OPERATING INSTRUCTIONS

FOR MODEL TV-12

TRANS-CONDUCTANCE TUBE TESTER

MANUFACTURED BY

SUPERIOR INSTRUMENTS CO.

2435-41 WHITE PLAINS ROAD   NEW YORK 67, N.Y.

The Model TV-12 Trans-Conductance Tube Tester was designed to test tubes under dynamic conditions closely resembling the operating conditions of the tube. It performs this function by measuring the plate current of the tube under test while under the direct influence of an in-phase grid voltage applied to the tube. (See Page 9 for a detailed explanation of the unique circuit employed in the Model TV-12)

With its simplified controls, fast-acting roll chart, self-cleaning lever switches and its English reading "Replace-Weak-Good" meter, the Model TV-12 will quickly and efficiently test the ever increasing number of tube types used in Radio, TV etc. for quality, shorts, leakage and noise. As an extra service, TRANSISTORS may be tested for quality in a circuit which converts them to their tube equivalents.

Simplification of switching and controls has enabled us to present the operating instructions in a simple, easy to understand style. On the following pages, we have illustrated procedures wherever possible. We suggest you study the data and the instrument panel before you attempt to use the instrument. The 10 minutes spent in doing so will be well invested for if you acquire a proper understanding of how this instrument operates, it will become your most frequently used piece of test equipment.

Like all better types of tube testers, the Model TV-12 provides the means of making the three basic tube tests.

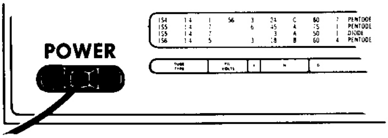
1. Tests for shorts and leakages
2. Tests for quality (Good-Weak-Bad)
3. Tests for noise

An additional tube characteristic, mutual conductance, while not necessary for ordinary servicing work, can be computed from data supplied by the Model TV-12. (See Page 10)

It is always best to proceed with the short and leakage test first and then follow through with the quality test. It is advisable to do so because a "shorted" tube would be identified as such when making the short and leakage test. If such a tube were tested for quality first, it could possibly damage the sensitive meter beyond repair.

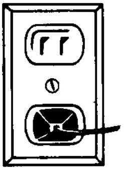
TO TEST A TUBE FOR SHORTS AND LEAKAGES

(1)



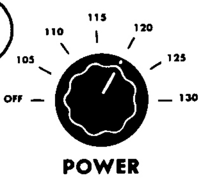
Insert the line cord into the panel of the TV-12.

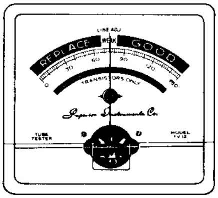
(2)



Plug the line cord into any 110 Volt A.C. power line.

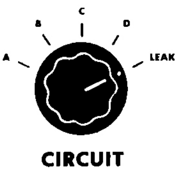
(3)





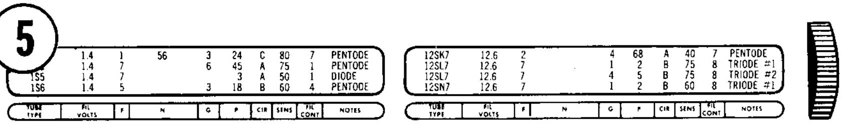
Rotate the "power" switch to the position that most nearly approximates your power line voltage. The correct setting is the position where the meter reading is closest to the "line-adjust" mark appearing in the center of the meter scale.

(4)



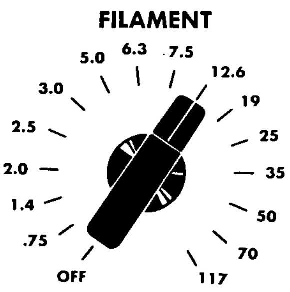
Rotate the "circuit" selector switch to its "leakage" position.

(5)



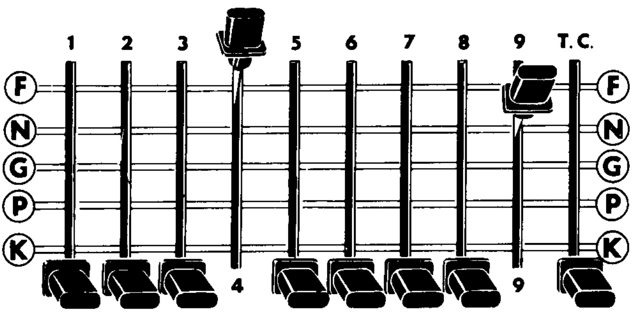
Rotate the roll chart until the required tube test data appears.

(6)



Turn the filament switch to the voltage indicated on the roll chart for the tube under test.

(7)

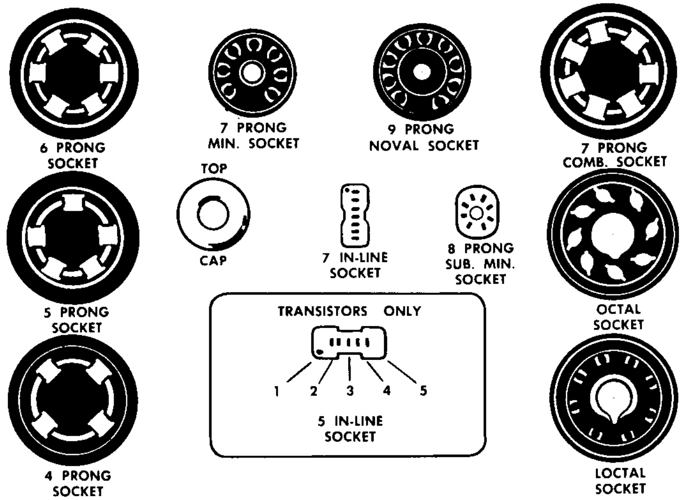


Place lever switches in the "F" and "N" columns as directed on the roll chart. *All* other levers should be down in the "K" position.

