

**VACUUM TUBE TEST SET
HICKOK MODEL 531 (KS-13588 L1)
AND MODIFIED 530B (KS-13725 L1) TUBE TESTER
DESCRIPTION AND APPLICATION**

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1. GENERAL

1.01 This section describes the set and gives the methods for operating and maintaining the Hickok model 531 and modified 530B vacuum tube testers. These sets are capable of testing most low power amplifier and rectifier type tubes of Western Electric or other manufacture for which test sockets are provided (Paragraph 2.06). The tubes are tested at a fixed plate potential of about 150 volts less the IR drop in the circuits of the set. By suitable adjustment of the grid bias as prescribed, satisfactory tests may be made both on tubes normally operating at

lower plate potentials and on tubes normally operating at higher plate potentials up to about 300 volts.

1.02 Changes and improvements in the model 531 (KS-13588 L1) tube tester as compared with older 530B (KS-8235), models include:

(1) Replacement of the obsolete BANTAM miniature socket with a new "RED" 7-pin standard miniature socket wired to test miniature types with filament or heater connections to pins 3 and 4. This is to accommodate W.E. electron tubes of the 403B, 401A type and similar miniature types of other manufacture.

(2) A metal micromhos meter scale with additional ranges of 0-6000 and 0-15000 micromhos and designated "INDICATED TRANSCONDUCTANCE" replaces the translucent glass scale with dial lamp illumination previously provided. The additional meter ranges facilitate direct readings of Indicated Transconductance in conjunction with appropriate settings of the "L" potentiometer dial.

(3) A new roll chart designated model 531 by the manufacturer, provides test data for certain additional tubes of other than W.E.Co. manufacture which the set is capable of testing. The serial number designation of the set has been removed from the designation panel and now appears on a decalcomania transfer label on the inside partition of the cord compartment.

(4) The set incorporates improved electrical design features, principally improved power transformer winding insulation, moisture-proof varnish impregnation and glass braid or cellulose acetate insulated hookup wire.

1.03 Modified 530B Tube Tester (KS-13725 L1)

(1) Older model 530B or KS-8235 sets which have been modified by the Hickok Co. to include the "RED" 7-pin miniature socket (see Paragraph 1.02, Item (1)) have been designated KS-13725 L1. Additional changes (KS-13725 L1) also include any external test features not found in earlier manufacture of the model 530B sets, so that a modified set would be capable of all electrical tests covered in these practices for the model 531 (KS-13588 L1) tester. These changes are principally the addition of a 117N7 switch to reverse the micromhos meter as required, and in very old sets, the inclusion of the original "BLACK" 7-pin miniature test socket, in addition to the new "RED" 7-pin socket. Changes such as improved power transformer insulation or hookup wire are not found in modified 530B testers (KS-13725 L1).

(2) A limited number of sets delivered in the early part of 1946 bear the original KS-8235 and model 530B designation, but were modified in factory production to include the "RED" 7-pin miniature test socket only. Some of these sets also were equipped with micromhos meters utilizing the metal scale (see Paragraph 1.02, Item (2)). Although not so identified, such sets will be considered in these practices, as the equivalent of the KS-13725 L1 tester. Tubes which may be tested in the 7-pin socket have the designation "RED" after the code number on the chart and in Table I.

1.04 The model 531 and modified 530B testers provide means for the following tests:

(1) Measurement of the "indicated transconductance" in micromhos. The meter reading is proportional to the transconductance of the tube under test, but under test conditions is not a rigorous measurement of transconductance. For this reason it is referred to herein as "indicated transconductance."

(2) Test of the filament (or cathode) activity in terms of the change in transconductance for a 10 per cent reduction in filament voltage.

(3) Tests for internal short circuits by means of a neon lamp continuity test circuit.

(4) Test for excessive grid current due to the presence of gas or grid insulation leakage.

(5) Rectifier plate current tests for high vacuum and gas-filled thermionic rectifier tubes and low current diode detector types, based on measurement of rectified anode current. A few gas triode, thermionic grid controlled (thyratrons) and cold cathode tubes of other than Western Electric manufacture can also be checked in this set. W.E.Co. ballast lamps, cold cathode and small thyatron tubes cannot be tested.

(6) Small incandescent or neon type pilot lamps can also be checked in the set.

1.05 The only power supply required is commercial 60- or 50-cycle a-c power of 105 to 125 volts. Built-in rectifier circuits supply the necessary pulsating d-c potentials for the various tests.

1.06 General purpose information concerning the rejection limits for Western Electric tubes tested with the set is covered in Part 5 of this section. In particular applications, other test limits and other methods of test are specified for tubes in Bell System Practices describing the equipment involved. Where so given these should be followed in place of the limits and methods given in this section. Information regarding the tests for tubes of other than Western Electric manufacture is supplied in the form of a roll chart incorporated in the set, and in the manufacturer's instruction booklet furnished with the set.

1.07 The chart is revised from time to time by the manufacturer. The post card supplied with the set, which should be returned to the manufacturer with the amount of the charge for a revised chart, entitles the owner of the set to the next issue when made available. By repeating this procedure on receipt of the new chart the owner can be assured of having the latest information on tubes of other than Western Electric manufacture.

1.08 The 531 tube tester is identified also on the designation panel by the specification number (KS-13588 L1) to cover supplier requirements. The modified 530B (KS-8235) tester is marked with a supplementary designation KS-13725 List 1.

2. DESCRIPTION OF SET

(A) General

2.01 The set is self-contained in a carrying case for portable use. The outside dimensions of the case, including removable cover, are 14-1/4 inches by 13-3/4 inches and 6

inches deep. The net weight is about 20 pounds. It can be shipped in a suitable padded container similar to that in which it is shipped from the factory.

2.02 The set is intended to be used in a horizontal position and requires 105-125-volt, 60-cycle (or 50-cycle) a-c supply. The vacuum tube test data described in this Practice are based on 60-cycle operation, for which this set is designed. These data, however, should be satisfactory for all practical purposes when the set is operated on commercial 50-cycle supply. It will not operate on 25-cycle a-c supply.

2.03 The set is mounted on a metal foundation panel 13 inches deep and 10-3/4 inches wide, containing the MICROMHOS meter, a group of vacuum tube test sockets, a smaller control panel carrying various selector switches and potentiometer control dials, a neon lamp for short-circuit tests, an auto bulb fuse, two switches and a series of test push buttons, all suitably designated and arranged as shown in the attached photograph. A roll chart is provided below the control panel, giving the test adjustments for tubes of other than Western Electric manufacture. Arrows on the face of the set point from the figures on the roll chart to the selector switches and control dials to which they refer.

(B) Description of Equipment on Panel of Set

2.04 The principal meter (designated herein as the MICROMHOS meter) is a d-c milliammeter calibrated in micromhos. The 531 set has 3 basic scales corresponding to 0-3000, 0-6000 and 0-15000-micromho ranges, to read the indicated transconductance of the tube under test. Also a supplementary direct-reading scale designated GOOD (green) and REPLACE (red) is provided to test tubes without recourse to micromho readings. These color ranges normally are used for radio tubes listed on the roll chart and a few tubes in Table I. A single 0-3000-micromho meter scale range only is provided for older modified 530B (KS-8235) sets. In the case of rectifier and diode types, the value of rectified plate current in terms of the GOOD - REPLACE color ranges or DIODES OK index is also used as a criterion for rejection instead of micromhos (which is an indicated transconductance measurement).

2.05 A small a-c voltmeter, designated A.C. VOLTS and located externally to the main panel in the rear of the test cord space, is provided to indicate when the line voltage adjustment is correct, and to check the value of the external a-c supply voltage.

2.06 Eight types of push-type vacuum tube sockets are provided, which include the standard 4-, 5-, 6-, 7-prong bases and two 8-prong types for the OCTAL and LOKTAL type tube basis. The remaining sockets are for miniature tubes of the 7-pin type BLACK (left side) and RED 7-pin miniature (right side). Suitable adapters, not provided as part of the set, must be obtained for testing the following Western Electric tubes:

<u>Western Electric Tube</u>	<u>Standard Adapter</u>
101-, 102-, or 104-Type	Alden No. 944 WEB
205-Type	" No. 978 WEB
215A	" No. 972
380A, 384A or 386A (unbased)	W.E. per ED-62777-01 Group 1

Adapters are necessary for certain other Western Electric tubes. These adapters have not been standardized, but where needed should be provided locally (see Subdivision 3(F)).

Caution: Caution should be exercised when inserting tubes into and removing them from adapter assemblies, as tubes may be crushed easily (the 375A especially is easily broken). A glove may be worn on the hand for protection from broken glass and from hot tubes.

Controls

2.07 The upper five controls are all necessary in making a measurement of indicated transconductance.

2.08 A & B Selector Switches - Two selectors designated A and B are located first in order toward the back of the control panel. Settings of these switches control the proper connections for any tube to be tested, when it is inserted in its proper socket. These settings are obtained from Table I for Western Electric tubes, or from the roll chart for other tubes.

2.09 Filament Voltage - Filament (or heater) voltage is supplied from a multiple tap transformer and is controlled by the middle switch designated FIL. Eighteen switch positions including an OFF setting are provided to include 16 values of voltage as follows:

1.1	3.0	7.5	35
1.5	4.3	10.0	50
2.0	5.0	12.6	75 and
2.5	6.3	25.0	117 volts

The remaining switch position, designated BLST, is a special "off" position necessary in making certain tests where the cathode return circuit

is disconnected from the mid-point of a resistance normally bridged across a filament (or heater). The accuracy of the voltage for each position is within ± 3 per cent when the LINE ADJUSTMENT control is properly adjusted.

