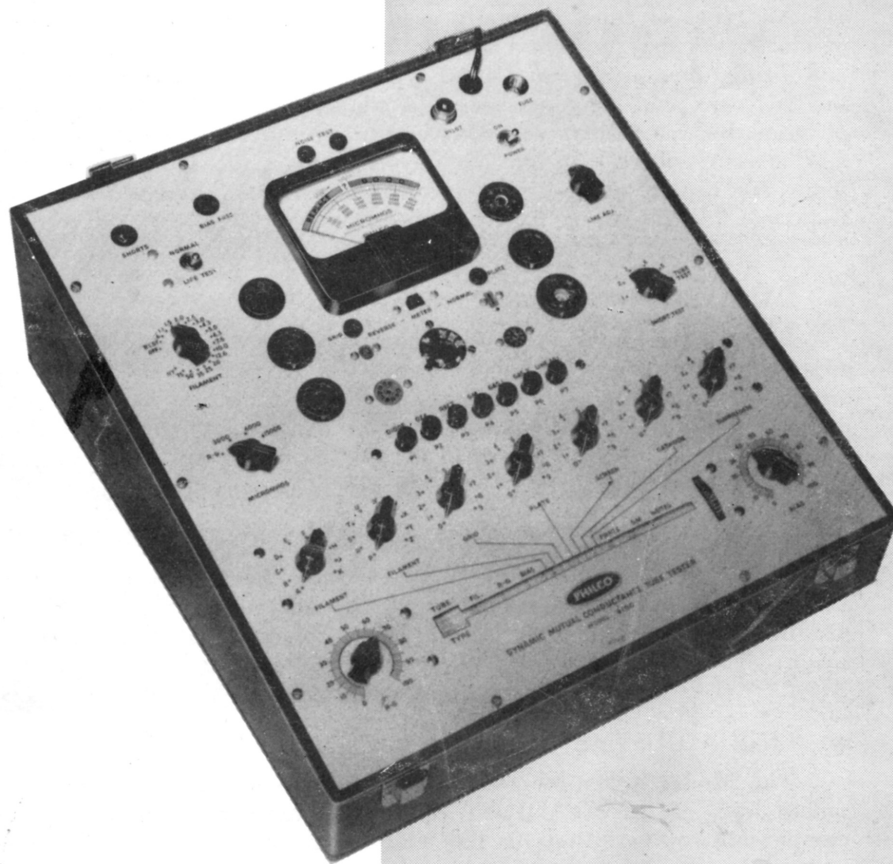


# INSTRUCTIONS FOR PHILCO<sup>®</sup> DYNAMIC MUTUAL CONDUCTANCE TUBE TESTER MODEL 9100



*Famous for Quality the World Over*

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Your new Philco Mutual Conductance Tube Tester, Model 9100, is one of the most versatile, accurate instruments of its type available to the service industry today. You will find this unit precision designed to accomplish a great variety of tube tests, quickly and accurately. By carefully following the operating instructions below, you can look forward to years of reliable performance and increased service efficiency from it.

## FEATURES

- **WIDE APPLICATION**

All types of tubes normally used in radio, television, and similar phases of electronics may be tested by this unit. Panel sockets accommodate 4, 5, 6, and 7-pin tubes, octal and Loktal types, 7 and 9-pin miniatures, acorns, hearing-aid types, and subminiatures. In addition to testing the high-vacuum type of tube this instrument will also test many other types such as cold-cathode and mercury-vapor rectifiers, thyratrons, ballast tubes, etc. Provision is also made for testing all miniature types of bayonet and screw-base pilot lamps requiring voltages up to 12.6 volts.

- **DYNAMIC MUTUAL CONDUCTANCE TEST**

Because the Model 9100 tube tester is of the dynamic mutual conductance type, tubes are tested under conditions which closely simulate the conditions which exist in actual operation, thus providing the best and most trustworthy indication of the tube's condition. This instrument will detect faulty tubes which in many cases will give a normal indication on other types of testers.

- **BOTH MICROMHO AND REPLACE (?) GOOD INDICATIONS**

The Model 9100 tube tester indicates tube operating quality either directly in micromho values, for the technician, or in terms of REPLACE (?) GOOD readings for easy interpretation by the customer. Mutual conductance values can be measured in three ranges: 0-3000, 0-6000, and 0-15,000 micromhos.

