INSTRUCTION MANUAL

FOR

STARK

'DYNAMIC' TUBE TESTER

MODEL 9-11 AND 9-55

STARK

STARK ELECTRONIC INSTRUMENTS LIMITED
MADE IN TORONTO, CANADA

500 2-50 D. Co.

MODEL 9-11 AND 9-55 TUBE TESTERS

1. GENERAL

The Stark Models 9-11 and 9-55 Tube Testers have been designed to provide a rapid, simple and reliable means of determining the worth of receiving type tubes. The principle employed has been used for a number of years with very satisfactory results. It will be described in some detail, since it is believed that a working knowledge of the circuit is an important factor in the intelligent operation of any instrument.

2. CIRCUIT DESCRIPTION

2.1 GENERAL CONSIDERATIONS

A tube tester, to be satisfactory, must perform three functions. First, it must supply proper voltages to the filament and other elements of the tube to be tested. Then it must provide a reliable means of determining whether each element in the tube is in its proper position with respect to all other elements, and has no electrical connection with them unless so designed. The tube tester must finally provide a means of measuring the actual worth of a tube, in terms of a standard which is the average of all tubes of the same type.

2.2 POWER SUPPLY

All voltages for the testing of a tube are supplied by a single transformer. A potentiometer in the primary circuit of this transformer may be adjusted to compensate for changes in power line voltage, and thus maintain reasonably constant potentials in the secondary windings.

2.3 SHORT TEST

The means whereby leakage or short circuits between elements is detected, is termed a "short test". The method employed is simple and direct. Each tube element in turn is connected to a relatively high voltage, while the remaining elements are connected to ground. A neon bulb is inserted in series with the high voltage source. Due to the rectifying action of the tube under test, current will flow in the circuit in one direction only if the tube is a good one, and will cause one plate of the neon bulb to glow. Since current would not flow in either direction if the filament circuit were open, the glow indicates immediately that the filament of the tube is intact.

If, now, there is leakage or a short circuit between the element under test and any of the remaining elements in the tube, current will also flow in the reverse direction, causing both plates of the neon bulb to glow. The sensitivity of the neon bulb is adjusted so that a glow in the second plate is visible even if the resistance between the elements of the tube is 150,000 ohms. The neon bulb therefore indicates three things:—

1. Whether or not the filament circuit of the tube under test is in operating condition.

2. Whether or not there is leakage between elements, indicated by a weak glow on one plate and a strong glow on the other.

3. Whether or not there is a short circuit between any two elements, indicated by an equally strong glow on both plates.

2.4 QUALITY TEST

The worth of a tube is measured in terms of the current which flows through it, compared to the current which would flow through a standard tube of the same type under the same conditions. For this measurement the appropriate elements of the tube are connected together, and the tube is then connected in series with a voltage source, a suitable load resistor, and a meter. The meter is calibrated to read POOR — WEAK — GOOD rather than actual milliamperes, and is provided with an adjustable shunt. The total tube current is divided between the shunt and the meter, by adjustment of the shunt, so that standard current for the tube under test will deflect the meter pointer to a central position in the GOOD section of the scale. If the tube allows more or less than the standard current to flow, the pointer then indicates this fact, and translates it into easily understood terms.

The meter may thus indicate three things also:—

1. Whether the tube is good, weak or poor, as shown by the position of the pointer.

2. Whether the tube is abnormally active, as indicated by the tendency of the meter to read very high on the scale. This may indicate a soft or gassy tube.

3. Whether the tube is erratic in operation, characterized by erratic or unsteady deflection of the meter pointer.

3. CIRCUIT COMPONENTS

3.1 "FILAMENT" SWITCH

This switch has the simple function of connecting the filament wiring on all sockets to the appropriate transformer tap for the filament circuit of the tube under test. A second circuit on this switch chooses the proper load resistor for the tube.

3.2 "SHUNT" CONTROL

This control is the adjustable shunt in parallel with the meter. Its position determines the proportion of tube current which will flow through the meter.

