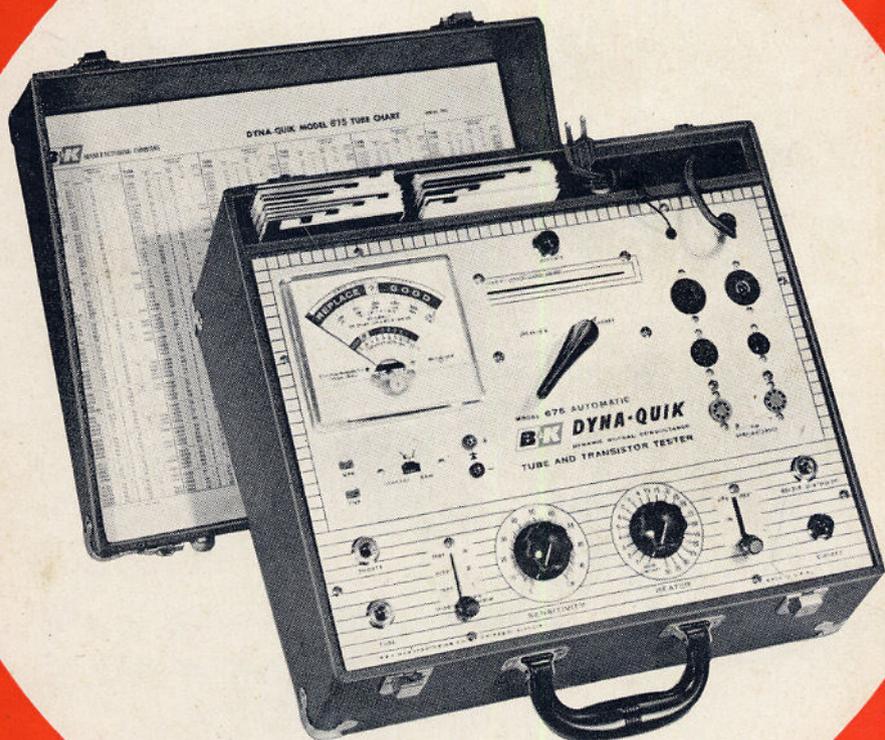


DYNA-QUIK Model 675

**DYNAMIC MUTUAL CONDUCTANCE
TUBE & TRANSISTOR TESTER**



INSTRUCTION MANUAL



B & K MANUFACTURING COMPANY

3726 N. SOUTHPORT AVENUE • CHICAGO 13, ILLINOIS

WARRANTY

Your DYNA-QUIK Tube Tester is made of the finest material and then carefully tested at the factory before shipment. It carries the standard RETMA warranty against defects in material and workmanship for a period of 90 days from date of purchase. Should any defect be discovered within this warranty period, return the unit to the distributor from whom it was purchased.

BE SURE TO MAIL YOUR WARRANTY REGISTRATION CARD IMMEDIATELY TO REGISTER YOUR UNIT WITH THE FACTORY.



B & K MANUFACTURING COMPANY

3726 N. SOUTHPORT AVE. • CHICAGO 13 • EAstgate 7-7270

OPERATING INSTRUCTIONS

FOR

Model 675

AUTOMATIC

DYNA-QUIK

**DYNAMIC MUTUAL CONDUCTANCE
TUBE and TRANSISTOR TESTER**

B & K MANUFACTURING COMPANY

3726 North Southport Avenue

Chicago 13, Illinois

WHAT IT WILL DO

No. 1—The Dyna-Quik Model 675 automatic punched card Tube Tester will check more than 99% of the TV tubes in general use. Tubes can be tested in an incredibly short time since only a minimum number of controls need be set.

No. 2—The Model 675 will provide accurate results because it checks tubes for their Dynamic Mutual Conductance (G_m) in a true transconductance bridge. Diodes are checked for emission only, since they possess no mutual conductance.

No. 3—Each tube is automatically checked for short circuits and leakage up to 1 megohm. These tests are made between the various elements of the tube and furthermore this test is made before the G_m measurement.

No. 4—The Model 675 Tester will provide an indication of the probable useful life remaining in a tube by means of a special LIFE TEST.

No. 5—Gas, grid contamination, or even obscure grid-to-cathode leakage are all disclosed by an exceptionally sensitive grid current check. This test will reveal as little as 2 or 3 microamperes of current in the grid circuit.