TO TEST A TUBE FOR SHORTS AND LEAKAGES

(continued)

(8)



Insert the tube into its correct socket. Be especially careful with the 7 pin in-line types. The dot or red mark should be near the raised section of the socket.

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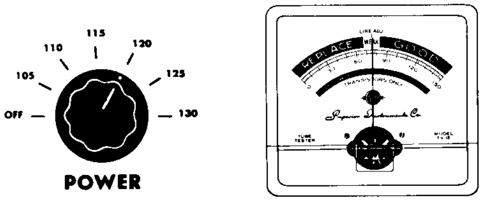
(9)



Re-adjust the "power" switch (step 3), if necessary, to compensate for the tube current drain.

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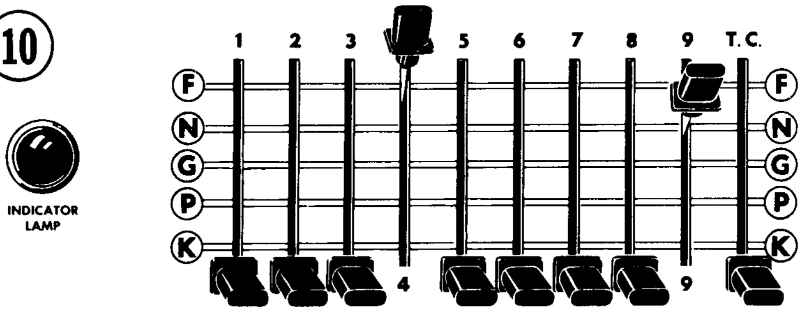
(10)



One at a time, move each lever (except those previously placed in the "F" or "N" positions) up to the "P" position. Tap the tube and observe the neon indicator lamp. A glow when any of the levers are moved to the "P" position indicates a "short." Each lever switch must be returned to its "K" position before proceeding with the next element test.

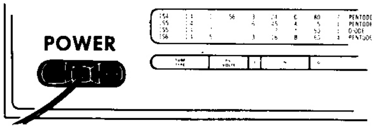
A slight glow may be disregarded when testing audio tubes such as the 6L6, 43, 50L6 etc. These tubes have a high inherent leakage, which in many cases does not effect the operation of the tube. No glow is of course desirable but a slight glow may be considered passable.

A steady glow on any element listed in the filament continuity column of the roll chart does not indicate a shorted tube. It does indicate filament continuity which should be present.

TO TEST A TUBE FOR QUALITY

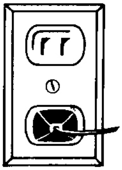
(AFTER FIRST CHECKING FOR SHORTS AND LEAKAGES)

1



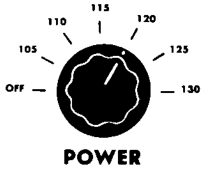
Insert the line cord into the panel of the TV-12.

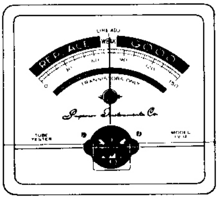
2



Plug the line cord into any 110 Volt A.C. power line.

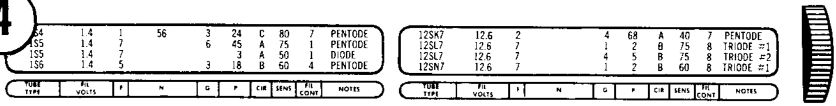
3





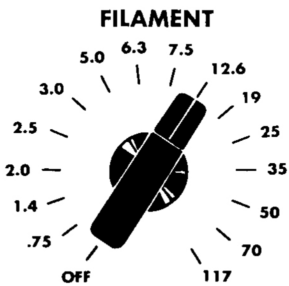
Rotate the "power" switch to the position that most nearly approximates your power line voltage. The correct setting is the position where the meter reading is closest to the "line-adjust" mark appearing in the center of the meter scale.

4



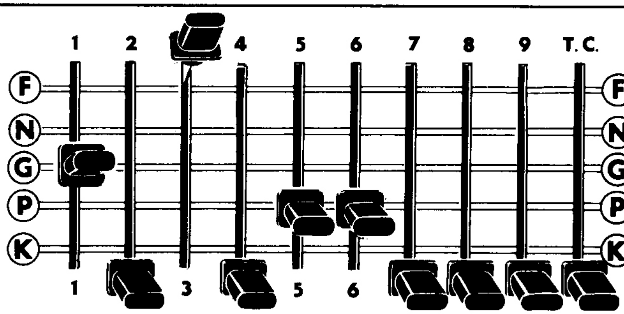
Rotate the roll chart until the required tube test data appears.

5



Rotate the "filament" switch to the voltage indicated on the roll chart for the tube type under test.