3.3 "TUBE SELECTOR" SWITCH

This switch selects the elements of the tube under test, for both the short test and the quality test. When the switch is set in any numerically designated position, a single tube element is connected to the short test circuit, while all other elements are connected to one side of the filament, that is, to ground. Any leakage or short circuit between this element and any of the remaining elements will therefore be indicated. Since the cathode is one of the elements which can be so connected, cathode leakage is also shown in this circuit.

Those switch positions marked alphabetically provide various combinations of elements connected together for the quality test. In general, the numerically designated positions are utilized in making the short test, and the alphabetically designated positions in making the quality test, but there are a few exceptions to this rule, necessitated by special socket connections or tube characteristics.

3.4 SHORT TEST

These words designate the neon bulb used in making the leakage and short tests. One plate only of this bulb will glow when the cathode or filament of the tube under test has reached its operating temperature. This glow should be obtained at one or more positions of the TUBE SELECTOR switch. If a glow is noted on both plates at any position of the switch, the tube should be discarded, and under no circumstances should the TEST BUTTON or, in the case of the Model 9-55 tester, the lever switch, be operated. There are several tubes, however, for which a glow on both plates is normal, due to internal connections between elements in the tube itself, but wherever this condition occurs, reference is made to it in the Index Chart which accompanies the tube tester.

A momentary glow of the neon bulb as the TUBE SELECTOR switch is rotated is due to transitional changes in the circuit connections, and does not indicate a short circuit in the tube.

3.5 TEST BUTTON

This component is supplied only in the Model 9-11 and similar instruments. When depressed, the TEST BUTTON transfers any tube element or elements, chosen by the setting of the TUBE SELECTOR switch, from the short test circuit to the quality test circuit, thus extinguishing the neon bulb and causing the meter to show a deflection. This deflection immediately indicates to the operator the condition of the tube under test.

3.6 LINE TEST — TUBE TEST SWITCH

This component is supplied only in the Model 9-55 and similar instruments. When operated to the TUBE TEST position it performs the same function as does the TEST BUTTON described in paragraph 3.5. When operated to the LINE TEST position it connects the meter and a small copper oxide rectifier in parallel with one of the transformer secondary voltages. The meter reads the secondary voltage, and the LINE CONTROL, described in paragraph 3.7, can then be adjusted to bring this voltage to a standard value. The standard value is reached when the meter deflects exactly to the LINE TEST mark on the scale.

3.6A (1) A.C. LINE SWITCH — MODEL 9-55 ONLY

On the upper left hand corner above the 4 prong socket is an A.C. (on-off) line switch.

3.6B (2) CONTINUITY TEST — MODEL 9-55 ONLY

Two red pinjacks marked "Continuity Test" on the upper left hand side of the panel provide an easy method of testing continuity through mazda lamps, coils, transformers, heaters, irons, etc. Place test leads, in the pinjacks and place the opposite ends of the test leads against the terminals of the element to be tested. If there is continuity in the circuit under test a glow will appear on the neon marked "short indicator". If no glow appears then the circuit may be considered "open".

3.6C (3) BATTERY TEST — MODEL 9-55 ONLY

The Model 9-55 provides a test for both radio "A" and "B" Batteries under load conditions as prescribed by battery makers.

(a) To test "B" and "C" batteries insert the test leads in the pinjacks on the upper right hand side of the panel marked "Battery Test" and touch the test prods to the terminal of the battery under test (first noting polarity) and read battery voltage directly on the meter scale 0-60 volts.

(b) To test radio "A" batteries apply the same procedure as outlined in (a) but press the test button marked "Press for 6 volts". In pressing this button the circuit is automatically changed so that the full scale deflection becomes 6 volts instead of 60 volts and at the same time a load resistor is placed across the battery under test giving similar conditions to actual operation. This test provides a simple but accurate determination of the actual condition of a battery.

