0	22	...	P4	1260	...	
26C6	48	25.0	JR-3702-0	18	...	P4	1200	Triode Sect.	...	P4	...	58	JR-4235-0	25.0	48	25.0	JR-4235-0	58	...	P4	1260	...	
26C6	49	25.0	JR-3602-0	18	0	P1	...	Diode No. 1	...	P1	...	49	JR-3240-0	2.0	49	2.0	JR-3240-0	49	...	P4	710	...	
26C6	50	25.0	JR-3502-0	18	0	P1	...	Diode No. 2	...	P1	...	61	JR-3200-0	7.5	50	7.5	JR-3200-0	61	...	P4	950	...	
26D6	50A5	25.0	JR-7562-3	11	...	P4	900	Ampl. Sect.	4750	P4	...	30	JR-6237-0	50.0	50A5	50.0	JR-6237-0	30	...	P4	4750	...	
26D6	50B5	25.0	JR-3562-7	0	...	P4	1000	Osc. Sect.	4750	P4	...	23	JR-3562-0	50.0	50B5	50.0	JR-3562-0	23	...	P4	4750	...	
27	50C5	2.5	JR-3204-0	41	...	P4	630	...	4750	P4	...	44	JR-2763-0	50.0	50C5	50.0	JR-2763-0	44	...	P4	4750	...	
28D7	50C6	25.0	JR-7536-2	13	Low Sig.	P4	2150	Pentode No. 1	4400	P4	...	23	JR-2763-0	50.0	50C6	50.0	JR-2763-0	23	...	P4	4400	...	
28D7	50L6	25.0	JR-2436-7	13	Low Sig.	P4	2150	Pentode No. 2	4100	P4	...	30	JR-5347-0	50.0	50L6	50.0	JR-5347-0	30	...	P4	4100	...	
30	50X6	2.0	JR-3200-0	40	...	P4	570	...	...	P4	55	...	JR-0607-5	50.0	30	50.0	JR-0607-5	0	...	P3	...	Plate No. 1
31	50X6	2.0	JR-3200-0	65	...	P4	580	...	...	P4	55	...	JR-0302-5	50.0	31	50.0	JR-0302-5	0	...	P3	...	Plate No. 2
32	50Y6	2.0	JR-0230-0	37	...	P4	400	Cap = G	...	P4	55	...	JR-0507-0	50.0	32	50.0	JR-0507-0	0	...	P3	...	Plate No. 1	
32L7	50Y6	35.0	JR-5347-0	22	...	P4	3000	Ampl. Sect.	...	P4	55	...	JR-0304-0	50.0	32L7	50.0	JR-0304-0	0	...	P3	...	Plate No. 2	
32L7	50Y7	35.0	JR-0602-3	0	50	P3	...	Rect. Sect.	...	P3	...	...	JR-0060-0	BLST	32L7	BLST	JR-0060-0	...	...	P3	...	Short on 1-2-3-4-5
33	50Y7	2.0	JR-3240-0	35	...	P4	900	...	...	P4	55	...	JR-0507-0	50.0	33	50.0	JR-0507-0	0	...	P3	...	Plate No. 1
RK33	50Y7	6.3	JR-4506-0	17	...	P4	860	Triode No. 1, Cap = G	...	P4	55	...	JR-0304-0	50.0	RK33	50.0	JR-0304-0	0	...	P3	...	Plate No. 2	
RK33	50Z7	6.3	JR-0302-0	17	...	P4	860	Triode No. 2	...	P4	...	...	JR-0060-0	BLST	RK33	BLST	JR-0060-0	...	...	P3	...	Short on 1-2-3-4-5
34	50Z7	2.0	JR-0234-0	33	...	P4	380	Cap = G	...	P4	55	...	JR-0507-0	50.0	34	50.0	JR-0507-0	0	...	P3	...	Plate No. 1	
35	50Z7	2.5	JR-0230-0	24	...	P4	650	Cap = G	...	P4	55	...	JR-0304-0	50.0	35	50.0	JR-0304-0	0	...	P3	...	Plate No. 2	
35A5	HD-51	35.0	JR-6237-0	33	...	P4	3700	...	...	P4	0	...	KR-0302-0	.....	35A5	HD-51	KR-0302-0	0	...	P2	...	Cap = G
35B5	51/51S	35.0	JR-6237-0	33	...	P4	2830	...	...	P4	0	...	JR-0234-0	2.5	35B5	51/51S	JR-0234-0	24	...	P4	640	...
35C5	52	35.0	JR-3562-0	34	...	P4	2830	P4	...	33	JR-3240-0	6.3	35C5	52	6.3	JR-3240-0	33	...	P4	1500	...
35L6	53	35.0	JR-2763-0	34	...	P4	2830	P4	...	12	JR-5604-2	2.5	35L6	53	2.5	JR-5604-2	12	...	P4	950	...
35W4	55	35.0	JR-5347-0	39	...	P4	3650	P4	...	12	JR-3204-6	2.5	35W4	55	2.5	JR-3204-6	12	...	P4	950	...
35W4	55	35.0	JR-0367-0	...	55	P3	...	Short on 1-2-3-4-5	...	P3	0	...	JR-0205-0	2.5	35W4	55	2.5	JR-0205-0	39	...	P4	610	...
35Y4	55	35.0	JR-0507-0	0	55	P3	...	Rect. Sect.	...	P3	0	...	JR-0405-0	2.5	35Y4	55	2.5	JR-0405-0	39	...	P1	...	Triode No. 1
35Z3	55	35.0	JR-0247-0	...	55	P3	...	Short On 1-2-3-4-5	...	P3	0	...	JR-0305-0	2.5	35Z3	55	2.5	JR-0305-0	39	...	P1	...	Triode No. 2
35Z3	55	35.0	JR-0207-0	0	60	P3	...	Rect. Sect.	...	P3	0	...	JR-0305-0	2.5	35Z3	55	2.5	JR-0305-0	39	...	P1	...	Triode Sect., Cap = G
35Z4	55	35.0	JR-0207-0	0	60	P3	...	Rect. Sect.	...	P3	0	...	JR-0305-0	2.5	35Z4	55	2.5	JR-0305-0	39	...	P1	...	Diode No. 1
35Z5	55	35.0	JR-0537-0	...	60	P3	...	Rect. Sect.	...	P3	0	...	JR-0305-0	2.5	35Z5	55	2.5	JR-0305-0	39	...	P1	...	Diode No. 2
35Z5	55	35.0	JR-0507-0	0	60	P3	...	Rect. Sect.	...	P3	0	...	JR-0305-0	2.5	35Z5	55	2.5	JR-0305-0	39	...	P1	...	OK over 500
35Z6	55	35.0	JR-0507-0	0	60	P3	...	Rect. Sect.	...	P3	0	...	JR-0305-0	2.5	35Z6	55	2.5	JR-0305-0	39	...	P1	...	OK over 500
35Z6	55	35.0	JR-0304-0	0	60	P3	...	Rect. Sect.	...	P3	0	...	JR-0305-0	2.5	35Z6	55	2.5	JR-0305-0	39	...	P1	...	OK over 500
36	58A/58AS	6.3	JR-0234-0	24	...	P4	660	P4	24	...	JR-0235-4	6.3	36	58A/58AS	6.3	JR-0235-4	24	...	P4	900	...
37	59	6.3	JR-3204-0	41	...	P4	570	P4	22	...	JR-4236-5	2.5	37	59	2.5	JR-4236-5	22	...	P4	1260	...

TABLE 4-3 (Continued)

Tube Type	Fil Volts	Selectors	Bias	Shunt	Press	Mut. Cond.	Notations	Tube Type	Fil Volts	Selectors	Bias	Shunt	Press	Mut. Cond.	Notations
HY-65	6.3	JR-5040-7	0	...	P4	1900	Cap = P	117L7	117.0	JR-4357-0	37	...	P4	2500	Pent. Sect.
VT-67	2.0	JR-3200-0	40	...	P4	570	Cap = P	117L7	117.0	JR-0602-0	37	61	P3	2500	Rect. Sect.
HY-69	6.3	JR-3024-0	0	...	P4	1900	Pent. Sect.	117M7	117.0	JR-4357-0	37	...	P4	2500	Pent. Sect.
70A7	75.0	JR-5347-0	50	...	P4	1900	{ Rect. Sect. Reverse Meter	117M7	117.0	JR-0602-0	37	61	P3	3150	Rect. Sect.
70A7	75.0	JR-0200-0	50	55	P3	.....	Reverse Meter	117N7	117.0	JR-4356-0	37	...	P4	3150	Pent. Sect.
70L7	75.0	JR-5346-0	41	...	P4	3150	Pent. Sect.	117N7	117.0	JR-0700-0	37	75	P3	.....	Rect. Sect.
70L7	75.0	JR-0702-3	41	61	P3	.....	Rect. Sect.	117P7	117.0	JR-4356-0	37	...	P4	2500	Pent. Sect.
71A	5.0	JR-3200-0	73	...	P4	1040	.....	117P7	117.0	JR-0700-0	37	61	P3	.....	Rect. Sect.
75	6.3	JR-0205-0	11	...	P4	470	Triode Sect., Cap = G	.....	.....	.....	.....	.....	.....	.....	Reverse Meter
75	6.3	JR-0405-2	11	0	P1	.....	Diode No. 1	117Z3	117.0	JR-0506-0	0	50	P3	.....	.....
75	6.3	JR-0305-2	11	0	P1	.....	Diode No. 2	117Z4	117.0	JR-0507-0	0	67	P3	.....	.....
75MG	6.3	JR-0407-0	11	...	P4	470	Triode Sect., Cap = G	117Z6	117.0	JR-0507-0	0	60	P3	.....	Plate No. 1
75MG	6.3	JR-0507-0	11	0	P1	.....	Diode No. 1	117Z6	117.0	JR-0304-0	0	60	P3	.....	Plate No. 2
75MG	6.3	JR-0607-0	11	0	P1	.....	Diode No. 2	C182	5.0	JR-3200-0	46	...	P4	630	.....
76	6.3	JR-3204-0	29	...	P4	900	Cap = G	C182A	5.0	JR-3200-0	79	...	P4	950	.....
77	6.3	JR-0235-4	21	Low Sig.	P4	770	Cap = G	182B	5.0	JR-3200-0	58	...	P4	950	.....
78	6.3	JR-0235-4	24	...	P4	900	Cap = G	183	5.0	JR-3200-0	79	...	P4	950	.....
79	6.3	JR-0504-0	15	...	P4	630	Triode No. 1, Cap = G	205F	5.0	JR-3200-0	34	...	P4	920	.....
79	6.3	JR-3204-0	15	...	P4	630	Triode No. 2	231D	3.0	JR-3200-0	49	...	P4	340	.....
80	5.0	JR-0300-0	0	20	P3	.....	Plate No. 1	244A	2.0	JR-3204-0	42	...	P4	570	.....
80	5.0	JR-0200-0	0	15	P3	.....	Plate No. 2	245A	2.0	JR-0234-0	55	...	P4	460	Cap = G
81	7.5	JR-0200-0	0	6	P1	.....	.....	247A	2.0	JR-3204-0	33	...	P4	580	.....
82	2.5	JR-0300-0	0	67	P3	.....	Plate No. 1	TS251	50.0	JR-5347-6	50	...	P4	1140	Pent. Sect.
82	2.5	JR-0200-0	0	61	P3	.....	Plate No. 2	TS251	50.0	JR-0602-3	0	50	P3	.....	Rect. Sect.
83	5.0	JR-0300-0	0	70	P3	.....	Plate No. 1	257A	3.0	JR-0200-0	49	...	P4	340	Cap = G
83	5.0	JR-0200-0	0	65	P3	.....	Plate No. 2	259A	2.0	JR-0234-0	33	...	P4	1100	Cap = G
83V	5.0	JR-0300-0	0	60	P3	.....	Plate No. 1	262B	10.0	JR-0203-0	31	...	P4	1000	Cap = G
83V	5.0	JR-0200-0	0	60	P3	.....	Plate No. 2	264B	1.5	JR-3200-0	49	...	P4	365	.....
84	6.3	JR-0304-0	0	35	P3	.....	Plate No. 1	264C	5.0	JR-3204-0	54	...	P4	365	.....
84	6.3	JR-0204-0	0	35	P3	.....	Plate No. 2	271A	10.0	JR-3204-0	32	...	P4	2900	.....
85	6.3	JR-0205-0	39	...	P4	620	Triode Sect., Cap = G	272A	10.0	JR-3204-0	51	...	P4	600	.....
85	6.3	JR-0405-2	39	0	P1	.....	Diode No. 1	274B	5.0	HR-0600-0	0	20	P3	.....	Plate No. 1
85	6.3	JR-0305-2	39	0	P1	.....	Diode No. 2	274B	5.0	HR-0400-0	0	20	P3	.....	Plate No. 2
85AS	6.3	JR-0205-0	28	...	P4	700	Triode Sect., Cap = G	275A	5.0	JR-3200-0	68	...	P4	1700	.....
85AS	6.3	JR-0405-2	28	0	P1	.....	Diode No. 1	283A	2.0	JR-0234-0	28	...	P4	1700	Cap = G
85AS	6.3	JR-0305-2	28	0	P1	.....	Diode No. 2	285A	2.0	JR-0230-4	40	...	P4	630	Cap = G
89/89Y	6.3	JR-0235-4	37	...	P4	980	Cap = G	300B	5.0	JR-3200-0	60	...	P4	2900	.....
99	3.0	JR-3200-0	55	...	P4	270	.....	307A	5.0	JR-3020-4	32	...	P4	1600	Cap = P
101D	4.3	JR-3200-0	55	...	P4	700	.....	309A	10.0	JR-0234-0	31	...	P4	570	Cap = G
101F	4.3	JR-3200-0	53	...	P4	700	.....	310A	10.0	JR-0235-4	19	Low Sig.	P4	1130	Cap = G
102D	2.0	JR-3200-0	25	...	P4	315	.....	311A	10.0	JR-0234-0	38	...	P4	1500	Cap = G
102F	2.0	JR-3200-0	25	...	P4	365	.....	313CA	.....	AP-8201-0	0	80	P5	.....	.....
104D	4.3	JR-3200-0	75	...	P4	700	.....	328A	7.5	JR-0235-4	19	Low Sig.	P4	1130	Cap = G
CK108	6.3	JR-0235-4	21	Low Sig.	P4	770	.....	329A	7.5	JR-0234-0	38	...	P4	1550	Cap = G
112A	5.0	JR-3200-0	44	...	P4	1040	.....	336A	10.0	JR-4235-0	10	Low Sig.	P4	1950	.....
CK113	50.0	JR-5347-6	48	...	P4	1130	.....	337A	10.0	JR-0235-4	21	Low Sig.	P4	1070	Cap = G
HY-114	1.5	JR-0000-0	19	...	P4	700	Right Cap = P Lower Cap = G	339A	5.0	JR-3024-0	0	...	P4	2000	Cap = P

TABLE 4-3 (Continued)

Tube Type	Fill Volts	Selectors	Bias	Shunt	Press	Mur. Cond.	Notations
348A	6.3	JR-0347-5	19	Low Sig.	P4	1130	Cap=G
349A	6.3	JR-5347-0	10	Low Sig.	P4	2500	Cap=P
350B	6.3	JR-5347-0	25	...	P4	3900	Plate No. 1
351A	6.3	JR-0507-2	0	50	P3	...	Plate No. 2
351A	6.3	JR-0307-2	0	50	P3	...	Triode Sect., Cap=G
352A	10.0	JR-0205-0	36	...	P4	410	Diode No. 1
352A	10.0	JR-0405-0	0	21	P1	...	Diode No. 2
352A	10.0	JR-0305-0	0	21	P1	...	...
367A	6.3	JV-6147-0	24	...	P4	3800	...
373A	2.0	JR-4760-3	17	Low Sig.	P4	850	...
374A	3.0	JR-4760-2	40	Low Sig.	P4	1700	...
375A	20.0	JR-5347-0	53	...	P4	2330	...
381A	6.3	HR-0502-0	0	60	P1	...	...
383A	6.3	HR-4602-0	25	Low Sig.	P4	1770	Cap=P
385A	6.3	HR-5032-8	15	Low Sig.	P4	1480	Cap=P
387A	6.3	HR-5032-8	15	Low Sig.	P4	2000	Triode No. 1
396A	6.3	KR-3402-8	17	Low Sig.	P4	3300	Triode No. 2
396A	6.3	KR-7608-2	17	Low Sig.	P4	3300	...
398A	6.3	JR-4760-3	37	...	P4	3350	Pent. Sect.
400A	1.1	DX-6218-5	35	...	P4	315	Osc. Sect.
400A	1.1	DX-8216-5	35	...	P4	315	...
401A	6.3	JR-3567-0	30	...	P4	1260	...
403A	6.3	JR-3562-0	10	Low Sig.	P4	2750	Plate No. 1
420	2.5	JR-0300-0	0	70	P3	...	Plate No. 2
420	2.5	JR-0200-0	0	70	P3	...	...
482A	5.0	JR-3200-0	79	...	P4	950	...
482B	5.0	JR-3200-0	57	...	P4	950	...
483	5.0	JR-3200-0	79	...	P4	850	...
484	3.0	JR-3204-0	37	...	P4	820	...
484A	3.0	JR-3204-0	37	...	P4	820	...
485	3.0	JR-3204-0	37	...	P4	820	...
486	3.0	JR-3204-0	43	...	P4	280	...
GL-502	6.3	JR-5367-0	#	55	P3	...	Strikes at approx. 70
629	2.5	JR-3204-0	#	25	P3	...	Strikes at approx. 73
717A	6.3	JR-4763-0	0	...	P4	2200	...
801A	7.5	JR-3200-0	0	...	P4	950	Cap=P
802	6.3	JR-4036-5	22	...	P4	1260	Cap=P
807	6.3	JR-3024-0	33	...	P4	2400	Cap=P
809	6.3	JR-3000-0	0	...	P4	1050	Cap=P
811	6.3	JR-3000-0	0	...	P4	900	Cap=P
812	6.3	JR-3000-0	0	...	P4	1400	Cap=P
814	10.0	JR-3024-0	0	...	P4	1900	Cap=P
815	12.6	HS-8043-0	40	...	P4	2500	Left Cap=P
816	12.6	HS-1043-0	35	...	P4	2500	Right Cap=P
834	2.5	JR-0000-0	0	75	P3	...	Cap=P
834	7.5	JR-0000-0	0	...	P4	1140	Near Cap=G
834	7.5	JR-0000-0	0	...	P4	1140	{ Near Cap=G Far Cap=P
837	12.6	JR-4036-5	0	...	P4	2500	Cap=P
841	7.5	JR-3200-0	61	...	P4	630	...
842	7.5	JR-3200-0	0	Low Sig.	P4	750	...
843	2.5	JR-3204-0	12	...	P4	1050	...
864	1.1	JR-3200-0	45	...	P4	410	...
865	7.5	JR-3020-0	34	...	P4	390	Cap=P
866A	2.5	JR-0000-0	0	75	P3	...	Cap=P
879	2.5	JR-0000-0	0	73	P5	...	Cap=P
884	6.3	JR-5307-0	#	91	P5	...	Strikes at approx. 72
885	2.5	JR-3204-0	72	91	P5	...	...
950	2.0	JR-3240-0	45	...	P4	600	...
951	2.0	JR-0230-0	35	...	P4	400	Cap=G
954	6.3	JR-7036-4	21	...	P4	700	Cap=P
955	6.3	JR-4306-0	22	...	P4	1200	...
956	6.3	JR-7036-4	17	...	P4	950	Cap=P
957	1.5	JR-4300-0	28	...	P4	400	...
958	1.5	JR-4300-0	41	...	P4	750	...
959	1.5	JR-7030-0	28	...	P4	380	Cap=P
FM-1000	6.3	JR-2453-6	12	...	P4	950	No. 1 Grid
FM-1000	6.3	JR-6453-2	12	...	P4	950	No. 2 Grid
E1148	6.3	JR-0007-0	14	...	P4	1386	{ Upper Cap=P Lower Cap=G
1201	6.3	JS-1304-0	18	Low Sig.	P4	1900	...
1203	6.3	JR-0407-0	0	30	P1	...	...
1204	6.3	HS-5314-0	10	Low Sig.	P4	1150	...
1231	6.3	JR-6237-4	0	...	P4	1600	...
1232	6.3	JR-6237-4	18	...	P4	1250	...
HY-1269	12.6	JR-3024-0	0	...	P4	2500	Cap=P
1273	6.3	JR-6237-4	11	...	P4	1450	...
1280	12.6	JR-6237-4	11	...	P4	1450	...
1284	12.6	JR-6237-4	28	...	P4	1250	...
1285	25.0	JR-5347-0	38	...	P4	3650	...
1291	2.5	JR-6700-0	12	...	P4	950	Triode No. 1
1291	2.5	JR-3200-0	25	...	P4	950	Triode No. 2
1293	1.5	JR-6200-0	30	...	P4	820	...
1294	1.5	JR-0407-0	0	0	P1	...	...
1299	2.5	JR-6230-0	37	...	P4	1300	...
1603	6.3	JR-0235-4	21	...	P4	770	Cap=G
1609	1.1	JR-3240-0	22	...	P4	450	...
1612	6.3	JR-0347-5	23	...	P4	410	Cap Grid, Cap=G
1612	6.3	JR-5347-2	27	...	P4	410	Pin Grid
1613	6.3	JR-5347-0	0	...	P4	1400	...
1617	6.3	JR-5347-2	23	...	P4	3150	Cap=P
1616	2.5	JR-0000-0	0	6	P3	...	...
1619	2.5	JR-5340-7	12	...	P4	2150	...
1620	6.3	JR-0347-5	22	...	P4	770	Cap=G
1621	6.3	JR-5347-0	29	...	P4	1250	...
1622	6.3	JR-5347-0	23	...	P4	3150	...