2.10 L Dial - The L dial controls a potentiometer shunt bridged across the MICROMHOS meter to adjust its sensitivity. It is calibrated in an arbitrary scale from 0 to 82. When set at $G_M(60)$, at approximately 70.5 or 76.5, the full-scale deflection of the meter corresponds to indicated transconductances of 3000, 6000 or 15,000 micromhos, respectively, as discussed in Paragraph 3.09. The manufacturer's booklet supplied with each set should give the exact calibrated values of the L dial setting to obtain a full-scale deflection of 6000 and 15,000 micromhos for that particular set. These values should be used instead of the approximate values of 70.5 and 76.5. If the calibration is suspected of being in error, or if the manufacturer's calibration is not available, the dial may be recalibrated (see Paragraphs 3.25 and 3.26). If the settings are within the tolerances given, these new values should be used subsequently, and may be stenciled on the L dial. If the tolerances cannot be met, it is an indication of probable trouble in the set. Other arbitrary settings are called for in Table I and on the roll chart to make the colored GOOD - REPLACE or MICROMHOS ranges on the meter scale apply to tubes of other than Western Electric manufacture and to a few Western Electric tubes.

2.11 R Dial - The right-hand dial R controls a potentiometer calibrated in a 0 to 82 scale, which provides a continuously adjustable range of grid voltage from 0 to about -42 volts.

2.12 Line Adjustment - This potentiometer, designated LINE ADJUSTMENT, controls the a-c voltage applied to the primaries of the various transformers in the set. When adjusted so that the A.C. VOLTS voltmeter referred to in Paragraph 2.05 deflects to the red index mark designated TEST on its scale, the voltage applied to the set is 100 volts.

2.13 Short Test Switch - On a six-position selector switch, designated SHORT, five steps are provided to make short-circuit tests between various electrodes of the tube under test, using the neon lamp test circuit, as indicated in Fig. 1. This short test may be made with the tube filament (or heater) on or off,

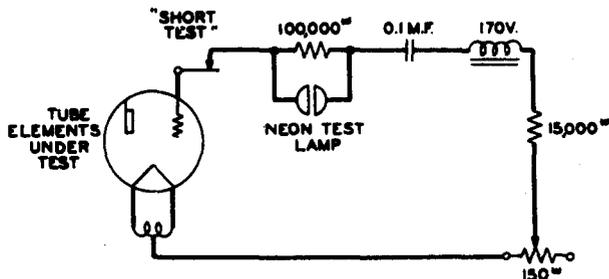


Fig. 1 - Short Test Circuit

but usually is made with the filament (or heater) heated. In the sixth position labeled TUBE TEST the neon lamp short test circuit is disconnected and the tube under test is connected for indicated transconductance, filament (or cathode activity), and other tests.

2.14 Toggle Switches - In line with the LINE ADJUSTMENT and SHORT controls, two switches appear on the extreme left and right of the control panel and are designated respectively:

(1) FIL ACT., a locking toggle switch required for filament (or cathode) activity tests, is located on the left-hand side. When operated to NORM., the filament (or heater) voltage is the value for which the filament voltage switch is adjusted. When in the TEST position, the voltage applied to the filament (or heater) of a tube under test is reduced 10 per cent below its normal value. The per cent reduction in indicated transconductance observed for this 10 per cent filament voltage change is used as a fundamental criterion of the condition of tubes so tested.

(2) POWER - This switch with ON and OFF positions, controls the commercial a-c power supplied to the set through the 5-foot cord and plug attached.

2.15 Push Button Switches - Six of these switches are located in line in the front part of the control panel and are operated to make the various tests in conjunction with the selector and potentiometer dials described in the preceding paragraphs.

(1) The AMPL. TEST button (colored red) is a locking type, which when operated places d-c potentials on the plate and screen of the tube under test, impresses a 5-volt signal on its grid and connects the MICROMHOS meter to the plate circuit. The

button is locked by depressing it and turning it. A locking type switch is provided to ensure continuously applied operating potentials to a tube during the time required for a filament (or cathode) activity test.

(2) The GAS TEST button, non-locking type, when operated with the AMPL. TEST button in the locked position, places a $1/4$ -megohm resistor in series with the grid circuit.

(3) Two RECTIFIER TEST buttons, both non-locking, are located in the left front part of the panel. The right-hand button, designated ST'D, places an a-c potential on the plate of the rectifier tube under test. This a-c voltage is rectified and measured as direct current on the MICROMHOS meter, where the reading on the GOOD - REPLACE scale gives a measure of the condition of the tube. The left-hand button, designated OZ₄, provides a similar test for rectifiers of the cold cathode type. A protective series resistor is employed in this test circuit to limit the rectified current flow through the tube to a value which will not damage it.

(4) Two test buttons, both non-locking, are located in the right front panel space. The LINE VOLTS button, when operated, disconnects the small a-c voltmeter from the LINE ADJUSTMENT control circuit and connects it to check the external a-c supply voltage. The DIODE TEST button controls a rectified current test for small hot cathode diodes or diode sections of multi-purpose tubes. This test is similar to the rectifier tests except that a much lower a-c voltage (about 15 volts) is applied to a diode plate through a protective resistor.

(5) The RECT. 117N7 button, non-locking, located just behind the R potentiometer, operates a switch which reverses the L potentiometer connections to the MICROMHOS

meter. This permits tests of each section of combination tubes, such as the 117N7GT, where each section has a separate cathode, and avoids a reversed meter reading in testing one of the sections in such cases.

(C) Description of Circuits

2.16 A complete circuit diagram of the model 531 set is given in Fig. 6 on Page 104. The circuits of modified 530B sets may differ slightly from this diagram. To aid in understanding the principles underlying the several tests, reference will be made to a few simplified schematic diagrams. The various circuit arrangements are secured by the proper operation of the controls just described.

2.17 When measuring indicated transconductance or testing filament (or cathode) activity, the set is arranged to provide the circuit shown in Fig. 2. The 5Y3GT-type (or 5W4) full-wave rectifier tube supplies unfiltered d-c potentials to the control and screen grids (if any) of the tube under test. The plate potential is derived from a separate rectifier employing an 83-type tube with balanced transformer secondaries supplying a-c potentials of 170 volts to each plate of the rectifier tube. The #83 full-wave rectifier tube is of the mercury vapor type and is used to ensure a minimum internal voltage drop, with better regulation, regardless of load current. The MICROMHOS meter is connected across the potentiometer resistances in the rectifier circuit as shown. Since the currents in the two resistances are equal, the arrangement is balanced and no potential is impressed on the meter if no a-c signal is impressed on the control grid.

2.18 However, the circuit actually is arranged to impress an a-c (60-cycle) potential of approximately 5 volts on the grid by means of a transformer winding inserted between the grid and the cathode. This potential appears amplified in the plate circuit of the tube under

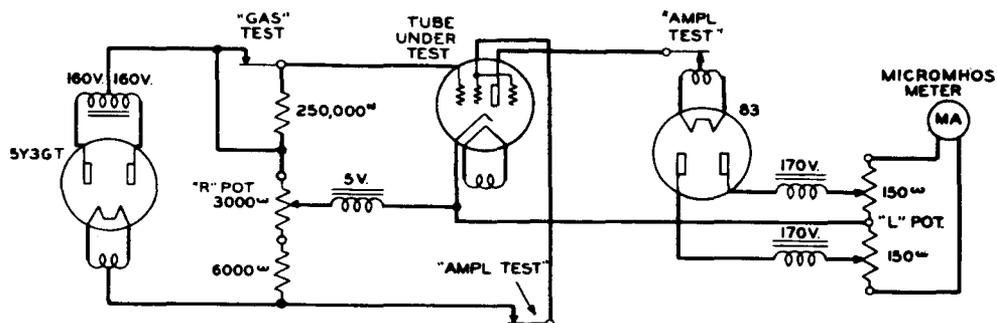


Fig. 2 - Basic Transconductance Test Circuit

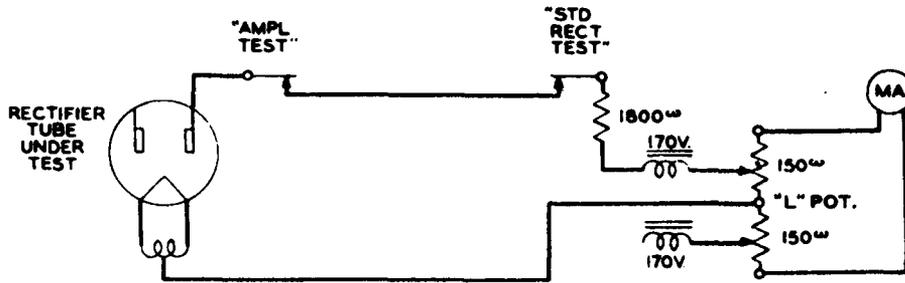


Fig. 3 - Standard Rectifier Test Circuit

test, and is in phase with the a-c potential impressed by the rectifier transformer on one plate of the 83 tube, and in opposition to the potential on the other plate. Thus the rectified current in one side of the 83 rectifier is increased and in the other is decreased, unbalancing the meter circuit and causing the meter to deflect. The amount of deflection is proportional to the transconductance of the tube under test, but under test conditions is not a rigorous measurement of the transconductance. For this reason it is referred to herein as "indicated transconductance."

2.19 When testing a rectifier type tube the set is arranged as shown in Fig. 3. Each anode is tested separately. The 83 tube has no function in this circuit arrangement, the rectifier plate circuit under test being substituted for one side of it. A current limiting resistance of 1800 ohms is in series with the tube under test, and the MICROMHOS meter reads proportionally to the rectified a-c current as indicated on the GOOD-REPLACE scale.

2.20 When testing the diode section of a multi-purpose tube, or small hot cathode diodes, the circuit (Fig. 4) is the same as described in Paragraph 2.19 except that the

a-c potential is decreased from 170 to about 15 volts, and the current limiting resistance is dropped to 1250 ohms. Only one plate of the diode is tested at a time.

2.21 When testing a cold cathode tube, the circuit (Fig. 5) is the same as described in Paragraph 2.19 except that both windings of the rectifier transformer are employed in series, applying an a-c potential of 340 volts in series with a current limiting resistor to the tube under test.

2.22 Gas current in a tube or grid leakage current due to poor grid to filament insulation may be detected by the insertion of a high resistance into the grid circuit of a tube set up for a transconductance measurement. This test is made with the negative grid bias voltage increased by the proper adjustment of dial R to obtain a low reading on the MICROMHOS meter. When the test resistance of 1/4 megohm is introduced into the grid circuit by operation of the GAS TEST button a change in the meter reading will occur with tubes having grid currents in excess of approximately 2 microamperes. This change corresponds to the change in grid bias resulting from the flow of grid current through the 1/4 megohm resistance.