- **LINE ADJUSTMENT**

The Model 9100 tube tester operates from a 105 to 125-volt, 60-cycle a-c power line. A LINE ADJUST control is incorporated in the instrument to compensate for variations in line voltage and thereby maintain standard test voltages on the tube elements.

### ● RAPID TESTING

A smooth, positive, free-running roll chart built into the instrument, makes control setting information quickly available. In addition, the control settings given on the roll chart are keyed to the particular controls involved by means of red guide lines, thereby further increasing the speed and simplicity of the testing procedure.

### ● LIFE TEST

The life test, which permits the remaining life expectancy of a tube to be ascertained, is another special feature which has been incorporated into the tester. By means of this test it is possible to determine whether a tube is likely soon to fall below standard specifications for its type, and to replace it before such a substandard condition is reached. This feature also has considerable value for the accurate matching of tubes and similar applications.

### ● SENSITIVE GAS TEST

Even a very small amount of gas in a tube may result in unsatisfactory circuit operation and possible damage to other components. This is particularly true when the tube is to be used in critical circuits, such as those used, for example, in the modern television receiver. A highly sensitive method of checking tubes for gas content is therefore a necessity, and is incorporated into the Model 9100 tube tester.

### ● SHORT, LEAKAGE, AND NOISE TESTS

The SHORT check incorporated into the Model 9100 tube tester provides indication of direct short circuits or leakages between the elements in the tube being tested. Also included in this tester are provisions for making noise tests. NOISE TEST jacks on the front panel of the instrument permit connections to be made to the input of any radio receiver. Intermittent disturbances caused by loose elements, etc., which are too brief to be registered on the indicator lamp will be reproduced in the loud speaker when the tube is tapped.

### ● FUSE-LAMP PROTECTION

A fuse-lamp, easily accessible from the front panel, is employed to provide over-all protection for the tester. Under normal conditions of operation this fuse-lamp will glow (to a greater or lesser degree, depending upon the type of tube being tested), but this will in no way affect the instrument indication. In case of overload, however, the lamp will open and thereby disconnect the tester from the power source. Additional protection for the tester is provided by another fuse-lamp, also accessible from the front panel, which is connected in the portion of the power supply which furnishes grid-bias voltages. This bias fuse-lamp does not glow in normal operation, but will open in case of bias-circuit overload. The use of fuse-lamps for overload protection provides the operator of the tester with an immediate and highly visible indication if an overload should occur.

### ● CONTINUITY TESTER

Still another feature which adds to the versatility of the Model 9100 tube tester is its application as a continuity checker through circuits which may have resistances as high as 200,000 ohms.

### ● PILOT LAMP TESTS

All miniature screw-base and bayonet-base pilot lamps requiring up to 12.6 volts for operation can be tested by means of a receptacle provided on the front panel of the instrument.

### ● CATHODE-RAY-TUBE TESTING

All commonly used picture tubes may be checked with the Model 9100 Dynamic Mutual Conductance Tube Tester by using the CRT Adapter Cable Kit, Philco Part No. 425-0001. Complete operating instructions and tube data are included in the kit.

## OPERATION

The instrument is placed in operation by connecting it to a source of 105 to 125-volt, 60-cycle, a-c power, and setting the POWER switch to the ON position.

### ● PRELIMINARY

First set all controls in accordance with the data given on the roll chart for the type of tube to be tested; then insert the tube into its proper socket. Two jacks, located in the upper-center of the con-

trol panel, and marked GRID and PLATE, are used for making connections to tubes which have leads brought out through top caps. The notation CAP=G or CAP=P appears in the roll chart information for such types. CAP=G indicates that the top cap is to be connected to the GRID jack, and CAP=P indicates that the top cap should be connected to the PLATE jack.

NOTE: Improved versions of tubes are occasionally brought out after the original design, and are usually identified by adding a letter

(such as A, B, etc.) after the original type designation. Unless specifically listed on the roll chart, these tubes should be tested in accordance with the data given for the original type.

#### ● LINE-VOLTAGE ADJUSTMENT

Press the LINE ADJ switch, P7, which will cause the indicating meter pointer to move up-scale. Keeping the switch depressed, set the LINE ADJUST knob to bring the meter pointer exactly over the mark LINE TEST at 1500 on the meter scale; then release the LINE ADJ switch. This procedure serves to establish standard test voltages on the tube elements.

