

COLD CATHODE TUBE TEST SET J24754A DESCRIPTION AND APPLICATION

1. GENERAL

1.01 This section describes the portable cold cathode tube test set per SD-25808-01 (J24754A).

1.02 This test set is used for testing both wired-in and socket mounted three-element cold cathode tubes and two-element voltage regulator tubes. Tubes provided with lead-in wires may also be tested by making connections to binding posts provided in the test set.

1.03 The principal application of this test set is to determine the voltage at which cold cathode tubes ionize, the voltage drop across the starter and anode gaps of three-element tubes and the voltage regulating characteristics of cold cathode two-element tubes.

1.04 Tubes other than the wired-in type may be tested by placing them in the proper sockets on the test set or by connecting to the binding posts provided on the test set. Wired-in three element tubes having the high voltage connected directly to the main anode may be tested by connecting the TST jack of the test set to the tube by means of a patching cord provided with the test set.

2. EQUIPMENT FEATURES

2.01 The principal equipment of the test set consists of a voltmeter, a milliammeter, potentiometers, keys and jacks, all of which are encased in a standard metal portable test set box. The approximate dimensions of this box are 14" x 11" x 6". The apparatus which is exposed to view when the cover is removed is shown in Fig. 1.

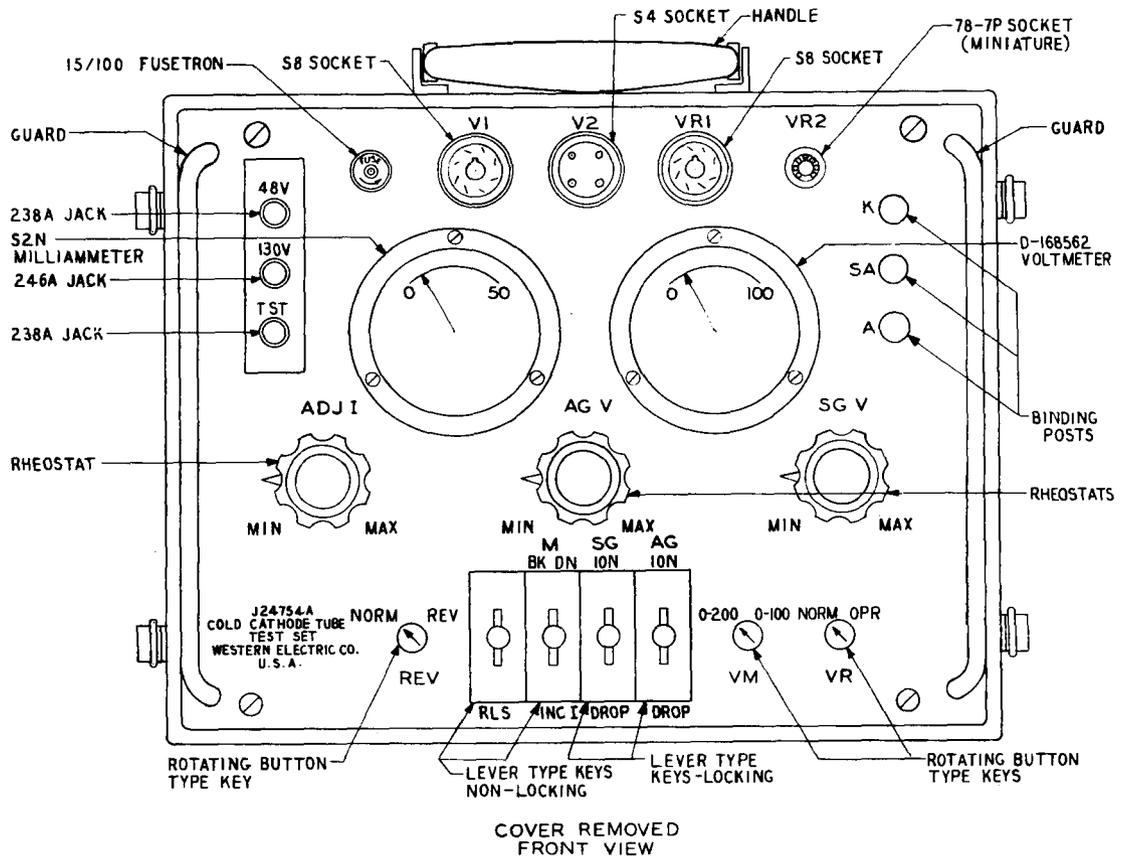


FIG. 1 COLD CATHODE TUBE TEST SET

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- 2.02 The set may be located on the steps of a rolling ladder if desired and fastened to the side of the ladder by means of a ladder strap.
- 2.03 The voltmeter is a Western Electric Co. model per D-168562. The voltmeter is arranged to read to 100 or 200 volts dependent upon the position of the VM key.
- 2.04 The milliammeter is a Western Electric Co. G2N Model and has a single scale range of 0 to 50 milliamperes.
- 2.05 Two locking lever type keys are provided, as follows:
- (1) The SG (starter gap) key arranges the circuit for applying the breakdown voltage to the tube in the ION (ionize) position, or for measuring the voltage drop across the starter gap of the tube in the DROP position.
 - (2) The AG (anode gap) key arranges the circuit for applying the forward or working voltage across the anode gap of the tube in the ION position, or for measuring the voltage drop across the anode gap of the tube in the DROP position.
- 2.06 Two non-locking lever type keys are provided, as follows:
- (1) The RLS (release) key opens the anode and cathode circuits to the tube to restore the tube from the ionized condition and prepare for a repeat test.
 - (2) The M key in the INC-1 (increase current) position provides for increasing the current reading when the ADJ I (adjust current) potentiometer does not provide adequate range. The BK DN (breakdown) position of the M key applies a voltage to the starter anode of three-element tubes for ionizing the tube or applies a small additional transient voltage in series with the d-c test voltage for insuring that an adequate breakdown voltage is provided when required for testing two-element tubes.