TABLE 4-3 (Continued)

Tube Type	Tube Type	Notations	Mut. Cond.	Shunt	Press	Electors	Bias	Shunt	Press	Mut. Cond.	Notations	Electors	Bias	Shunt	Press	Mut. Cond.	Notations
1623	6.3 JR-3000-0	Cap=P	1400	0	P4	JR-3000-0	0	0	P4	1400	Cap=P	JR-3000-0	0	0	P4	1400	Cap=P
1624	2.5 JR-3020-0	Cap=P	2500	17	P4	JR-3020-0	17	0	P4	2500	Cap=P	JR-3020-0	17	0	P4	2500	Cap=P
1625	12.6 JR-4036-0	Cap=P	2000	33	P4	JR-4036-0	33	0	P4	2000	Cap=P	JR-4036-0	33	0	P4	2000	Cap=P
1626	12.6 JR-5307-0	Eye Open	1325	52	P4	JR-5307-0	52	0	P4	1325	Eye Open	JR-5307-0	52	0	P4	1325	Eye Open
1629	12.6 JR-5407-0	Eye Closed	3150	23	P4	JR-5407-0	23	0	P4	3150	Eye Closed	JR-5407-0	23	0	P4	3150	Eye Closed
1631	12.6 JR-5347-2		5000	18	P4	JR-5347-2	18	0	P4	5000		JR-5347-2	18	0	P4	5000	
1632	12.6 JR-5347-0		1650	23	P4	JR-5347-0	23	0	P4	1650		JR-5347-0	23	0	P4	1650	
1633	25.0 JX-4506-0	Triode No. 1	1650	23	P4	JX-4506-0	23	Low Sig.	P4	1650	Triode No. 1	JX-4506-0	23	Low Sig.	P4	1650	Triode No. 1
1633	25.0 JX-2103-0	Triode No. 2	1650	23	P4	JX-2103-0	23	Low Sig.	P4	1650	Triode No. 2	JX-2103-0	23	Low Sig.	P4	1650	Triode No. 2
1634	12.6 JX-4506-2	Triode No. 1	650	0	P4	JX-4506-2	0	0	P4	650	Triode No. 1	JX-4506-2	0	0	P4	650	Triode No. 1
1634	12.6 JX-3106-2	Triode No. 2	650	0	P4	JX-3106-2	0	0	P4	650	Triode No. 2	JX-3106-2	0	0	P4	650	Triode No. 2
1635	6.3 JR-4307-0	Triode No. 1	540	0	P4	JR-4307-0	0	0	P4	540	Triode No. 1	JR-4307-0	0	0	P4	540	Triode No. 1
1635	6.3 JR-5607-0	Triode No. 2	540	0	P4	JR-5607-0	0	0	P4	540	Triode No. 2	JR-5607-0	0	0	P4	540	Triode No. 2
1642	6.3 JR-4506-0	Triode No. 1	875	17	P4	JR-4506-0	17	0	P4	875	Triode No. 1	JR-4506-0	17	0	P4	875	Triode No. 1
1642	6.3 JR-0302-0	Triode No. 2, Cap=0	875	17	P4	JR-0302-0	17	0	P4	875	Triode No. 2, Cap=0	JR-0302-0	17	0	P4	875	Triode No. 2, Cap=0
1644	12.6 JW-2751-3	Pentode No. 1	1350	10	P4	JW-2751-3	10	0	P4	1350	Pentode No. 1	JW-2751-3	10	0	P4	1350	Pentode No. 1
1644	12.6 JW-3451-2	Pentode No. 2	1350	10	P4	JW-3451-2	10	0	P4	1350	Pentode No. 2	JW-3451-2	10	0	P4	1350	Pentode No. 2
1654	1.5 DX-0000-0	Reads 500 on Meter, Short on 3, Cap=P	570	0	P2	DX-0000-0	0	0	P2	570	Reads 500 on Meter, Short on 3, Cap=P	DX-0000-0	0	0	P2	570	Reads 500 on Meter, Short on 3, Cap=P
1658	2.0 JR-3200-0	Cap=G	3150	40	P4	JR-3200-0	40	0	P4	3150	Cap=G	JR-3200-0	40	0	P4	3150	Cap=G
1851	6.3 JR-0347-5	Cap=P	2850	10	P4	JR-0347-5	10	Low Sig.	P4	2850	Cap=P	JR-0347-5	10	Low Sig.	P4	2850	Cap=P
1852	6.3 JR-4765-3		2200	0	P4	JR-4765-3	0	0	P4	2200		JR-4765-3	0	0	P4	2200	
1853	6.3 JR-4765-3		2200	0	P4	JR-4765-3	0	0	P4	2200		JR-4765-3	0	0	P4	2200	
2050	6.3 JR-5367-0		2500	60	P3	JR-5367-0	60	49	P3	2500		JR-5367-0	60	49	P3	2500	
2051	6.3 JR-5367-0		2500	60	P3	JR-5367-0	60	49	P3	2500		JR-5367-0	60	49	P3	2500	
5516	6.3 JR-5032-0	Cap=P, Short on 3	2500	20	P4	JR-5032-0	20	0	P4	2500	Cap=P, Short on 3	JR-5032-0	20	0	P4	2500	Cap=P, Short on 3
5517	AP-0807-0	Cap=P	625	0	P2	AP-0807-0	0	35	P2	625	Cap=P	AP-0807-0	0	35	P2	625	Cap=P
5556	4.3 JR-3200-0		2650	26	P4	JR-3200-0	26	0	P4	2650		JR-3200-0	26	0	P4	2650	
5591	6.3 JR-3562-0		3350	37	P4	JR-3562-0	37	Low Sig.	P4	3350		JR-3562-0	37	Low Sig.	P4	3350	
5603	6.3 JR-4760-3		1900	24	P4	JR-4760-3	24	0	P4	1900		JR-4760-3	24	0	P4	1900	
5618	6.3 DX-6218-0		2700	0	P5	DX-6218-0	0	50	P5	2700		DX-6218-0	0	50	P5	2700	
5651	AP-0307-0		1900	10	P4	AP-0307-0	10	Low Sig.	P4	1900		AP-0307-0	10	Low Sig.	P4	1900	
5654	6.3 JR-3562-0		840	8	P4	JR-3562-0	8	0	P4	840		JR-3562-0	8	0	P4	840	
5659	12.6 JR-5347-0		1250	22	P4	JR-5347-0	22	0	P4	1250		JR-5347-0	22	0	P4	1250	
5660	12.6 JR-0367-0		3300	0	P1	JR-0367-0	0	0	P1	3300		JR-0367-0	0	0	P1	3300	
5660	12.6 JR-0567-0		3300	0	P1	JR-0567-0	0	0	P1	3300		JR-0567-0	0	0	P1	3300	
5660	12.6 JR-0467-0		1250	21	P4	JR-0467-0	21	0	P4	1250		JR-0467-0	21	0	P4	1250	
5661	12.6 JR-4765-3		3300	17	P3	JR-4765-3	17	70	P3	3300		JR-4765-3	17	70	P3	3300	
5663	6.3 JR-3752-0	Strikes at approx. 76	3300	17	P4	JR-3752-0	17	Low Sig.	P4	3300	Strikes at approx. 76	JR-3752-0	17	Low Sig.	P4	3300	Strikes at approx. 76
5670	6.3 KR-7608-0	Triode No. 1	3300	17	P4	KR-7608-0	17	Low Sig.	P4	3300	Triode No. 1	KR-7608-0	17	Low Sig.	P4	3300	Triode No. 1
5670	6.3 KR-3402-0	Triode No. 2	3300	17	P4	KR-3402-0	17	Low Sig.	P4	3300	Triode No. 2	KR-3402-0	17	Low Sig.	P4	3300	Triode No. 2
5679	6.3 JR-0607-5	Diode No. 1	4800	0	P1	JR-0607-5	0	49	P1	4800	Diode No. 1	JR-0607-5	0	49	P1	4800	Diode No. 1
5679	6.3 JR-0302-5	Diode No. 2	4800	0	P1	JR-0302-5	0	49	P1	4800	Diode No. 2	JR-0302-5	0	49	P1	4800	Diode No. 2
5687	12.6 EV-7906-1	Triode No. 1	4800	26	P4	EV-7906-1	26	Low Sig.	P4	4800	Triode No. 1	EV-7906-1	26	Low Sig.	P4	4800	Triode No. 1
5687	12.6 EV-2103-9	Triode No. 2	1000	26	P4	EV-2103-9	26	Low Sig.	P4	1000	Triode No. 2	EV-2103-9	26	Low Sig.	P4	1000	Triode No. 2
5691	6.3 JX-4506-1	Triode No. 1	1000	11	P4	JX-4506-1	11	Low Sig.	P4	1000	Triode No. 1	JX-4506-1	11	Low Sig.	P4	1000	Triode No. 1

TABLE 4-4. TEST DATA FOR SUB-MINIATURE TUBES

Tube	Fil.	Basing	Selectors	Bias	Shunt	Press	Min. Mut. Cond.	Notes
1Q6	1.1	F	EV-2780-0	30	Low Sig.	P4	200	Triode Sec. Diode Sec.
1Q6	1.1	F	EV-0600-0	0	0	P1	OK over 400 on 3000 scale	
1W5	1.1	F	EV-2780-0	27	Low Sig.	P4	410	
6K4	6.3	C	DU-2105-0	31	Low Sig.	P4	2000	
SN976C	6.3	F	DW-1574-0	49	High Sig.	P4	2500	
5633	6.3	E	EW-3051-2	15	Low Sig.	P4	1500	
5634	6.3	E	EW-3051-2	17	Low Sig.	P4	1825	
5637	6.3	C	DU-2105-0	17	Low Sig.	P4	950	
5644	6.3	D	FT-4102-0	16	Low Sig.	P4	950	
5645	6.3	D	FT-4102-0	29	Low Sig.	P4	1380	

(29) TESTING BALLAST TUBES.

- (a) Turn the tester ON.
- (b) Set FILAMENT voltage switch S101 to BLST.
- (c) Set SHORTS test switch on position 1.
- (d) Refer to TABLE 4-5. Set first SELECTOR switch S103 (lettered A to K) to letter in column headed "First Selector." Set all numbered SELECTORS on zero.
- (e) Rotate second SELECTOR switch S104 (lettered P to Z) from P to Z. Neon lamp, E103, should light on positions noted.

TABLE 4-5. BALLAST TUBE TEST CHART

TUBE TYPE	First Selector	Neon lamp should light in these positions.					
		R	S	T	U	V	X
1A1-1B1-1C1-1E1-1F1-1G1-1J1-1K1-1L1-1N1-1P1-1Q1-1R1G-1S1G-1T1G-1U1G-1V1-1Y1-1Z1-2	J	R					
2UR224	J			T			X
2LR212	H	R	S		U		
3	J	R					
03G	J			T			
4-5	J	R					
6-133	J			T			
6-6AA	J	R					
7-8-9	J	R					
10A-10AG	J			T			

BALLAST TUBE TEST CHART (Continued)

TUBE TYPE	First Selector	Neon lamp should light in these positions.					
10AB	J			T			X
K17B-M17C-EM17C	J			T			X
M17HG-M17H	J		S				X
	D	R					
K23B-K23C-KX23B-KX30C	J			T			X
M30H	J		S				X
	D	R					
30A-K30A	J			T			
K30D	J	R		T			X
33A-33AG	J			T			
K34B	J			T			X
36A	J			T			
K36B-BK36B-L36B-EM-L36C-KX36C	J			T			X
KX36A	J	R					
36D-L36D	J	R		T			X
L36DJ	J	R		T	U		X
K36H-M36H-M36HG	J		S				X
	D	R					
L40S1-L40S2	J	R		T		V	
42A	J			T			
42A1	H				U		
42A2-42B2	H		S		U		
K42B-L42B-M42B-KX42B-LX42B-L42BX-K42C-L42C-M42C	J			T			X
KB42D-K42D-L42D	J	R		T			X
LX42D-L42DX	J	R	S	T			
K42E-L42E	J			T			X
L42F	J						X
	D	R					
42HA-K42HJ-M42H-M42HG	J		S				X
	E	R		T			
KX42C	J			T			X

BALLAST TUBE TEST CHART (Continued)

TUBE TYPE	First Selector	Neon lamp should light in these positions.					
		R		T			X
K55D-L55D	J	R		T			X
L55E-M55E	J			T			X
L55F-M55F-BL55F	J						X
	D	R					
K55H-M55H-M55HG	J		S				X
	D	R					
L55S1-L55S2	J	R		T		V	X
60R30G	J	R		T			
64.23	J			T			
67A	J			T			
K67B-L67B	J			T			X
L73B-K74B-L74B-CX74C	J			T			X
80A	J			T			
K79B-K80B-M80B-K80C-KX80B-L80B	J			T			X
	J						X
K80F	D	R					
	J			T			X
KX87B-LX87B-L90B	J						X
K90F-M90F-K92F-M92F	J						X
	D	R					
92A	J			T			
L92B-95K2	J			T			X
L99D	J	R		T			X
100R8	J			T			X
120R	J	R					
120RS-135K1	J			T			X
135K1A	J			T	U		X
140L4-140L8-140R4-140R8	J	R		T			
140R	J	R					
140L44-140R44	J	R	S	T			
165L4-165R4-165R8	J	R		T			
165R	J	R					
165L44-165R44	J	R	S	T			
185L4-185L8-185R4-185R8	J	R		T			
185R	J	R					
185L44-185R44	J	R	S	T			
200R-250R	J	R					
250R8-290L4	J			T			X
300R4-320R4	J			T			X
340	J	R					
808-1	J			T	U		X
E14980-W43357-W4588-3613	J			T			X
3334-3334A	J	R		T			X
8593-8598-8601-8664	J			T			X
3ER248	J	R		T	U		X
3CR241	J	R		T			X

BALLAST TUBE TEST CHART (Continued)

TUBE TYPE	First Selector	Neon lamp should light in these positions.					
		R		T		V	
L42S1	J						
49A-49AJ-K49AJ	J						
KX49A	J						X
49A1	H					U	
49A2-49B2	H		S			U	
K49B-L49B-M49B-EM49B-K49C-M49C-EM49C-BK49C-K49E-L49E	J						X
K49D-BK49D-L49D	J						X
L49F	J						X
	D	R					
M49H-M49HG	J		S				X
	D	R					
KZ49B-KZ49C	J	R				V	
K49BJ-L49BJ	J				T	U	X
L49S2	J	R					V
49AJ-K49AJ	J						T
KX49B-LX49B-LX49C	J						T
L49DJ	J	R				T	U
L49S3	J	R					T
50A2	J	R					T
50A2MG-50B2	J	R					V
50X3	J	R					
K52H-M52H	J		S				
	D	R					
K54B	J						T
55A-K55A	J						T
55A1	H						U
KX55A	J	R					
55B-K55B-M55B-EM55B-L55BG-LX55B	J						T
55A2-55B2	H		S				U
K55C-L55C-KX55C	J						T
K55CP	J						T
						V	X

b. When the Tube Tester TV-3 U is used as a Multimeter to measure VOLTS, A.C. or D.C., OHMS, D.C. MILLIAMPERES, AND MICROFARADS, the eleven position MASTER SWITCH, S112, in the upper right of the main panel is used to select the range used in making measurements. It switches the indicating meter into different circuits. The METER, M101, has a sensitivity of 200 microamperes and an internal resistance of 2365 ohms.

Toggle switch S114 connects the copper oxide rectifier CR101 in the meter circuit for A.C. and CAPACITY and disconnects it for D.C.

The two jacks J103 and J104 just above the meter are used when measuring VOLTS, OHMS, MILLIAMPERES or CAPACITY. The RED jack J104 is positive when dc measurements are made.

The different scales on the meter dial are shown in distinctive colors. The points on the MASTER SWITCH are shown in corresponding colors. Thus OHMS are shown in ORANGE, VOLTS and MILS are shown in RED and CAPACITY is shown in GREEN. This makes it easy to select the meter scale to be read when making measurements.

(1) VOLTS D.C. When measuring volts the circuit has a sensitivity of 1000 ohms per volt. Ranges are 0 to 20, 0 to 200, 0 to 500, and 0 to 1000.

(a) Set the MASTER SWITCH S112 to the appropriate range.

(b) Set the toggle switch S114 at the left of the meter to D.C.

(c) Insert the test leads W104 and W105 into the jacks J103 and J104 at the upper right hand corner of the main panel. The RED jack and the RED lead are POSITIVE.

(2) VOLTS A.C. The sensitivity of the circuit is 1000 ohms per volt. Ranges are the same as for D.C. VOLTS.

(a) Set the MASTER SWITCH, S112, to the appropriate range the same as for dc volts.

(b) Set the toggle switch, S114, to A.C. and CAP.

(c) Insert the test leads W104 and W105 into the jacks, J103 and J104, at the upper right hand corner of the main panel. In measuring ac the polarity does not matter.

(3) OHMS. Ohms are measured in two overlapping ranges, the center scale readings of which are respectively 2,000 and 200,000 ohms. No batteries are used as the power is obtained from the built-in power supply. Therefore, when measuring ohms the power

switch, S106, must be turned on.

When the MASTER SWITCH is set on OHMS X1 the ohms scale reads direct. The center of the scale is 2,000 ohms and may be read from 10 ohms to 1 megohm.

When the MASTER SWITCH is set on OHMS X100 the scale is multiplied by 100. The center of the scale is 200,000 and may be read from 1000 ohms to 100 megohms.

TO OPERATE:

(a) Set the MASTER SWITCH S112 on the appropriate point. (OHMS X1 or OHMS X100)

(b) Plug the line cord of the tester into a 115 volt ac outlet and turn the power switch, S106, ON.

(c) The pointer of the meter will move to the top of the scale.

(d) Turn the knob of LINE ADJUST R113 until the meter pointer rests exactly over the end of the scale marked INF. (infinity).

(e) Insert the test leads, W104 and W105, in the two jacks, J103 and J104, in the upper right hand corner of the panel marked VOLTS, OHMS, MILS, CAP.

(f) Touch the prods of the test leads to the terminals of the resistance to be measured. The meter pointer will indicate the resistance in ohms. The resistance being measured should not be shunted by any other resistance, capacitance, or inductance.

(4) CAPACITY—.05 Mfd. or higher. Capacity is measured in two ranges, 0-5 and 0-50 microfarads. It is necessary to apply a standard voltage to the capacitor being measured, therefore:

(a) Turn the MASTER SWITCH, S112, to OHMS X100 and turn knob of LINE ADJUST R113 to bring the meter pointer to the INF. mark. This establishes standard voltage across the capacitor.

(b) Turn the MASTER SWITCH, S112, to the appropriate point (5 MFD. or 50 MFD.).

(c) Set the toggle switch S114 to CAP.-A.C.

(d) Insert the test leads, W104 and W105, in the two jacks, J103 and J104, marked VOLTS, OHMS, MILS, CAP.

(e) Touch the prods of the test leads to the terminals of the capacitor being measured. The pointer of the meter will indicate the value of the capacitance in microfarads. The capacitor being measured should not be shunted by other capacitance, resistance, or inductance.