6



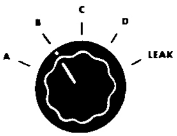
Place the lever switches appearing in the "F," "N," "G" and "P" columns in their respective positions. All other levers should be down in the "K" position.

EXCEPTION: If more than one number appears in either the P or N columns, the numbers listed are *all* placed in the specified position. Thus, for type 6AU6 tube, where the numbers 5 and 6 appear in the P column, both levers 5 and 6 are placed in the P position.

TO TEST A TUBE FOR QUALITY

(continued)

7

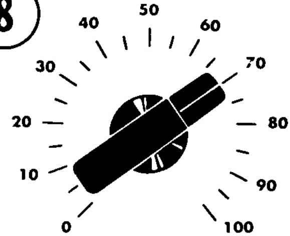


CIRCUIT

Rotate the "circuit" selector switch to the position indicated in the "circuit" column of the roll chart.

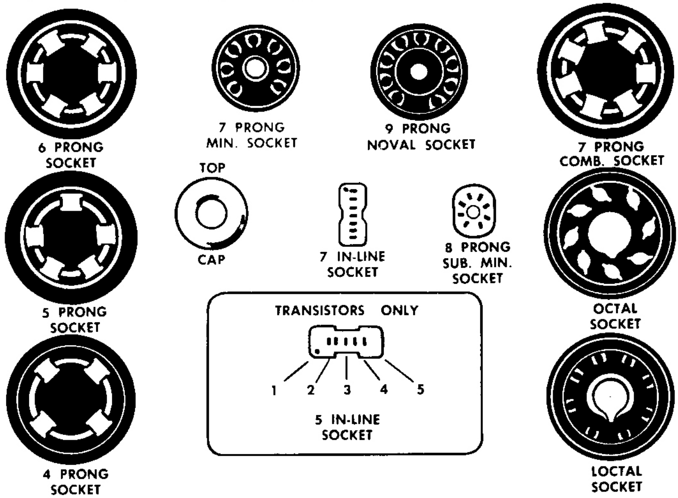
8

SENSITIVITY



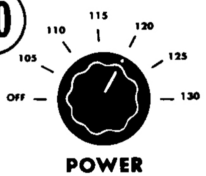
Rotate the "Sensitivity" control to the position indicated in the "Sensitivity" column of the roll chart.

9

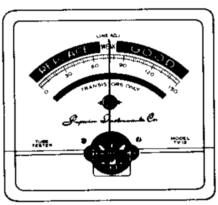


Insert the tube into its correct socket. Be especially careful with the 7 pin in-line types. Allow at least 15 seconds for the tube to heat up.

10



POWER



Re-set the "power" switch (step #3) if necessary to compensate for the tube current drain.

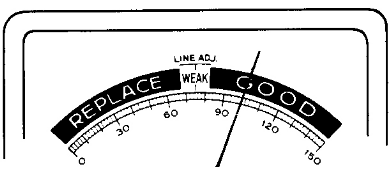
11

PRESS

TO READ

Press the "press to read" safety button.

12



Read the quality of the tube directly on the meter scale. The "Replace-Weak-Good" markings are self-explanatory. If the meter does not move at all, the trouble may be due to an open filament. To verify, check for filament continuity as described on page 7.

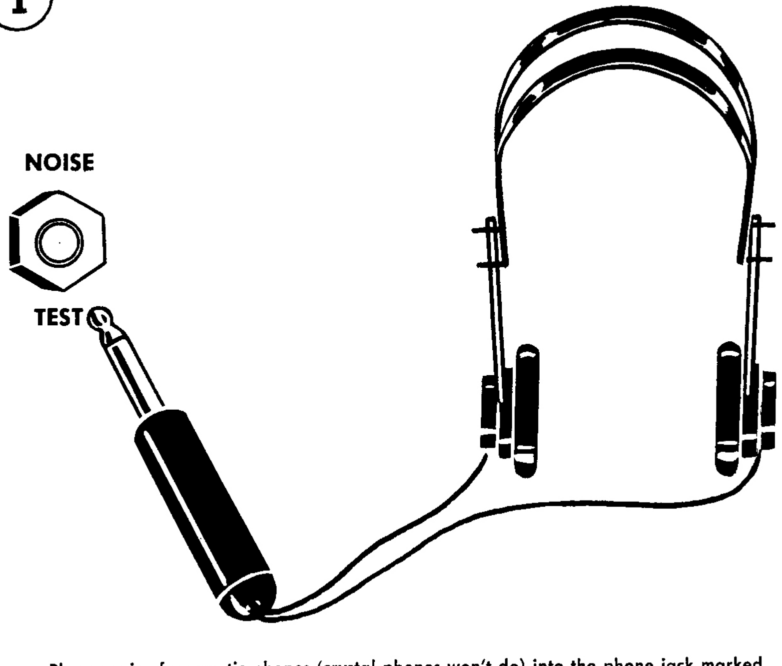
CAUTION: If meter hand slams hard, *release the "press to read"* button immediately and re-check all settings to see that they conform to the roll chart. This button is a "safety feature" designed to protect the meter.

TO TEST FOR FILAMENT CONTINUITY

A tube will not operate if its filament is open. To test for filament continuity, proceed as in "To test for shorts and leakages," but use the lever switch listed in the "filament continuity" column of the roll chart. When this lever is moved to the "P" position, the indicator lamp will light if the filament is *good*. No glow indicates an open filament.