- 2.07 Three rotating button type keys are provided, as follows:
- (1) The REV (reverse) key provides for reversing the cathode and control anode connections for testing bidirectional three-element tubes.
 - (2) The VR (voltage regulator) key used in combination with the AG ION key provides for measuring the breakdown potential and anode voltage drop of voltage regulator tubes.
- (3) The VM (voltmeter) key in the left position provides a range of 0-200 volts on the voltmeter and a range of 0-100 volts in the right position.
- 2.08 Three potentiometers are provided, as follows:
- (1) The AG V (anode gap voltage) potentiometer provides for regulating the voltage across the anode or main gap of the tube under test.
 - (2) The SG V (starter gap voltage) potentiometer provides for regulating the voltage across the starter gap of three-element tubes.
 - (3) The ADJ I potentiometer provides for regulating the current in the starter gap or the anode gap of the tubes depending upon whether the SG or AG key is operated. This potentiometer may be used in combination with the M key, (INC I position) if it is desired to control the current in a higher range.
- 2.09 Three jacks are provided, as follows:
- (1) The 48V jack is of the 238 type and is used to patch the -48 volt supply jacks in the office to the test set using a cord provided with No. 310 plugs.
 - (2) The 130V jack is of the 246 type and is used to patch the +130V supply in the office to the test set using a cord provided with No. 309 plugs.
 - (3) The TST jack is of the 238 type and is used for establishing connections to wired-in tubes. A cord equipped with a No. 310 plug and 360 type tools and KS-6278 tools is used for this purpose. The No. 360C (white) tool is connected to the starter anode of the tube to be tested and the No. 360B (black) tool is connected to the cathode (usually through resistance) of the tube.
- 2.10 Three binding posts are provided for making direct connections to tubes equipped with lead in wires such as the 333A or 372A tubes, as follows:
- (1) K binding post. Connection to yellow wire (Cathode)
 - (2) SA binding post. Connection to red wire (Starter Anode)
 - (3) A binding post. Connection to black wire (Main Anode)
- 2.11 Four tube sockets are provided as follows:

- (1) V1 Socket for 376 type tubes and 1C21 and OA-4G tubes
- (2) V2 Socket for 313 type tubes
- (3) VR1 Socket for VR tubes with octal bases
- (4) VR2 Socket for VR tubes with miniature bases

2.12 A fuse is provided for the purpose of protecting the test set against excessive currents.

3. CIRCUIT FEATURES

3.01 Drawing SD-25808-01 shows the circuit arrangement of the test set. A detailed circuit description is covered in CD-25808-01. Part 4 of this section describes the test arrangements which are used in applying various conditions to the tubes for making breakdown tests and determining the characteristics of the tubes.

4. TEST ARRANGEMENTS

Starter Gap Breakdown Voltage - Three-Element Tube Tests

4.01 The circuit arrangement for applying the breakdown test voltage to the starter gap of three element tubes is shown in simplified form in Fig. 2.