(f) The capacity scale is calibrated for use on 60 cycles. For other power line frequencies consult the conversion chart, Figure 4-5.

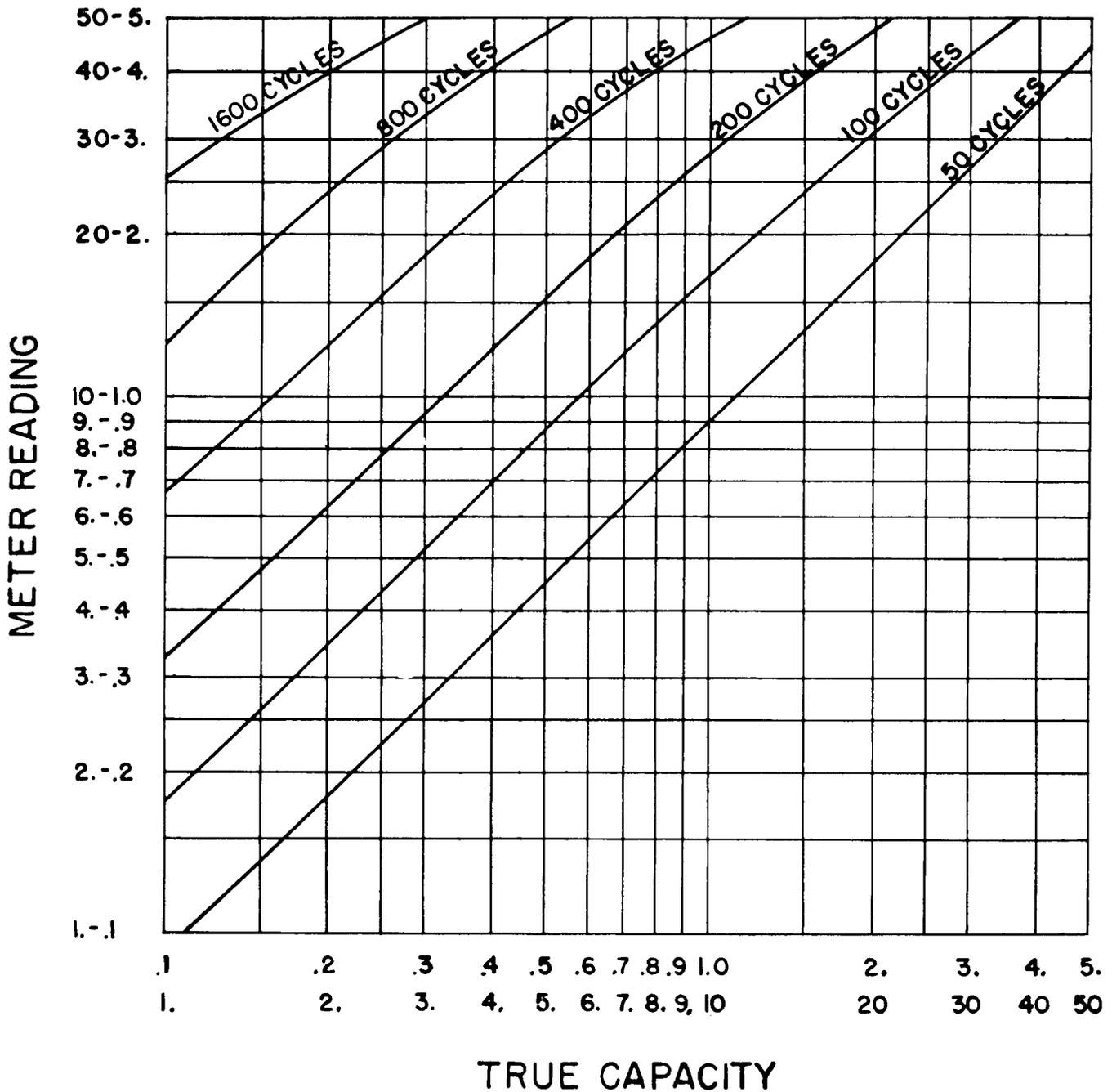


Fig. 4-5. Conversion Chart for Capacity Measurements at Frequencies Other Than 60 Cycles

(5) TO CHECK SMALL CAPACITORS. Capacitors from .0001 to .05 M.F. may be checked as follows:

(a) Make line adjustment the same as for tube testing. See paragraphs 4a(4) and 4a(5), page 4-3.

(b) Set the master switch S112 to CAPS on Volts 200. Set toggle switch S114 to A.C.-CAP.

(c) Set SELECTORS to JR-0204-0.

(d) Furnished with the TV-3 U is a special capacity test cable, W102. One end of this cable is

equipped with a 5 pin plug. The black wire terminates in a pin tip. The red wire terminates in an alligator clip.

(e) Insert the 5 pin plug of W102 in the 5 pin tube test socket. Insert the pin tip in the black pin jack J103 in the upper right corner of the panel.

(f) Connect the alligator clip of W102 to one terminal of the capacitor to be measured. Insert the red test lead W104 in the red pin jack J104, and hold the prod on the other terminal of the capacitor.

(g) Press button marked P5 and note the reading of the voltmeter. The value of the capacitor is found in Table 4-6 below.

TABLE 4-6. CAPACITY TO VOLTAGE CONVERSION TABLE FOR SMALL CAPACITORS

CAPACITY IN M.F.	VOLTMETER READING ON 200 VOLT SCALE
.0001	1.5 Volts
.0002	3. "
.00025	3.5 "
.0005	7. "
.001	13. "
.002	25. "
.003	37. "
.004	49. "
.005	59. "
.006	70. "
.007	79. "
.008	85. "
.009	92. "
.01	99. "
.015	125. "
.02	139. "
.025	147. "
.03	153. "
.035	156. "
.04	160. "
.05	162. "

(6) MILLIAMPERES, D.C. Milliamperes D.C. are measured in two ranges, 0-20 and 0-200.

(a) Turn the power switch S106 to OFF position.

(b) Turn the MASTER SWITCH S112 to the appropriate MILS range.

(c) Connect the current being measured to the jacks, J103 and J104, marked VOLTS, OHMS, MILS, CAP., by means of test leads W104 and W105.

(d) The RED jack is positive.

(7) INDUCTANCE. In measuring inductance of choke coils make switch settings exactly as for measuring capacity. (See paragraph 4b(4) of this section.)

(a) Set the MASTER SWITCH, S112, on CAP. 5 MFD.

(b) Connect the prods to the terminals of the choke being measured and read the microfarad scale of the meter.

(c) Divide the reading in microfarads into 7.04, which will give the results in henries.

(d) The following is a conversion table for inductance values:

TABLE 4-7. CONVERSION FROM CAPACITY READING TO INDUCTANCE

CAPACITY READING M.F.	INDUCTANCE HENRIES
.1	70.4
.2	35.2
.3	23.4
.4	17.6
.5	14.1
.6	11.7
.7	10.1
.8	8.8
.9	7.8
1.0	7.0

SECTION 5

OPERATOR'S MAINTENANCE

1. LINE CORD AND PLUG.

a. Inspect cord for cuts or breaks in the insulation. Minor damage to the outer jacket may be repaired with friction tape. If, however, the break or cut is deep enough to expose either of the conductors, the cord should be replaced.

b. If the panel indicator I110 does not light when the Tube Tester TV-3/U is connected to a live 105-125 volt ac 50-1600 cycle outlet (see paragraph c below), check the FUSE lamp E102 for possible burn out or loose socket connection. If FUSE lamp is OK unscrew the red jewel of indicator I110 and check pilot lamp E101 for loose socket connection, or burn out.

c. To check ac voltage source use the 200 volt ac range of the Multimeter section.

2. TEST LEADS.

a. Inspect test leads for worn or broken insulation, also check all leads for continuity, using the OHMS X1 range of the Multimeter section. If leads are badly damaged or open they should be replaced.

3. FUSE LAMP.

a. E102, a type 81, Mazda lamp, is used as a fuse and overload indicator. Two spare lamps are supplied as operating spares, and are kept in the lead compartment.

4. PILOT LAMP.

a. A number 47 lamp 6.3 volts at .15 amps., E101, serves as a pilot lamp in panel indicator I110. A spare lamp is supplied with the operating spares kept in the lead compartment.

5. NEON LAMP.

a. The neon lamp E103 used as a short indicator should be checked as follows:

- (1) Be sure lamp is firmly screwed into its socket.
- (2) With the tester plugged in, and the power switch ON, but with no tube in test sockets, set the MASTER switch S112 to TUBE TEST.
- (3) Set SELECTORS to JR-1111-1.
- (4) Turn the SHORTS test switch S113 through

positions 1, 2, 3, 4, and 5. The neon lamp should glow in positions 2 and 3.

b. If the neon lamp is defective replace it from the operating spares in the lead compartment.

Note

Do not deplete the supply of operating spares furnished with the tester without taking the necessary steps to secure replacements.

6. TUBES.

a. Two full wave rectifier tubes are used in the TV-3/U. One type 83 V101 used in the mutual conductance test circuit to supply dc plate voltage for the tube under test and dc voltage for the ohmmeter portion of the Multimeter. The type 5Y3, V102, supplies screen and bias voltages to the tube under test.

b. Failure of the 83 tube V101 is indicated if, with no tube in the test sockets but the controls set for tube test, the pointer of the METER M101 moves sharply off scale to the right when the G_m push button P4 is pressed.

c. Failure of the type 5Y3GT tube would result in lack of voltage on the screen, and bias circuits of the tube under test. To check plate and screen voltages refer to Section 7, paragraph 7.

d. To remove rectifier tubes V101 and V102 for test or replacement:

- (1) Remove the ten mounting screws around the edge of the panel.
- (2) Carefully lift the entire unit out of its case and turn face down on the test bench or other flat surface.
- (3) Slide the spring clamps holding the tubes in place away from the top of the tube, and to one side.

Note

After tubes are replaced in their sockets, BE SURE THE TUBE CLAMPS ARE IN PLACE BEFORE THE EQUIPMENT IS RETURNED TO ITS CASE.

SECTION 6

PREVENTIVE MAINTENANCE

Note

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

1. PRECAUTIONARY MEASURES.

a. The following precautions should be observed when operating the Tube Tester TV-3/U:

- (1) DON'T connect the TV-3/U into a dc power supply line. Be sure the power line to be used supplies 105 to 125 volts ac at a frequency between 50 and 1600 cycles.
- (2) DON'T insert a tube in any of the test sockets without first properly adjusting the controls.
- (3) DON'T attempt to test tubes for emission, or mutual conductance, without first checking for shorted elements.
- (4) DON'T press the mutual conductance G_m push button P4 when testing rectifier tubes.
- (5) DON'T fail to turn off the equipment and return all leads and adapters to the lead compartment when through using it.

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) 386)
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 OPERATIC

HANDLING OTHER (SPECIF)

INSTALLING

NATURE OF FAILURE AND REMARKS

DATE

NAME OF PERSON MAKING REPORT

RECEIVED

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

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			
<input type="checkbox"/> Navy	<input type="checkbox"/> Army	<input type="checkbox"/> USMC	<input type="checkbox"/> JAG
<input type="checkbox"/> Commercial		<input type="checkbox"/> Other (Specify)	
<input type="checkbox"/> Radio	<input type="checkbox"/> Radar	<input type="checkbox"/> Sonar	<input type="checkbox"/> Wire
<input type="checkbox"/> Test	<input type="checkbox"/> Test	<input type="checkbox"/> Power	<input type="checkbox"/> Sound
EQUIPMENT MODEL DESIGNATION		SERIAL NUMBER OF EQUIPMENT	
TYPE NUMBER AND NAME OF MAJOR UNIT INVOLVED		NAME OF CONTRACTOR	
SERIAL NUMBER OF UNIT		CONTRACT NO.	
CONTRACT OR PD DATA OF UNIT		DATE EQUIPMENT RECEIVED	
ITEM WHICH FAILED			
THIS SIDE FOR TUBES		THIS SIDE FOR PARTS (NOTE 9)	
TUBE TYPE, INCLUDING PREFIX LETTERS	SERIAL NO. (NOTE 8)	NAME OF PART	CIRCUIT SYMBOL (EGR 30)
TUBE MANUFACTURER	CONTRACT NO. (NOTE 4)	SERIAL NO.	*DATE RECD.
FAILURE OCCURRED IN:	GUARANTEED HOURS (NOTE 4)	*CHECK-OFF OR TAG DATA (NOTE 8)	*MANUFACTURER'S DATA (NOTE 9)
<input type="checkbox"/> Storage	ACTUAL HOURS	BRIEF DESCRIPTION AND CAUSE OF FAILURE, INCLUDING APPROXIMATE LIFE (CONTINUE ON BACK)	
<input type="checkbox"/> Handling	DATE OF ACCEPTANCE (NOTE 8)		
<input type="checkbox"/> Installing	DATE OF FAILURE		
NATURE OF FAILURE AND REMARKS (NOTE 4) (CONTINUE ON BACK)		TUBE CIRCUIT SYMBOL V-	
CONCLUSION			
<input type="checkbox"/> Normal replacement	<input type="checkbox"/> Shortage	<input type="checkbox"/> Modification	<input type="checkbox"/> Failure
<input type="checkbox"/> Transportation breakage	<input type="checkbox"/> Other (Specify)		

*NOT REQUIRED FOR REPORTS SUBMITTED BY NAVAL ACTIVITIES.

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SECTION 7 CORRECTIVE MAINTENANCE

1. FUSE LAMP.

a. The Tube Tester TV-3 U is protected by a combination FUSE lamp and overload indicator, E102, in the primary circuit of power transformer, T101. If the pilot light I102 does not glow when the tester is connected to a live ac line of proper voltage, remove FUSE lamp E101 from its socket, and check for continuity, using a low range ohmmeter. If FUSE is open replace from spares found in the lead compartment.

b. Line voltage of the power source may be checked by using the 200 volt ac range of the Model TV-3 U Multimeter section.

2. PILOT LAMP.

a. The type 47, 6.3 volt bayonet base pilot lamp E101 should glow when the TV-3 U is plugged into a live 115 volt ac outlet, and the power switch S106 is turned ON. If the lamp does not glow, but FUSE lamp E102 checks OK, unscrew the red jewel cover of the indicator I110 and check the lamp for continuity and looseness in the socket.

b. A burned out pilot lamp should be replaced with one from the operating spares found in the lead compartment.

3. NEON LAMP.

a. The neon lamp E103 used as a short indicator should be checked as follows:

- (1) Be sure lamp is firmly screwed into its socket.
- (2) With the tester plugged in and the power switch ON, but with no tube in test sockets, set the MASTER switch S112 to TUBE TEST.
- (3) Set SELECTORS to JR-1111-1.
- (4) Turn the SHORTS test switch S113 through positions 1, 2, 3, 4, and 5. The neon lamp should glow in positions 2 and 3.

b. If the neon lamp is defective replace it from the operating spares in the lead compartment.

Note

Do not deplete the supply of operating spares furnished with the equipment without taking the necessary steps to secure replacements.

4. TUBES.

a. Two full wave rectifier tubes are used in the TV-3 U. One type 83 V101 used in the mutual conductance test circuit to supply plate voltage and to supply dc voltage for the ohmmeter circuit of the Multimeter section. The 5Y3GT, V102 supplies dc screen and bias voltages for the tube under test.

b. Failure of the 83 tube V101 is indicated if, with no tube in the test sockets but the controls set for tube test, the pointer of the METER M101 moves sharply off scale to the right when the G_m push button P4 is pressed.

c. Failure of the type 5Y3GT tube would result in lack of voltage on the screen and plate circuits of the tube under test. To check plate and screen voltages refer to paragraph 7 of this section.

d. To remove rectifier tubes V101 and V102 for test, or replacement:

- (1) Remove the ten mounting screws around the edge of the panel.
- (2) Carefully lift the entire unit out of its case, and turn face down on the test bench or other flat surface.
- (3) Slide the spring clamps holding the tubes in place, away from the top of the tube and to one side.

Note

After tubes are replaced in their sockets BE SURE THE TUBE CLAMPS ARE IN PLACE BEFORE THE EQUIPMENT IS RETURNED TO ITS CASE.

5. TEST LEADS.

a. Inspect all test leads for defective insulation and test for continuity. Make any minor repairs necessary, but if leads are in poor condition, or beyond repair, requisition replacements immediately.

6. SCHEMATIC WIRING DIAGRAM.

a. Refer to schematic diagram Figure 7-6 and internal views Figure 7-2, 7-3, 7-4, and 7-5 for correct wiring and placement of parts in the TV-3/U.

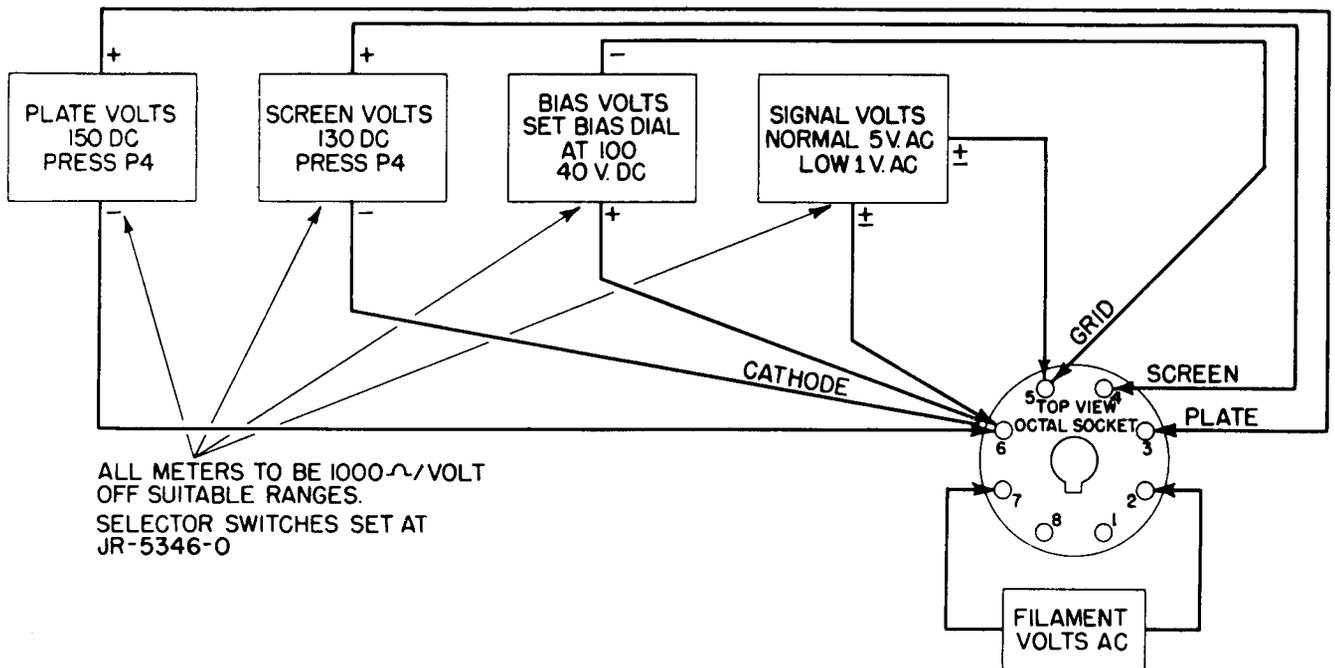


Fig. 7-1. Voltage Calibration Check Diagram

7. VOLTAGE AND CALIBRATION CHECK.

a. The Tube Tester section of the TV-3/U may be checked for proper voltages and for correct calibration of the SHUNT and BIAS control dials as outlined in the following steps:

(1) Set the MASTER switch, S112, and the SHORTS switch, S113, to TUBE TEST. Set the SELECTORS, S103, S104, S105, S108, S109, S110, and S115 to JR-5346-0. Turn power switch, S106, ON. Press LINE ADJ. push button P7 and turn LINE ADJUST control R113 until the METER pointer is set at LINE TEST.

Note

Voltage tests must be made with a multimeter, or individual meters of 1000 ohms per volt sensitivity having suitable ranges of ac and dc.

The Multimeter section of the TV-3/U cannot be used for these tests.

(2) PLATE VOLTAGE CHECK (150 vdc).

(a) Connect the positive (+) terminal of the voltmeter to contact No. 3 (RMA) of the octal test socket, X107, and the negative (-) terminal to contact No. 6 of the same socket. (See Figure 7-1)

(b) Press G_m push button P4. The voltmeter should read approximately 150 volts dc, ± 2 volts.