TO TEST FOR NOISE

(1)



Plug a pair of magnetic phones (crystal phones won't do) into the phone jack marked "noise test."

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(2)

Follow procedures 1 to 12 as outlined in "To test a tube for quality."
The "circuit" and "sensitivity" controls may be left in any position. Tubes that are microphonic due to loose or touching elements will cause a "pinging" sound in the phones when the tube is tapped. The "ping" will be heard super-imposed above the hum of the tube.

EXAMPLE OF A TYPICAL TUBE TEST

TYPE 12AU7

FIRST *TEST FOR SHORTS AND LEAKAGES*

- ✓ Insert the line cord into the power socket located at the lower left hand corner of the TV-12.
- ✓ Insert the line cord into any 110 Volt, A.C. power source.
- ✓ Rotate the "power" switch to the position that causes the meter to read closest to the "line-adjust" mark appearing in the center of the meter scale.
- ✓ Rotate the "circuit" selector switch to its "leakage" position.
- ✓ Rotate the roll chart until the data for the 12AU7 appears. Note that two listings appear for this tube. This is necessary since the glass envelope contains 2 separate sections and each section must be tested individually.

It will read —

Tube	Fil. Volts	F	N	G	P	Circuit	Sensitivity	Fil. Cont.	Notes
12AU7	12.6	4	9	2	1	B	60	5	TRIODE-1
12AU7	12.6	4	9	7	6	B	60	5	TRIODE-2

- ✓ Turn the "filament" switch to the 12.6 Volt position.
- ✓ Place the #4 lever up in the "F" position.
- ✓ Place the #9 lever up in the "N" position.
- ✓ Insert the tube into the 9 pin noval socket which is the correct socket for this tube.
- ✓ Re-adjust the "power" switch if necessary.
- ✓ One at a time, move each lever switch (except #4 and #9) up to the "P' position. Tap the tube and observe the "short" indicator lamp. A steady glow (not a flash) when the levers are moved to the "P" position indicates a "short." Be sure to return each lever back to the "K" position before proceeding to the next lever.

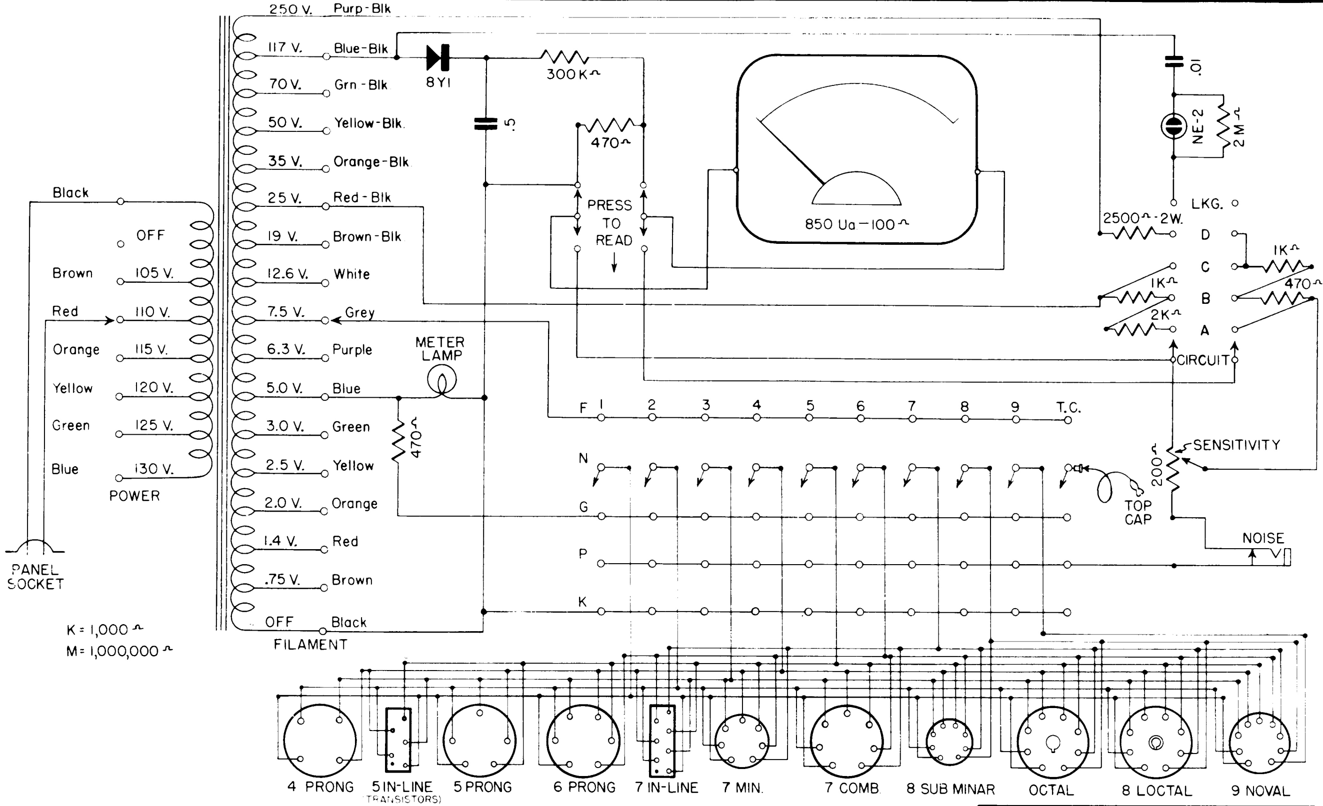
  #5 lever will light if the complete filament is intact thus indicating filament continuity between pins #4 and, #5 which is the complete filament of the tube.