No. 6—Each section of a multisection tube is checked separately. Therefore tubes can be checked and selected for balance between sections. This is convenient for selecting dual section tubes to be used in push pull circuits.

No. 7—Semiconductors (rectifiers, diodes, and transistors) can be tested. Rectifiers checked for Forward-to-Reverse Conduction Ratio. Diodes for Forward-to-Reverse Ratio. Transistors for Leakage and Gain.

TESTING TUBES FOR DYNAMIC MUTUAL CONDUCTANCE

In radio and television circuits practically all tubes (except rectifiers and diodes) are used as some type of amplifier. Even oscillator circuits (i.e.—R.F. or horizontal oscillators) are basically amplifiers with regenerative feedback. Therefore, the most important characteristic to be checked to determine how effectively any radio or TV tube will function in its circuit, is its ability to amplify. This, in turn, is governed by its mutual conductance.

The mutual conductance is the ratio of the change in the plate current that results from a small change in grid voltage.

$$G_m = \frac{\Delta I_p}{\Delta E_g} \quad \text{where:}$$

ΔI_p = a change in plate signal current.
 ΔE_g = a small change in grid signal voltage.

The amplification of a circuit = $G_m R_l$. Where R_l is the equivalent load resistance of the stage.

Since R_l is constant in any circuit, we see that the amplification depends directly on the G_m of the tube.

The G_m for a given tube can be measured accurately by applying the correct amount of a.c. signal voltage to the grid and measuring the resulting a.c. plate current. This is done by means of a sensitive bridge circuit.

Measuring the mutual conductance of a tube provides the most accurate and all inclusive single test that can be made on any tube.

TESTING DUAL TRIODES AND OTHER MULTI-SECTION TUBES

Each section of a multi-section tube is checked separately and quickly by setting a single switch. Therefore, tubes can be checked and selected for balance between sections. This test is illustrated in Fig. 1.

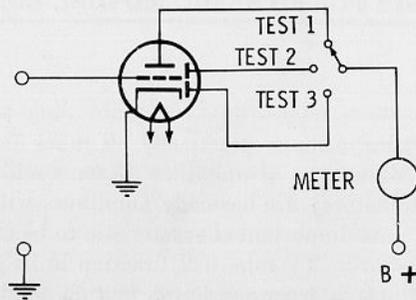


Figure 1
Each Section of Multisection Tube Tested Separately.

LIFE TEST

Many manufacturers have found that testing tubes under reduced heater voltage conditions will give a strong indication of its probable useful life. A tube may show adequate G_m under normal test conditions; however, a reduction of 10% to 15% of heater voltage may be marked by a sharp slump in G_m reading. This slump or decay indicates that the space charge of the tube has been depleted to the point where the tube will have a short remaining useful life. While the amount of life remaining cannot be too closely estimated, you can be reasonably sure that a tube showing a sharp slump is not a good risk for continued trouble-free service.

TESTING TUBES FOR GRID EMISSION AND GAS

The Grid Emission and Gas Test is an invaluable aid in TV servicing because it quickly picks out those tubes which can cause trouble in a.g.c., sync, I.F. amplifier, and R.F. tuner circuits.

In order to understand how a tube can have "grid emission" and "gas current" we must look into the theory of electron tubes.

There is normally some little evaporation of the cathode coating material on the grid of a tube. Some of this vapor tends to deposit on the grid and gives rise to what is known as "grid emission", where the grid itself emits

electrons and draws current commonly known as "negative grid current". The flow of this "negative grid current" can be followed in Figure 2.

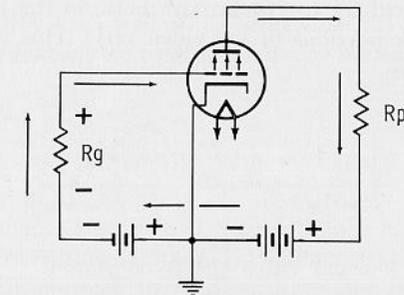


Figure 2
Negative Grid Current.

The electrons flow from the grid to the plate then back through the power supply to the grid leak resistor R_g and up to the grid again. Notice that the voltage drop across the grid leak resistor R_g is such that it causes the grid to go more positive than it normally would with no grid emission.

If a slight amount of "gas" is present in a tube some of the electrons from the cathode will collide with molecules of the gas and may knock off one or more electrons, leaving positive ions (ionization). Some of these positive ions may then strike the grid, taking an electron from the grid to form a gas molecule again. The electron flow of this "gas current" is exactly the same as it is for the "grid emission current" and can be traced on Figure 2. Notice again that the grid is made more positive by this "gas current".