(3) SCREEN VOLTAGE CHECK (130 vdc).

(a) Connect the positive (+) terminal of the voltmeter to contact No. 4 (RMA) of the octal test socket X107, and the negative (-) terminal to contact No. 6. (See Figure 7-1)

(b) Press G_m push button P4. The voltmeter should read approximately 130 volts dc, ± 2 volts.

(4) BIAS VOLTAGE CHECK (40 vdc).

(a) Set the BIAS dial, I101 of bias control R116, at 100.

(b) Connect the positive (+) terminal of the voltmeter to contact No. 6 (RMA) of the octal test socket X107 and the negative (-) terminal to the No. 5 contact. (See Figure 7-1)

(c) The voltmeter should read approximately 40 volts dc, ± 0.8 volts.

(5) SIGNAL VOLTAGE CHECK (1 and 5 vac).

(a) Set BIAS dial I101 of bias control R116 at zero.

(b) Connect the terminals of the ac voltmeter to contacts 5 and 6 (RMA) of the octal test socket X107. (See Figure 7-1)

(c) With the SIGNAL switch S107 set at NORMAL the meter should read approximately 5 volts ac, ± 0.2 volts.

(d) With the SIGNAL switch S107 set at LOW the meter should read approximately 1 volt ac, \pm 0.04 volts.

(6) FILAMENT VOLTAGE CHECK (1.1 to 117 vac).

(a) Set FILAMENT voltage switch S101 to the desired voltage.

(b) Connect the terminals of an ac voltmeter or a multimeter of suitable range between contacts 2 and 7 (RMA) of octal test socket X107.

(c) The meter should read within the limits indicated in Table 7-1 for the various nominal setting of the FILAMENT voltage switch S101.

TABLE 7-1. FILAMENT VOLTAGE CHART FOR TUBE TESTER TV-3/U

NOMINAL	MIN.	MAX.
1.1	1.1	1.2
1.5	1.5	1.7
2.0	2.0	2.2
2.5	2.7	2.9
3.0	3.3	3.5
4.3	4.4	4.7
5.0	5.4	5.6
6.3	6.4	6.7
7.5	7.6	8.0
10.0	10.1	11.0
12.6	12.5	13.2
20.0	19.0	21.0
25.0	26.0	28.0
35.0	34.0	39.0
50.0	50.0	56.0
75.0	73.0	83.0
117.0	118.0	128.0

(7) BIAS dial I101 and SHUNT dial I102 should indicate zero when they are in full counter clockwise positions.

b. If a tube shows defective in one TV-3/U tester and it checks good in other TV-3/U checkers, make a comparison check of voltages and resistances between socket connections with the selector switches and other controls set at the same settings on both the good and defective testers.

c. This comparison check will help to localize the trouble.

8. RESISTANCE CHECK FOR MULTIMETER SECTION.

a. TABLE 7-2 is intended as an aid in localizing trouble in the Multimeter section of the TV-3/U.

b. An ohmmeter or multimeter having suitable ranges should be connected to the VOLTS, MILS, OHMS, CAPACITY jacks J103 and J104.

CAUTION: Disconnect power cord before starting resistance measurements.

9. COPPER OXIDE RECTIFIER.

a. Failure of meter rectifiers of the type used in the Model TV-3/U seldom occurs in normal use.

b. A defective rectifier CR101 will cause a considerable drop in sensitivity on the ac ranges only. If the dc voltage circuits check out properly, but an appreciable error is found when measuring ac voltages, it is a definite indication that the rectifier CR101 is defective and should be replaced.

Caution

DURING FUNGUS PROOFING OPERATIONS BE SURE THAT NONE OF THE COATING COMPOUND IS USED ON OR PERMITTED TO COME IN CONTACT WITH THE COPPER OXIDE RECTIFIER. CHEMICALS USED IN THESE COATING COMPOUNDS MAY CAUSE DAMAGE TO METALLIC RECTIFIER ELEMENTS.

TABLE 7-2. POINT TO POINT RESISTANCE CHECK FOR MULTIMETER SECTION

POSITION OF MASTER SWITCH	RESISTANCE ACROSS PIN JACKS J 103 AND J 104	COMPONENT PARTS BY SYMBOL DESIGNATION WHICH SHOULD BE CHECKED FOR POSSIBLE FAILURE IF PROPER RESISTANCE READING ACROSS PIN JACKS IS NOT OBTAINED
OHMS X 1	1920 OHMS	R124, R125, R126, R127, R128, R130
OHMS X 100	205,000 OHMS	R119, R120, R124, R126, R127, R128, R130
VOLTS 20	20,000 OHMS	R131, R132, R133
VOLTS 200	200,000 OHMS	R131, R132, R133, R137
VOLTS 500	500,000 OHMS	R131, R132, R133, R137, R138
VOLTS 1000	1 MEGOHM	R131, R132, R133, R137, R138, R139
NOTE: FOR A.C. VOLTAGE RANGES CR101 SHOULD ALSO BE CHECKED		
CAPACITY 5	580 OHMS	R136
CAPACITY 50	65	R135
MILS 20	38	R125, R126, R127, R128
MILS 200	3	R125, R126, R127, R128

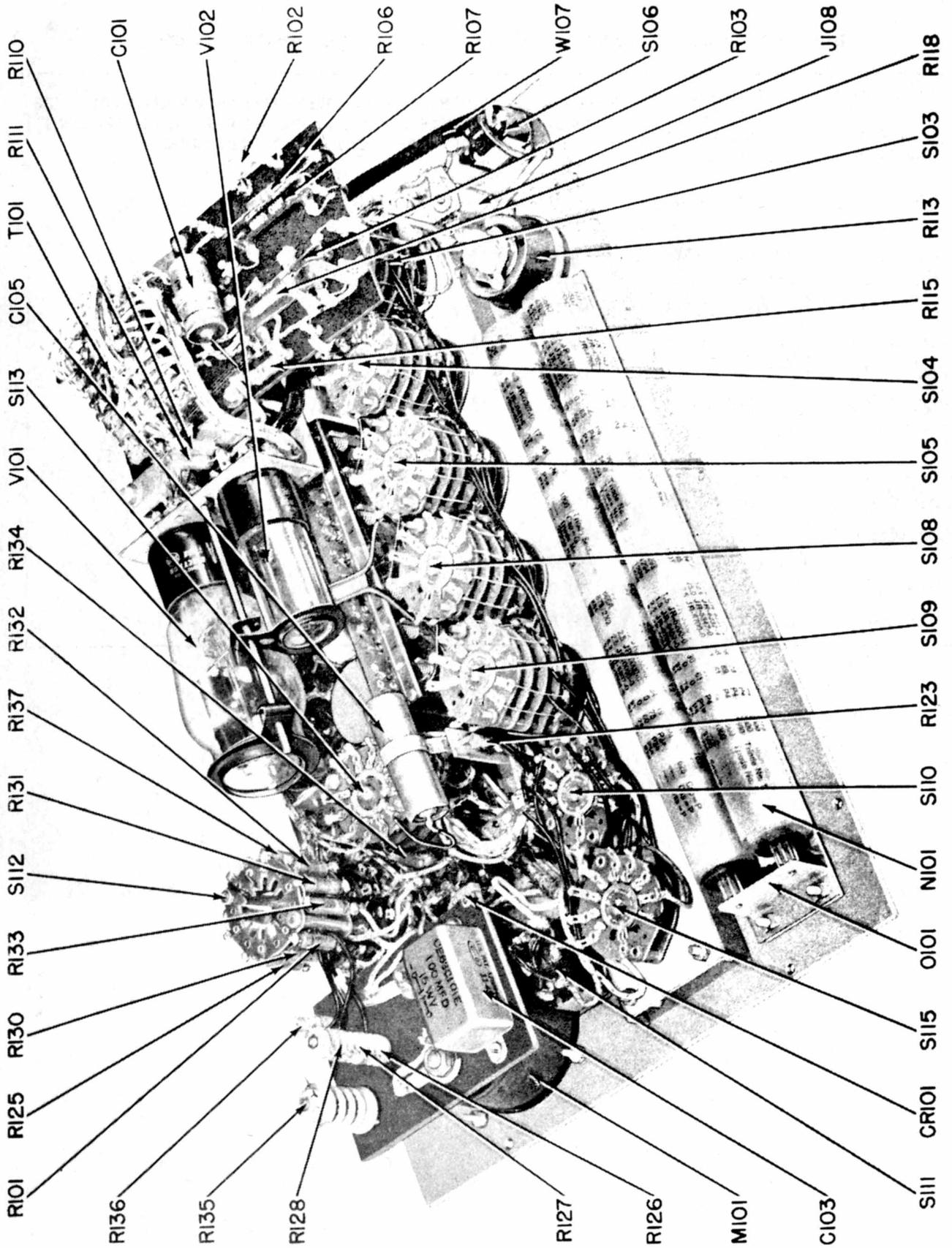


Figure 7-2. Internal View of Tube Tester TV-3/U (Front Left Oblique)

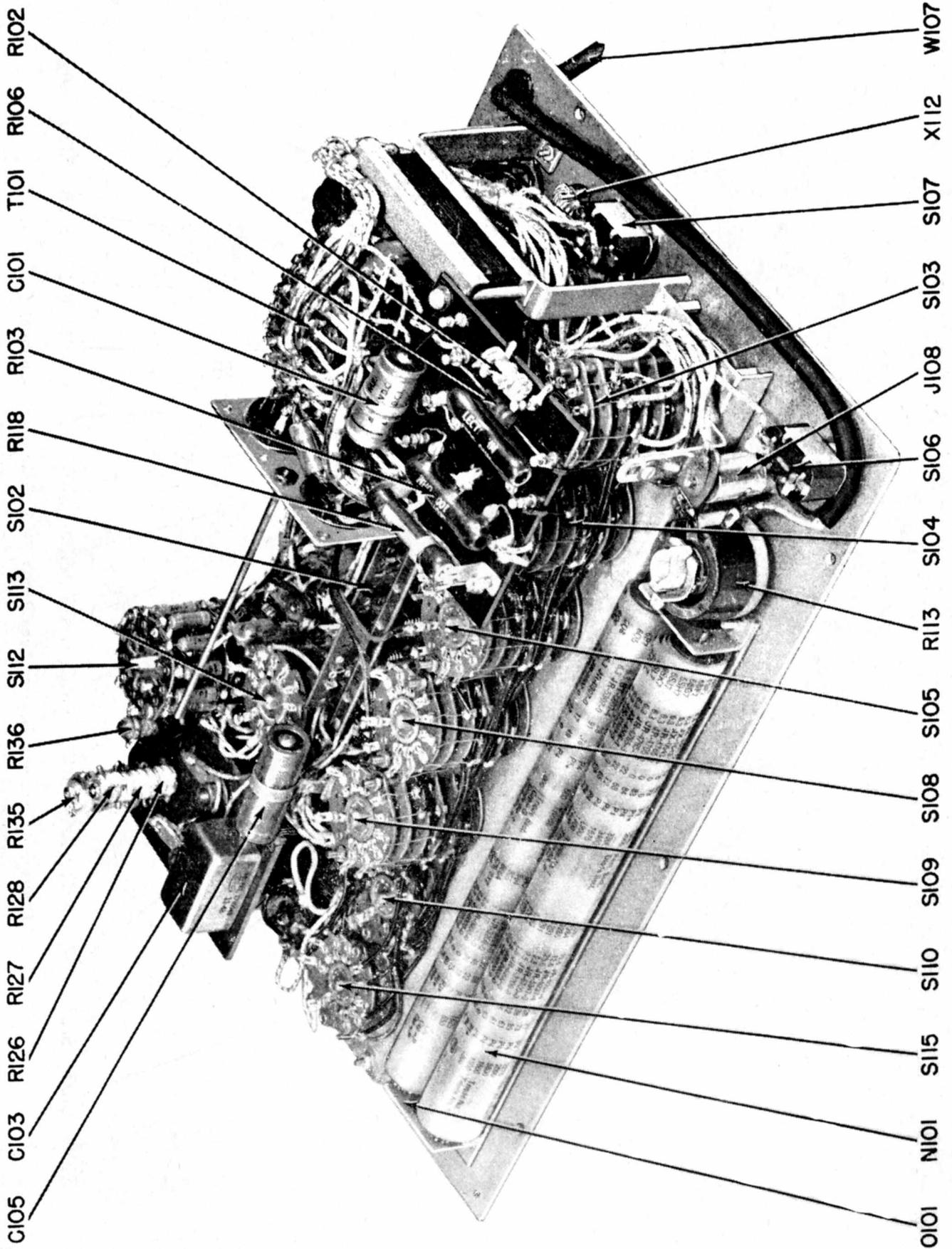


Figure 7-3. Internal View of Tube Tester TV-3/U (Front Right Oblique)

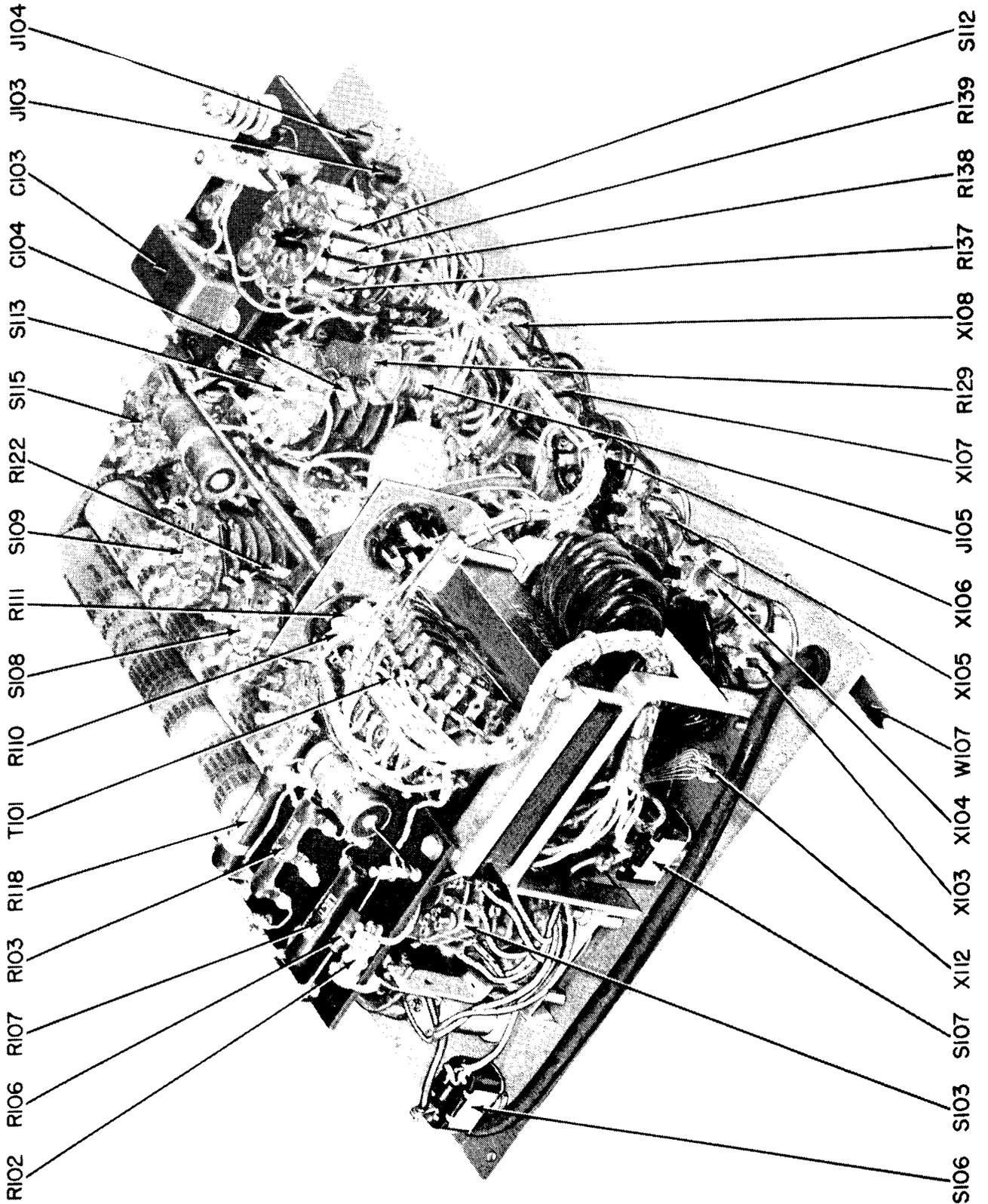


Figure 7-4. Internal View of Tube Tester TV-3/U (Rear Left Oblique)

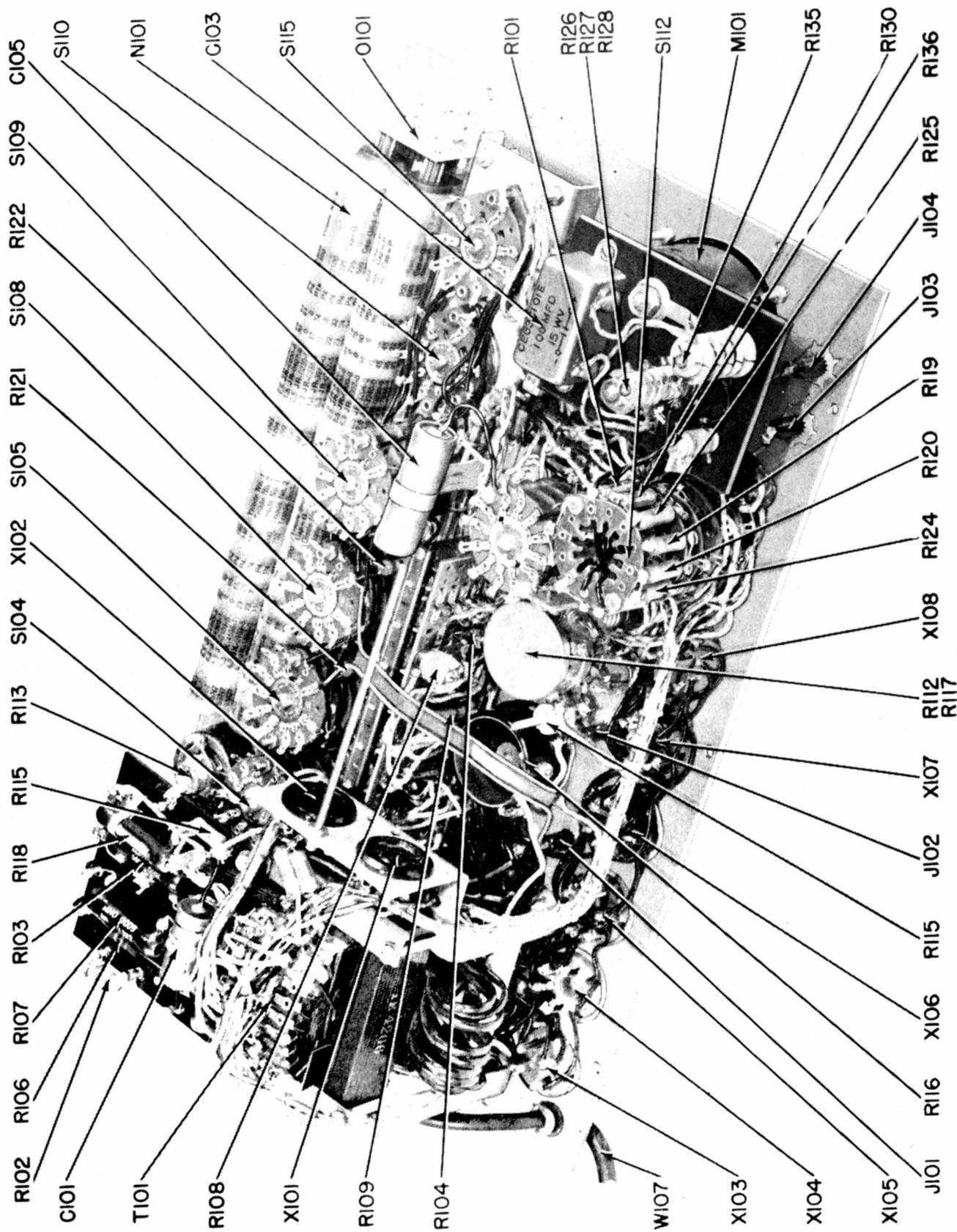


Figure 7-5. Internal View of Tube Tester TV-3/U (Rear Right Oblique)

