

BELL SYSTEM PRACTICES
Outside Plant Construction
and Maintenance

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CABLE TESTING—GENERAL

DETECTING DEFECTIVE PAIRS—

BATTERY AND RECEIVER METHOD

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1. GENERAL

1.01 This section describes the method of detecting defective conductors in Exchange and Toll Cables using a receiver and battery.

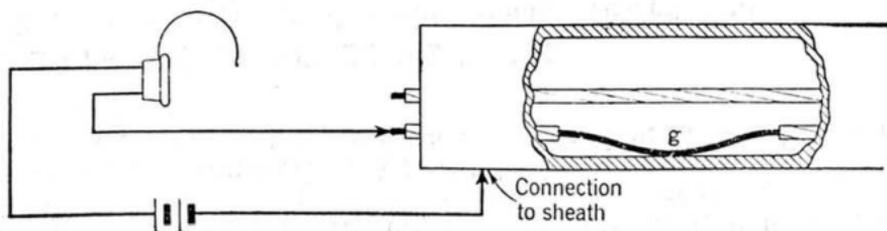
1.02 The battery supply for these tests can be obtained from any of the test sets ordinarily supplied for conductor identification purposes.

1.03 For the purposes of this section it is assumed that the tests are made between two open ends of a cable. Tests made on a cable which has one or both ends terminated at a Central Office Main Frame or cable terminal are made in a similar manner.

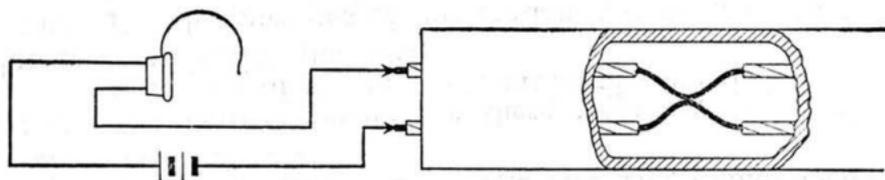
1.04 In all of these battery tests, care must be taken to distinguish between a click due to a ground and that due to the capacity of a non-grounded wire. If the cable is long, the capacity click will be heavy when the wire is first touched with the test clip, but when the wire is tapped several times in quick succession, capacity clicks, after the first, will be very slight. A ground click will be as heavy on successive tappings as on the first connection. A ground click is heard on make and break of the contact, whereas a capacity click is heard only on making the contact.

2. DETECTING DEFECTIVE PAIRS

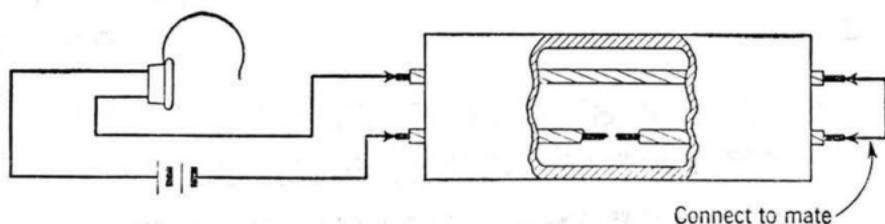
2.01 The tests for detecting open, crossed and grounded pairs with a battery and receiver are made as shown in the following diagrams.

(a) Detection of Ground.

To detect a grounded wire, connect one side of the battery to the sheath of the cable (ground) and the other side to one terminal of the receiver; the other receiver terminal is connected to the wire under test. A circuit is formed when the grounded wire is touched with the test clip and a click will be heard in the receiver.

(b) Detection of Crosses and Short Circuits.

The method of detecting crosses and short circuits is similar to that used for detecting grounds. The test can be made as indicated in the above diagram. A distinct click indicates the presence of a cross.

(c) Detection of Opens.

Opens are detected by the absence of an electrical circuit. The wire suspected of being open may be connected to its mate or to any known wire and then tested for cross as shown above. Failure to detect a cross will indicate that the wire is open.

3. DEFECTIVE PAIRS — COMBINED TEST — PAIRED CABLE

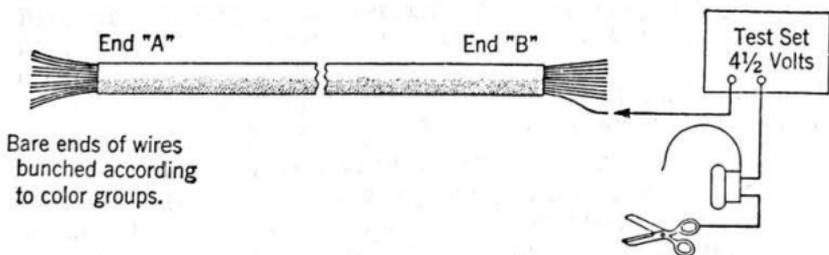
3.01 The test for open, crossed and grounded pairs may be combined in one test, using a modification of the battery and receiver tests outlined in Paragraph 2.01. The method of finding defects outlined below is used primarily in testing individual lengths of cable or in testing several lengths of spliced cable before terminating.