Now let us see what happens if an I.F. amplifier tube in a TV set has grid emission current or gas current (negative grid current). In Figure 2 we noted that the grid would tend to go more positive if negative grid current flowed.

In Figure 3, a typical I.F. stage, we see that if there is any negative grid current, the bias voltage in that stage and other associated stages will go more positive because of the flow of current through R_1 . Making the grid more positive will drive the tubes to saturation, causing clipping or overloading.

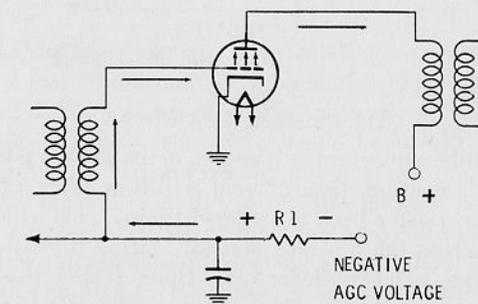


Figure 3
Typical I.F. Stage.

After detection, a video signal normally appears as shown in Figure 4. If the signal is clipped in an I.F. stage it will look like Figure 5. Now the horizontal oscillator will try to synchronize both on the blanking signal (A) and on the very black portions of the video (B). This results in pulling or snaking of the picture.



Figure 4
Normal Video and Sync Signal.

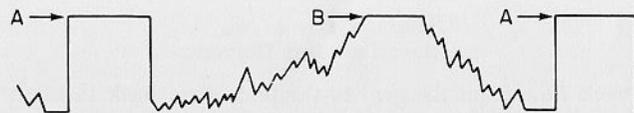


Figure 5
Overloaded or Clipped Video and Sync Signal.

To achieve this sensitive grid emission or gas test, the circuit shown in Figure 6 was employed.

The tube under test has its normal plate to grid voltage applied, but the grid is biased beyond cut-off so that no plate current flows. This bias is applied through the 5.6 megohm resistor. The same 5.6 megohm resistor is also in the grid circuit of a 6AT6 d.c. amplifier and the conditions in this tube are such that it, too, is biased just beyond cut-off. Under these conditions, no plate current flows in the 6AT6 and no reading is obtained on the meter in its plate circuit.

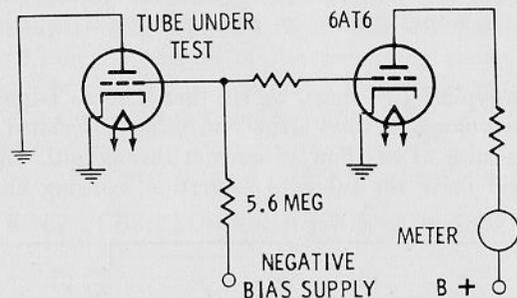


Figure 6
Grid Emission Test Circuit.

However, if the tube under test is gaseous, or its grid is contaminated with some of the cathode coating, then current will flow from grid to plate and through the 5.6 meg resistor back to the grid again. This will produce a positive voltage drop across the 5.6 meg resistor, lifting the cut-off bias on the 6AT6 and producing a meter deflection. Upon seeing this deflection, the technician immediately knows that the test tube is defective and a replacement is indicated.

SHORTS TEST

The test for SHORTS is made at the same time the tube is being checked for gas. Shorts and leakage up to 1 megohm are indicated by the neon lamp, marked SHORTS.

SEMICONDUCTOR DEVICES

Semiconductor devices are made of materials such as germanium, selenium and silicon which are neither really good conductors or good resistors. However, they will permit or resist current flow depending upon conditions. Semiconductors are classified as N-type or P-type. If the material contains a surplus of free electrons it is classed as an N-type. When the material has a deficiency of electrons, referred to as holes, it is P-type.

DIODES

Current will flow in either direction through N-type and P-type semiconductor materials when one of these materials is used alone. If an N-type and a P-type are joined together they form a diode (or rectifier). Current will flow through this diode if a voltage is applied across it in the correct polarity because of the low resistance of the diode to current flow in this (the forward) direction. If the voltage is applied in the opposite polarity across the diode very little current will flow because of the high resistance presented by the diode to current flow in the reverse direction. Diodes are rated for their maximum rectified current and maximum inverse voltage (voltage applied in the opposite polarity to that which would produce maximum forward current).