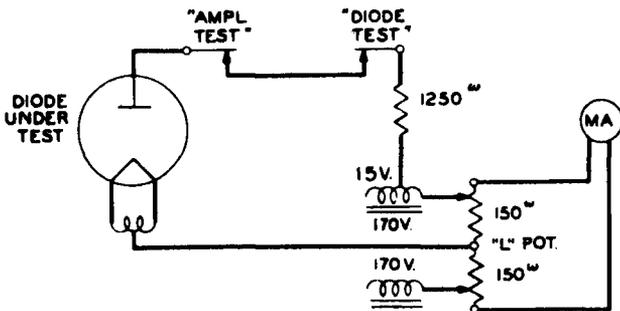


Fig. 4 - Diode Test Circuit

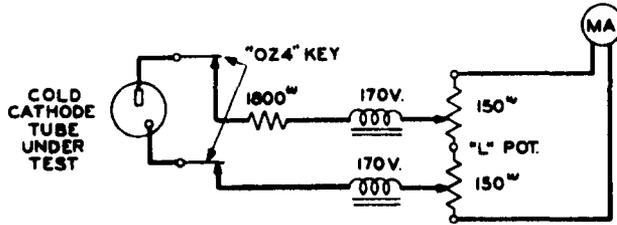


Fig. 5 - Cold Cathode Tube Test Circuit

(D) Power Supply

2.23 The set consumes about 60 watts of 60-cycle commercial power (105 - 125 volts). A plug with a 5-foot cord attached to the set permits convenient connection to a local power outlet. This power supply is protected by a standard No. 81 Mazda 6-volt 3 c.p. single contact auto bulb. This is used as a fuse, and is replaceable easily from the face of the set panel. When not in use the POWER toggle switch should be operated to OFF to avoid unnecessary heating of the set. Prolonged unnecessary operation may injure the R potentiometer which in series with resistor R6 bleeds the output of the 5Y3GT rectifier.

2.24 Adjustment to compensate for power voltage fluctuations and tube variations is provided by the LINE ADJUSTMENT dial to maintain a steady voltage as read at the red index line of the small A.C. VOLTS voltmeter.

(E) Special Features

2.25 Neon Lamp Short Test Circuit - This test circuit is for locating shorts in any inter-electrode path within a tube, as indicated previously in Paragraph 2.13. The actual method of test is given in Paragraph 3.07. Table II, or the corresponding table in the manufacturer's booklet delivered with the set, provides the necessary information to determine the exact location of a short by observing which of the five positions of the SHORT selector switch cause the neon lamp to light.

2.26 The various short locations given in Table II represent paths commonly encountered for typical tube basing arrangements. In the case of certain octal and miniature types appropriate notations in Table I and on the roll chart show neon lamp short positions which will flash because of base wiring interconnections. These short indications should be ignored. It may be pointed out also that other inter-electrode short paths than those identified in Table II may be found, particularly in certain octal type tubes. This may result in an apparent identification of a path which does not apply to the particular type of tube base connection arrangement. Such short test indications usually should be interpreted as resulting from an unsatisfactory tube condition.

2.27 Adapters are required for Western Electric tubes equipped with bayonet type bases or certain other basing, as discussed in Paragraph 2.06.

2.28 A pin jack designated CAP, located above the control panel and to the right side, is provided for the insertion of the grid cap

clip lead furnished separately for use in testing tubes having a metal cap connection on top. A similar plate cap clip lead is supplied with a banana plug for insertion into the proper test socket pin connection.

2.29 Noise Test Circuit - A pair of pin jacks to the left panel center, designated NOISE TEST, is included as part of the noise test to be used in conjunction with a broadcast type radio receiver equipped with a loudspeaker. These pin jacks are connected to the neon lamp test circuit through a small condenser (0.0005 mf). The left jack is for a pin plug connection to the radio receiver's antenna post and the right jack for the ground terminal. The noise test is made with the tube energized by the proper filament voltage in a test socket and connected by means of the required A and B selector settings. The test is made by rotating the SHORT switch through positions 1 through 5 (no other test buttons operated) while tapping the tube lightly by hand and listening to the loudspeaker. This test, described in the manufacturer's booklet, is not recommended for Western Electric tubes.

2.30 Lamp Test - The center of the 7-prong socket has a live receptacle for testing miniature screw or bayonet, or candelabra based pilot or indicator lamps for burn-outs. The voltage that is applied is under the control of the FIL selector and may be varied in the voltage steps of that selector, as required, for the lamp to be tested. Small neon indicator lamps may also be tested here.

3. METHODS FOR TESTING TUBES(A) General Procedure

3.01 Detach the cover of the set unless it is properly supported in an open position, to avoid damage to the hinges. With the POWER switch thrown to OFF, plug the attachment cord into a suitable source of a-c power.

Caution: Operate the POWER switch to OFF after each test unless the same type of tube is to be tested in sequence. In the latter case it is only necessary to unlock the AMPL. TEST button while changing tubes.

3.02 Adjust the A and B selector switches, the FIL selector switch, and the L and R potentiometers to the proper values for the type of tube to be tested. These settings may be found on Table I (attached) for Western Electric tubes and on the roll chart for tubes

of other manufacture. See that the FIL ACT key is operated to NORM and the SHORT selector switch is turned to TUBE TEST.

Caution: The A, B, or FIL selector should never be operated with the AMPL. TEST button in a locked (operated) position. Also it should be emphasized that, except in the case of tests using the RECT. 117N7 button, or the GAS TEST, test procedures usually call for the operation of only one push button at a time.

3.03 Attach the grid clip lead if the tube has a top terminal and insert the tube to be tested into the socket which is proper for the tube base. This grid clip should be attached in a vertical position on metal shell tubes to avoid a short between grid cap and shell. For Western Electric tubes with bayonet type bases and for certain other tubes with special basing arrangements, a socket adapter will be required, as discussed in Paragraph 2.06. As indicated in Table I, certain tubes have the plate terminal at the top. In such cases a special connection is required using the plate clip lead as discussed in the table or on the roll chart.

3.04 Operate the POWER switch to ON. Adjust the LINE ADJUSTMENT potentiometer until the needle of the A.C. VOLTS voltmeter rests on the TEST calibration mark (red). Check this adjustment from time to time during the tests, particularly as the plate current load comes on when the AMPL. TEST button is operated.

3.05 In following the subsequent detailed instructions, to permit the tube to become stable before making any test involving meter readings, an important precaution is to allow a minimum of 1-1/2 minutes for heater type and 1/2 minute for filamentary tubes after turning on the power or making any change in filament (or heater) voltage applied to the tube. Considerable variations in heating and stabilizing time for either filamentary or heater tubes may occur, depending upon the tube design. This precaution should be observed after operating the FIL ACT. switch to TEST during an activity test as well as after first turning on the power. Filamentary tubes may stabilize in less time after the FIL ACT. switch is operated to TEST than is required for the initial stabilizing interval. An indication of saturation in the tube is a steady MICROMHOS meter reading, allowing for temporary power voltage fluctuations.

A-c power voltage fluctuations may be checked by operating the LINE VOLTS push button and observing the A.C. VOLTS meter behavior.

(B) Tests of Amplifier Types of Tubes

3.06 These tests apply to all tubes having control grids, whether they are used in service as amplifiers, modulator or demodulators, detectors or oscillators.

Short Test

3.07 Operate the SHORT test switch slowly through positions 1 through 5. If the neon lamp, designated SHORTS, lights continuously in any of these positions a short circuit between elements is indicated. The location of the short usually can be determined by reference to Table II. Under certain conditions, however, as discussed in Paragraph 2.26, the path indicated by the table may not exist. In these cases an unsatisfactory tube usually is indicated. Ordinarily this test is made with the filament (or heater) heated but it can be made with the filament (or heater) cold (i.e., FIL voltage selector in the OFF position).

3.08 Intermittent shorts can be detected by tapping the tube with the finger. In this test an intermittent flash may be obtained instead of a steady light.

Note: An instantaneous flash as the switch is moved from one position to another should be disregarded. This is caused by the discharging of the condenser in the short test circuit.

Transconductance Test

3.09 Make the basic settings as required for the tube to be tested as in Paragraph 3.02. With the FIL ACT. test switch in the NORM. position and SHORT switch in the TUBE TEST position, operate the AMPL. TEST button and lock it in position. Recheck the line adjustment voltage reading. Read the deflection of the MICROMHOS meter, changing the multiplying factor, if necessary, by readjusting the L dial according to the following table. Readings on the upper half of the meter scale are to be preferred. In the case of the 531 sets the reading is direct on the proper scale as indicated in the following table; in the case

of the modified 530B sets with the single scale meter multiply the scale reading by the factor from the following table:

Interpretation of Scale Reading in Micromhos for Settings Given in Table I.

Setting of L Dial	(3-range Scale) Micromhos Range	(0-3000 Scale only) Multiply Meter Scale Reading by:
Less than $G_M(60)$	3000	1
$G_M(60)$	3000	1
70.5 ϕ	6000	2
76.5 ϕ	15000	5

ϕ This is a nominal value. Use the calibrated value. (See Paragraph 2.10.)

3.10 For Western Electric tubes, the prescribed settings of the L potentiometer are such as to give indicated transconductance readings under the test conditions obtained in this set directly on the scale of the MICROMHOS meter. In certain cases, such as for example the 310A and 401A as indicated in Table I, L dial settings lower than $G_M(60)$ are required to obtain indicated transconductance on the 3000-micromhos scale. Such tubes should meet the minimum micromhos limit given in Table I, at the required L potentiometer setting shown. In the case of rectifier and diode tube tests the micromhos meter registers d-c rectifier plate current, differing from the usual micromhos indicated transconductance reading. Therefore rejection or normal values of rectified plate current are observed directly on the GOOD - REPLACE sectors without regard to the numerical values, with the L potentiometer adjusted to the required shunt value. In the case of diode tests, the DIODES OK index mark above the REPLACE red sector is used to measure tubes with appropriate dial settings. Hence, the L potentiometer settings for diodes or rectifiers bear no relation to the G_M settings discussed in Paragraph 3.09.