NOTES

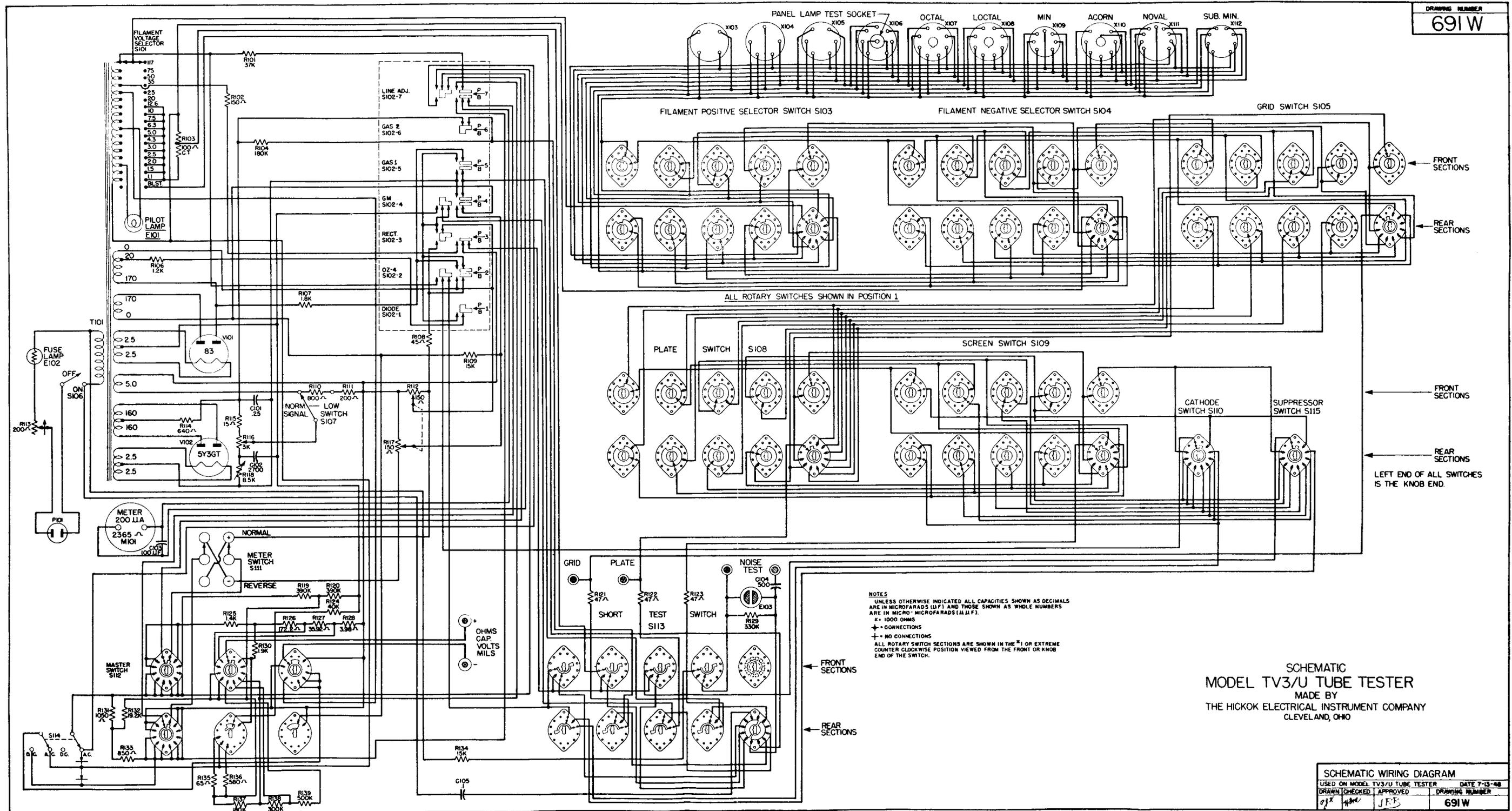
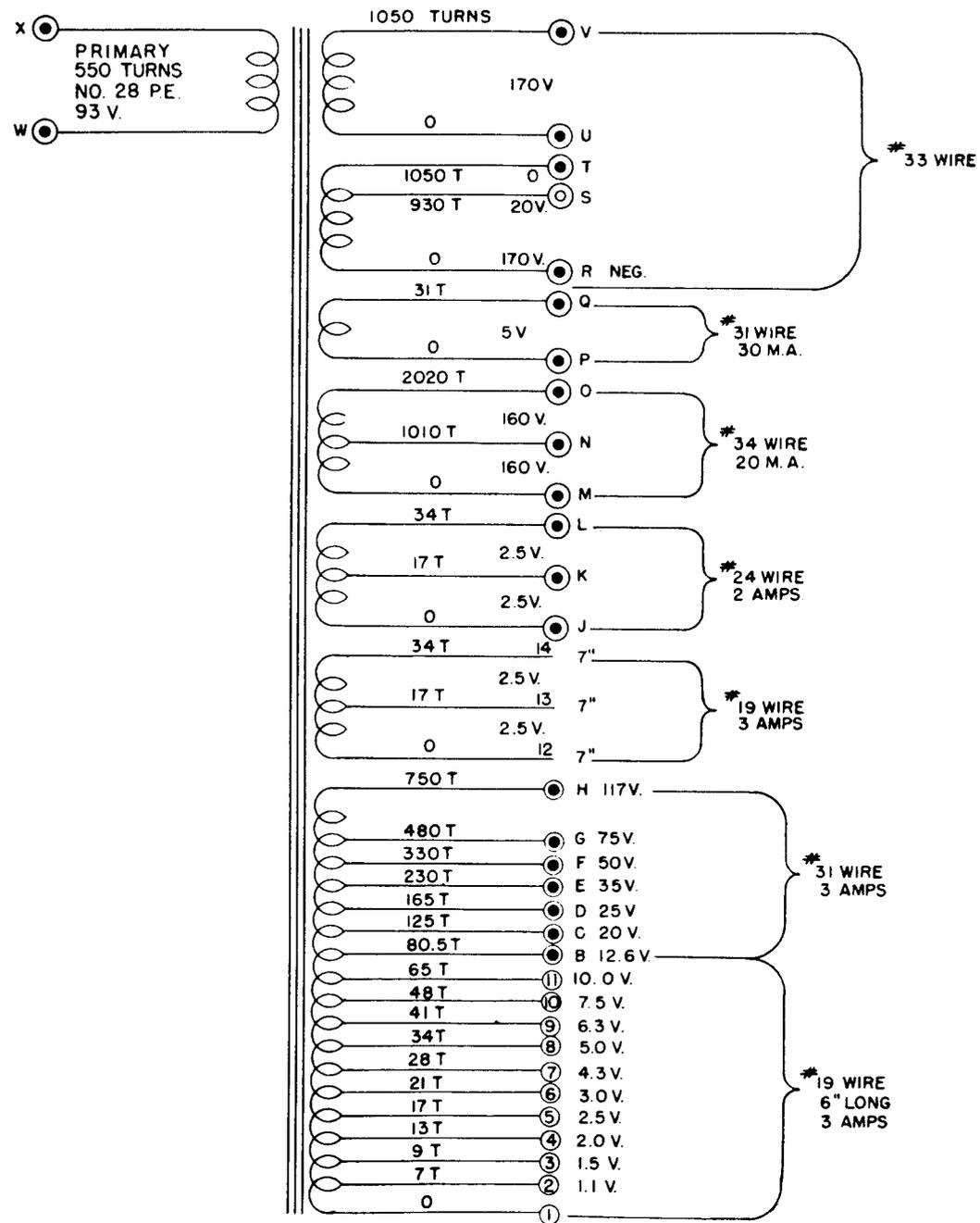


Figure 7-6. Schematic Diagram for Tube Tester TV-3/U



(●) = SOLDERING CLIPS, IDENTIFIED BY LETTERS AS INDICATED.
 (I) = WIRE LEADS WITH BLACK POLYVINYL CHLORIDE INSULATING SLEEVES, LENGTH AND IDENTIFICATION NUMBERS AS INDICATED.

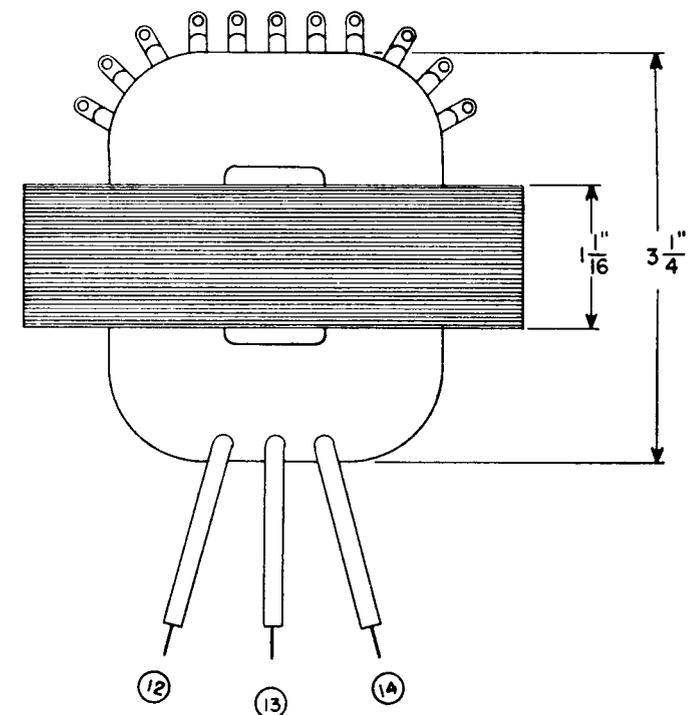
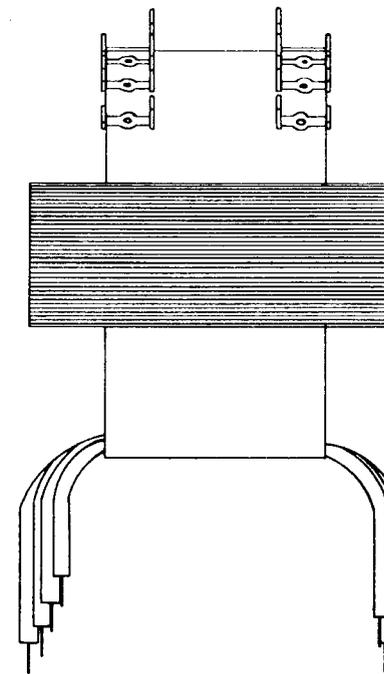
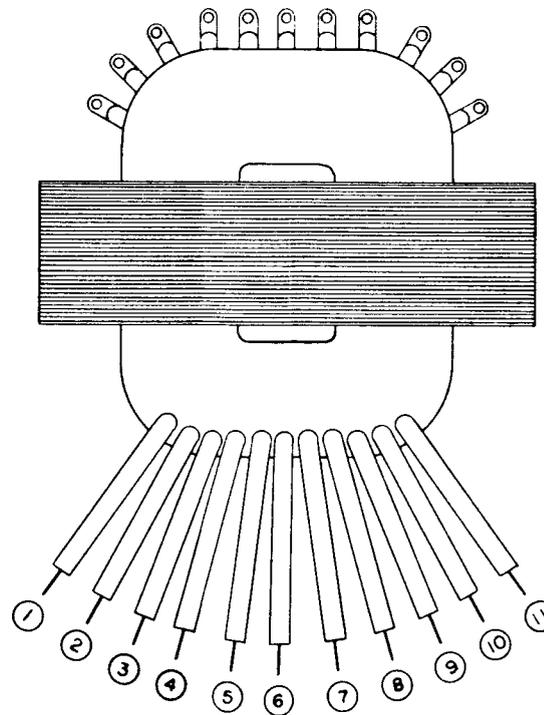
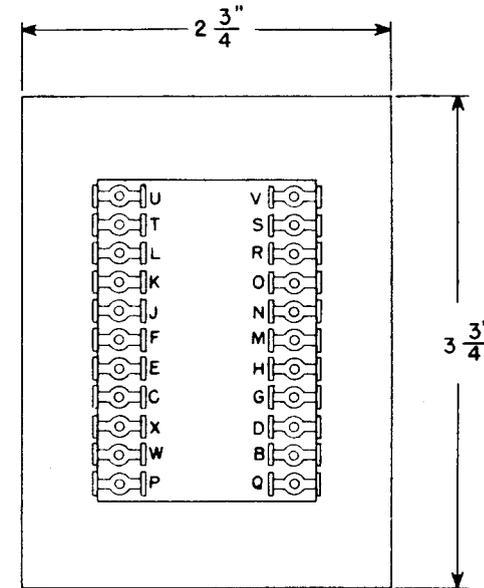


Figure 7-7. Transformer Diagram

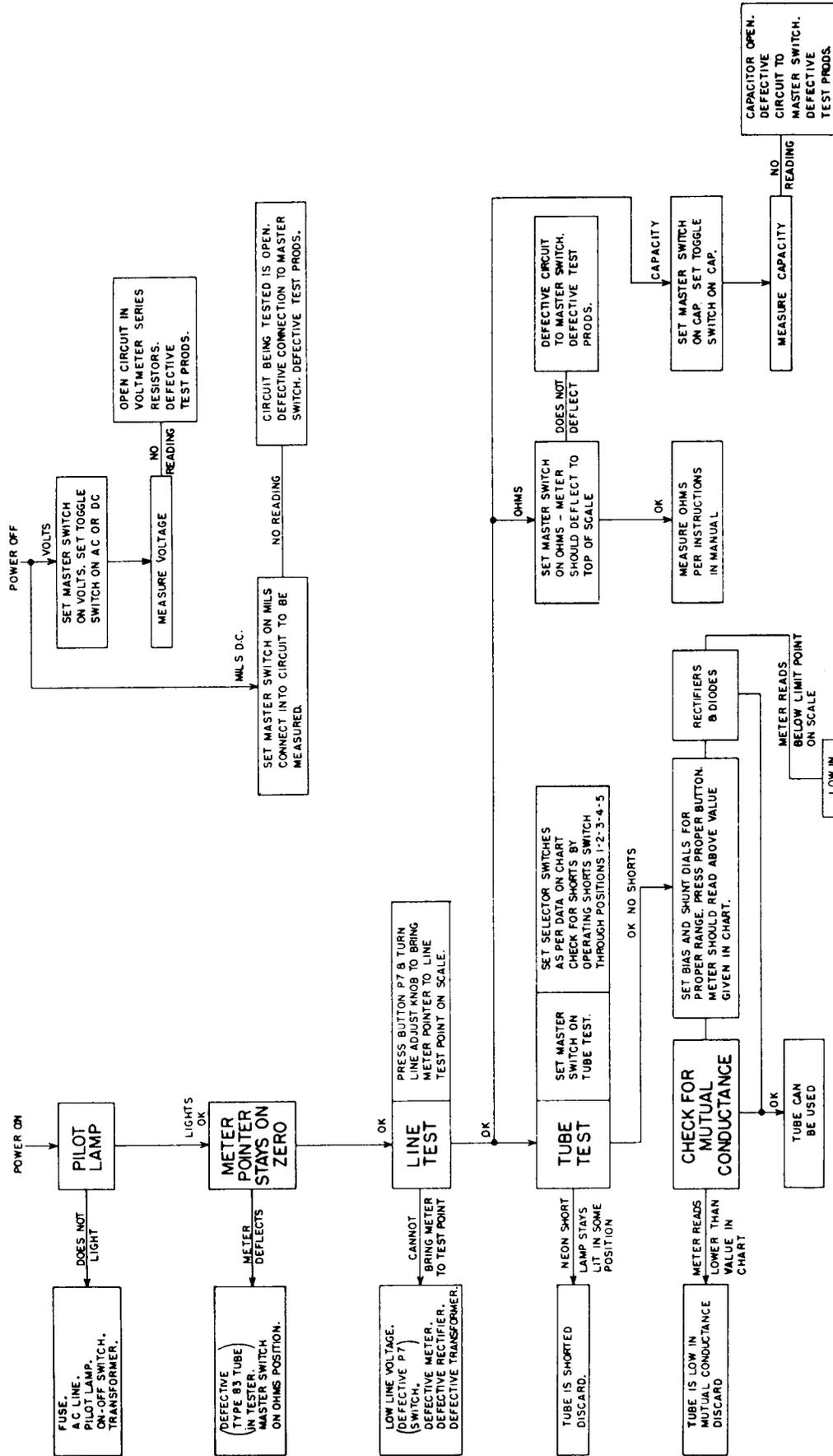


Figure 7-8. Trouble Shooting Chart

NOTES

TABLE 8-1. WEIGHT AND DIMENSIONS OF SPARE PARTS BOX

EQUIPMENT SPARES					
Spare Parts Box	Overall Dimensions			Volume	Weight
	Height	Width	Depth		
1	6 $\frac{1}{8}$ "	9 $\frac{1}{4}$ "	18 $\frac{1}{4}$ "	1040 cu in	26 $\frac{1}{4}$ lbs

TABLE 8-2. SHIPPING WEIGHT DIMENSIONS OF SPARE PARTS BOX

EQUIPMENT SPARES					
Spare Parts Box	Overall Dimensions			Volume	Weight
	Height	Width	Depth		
1	9"	22"	11 $\frac{1}{2}$ "	2280 cu in	42 lbs

TABLE 8-3. LIST OF MAJOR UNITS

Symbol Group	Quantity	Name of Major Unit	Navy Type	Designation
	1	Tube Tester	TV-3/U	

TABLE 8-4. COMBINED PARTS AND SPARE PARTS LIST

PARTS									
SYMBOL DESIG.	NAME OF PART AND DESCRIPTION	FUNCTION	AWS, JAN OR NAVY TYPE DESIG.	NAVY STOCK NO.	ARMY STOCK NO.	MFR AND MFR'S DESIG.	CONTRAC- TOR'S DWG. AND PART NO.	ALL SYMBOL DESIGNA- TIONS INVOLVED	TO TOTAL QUAN- TITY
C-101	CAPACITOR, fixed: paper; single section; 250,000 mmf p/m 10%; 400 VDCW; herm sealed metal case, 1 3/8" lg. x 1 1/8" diam; mineral oil impreg; two axial wire leads; no internal ground; radial mtg. bracket.	Filter Capacitor Bias Network		N16-C-46343-7706	3DA250-479	Sollar XTTLW0	3105-120	C-101	1
C-102	CAPACITOR, fixed: mica; JAN type CM30B272K; 2700 mmf p/m 10%; Spec #JAN-C-5	Neutralizing Capacitor	CM30B272K	N16-C-32145-5164	3K3027221	Cornell Dubilier	X3095-41	C-102	1
C-103	CAPACITOR, fixed: electro-lytic; JAN type CE63C101E; 100 mfd. = 10%, +250, 15 VDCW; Spec JAN-C-62	Filter Capacitor across Meter	CE63C101E	N16-C-20179-5441	3DB100-45	Cornell Dubilier	3085-35	C-103	1
C-104	CAPACITOR, fixed: mica; JAN type CM20B471K; 470 mmf p/m 10%; Spec #JAN-C-5	Isolating Capacitor Noise Test	CM20B471K	N16-C-30114-4276	3K2047121	Cornell Dubilier	N3095-S	C-104	1
C-105	CAPACITOR, fixed: paper; JAN type CP26A1EF104K; 100,000 mmf p/m 10%; 600 VDCW; Spec #JAN-C-25	Isolating Capacitor Short Test	CP26A1EF-104K	N16-C-45777-4137	3DA100-730	Hickok Part #3105-114	3105-114	C-105	1
CR-101	RECTIFIER, metallic; copper oxide; input 4.5 V.A.C.; output 3 V.D.C. @ .5 ma; 1/16" lg x 3/8" wd x 1/4" h o/a excluding term; 3/32" mtg holes, on 5/32" mtg/c; 4 wire leads 4" lg; p/o Navy Tube Tester Model TV-3/U;	Meter Rectifier		N17-R-50882-2338	3H4838-15.3	Bradley Type #CX2E2D	Part/Dwg #18150-14	CR-101	1
E-101	LAMP, incandescent; 6 to 8 volts @ .15 amps; bulb T 3 1/4 clear; 1 1/8" lg overall; miniature bayonet base; C-2 filament; burn any position;	Pilot Lamp		N17-L-6297	2Z5952	Sylvania Prod type #S-47	12270-12	E-101	1
E-102	LAMP, incandescent; 6 to 8 V 6 cp; type G6 clear; 1 1/16" ; miniature bayonet base; C-2R filament; burn any position.	Fuse		N17-L-6686	6Z6806.14	Tungsol #81	X-12270-2	E-102	1