Selenium, copper oxide, silicon and germanium rectifiers, such as used in power supplies, are similar in operation to the diodes discussed. Their most outstanding difference is in current rating.

PNP AND NPN TRANSISTORS

Transistors, of the types shown (with batteries connected) in Figs. 7 and 8 are composed of two P and one N-type material (Fig. 7) or two N and one P-type (Fig. 8). When voltage is applied with the polarities shown in Figs. 7 and 8, electrons will flow from N to P and holes will move from P to N. Under these conditions current would not normally flow through the collector. However, current will flow from the emitter through the collector because of the surplus of holes at the base and collector junction. In this way the collector current is controlled by the emitter. Most of the current flows through the emitter to the collector and very little flows through the common base. The gain of a transistor is due to the comparatively large

amount of current flowing in the output circuit which is controlled by a small current flow into the emitter.

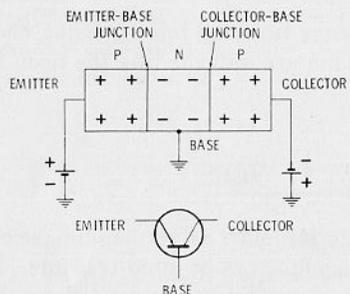


Figure 7

Construction and Symbol of PNP Junction Transistor.

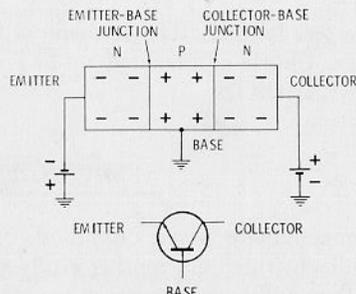


Figure 8

Construction and Symbol of NPN Junction Transistor.

AUTOMATIC LINE VOLTAGE COMPENSATION

Every effort has been made to make the operation of this instrument as fast and simple as possible. Toward this end, automatic line voltage compensation has been incorporated into the tester. A voltage sensitive bridge monitors the line voltage at all times and automatically adjusts the sensitivity of the G_m bridge to compensate for these line voltage variations. This eliminates the necessity of readjusting the line voltage for different types of tubes and at different line voltages.

HEATER CONTINUITY TEST

A heater continuity position is provided on the heater switch to enable you to rapidly test tubes for heater continuity only. This is a valuable service aid in servicing TV receivers with series heaters when one tube has an open filament, since a whole string of tubes will not light up.

HOW TO OPERATE THE DYNA-QUIK MODEL 675 TUBE TESTER

1. Place OFF-ON-LIFE Switch in ON position.
2. Insert tube in socket.
3. Insert correct Dyna-card in slot as far as it will go.
4. Set Heater Switch to proper Heater Voltage.
5. Turn Insert-Operate Switch to Operate Position (Operate lamp will light).
6. Set SENSITIVITY control.
7. Test in sequence: SHORTS and GRID EMISSION, G_m and LIFE.

Test Procedure

The Model 675 is designed for use on 105-125 volts 60 cycles AC only. Do not use on any other type of current. When the tester is plugged into an AC outlet the power can be turned on by means of the OFF-ON-LIFE (Fig. 9) switch in the lower right-hand corner of the test panel. The red pilot lamp just above the switch, will light when the tester is on.

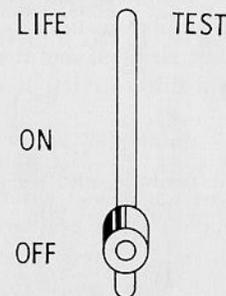


Figure 9

OFF-ON-LIFE TEST Switch

The punched plastic Dyna-cards which set up the socket connections and voltages are numbered and colored so that it will be immediately evident if a card is not put back into the correct place in the rack. The first ten cards in each rack will be the most used, as these Dyna-cards test the most popular TV tube types. After a few days of use the serviceman will probably remember the cards for the more popular tubes, making the test procedure that much faster. The Sensitivity settings for the most important tubes tested on each card are printed right on the card itself.

The tube chart mounted on the inside of the cover is a listing of all the types tested in the Model 675, as well as the Dyna-card used, Heater voltage and Sensitivity setting.

The setting of the Heater switch position determines the filament voltage applied to the tube under test. For example: the switch is set to 3 for 3.15 volt filament tubes, and the switch is set for 6 for 6.3 volt filament tubes, etc. This setting is determined by the first number of the tube designation. Thus, for a 3AL5, the heater control would be turned to 3; for a 6AL5, it would be turned to 6; and for a 12AL5, the control would be set to 12.