3.11 Except when otherwise indicated under NOTATIONS on the chart for tubes of other than Western Electric manufacture, a deflection to the GOOD (green) portion of the scale indicates a satisfactory transconductance, while a deflection to the REPLACE (red) portion of the scale indicates an unsatisfactory transconductance. In the latter case the tube should be rejected. The setting of the L dial given on the chart is such as to make the set indicate directly on the colored sectors of the meter scale whether the tube is satisfactory or unsatisfactory. If it is desired to check the

indicated value of the transconductance as given under AVERAGE MUT. COND. on the chart, dial L should be adjusted to $G_M(60)$ unless otherwise noted on the chart and the value can be read from the meter scale, as indicated in Paragraph 3.09.

Grid Current Test

3.12 With operating conditions established as in Paragraph 3.09, increase the grid bias by turning potentiometer R to the right until a reading of 100 micromhos (2 scale divisions) is obtained on the MICROMHOS meter.

3.13 Depress the GAS TEST button and note any increase in the meter reading. If the increment is more than 2 scale divisions, the grid current exceeds a few microamperes and the tube should be rejected.

Filament (or Cathode) Activity Test

3.14 With operating conditions as in Paragraph 3.09 and the AMPL. TEST button still locked in its operated position the steady deflection of the MICROMHOS meter is observed for the NORM. position of the FIL ACT. switch.

Note: As the test is a comparison of two scale readings, measured values from which to determine per cent activity should be read directly on the 3000-micromhos meter scale without reference to the actual value of indicated transconductance.

3.15 Operate FIL ACT. switch to the TEST position, and, after waiting the time specified in Paragraph 3.05, note again the reading of the MICROMHOS meter. After each filament (or cathode) activity test restore the FIL ACT. switch to the NORM. position and release the AMPL. TEST button.

3.16 For Western Electric tubes this TEST reading (Paragraph 3.15) should not fall below the initial NORM. reading (Paragraph 3.14) by a percentage greater than the limits given in Table I under Max. % Fil Act. For this purpose Table III may be used to determine whether the required per cent activity rejection limit has been exceeded, for the particular micromhos scale reading of the tube under test. Tubes which fail in this test should be replaced.

3.17 Tubes of other than Western Electric manufacture usually are rejected on the basis of the MICROMHOS meter reading using the GOOD - REPLACE color scales only, and activity test limits usually are not specified for

them. If, however, it is desired to apply a filament (or cathode) activity test, a limit of 25 per cent maximum change in micromhos scale reading may be assumed in the absence of other specified values.

3.18 As an alternative to the method described in Paragraph 3.14, the filament (or cathode) activity test may be made by adjusting the L potentiometer dial until the deflection of the MICROMHOS meter is exactly at a scale reading of the highest one of the following values which can be reached: 500, 1000, 2000 or 3000. Then the reading of the MICROMHOS meter observed with the FIL ACT. switch in the TEST position may be compared with the micromhos reading corresponding to the required percentage activity limit by using the following table:

NORM. Position Meter Reading	TEST Position Meter Reading for Activity Limits of				
	15%	20%	25%	30%	35%
500	425	400	375	350	325
1000	850	800	750	700	650
2000	1700	1600	1500	1400	1300
3000	2550	2400	2250	2100	1850

3.19 The limits for minimum MICROMHOS meter reading (Paragraph 3.10) and activity given in Table I are for general use and correspond approximately to the limits generally employed for corresponding tests made by other standard testing methods and other comparable test sets. As mentioned in Paragraph 1.06 these general limits may be superseded for any specific application of the tubes in Table I.

(C) Test of Half- and Full-wave Rectifier Tubes and Diode Sections of Multi-purpose Tubes

3.20 The tube is set up for test as described in Paragraphs 3.01 through 3.04. The AMPL. TEST button should be released and never should be operated during a rectifier or diode tube test. Adjust the L dial as required. The R dial setting is 0 for a rectifier test. The FIL ACT. switch always should be in the NORM. position for tests of rectifier, diode and similar type tubes. No filament (or cathode) activity test is required for these tubes.

3.21 For testing half- or full-wave rectifier tubes, depress the RECTIFIER TEST ST'D button. If the deflection of the MICROMHOS meter falls in the GOOD (green) sector, the tube is satisfactory. If it falls in the REPLACE (red) area, the tube is unsatisfactory and should be replaced. For full-wave rectifier tubes, two tests must be made, one for each plate of the tube. Two A and B selector settings are listed for this purpose.

3.22 For testing diode sections of multi-purpose tubes, depress the DIODE TEST button with the A and B selectors and the L and R potentiometer dials set as given in Table I or on the roll chart. If the deflection of the MICROMHOS meter is less than the special calibration line marked DIODES OK for a test of either diode plate, the tube should be replaced. Diode plate current tests preferably should be of short duration. SHORTS tests in diodes or diode sections should be avoided.

3.23 In testing the rectifier section of dual purpose tubes such as the 117N7GT, 117P7GT or similar type tubes, the RECT. 117N7 button is depressed first and then the RECTIFIER TEST ST'D button is depressed, and the MICROMHOS meter reading is observed as usual. The use of the RECT. 117N7 button, when required, is indicated on the chart.

(D) Special Tests

3.24 The set is arranged to provide rough tests on cold cathode tubes, electron ray (magic eye) indicator tubes and ballast resistor tubes of other than Western Electric manufacture. Settings for tests of these types of tubes (except ballast tubes) are contained on the roll chart. Methods of making these tests including tests of ballast tubes are described in the instruction booklet furnished by the manufacturer of the test set or on the roll chart. As mentioned in Paragraph 1.04, Western Electric ballast lamps cannot be tested.

(E) Calibration Check of MICROMHOS Meter

3.25 Calibration of 6000-micromho Range - The purpose of this test is to determine the exact calibration setting of the L dial required for the 6000-micromho range of the meter. The procedure is as follows:

(1) Insert a Western Electric 300A (or equivalent*) tube in the set with the A, B and FIL selector settings as given for this tube in Table I.

* A Western Electric 350B, or a 2A3, 6L6, 25L6 or similar power type tube having high transconductance may be substituted, using the proper selector settings as obtained from Table I or the chart.

(2) Set the L dial at exactly $G_M(60)$ on scale.

(3) Set the R dial at about 65 on scale.

(4) Operate the POWER switch to ON with the FIL ACT. switch on NORM. Depress and lock the AMPL. TEST button and adjust

the LINE ADJUSTMENT dial to obtain a 100-volt (red index TEST mark) reading on the A.C. VOLTS meter.

(5) Vary the R dial (grid bias voltage control) to obtain an exact reading of 3000 micromhos (full scale) on the MICROMHOS meter.

(6) Leave the R dial on the setting obtained in Item (5) and readjust the L dial to obtain an exact mid-scale meter reading of 1500 micromhos.

(7) The L potentiometer dial setting obtained in Item (6) is the calibration setting of the particular set to read 6000 micromhos full scale, i.e., direct reading for the 531 sets, or the scale values as read on the MICROMHOS meter multiplied by 2 for the modified 530B sets. Unless there is trouble in the set, this calibration point should be found between 69.5 and 71 on the dial of the L potentiometer. It should be recorded for future use in place of the nominal value of 70.5. If desired this may be stenciled on the dial.

3.26 Calibration of 15,000-micromho Range -

The purpose of this test is to determine the exact calibration setting of the L dial required for the 15,000-micromho range of the meter. Proceed to set up the Western Electric 300A tube (or equivalent) for test as outlined in Paragraph 3.25, Items (1) through (5); then proceed as follows:

(1) Leave the R dial on the setting obtained as in Item (5) and readjust the L dial to obtain an exact MICROMHOS meter reading of 600 ($1/5$ full-scale reading).

(2) The L potentiometer reading so obtained is the calibration setting of the particular set to read 15,000 micromhos full scale (i.e., direct reading for the 531 sets, or using a 5-time multiplying factor for the modified 530B sets). Unless there is trouble in the set, this calibration point should occur between 75 and 77.5 on the L dial. It should be recorded for future use in place of the nominal value of 76.5. If desired this may be stenciled on the dial.

(F) Special Adapter Assembly

3.27 The attached Figs. 7 through 12 list the adapters required for the following tubes: 367A, 373A, 374A, 375A, 380A, 383A, 385A, and 387A; and an adapter which may be used for the 384A and 386A tubes (see Paragraph 2.06).

3.28 The general details of the construction are shown on the respective figures and information is given with regard to the preference existing between various adapter arrangements available.

3.29 Where no wires are shown within or between the two parts of the adapter, it is important to make sure that no connection is supplied, as this may cause damage to the tube or test set when the adapter is used with it. Terminals which are to be left unconnected in the socket have been marked with the letters "NC."

3.30 Except for the plate cap wire in Fig. 12 the wiring should be done with 20-gauge tinned (solid) copper wire.

3.31 It is suggested that the adapter be marked with identification as to the type of tube for which it is designed.

3.32 Except where indicated otherwise, as in Fig. 9, the resistors used should have tolerances of 10 per cent, or better, and this information is needed in ordering. The resistor for self bias in the cathode circuit of Fig. 9 is indicated as having a tolerance of 5 per cent. Types F1/2, EB1/2, and BW1/2 resistors are $1/2$ -watt resistors. The wattage of other types required should be specified in ordering, according to the requirements indicated in the figures.

3.33 The adjustable heater resistor (15-ohm, 10-watt) used for the 375A tube (Fig. 9) should be adjusted locally for the particular Hickok tester with which it is to be used, so as to obtain between 20 and 20.5 volts (measured with an a-c voltmeter) across the heater circuit of a 375A tube. At least two new tubes should be tried, to check that the required voltage range is satisfactory.

4. MAINTENANCE

4.01 Installation of Rectifier Tubes in Set -
Before the set can be used, a No. 83 full-wave mercury-vapor rectifier tube (the high vacuum No. 83V type rectifier tube is not suitable) and a No. 5Y3GT full-wave high vacuum type (or 5W4) rectifier tube must be installed within it.