4.02 When a tube is connected to the test set in one of the several ways indicated and the SG ION key is operated, the SG V potentiometer controls the voltage which is applied to the control anode of the tube and, at the same time ground through the milliammeter is connected to the cathode of the tube.

4.03 The test voltage is gradually increased by turning the SG V potentiometer toward the MAX position until the tube ionizes as indicated by the sudden appearance of a reading on the milliammeter.

4.04 When the RLS key is held operated, the voltmeter reading corresponds to the open circuit voltage at which the tube ionized.

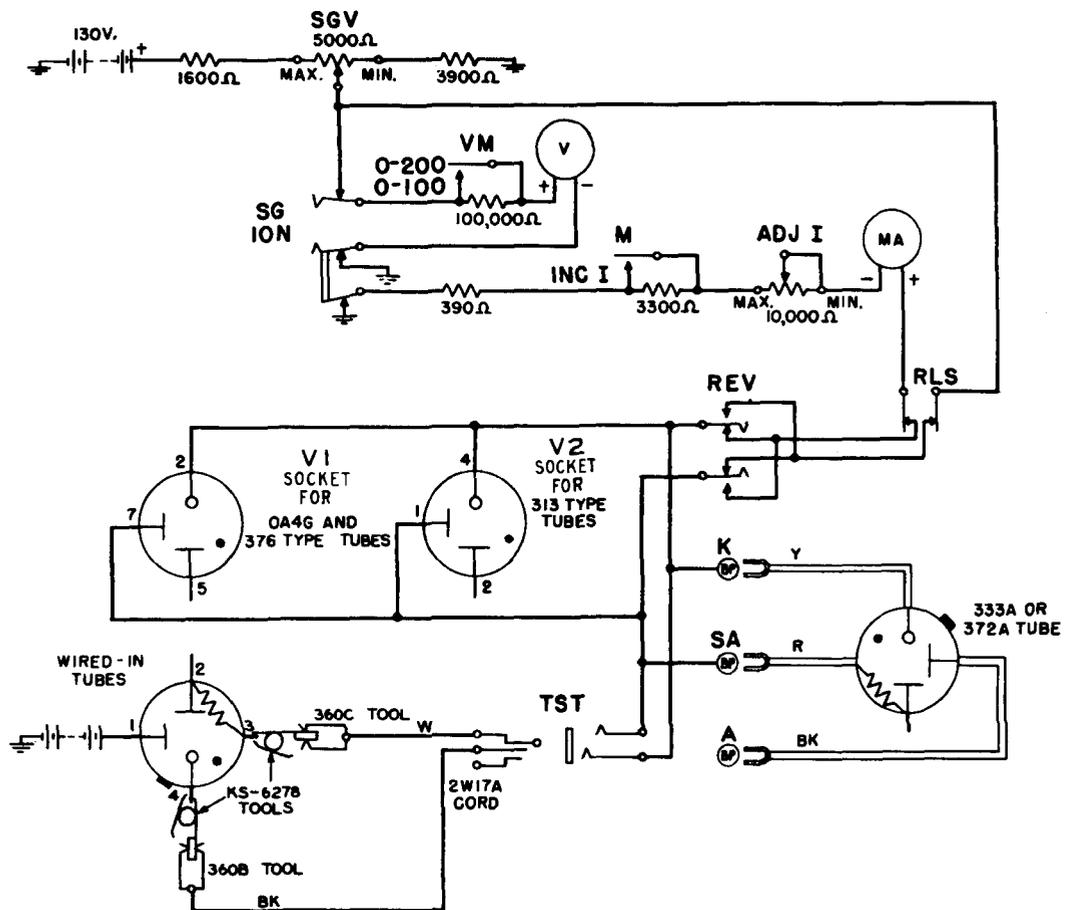


Fig. 2 - Starter Gap - Breakdown Tests - Three Element Tubes

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4.05 The SG V potentiometer is then re-stored to the MIN position and the RLS key is momentarily operated causing the tube to deionize.

4.06 In order to improve the accuracy of the reading, it is desirable to repeat the test described in 4.02 to 4.05 five or six times and take the average of all the voltmeter readings except the first.

Note: The reading of the first test is eliminated because the tube under test may not have been ionized during the previous 24 hours and might therefore give an incorrect reading due to "shelf" effect.

Starter Gap Voltage Drop - Three Element Tubes

4.07 The circuit arrangement for measuring the voltage drop across the starter

gap after the tube has ionized is shown in Fig. 3.

