BELL SYSTEM PRACTICES
Outside Plant Construction
and Maintenance

SECTION G86.062.1
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AT&T Co Standard

90A TEST SET

Contents

1. GENERAL

1.01 This section describes the 90A Test Set and the superseded D-171237 Test Set which are high voltage Wheatstone bridges used in locating faults in coaxials.

1.02 The section includes a description of the specially insulated cords provided for use with the bridge and contains information regarding field maintenance of the bridge and associated items.

1.03 Information on the use of this apparatus in locating faults is covered in a separate section.

2. PRECAUTIONS

2.01 The power supply in the bridge delivers a substantial current at potentials as high as 3000 volts. It is, therefore, essential that the operator exercise extreme caution in working with the bridge, to avoid electric shock. The pre-

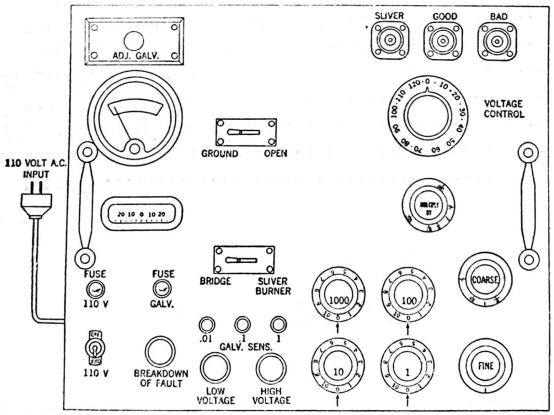
cautions are covered in Section G50.244.3. Only the well-insulated test cords furnished with the set should be used in connecting the bridge to the cable under test.

2.02 The 90A Test Set is a precision instrument and requires careful handling to avoid damaging the galvanometer and other delicate parts. It should preferably be transported in a padded apparatus case to minimize the effect of road shocks.

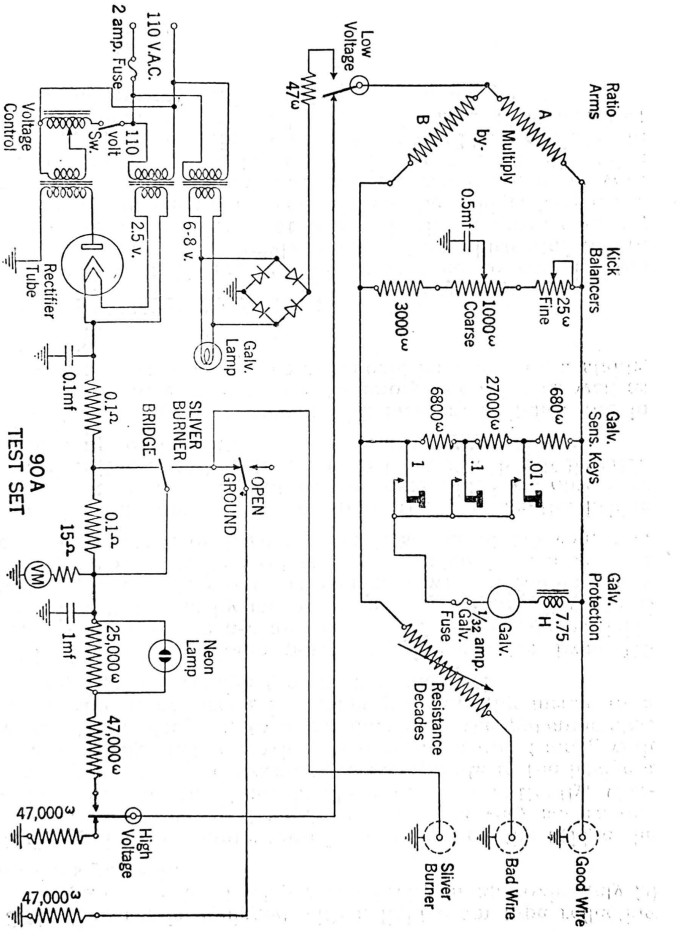
3. DESCRIPTION OF BRIDGE

3.01 The 90A Test Set and superseded D-171237 Test Sets consist essentially of a Wheatstone bridge with a high voltage d-c power supply variable from 0 to 3000 volts for locating arcing faults, and a 5-volt d-c power supply for making ordinary resistance measurements.