4.02 The following is the procedure for installing the rectifier tubes:

(1) Remove the screws holding the control panel and lift the panel from the cabinet.

- (2) Insert a 5Y3GT-type (or 5W4) tube in the 8-pin octal socket on the sub-panel inside the set.
- (3) Insert a No. 83 tube in the 4-pin socket on the sub-panel inside the set.
- (4) Plug the power supply cord into a source of 60-cycle 105- to 125-volt a-c power, operate the POWER switch to ON and depress the AMPL. TEST button. If the MICROMHOS meter needle vibrates and the fuse lamp lights up brilliantly, an unsatisfactory #83 tube is indicated. This condition seldom obtains with a new tube of reliable manufacture and is caused by an excess of metallic mercury within the bulb. Replace the tube with a #83 which does not produce this effect.
- (5) Remount the panel and reinsert the screws. The set is ready for use.

4.03 The following data apply to the lamps used in this set:

Fuse Lamp	#81 Mazda, 6-8 volts
(Modified 530B Sets only) Meter Illuminating Lamp	#55 Mazda, 6-8 volts
Short Test Lamp	Neon, Type NE, 1/4-watt, 115 volts

4.04 The care ordinarily accorded any piece of calibrated testing apparatus should be given to the test set to ensure satisfactory operation. The top cover should be in place at all times when the set is not in use, to prevent dust or dirt from entering any of the moving parts, particularly the sliding potentiometer contacts. These contacts should be inspected periodically and cleaned if necessary by the standard methods for such apparatus. Key contacts and the contact prongs of the vacuum tube sockets should also be kept free from corrosion and dirt, and should be burnished as required.

4.05 The meters of this set should be stable if the set is not subjected to serious mechanical shocks or electrical abuse. Factory meter calibrations are within 1.5 per cent at full-scale deflection. The set is calibrated to be used in a normal horizontal position. Zero settings of the meters should be checked on installation, each time the set is carried to a new location, and from time to time as required.

4.06 The 5Y3GT (or 5W4) and #83 rectifier tubes, used in the power supply of the tester, should be replaced by new tubes tem-

porarily and should be tested once a year in the set. They should be rejected for further use if test requirements are not met.

4.07 With the 60-cycle a-c power voltage at any value between 105 and 125 volts the set is designed to permit the No. 83 rectifier circuit to supply an adequate value of d-c operating plate potential (max. approx. 155 volts), and the 5Y3GT rectifier circuit to provide 0 to 42 volts grid bias and sufficient screen grid positive supply of about 130 volts. The grid signal voltage supply calibration also should be satisfactory over this 60-cycle voltage range. Should inadequate operating potentials be encountered, the a-c line voltage should be measured first and verified, using the a-c line volts check circuit. The rectifier tubes 83, and 5Y3GT (or 5W4) should be checked and replaced if necessary in case of inadequate operating conditions.

4.08 In case the set fails to operate, i.e., no d-c voltage, or no grid signal supply (as indicated by the absence of a MICROMHOS meter reading with the POWER switch turned to ON), or (in the modified 530B sets) no meter lamp illumination, the small fuse lamp should be inspected first before removing the front panel for further investigation. Burning out or extreme brilliancy of this fuse lamp, which is located in the main primary transformer circuit, usually is an indication of overload or circuit trouble, which should be cleared before continuing the operation of the set.

4.09 Reference may be made to Fig. 6, Page 104, or to the manufacturer's drawings which are part of the booklet delivered with the test set, in case it is desired to check its wiring. These drawings are schematic wiring diagrams showing essential circuit details. In the event of serious physical or electrical injury to the test set it should be returned for repair to the Western Electric Company.

5. TEST DATA

5.01 The attached tables, referred to throughout this Practice provide test data for Western Electric tubes, which are not given on the roll chart. Table I lists for each tube type the five principal settings necessary for an indicated transconductance and a filament (or cathode) activity test, i.e., A and B selector switches, filament (or heater) voltage (FIL selector setting) and the L and R potentiometer settings. In addition, rejection limits are given under two column headings, (a) the maximum limit of the filament activity percentage and (b) the minimum MICROMHOS meter value required at normal filament voltage. Another column in Table I lists the nominal

value of indicated transconductance, (G_M), as measured by the set for a tube in good condition. Individual tubes will vary from this nominal value, the amount depending on particular tube type.

5.02 The L and R dial settings have been selected to approximate normal plate current operation as well as to obtain MICROMHOS meter readings as near as possible to nominal values for Western Electric tubes, within the limitations imposed by the set. In the case of certain tubes this requires prescribed settings of the L dial at other than the $G_M(60)$ and in the case of modified 530B sets may require corresponding multiplier values, as discussed in Paragraph 3.10.

Attached:
Pages 101 to 111 inclusive.

5.03 A column heading labeled "Special Instructions" shows test operations as required for certain tubes by reference to the particular test button. Multi-purpose tubes and the separate anode circuits of diodes and full-wave rectifier types require tests with more than one series of settings.

5.04 It should be noted that the nominal values of indicated transconductance listed in Table I for Western Electric tubes are for the test conditions obtained with this set and as affected by the fixed plate and other operating voltages. Of necessity, therefore, these nominal values of transconductance will not always correspond exactly to values given in Western Electric vacuum tube data sheets for the particular tube type.

TABLE I
WESTERN ELECTRIC TUBE TEST DATA
HICKOK MODEL 531 (KS-1358811) TUBE TESTER
& MODIFIED MODEL 530B (KS-1372511)

Tube Type	SELECTORS			POTENT.		Single Meter Scale Multi- plier	MICROMHOS (NOTE 2) FIL. ACT.-NORM.		Max. % Fil. Act.	Special Instructions
	A	B	FIL	L	R		Nom.	Min.		
101D, D86326, D92L37	2	10	4.3	60	40	1	1100	830	25	Use Alden 944 WEB Adapter
101F, J, L, K	2	10	4.3	60	35	1	1100	830	25	Use Alden 944 WEB Adapter
101FA	2	10	4.3	60	35	1	1500	1100	25	Use Alden 944 WEB Adapter
102D, E, G	2	10	2.0	40	23	1	500	360	20	Use Alden 944 WEB Adapter
102F, L	2	10	2.0	40	23	1	580	430	20	Use Alden 944 WEB Adapter
104D, D86327	2	10	4.3	60	60	1	1100	830	25	Use Alden 944 WEB Adapter
205D, E, F, D156734	2	10	5.0	60	28	1	1450	1200	15	Use Alden 978 WEB Adapter**
215A	2	10	1.1	60	45	1	420	320	25	Use Alden 972 Adapter
231D	2	10	3.0	60	35	1	540	400	25	
239A	2	10	1.1	60	40	1	450	320	25	
244A	1	6	2.0	60	30	1	900	680	25	
245A	7	6	2.0	60	35	1	725	525	25	
247A	1	6	2.0	60	28	1	630	400	25	
257A	2	10	3.0	60	35	1	540	400	25	
259A, B	7	6	2.0	60	25	1	1050	750	25	
262A, B	2	6	10.0	40	30	1	1100	820	25	
264B, C	2	10	1.5	60	40	1	580	440	25	
271A	1	6	5.0	60	30	1	2100	1580	25	
272A	1	6	10.0	60	45	1	800	600	25	
274A	(2	7	5.0	35	0	-	-	-	None)	Use GOOD-REPLACE Color Range
	(3	7	5.0	35	0	-	-	-	None)	Depress RECTIFIER TEST STD.
274B	)4	11	5.0	40	0	-	-	-	None)	Use GOOD-REPLACE Color Range
	)5	11	5.0	40	0	-	-	-	None)	Depress RECTIFIER TEST STD.
275A	2	10	5.0	60	68	1	2000	1500	25	
283A	7	6	2.0	55	25	1	1200	850	25	
285A	7	6	2.0	60	30	1	880	660	25	
286A	1	7	2.0	60	25	1	900	660	25	
290A	1	7	10.0	60	25	1	920	680	25	
291A	(10	6	10.0	60	35	1	360	250	30	Oscillator Section Test
	(7	6	10.0	40	33	1	170	-	None	Modulator Ampl. Section Test
	)7	6	10.0	60	28	1	640	480	25	Triode Test
292A	)10	6	10.0	0	0	-	Use DIODES-OK	None	None	Diode #1) Press DIODE
	)10	3	10.0	0	0	-	on Meter	None	None	Diode #2) TEST Button
293A	8	5	10.0	60	30	1	1120	840	25	
294A	7	6	10.0	60	30	1	1120	840	25	
300A, B	2	10	5.0	70.5	55	2	3200	2500	25	
	(7	6	2.0	60	28	1	640	480	25	Triode Test
303A	(10	6	2.0	0	0	-	Use DIODES-OK	None	None	Diode #1) Press DIODE
	(10	3	2.0	0	0	-	on Meter	None	None	Diode #2) TEST Button
307A	)4	7	5.0	60	30	1	2000	1500	30	Grid as Control)Plate Cap
309A	)4	9	5.0	60	30	1	1400	-	None	Suppres.Grid as Control)Conn.*
	7	6	10.0	60	25	1	850	640	25	
310A, B	2	5	10.0	40	25	1	1750	1200	25	
311A	7	6	10.0	60	30	1	2450	1700	20	See Note 1
328A	2	5	7.5	40	25	1	1750	1200	25	
329A	7	6	7.5	60	30	1	2450	1700	20	See Note 1
336A	8	5	10.0	70.5	20	2	3100	2300	25	
337A	2	5	10.0	40	25	1	1700	1280	25	

TABLE 1. (Cont'd)