4.08 When the SG DROP key is operated and the SG V potentiometer is turned to the MAX position, the circuit is arranged so that the starter gap current may be adjusted by means of the ADJ I potentiometer in combination with the INC I key if necessary to the specified value for the tube under test.

4.09 The voltmeter reading under this condition corresponds to the starter gap voltage drop.

4.10 This test cannot be applied to wired-in tubes having the +130 volt potential connected to the main anode of the tube. When making this test on tubes of the No. 346B type not in the circuit, it is necessary that the tip connection be made directly to the control anode rather than

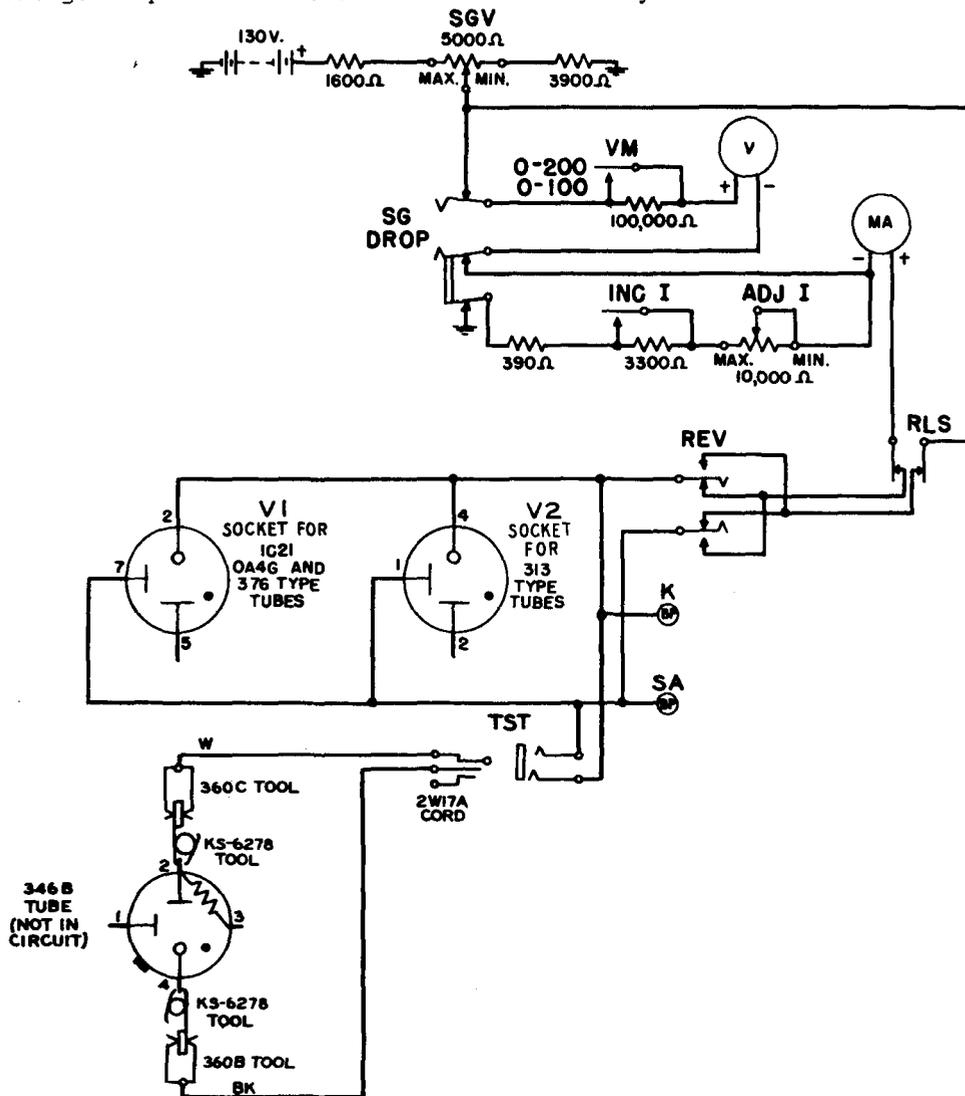


Fig. 3 - Starter Gap - Voltage Drop - Three Element Tubes

through the 100,000 ohm protective resistance in the tube.

Anode Gap Forward or Working Voltage - Three-Element Tubes

4.11 The circuit arrangement for applying the forward or working voltage is shown in Fig. 4.

4.12 When the AG ION key is operated, the AG V potentiometer controls the voltage which is connected across the main gap of the tube under test and this voltage is indicated directly on the voltmeter.