(1) Remove the sheath for a distance of about 12 inches at one end (A) of the section of the cable to be tested. (When making a test for defective pairs remove no more of the sheath than is necessary for making the test.)

(2) Strip the insulation off all the conductors for a distance of about 3 inches from the end.

(3) Bunch the conductors of each color group separately by binding the bare ends tightly together with a piece of wire or cotton sleeving. By bunching the pairs according to their colors, any pairs which are split or transposed between color groups will be detected in making the test for opens. Split pairs and transpositions occur only at splices and, therefore, such troubles are not involved in tests of single sections. Wrap the end of the cable loosely with muslin and protect the end as necessary.

(4) **Test for Opens:** Strip off about 12 inches of the cable sheath at end (B) and test each color group for opens as follows: Connect the receiver to one side of the battery and to a pair of shears as shown below. Connect one of the conductors of the color group under test to the other side of the battery.

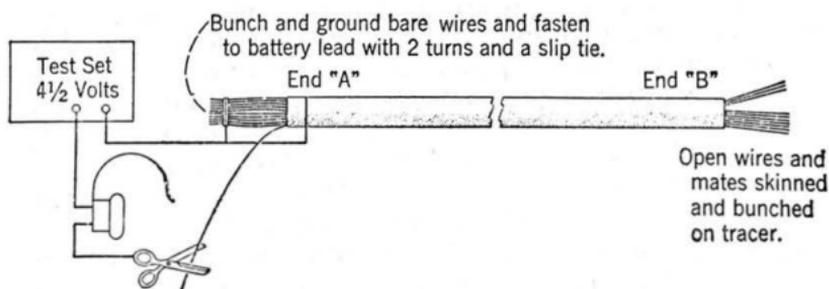


(5) Make contact with each of the other conductors in the group with the shears. A battery click will be heard on all conductors which are not open. If no click is heard when any one of the wires is touched with the shears, tag the wire, "Open." The testing and clearing may be done in one operation by cutting off the end of each wire as it is tested. As the wires are tested, clear the ends and set them aside.

(6) Test each wire tagged "Open" to make sure that the pair is not split with one of another group. To test for split pairs, remove the battery connection from the group under test and connect it to a conductor suspected of being open. Then with the shears touch the ends of two or three wires of each of the remaining color groups. A distinct click in the receiver when one of the groups is touched indicates the presence of a split pair between that group and the one being tested for opens. If no battery click is heard the pair is open. Tag the conductors found open and also any found to be split, making a note of the color groups in which the split pairs appear.

(7) Upon completion of the test for opens, skin the ends of all open conductors and their mates and bunch them on a good tracer wire together with the ends of any split pairs. Wrap the end of the cable loosely with muslin and protect the end as necessary. Make sure that all "cleared" ends are cleared and that the bunched wires are cleared from ground.

(8) **Test for Crosses and Grounds:** At end (A) connect all the bunches together and to the sheath (ground). Connect one side of the battery to the sheath and the other side to one terminal of a receiver. Connect the other side of the receiver to a pair of shears, as shown below.



(9) Pull one conductor at a time from the bunch and make contact between it and the shears. If a battery click is heard, the wire is either grounded, crossed with some other conductor or is the good side of one of the open pairs which is bunched on the tracer at the other end. Each wire on which a click is heard should be tagged and connected to the lead from the test set to ground. While making this test, touch the untested bunch after about every 25 pairs are tested, to make sure that the testing apparatus is working properly, and tighten the tie wire on the bunch being tested.

3.02 Tagging Defective Pairs:

- (1) When all conductors have been tested, disconnect the defective conductors from the ground lead and test them one at a time. All conductors which give a loud click when tested are grounded. Tag the grounded conductors "Ground."
- (2) At (A) ground the tracer wire to which the open conductors were connected at (B) and test the remaining defective conductors. If but one conductor of each of these pairs is open, the good side of each will give a click when tested. Tag the open side of each pair "Open."
- (3) Ground one of the remaining defective conductors and test the others for crosses. Any conductor which gives a click when tested is crossed with the wire which has been grounded. If the crossed wire is the mate of the grounded conductor, the fault is a short circuit. If the sides of two pairs are crossed, tag each of the crossed wires to indicate the color of the wire with which it is crossed. If there is more than one cross in a color group, indicate on the tag the color of the wire and pair with which the tagged wire is crossed; i.e., "X with R of G.R."
- (4) After all the troubles are tagged, bunch the clear mates of all crosses, and one side of each short-circuited pair, on the tracer. Clear all crossed sides and the other sides of all short circuits. Clear all grounded wires which have been picked in connection with the test for Opens and Grounds. Wrap up the end of the cable with muslin and protect the end as necessary.
- (5) At end (B) of the cable remove the tracer from the bunched open pairs and ground the tracer. Test through all conductors and pick out all grounded wires. After this is done, clear the tracer and test for grounds on all pairs that were picked out. All wires which are found grounded on this test should be tagged "Grounded."
- (6) The remaining wires are "good" mates of crossed wires or sides of short-circuited pairs, bunched to the tracer. With the battery and receiver, test for crosses between each of these wires and the tracer. If both wires of a pair are crossed with the tracer the pair is short-circuited and should be so tagged.
- (7) Clear all ends. This completes the test for crosses, opens and grounds and all grounded, open, crossed and short-circuited pairs are tagged at both ends.
- (8) Following the test, the ends of the cable should be protected in the usual manner.