E-103	LAMP, glow; 115 V $\frac{1}{4}$ W, striking voltage AC55 DC70; T $\frac{1}{2}$ clear; 1 $\frac{1}{2}$ " overall length; Candelabra screw base; PW 27 Electrode; burn any position; Neon gas.	Short Test Indicator	N17-L-6793	2Z5889-16	G.E. Catalogue #NE 17	X-12270-1	E-103	1
E-104	CLIP ASSEMBLY, tube contact; grid and plate connector for lighthouse tubes; used with Tube Tester TV-3 U; one 1 $\frac{1}{4}$ " diam plate clip and one silver plated phosphor bronze grid clip mounted in and insulated from a cylindrical metal shell; blue steel shell; phenolic insulation; cylindrical shape; 1 $\frac{1}{8}$ " diam x 1 $\frac{1}{4}$ " lg excluding contact clips; friction fit mtg over plate and grid connections of tube; replacement part, supplied less leads.	Replacement Tube cap; part of W-101			Ucinite #J-1348-1-2	#3075-13	E-104	1
E-105	INSULATOR, clip; conical shape; black polyvinyl acetate; 1 $\frac{1}{8}$ " lg; $\frac{9}{16}$ " OD x $\frac{1}{2}$ " ID max.	Replacement Test clip insulator; part of W-103			Mueller #87 Black	#9720-12	E-105	1
E-106	INSULATOR, clip; conical shape; red polyvinyl acetate; 1 $\frac{1}{8}$ " lg; $\frac{9}{16}$ " OD x $\frac{1}{2}$ " ID max.	Replacement Test Clip Insulator; part of W-102			Mueller #87 Red	#9720-11	E-106	1
E-107	PROD, test; nickel plated tip with black plastic handle; wire secured in tip by knurled sleeve nut; will accommodate #18 AWG wire, handle 1 $\frac{1}{16}$ " ID; 5" lg x 3" diam approx over-all.	Replacement Prod; part of W-105			American Radio Hd'ware part #145 Black	#16975-13	E-107	1
E-108	PROD, test; nickel plated brass tip with red plastic insulating handle; wire secured in tip by knurled sleeve nut; will accommodate #18 AWG wire; handle 1 $\frac{1}{16}$ " ID; 5" lg x 3" diam approx over-all.	Replacement Prod; part of W-104			American Radio Hd'ware part #145 Red	#16975-1	E-108	1
H-101	PLATE, indicator; Cellulose acetate clear; 11 $\frac{3}{8}$ " lg x 11 $\frac{1}{2}$ " wd x .020 thk; four $\frac{3}{16}$ " diam mtg holes on 11 $\frac{1}{4}$ x 11" mtg C; single red indicator line 1 $\frac{1}{32}$ " wd printed lengthwise on center line; $\frac{3}{16}$ " x 1 $\frac{1}{4}$ " cut out at one end to clear roller index knob.	Protection and Guide Line for Roll Chart	N16-P-403561-112	2Z7091-225	Hickok Part #23800-19	Part/Dwg. #23800-19	H-101	1

TABLE 8-4 (Cont.) COMBINED PARTS AND SPARE PARTS LIST

PARTS									
SYMBOL DESIG.	NAME OF PART AND DESCRIPTION	FUNCTION	AWS, JAN OR NAVY TYPE DESIG.	NAVY STOCK NO.	ARMY STOCK NO.	MFR AND MFR'S DESIG.	CONTRAC- TOR'S DWG AND PART NO.	ALL SYMBOL DESIGNA- TIONS INVOLVED	TOTAL QUAN- TITY
I-101	DIAL: bias control; etched aluminum dial filled in black attached to black phenolic bar knob; approx. dimen $1\frac{15}{16}$ " diam x $\frac{7}{8}$ " high o/a; mounts on $\frac{1}{4}$ " diam shaft by means of one #8-32 set screw; filled black numerals 0, 10, 20, through 100, 100 scale divisions on 300° arc, non uniform spacing.	Adjustment of Bias Voltage Applied to Tube under Test		N16-D-46346-6726	2Z3718.142	Hickok Part #4160-57	Part #4160-57 Dwg. #4160-12	I-101	1
I-102	DIAL: SHUNT control; etched aluminum dial filled in black attached to black phenolic bar knob; approx. dimen $1\frac{15}{16}$ " diam x $\frac{7}{8}$ " high o/a; mounts on $\frac{1}{4}$ " diam shaft by means of one #8-32 set screw; filled black numerals 0, 10, 20 etc. through 100, 100 scale divisions;	Adjustment of Shunt and Micromho Range Selector		N16-D-46346-6686	2Z3718.138	Hickok Part #4160-60	Part #4160-60 Dwg. #4160-12	I-102	1
I-103	DIAL: brass, temper $\frac{1}{2}$ H with etched letters enamelled black, satin chrome background; alphabetical range: BCDEFGHJK; $1\frac{15}{16}$ " diam, center hole .253" dia with .190" flat; mounts on $\frac{1}{4}$ " dia flattened shaft behind panel.	For Indication of Proper Setting of Selector Switches		N16-S-117101-262	2Z3718.137	Hickok Part #X4150-65	Part #X-4150-65 Dwg. #4150-16	I-103	1
I-104	DIAL: brass, temper $\frac{1}{2}$ H with etched letters enamelled black, satin chrome background; alphabetical range: RSTUVWXYZ; $1\frac{15}{16}$ " diam, center hole .253" dia with .190" flat side; mounts on $\frac{1}{4}$ " diam flattened shaft behind panel.	Same as I-103		N16-S-117101-260	2Z3718.136	Hickok Part #X-4150-66	Part #X-4150-66 Dwg. #4150-16	I-104	1
I-105	DIAL: brass, temper $\frac{1}{2}$ H with etched numbers enamelled black, satin chrome background; numerical range 0 to 9 inclusive; $1\frac{15}{16}$ " diam, center hole .253" dia with .190" flat; mounts on $\frac{1}{4}$ " diam flattened shaft behind panel.	Same as I-103		N16-S-117101-261	2Z3718.135	Hickok Part #X-4150-64	Part #X-4150-64 Dwg. #4150-16	I-105 I-106 I-107 I-108 I-109	5

I-106	DIAL: Same as C-105	Same as I-103							
I-107	DIAL: Same as C-105	Same as I-103							
I-108	DIAL: Same as C-105	Same as I-103							
I-109	DIAL: Same as C-105	Same as I-103							
I-110	LIGHT, indicator: with lens; $\frac{1}{2}$ " clear red jewel lens; for miniature bayonet base T-3 $\frac{1}{4}$ " lamp; open frame; brass nickel plate; $1\frac{1}{16}$ " x $\frac{1}{8}$ " x $1\frac{1}{16}$ " H o/a, behind mtg. sur jewel extends approx $\frac{1}{2}$ " in front of mtg sur; mounts in $\frac{1}{16}$ " mtg hole, $\frac{1}{4}$ " max panel thickness; lamp mounted horiz, removable from front; threaded jewel; two solder lug terminals.	Used with E-101	N17-L-76850-3998	2Z5991-3	Drake type #40	19350-112	I-110	1	
J-101	CONNECTOR, receptacle: single contact, phosphor bronze; straight; $\frac{1}{2}$ " diam x $\frac{3}{4}$ " lg o/a excluding term; cylindrical black phenolic body; opening for .080" to $\frac{3}{32}$ " diam pin plug mounts in $\frac{1}{32}$ " diam panel hole; supplied with speed nut for mtg.	For insertion of Grid Cap Lead	N17-C-73108-1999	2Z55381-5	Ebv type #52 black	10300-2	J-101 J-103 J-106 J-107	4	
J-102	CONNECTOR, receptacle: single contact, phosphor bronze; straight; $\frac{1}{2}$ " diam x $\frac{3}{4}$ " lg o/a excluding term; cylindrical red phenolic body; opening for .080" to $\frac{3}{32}$ " diam pin plug; mounts in $\frac{1}{32}$ " diam panel hole; supplied with speed nut for mtg.	For Insertion of Plate Cap Lead	N17-C-73108-2000	2Z55381-4	Ebv type #52 Red	10300-1	J-102 J-104	2	
J-103	CONNECTOR, receptacle: Same as J-101	For Insertion of Black Test Lead							
J-104	CONNECTOR, receptacle: Same as J-102	For Insertion of Red Test Lead							
J-105	LAMPHOLDER: candleabra screw; brass shell body; 115 V, 10 W; $\frac{1}{2}$ " diam x $\frac{1}{2}$ " lg excluding terminals and mtg bracket; one elongated mtg hole $\frac{3}{16}$ " x $\frac{7}{8}$ " in bracket; mtg bracket extends $1\frac{1}{4}$ " behind base of socket, two solder lug term on opposite sides.	Used with E-103	N17-L-50844-4672	2Z5936.16	Drake type #414-14L-LT	X-19350-2	J-105	1	

TABLE 8-4 (Cont.) COMBINED PARTS AND SPARE PARTS LIST

PARTS									
SYMBOL DESIG.	NAME OF PART AND DESCRIPTION	FUNCTION	AWS, JAN OR NAVY TYPE DESIG.	NAVY STOCK NO.	ARMY STOCK NO.	MFR AND MFR'S DESIG.	CONTRAC- TOR'S DWG AND PART NO.	ALL SYMBOL DESIGNA- TIONS INVOLVED	TOTAL NO. PER EQUIP.
J-106	CONNECTOR, female con- tact; Same as J-101	For Insertion of Noise Test Lead							
J-107	CONNECTOR, female con- tact; Same as J-101	Same as J-106							
J-108	LAMPHOLDER; candleabra bayonet; steel shell body; 115 V, 10 W; $\frac{3}{8}$ " diam x $\frac{1}{16}$ " lg excluding terminals and mtg bracket; one elongated mtg hole $\frac{3}{16}$ " x $\frac{1}{8}$ " in bracket; mtg bracket extends $1\frac{1}{4}$ " behind base of socket, two solder lug term on opposite sides.	Used with E-102		N17-L-51678- 3452	6Z8832	Drake type #614L-CH-LT	X-19350-1	J-108	1
M-101	METER, multi-scale: DC; scale ranges 0 / 3000 / 6000 / 15000 microhms, 0.1 Meg / 100 Meg, ohms 0/200/500/ 1000 volts and mills, 0/5/50 microfarad; square phenolic, flush mtg case; barrel diam $2\frac{3}{4}$ " depth behind flange $1\frac{13}{32}$ " rectangular flange $3\frac{1}{8}$ " x $3"$ x $\frac{1}{32}$ ", excluding terminals; accuracy 2%; D. Arsonval movement; 200 Microamps basic movement sensitivity, resistance 2365 ohms p/m 50 ohms; calibrated for non-mag- netic panel; microhmo scale 60 divisions, black on white; ohms scale 130 divisions, black on pastel orange; volts and mils scale 50 divisions, black on pastel red; microfarad (MF) scale 40 divisions, black on pastel green; meter designed only for use in Navy Model TV-3/U. Tube Tester which contains all associated circuit components; four 4-36 mtg studs $\frac{1}{16}$ " lg on $2\frac{1}{4}$ " mtg/c; two stud terminals $\frac{1}{4}$ "-28 th/d $1\frac{1}{16}$ " lg spaced $1\frac{1}{2}$ " c to c; check points for diodes, recti- fier and line test; Hickok Model S46.	For Indications of Line Test Microhms Volts Ohms Mils Capacity		N17-M-29380- 5596	3F3290-9.2	Hickok Part #460-641	Part #460-641 Dwg. #A-478 S-46	M-101	1

N-101	CHART, roll; Tube test data; Translucent plastic .003" thick x 10.25" wide x approx 90" long; Black print on translucent white background; p.o. Navy Tube Tester Model TV-3 U	Tube Test Settings and Instructions	N16-S-290001-102	6D10124-2	Hickok Part #X3200-32	#X3200-32	N-101	1
O-101	DRIVE, chart; p.o. Navy Tube Tester Model TV-3 U; Dual fiber rollers, 3/4" diam mounted and geared on ead. plated welded panel assembly; Rectangular; 1 1/2" wide x 1 1/8" long x 1 1/2" deep; 4 mounting holes 3/16" d on 1" x 1 1/4" mfg c.	Mounting and Rotation of Roll Chart	N16-D-900201-101	2Z3876.108	Hickok Part #X-9600-7	Part/Dwg #X-9600-7	O-101	1
O-102	CLIP; electron tube contact; connector for grid or plate caps 1/4" to 3/8" diam; spring brass, cad plated; 1 1/4" lg x 1/16" wd x 7/16" h overall; black phenolic insulation; one solder connection.	Replacement Tube Cap; part of W-106			Amphenol #63-1 black	#3075-12	O-102	1
O-103	CLIP; test; steel cad plate; 1 1/2" lg x 5/16" wd x 1/2" h overall; one pierced hole for solder connection; (see note) 3/8" maximum jaw opening; supplied less terminal screw, solder connection required; (see note)	Replacement Test Clip; part of W-102 and W-103			Mueller #45 Pee Wee	#3300-3	O-103	2
P-101	CONNECTOR, plug; one r'nd male contact, nickel plated brass 3/32" diam x 7/16" lg; straight; red phenolic head 25/64" diam x 3/8" lg; overall dimen 25/64" diam x 13/16" lg; will accommodate #18 AWG wire; solder connection to wire.	Replacement Plug; part of W-101, W-102, W-103, W-105 and W-106			Amphenol part #71-1S Red	#16526-29	P-101	5
P-102	CONNECTOR, plug; one r'nd male contact, nickel plated brass, 3/32" diam x 7/16" lg; straight; black phenolic head 25/64" diam x 3/8" lg; overall dimen 25/64" diam x 13/16" lg; will accommodate #18 AWG wire; solder connection to wire.	Replacement Plug; Part of W-101 and W-104			Amphenol part #71-1S Black	#16525-40	P-102	2

TABLE 8-4 (Cont.) COMBINED PARTS AND SPARE PARTS LIST

PARTS									
SYMBOL DESIG.	NAME OF PART AND DESCRIPTION	FUNCTION	AWS, JAN OR NAVY TYPE DESIG.	NAVY STOCK NO.	ARMY STOCK NO.	MFR AND MFR'S DESIG.	CONTRACTOR'S DWG AND PART NO.	ALL SYMBOL DESIGNA- TIONS INVOLVED	TOTAL NO PER EQUIP
P-103	CONNECTOR, plug; 5 round male contacts, nickel plated brass, .125" diam x $\frac{9}{16}$ " lg, to fit standard 5 pin tube socket; straight; overall dimensions $1\frac{1}{8}$ " diam x $\frac{3}{8}$ " lg excluding contacts; round phenolic body.	Replacement Socket Connection; part of W-102				Amphenol part #71-5	#16525-1	P-103	1
P-104	CONNECTOR, plug; two flat parallel blades; straight; $1\frac{3}{8}$ " diam x $1\frac{1}{16}$ " lg overall excluding terminals; 15 amps 125 volts 10 amps 250 volts; round rubber body; molded rubber insert; cable opening .260" to .312"	Replacement Plug for W-107				Bryant type HRB	#16525-3S	P-104	1
R-101	Note: P-104 is listed as a replacement part only and is not used on original equipment.								
R-101	RESISTOR, fixed; Composition; 37,000 ohms p/m $1\frac{1}{2}$ watt; F characteristic; $\frac{5}{8}$ " long x $1\frac{1}{16}$ " diam; insulated, moisture resistant; 2 axial wire leads; polyvinyl chloride insulating sleeve.	Dropping Resistor Line Test Circuit		N16-R-73135-6901	3Z6637	Wilkor Prod. Carbolim #CP 1-2	Part #X-18525-378 Dwg #A-592	R-101	1
R-102	RESISTOR, fixed; wire wind; 150 ohms p/m $1\frac{1}{2}$ watt; body dimen $\frac{3}{4}$ " lg x $\frac{3}{8}$ " diam excluding term; resistant to humidity; two radial wire stub terminals; ceramic body; p/o Navy Model TV-3/U Tube Tester.	Load Resistor Rectifier Test		N16-R-81199-9849	3Z6015-102	Hickok Part #18673-218 (150)	Part #18673-218 (150) Dwg #19430-32	R-102	1
R-103	RESISTOR, fixed; wire wind; JAN type RW31F101T; 100 ohms p/m $5\frac{1}{2}$ C/T; 10 watts; Spec #JAN-R-26A	Provides Center Top for Filament in Filament Type Tubes	RW31F101T	N16-R-67393-2596	3RW18326	Hickok Part #X-18575-19	Part # X-18575-19	R-103	1
R-104	RESISTOR, fixed; Composition; JAN type RC20BF184K; 180,000 ohms p/m $10\frac{1}{2}$ watt; Spec. # JAN-R-11	Series Resistor Gas Test Circuit	RC20BF184K	N16-R-50696-811	3RC20BF184K	Hickok Part #X-18414-182	X-18414-182	R-104	1

R-106	RESISTOR, fixed; Composition: JAN type RC30BF122K; 1200 ohms p m 10 ⁶ ; 1 watt; Spec #JAN-R-11	Limiting Resistor Diode Test Circuit	RC30BF122K	N16-R-40941-231	3RC30BF122-K	Hickok Part #X-18422-122	X-18422-122	R-106	1
R-107	RESISTOR, fixed; wire w'nd; JAN type RW31F182; 1800 ohms p m 5 ⁷ ; 10 watts; Spec #JAN-R-26A	Limiting Resistor 0Z4 Test Circuit	RW31F182	N16-R-66094-5706	3RW25819	Hickok Part #X-18575-12	X-18575-12	R-107	1
R-108	RESISTOR, fixed; wire w'nd; 45 ohms p m 1 ⁷ ; 1/2 watt; body dimen 1/2" lg x 1/2" diam excluding term; resistant to humidity; two radial wire stub terminals 1/8" lg; ceramic body; p/o Navy Model TV-3 U Tube Tester	Meter Shunt Rectifier Test Circuit		N16-R-81081-8369	3Z6004E5-12	Hickok Part #18673-312 (45)	Part #18673-312 (45) Dwg #19430-33	R-108	1
R-109	RESISTOR, fixed; Composition: JAN type RC30BF153J; 15000 ohms p m 5 ⁷ ; 1 watt; Spec #JAN-R-11	Limiting Resistor Tube Test, Plate Circuit	RC30BF153J	N16-R-50335-751	3RC30BF153J	Hickok Part #X-18423-151	X-18423-151	R-109 R-134	2
R-110	RESISTOR, fixed; Composition: 800 ohms p m 1 ⁷ ; 1/2 w; "p" characteristic; 3/8" lg x 1/8" diam, insulated; moisture resistant; two axial wire leads; polyvinyl chloride insulating sleeve.	Part of Voltage Divider Signal Volts		N16-R-72478-7158	3Z6080-66	Wilkor Prod. Type CP1 ₂	Part #18525-402 Dwg. A-592	R-110	1
R-111	RESISTOR, fixed; Composition: 200 ohms p m 1 ⁷ ; 1/2 w; "p" characteristic; 3/8" lg x 1/8" diam; insulated; moisture resistant; two axial wire leads; polyvinyl chloride insulating sleeve.	Same as R-110		N16-R-72419-2958	3Z6020-260	Wilkor Prod. Type CP1 ₂	Part #18525-401 Dwg #A592	R-111	1
R-112	RESISTOR, variable; wire wound; dual section 150 ohms each section; p/m 5 ⁷ ; 4 watts max; 3 solder lug term each section; metal case 1 3/4" diam x 1 7/8" deep including both sections; enclosed; round metal shaft 1/4" diam x 3/8" lg from mtg surface; linear; contact arms insulated from case; normal torque; 3/8-32 mtg bushing 1/4" lg from mtg surface; both sections must be within 5% of 150 ohms but each section must also be within 1% of the total resistance of the other section; adjusted at contractors factory; p/o Navy Tube Tester model TV-3/U	Shunt Potentiometer Control of Meter Sensitivity		N16-R-92231-4291	3Z7150-9	Hickok Part #16926-1	Part #16926-1 Dwg #16925-4	R-112 R-117	1