3.02 The 90A Test Set is housed in a metal box approximately 20-1/4" x 16-1/4" x 9-3/4". This set, the associated cords and the artificial line are assembled in a padded instrument trunk which is approximately 23-3/4" x 19" x 13-3/4". The superseded D-171237 Test Set and power supply are housed in a wood box approximately 25" x 16" x 11". The arrangement of the apparatus and keys on the panel is shown in the following sketch.



3.03 The Wheatstone bridge makes use of resistance decades and ratio arms similar to those in the standard 5430A bridge. The circuit of the high-voltage bridge, however, is arranged for making loop and Varley resistance measurements only. A schematic circuit diagram of the set is shown below.



3.04 The set is equipped with a light-beam type reflecting galvanometer having a sensitivity of approximately 20 megohms per volt.

3.05 In locating faults with high voltage on the bridge the fluctuations of the galvanometer are very severe due to the fact that the fault breaks down intermittently. Consequently, it has been necessary to incorporate in the bridge a "kick-balancing" network which requires adjustment along with the resistance decades, to avoid damaging the galvanometer. The galvanometer circuit is further protected by means of a 1/32-amp. glass cartridge type replaceable fuse.

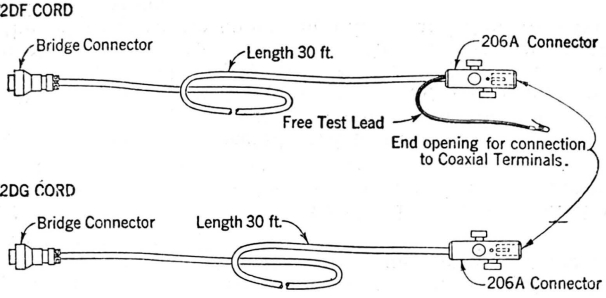
3.06 The high voltage power supply operates from 110 volts 60-cycle a-c and delivers a d-c voltage variable from 0 to 3000 volts by means of the VOLTAGE CONTROL knob. The 110-volt circuit is equipped with a 2-amp. glass cartridge type fuse. The set can be operated from a 110-volt a-c lighting circuit or from a portable source of 110 volts a-c.

3.07 The instant of breakdown of the fault as the bridge voltage is increased can be determined by observing the flash in the neon lamp marked BREAKDOWN OF FAULT on the panel of the set.

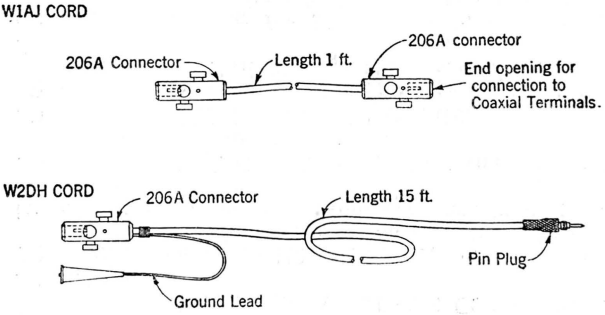
3.08 The bridge is equipped with mercury switches and in order to ensure their satisfactory operation as well as that of the galvanometer, the set should be placed on a stable, level base.

4. DESCRIPTION OF CORDS

4.01 The W2DF and W2DG cords used to connect the bridge to the coaxials under test are illustrated below. These cords are equipped at one end with a screw-coupling plug which fastens to a receptacle on the bridge. The other end has a well insulated connector for making contact with the inner conductor of .270 or .375 inch coaxials in the cable or at a 31B, 35A and similar type terminals. The connection to the "third wire" or "ground" is made by means of the short lead on the W2DF cord.



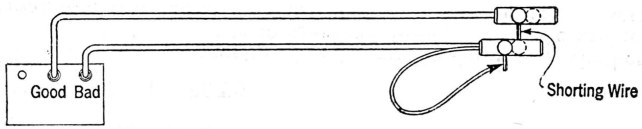
4.02 The W1AJ and W2DH cords illustrated below are used to strap the good and bad coaxials together at the distant end. The particular cord used depends on whether the connection is made in the cable or between coaxial terminals at auxiliary repeater stations.



4.03 The flexible coaxial cordage used in these cords consists of Ca 1282 cable.

5. OPERATING TESTS

5.01 **Cord and Connector Resistance:** To determine whether the test cords are in good condition, set up the bridge, arrange the test cords as illustrated and proceed as follows:



Low Voltage Test

(1) Check to see that the switch marked "110-V" is in the "Off" position and the VOLTAGE CONTROL dial is set at "0."