#### ● SHORT TEST

This test should *always* be made first, before proceeding to other tests.

Turn the SHORT TEST switch successively through positions 1, 2, 3, 4, and 5. This connects the various tube elements, in turn, across the test voltage. Tubes having shorts or leakages between elements will cause the neon SHORT lamp to glow continuously. *A tube showing a short or leakage between elements should be discarded without further test.* The SHORT TEST switch must be reset to the TUBE TEST position at the conclusion of the test.

A momentary flash of the indicator lamp as the SHORT TEST switch is turned from one position to another should be disregarded.

#### ● DYNAMIC MUTUAL CONDUCTANCE TESTS

To determine the dynamic mutual conductance of a tube directly in micromhos, the MICROMHO switch is set to the range (0-3000, 0-6000, or 0-15,000) covering the value given in the roll chart, and the GM switch, P4, is pressed to obtain the meter indication. The micromho values given on the roll chart are the low-limit values for good tubes. A reading less than the value given indicates a weak tube, which should be discarded.

The GM values shown on the roll chart may differ from those shown in tube manuals. There are two reasons for this. First, tube-manual data indicates average values, whereas the roll chart gives low-limit values to facilitate the determination of a tube's condition. Second, the operating conditions in the tester may differ from those conditions specified in the tube manual. This has been taken into account in the roll-chart readings, and need cause no concern.

When it is desired to test the tube in terms of REPLACE (?) GOOD, the MICROMHO switch is set to the R-G position. The R-G control is then set to the figure given under the R-G heading on the roll chart, and the GM switch, P4, is pressed. Good

tubes will read in the GOOD sector of the meter scale, and poor tubes will read in the REPLACE sector. Those tubes which read in the sector marked (?) may still have some useful life, but are soon likely to need replacement.

The REPLACE (?) GOOD meter scale, which also indicates dynamic mutual conductance, is designed to make tubes read at the left edge of the GOOD sector when they are 25 percent below average for amplifier tubes, and 35 percent below average for power tubes.

**CAUTION:** Before applying voltages to subminiature tubes, care must be taken to see that none of the tube leads are shorted to each other. In the round subminiature tubes, leads are numbered in a clockwise direction (looking from the bottom) lead No. 1 being identified by an arrow on the side of the tube.

In the rectangular subminiature tubes, lead No. 1 is identified by a red dot.

#### ● GAS TEST

In some cases a tube will develop gas after the tube has been heated for a period of time. It is therefore advisable to permit a suspected tube to become thoroughly warmed up before making this test.

With the MICROMHO switch set to the 0-3000 range, the GAS 1 switch (P5) is depressed and the BIAS control is adjusted to make the meter pointer indicate 100 micromhos.

With the GAS 1 (P5) switch still depressed, the GAS 2 (P6) switch is then pressed. If the tube contains gas, the meter pointer will move up-scale. If the pointer movement is not more than one scale division, the gas content may be considered satisfactory.

With some tubes, such as the type 45, it may not be possible to bring the micromhos reading down to 100 by adjusting the BIAS control. In such cases, set the BIAS control to 100 and proceed with the remainder of the test.

#### ● RECTIFIER TESTS

Switches P1, P2, and P3 are used for testing the various types of tube rectifiers. The MICROMHO switch must be in the R-G position for testing these types.

Switch P1 is used for testing detector diodes. When this switch is depressed, it applies a low voltage which will not injure the delicate cathode. Good diodes will cause the meter pointer to read above the DIODES OK mark.

Switch P2 is used when testing cold-cathode rectifiers such as the type OZ4. When this switch is pressed it applies a voltage sufficient to ionize the tube and start conduction. Good tubes will read in the GOOD sector of the meter scale.

Switch P3 is used for testing regular rectifier tubes such as the 5Y3. When this switch is pressed it applies a medium value of voltage which is best adapted to reveal defects in tubes of this type. Good tubes will read in the GOOD sector of the meter scale.

