BELL SYSTEM PRACTICES
Outside Plant Construction
and Maintenance

SECTION G72.261
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AT&T Co Standard

CABLE TESTING
45-A TEST SET

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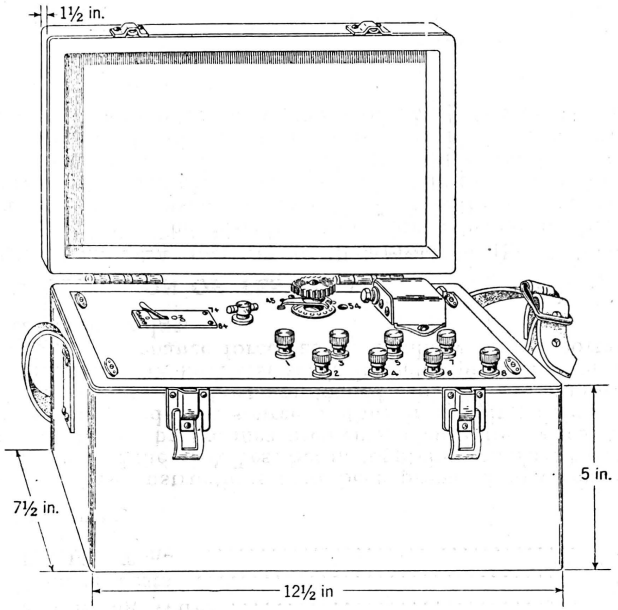
1. GENERAL

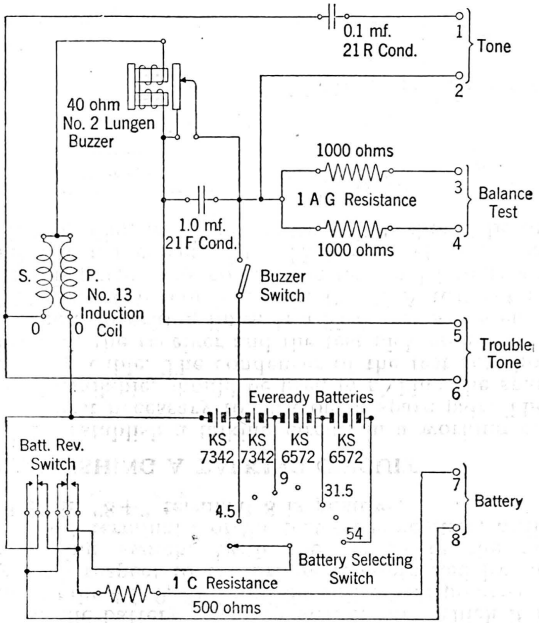
1.01 These instructions have been prepared to cover the use of the 45-A Test Set in supplying external battery for Wheatstone bridge measurements, identifying wires, balance testing, and as a source of tone in running down low resistance faults on short non-loaded cable by the exploring coil method. The 45-A test set is intended primarily for use by cable maintenance forces as an auxiliary to the portable Wheatstone bridge.

2. DESCRIPTION OF TEST SET

2.01 The 45-A test set is illustrated in the following sketch. The 54-volt battery for Wheatstone bridge measurements consists of two KS-7342 batteries (4.5 volts each) and two KS-6572 batteries (22.5 volts each) and is connected to terminals 7 and 8 of the test set through a guard resistance of 500 ohms. Switches are provided for reversing the battery and selecting voltages of 4.5, 9, 31.5 or 54 volts.



2.02 The tone circuit of the set consists essentially of a 40-ohm Lungen buzzer, a No. 13 induction coil, a starting switch, and a 4.5 volt battery obtained by a tap on the 54-volt battery. A one microfarad condenser is bridged across the vibrator contacts of the buzzer to prevent excessive sparking. The predominant frequency of the tone output is about 150 cycles per second. The schematic circuit diagram of the test set is given below.

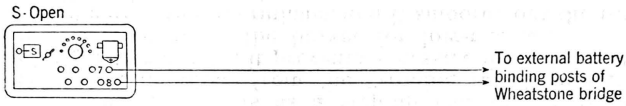


2.03 The induction coil in the tone circuit serves several purposes. It acts as a step-up transformer to increase the tone output from the "trouble tone" terminals (binding posts 5 and 6), it prevents excessive drain from the battery or stopping of the buzzer for low-resistance loads connected across these terminals, and it smooths out the tone so that it is pleasant to the ear.