3.6D USEFUL BATTERY DATA — MODEL 9-55 ONLY

"A" BATTERIES

In general — "A" BATTERIES such as the standard 1.5 volt cells will operate to 1.1 volts per cell for radio application. This is the minimum cut-off voltage generally permitted by the design of the vacuum tubes. FLASHLIGHT AND LANTERN batteries within this range will operate, with decreasing power, down to one half rated voltage, under "load". General purpose NO. 6 CELLS will also operate to a minimum of half the rated voltage and HEARING AID "A" batteries are generally suitable to 1.0 volts when under load. RADIO AIR CELLS will test approximately 1.33 volts when new. For 75% of the normal life of this type of battery, the voltage will read approximately 1.25 volts and the minimum cut off voltage is 1.1 volts.

"B" BATTERIES

Portable and rural type radios should give operation down to approximately one half the rated voltage, dependent upon the receiver design. HEARING AID "B" BATTERIES should operate on instrument satisfactorily down to a cut-off voltage of 2/3 the rated voltage.

3.7 LINE CONTROL

The LINE CONTROL is a potentiometer in the primary circuit of the transformer, and is used to adjust the turns ratio between the primary and the secondaries. This adjustment permits substantially constant secondary voltages to be maintained for any line voltage within the limits 105 to 125 volts.

The adjustment is accomplished in one of two ways. In instruments equipped with a LINE TEST - TUBE TEST switch, such as the Model 9-55, the switch should be operated to the LINE TEST position. The resultant meter deflection should be varied by rotation of the LINE CONTROL knob until it coincides with the scale marking designated LINE TEST. All voltages for the testing of a tube are then at their normal value.

In instruments, such as the Model 9-11, which are not equipped for direct meter indication of the proper LINE CONTROL adjustment, a somewhat different procedure can be followed. The operator may use any tube which is known to be good and insert it in the appropriate socket of the instrument. The quality test for this tube should then be made in the usual manner, except that the LINE CONTROL knob should be adjusted until the meter reads between the two O's in the word GOOD. When this adjustment is made the secondary voltages are then at their standard values and the testing of tubes whose worth is unknown may be proceeded with. It is advisable that the operator carry one standard tube with the instrument for calibration purposes.

If the line voltage in a particular district is known, the LINE CONTROL knob may be set at this value directly, since markings are shown on the panei around the knob for this purpose. In this case the carrying of a standard tube with the instrument may be dispensed with.

3.8 SOCKETS

Sufficient sockets are provided to accomodate all standard types of receiving tubes. Where it is required to test non-standard types, adapters may be obtained and fitted into one of the standard sockets in the instrument. In order to make provision for special connections and for possible future requirements, several additional octal sockets may be included on the instrument panel, and designated "1", "2", and "3". The great majority of tests for octal based tubes, however, are made in the standard unmarked socket.

A small socket is provided for testing screw base or bayonet base pilot lamps. The circuit makes use of the neon bulb as an indicator of continuity. If the filament of the pilot lamp is not burned out, the neon bulb will glow on both plates when the lamp is inserted in the socket, but the pilot lamp itself will not glow. Any pilot lamp, regardless of voltage or current rating, can be tested in this manner with no danger of burn-out during the test.

3.9 INDEX CHART

The index chart lists in convenient form all the information required to test receiving type tubes. The information is given in the sequence in which it should be applied, that is, the FILAMENT switch should be set first, then the SHUNT control, and finally the TUBE SELECTOR switch. The FILAMENT switch MUST be set before inserting a tube in any socket, to insure that the correct filament voltage is applied to the tube, and it is essential that the remaining two controls be set as indicated before the quality test is made, to prevent damage to the meter in the instrument.

A number of tubes require more than one test to completely determine their condition. These include rectifiers and diodes, both of which require a test for each plate, and double triodes, triode-diodes, converters, and other multi-purpose tubes which requires separate tests for each function. The additional tests are indicated on the chart immediately below the standard test for the tube.

Special information regarding the testing of certain tubes is required at times. In these cases marginal notations are made on the chart, and an explanation of their specific meaning is to be found at the bottom of the chart. This section of the chart should be consulted before the tube concerned is placed in its socket.

In order to simplify the chart as much as possible, suffixes are not generally shown after the tube type numbers. The operator will therefore assume that all tubes with the same basic type number are to be given the same test. As an example, the test listed for the type 6J5 tube also applies to the 6J5G and 6J5GT tubes.