4.13 Under this condition, the tube should not ionize as indicated by no reading being obtained on the milliammeter.

Anode Gap Voltage Drop - Three-Element Tubes

4.14 The circuit arrangement for measuring the anode gap voltage drop is shown in Fig. 5.

4.15 When the AG DROP key is operated and the SG V potentiometer is turned to its MAX position, the circuit is arranged

so that a momentary operation of the BK DN key will cause the tube under test to ionize. The anode gap current may be adjusted by means of the ADJ I potentiometer in combination with the INC I key if necessary to the specified value for the tube under test.

4.16 The voltmeter reading under this condition corresponds to the anode gap voltage drop.

Breakdown Voltage Tests - OD-3 (VR-150) and OA-2 (VR-150) - Two-Element Tubes

4.17 The circuit arrangement for applying the breakdown test voltage when testing the OA-2 (VR-150) and OD-3 (VR-150) two-element tubes is shown in Fig. 6.

4.18 When the AG ION key is operated, the AG V potentiometer controls the voltage which is applied across the control gap of the tube under test. If the tube does not ionize at the MAX position of the AG V potentiometer, the BK DN key is momentarily operated which causes a small transient voltage to be applied in series with the breakdown voltage to assist in ionizing the tube. The voltmeter reading with the RLS

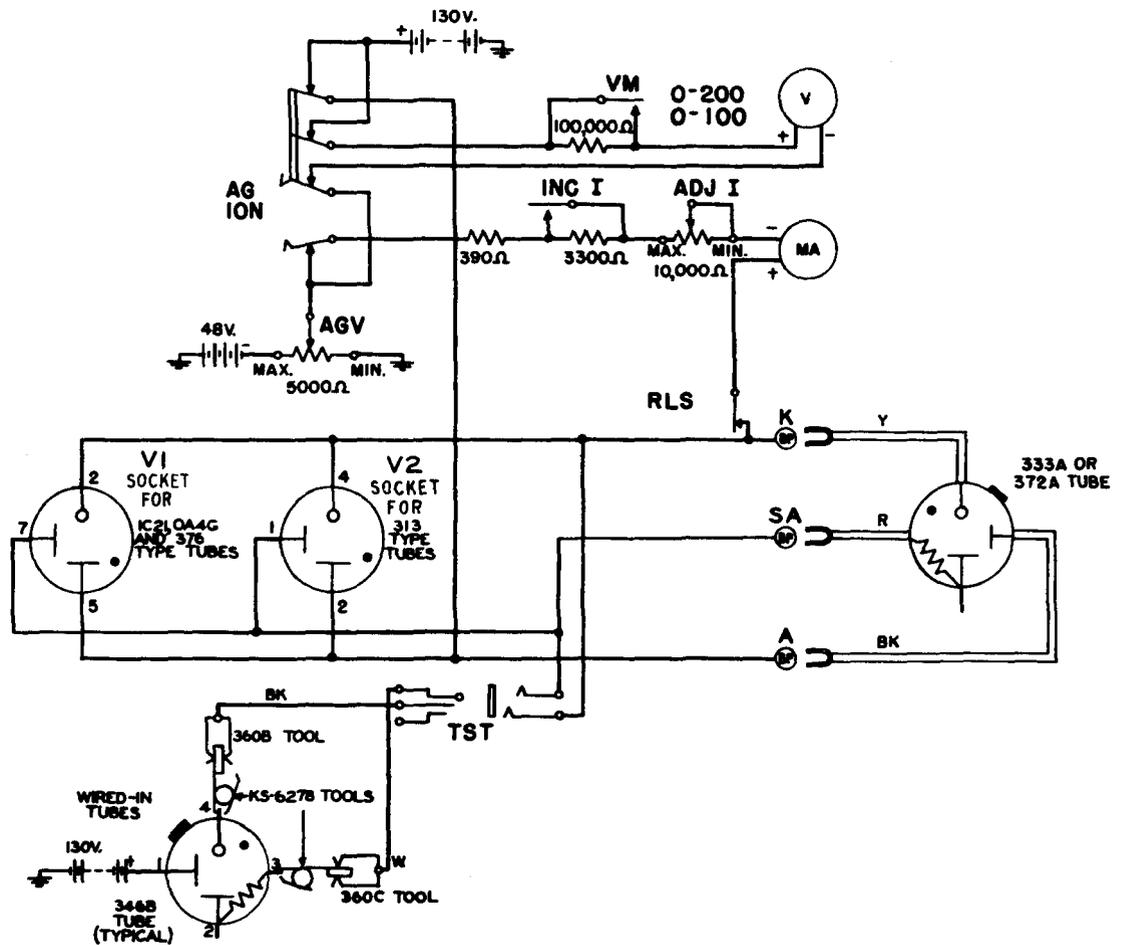


Fig. 4 - Anode Gap - Forward Voltage - Three Element Tubes

key held operated corresponds to the breakdown voltage of the tube.