2.04 Tone for identifying wires is obtained from terminals 1 and 2 of the test set through a 1/10 microfarad condenser in series with terminal 1. This condenser makes it possible to use the set on cable containing working dial system lines without interfering with dialing, and it reduces the tone output to a volume which will not cause serious induction on other wires in the cable. Terminals 3 and 4 provide means for balance testing, an alternating current bridge circuit being formed by two equal resistances and the two wires under test when a receiver is connected across these terminals and terminal 1 is grounded.

3. WHEATSTONE BRIDGE BATTERY

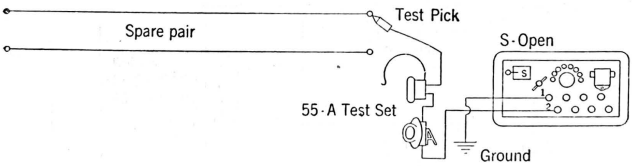
3.01 Portable Wheatstone bridges are usually equipped with a self-contained 4.5-volt battery. However, the use of an external battery of higher potential than that provided in the bridge can sometimes be used to advantage when the fault resistance is high or when fluctuations of the galvanometer due to ground potentials are severe. External battery for portable Wheatstone bridges may be obtained from terminals 7 and 8 of the test set, the connections being made as indicated below.



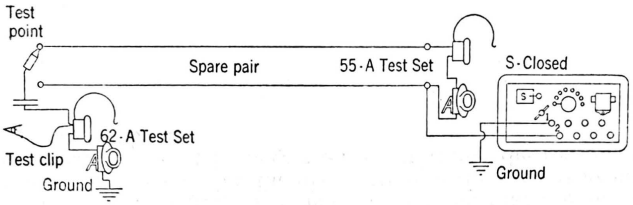
3.02 The voltage of the battery may be varied by means of the battery selecting switch with which it is possible to obtain 4.5, 9, 31.5 and 54 volts. The polarity of the battery with respect to the bridge is controlled by the battery reversing switch. With the switch in the position marked "7+" terminal 7 of the test set is positive, while with the switch in "8+" terminal 8 is positive.

4. ESTABLISHING A TALKING CIRCUIT

4.01 To establish a talking circuit in a working cable, it is first necessary to pick out a spare pair. The 62-A test set, if available, should be used in picking the spare pair in a working cable. The condenser of the test set should be in series with the receiver and the test pick so as to prevent interference on working lines. If a 55-A test set is employed, the 1/10 microfarad condenser in the 45-A test set may be used for this purpose by connecting terminal 1 to ground and terminal 2 to a receiver of the 55-A test set as indicated in the following diagram. The buzzer switch should be open.

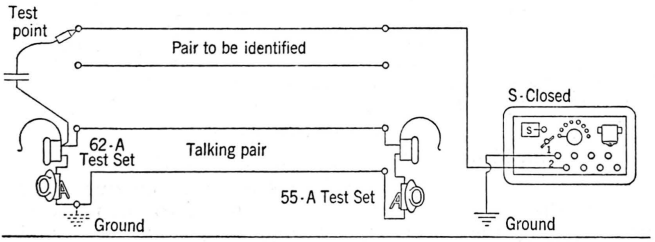


4.02 The usual method for identifying the pair to be used as the talking circuit is that of connecting the talking set across the spare pair with the tone between one side of the pair and ground as indicated below. At the other end of the cable the various wires are tested with a 62-A test set. Tone in the receiver is an indication that the proposed talking pair has been identified. Tone for this purpose is obtained from terminals 1 and 2 of the test set.



5. IDENTIFYING WIRES

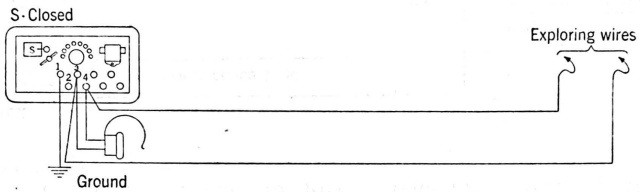
5.01 After the talking circuit has been established, the wires may be identified as indicated below. The connection from one side of the talking circuit to ground may be omitted if the talking pair is long enough to have sufficient capacitance to ground to give satisfactory tone in the receivers.