NOW *CHECK FOR QUALITY*

- ✓ Leave the power switch in the position that causes the meter to read closest to the "line-adjust" mark.
- ✓ Leave the power switch in the 12.6 Volt position.
- ✓ Leave the #4 lever in the "F" position.
- ✓ Leave the #9 lever in the "N" position.
- ✓ Place the #2 lever in the "G" position.
- ✓ Place the #1 lever in the "P" position.
- ✓ Leave all other levers down in the "K" position.
- ✓ Rotate the circuit selector switch to the "B" position.
- ✓ Set the sensitivity control to 60.
- ✓ Press the "press to read" button and read the quality of the first section of the tube directly from the meter scale.

Repeat above using lever #7 in the "G" position and lever #6 in the "P" position to complete the test of the second section of the tube. Levers #1 and #2, previously used, are returned to the "K" position during the second test.

If more than one number appears in either the P or N columns, the numbers listed are *all* placed in the specified position. Thus, for type 6AU6 tube, where the numbers 5 and 6 appear in the P column, both levers 5 and 6 are placed in the P position.



The Model TV-12 is a dynamic trans-conductance type of tube tester. Although an understanding of the term trans-conductance is not at all necessary for the average Radio and TV Serviceman, the detailed explanation given below may be of some benefit to Radio Engineers who employ instruments in research and development.

The trans-conductance of a tube is the change in plate current divided by the grid voltage causing that change. The resultant figure is "milliamperes — volts" and when that is multiplied by 1000 the result is referred to as "conductance." (MICROMHOS)

In the Model TV-12 this is accomplished by placing a 5 volt in-phase voltage on the grid of the tube under test and observing the plate current meter. Since a D. C. meter is used in the plate circuit, the reading will be an average value falling between the plate current flowing when +5 volts is applied to the grid and zero volts is applied to the grid. The tube is in a non-conducting state for all values of grid voltage swing between zero grid volts and −5 grid volts. The meter then reads the average change in plate current divided by the change in grid voltage or $\frac{\Delta Ip}{\Delta Eg}$. The result is the trans-conductance of the tube under test.

SUPERIOR INSTRUMENTS CO.	
MODEL TV•12	
Designed by: S. Litt	Drawn by: J. Moss
Checked by: M. H.	Date: 10-5-55
Remarks:	

TO DETERMINE THE MUTUAL CONDUCTANCE OF ANY TUBE

The following data is supplied only for the use of Research Engineers and Technicians to whom the mutual conductance evaluation of a tube is of some significance.

That information is not required for ordinary Radio & TV Service work and this section may therefore be disregarded by the user who is engaged primarily in Radio & TV servicing.

The design of the Model TV-12 permits the mutual conductance of a tube to be calculated from the meter readings obtained and the published data furnished by the tube manufacturer.

The following abbreviations are used in all the formulae:

Ik = Cathode current

Ic_2 = Screen current

Ib = Plate current

Gm = Pentode Plate conductance or triode mutual-conductance (if tube is triode)

Gt = Triode mutual-conductance of pentode (plate and screen tied together)

Gs = Screen trans-conductance of pentode

u = Amplification factor

Rp = Plate resistance

The following formulae will assist in the mutual conductance determinations

1. $Gm = \frac{u}{Rp}$ or

$$\text{Mutual Conductance} = \frac{\text{Amplification factor}}{\text{Plate Resistance}}$$

2. $u = \frac{Gm.\ Rp}{10^6}$ or

$$\text{Amplification factor} = \frac{\text{Transconductance X Plate Resistance (Ohms)}}{10^6}$$

3. $R = \frac{e}{i}$ or

$$\text{Resistance} = \frac{\text{Voltage}}{\text{Current}}$$

4. $\frac{Gm}{Gt} = \frac{Ib}{Ik}$ or

$$\frac{\text{Pentode Transconductance}}{\text{Triode Transconductance}} = \frac{\text{Plate Current}}{\text{Cathode Current}}$$

Formula #2 is useful in the determination of the transconductance of a pentode since the amplification factor of pentodes is seldom given in tube charts.
Formula #4 is given for a similar reason and is derived from the following.