(2) Connect the set to 110-volt power, but **do not** turn on the "110-V" switch. This should light the galvanometer lamp. If the galvanometer lamp does not light, it should be replaced.

(3) With the ADJ. GALV. knob, adjust the galvanometer spot light to zero on the scale.

(4) Set the MULTIPLY-BY dial at 1/100.

(5) Depress the black LOW VOLTAGE key and operate the .01 GALV. SENS. key. Then balance the bridge in the usual way.

(6) The dial reading for 30-ft. cords in good condition should be approximately 31 ohms. The resistance may be slightly higher or lower depending on the length and temperature.

(7) When the bridge is balanced, hold down the LOW VOLTAGE and 1 GALV. SENS. keys and in turn jiggle the cord adjacent to each of the connectors and simultaneously observe the galvanometer. The light spot will remain relatively still if the various connections are solid. Sharp deflections of the galvanometer spot would generally indicate poor connections at the bridge or shorting wire, or a defect in the cord somewhere near the point where it is being jiggled.

5.02 **Voltage Breakdown of Cords:** If it is suspected that one of the cords has inadequate dielectric strength, the cord should be tested as follows:

(1) Connect the suspected cord to the SLIVER BURNER jack and lay the coaxial connector so that it is clear.

(2) Make sure that the VOLTAGE CONTROL knob is set at zero and the "110-V" switch is "Off." Then connect the bridge to a source of 110-volt a-c power, allow the set to warm up about one minute and then turn on the "110-V" switch.

(3) To check the breakdown voltage, simultaneously operate the upper lever key to OPEN and the other lever key to SLIVER BURNER with the left hand. Then slowly turn the VOLTAGE CONTROL knob and observe the voltmeter carefully.

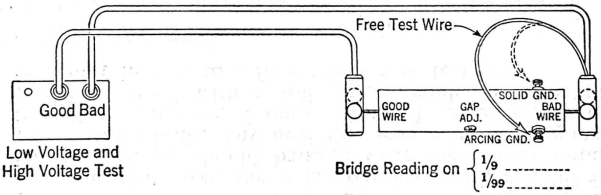
(4) If the cord or a connector is defective the voltmeter needle will kick toward zero indicating breakdown before the maximum voltage is reached, and may kick intermittently thereafter.

(5) If the cord and connectors are in good condition no breakdown should occur at the maximum voltage delivered by the set.

(6) On completion of the test the condensers in the set should be discharged by throwing the lever key to SLIVER BURNER and holding it for one or two seconds.

5.03 **Bridge Performance:** The over-all performance and accuracy of the bridge can be determined by measurements on the 427A Artificial Line provided with the bridge for this purpose. The artificial line is arranged to simulate a solid or an arcing fault. The testing procedure is as follows:

(1) Set up the bridge and connect the GOOD and BAD cords to the artificial line as illustrated below.



(2) **Solid Fault:** The free test lead is connected to terminal marked SOLID for the initial test. The bridge should then be balanced in the usual manner using the LOW VOLTAGE battery with the MULTIPLY-BY dial set at 1/9 or 1/99. The bridge should balance at or very near the values marked on the artificial line for the selected ratio setting. A deviation of more than ± one ohm for the 1/9 setting and ± five ohms for the 1/99 setting would indicate poor connections or a faulty bridge.

(3) **Arcing Fault:** The second test is made with the free test lead connected to the ARCING terminal and the MULTIPLY-BY dial set at 1/9 or 1/99.

(4) This test should be made with the arcing gap of the artificial line adjusted to the desired breakdown voltage (1500 volts is usually satisfactory).

(5) The gap in the artificial line can be readjusted to break down at the desired voltage. Turning the GAP ADJ. screw clockwise, lowers, and counter-clockwise, increases the voltage breakdown. To avoid the possibility of electrical shock, the VOLTAGE CONTROL dial should be turned to zero and the 110-V switch turned to "Off" before making this adjustment.

(6) The bridge should then be balanced as outlined in Section G50.250.1.

(7) The measured value for an arcing fault may differ somewhat from the value obtained with a solid fault, but the bridge should balance near the values obtained with a solid fault. Any deviation exceeding ± 2 ohms for the 1/9 setting or ± 5 ohms for the 1/99 setting from the values obtained with a solid fault should be investigated as it may be due to a faulty bridge or test leads.