NOTE: Directly below the indicating meter is a switch marked REVERSE-NORMAL. With this switch set to NORMAL, certain tubes such as the 117N7 will cause the meter pointer to deflect backwards (to the left) when switch P3 is pressed. In such instances, setting the NORMAL-REVERSE switch to REVERSE will permit the meter to read up-scale. The switch should always be reset to NORMAL after the test has been made.

● LIFE TEST

Before this test is performed it is advisable first to check for dynamic mutual conductance in the normal manner, to make certain that the tube is capable of satisfactory operation.

In making the life test, the MICROMHO switch is first set to the R-G position; then switch P4 is depressed and the R-G control is adjusted to make the meter pointer read at 2000 in the GOOD sector of the scale.

With switch P4 still depressed, the NORMAL-LIFE TEST switch is thrown to the LIFE TEST position. This serves to reduce the cathode temperature. If the meter pointer is still within the GOOD sector of the scale, the tube has a large life reserve and will probably perform satisfactorily for an extended period.

Since rectifiers have no mutual conductance, a different procedure is required for making the life test on such types. For such types the tube is first checked in the normal manner, as given under RECTIFIER TESTS, and the meter reading is carefully noted. The twenty-position FILAMENT switch

is then reduced by one position and the meter reading is again noted. The drop in reading should not exceed 25 percent.

● PILOT-LAMP TEST

A receptacle in the center of the seven-pin socket is used for testing all miniature types of bayonet and screw-base pilot lamps. Voltages up to 12.6 are available for such tests, and are controlled by the twenty-position FILAMENT switch. No other switch settings are required.

● FILAMENT AND HEATER CONTINUITY

For this test the controls are first set in accordance with the data given on the roll chart, except that the twenty-position FILAMENT switch is set to BLST instead of the voltage indicated on the chart. Certain tubes which have tapped filaments, such as the 3Z5, 50Z7, etc., have special continuity test settings. These are given on the roll chart.

The SHORT TEST switch is set to position 1 and the tube is then inserted into its proper socket. If the neon lamp does not glow, the filament is open.

● CONTINUITY TEST

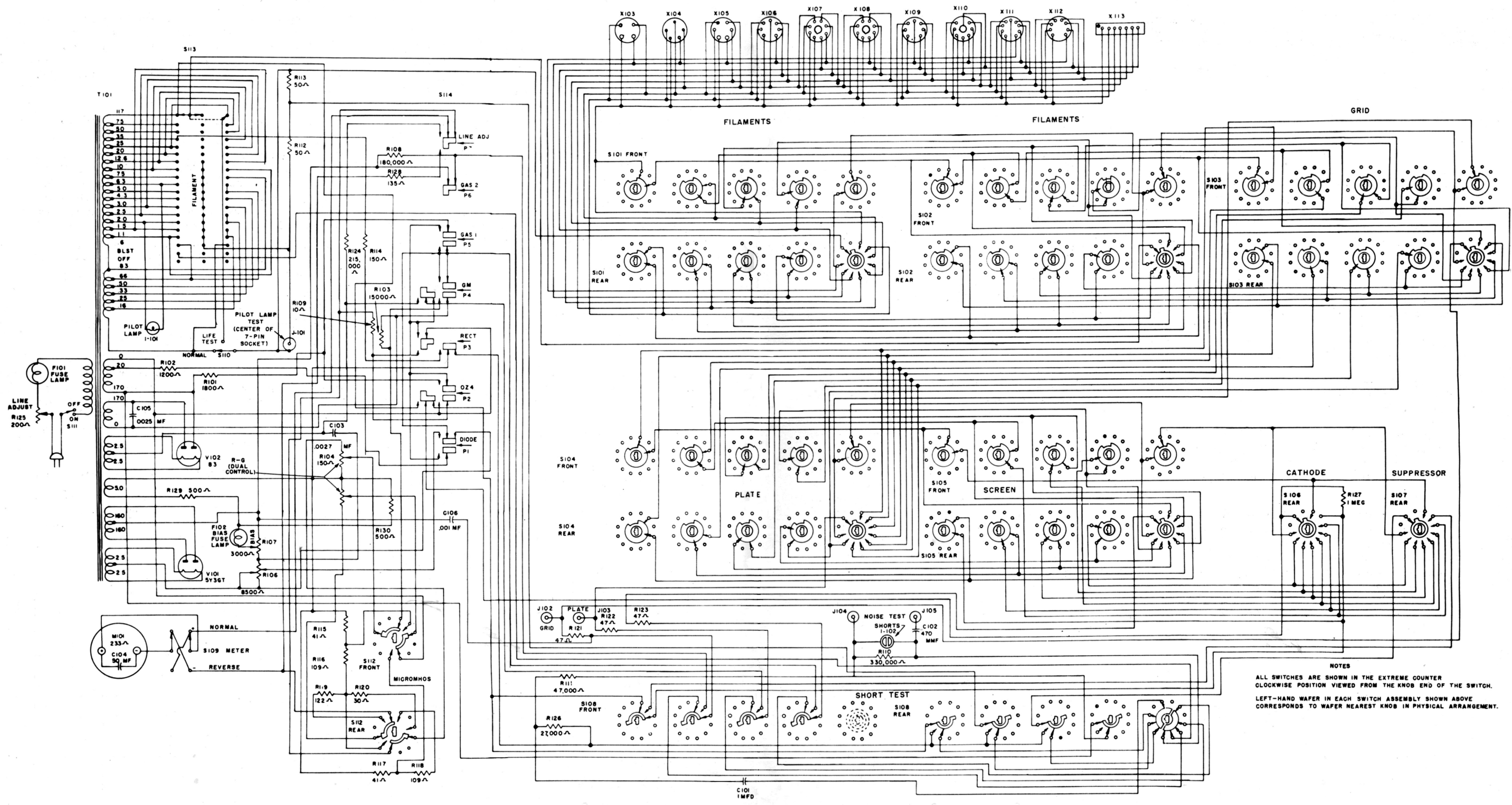
The Model 9100 tube tester can be used in the following manner to test for continuity through circuits having resistances up to 200,000 ohms.