TABLE 8-4 (Cont.) COMBINED PARTS AND SPARE PARTS LIST

PARTS									
SYMBOL DESIG.	NAME OF PART AND DESCRIPTION	FUNCTION	AWS, JAN OR NAVY TYPE DESIG.	NAVY STOCK NO.	ARMY STOCK NO.	MFR AND MFR'S DESIG.	CONTRACTOR'S DWG. AND PART NO.	ALL SYMBOL DESIGNATIONS INVOLVED	TOTAL NO PER EQUIP.
R-113	RESISTOR, variable; wire wound JAN type RP101FD-201KK; 200 ohms p/m 10%; Spec JAN-R-22	Line Adjust Rheostat	RP101FD201-KK	N16-R-90301-2675	3RP6007	Hickok Part #X-18750-13	X-18750-13	R-113	1
R-114	RESISTOR, fixed; Composition; 15 ohms p/m 1%; 1 w; "F" characteristic; 1/8" lg x 9/16" diam; non-insulated; resistant to humidity; two radial wire leads.	Part of Voltage Divider Bias and Screen Volts		N16-R-73454-3176	3Z6001E18-3	Continental Carbon Type X-1	Part #18550-99 Dwg A-623	R-114	1
R-115	RESISTOR, fixed; Composition; 640 ohms p/m 1%; 1 watt; "F" characteristic; 7/8" lg x 2/16" diam; insulated, moisture resistant; 2 axial wire leads; polyvinyl chloride insulating sleeve.	Dropping Resistor for 5Y3 Plate Voltages		N16-R-72964-8201	3Z6004-3	Wilkor Prod. Carbolfilm #CP 1	Part #X-18550-98, Dwg #A-592	R-115	1
R-116	RESISTOR, variable; wire wound 3000 ohms p/m 10%; 1 watt; 3 terminal nuts with solder lugs; phenolic case 17/32" diam x 7/8" deep; open; round shaft 1/4" diam x 3/4" lg from mtg surface; special taper, 35% rotation 466 ohms, 50% rotation 882.2 ohms, 65% rotation 1583 ohms; Contact arm grounded to mtg bushing; normal torque; 3-32 bushing 3/8" lg from mtg surface, p/o Navy Tube Tester model TV-3/U	Bias Potentiometer Controls Bias Voltage Divider Screen and Bias Volts		N16-R-90301-1305	3Z7330-23	Hickok Part #16927-1	Part/Dwg #16927-1	R-116	1
R-117	RESISTOR, Same as R-112	Part of R-112							
R-118	RESISTOR, adjustable; wire wound; 8500 ohms p/m 10%; watts; one adjustable sliding contact; 9/16" diam x 1 3/4" lg; two mtg brackets supplied; vitreous enamel; two radial tab terminals, one sliding tab terminal	Part of Voltage Divider Used for Calibrating Bias Voltage		N16-R-43688-3689	3Z6585-10	Mallory Part #1AV8500	Part #18575-89	R-118	1

R-119	RESISTOR, fixed; Composition: 390,000 ohms p m 1/2; 1/2 watt; F characteristic; 5/8 long x 1/64" diam; insulated, moisture resistant; 2 axial wire leads; polyvinyl chloride insulating sleeve.	Part of Ohmmeter Voltage Divider		N16-R-73258-7057	3Z6739-12	Wilkor Prod. Carbofilm #CP 1/2	Part #X-18523-368 Dwg #A-592	R-119 R-120	2
R-120	RESISTOR, Same as R-119	Same as R-119						R-121 R-122 R-123	3
R-121	RESISTOR, fixed; Composition: JAN type RC20BF470K; 47 ohms p m 10/2; 1/2 watt; Spec. #JAN-R-11	Neutralizing Resistor	RC20BF470K	N16-R-40427-811	3RC20BF470K	Hickok Part #X-18410-472	X-18410-472		
R-122	RESISTOR, Same as #R-121	Same as R-121							
R-123	RESISTOR, Same as R-121	Same as R-121							
R-124	RESISTOR, fixed; Composition: 40,000 ohms p m 1/2; 1/2 watt; F characteristic; 5/8 long x 1/64" diam; insulated, moisture resistant; 2 axial wire leads; polyvinyl chloride insulating sleeve.	Part of Ohmmeter Voltage Divider		N16-R-73139-7657	3Z6640-93	Wilkor Prod. Carbofilm #CP 1/2	Part #X-18523-373 Dwg #A-592	R-124	1
R-125	RESISTOR, fixed; Composition: 1400 ohms p m 1/2; 1/2 watt; F characteristic; 5/8 long x 1/64" diam; insulated, moisture resistant; 2 axial wire leads; polyvinyl chloride insulating sleeve.	Part of Meter Shunt Mills Ranges		N16-R-73000-9867	3Z6140-12	Wilkor Prod. Carbofilm #CP 1/2	Part #X-18523-370 Dwg. #A-592	R-125	1
R-126	RESISTOR, fixed; wire wind; 172.2 ohms p m 1/2; 1/2 watt; body dimen 5/32 lg x 1/2 diam excluding term; resistant to humidity; two radial wire stub terminals 1/8" lg; ceramic body; p. o. Navy Model TV-3 U Tube Tester	Part of Meter Shunt Mills Ranges		N16-R-81205-5279	3Z6017 B2-2	Hickok Part #18673-319 (172.2)	Part #18673-319 (172.2) Dwg #19430-33	R-126	1
R-127	RESISTOR, fixed; wire wind; 35.92 ohms p m 1/2; 1/2 watt; body dimen 5/32 lg x 1/2 diam excluding term; resistant to humidity; two radial wire stub terminals 1/8" lg; ceramic body; p. o. Navy Model TV-3 U Tube Tester	Part of Meter Shunt Mills Ranges		N16-R-81073-5099	3Z6003E5-24	Hickok Part #18673-311 (35.92) Dwg #19430-33	Part #18673-311 (35.92) Dwg #19430-33	R-127	1

TABLE 8-4 (Cont.) COMBINED PARTS AND SPARE PARTS LIST

PARTS									
SYMBOL DESIG.	NAME OF PART AND DESCRIPTION	FUNCTION	AWS, JAN OR NAVY TYPE DESIG.	NAVY STOCK NO.	ARMY STOCK NO.	MFR AND MFR'S DESIG.	CONTRAC- TOR'S DWG AND PART NO.	ALL SYMBOL DESIGNA- TIONS INVOLVED	TOTAL EQUIP.
R-128	RESISTOR, fixed; wire w'nd; 3.98 ohms p/m 1%; 1/2 watt; body dimen 5/32" lg x 1/2" diam excluding term; resistant to humidity; two radial wire stub terminals; ceramic body; p/o Navy Model TV-3/U Tube Tester	Part of Meter Shunt Mils Ranges		N16-R-80907- 8699	3Z5993J9-1	Hickok Part #18673-303 (3.98)	Part #18673- 303 (3.98) Dwg #19430-33	R-128	1
R-129	RESISTOR, fixed; Composition; JAN type RC20BF334K; 330,000 ohms p/m 10%; 1/2 watt; Spec. #JAN-R-11	Shunt for Neon Lamp	RC20BF334K	N16-R-50759- 811	3RC20BF334K	Hickok Part #X-18414-332	X-18414-332	R-129	1
R-130	RESISTOR, fixed; Composition; 1900 ohms p/m 1%; 1/2 watt; F characteristic; 5/8" long x 1/64" diam; insulated, moisture resistant; 2 axial wire leads; polyvinyl chloride insulating sleeve.	Part of Ohmmeter Voltage Divider		N16-R-73009- 4101	3Z6190-15	Wilkor Prod. Carbofilm #CP 1/2	Part #X-18525- 377 Dwg #A-592	R-130	1
R-131	RESISTOR, fixed; Composition; 1050 ohms p/m 1%; 1/2 watt; F characteristic; 5/8" long x 1/64" diam; insulated, moisture resistant; 2 axial wire leads; polyvinyl chloride insulating sleeve.	Part of Meter Shunt Voltmeter		N16-R-72994- 4551	3Z6105-2	Wilkor Prod. Carbofilm #CP 1/2	Part #X-18525- 375 Dwg #A-592	R-131	1
R-132	RESISTOR, fixed; Composition; 19,200 ohms p/m 1%; 1/2 watt; F characteristic; 5/8" long x 1/64" diam; insulated, moisture resistant; 2 axial wire leads; polyvinyl chloride insulating sleeve.	Part of Voltmeter Multiplier Network		N16-R-73110- 9701	3Z6619B2-2	Wilkor Prod. Carbofilm #CP 1/2	Part #X-18525- 374 Dwg #A-592	R-132	1
R-133	RESISTOR, fixed; Composition; 850 ohms p/m 1%; 1/2 watt; F characteristic; 5/8" long x 1/64" diam; insulated, moisture resistant; 2 axial wire leads; polyvinyl chloride insulating sleeve.	Part of Meter Shunt Voltmeter		N16-R-72983- 6757	3Z6085-6	Wilkor Prod. Carbofilm #CP 1/2	Part #X-18525- 376 Dwg #A-592	R-133	1

R-134	RESISTOR, fixed; Same as R-109	Limiting Resistor Short Check	N16-R-81195-1049	3Z600615-8	Hickok Part #18673-414 (65)	Part #18673-414 (65) Dwg #19430-34	R-135	1
R-135	RESISTOR, fixed; wire wind; 65 ohms p m 1°C; 1 watt; body dimen 1 1/4" lg x 3/4" diam excluding term; resistant to humidity; two radial wire stub terminals 1/8" lg; ceramic body; p o Navy Model TV-3 U Tube Tester	Capacity Calibration 0-50MF	N16-R-81283-8089	3Z6058-3	Hickok Part #18673-224 (580)	Part #18673-224 (580) Dwg #19430-32	R-136	1
R-136	RESISTOR, fixed; wire wind; 580 ohms p m 1°C; 1/2 watt; body dimen 3/4" lg x 3/8" diam excluding term; resistant to humidity; two radial wire stub terminals 1/8" lg; ceramic body; p o Navy Model TV-3 U Tube Tester	Capacity Calibration 0-5MF	N16-R-73216-3057	3Z6718-27	Wilkor Prod. Carbofilm #CP 1/2	Part #X-18525-345 Dwg #A-592	R-137	1
R-137	RESISTOR, fixed; Composition; 180,000 ohms p m 1°C; 1/2 watt; F characteristic; 5/8" long x 1/64" diam; insulated, moisture resistant; 2 axial wire leads; polyvinyl chloride insulating sleeve.	Part of Voltmeter Multiplier Network	N16-R-73243-8257	3Z6730-48	Wilkor Prod. Carbofilm #CP 1/2	Part #X-18525-393 Dwg #A-592	R-138	1
R-138	RESISTOR, fixed; Composition; 300,000 ohms p m 1°C; 1/2 watt; F characteristic; 5/8" long x 1/64" diam; insulated, moisture resistant; 2 axial wire leads; polyvinyl chloride insulating sleeve.	Part of Voltmeter Multiplier Network	N16-R-73271-1558	3Z6750-107	Wilkor Prod. Carbofilm #CP 1/2	Part #X-18525-392 Dwg #A-592	R-139	1
R-139	RESISTOR, fixed; Composition; 500,000 ohms p m 1°C; 1/2 W; F characteristic; 5/8" lg x 1/64" diam; insulated, moisture resistant; 2 axial wire leads; polyvinyl chloride insulating sleeve.	Part of Voltmeter Multiplier Network	N17-S-63709-5349	3Z9825-62-379	Oak #39641-1.2	Part/Dwg #X-19912-160	S-101	1
S-101	SWITCH, rotary; 18 position 1 section; silver brass contact Phenolic insulation; Body dim 2 5/16" x 1 5/16" d behind mtg surface; non shorting; solder lug term; Single hole mtg bushing ing 3/8" x 1/4" lg from mtg surface; 1/4" diam shaft 3/4" lg from mtg surface; flattened shaft; p o Navy Model TV-3 U Tube Tester	Filament Voltage Selector						

TABLE 8-4 (Cont.) COMBINED PARTS AND SPARE PARTS LIST

PARTS									
SYMBOL DESIG.	NAME OF PART AND DESCRIPTION	FUNCTION	AWS, JAN OR NAVY TYPE DESIG.	NAVY STOCK NO.	ARMY STOCK NO.	MFR AND MFR'S DESIG.	CONTRAC- TOR'S DWG. AND PART NO.	ALL SYMBOL DESIGNA- TIONS INVOLVED	TOTAL NO.
S-102	SWITCH, push; seven sections each of which is operated by a separate push button independently of the other sections; #1 section, one SPST switch normally open, operated by push button P 1; #2 section, one DPST shorting type switch normally open and one SPDT non shorting type switch, both operated by push button P 2; #3 section, one SPDT non shorting type switch and one DPST switch normally open, both operated by push button P 3; #4 section, one DPST non shorting type, both operated by push button P 4; #5 section, one DPST switch normally open, operated by push button P 5; # 6 section, one SPST switch normally open, operated by push button P 6; #7 section, one SPDT non shorting switch, one SPST switch normally open, one DPDT non shorting switch, all three operated by push button P 7; (for contact arrangement refer to Hickok dwg. #X-19910-50); metal frame with bakelite insulation; o/a body dimensions 6 11/16" lg x 1 5/16" high x 1 15/16" d behind mtg surface, excluding push rods and terminals; shorting type contacts on sections 2 and 3 only as indicated on Hickok Dwg #X - 19910-50; momentary; solder lug term; two .140" mtg holes on 6 1/8" mtg/c seven push rods; .032" thk x 3/16" wd extend 7/8" from mtg surface; p/o Navy Model TV-3/U Tube Tester.	Apply proper voltages for Various Tests		N17-S-38845-3931	3Z9824-38.3	Oak #39644-130	Part Dwg. #X-19910-30	S-102	1

S-103	SWITCH, rotary; 10 position; 5 sections; silver brass cont; Bakelite insulation; Body dim 1 7/8" x 2 1/8" overall d behind mtg surface; non-shorting solder lug term; Single hole mtg; bushing 3/8" x 3/8" lg from mtg surface; 1/4" diam shaft 1 3/16" lg from mtg surface; flattened shaft; p/o Navy Model TV-3 U Tube Tester.	Connects one side of Filament to Selected Socket Contact	N17-S-66623-4964	3Z9825-62-378	Oak #39646-H5	Part/dwg #X-19912-159	S-103 S-104 S-105 S-108 S-109	5
S-104	SWITCH, Same as S-103	Connects one side of Filament to selected Socket contact						
S-105	SWITCH, Same as S-103	Connects Grid to Selected Socket Contact						
S-106	SWITCH, toggle; SPST JAN type ST42A; Spec. JAN-S-23	Power, ON-OFF, Switch	N17-S-70412-4406	3Z9863-42A	Hickok Part #X-19911-31	X-19911-31	S-106	1
S-107	SWITCH, toggle; SPDT JAN type ST42D; Spec. JAN-S-23	High, Low Signal Switch	N17-S-71894-1544	3Z9863-42D	Hickok Part #X-19911-30	X-19911-30	S-107	1
S-108	SWITCH, Same as S-103	Connects Plate to Selected Socket Contact						
S-109	SWITCH, Same as S-103	Connects Screen to Selected Socket Contact						
S-110	SWITCH, rotary; 10 position; 1 section; silver brass cont; bakelite insulation; Body dim. 1 7/8" x 1 3/16" overall d, behind mtg surface; non-shorting; solder lug term; Single hole mtg bushing 3/8" x 3/8" lg from mtg surface; 1/4" diam shaft 1 3/16" lg from mtg surface; flattened shaft; p/o Navy Model TV-3 U Tube Tester	Connects Cathode to Selected Socket Contact	N17-S-60322-7969	3Z9825-62-377	Oak #39642-H1	Part/dwg #X-19912-158	S-110	1
S-111	SWITCH, toggle; DPDT; JAN type ST32N; Spec. JAN-S-23	Meter Reversing Switch	N17-S-73959-1059	3Z9863-52N	Hickok Part #X-19911-29	X-19911-29	S-111 S-114	2
S-112	SWITCH, rotary; 11 position; 5 sections; silver brass cont; Bakelite insulation; Body dim. 1 7/8" x 1 9/16" oval, 3/16" d; non-shorting solder lug term; Single hole mtg, bushing 3/8" x 3/8" x 1 1/4" lg from mtg surface; 1/4" diam shaft 5/8" lg from mtg surface; flattened shaft; p/o Navy Model TV-3/U Tube Tester.	Master Switch Selects Functions and Ranges	N17-S-66623-6814	3Z9825-62-376	Oak #39645-H5	Part/dwg X-19912-161	S-112	1

TABLE 8-4 (Cont.) COMBINED PARTS AND SPARE PARTS LIST

PARTS									
SYMBOL DESIG.	NAME OF PART AND DESCRIPTION	FUNCTION	AWS, JAN OR NAVY TYPE DESIG.	NAVY STOCK NO.	ARMY STOCK NO.	MFR AND MFR'S DESIG.	CONTRACTOR'S DWG. AND PART NO.	ALL SYMBOL DESIGNATIONS INVOLVED	TOTAL PER FORN C/P
S-113	SWITCH, rotary; 6 position; 5 section; silver brass cont; Bakelite insulation; Body dim. 1 7/8" x 1 9/16" oval, 2 5/16" d; non-shorting; solder lug term. Single hole mounting, 3/8-32 bushing 7/4" lg from mtg surface, 1/4" diam shaft 5/8" lg from mtg surface; flattened shaft; p/o Navy Model TV-3/U Tube Tester	Shorty Test Switch		N17-S-66623-5044	3Z9825-62-375	Oak #39613-H5	Part/dwg #X-19912-157	S-113	1
S-114	SWITCH, Same as S-111	Meter Reverse Switch							
S-115	SWITCH, Same as S-110	Same as S-110							
T-101	TRANSFORMER, power; filament and plate type; pri 93 V.A.C., 35 amps, 50 to 1600 cycles, single phase; seven secondary windings; secd #1, 117 V @ 3A tapped at 75 V @ .3 A, 50 V @ .3 A, 35 V @ .3 A, 25 V @ .3 A, 20 V @ .3 A, 12.6 V @ .3 A, 10 V @ .3 A, 7.5 V @ .3 A, 6.3 V @ .3 A, 5 V @ .3 A, 4.3 V @ .3 A, 3.0 V @ .3 A, 2.5 V @ .3 A, 2 V @ .3 A, 1.5 V @ .3 A, and 1.1 V @ .3 A; secd #2, 5 V @ 3 A C/T; secd #3, 5 V @ 2 A C/T; secd #4, 320 V @ 20 ma; C/T; secd #5, 5 V @ 30 ma; secd #6, 170 V @ 70 ma, tapped at 20 V; secd #7, 170 V @ 70 ma; secd #1, 750 turns total, 80 1/2 turns #19 wire, 669 1/2 turns #31 wire; secd #2, 34 turns #19 wire C/T; secd #3, 34 turns #24 wire C/T; secd #4, 20 turns #34 wire C/T; secd #5, 31 turns #31 wire C/T; secd #6, 1050 turns #33 wire tapped at 930 turns; secd #7, 1050 turns #33 wire; open frame construction; o/a dimen excluding terminals 3 1/16" x 2 3/4" x 3 3/8"; 22 solder lug terminals on top, 14 wire lead terminals on bottom; clamp mtg; see Hickok dwg #X-20800-85; acetate insulation; moisture and fungus proofed per JAN-I-152; p/o Navy Tube Tester Model TV-3/U.	Meter Reverse Switch Power Transformer		N17-T-75489-5451	2Z9619-220	Hickok Part #X-20800-85	Part/dwg #X-20800-85	T-101	1

