

CABLE TESTING — GENERAL LOCATING FAULTS IN SHORT AND NON-LOADED BURIED CABLES BY MODEL 2775 TEST SET METHOD

1. GENERAL

1.01 This section describes the use of the Model 2775 Test Set in locating faults in short or non-loaded buried cable and buried wire by prod and snooper method.

1.02 Whenever this section is reissued, the reason(s) for reissue will be provided in this paragraph.

1.03 The method is applicable to lead cables and PIC cables having alpth, stalpth, PAP, or PASP sheath. The effectiveness of the method of having PIC cables protected with steel tapes or wire armor will depend largely on the cause of the trouble or the nature of the opening. Experience with such cables thus far is very limited.

1.04 The Model 2775 Test Set is designed to locate fault in a cable after the nature of the fault has been determined and isolated between pedestal or load points. The normal method of verifying the faulty wire and sheath of the cable should be used. These are standard procedures and will not be covered in this section.

1.05 The Model 2775 Test Set is described in Section 106-360-900NB.

2. OPERATION

2.01 The transmitter (2775-1) generates an alternating current source (audio tone) for connection to the faulty wire under test to form a complete electrical circuit. The circuit thus completed permits the alternating current to flow through the faulty wire, the fault, and return via the sheath or other path. The alternating current flow develops an electromagnetic field around the cable as shown in Figure 1.

2.02 The detection of the electromagnetic field is accomplished by connecting an exploring coil probe, such as the Snooper Probe or Return Ground

Probe, to the input of the receiver and placing the probe in position to detect the electromagnetic field by induction and subsequent amplification by the receiver circuit. Figure 1, illustrates the relative tone level in relation to probe positioning. The null occurs when the lines of force are cutting the coil at an angle which causes cancellation. The magnitude of the electromagnetic field will vary with the type of fault being sought, depth of cable, and the level setting of Test Set equipment.

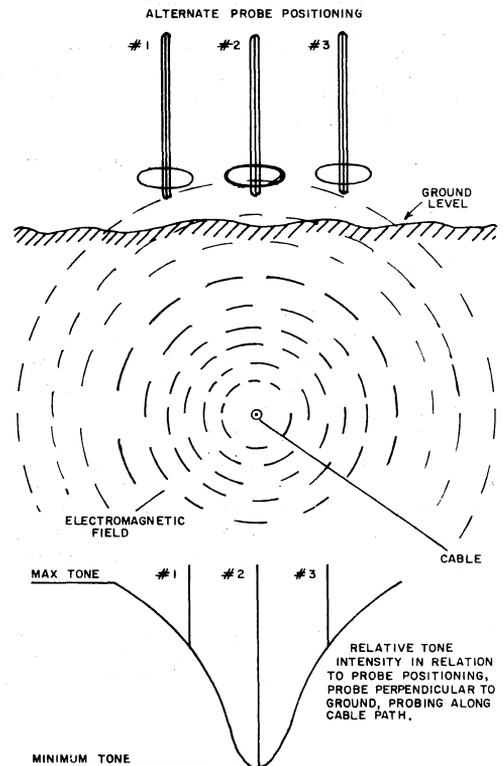


FIGURE 1
ELECTROMAGNETIC FIELD AROUND CABLE
AND DETECTION

NOTICE

Not for use or disclosure outside Indiana Bell
except under written agreement.

2.03 The same electromagnetic field is present in all tests but is not always the result desired. This is particularly true of tests for “grounds” and “wet spots”, utilizing the Return Ground Probe. This fault utilizes the sensitivity of the receiver (2775-5), to measure the return currents through the soil to the transmitter (2775-1). The return path is via the “ground” or “wet spot”, to soil and not through the sheath or another wire. This results in areas of high current at two points, directly over the “ground” or “wet spot”, and at the ground point of transmitter (2775-1).

2.04 All test setups have one thing in common: an attempt to create an electrical current flow through the fault in order that it can be detected by the use of the receiver and appropriate probe.

2.05 The resistance of the fault becomes a significant factor, and the search is for the lowest resistant fault in the case of multiple trouble.

2.06 Certain types of faults are much easier to locate than others. Always take full advantage of all possible faults. As a guide to the ease of location, follow the order listed below:

- a. Sheath break (shield to earth fault in PIC cable)
- b. Grounds
- c. Cross
- d. Short

2.07 When the test setup calls for external ground, a low resistant ground is imperative. Remember that the circuit consists of a series arrangement whereby the fault is in series with the earth ground. If the cable fault is low resistance you will need a correspondingly low resistance ground. In very dry or sandy soil recommendations are for use of additional ground rods (2 or 3). Guy anchor on utility poles could be a substitute for grounding. Avoid the use of pedestal or water pipe ground; otherwise you may induce a misleading signal into other lines or equipment.

2.08 If there is an indication of sheath damage regardless of other faults, locate the sheath break and you will probably find your other trouble.

2.09 If test results appear to be of doubtful nature, try placing the transmitter at the distant end of the cable and take another look. In any event be particularly careful of unusual readings when checking in the immediate vicinity of the transmitter.

2.10 Lost sleeves and splice case can be located in buried plant, by using the method indicated for sheath break faults. (See item 2.16.)

2.11 Transmitter adjustment
(See Figure 2.)

- a. The following steps are preliminary and applicable to all tests.
- b. Connect the red and black output terminal to faulty conductor under test. Short — Crosses and Ground.

CAUTION:
DO NOT CONNECT OR DISCONNECT LEADS WITH TRANSMITTER IN OPERATION.