The SHORT TEST switch is first set to position 4. Two leads having prods and pin tips are then connected to the panel jacks marked PLATE and GRID. If the prods are then touched to the terminals of the circuit to be checked, the neon lamp will glow if the circuit is continuous.

● ADDITIONAL SHORT TEST INFORMATION

The following table gives the positions of the SHORT TEST switch in which the indicator will glow when a short or leakage exists between particular tube elements.

Location of Short	Switch Positions				
FILAMENT—CATHODE			3		
FILAMENT—GRID	1	2			5
FILAMENT—PLATE	1	2		4	5
FILAMENT—SCREEN	1		3	4	5
FILAMENT—SUPPR.		2			
GRID—CATHODE	1	2	3		5
GRID—PLATE				4	
GRID—SCREEN		2	3	4	
GRID—SUPPR.	1				5
PLATE—SCREEN		2	3		
PLATE—SUPPR.				4	5
SCREEN—SUPPR.	1	2	3	4	5



NOTES  
 ALL SWITCHES ARE SHOWN IN THE EXTREME COUNTER  
 CLOCKWISE POSITION VIEWED FROM THE KNOB END OF THE SWITCH.  
 LEFT-HAND WAFER IN EACH SWITCH ASSEMBLY SHOWN ABOVE  
 CORRESPONDS TO WAFER NEAREST KNOB IN PHYSICAL ARRANGEMENT.

Philco Dynamic Mutual Conductance Tube Tester Model 9100, Schematic Diagram

## MAINTENANCE

The Philco Model 9100 Dynamic Mutual Conductance Tube Tester has been engineered to make it outstanding, not only in electrical performance, but also in mechanical ruggedness. In addition, the use of quality components further assists in reducing the possibility of trouble. However, if the instrument should at any time become inoperative, the condition of the rectifier tubes in the power supply should first be checked. If the trouble persists, a visual inspection of parts, wiring, and connections is next in order. In general, the source of trouble will be easy to locate and to correct. Should it ever become necessary to replace voltage-divider resistor R106, however, the following procedure should be used after the replacement resistor has been installed.

1. Apply power to the tester, press P7, and then adjust the LINE ADJUST control to make the meter needle coincide with the LINE TEST indication.

2. Connect a VTVM (or a 20,000-ohms-per-volt voltmeter) across the outside terminals of the BIAS potentiometer, with negative (—) meter lead connected to the terminal nearest the outside edge of the front panel.