CAUTION: THE HEATER CONTROL MUST BE SET TO THE CORRECT FILAMENT VOLTAGE BEFORE TURNING THE "INSERT-OPERATE" SWITCH, INTO THE OPERATE POSITION. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BURNING OUT A FILAMENT.

Since hundreds of other tube types besides those listed on the Dyna-Card can be tested on the Model 675, each additional type (with Dyna-Card number and control settings) is listed on the Dyna-Quik Tube Chart. The Dyna-Cards are placed in numerical order to aid in the quick identification of the correct card.

The setting for the sensitivity control are printed right next to the tube type on the Dyna-Card. Examples: — 6AU6 — 72

6U8 — 71·53

The tubes with multiple sections, as the 6U8, have two sensitivity settings because there are 2 separate sections in this tube envelope. Because this type has 2 dissimilar sections of the tube, the sensitivity setting are different for each section, although on some types (e.g. 6SN7 — 92·92) the 2 sections are the same and therefore the sensitivity settings are the same.

When a multiple tube of dissimilar sections is tested, the Test 1 position tests the section that has the most elements and the other section will be tested in Test 2 position. If there is a third section it will be tested in the Test 3 position.

EXAMPLES: 6U8 — 71·53

The first section tested is the pentode, and then the triode is tested.

6AT6 — Test 1 — 90

Test 2 — 62

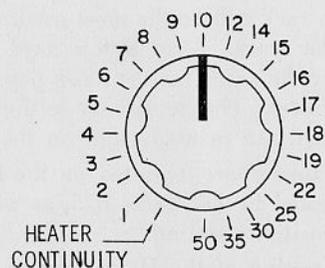
Test 3 — 62

Sequence of tests for 6AT6 — triode, diode, diode.

(Note: — When the 6T8 is tested, the Test 3 position tests two of the diodes in series.)

A lead fitted with plate cap connector is supplied for testing tubes having plate leads connected to caps on the top of the tubes.

The HEATER CONTINUITY position on the HEATER switch (Fig. 10) has been incorporated in the Model 675 Tester to save time with series filament TV receivers. Insert Dyna-Card marked "Heater Continuity" into slot. Put "INSERT-OPERATE" switch in operate position. Put HEATER switch to heater continuity position. Insert tube to be tested into correct socket. Heater continuity lamp will light immediately, if heaters are O.K. If neon lamp fails to light the heater is open and no further tests need be made. This test will not work on power rectifier tubes such as 5U4, battery radio tubes, local tubes and U.H.F. tuner tubes.



HEATER
Figure 10
Heater Switch

Short Test

With the Model 675 turned ON, the HEATER switch should be set to the correct heater voltage, and the INSERT-OPERATE switch to "Operate".

The TEST switch (Fig. 11) is set in the bottom or starting position, marked SHORT-GRID EMISSION, for the Shorts Test. The neon SHORTS lamp should be observed while making the Shorts test. Any short or leakage, up to 1 megohm in value, between the elements of the tube under test, will cause the SHORTS lamp to light up. Any tube which causes the SHORTS lamp to light is defective and should be discarded immediately. It is generally desirable when making the Shorts test, to tap the tube being tested in order to bring out any intermittent shorts.