4. DEFECTIVE PAIRS—QUADEDDED CABLE

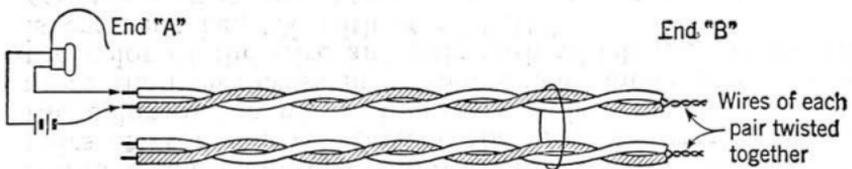
4.01 **Tests for Shorts, Crosses, Grounds:** In making the following tests, two splicers may conveniently work together, one testing at the middle loading point while the other tests with him from the two adjacent loading points. In this manner each splicer may prepare the ends of a section for making the cross and ground tests and the insulation resistance tests as well as assisting the other in making continuity tests.

4.02 Make the tests for shorts, crosses and grounds at one end (B), as outlined in Paragraph 3.01.

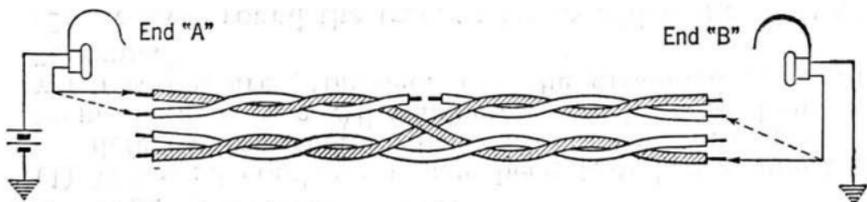
4.03 If the cable contains quads of more than one gauge, or if the quads of either gauge are segregated into two or more groups, test the groups of each gauge separately to detect transpositions between groups or between gauges.

4.04 **Tests for Opens and Split Pairs:** At end (B), pick out one of the groups in the outer layers of the cable and twist together the bare ends of the wires of each pair. Separate the pairs of each quad so that the twisted ends are not in contact with each other nor with the wires of other quads.

4.05 At end (A), test each pair in the first group for opens as indicated below. If the short circuit at end (B) is not picked up at end (A), the pair is either split or open. Tag the pair for further test.



4.06 When all pairs in the first group are tested, the tagged pairs should be picked up at end (B). Each wire involved should be tested with a battery and receiver to determine whether the pairs are open or split, as shown below.

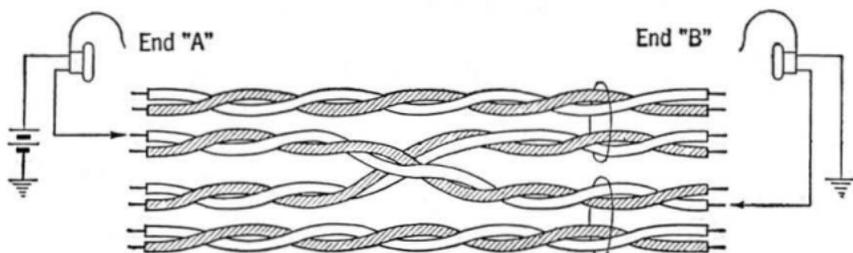


4.07 **Test for Split Quads:** After the test for opens and split pairs is completed test for split quads as follows: At end (B) twist together the bare ends of the wires of each quad in the first group. Separate the quads so that the ends do not come in contact with other quads.

4.08 At end (A) test each quad in the first group for splits as indicated below. If the cross at end (B) is not picked up at end (A) the quad is split. Tag the quad for further test.



4.09 When all quads in the group are tested, pick out the defective quads at end (B). Check test each wire with battery and receiver as indicated below and tag the split quads.



4.10 When any of the tests indicate a fault, notify the supervisor so that steps may be taken to clear the trouble.