When the cathode current of a tube is shared by two collecting electrodes (plate and screen), the whole cathode stream (the "triode Gm") is shared in the same proportion as the current.

$$Ik = Ic_2 + Ib$$
$$Gt = Gm + Gs$$

Therefore

$$\frac{Gm}{Gt} = \frac{Ib}{Ik}$$

If it is desirable to find the screen transconductance, it can be calculated from

$$\frac{Gs}{Gm} = \frac{Ic_2}{Ib} \text{ or } \frac{Gs}{Gt} = \frac{Ic_2}{Ik}$$

EXAMPLE OF MUTUAL CONDUCTANCE CALCULATIONS

TUBE 6J7

100 Volts on plate & screen
−3 Volts grid bias
Mutual Conductance — 1185 Micromho's
Plate Current — 2.0 Ma.
Screen Current — .5 Ma.
The total cathode current is then
$Ik = Ib + Ic_2 = 2.0 + .5 = 2.5$ Ma.
The "triode" mutual conductance is therefore

$$\frac{Gt}{Gm} = \frac{Ik}{Ib} = \frac{Gt}{1185} = \frac{2.5}{2.0} = 1482 \text{ Micromho's}$$

Since the screen and plate voltages were identical, the calculated triode mutual conductance will be exact for conditions of −3 Volts grid bias and 100 Volt plate voltage as in the pentode transconductance. If plate and screen voltages were not identical, the calculated mutual conductance would still be within 10% since we then assume that the plate current of a pentode does not change as the plate voltage is increased from the screen voltage up to the value for pentode operation and exhibits constant current effects.

In all determinations of mutual conductance with the Model TV-12, it is also important to remember that a plate voltage of 35 Volts peak is used and the transconductance will be determined by the plate voltage. The calculations may therefore not agree with published data but would be correct for this plate voltage.

MEASUREMENT OF MUTUAL CONDUCTANCE WITH THE TV-12

1. After testing a tube for shorts and leakages, set all controls and switches as outlined in "How To Test a Tube for Quality."
2. Regardless of the roll chart settings, set the "circuit" selector to "C" and the sensitivity control to 50.
3. Press the "press to read" button and record the reading of the tube using the numerical 0-150 scale. The scale reading divided by 10 is the current in milliamperes (Ik) passed by the tube.
4. Using formula #3 (above) and E = 35 determine the effective resistance of the tube in the Model TV-12.
5. Formula #1 (above) is then used. u is taken from the published tube data chart or calculated using formula #2 (above). Rp is the resistance of the tube in the Model TV-12 as calculated in step #4.
   The result will be the mutual conductance of the tube.

EXAMPLE OF A TYPICAL TRIODE TEST

Tube — 6BK7 — each section

Data furnished by tube manufacturer

Amplification factor (u) 43
Plate Resistance (Rp) 4600 Ohms
Mutual Conductance (or transconductance) (Gm) 9300 Micromho's

When tested in the Model TV-12, one section of this tube showed a plate current of 7.5 Ma. therefore:

$$R = \frac{e}{i} = \frac{35}{0075} = 4750 \text{ Ohms effective plate resistance}$$

in the Model TV-12

$$Gm = \frac{u}{Rp} = \frac{43}{4750} = 9050 \text{ Micromho's}$$

NOTE: If the amplification factor were not given, it could have been calculated from formula #2 as

$$u = \frac{Gm \ X \ Rp}{10^6} = \frac{4600 \ X \ 9300}{10^6} = 42.78$$

EXAMPLE OF PENTODE TEST

Tube — 3BA6
Data furnished by manufacturer
Plate Voltage 100 Volts
Plate Current (Ib) 10.8 Ma.
Screen Current (Ic_2) 4.4 Ma.
Mutual Conductance (Gm) 4300 Micromho's

Using the above information furnished by the tube manufacturer, the triode transconductance is calculated using formula #4

$$\frac{Gm}{Gt} = \frac{Ib}{Ik} \text{ or } \frac{4300}{Gt} = \frac{10.8}{15.2} = 5950 \text{ Micromho's}$$

When tested in the Model TV-12, this tube showed a plate current of 7 Ma. Therefore, using formula #3

$$R = \frac{e}{i} = \frac{35}{.007} = 5000 \text{ Ohms effective plate resistance.}$$

The amplification factor of the tube is (formula #2)

$$u = \frac{Gm.\ Rp}{10^6} \text{ or } \frac{5950 \times 5000}{10^6} = 29.750000 \text{ or } 30.$$

The mutual conductance is therefore (formula #1)

$$Gm = \frac{u}{Rp} = \frac{30}{5000} = .006 \text{ mho's or } 6{,}000 \text{ micromho's}$$

The mutual conductance of a pentode derived with the Model TV-12 is the triode transconductance. It can be changed to the pentode value by reversing Formula #4 and solving for Gm.