Tube Type	SELECTORS			POTENT.		Single Meter Scales Multiplier	MICROMHOS (NOTE 2) FIL. ACT.-NORM.		Max. % Fil. Act.	Special Instructions
	A	B	Fil	L	R		Nom.	Min.		
339A	4	7	5.0	70.5 ϕ	35	2	3100	2300	25	Plate Cap Connection*
347A	10	5	6.3	40	30	1	1100	820	25	
348A	1	9	6.3	40	25	1	1750	1200	25	
349A	8	5	6.3	70.5 ϕ	20	2	3100	2300	25	
350A	4	7	6.3	70.5 ϕ	25	2	5000	3500	25	Plate Cap Connection*
350B	8	5	6.3	70.5 ϕ	25	2	5000	3500	25	
351A	(2	9	6.3	40	0	-	-	-	None)	Depress RECTIFIER TEST STD.
	(10	2	6.3	40	0	-	-	-	None)	Use GOOD-REPLACE Color Range
	) 7	6	10.0	60	28	1	610	460	25	Triode Test
352A	)10	6	10.0	0	0	-	Use DIODES-OK		None	Diode #1) Press DIODE
	)10	3	10.0	0	0	-	or Meter		None	Diode #2) TEST Button
367A	8	5	6.3	70.5 ϕ	25	2	5000	3500	25	Use Adapter per Fig. 7
373A	4	2	2.0	30	25	1	1150	700	25	Use Adapter per Fig. 8
374A	4	2	3.0	60	40	1	2500	1750	25	Use Adapter per Fig. 8
375A	8	5	25.0	55	45	2	4800	3800	20	Use Adapter per Fig. 9
380A	7	2	6.3	50	0	1	1000***	550***	400***	Press DIODE TEST button ##
381A	7	1	6.3	50	0	1	1000***	550***	400***	Press DIODE TEST button
383A	7	5	6.3	50	30	1	1900	600	30	Use Adapter per Fig. 10
384A	8	5	6.3	40	23	1	2000	950	30	Use Adapter per Fig. 11 (Note 3)
385A	8	5	6.3	40	23	1	2000	950	30	Use Adapter per Fig. 12
386A	8	5	6.3	40	23	1	2750	1500	30	Use Adapter per Fig. 11 (Note 3)
387A	8	5	6.3	40	23	1	2750	1500	30	Use Adapter per Fig. 12
398A	4	2	6.3	70	32	2	5400	3400	25	
399A	1	7	1.1	44	28	1	1100	600	omit	
400A	(7	7	1.1	55	32	1	-	400	omit	G1 Test Short on 4-5
	(1	7	1.1	55	32	1	-	150	omit	G3 Test Short on 4-5
401A RED	1	9	6.3	40	32	1	2000	1400	25	Short on 4-5
6AK5/403A RED	1	9	6.3	55	20	2	5000	3000	25	Short on 4-5
403B RED	1	9	6.3	55	20	2	5000	3000	25	Short on 4-5
409A RED	1	9	6.3	23	23	2	3200	2300	25	
+CK108(77)	2	5	6.3	48	17	1	1225	850	25	Read Color Range for L Pot. = 48; For Micromhos Use L Pot. = 60
+CK113 (like 25A7G)	(11	5	50.0	40	0	-	-	-	-	Check for Shorts
	(11	5	50.0	40	0	-	-	-	-	Depress RECTIFIER TEST STD.
	(8	5	50.0	58	35	1	1800	1260	25	Use GOOD-REPLACE Color Range Read Color Range for L Pot. = 58; For Micromhos Use L Pot. = 60

* Connect the tube Cap (plate terminal) to the No. 3 pin of the 4-prong socket.

ϕ This is a nominal value. Use the calibrated value (see Paragraph 2.10). If meter reads off scale, change the L dial setting for the 15000 micromhos scale (or the 5-time multiplier).

† Non-Western Electric tube coded for Bell System use.

Use adapter per Fig. 11. (Note 3) Clip G1 lead to diode plate (isolated pin); K lead to cathode (center pin of group 3); H-H leads to remaining (heater) pins; make sure G2, G3 & P leads are insulated.

** Adapter is not required for the D156734 tube.

*** These values are meter readings but not micromhos. The filament activity test reading means that the TEST value should not be less than the NORM value by more than 400.

Note 1. Singing as indicated by unstable meter readings, may be experienced. In such cases insert a resistor having any value between 100 and 500 ohms in the grid cap connection at the grid cap end of the cord.

Note 2. For model 531 sets these values represent direct meter readings on the appropriate scale. For modified 530B sets these values are obtained by applying multiplier to the single scale reading.

Note 3. In place of Fig. 11 adapter WECO adapter per ED-62777-01 group 1 can be used.

TABLE II
SHORT TEST LOCATION
BY NEON LAMP LIGHTING UNDER X
Hickok Model 531 or Modified
Model 530B Tube Tester

Kind of Short	Selector Switch Position				
	1	2	3	4	5
FIL. - CATHODE				X	X
FIL. - GRID			X	X	X
FIL. - PLATE	X	X	X		
FIL. - SCREEN		X	X	X	X
CATH. - GRID			X		
GRID - PLATE	X	X		X	X
GRID - SCREEN		X			
PLATE - SCREEN	X			X	X
GRID CAP - FIL.	X	X	X	X	
GRID CAP - GRID	X	X			X
GRID CAP - CATH.	X	X	X		X
GRID CAP - SCREEN	X				X
GRID CAP - PLATE				X	
SHELL - FIL.	X				
SHELL - PLATE		X	X		
SHELL - GRID	X		X	X	X
SHELL - SCREEN	X	X	X	X	X
SHELL - CATHODE	X			X	X
SHELL - GRID CAP.		X	X	X	

TABLE III (Cont'd)

MICROMHOS Meter Rdg. Fil. Act. Norm.	TEST Position Meter Reading for Activity Limits of:			
	15%	20%	25%	30%
680	580	540	510	475
720	610	575	540	505
760	645	610	570	530
800	680	640	600	560
840	715	670	630	590
880	750	705	660	615
920	780	735	690	645
960	815	770	720	670
1000	850	800	750	700
1040	885	830	780	730
1080	920	865	810	755
1120	950	900	840	785
1160	985	930	870	810
1200	1020	960	900	840
1240	1050	990	930	870
1280	1090	1020	960	900
1320	1120	1060	990	925
1360	1160	1090	1020	950
1400	1190	1120	1050	980
1440	1220	1150	1080	1010
1480	1260	1180	1110	1040
1520	1290	1220	1140	1060
1560	1325	1250	1170	1090
1600	1360	1280	1200	1120
1640	1390	1310	1230	1150
1680	1430	1345	1260	1180
1720	1460	1380	1290	1200
1760	1500	1410	1320	1230
1800	1530	1440	1350	1260
1840	1565	1470	1380	1290
1880	1600	1500	1410	1320
1920	1630	1540	1440	1345
1960	1670	1570	1470	1370
2000	1700	1600	1500	1400
2040	1735	1630	1530	1430
2080	1770	1665	1560	1460
2120	1800	1700	1590	1485
2160	1840	1730	1620	1510
2200	1870	1760	1650	1540
2240	1900	1790	1680	1570
2280	1940	1825	1710	1600
2320	1970	1860	1740	1625
2360	2000	1890	1770	1650
2400	2040	1920	1800	1680
2440	2080	1950	1830	1710
2480	2110	1985	1860	1740
2520	2140	2020	1890	1765
2560	2180	2050	1920	1790
2600	2210	2080	1950	1820
2640	2245	2115	1980	1850
2680	2280	2140	2010	1880
2720	2315	2180	2040	1900
2760	2350	2210	2070	1930
2800	2380	2240	2100	1960
2840	2420	2275	2130	1990
2880	2450	2300	2160	2020
2920	2480	2340	2190	2040
2960	2520	2370	2220	2070
3000	2550	2400	2250	2100

TABLE III

MICROMHOS Meter Rdg. Fil. Act. Norm.	TEST Position Meter Reading for Activity Limits of:			
	15%	20%	25%	30%
200	170	160	150	140
240	205	190	180	170
280	240	225	210	195
320	270	255	240	225
360	305	290	270	250
400	340	320	300	280
440	375	350	330	310
480	410	385	360	335
520	440	415	390	365
560	475	450	420	390
600	510	480	450	420
640	540	510	480	450

Per cent. activity limits in this table computed to ± 5 micromhos (approximately).