V-101	TUBE, electron; JAN type 83; full wave mercury vapor rectifier.	Rectifier Plate Supply	83	N16-T-60830	2J83	Hickok Part #X-20875-28	X-20875-28	V-101	1
V-102	TUBE, electron; JAN type 5Y3 GT/G full wave rectifier.	Rectifier Screen and Bias Supply	5Y3 GT/G	N16-T-55735	2J5Y3GT	Hickok Part #X-20875-6	X-20875-6	V-102	1
W-101	LEAD, grid and plate for light-house tubes; two #18 AWG stranded copper conductors; 16 #30 AWG strands; neoprene insulation, one red & one black; 5 1/2" lg excluding term; both leads terminated one end in special grid and plate connector for light-house tubes U-cinite #J-1348; 1 & 2, other end of red lead terminated in Amphphenol #71-1S red tip plug, other end of black lead terminated in Amphphenol #71-1S black tip plug; u/w Navy Tube Tester model TV-3/U.	Adapter for Making Contact to Grid and Plate of Light House Tubes		N17-L-64608-5801	3E8000-5	U-cinite #J-1348	1050-7	W-101	1
W-102	LEAD, test: One each of #18 AWG stranded copper conductor 41 #34 AWG strands 1/32" rubber jacket color coded black and red respectively; Red lead 44" long excluding term, black lead 14" long excluding term; One American Phenolic #71-5 speaker plug connects one end of each lead; opposite end black lead connected to American Phenolic #71-1S black midget plug, opposite end red lead connected to Mueller Electric numbers 45 battery clip and #87 red insulator; p/o Navy Tube Tester Model TV-3/U.	Adapter for Checking Low Value Capacitors		N17-L-64604-3492	3E8000-44	Hickok Part #X-12450-8	Part/dwg #X-12450-8	W-102	1
W-103	LEAD, test: One #18 AWG stranded copper conductor, 41 #34 AWG strands 1/32" black rubber; 7 1/4" long excluding term; American Phenolic #71-1S black midget tip plug on one end and Mueller Electric number 87 insulator and 45 battery clip on other end; p/o Navy Tube Tester Model TV-3/U.	Connects Top Cap of Tubes to Plate Jack		N17-L-63201-4677	3E8000-7	Hickok Part #X-12450-145	Part/dwg #X-12450-145	W-103	1

TABLE 8-4 (Cont.) COMBINED PARTS AND SPARE PARTS LIST

PARTS									
SYMBOL DESIG.	NAME OF PART AND DESCRIPTION	FUNCTION	AWS, JANIOR NAVY TYPE DESIG.	NAVY STOCK NO.	ARMY STOCK NO.	MFR AND MFR'S DESIG.	CONTRACTOR'S DWG. AND PART NO.	ALL SYMBOL DESIGNATIONS INVOLVED	TOTAL PER EQUIP
W-104	LEAD, test: #18 AWG stranded copper conductor, 41 #34 AWG strands, paper wrap, 1/8" red rubber insulation; 4 ft long including terminations; American Radio Hdwe #145 red test prod on one end and Amphenol #71-1S red tip plug on other end; p/o Navy Multimeter TV-3/U	Positive Test Lead for Multimeter Section		N17-L-63205-4185	3E8000-48.1	Hickok Part #X-12450-152	Part/dwg #X-12450-152	W-104	1
W-105	LEAD, test: #18 AWG stranded copper conductor, 41 #34 AWG strands, paper wrap, 1/8" black rubber insulation; 4 ft long including terminations; American Radio Hdwe #145 black test prod on one end and Amphenol #71-1S black tip plug on other end; p/o Navy Multimeter TV-3/U	Negative Test Lead for Multimeter Section		N17-L-63205-4190	3E8000-48	Hickok Part #X-12450-153	Part #X-12450-153 Dwg #X-12450-152	W-105	1
W-106	LEAD, test: One #18 AWG stranded tinned copper conductor, 7 #28 AWG strands 1/8" neoprene black; 10" lg excluding term; One American Phenolic #71-1S black midget tip plug at one end and one Amphenol #63-1 grid cap at other end; p/o Navy Tube Tester Model TV-3/U	Connects Top Caps of Tubes to Grid Jack		N17-L-63201-7851	3E8000-10.5	Amphenol #63-1W	Part/dwg #X-12450-180	W-106	1
W-107	CABLE ASSEMBLY, power: underwriters type SJ, two #18 AWG stranded conductors, 300 volts working; 7 ft lg excluding terminations Cornish Wire #52 R two contact male appliance plug on one end, other end stripped 3/4" and tinned; u/w Navy Tube Tester Model TV-3/U	AC Line Cable		N17-C-48234-4017	3E7350.1-84.6	Cornish Wire #S-108	Part #3675-11	W-107	1

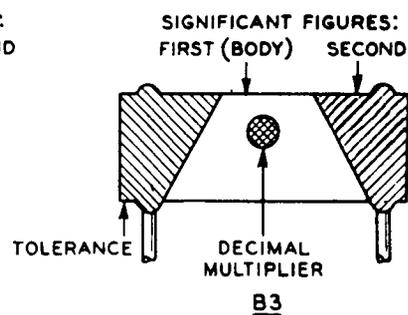
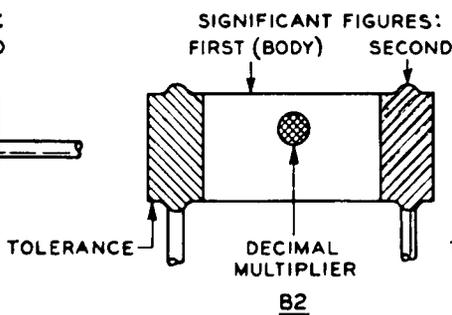
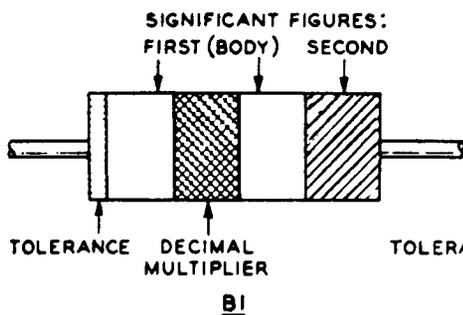
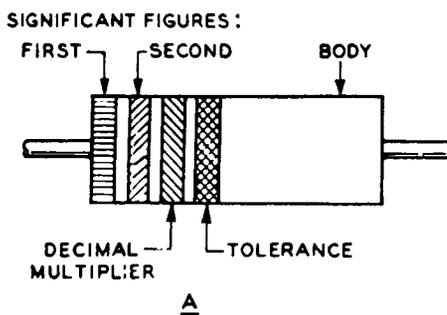
TABLE 8-4 (Cont.) COMBINED PARTS AND SPARE PARTS LIST

PARTS									
SYMBOL DESIG.	NAME OF PART AND DESCRIPTION	FUNCTION	AWS, JAN OR NAVY TYPE DESIG.	NAVY STOCK NO.	ARMY STOCK NO.	MFR AND MFR'S DESIG.	CONTRAC- TOR'S DWG. AND PART NO.	ALL SYMBOL DESIGNA- TIONS INVOLVED	TOTAL NO. PER EQUIP.
X-106	SOCKET, tube; 7 contact; large and small; Retainer ring mounting; One $1\frac{11}{64}$ " keyed mtg hole; Round mica filled brown bakelite 1.172 " dia x $\frac{7}{16}$ " h excluding term; brass cad plated; pilot light test socket in center.	7 Pin Tube Test Socket		N16-S-62762-2635	2Z8677.140	Amphenol 78-7C111	Part #X-19350-71	X-106	1
X-107	SOCKET, tube; 8 contact, octal; Retainer ring mounting; One $1\frac{11}{64}$ " keyed mtg hole; Round mica filled brown bakelite 1.172 " dia x $\frac{7}{16}$ " h, excluding term; brass cad plated.	8 Pin (Octal) Tube Test Socket		N16-S-63462-8245	2Z8678.318	Amphenol 78-S8T	Part #X-19350-73	X-107	1
X-108	SOCKET, tube; 8 contact, loktal; Retainer ring mounting; One $1\frac{11}{64}$ " keyed mtg hole; Round mica filled brown bakelite 1.172 " dia x $\frac{7}{16}$ " h, excluding term; brass cad plated.	8 Pin (Loktal) Tube Test Socket		N16-S-63579-2635	2Z8678.35	Amphenol 78-8L1	Part #X-19350-72	X-108	1
X-109	SOCKET, tube; 7 contact miniature; Saddle mtg; Two $.140$ " mtg holes on $\frac{7}{8}$ " mtg/c; Round mica filled brown bakelite $1\frac{1}{8}$ " lg x $\frac{47}{64}$ " wd x $\frac{19}{64}$ " h, excluding term; brass cad plated.	7 Pin Miniature Tube Test Socket		N16-S-62603-6198	2Z8677.142	Amphenol #140-170-24	Part #X-19350-76	X-109	1
X-110	SOCKET, tube; 7 contact acorn type, special, for testing acorn tubes with either 5 or 7 radial pins; mounts under panel; five $\frac{3}{8}$ " diameter mtg holes in flange of shell, $1\frac{3}{16}$ " diam cut out in panel; round mica filled phenolic body $1\frac{7}{8}$ " diam x $1\frac{1}{2}$ " deep; phosphor bronze silver plated contacts; spring loaded round silver plated brass plunger contact in base for end pin connection; p/o Navy Tube Tester model TV-3/U.	Acorn Type Tube Socket		N16-S-62646-8291	2Z8677.139	Alden #457V-1	Part/dwg #19350-74	X-110	1

X-111	<p>SOCKET, tube: 9 contact miniature; Saddle mounting; Two .095" mtg holes on 1/8" mtg/c; Round mica filled brown bakelite 7/8" x 1 1/2" h excluding term; brass cadmium plated.</p>	9 Pin (Miniature) Tube Test Socket	N16-S-64063-6220	2Z8679.25	Cinch #53F12884	Part #X-19350-58	X-111	1
X-112	<p>SOCKET, tube: 8 contact, sub-miniature; one piece saddle mtg; two 1/8" diam mtg holes on 3/8" mtg/c; round mica filled phenolic body 3/8" diam x 1 9/16" h excluding terminals; flattened sides for locking in mtg saddle; phosphor bronze silver plated contacts; center shield 3/32" ID.</p>	Test socket for sub-miniature tubes	Part of S-102	N17-B-840101-117	2Z1480.47	Cinch Mfg. Corp. #8694	Part/dwg #19350-101	X-112
	<p>BUTTON, push: p/o Navy tube tester Model TV-3/U; Phenolic black; 13/32" length x 7/16" dia, push on type to fit .052" x 3/16" flat shaft, with spring; No dimension greater than 1"</p>	Part of S-102	N17-B-840101-118	2Z1480.48	Friedman Co. #S-330-30	Part #X-2920-7 Dwg. #2920-7		6
	<p>BUTTON, Push: p/o Navy tube tester Model TV-3/U; Phenolic, red 19/32" long x 7/16" dia, push on type to fit .052" x 7/16" dia, push on type to fit .052" x 3/16" flat shaft, with spring; No dimension larger than 1"</p>	Part of S-102	N17-K-700073-551	2Z5821-142	Hickok Part #11500-11	Part/dwg #11500-11		3
	<p>KNOB: bar, black phenolic; for 1/4" diam shaft; single 8-32 set screw; filled white dot; 1 1/2" lg x 7/8" wd x 13/16" h o/a; shaft hole 3/4" deep; small metal pointer on lower front edge.</p>	Adjustment Knob for all Rotary Switches with Indexing Etched on Panel	N17-K-700068-701	2Z5821-141	Hickok Part #11500-12	Part/dwg #11500-12		7
	<p>KNOB: bar, black phenolic; for 1/4" diam shaft; single 8-32 set screw; filled white dot; 1 1/2" lg x 7/8" wd x 13/16" h o/a; shaft hole 3/4" deep.</p>	Adjustment Knob for Selector Switches with Dials under Panel	N16-S-290001-101	6D18100	Hickok Part #X-3122-6 and X-3122-7	Part #X-3122-6 and Part #X-3122-7		1
	<p>SHEETS, instruction: operating data; Navy Tube Tester Model TV-3/U; cardboard, white stock, black print; Rectangular 4 1/2" wide x 16" long; Slides under flanged edging</p>	Operating Data						

TABLE 8-5. CROSS REFERENCE PARTS LIST (Cont.)

SIGNAL CORPS STOCK NO.	KEY SYMBOL	SIGNAL CORPS STOCK NO.	KEY SYMBOL	SIGNAL CORPS STOCK NO.	KEY SYMBOL
2J183	V101	2Z8679-25	X111	3Z6020-260	R111
2J5Y3GT	V102	2Z9619-220	T101	3Z6058-3	R136
2Z1480.47	Button, push black	3DA100-730	C105	3Z6064-3	R115
2Z1480.48	Button, push red	3DA250-479	C101	3Z6080-66	R110
2Z3718.135	I105	3DB100-45	C103	3Z6085-6	R13:
2Z3718.136	I104	3E7350.1-84.6	W107	3Z6105-2	R131
2Z3718.137	I103	3E8000-5	W101	3Z6140-12	R125
2Z3718.138	I102	3E8000-7	W103	3Z6190-15	R130
2Z3718.142	I101	3E8000-44	W106	3Z6585-10	R118
2Z3876.108	O101	3E8000-48	W105	3Z6619B2-2	R132
2Z5581-4	J101	3E8000-48.1	W104	3Z6637	R101
2Z5581-5	J102	3F3293-9.2	W101	3Z6640-93	R124
2Z5821-141	J101	3F4838-15.3	N101	3Z6718-27	R137
2Z5821-142	Knob, bar	3K2047121	CR101	3Z6730-48	R138
2Z5889-16	Knob, bar	3K3027221	C104	3Z6739-12	R119
2Z5952	E103	3KC20BF184K	C102	3Z6750-107	R139
2Z5956.16	E101	3KC20BF334K	R104	3Z7150-9	R112
2Z5991-3	I105	3RC20BF470K	R19	3Z7330-23	R116
2Z8674.158	I110	3RC30BF122K	R121	3Z9824-38.3	S102
2Z8674.159	X103	3RC30BF153J	R106	3Z9825-62.375	S113
2Z8675.92	X104	3RW18326	R109	3Z9825-62.376	S112
2Z8676.96	X105	3RW25819	R113	3Z9825-62.377	S110
2Z8677.139	X110	3Z5993J9-1	R103	3Z9825-62.378	S103
2Z8677.140	X106	3Z6001E18-3	R107	3Z9825-62.379	S101
2Z8677.142	X109	3Z6003E5-24	R128	3Z9863-42A	S106
2Z8678.35	X108	3Z6004E5-12	R114	3Z9863-42D	S107
2Z8678.318	X107	3Z6006E5-8	R127	3Z9863-52N	S111
2Z8678.319	X102	3Z6015-102	R108	6D10124-2	N101
		3Z6017B2-2	R135	6D18100	Sheets, Ins.
			R102	6Z6806.14	E102
			R126	6Z8332	J108

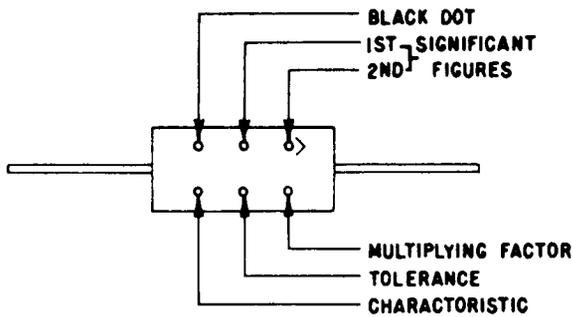


Color	First Significant Figure	Second Significant Figure	Decimal Multiplier	Tolerance
Black	0	0	1	—
Brown	1	1	10	± 1%
Red	2	2	100	± 2%
Orange	3	3	1,000	± 3%
Yellow	4	4	10,000	± 4%
Green	5	5	100,000	± 5%
Blue	6	6	1,000,000	± 6%
Violet	7	7	10,000,000	± 7%
Gray	8	8	100,000,000	± 8%
White	9	9	1,000,000,000	± 9%
Gold	—	—	0.1	± 5%
Silver	—	—	0.01	± 10%
No color	—	—	—	± 20%

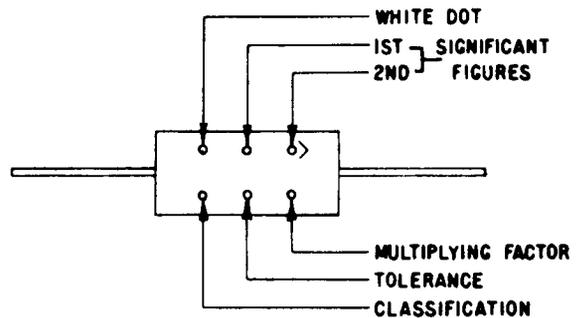
—Fixed Resistors: RMA and AWS Standard Color Codes

TABLE 8-6. APPLICABLE COLOR CODES — RESISTORS

JAN COLOR CODE
FOR
MOLDED MICA CAPACITORS



1946 RMA COLOR CODE
FOR
MOLDED MICA CAPACITORS



COLOR	SIGNIFICANT FIGURE	MULTIPLYING VALUE (MMF)	% TOL.	CHARA. #
BLACK	0	1	±20	A
BROWN	1	10		B
RED	2	100	±2	C
ORANGE	3	1,000		D
YELLOW	4	10,000		E
GREEN	5			F
BLUE	6			G
VIOLET	7			
GRAY	8			
WHITE	9			
GOLD		0.1	±5	
SILVER		0.01	±10	

* THESE LETTERS INDICATE COMBINATIONS OF VARIOUS ELECTRICAL CHARACTERISTICS. FOR DETAILS SEE SPECIFICATION JAN-C-5.

NOTE: VOLTAGE RATINGS VARY WITH CAPACITANCE.

NOTE: IF BOTH ROWS OF DOTS ARE NOT ON ONE FACE; ROTATE CAPACITOR ABOUT AXIS OF LEADS TO READ SECOND ROW ON SIDE OR REAR.

COLOR	SIGNIFICANT FIGURE	MULTIPLYING VALUE (MMF)	% TOL.	CLASS. #
BLACK	0	1	±20	A
BROWN	1	10		B
RED	2	100	±2	C
ORANGE	3	1,000	±3	D
YELLOW	4	10,000		
GREEN	5		±5	
BLUE	6			
VIOLET	7			
GRAY	8			I
WHITE	9			J
GOLD		0.1		
SILVER		0.01	±10	

* THESE LETTERS INDICATE COMBINATIONS OF VARIOUS ELECTRICAL CHARACTERISTICS PER RMA STANDARDS.

NOTE: VOLTAGE RATINGS VARY WITH CAPACITANCE.

NOTE: IF BOTH ROWS OF DOTS ARE NOT ON ONE FACE; ROTATE CAPACITOR ABOUT AXIS OF LEADS TO READ SECOND ROW ON SIDE OR REAR.

TABLE 8-7. APPLICABLE COLOR CODES — CAPACITORS

LIST OF MANUFACTURERS

ABBREVIATIONS	MFR'S PREFIX	NAME	ADDRESS
Alden.....	CYA	Alden Products Co.....	117 N. Main St., Brockton 64, Mass.
Amphenol.....	CPH	American Phenolic Corp.....	1830 S. 54th Ave., Chicago 50, Ill.
Bradley.....		Bradley Laboratories Inc.....	80 Meadow St., New Haven 10, Conn.
Cinch.....	CMG	Cinch Mfg. Corp.....	2335 W. Van Buren, Chicago 12, Ill.
Continental Carbon.....	CCC	Continental Carbon Co.....	13900 Lorain Ave., Cleveland, Ohio
Cornell Dubilier.....	CD	Cornell Dubilier Elec. Corp.....	333 Hamilton Blvd., S. Plainfield, N. J.
Cornish.....		Cornish Wire Co.....	Room 1010, 15 Park Row, New York, N. Y.
Drake.....	CAYS	Drake Mfg. Co.....	1713 W. Hubbard St., Chicago 22, Ill.
Eby.....	CEB	Hugh H. Eby Inc.....	18 W. Cheltenham Ave., Phila. 44, Penna.
Friedman.....		Friedman Co.....	220 West 23rd St., New York, N. Y.
G. E.....	CG	General Electric Co.....	1 River Road, Schenectady, N. Y.
Kurz-Kasch.....	CAUP	Kurz-Kasch Co. Inc.....	1417 S. Broadway, Dayton 1, Ohio
Mallory.....	CMA	P. R. Mallory & Co.....	3029 E. Washington St., Indianapolis, Ind.
Oak Mfg. Co.....	COC	Oak Mfg. Co.....	1260 Clybourne Ave., Chicago 10, Ill.
Solar.....	CSL	Solar Mfg. Co.....	1445 Hudson Blvd., N. Bergen, N. J.
Sylvania.....	CHS	Sylvania Elec. Prod. Inc.....	500 Fifth Ave., New York 18, N. Y.
Tung-Sol.....	CTL	Tung-Sol Lamp Works Inc.....	100 8th Ave., Newark 4, N. J.
Ucinite.....	CUF	The Ucinite Co.....	1 Nevada St., Newtonville, Mass.
Wilkor.....	CBIQ	Wilkor Products Co.....	3835 W. 150th St., Cleveland, Ohio