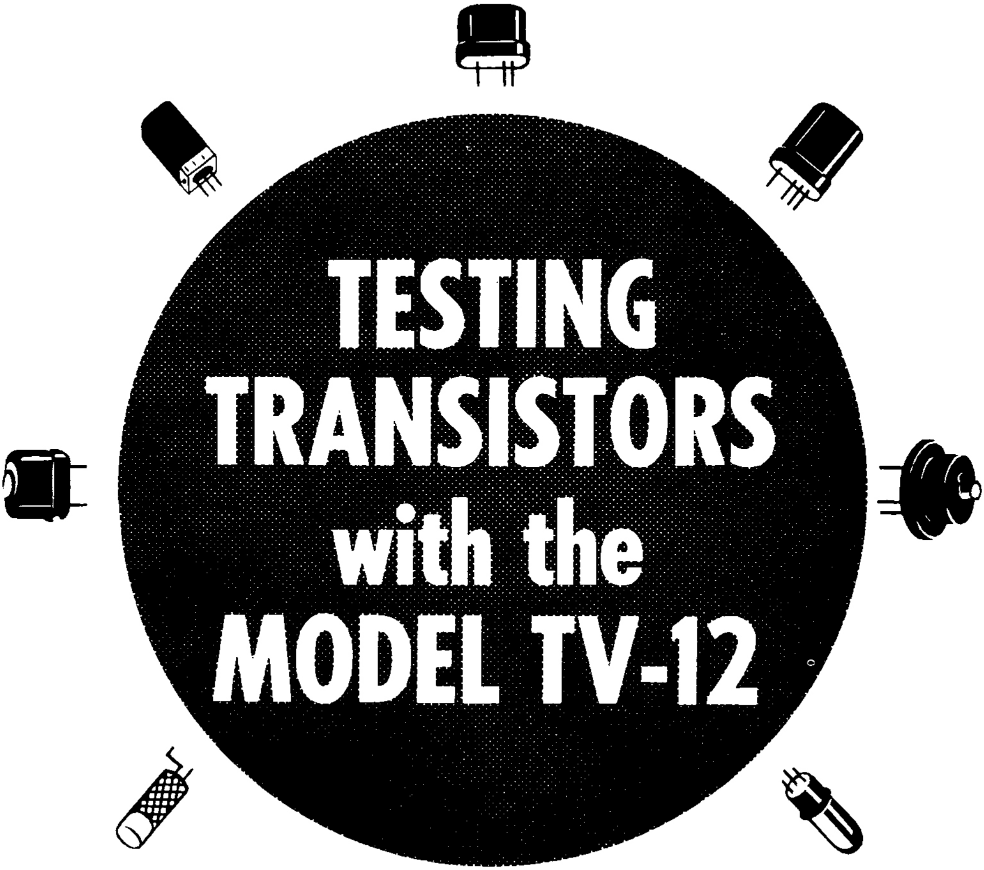
When testing a pentode in the Model TV-12, it is converted to a triode by means of the circuit and switching arrangement employed. It is, therefore, imperative to use the triode characteristics in the calculations. The triode characteristics of a pentode are not always published and must be calculated. Use of the pentode characteristics will give erroneous results as the screen current of a pentode under triode conditions with low plate and screen potentials may far surpass the plate current of the tube.

REPLACEMENT PARTS LIST FOR MODEL TV-12

Roll Chart $1.00
(To keep your tube tester up-to-date you need only replace the paper roll chart annually.)
Complete Meter $9.50
Power Switch $1.00
Circuit Switch $1.00
Filament Switch $2.00
Safety Switch $1.00
Sensitivity Control $1.00
Transformer $10.00
8Y1 Rectifier $1.50
Sockets (each) .... .50

Printed U.S.A.

TESTING TRANSISTORS with the MODEL TV-12



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2435-41 WHITE PLAINS ROAD NEW YORK 67, N.Y.

BASIC TRANSISTOR THEORY

Transistors belong to the family of "semi-conductors." A "semi-conductor" is a substance or material, which under certain conditions will permit the flow of an electrical current and under other conditions acts as an insulator and impedes the flow of an electrical current. Germanium, Selenium and Silicon are the most frequently used semi-conductors in use today. Almost all semi-conductors permit an electrical current to flow in one direction more easily than in the reverse direction and, therefore, may be used as rectifiers. Light, heat, and the presence of an electrical field all have an effect on the current flow. It is the presence of the electrical field in semi-conductors that permits transistor operation.

Current can flow through a semi-conductor in one of two ways:

1. An excess of free molecular electrons from a valence bond may become detached and travel to a point where a shortage of electrons exists. Semi-conductors which exhibit this property are called "donor" or "N" type materials.

2. Materials whose molecular valence bonds are not complete will accept free electrons to fill the "holes" in their valence bonds. Semi-conductors which exhibit this property are called "Acceptor" or "P" Type of materials.

A transistor is, therefore, a semi-conductor containing "P" or "N" material. A "junction" transistor is a transistor with a piece of "P" and "N" material placed side by side and in contact with one another. A "point contact" transistor is a transistor made with either "P" or "N" material, only. A "Cat's Whisker" wire pressing on one point of the "P" or "N" material is treated to form either an "N" or "P" contact (in reverse to the main semi-conductor body) in order to establish transistor action. The capacitance of the junction transistor is high, limiting the useful range to below 1 Kc. The capacitance of point contact transistors on the other hand can be made comparatively low. Point contact transistors therefore have a higher useful frequency range and some have been made to operate at frequencies greater than 100 Mc.

As previously stated, the flow of electrical current is produced by the presence of an electrical field. If the negative terminal of a power source is connected to an "N" type material and the positive terminal connected to a P-type material in contact with the N-type, free electrons move away from the terminal toward the "P" material which lacks the electrons. In a similar manner, it can be said that the "holes" move toward the negative terminal. If the polarity were reversed, no exchange of electrons and "holes" would occur. The transistor then acts as an insulator since no current flow would be permitted by the material.

Although a "PN" or "NP" transistor is in its simplest form, the usual procedure is to have a "NPN" or "PNP" transistor. The electrostatic field of the current flow of the first section of the transistor then controls to a great degree the current flow of the second section. The transistor then would be likened to a vacuum tube in which the input section controls the output section. The analogy stops there since a transistor is a low impedance device operating completely on current flow while the vacuum tube is a high impedance device operating on voltage differentials.