Note: When it is necessary to operate the BK DN key to cause the tube to ionize, 2 volts should be added to the voltmeter reading to determine the breakdown voltage.

4.19 The SG V potentiometer is then restored to the MIN position and the RLS key is momentarily operated causing the tube to deionize

4.20 In order to improve the accuracy of the reading, it is desirable to repeat the test described in 4.18 and 4.19 five or six times and take the average of all the voltmeter readings except the first. (See note in 4.06).

Breakdown Voltage Tests OA-3 (VR-75) OB-2 (VR-105), OC-3 (VR-105) Two-Element Tubes

4.21 The circuit arrangement for applying the breakdown test voltage when testing the OA-3 or OB-2 two-element tubes is shown in Fig. 7. This arrangement is similar to Fig. 6 except that the +130 volt potential is under control of the SG V potentiometer thereby making it possible to use a lower test breakdown voltage as required by the characteristics of these tubes.

Voltage Drop - All Voltage Regulator Two Element Tubes

4.22 The circuit arrangement for checking the voltage drop to determine the voltage regulating characteristics of two-element tubes is shown in Fig. 8.

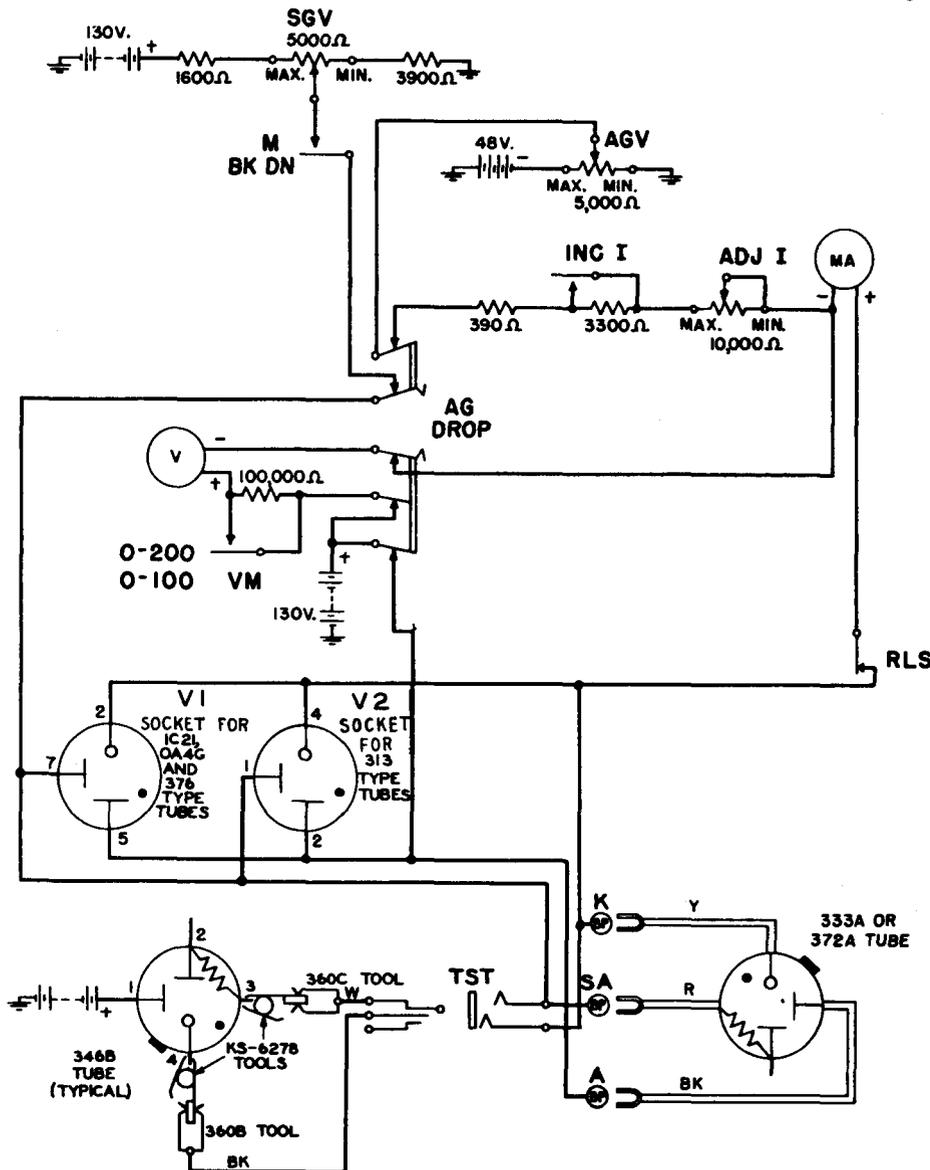


Fig. 5 - Anode Gap - Voltage Drop - Three Element Tubes

- 4.23 When the AG DROP key is operated, the AG V potentiometer controls the voltage which is applied across the control gap of the tube under test. If the tube does not ionize at the MAX position of the AG V potentiometer, the BK DN key is momentarily operated to assist in causing the tube to ionize.
- 4.24 The ADJ I potentiometer in combination with the INC I key if necessary then controls the amount of current flowing in the tube.
- 4.25 Voltmeter readings may be noted at two or more specified current values. The difference in the successive voltmeter

readings gives the voltage regulation characteristics of the tube.

5. MAINTENANCE

5.01 Removing the four corner screws in the top of the test set and lifting the top from the casing makes the apparatus readily accessible. The keys, jacks and meters should be adjusted to meet the requirements given in the Bell System Practices sections applying to the particular piece of apparatus. In case the voltmeter or milliammeter becomes defective it should be removed from the set and returned through the usual channels for repair.