3. Resistor R106, mounted on the fiber terminal strip near the power transformer, has two adjustable contactor clamps. The adjustable contactor clamp having the short bus-wire jumper attached to it should be adjusted until the VTVM reads 40 volts  $\pm 1$  volt. The clamp should then be tightened.

The other adjustable clamp should be kept tight during this adjustment.

4. Disconnect the positive (+) lead of the VTVM from the BIAS potentiometer, and connect it to the adjustable clamp on R106 which is farthest from the power transformer. Adjust this sliding clamp to obtain a reading of 55 volts on the VTVM, and then tighten the clamp.

5. Reconnect the positive (+) lead of the VTVM to the BIAS potentiometer terminal. The reading obtained should be 40 volts  $\pm 1$  volt. If the reading obtained is not within this tolerance, the complete procedure should be repeated to bring the reading within the tolerance limits.

After either R106 or the BIAS potentiometer, R107, has been replaced, the panel calibration of the BIAS control should be checked as follows:

1. Set the panel controls to the following settings:  
Fil Fil Grid Plate Screen Cath Suppr RG Bias  
J R 3 5 6 2 0 65 24

2. Insert the negative lead of the VTVM (or 20,000-ohms-per-volt voltmeter) into pin 3 of the octal socket, and the positive lead into pin 1. A reading of 4.3 volts should be obtained, and should coincide with a BIAS control setting of 24. If a reading of 4.3 volts is not obtained, adjust the potentiometer slightly until the meter indicates this value; then loosen the BIAS control knob, set it to 24, and tighten.

# REPLACEMENT PARTS LIST

REFERENCE  
SYMBOL

DESCRIPTION

SERVICE  
PART NO.

C101	Condenser, paper, .1 mfd, 400v .....	30-4650-47
C102	Condenser, mica, 470 mmfd .....	60-10475017
C103	Condenser, mica, .0027 mfd .....	60-20275404
C104	Condenser, electrolytic, 500 mfd, 10v working .....	30-2417-31
C105	Condenser, mica, .0027 mfd .....	60-20275404
C106	Condenser, mica, .001 mfd .....	60-20105411
F101	Fuse, line (lamp, type 81) .....	AD-2807
F102	Fuse, bias (lamp, type 47) .....	34-2068
I101	Lamp, pilot (type 47) .....	34-2068
I102	Lamp, short test (neon, type NE45) .....	34-2482
J102	Jack, grid, pin, black .....	27-6299-1
J103	Jack, plate, pin, red .....	27-6299
J104	Jack, noise test, pin, black .....	27-6299-1
J105	Jack, noise test, pin, black .....	27-6299-1
M101	Meter, 500 ua .....	45-1916-4
R101	Resistor, 1800 ohms, 10 w .....	33-1336-61
R102	Resistor, 1200 ohms, 1 w .....	66-2124240
R103	Resistor, 15,000 ohms, 1 w .....	66-3154240
R104 and R105	Potentiometer, dual, 150 ohms .....	45-3263
R106	Resistor, slide ohms, 2 taps, 8500 ohms, 10 w .....	45-3245
R107	Potentiometer, 3000 ohms .....	45-3261
R108	Resistor, 180,000 ohms, 1/2 w .....	66-4188340
R109	Resistor, deposited carbon, 10 ohms .....	33-1346-38
R110	Resistor, 270,000 ohms, 1/2 w .....	66-4278340
R111	Resistor, 47,000 ohms, 1/2 w .....	66-3478240
R112 and R113	Resistor, center-tapped, 100 ohms, 10 w .....	45-3245-1
R114	Resistor, deposited carbon, 150 ohms .....	33-1346-43
R115	Resistor, deposited carbon, 41 ohms .....	33-1346-40
R116	Resistor, deposited carbon, 109 ohms .....	33-1346-41
R117	Resistor, deposited carbon, 41 ohms .....	33-1346-40
R118	Resistor, deposited carbon, 109 ohms .....	33-1346-41
R119	Resistor, deposited carbon, 122 ohms .....	33-1346-42
R120	Resistor, deposited carbon, 30 ohms .....	33-1346-39
R121	Resistor, 47 ohms $\pm 10\%$ , 1/2 w .....	66-0478340
R122	Resistor, 47 ohms $\pm 10\%$ , 1/2 w .....	66-0478340
R123	Resistor, 47 ohms $\pm 10\%$ , 1/2 w .....	66-0478340
R124	Resistor, 215,000 ohms .....	33-1346-36
R125	Potentiometer, 200 ohms .....	45-3262
R126	Resistor, 27,000 ohms $\pm 5\%$ , 1/2 w .....	66-3278240
R127	Resistor, 1 megohm $\pm 10\%$ , 1/2 w .....	66-5108340
R128	Resistor, deposited carbon, 135 ohms .....	33-1346-44
R129	Resistor, 500 ohms .....	33-1346-37
R130	Resistor, 500 ohms .....	33-1346-37
S101	Switch, filament .....	45-3252
S102	Switch, filament .....	45-3252
S103	Switch, grid .....	45-3252
S104	Switch, plate .....	45-3252