4. TEST PROCEDURE

The following sequence should be adhered to in testing any tube:

(a) Connect the tube tester to the power supply. Make certain that the

power line voltage and frequency correspond to the values indicated on the instrument panel.

(b) Adjust the LINE CONTROL knob per paragraph 3.7.

(c) Set FILAMENT, SHUNT, and TUBE SELECTOR controls as indicated by the index chart for the tube to be tested. See paragraphs 3.1, 3.2, 3.3, and 3.9. Take special note of any marginal notations which may be shown on the index chart.

(d) Insert tube in socket. After the cathode or filament has reached its normal operating temperature, (See Paragraph 2.3) proceed with the short test per paragraphs 2.3 and 3.4. Tap the tube at each position of the TUBE SELECTOR switch to locate intermittent shorts. If any short or leakage is indicated, other than those allowed by the notations on the index chart, DO NOT proceed further with the test.

(e) If no short or leakage is indicated, reset the TUBE SELECTOR switch at the position shown on the index chart, operate the TEST BUTTON or LINE TEST - TUBE TEST switch (See paragraphs 3.5 and 3.6) and read the condition of the tube on the meter.

(f) If a second test is provided for the tube, reset the SHUNT and TUBE SELECTOR controls to the new positions and proceed as in paragraph 4(e) above. It is not necessary to repeat the short test in this case.

(g) The meter scale is divided into definite ratios, dictated by long experience, for the POOR, WEAK and GOOD sections. However, some types of tubes may actually be satisfactory in certain circuits although proven by test to be weak or poor. One example of this condition is a tube used as a voltage amplifier and drawing a relatively low amount of plate current. The operator must in such instances exercise his own judgment before condemning a tube. He should also use discretion where leakage is indicated, since in some circuits a large amount of leakage can be tolerated without detriment.

5. SERVICE NOTES

FOR STARK MODELS 9-11 and 9-55 TUBE TESTERS

The following suggestions for trouble-shooting in the Models 9-11 and 9-55 Tube Testers are condensed from our factory service experience. It is hoped they will be of some assistance to those who may be called upon to repair these instruments.

A. TESTER COMPLETELY INOPERATIVE.

1. Line cord open near plug or entrance to cabinet. Test with ohmmeter.
2. Transformer primary circuit open or shorted. Test with ohmmeter.
3. Line control potentiometer open or dirty. Test with ohmmeter.
4. Loose connection between line cord and transformer or line cord and potentiometer.

B. PRIMARY CIRCUIT FUNCTIONS NORMALLY BUT NO TEST.

1. 600 ohm load resistor (R3) open. Test with ohmmeter after setting filament switch to position 1 or 2.
2. 65 ohm resistor (R5) open. Disconnect one lead to meter and test resistor with ohmmeter.
3. Meter open or burned out. Disconnect one lead to meter and test with ohmmeter.
4. Loose or broken connection to carrier terminals of FILAMENT switch or of TUBE SELECTOR switch.

C. NEON BULB GLOWS AS SOON AS TESTER CONNECTED TO POWER LINE.

1. If glow is present for all TUBE SELECTOR positions (no tube in any socket), probably a short-circuit between insulated and non-insulated carrier terminals on TUBE SELECTOR switch. If so, switch replacement is required.
2. If glow is present for only certain positions of TUBE SELECTOR switch (no tube in any socket) probably a short circuit in socket wiring. Rotate TUBE SELECTOR switch and note positions for which glow appears. Disregard all alphabetical positions so noted, but determine faulty wire as follows:

SWITCH POSITION	FAULTY WIRE	SWITCH POSITION	FAULTY WIRE
1	Red	4	Green
2	Yellow	5	Blue
3	Grid cap	6	Brown