The following transistor connections can also be likened to the vacuum tube.

The transistor "emitter" is similar and analogous to the vacuum tube cathode since this element serves as the source of electrons.

The transistor "collector" is similar and analogous to the vacuum tube plate since this is the prime electron collecting element.

The transistor "base" is similar and analogous to the vacuum tube grid which is the controlling element.

The transistor can also be connected in circuits similar to that employed in vacuum tube circuits.

The transistor "grounded emitter" circuit is similar to the vacuum tube "grounded cathode."

The transistor "grounded base" circuit is similar to the vacuum tube "grounded grid."

The transistor "grounded collector" circuit is similar to the "grounded plate" or "cathode follower" circuit of the vacuum tube.

It is the analogy between the transistor and vacuum tube that permits the testing of transistors in the Model TV-12.

We wish to thank the following transistor manufacturers, who have provided transistors for evaluation:

Texas Instruments Inc.	R.C.A.
Radio Receptor Co.	Raytheon Corp.
General Electric	Philco Corp.
Sylvania Electrical Products	

TO USE THE MODEL TV-12 AS A TRANSISTOR TESTER

1. Insert the line cord into the panel of the Model TV-12.

2. Plug the line cord into any 110 Volt, A.C. power line.

3. Rotate the "power" switch to the position that most nearly approximates your power line voltage. The correct setting is the position where the meter reading is closest to the "line-adjust" mark appearing in the center of the meter scale.

4. Locate the test data on the transistor chart.

5. Rotate the "filament" switch to its *"off"* position. *This position is used for all transistors.*

6. Place the lever switches appearing in the "G" and "P" columns in their respective positions. *All* other levers should be down in the "K" position.

7. Rotate the "circuit" selector switch to the position indicated in the "circuit" column.

8. Rotate the "sensitivity" control to the position indicated in the "sensitivity" column.

9. You are now ready to insert the transistor under test into the transistor socket. At the present time there are only seven (7) types of lead terminations for standard transistors. More will probably be designed in the future, and when they are, data for them will be included in revised issues of our transistor chart.

Under the heading "lead type" we have indicated the type of lead termination for each transistor listed. Therefore, refer to the type of lead termination, then insert the leads of the transistor into the transistor socket referring to the illustrated diagram of that particular type.

10. Press the "press to read" safety button.

11. Read the quality of the transistor directly on the meter scale. The "Replace-Good" scale is self-explanatory. If the meter does not move at all, the transistor is defective or the leads have not been correctly inserted in the transistor socket.

(TRANSISTORS ARE NOT TESTED FOR "NOISE" OR "SHORTS." UNLIKE TUBES, THEY ARE TESTED FOR QUALITY ONLY.)

MODEL TV-12 TRANSISTOR CHART

(ISSUED DEC. 1955)

It is not possible to calculate the testing data for transistors. Instead, it is necessary to actually test an average sample of each type individually in order to compile calibrating data.

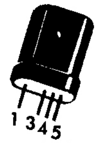
We have therefore listed below only transistors tested in our laboratory. As new transistors are released, we will check them and issue revised transistor data sheets.

TYPE	G	P	CIR.	SENS.	LEAD TYPE
RR14	4	1,5	B	40	1
RR20	4	1,5	B	40	1
RR34	4	1,5	B	40	1
RR115	4	1,5	B	40	1
ZJ3	4	1,5	B	35	7
2N32	4	1,5	B	40	1
2N34	4	1,5	B	45	1
2N35	5	4	B	25	1
2N36	3	1,5	B	40	3
2N37	4	1,5	B	50	1
2N38	3	1,5	B	50	3
2N43	4	1,5	B	35	7
2N44	4	1,5	B	35	7
2N45	4	1,5	B	35	7
2N47	3	1,5	B	40	5
2N49	3	1,5	B	40	5
2N62	3	1,5	B	40	5
2N63	4	1,5	B	40	1
2N64	4	1,5	B	40	1
2N65	4	1,5	B	40	1
200	5	4	B	35	1
201	5	4	B	25	1
202	5	4	B	30	1
300	4	1,5	B	40	1
301	4	1,5	B	40	1
700	5	3,4	B	35	2
721	3	1,5	B	40	3
722	3	1,5	B	40	3
723	3	1,5	B	40	3
725	3	1,5	B	40	3
727	3	1,5	B	40	3
800		1	B	25	4
with 100 Watt lamp 1" from window - Do not operate upright.					
903	5	4	B	70	1
904(-A)	5	4	B	70	1
905	5	4	B	80	1
1698	T.C.	1,4	B	40	6

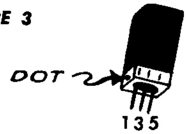
LEAD TYPES

TYPE 1

TYPE 2



TYPE 3



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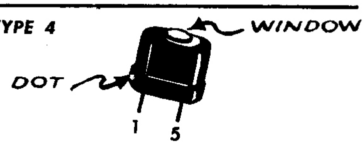

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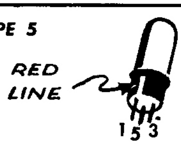
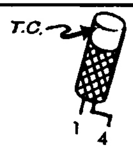


TYPE 6



TYPE 7

SUPERIOR INSTRUMENTS CO.

2435 White Plains Road **New York 67, N. Y.**