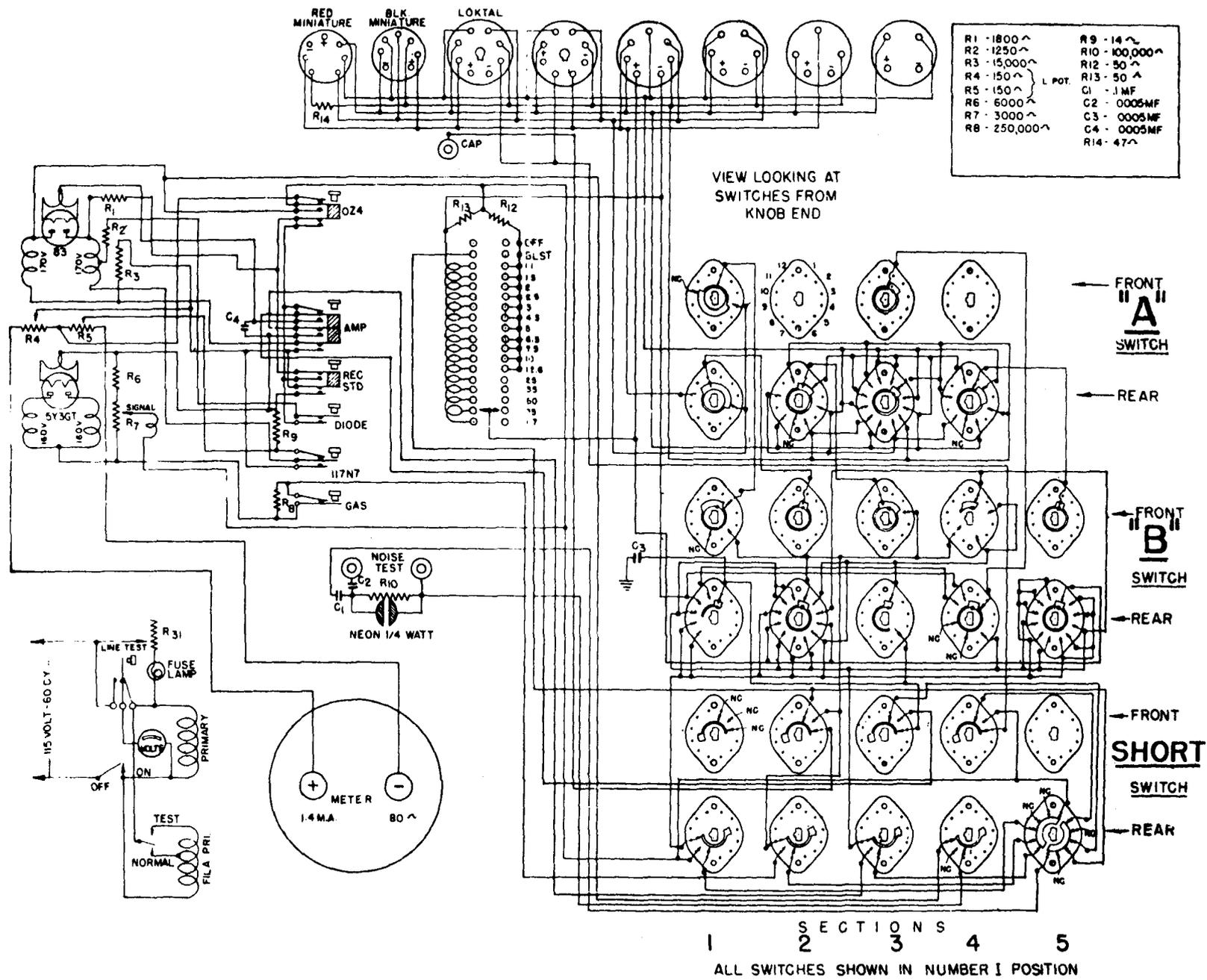
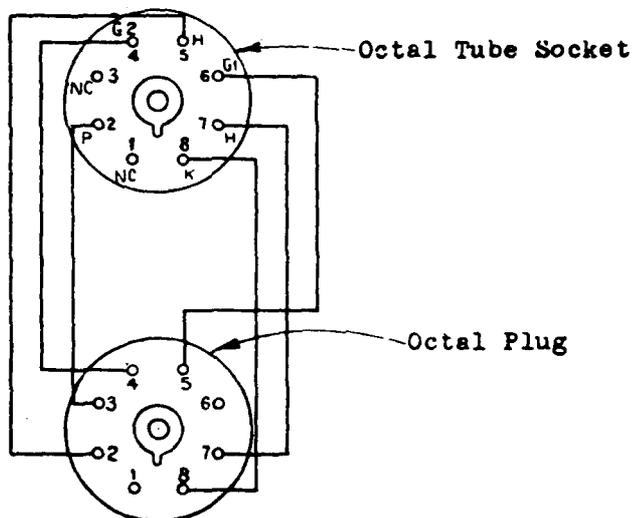


Fig. 6 - KS-13588 - Vacuum Tube Tester

ADAPTER FOR TESTING
367A Tube

Base Connections
Shown Similar To
6K6 GT Tube



Bottom View Shown
of Socket and Plug

General Instructions:

Solder heavy, tinned wires to socket terminals; cover with proper lengths of #20, KS-7851, impregnated, varnished sleeving (any color). Extend wires through the pins of the plug. After locking assembly draw leads up and solder to pins of plug.

1st Choice:

44-8 Amphenol socket with 50-8 SD Amphenol plug.

2nd Choice:

3-14 Amphenol adapter shell with S8 Amphenol socket and CP8 Amphenol plug.

3rd Choice:

2489 ICA Octal tube socket (base mounting); either CP8 Amphenol plug or 70-8 Amphenol speaker plug; #4-size round head brass machine screw 1-1/4" long. Drill and tap center post of plug for screw. After assembly cut screw flush with bottom of plug; tape exposed terminals of socket.

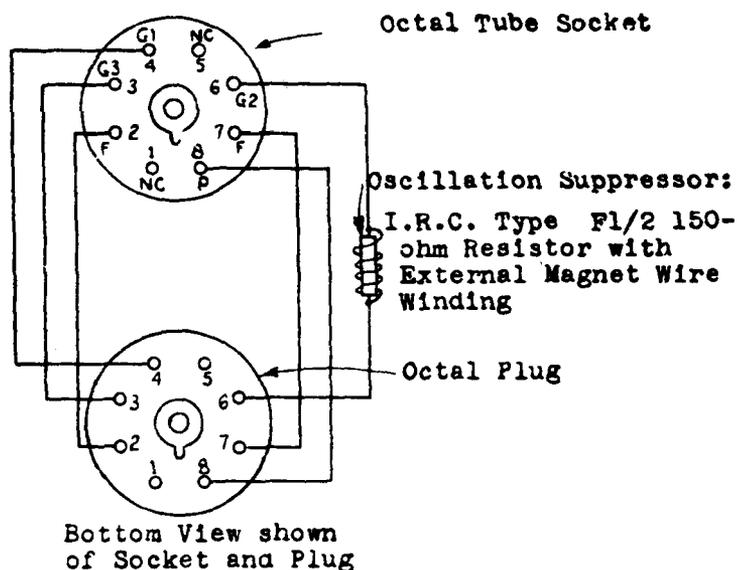
4th Choice:

ACS8 Amphenol socket; ACP8 Amphenol plug arranged for above chassis mounting; 3#6-32 round head brass machine screws 1/4" long; 3#6-32 hexagonal brass nuts. (Note: If the plug in the ACP8 assembly is arranged for below chassis mounting, remove the locking ring, reverse the plug in the shell, and insert the locking ring.)

Fig. 7

ADAPTER FOR TESTING

373A - 374A Tubes



General Instructions:

Solder heavy, tinned wires to socket terminals; cover with proper lengths of #20, KS-7851, impregnated, varnished sleeving (any color). Extend wires through the pins of the plug. For oscillation suppressor wind the space between terminals of resistor with a single layer of #28 or #30 d.c.c. magnet wire, connecting it in parallel with the resistor leads. Tape resistor. After locking assembly draw leads up and solder to pins of plug.

1st Choice:

AC8S Amphenol socket; ACP8 Amphenol plug arranged for above chassis mounting; 3#6-32 round head brass machine screws 1/4" long; 3#6-32 hexagonal brass nuts. Mount resistor inside shell. (Note: If the ACP8 assembly is arranged for below chassis mounting, remove the locking ring, reverse the plug in the shell, and insert the locking ring.)

2nd Choice:

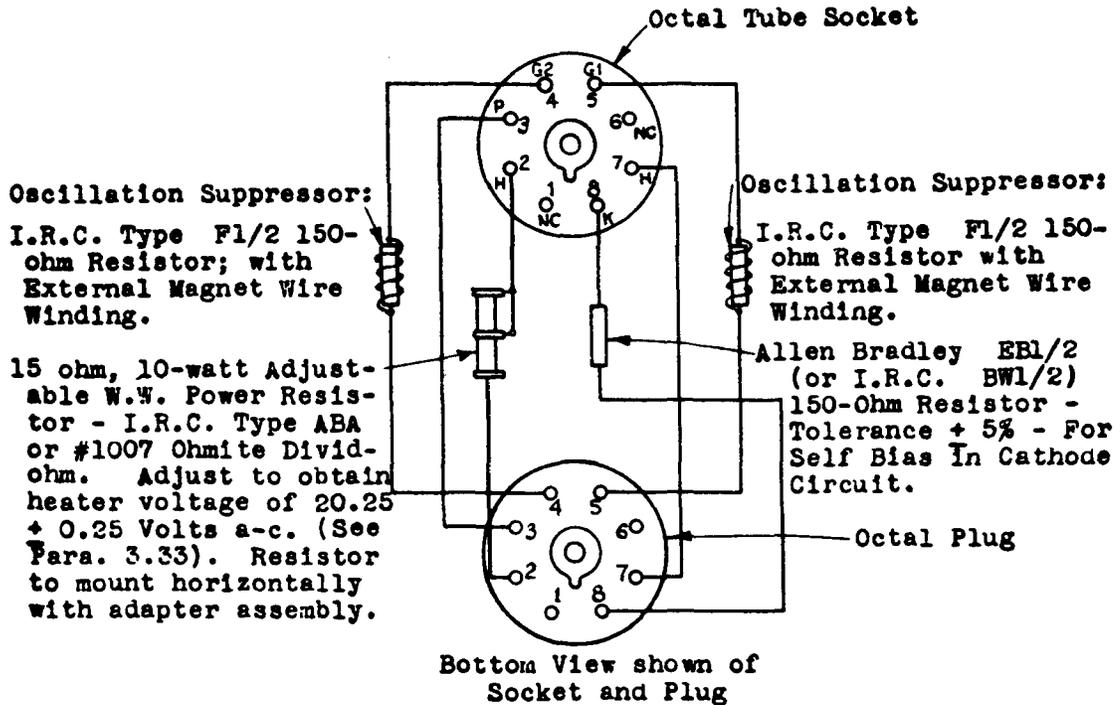
248S ICA octal tube socket (base mounting); either CP8 Amphenol plug or 70-8 Amphenol speaker plug; #4-size round head brass machine screw 1-1/4" long. Drill and tap plug for screw. After assembly cut screw flush with bottom of plug. The IRC resistor is external to this assembly and it should be taped to it; the exposed socket terminals should be taped.

3rd Choice:

44-8 Amphenol socket with 50-8 SD Amphenol plug. Slot upper edge of plug for upper lead from resistor and drill #50 size hole in side of 50-8 SD plug for lower resistor lead. Mount resistor on outside of the plug.