6. REPLACEMENTS

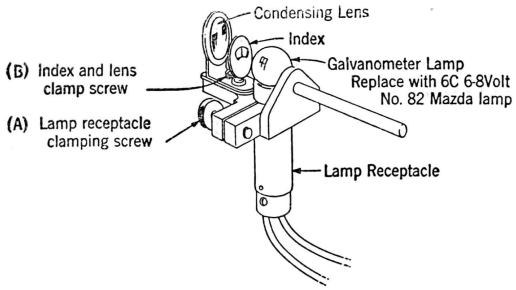
6.01 The fuses are accessible under the fuse caps on the panel. In the event that a fuse blows in the field remote from normal supply channels, the fuses can usually be obtained from radio supply stores.

6.02 **Galvanometer Fuse:** If the galvanometer fuse is blown due to a current surge in the course of balancing the bridge with high voltage battery, the fuse should be replaced. **A 1/32-amp. 8AG Littelfuse** should be used for this purpose. No larger fuse should be employed as the galvanometer may otherwise be injured.

6.03 **110-Volt Power Fuse:** If the 2-amp. fuse in the 110-volt power supply is blown, the fuse should be replaced with **2-amp. 4AG Littelfuse.** If the new fuse blows immediately after the set is again turned on, the set is probably defective internally and should be returned for repair.

6.04 **Galvanometer Lamp:** The galvanometer lamp, **6C 6-8 volt, No. 82 Mazda Lamp** is located under the faceplate. It is therefore necessary to remove the set from the box in order to replace the lamp. The procedure is as follows:

(1) Loosen the four screws at the bottom of the box and lift the set out of box by means of the handles. The following sketch shows the galvanometer index and lamp unit which is located below the galvanometer scale.



(2) The lamp can be replaced without removing the lamp assembly. To remove the lamp press down and rotate it counter-clockwise about 1/4 turn, then lift out. Insert the new lamp, press it down and turn clockwise to lock it in place.

6.05 Before assembling the set, check the adjustment of the lamp as follows:

(1) Make sure the VOLTAGE CONTROL knob is set at zero and that the "110-V" switch is in OFF position.

(2) Connect the cord to a source of 110 volts a-c. This should light the lamp.

(3) If the image of the index (light spot) on the scale is clear and sharp, no adjustment is necessary.

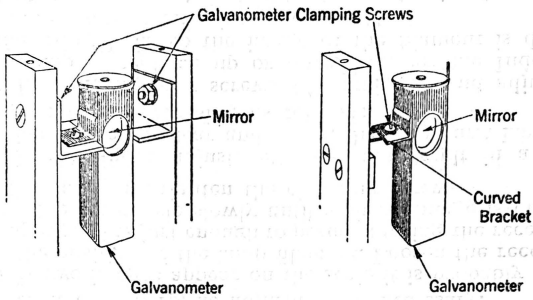
(4) If two images appear on the scale it is probably due to the position of the lamp filament. Loosen the receptacle clamping screw just enough to permit turning the receptacle. Turn the receptacle slowly until a single image is obtained on the scale and tighten the clamping screw.

6.06 If the above adjustment does not result in a single image that is clear and sharp, the index and lamp unit probably requires refocusing as follows:

(1) Loosen clamping screws (A) and (B) and adjust the Lamp Receptacle up or down and set the Index and Condensing Lens so the image of the filament is directed on the galvanometer mirror.

(2) Tighten screw A and slide the condensing lens toward or away from the lamp until the image is focused on the galvanometer mirror.

(3) Remove the cover plate from the galvanometer system by taking out the 4 screws at the top of the set. This will give access to the galvanometer system supporting bracket and screws as illustrated below.



NEWER METHOD OF MOUNTING GALVANOMETER

OLDER METHOD OF MOUNTING GALVANOMETER

(4) Loosen the screw or screws which hold the bracket in place and tilt the galvanometer backward or forward slowly until the image appears on the scale; then tighten the screws.

(5) Hold the condensing lens and slide the index toward or away from the lamp until the image of the index (light spot) is clear and sharp. Then tighten clamping screw B securely.

(6) If two images appears on the scale, correct by rotating the receptacle as described in Paragraph 6.05.