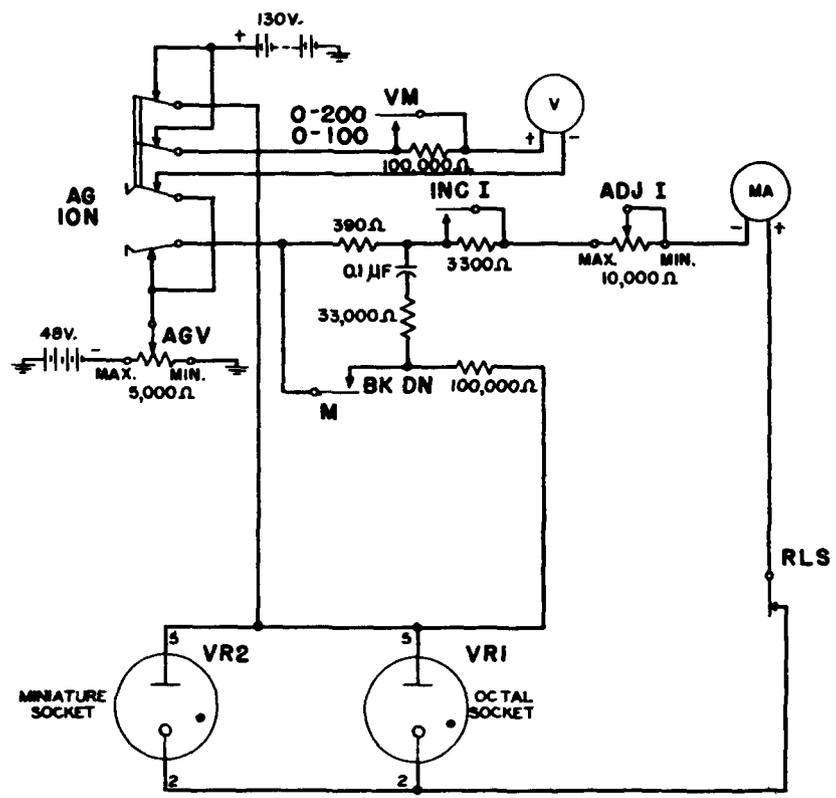


Fig. 6 - Breakdown Voltage Tests
 OA2/VR150 or OD3/VR150
 Two Element Tubes

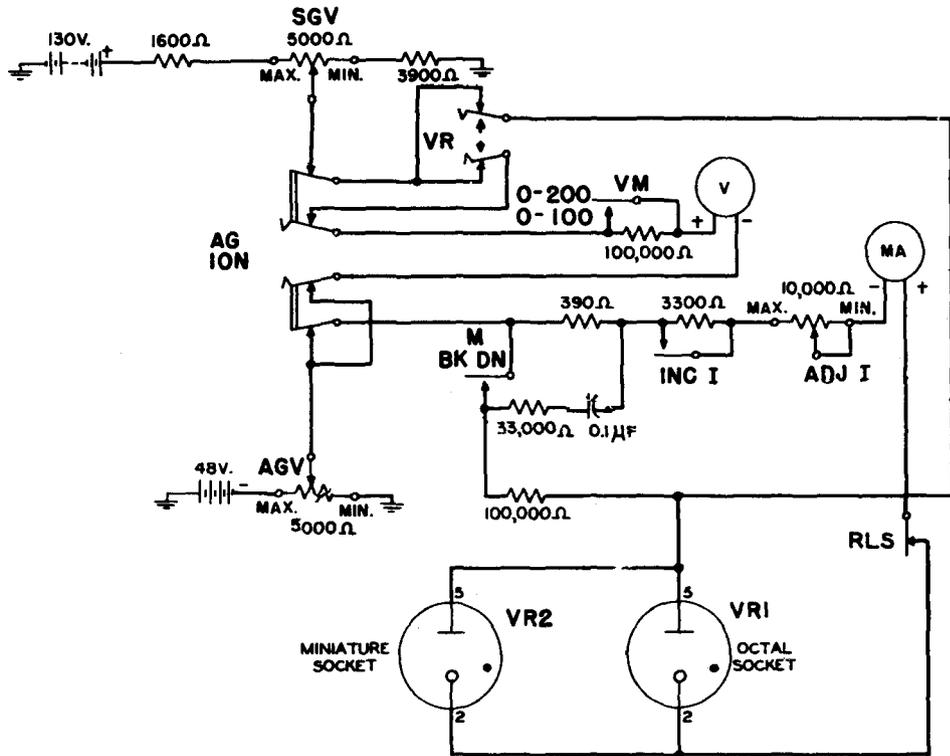