Fig. 6

**ADAPTER FOR TESTING
375A Tube**



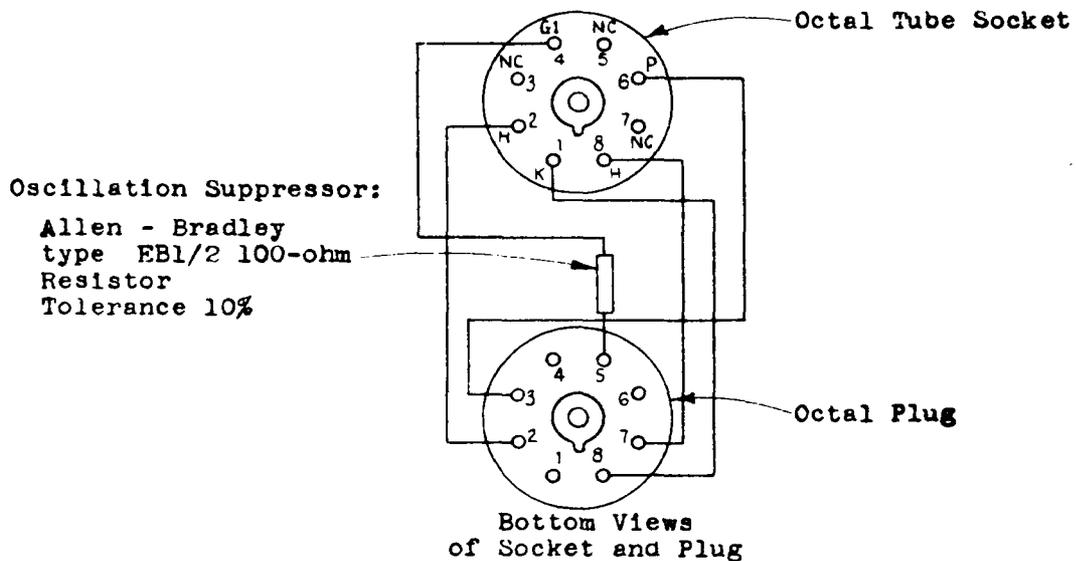
General Instructions:

Solder heavy, tinned wires to socket terminals; cover with proper lengths of #20, KS-7851, impregnated, varnished sleeving (any color). Extend wires through the pins of the plug. For the oscillation suppressors in the leads to G1 and G2 wind the space between terminals of resistor with a single layer of #28 or #30 d.c.c. magnet wire, connecting it in parallel with the resistor leads. Tape resistor. Mount oscillation suppressor and cathode bias resistors inside shell, power resistor externally (and suitably insulated from the shell). After locking assembly draw leads up and solder to pins of plug.

ACSB Amphenol socket; ACPB Amphenol plug arranged for above chassis mounting; 3#6-32 round head brass machine screws 1/4" long; 3#6-32 hexagonal brass nuts. Carry leads of power resistor through one or two of shell knock-outs and insulate from shell with grommets or tape. (Note: If the plug in the ACPB assembly is arranged for below chassis mounting, remove the locking ring, reverse the plug in the shell, and insert the locking ring.)

Fig. 9

ADAPTER FOR TESTING
383A Tube



General Instructions:

Solder heavy, tinned wires to socket terminals; cover with proper lengths of #20, KS-7851, impregnated, varnished sleeving (any color). Extend wires through the pins of the plug. Mount the oscillation suppressor resistor inside the shell. After locking assembly draw leads up and solder to pins of plug.

1st Choice:

44-8 Amphenol socket with 50-8 SD Amphenol plug.

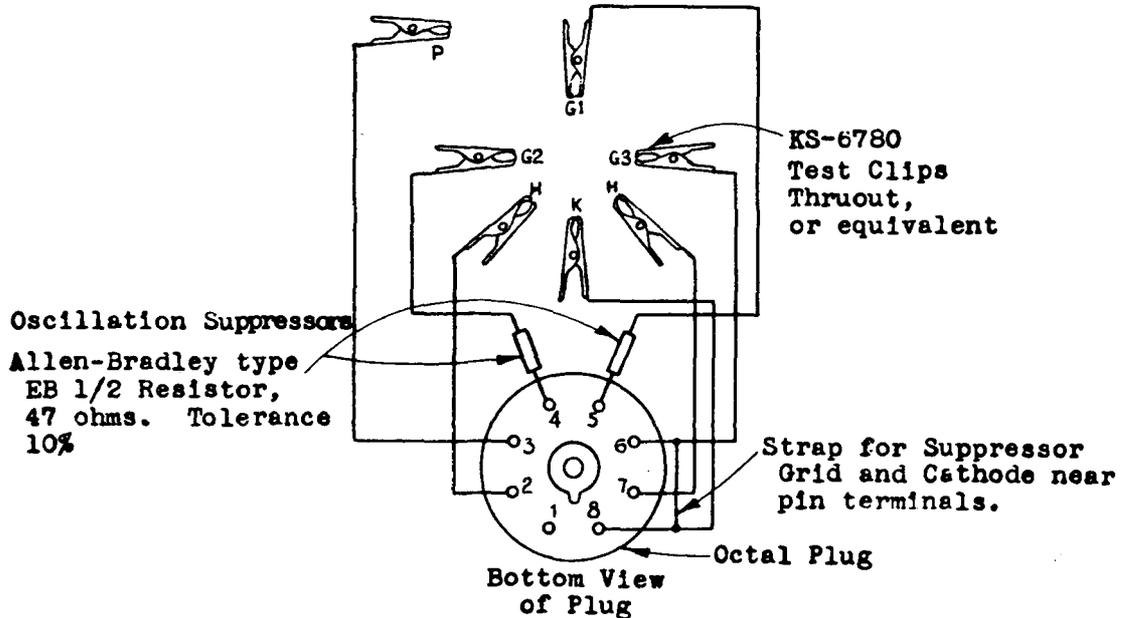
2nd Choice:

3-14 Amphenol adapter shell with S8 Amphenol socket and CP8 Amphenol plug.

3rd Choice:

ACS8 Amphenol socket; ACP8 Amphenol plug arranged for above chassis mounting; 3#6-32 round head brass machine screws 1/4" long; 3#6-32 hexagonal brass nuts. (Note: If the plug in the ACP8 assembly is arranged for below chassis mounting, remove the locking ring, reverse the plug in the shell, and insert the locking ring.)

**ADAPTER FOR TESTING
384A or 386A Tube
Pin Sequence Arrangement
Indicated**



General Instructions:

Use #18 or #20 bare, tinned, solid wire to mount test clips in proper rotational sequence, to extend approx. 3" above plug. Plate clip to extend 2" more for top tube lead. Insulate wire with #20, KS-7851, impregnated, varnished sleeving (any color). Identify G1 and K clips with colors, green and black, respectively. Solder the wires to the pins of the plug.

1st Choice:

50-8 SD Amphenol Plug.

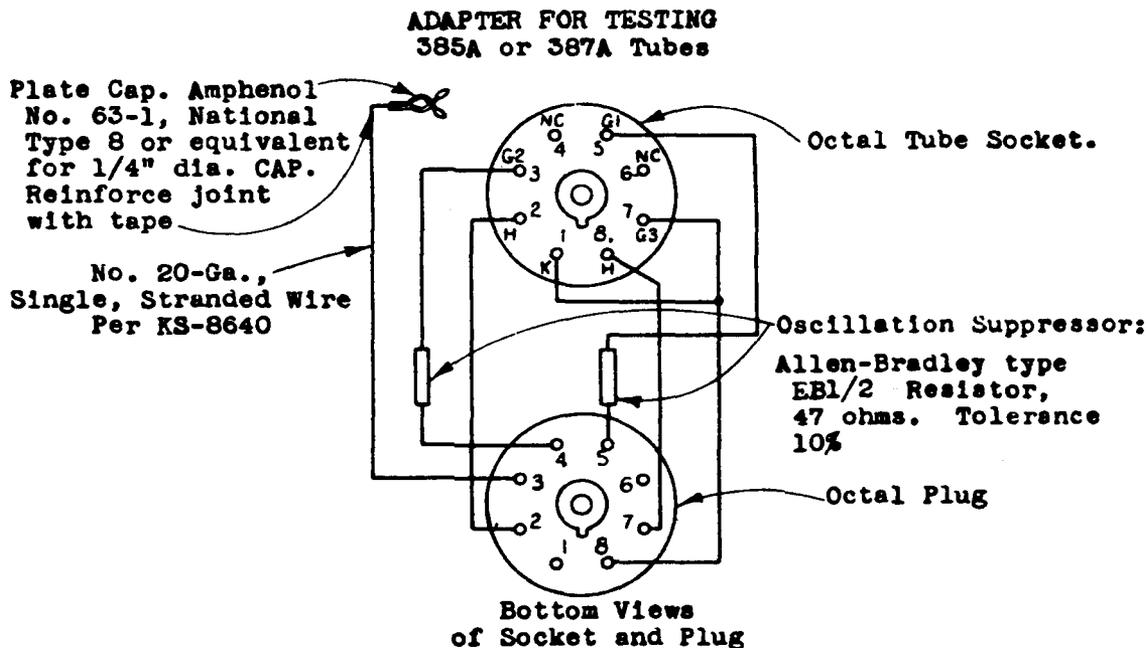
2nd Choice:

ACPS Amphenol plug arranged for above chassis mounting.

(Note: If the plug in this assembly is arranged for below chassis mounting, remove the locking ring, reverse the plug in the shell, and insert the locking ring.)

Note: This adapter may be utilized when the W. E. Company Adapter per ED-62777-01, Group 1 is not available.

Fig. 11

**General Instructions:**

Solder heavy, tinned wires to socket terminals; cover with proper lengths of #20, KS-7851, impregnated, varnished sleeving (any color). Extend wires through the pins of the plug. Mount the oscillation suppressor resistors inside the shell. After locking assembly draw leads up and solder to pins of plug.

1st Choice:

44-8 Amphenol socket with 50-8 SD Amphenol plug. Carry stranded lead for plate connection through hole in socket cup.

2nd Choice:

ACS8 Amphenol socket; ACP8 Amphenol plug arranged for above chassis mounting; 3#6-32 round head brass machine screws 1/4" long; 3#6-32 hexagonal brass nuts. Carry stranded lead for the plate connection through knock-out in the shell, using a grommet or tape to protect the wire from abrasion on the shell. (Note: If the plug in the ACP8 assembly is arranged for below chassis mounting, remove the locking ring, reverse the plug in the shell, and insert the locking ring.)

3rd Choice:

3-14 Amphenol adapter shell with 38 Amphenol socket and CP8 Amphenol plug. Carry stranded lead for plate connection through a hole drilled in the adapter shell, using a grommet or tape to protect the wire from abrasion on the shell.

Fig. 12