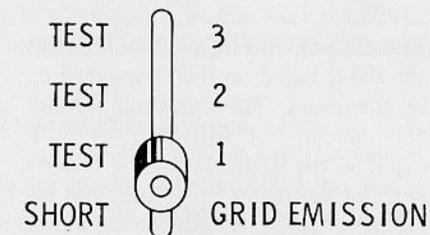


Figure 11
Test Switch

DO NOT GIVE FURTHER TESTS TO TUBES WHICH ARE SHORTED OR WHICH SHOW GRID EMISSION

Gas and Grid Emission Test

A tube is also being tested for gas and grid emission while the test switch is in the Shorts test position. The result of the Gas and Grid Emission test will be observed as a deflection of the meter needle if the tube is gassy or has a contaminated grid. These conditions cause grid current to flow and since a current as low as 2 or 3 microamperes can be detected, this is a very sensitive test. A tube, although it may seem to operate normally in a receiver, should be discarded if the meter reads into the Grid Emission—Reject area of the scale during the Gas and Grid Emission test because a gassy condition usually becomes progressively worse and eventually may cause serious trouble. The importance of the Gas and Grid Emission tests cannot be overstressed. Case histories of hundreds of tube failures, particularly those used in R.F., I.F., and Video Amplifier stages, reveal that a substantial number were due to gas, grid emission or grid to cathode leakage. Grid to cathode leakage, caused by a high resistance leak (can be 1 megohm or higher) between the grid and cathode of the tube under test, will produce a deflection on the meter during the Gas and Grid Emission test but will not light the neon SHORTS lamp as would a low resistance leak or direct short between the grid and cathode. Grid to cathode leakage can be the source of poor picture quality, twisting, bending or pulling of the picture, vertical jitter or bounce, and sync buzz. The test circuit in Fig. 6 illustrates how the presence of grid to cathode leakage in the tube under test will produce a deflection on the meter due to the fact that enough current will flow through the 5.6 megohm resistor to make the 6AT6 tube conduct.

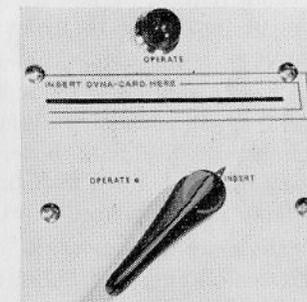


Figure 11A
Insert-Operate Switch

Gm Test (Mutual Conductance)

The TEST switch is moved up to the second position (marked TEST 1) for the *Gm* test, if the tube has passed the Short, Gas and Grid Emission tests.

The SENSITIVITY control is set at the value listed on the Dyna-card or in the chart. The condition of the tube under test will then be indicated on the REPLACE—?—GOOD scale of the meter. Any tube not indicating GOOD should be replaced.

The TEST switch is moved up to the TEST 2 position to make the *Gm* test on the second section of a dual section tube such as 6SN7GT. Three section tubes are tested in the TEST 1, TEST 2 and TEST 3 positions of the TEST switch and at the Sensitivity values indicated on the Dyna-card or on the chart. For example: the triode section of a 6AT6 is tested in the TEST 1 position with a Sensitivity value of 90, the first diode section in TEST 2 with a Sensitivity of 62 and the second diode section in TEST 3 position with a Sensitivity of 62.

NOTE: Since the customers for whom the tubes are checked can easily read the condition of the tube on the REPLACE—?—GOOD scale, this is the test that will normally be made. However, since the true *Gm* rating is included in most technical data concerning a tube, the exact *Gm* value of the tube under test can be obtained by using the Sensitivity value listed in the TRUE *Gm* column in the indexed chart.

There are two numerical scales on the meter for reading True *Gm*; 0-6000 micromhos and 0-18,000 micromhos. The 0-6000 micromhos scale is printed on the meter in black and the 0-18,000 is printed in red. If the true *Gm* reading is to be in the 0-6000 micromhos scale, the sensitivity setting in the TRUE *Gm* column *in the index* will appear in black. However, if the sensitivity setting in the TRUE *Gm* column *on the chart* is in red, then the meter reading will be on the red scale; 0-18,000 micromhos.

The printed table on the chart also indicates the standard *Gm* for a new tube. This is an average *Gm* value to be expected for that type tube. This can be tested with the TRUE *Gm* setting of the Sensitivity control.

The True *Gm* value of a tube is not needed to judge its condition. The relative REPLACE—?—GOOD indication will serve satisfactorily. However, the facility for exact *Gm* determination is available and may be employed, if desired. It is useful for selecting tubes used in push-pull output stages, for example.

For the protection of the instrument, a No. 44 pilot lamp mounted on the front panel is used as a fuse. This lamp will glow slightly, especially with high current tubes, during the *Gm* test. This glowing is normal and should be ignored. If this bulb glows brightly during the *Gm* test it indicates you are using the wrong Dyna-card or the tube is shorted.



SENSITIVITY

Figure 12
Sensitivity Control

Life Test

The ON-OFF-LIFE TEST switch (Fig. 9) is pushed up to the LIFE TEST position for the Life test. The Life test will help the service man judge how much useful life still remains in a tube being tested. A tube may test O.K. on the *Gm* test but the Life test will detect whether or not it is in the process of losing its *Gm*.