# REPLACEMENT PARTS LIST

REFERENCE SYMBOL	DESCRIPTION	SERVICE PART NO.
S105	Switch, screen .....	45-3252
S106	Switch, cathode .....	45-3254
S107	Switch, suppressor .....	45-3254
S108	Switch, short test .....	45-3255
S109	Switch, meter reverse, slide .....	42-1795-1
S110	Switch, life test .....	45-3243
S111	Switch, power .....	45-3243-1
S112	Switch, microphone .....	45-3257
S113	Switch, filament, 20-position .....	45-3256
S114	Switch, pushbutton .....	45-3258
T101	Transformer, power .....	45-3266
V101	Tube, rectifier, type 5Y3GT .....	
V102	Tube, rectifier, type 83 .....	
X101	Socket, octal (5Y3GT rectifier) .....	45-3248-1
X102	Socket, 4-pin (83 rectifier) .....	45-3248
X103	Socket, 4-pin .....	45-3244
X104	Socket, 5-pin .....	45-3244-1
X105	Socket, 6-pin .....	45-3244-2
X106	Socket, 7-pin and lamp .....	45-3251
X107	Socket, octal .....	45-3244-3
X108	Socket, Loktal .....	45-3244-4
X109	Socket, 7-pin miniature .....	27-6203-1
X110	Socket, acorn .....	45-3250
X111	Socket, 9-pin miniature .....	27-6203-6
X112	Socket, sub-miniature, round .....	45-3246
X113	Socket, sub-miniature, rectangular .....	45-3247

# MISCELLANEOUS

DESCRIPTION	SERVICE PART NO.
Case, complete .....	11058
Clip-lead assembly .....	45-3260
Instructions .....	78-1767
Jewel, pilot light .....	45-3242
Knob .....	54-4281
Knob, push-button, black .....	45-3273
Knob, push-button, red .....	45-3273-1
Line cord .....	41-3821-20
Roll chart .....	45-3109-1
Window, roll chart .....	54-5207
Socket assy., pilot lamp .....	45-3241
Socket assy., bias fuse .....	45-3241
Socket assy., neon lamp .....	27-6210
Socket assy., line fuse .....	45-3259



## STANDARD WARRANTY

"We warrant Philco Test Equipment to be free from defects in material and workmanship under normal use and service, our obligation under this warranty being limited to making good any part or parts thereof which shall, within ninety (90) days after delivery of such product to the original purchaser, be returned to us through our distributor with transportation charges prepaid, and which our examination shall disclose to our satisfaction to have been thus defective; this warranty being expressly in lieu of all other warranties expressed or implied, and of all other obligations or liabilities on our part, and we neither assume nor authorize any representative or other person to assume for us any other liability in connection with the sale of our products.

"In order to receive the benefit of the above ninety (90) day warranty it is required that the product be registered with Philco Corporation. The Registration Card, postage prepaid, attached to this booklet, must be completed and returned to Philco Corporation.

"We reserve the right to make changes in design or to make additions to or improvements upon this product, without incurring any obligation to modify such previously manufactured product.

"This warranty shall not apply to any product which shall have been repaired or altered in any way so as, in our judgment, to affect its stability or reliability, nor which has been subject to misuse, negligence or accident, nor which has had the serial number altered, effaced or removed. Neither shall this warranty apply to any product which has been connected otherwise than in accordance with the instructions furnished by us."

**PHILCO CORPORATION**

**ACCESSORY DIVISION**

**PHILADELPHIA 34, PA.**