Fig. 7 - Breakdown Voltage Tests OA3/VR75, OB2/VR105 or OC3/VR105 Two Element Tubes

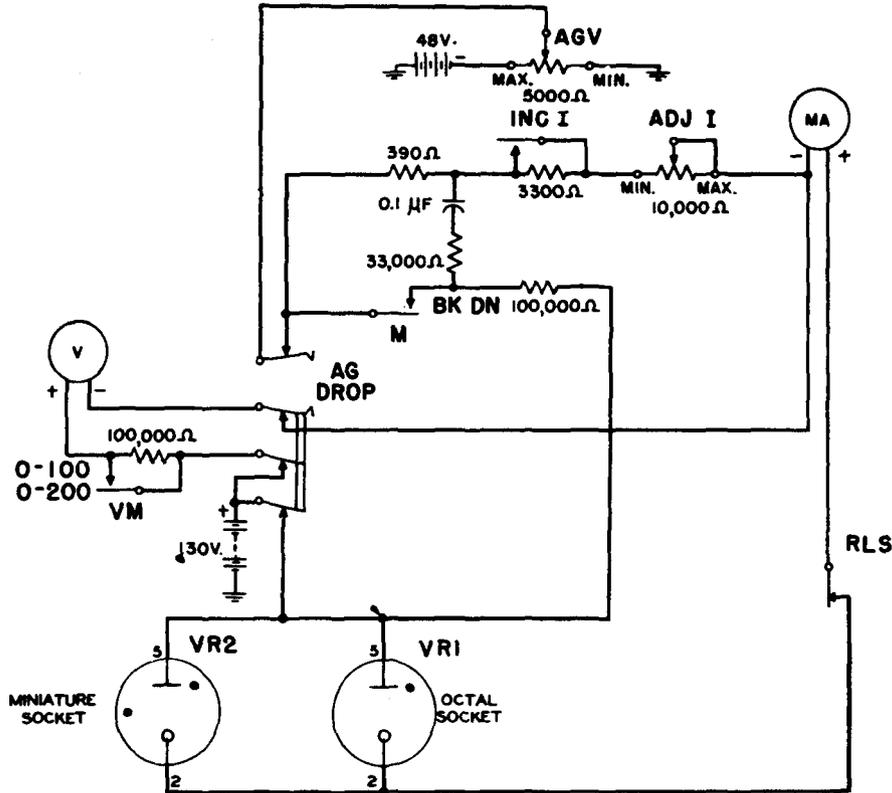


Fig. 8 - Voltage Drop All VR Tubes