The heater voltage is reduced by a predetermined amount when the ON-OFF-LIFE TEST switch is in the LIFE TEST position. The reading on the meter will drop very little under the reduced heater voltage conditions if the tube has sufficient reserve to continue to operate normally. If the meter reading does not drop, the tube is in excellent condition. But if the tube under test has a depleted space charge, a large drop will occur in the meter reading indicating that a replacement is warranted. A drop of 75% of the normal meter reading indicates the tube is reaching the end of its useful life.

Testing Selenium, Copper Oxide and Silicon Rectifiers Forward—To—Reverse Conduction Ratio

The Dyna-card labeled TRANSISTORS and DIODES is inserted in slot.

The Red (+) and Black (—) test jacks, located below the meter, are used (with the pair of test leads supplied with the Model 675) when checking the Forward-to-Reverse Conduction Ratio of a rectifier. The Red test lead is inserted into the Red (+) test jack and the Black lead inserted into the Black (—) test jack. The negative (Black) lead is clipped to the positive terminal of the rectifier being checked. The positive (Red) lead is clipped to the negative terminal of the rectifier. The rectifier is biased in the forward direction when connected with this polarity.

The TEST switch is set in the TEST 1 position and the ON-OFF Switch set to ON. The Sensitivity control is then adjusted for full scale reading on the meter (which is 100%). The connections to the rectifier are then reversed, to reverse the polarity and thereby bias the rectifier in the reverse direction, and the reading on the meter noted. Most good rectifiers will produce only a very small meter deflection when biased in the reverse direction. A multiple plate rectifier that produces a Forward-to-Reverse Conduction Ratio of 20:1 (twenty times as much current in the forward direction as in the reverse direction) is rated a good rectifier. This will be indicated by a 5% reading on the scale in the reverse direction.

Rectifiers which show a reverse current of 10% or over on the meter scale are in all probability defective and should be replaced. These tests are made with the rectifier disconnected from its TV receiver circuit.

Testing Germanium and Silicon Diodes

The same procedure is used in testing germanium and silicon diodes as used in testing rectifiers. Diodes differ from rectifiers in that they do not

have the current handling capabilities of the power rectifiers as well as some other operating characteristics. But they do operate because they rectify and that is why they are tested as rectifiers. The cathode of a diode is the positive terminal. The cathode terminal or lead of a diode is usually marked by a dot, a band, a K or a +, depending upon marking system employed by the manufacturer. A diode that exhibits a Forward-to-Reverse Conduction Ratio of at least 50:1 (2%) is considered to be good. Some knowledge of the characteristics of the diode to be tested should be known when making the test because some high conduction diodes, such as those often used as video detectors, can be rated as good if they produce a Forward-to-Reverse Conduction ratio of 10:1 (10%).

Testing Transistors

Junction and Point Contact transistors can be tested for Gain and Leakage in the Model 675 Tester. A simplified schematic of the transistor test circuit is shown in Fig. 13. The TRANSISTOR LEAKAGE-GAIN switch is shown in its normal Leakage position, which leaves the base of the transistor floating.

The button of the LEAKAGE-GAIN switch is pushed to the right, closing the switch and connecting the base of the transistor into the circuit, to make the Gain test. The collector current of a good transistor will produce a reading on the meter. The SENSITIVITY control is adjusted for full scale reading on the meter (or a maximum reading if the transistor under test will not produce a full scale deflection on the meter).

The TRANSISTOR GAIN switch is now released (returning it to its normal open [Leakage] position, which opens the base circuit) and the reading on Good—?—Poor scale of the meter is noted. Any reading on the meter, with the switch in the leakage position, is leakage current. If the leakage current is high, approaching or equalling the gain current (which is the amount obtained with the TRANSISTOR switch pushed to right), the transistor is shorted or defective and should be discarded. The leakage current should be much lower than the gain current. The greater the difference between the leakage current and the gain current the higher the relative value of the transistor as an amplifier. If no meter readings are obtained when testing the transistor, the transistor is open or defective and should be discarded.

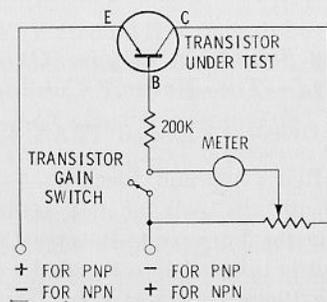


Figure 13
Transistor Test Circuit.
Transistor Gain Switch in Leakage Position.

Procedure for Testing Junction and Point Contact Transistors

Insert Dyna-Card marked "TRANSISTORS-DIODES" into slot.