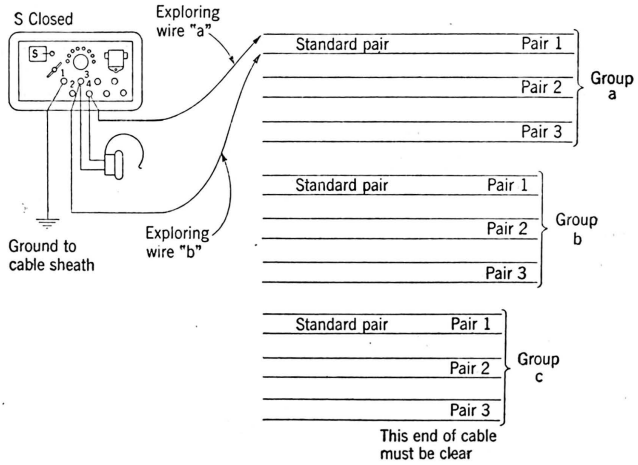
5.02 To identify wires, connect the tone to the pair at the splice and at the terminal or main frame test the pairs with the test point connected to the condenser of the 62-A test set, as shown in Paragraph 5.01. Tone in both receivers indicates that the correct pair has been found.

6. BALANCE TESTS

6.01 These tests are made by comparing the capacitance to ground of the various conductors of the cable to that of a selected conductor by means of an alternating current bridge arrangement. Balance tests are useful for such purposes as testing spare pairs in working cable. Terminals 3 and 4 of the set provide the balanced non-induction resistance arms of the bridge. The connections to the test set for the balance test are shown below.



6.02 Divide the cable pairs into groups. All wires in a group must have the same length. If the lengths are different, the capacitances will be different and a balance cannot be obtained. Likewise, they should be of the same gauge, since there may be small differences in the capacitances of wires of different gauges. It is also desirable that the splicer have a diagram showing the distribution of the various groups in the cable so that he may readily determine the reason for any small unbalances.



6.03 The conductors at the end of the cable should be clear.

(a) For each group pick out a pair which seems to be free from trouble. This pair is the standard pair to which the other pairs in the same group are to be compared. Test the standard pair with battery and receiver to make sure that it is not short-circuited or grounded. Connect exploring wire "a" to one side of the standard pair, pair 1 in the above diagram. Exploring wire "b" is then connected to the other side of the same pair. If the capacitance of the tip side to ground is equal to that of the ring side, no tone will be heard in the receiver. Exploring wire "b" is then connected to the tip side of pair 2, and then in turn to each of the other conductors to be tested. If no tone is heard in the receiver in any of these tests it may be assumed that the pairs tested are free from trouble. If a tone is heard it is probable that the wires on which tone is heard are defective, or at least not like the standard wire.

(b) The wires suspected of being defective should be tested further as follows: Connect exploring wire "a" to both sides of the standard pair. Go over each of the faulty conductors with exploring wire "b". The conductors which give no tone are either short-circuited or

crossed. If no tone is heard on either side of the faulty pair, the fault is a short circuit. If tone is heard on only one wire of the faulty pair, the fault is a cross. Then connect the exploring wire "a" to one side of the standard pair and go over the remaining faulty wires. Conductors which give a very loud tone are grounded. The remaining faults will probably be opens. They may be tested further by connecting exploring wire "a" to each faulty conductor in turn, leaving exploring wire "b" disconnected, and comparing the tone heard on each faulty conductor with that heard on the standard conductor. An open, unless near the distant end of the cable, will give a weaker tone than that heard on the standard conductor. The tone heard on a good conductor will be of about the same intensity as that heard on a standard conductor.

7. TROUBLE TONE

7.01 "Trouble tone" from terminals 5 and 6 may be used as the source of tone for locating faults with the exploring coil. The connections of the set to the faulty wires should be made in the usual manner, between the faulty wire and ground when the trouble is a ground, or between the two faulty wires in the case of a short circuit or cross. In some instances the 107-A amplifier may be required to amplify the tone pickup. The method of locating faults by the exploring coil method is described in Section G72.255.