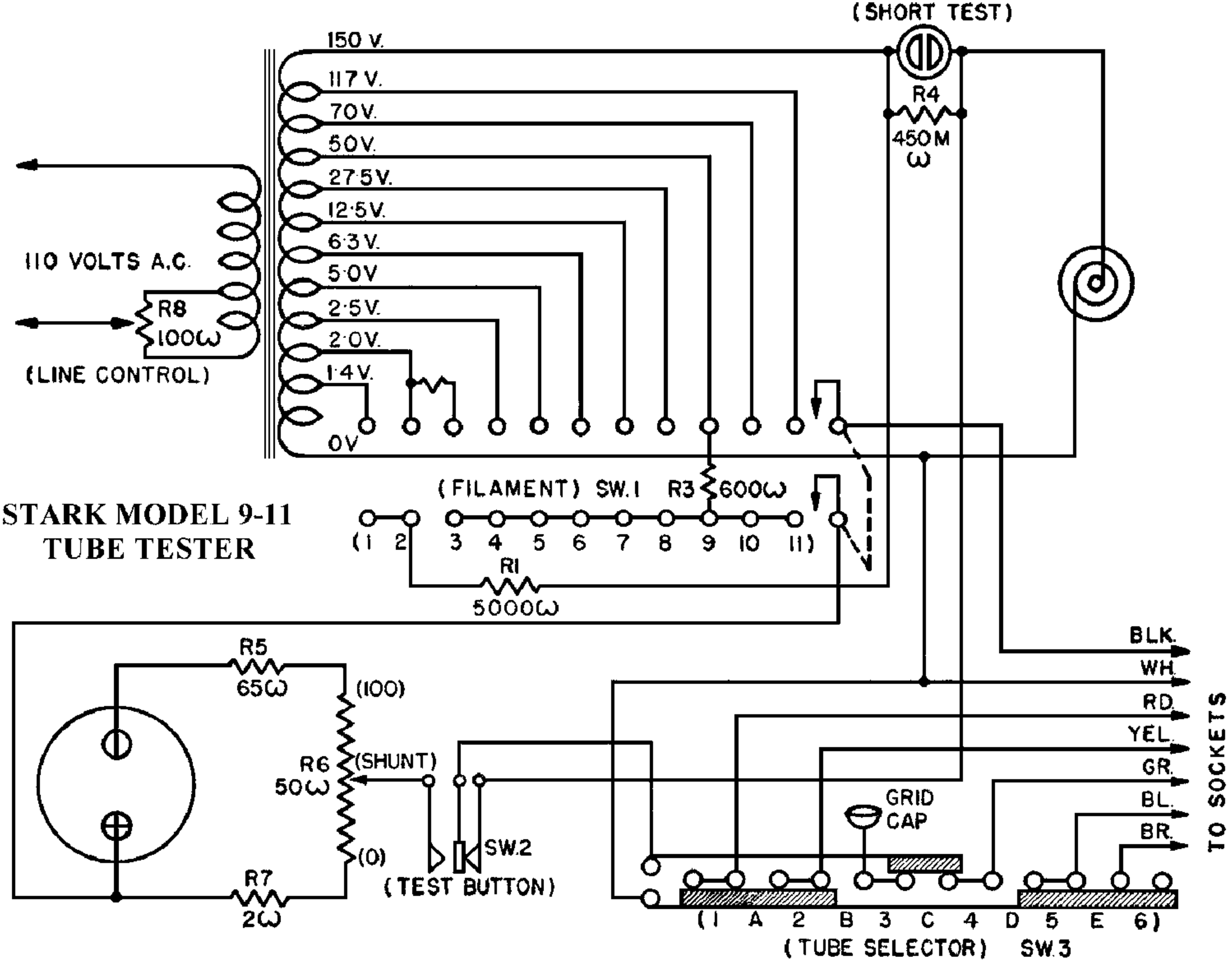
D. TESTER READS HIGH (OFF SCALE) FOR THE MAJORITY OF TUBES TESTED.