The TEST switch is set in the TEST 1 position for testing transistors. The transistor to be tested is inserted in the PNP transistor test socket if it is a PNP type transistor or into the NPN test socket if it is an NPN type. The

data supplied by the manufacturer of the transistor should be consulted to determine the type (PNP or NPN) because the transistor can be damaged if inserted in the wrong test socket. The OFF-ON-LIFE TEST switch is set on ON. The TRANSISTOR GAIN switch is pushed to right (in the Gain position) and the SENSITIVITY control is adjusted for full scale reading (or maximum reading if the transistor under test will not produce a full scale reading). The TRANSISTOR GAIN switch is then released and the leakage current is read on the Good—?—Poor scale of the meter. If the reading is in the Poor area, the transistor should be rejected. If no reading is obtained when the TRANSISTOR GAIN switch is held down, the transistor can be considered as open or defective and should be discarded.

Preparing New Dyna-Cards

2 blank cards are provided. These cards can be prepared for testing of a new type of tube with the use of the master card supplied.

Place blank card so that the half circle is at the bottom and to the right as you look at the card. Lay master card on top of blank card and carefully line up all four sides. With a pencil circle, through the master card onto the blank card the holes to be punched. See Figure 14, for the hole sequence on master. Carefully drill out the holes required with a 5/16" drill. Be sure to locate center of circle before drilling. After drilling, clean off edge of hole to eliminate any loose material.

NOTICE

The No. 44 pilot lamp mounted on the front panel labeled "FUSE" is used as a protecting fuse and must be replaced by the same type only. The pilot light may be used for a spare as it is also a No. 44 bulb. No *G_m* readings will be obtained when this fuse is out.

There is an A.C. line fuse on the under side of the instrument. Replace only with a 1 amp fuse of the same type. The pilot light will not light when this fuse is out.

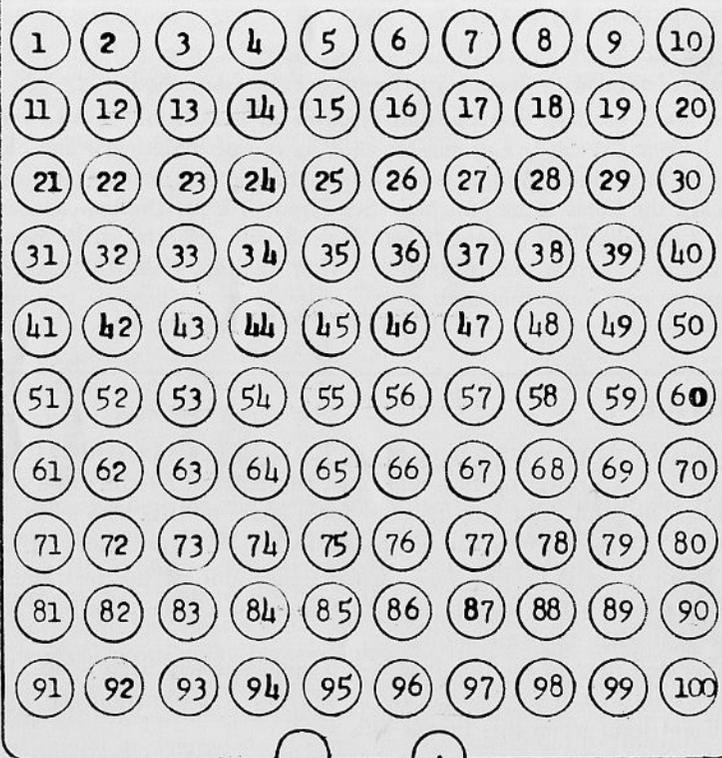
Located next to the line fuse is a 6 amp filament circuit fuse. Replace only with 6 amp fuse of the same type. The green operate light will not light when this fuse is out.

Some low *G_m* tubes can not be tested on the Replace—?—Good scale. They are tested only on the True *G_m* scale and no Sensitivity setting will appear in the GOOD-BAD column of the chart.

If either of the No. 55 pilot lamps under the socket panel fails, both lamps must be replaced at the same time with No. 55 type ONLY.

If a tube indicates a short in the short test, or reads grid emission reject, do not make any further tests as shorted tubes may damage the tube tester.

MASTER DYNA-CARD



Line up this notch on the Master Card
with notch on card to be punched.

Figure 14
Master Dyna-Card
Hole Sequence