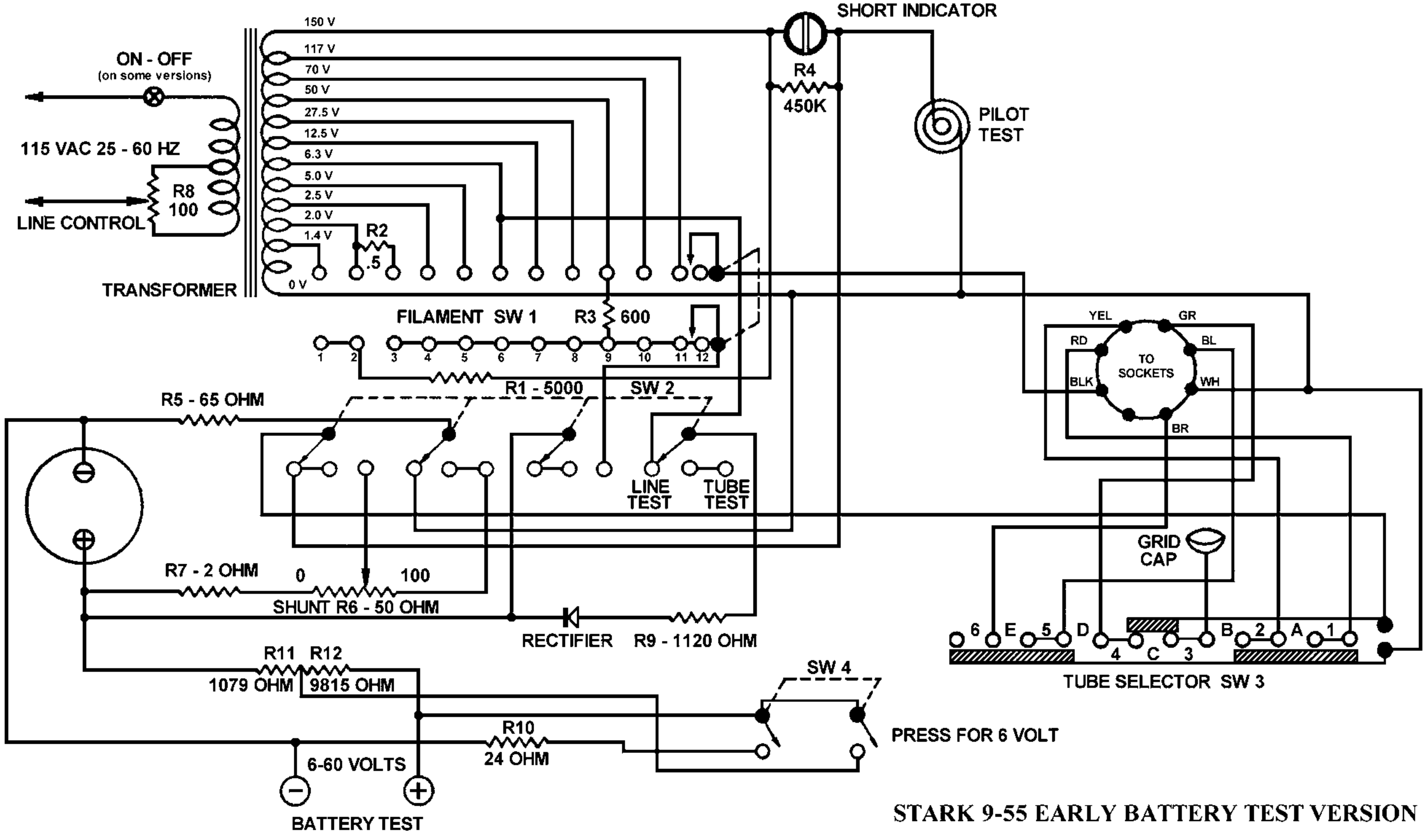
1. 2 ohm resistor (R7) open. Disconnect resistor and test with ohmmeter.
2. SHUNT potentiometer open. Disconnect one end and test with ohmmeter.

E. TESTER READS LOW FOR THE MAJORITY OF TUBES TESTED.

1. Socket terminals worn or spring tension weak. Repair by bending terminals to original shape or replace socket.
2. Grid cap wire broken at entrance to chassis.
3. Loose connections to resistors R5 or R7 (65 and 2 ohms respectively).

STARK MODEL 9-11
TUBE TESTER





STARK 9-55 EARLY BATTERY TEST VERSION