- c. Turn **OFF LEVEL CONTROL** clockwise to apply battery power.
- d. Operate **STEADY - INTERRUPT** switch in either the **STEADY** or **INTERRUPT** position as desired.
- e. Turn **MATCH SWITCH** (1-5) to set.
- f. Rotate **OFF LEVEL CONTROL** clockwise while observing the needle position for full scale reading.
- g. Turn **MATCHING SWITCH** to that numbered position (1 thru 5) which reflects a reading nearest the center of meter range.

2.12 The tone level output used for each test will be different. Too high a tone level will cause induction carry over, and will make it difficult to locate fault.

2.13 The best rule is to use only the tone output required to locate fault accurately.

2.14 Receiver Adjustment (See Figure 3.)

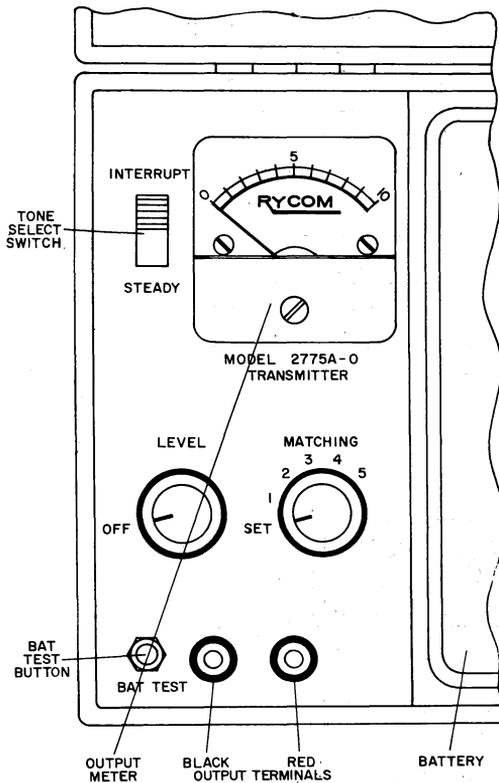


FIGURE 2

MATCHING CONTROL

Position Set - Load Impedance

1. 0 - 200 ohms Approx.
2. 150 - 600 ohms Approx.
3. 300 - 1000 ohms Approx.
4. 1000 - 10,000 ohms Approx.
5. 10,000 - 10 Meg ohms Approx.

BATTERY - 12 VOLTS

Burgess TW2 or Equivalent or
 2 - KS 6570 - 4.5v
 1 - KS 14495 - 1.5v
 10.5v

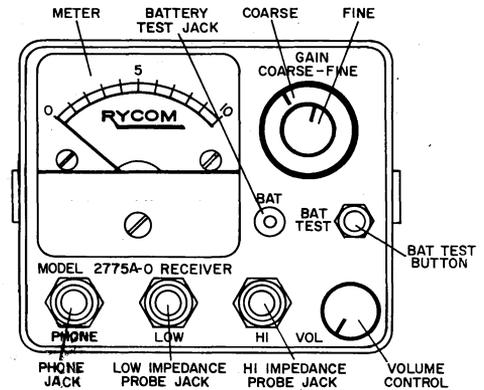
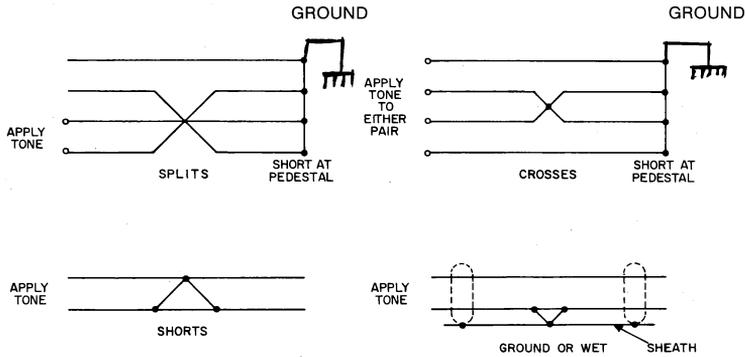


FIGURE 3

For Snooper
ProbeFor Return
Ground Probe

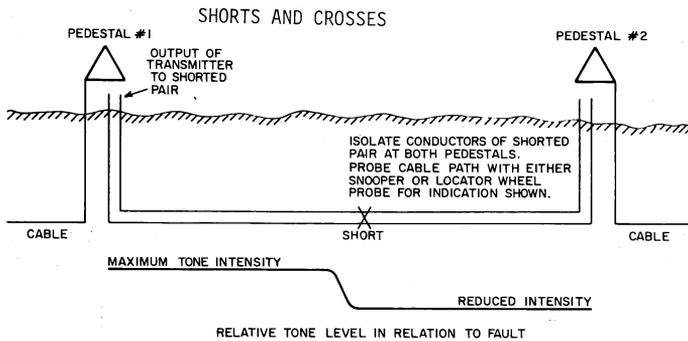
- a. Insert the magnetic headset (1000 ohm or luger) plug into a jack marked **PHONE**.
- b. Using the Snooper probe, insert the plug into a jack marked **LOW**, if using a return ground probe insert plug into a jack marked **HI**.
- c. Turn **VOLUME CONTROL** clockwise to apply battery.
- d. Position **SNOOPER PROBE** or **RETURN GROUND PROBE** to detect electromagnetic field of cable and adjust **COARSE - FINE - GAIN** and volume control for visual and aural indication of receiver tone. The needle of meter should be about on scale 2 on receiver.
- e. Proceed towards fault area noting aural and visual indications of the signal strength. Probe for multi indication and tone in this test. (See Figure 5.) Probe for peak and valley indication and tone for return ground type fault. (See Figures 6, 7, and 8.)

2.15 Typical Faults and Methods of applying tone is illustrated in Figure 4.



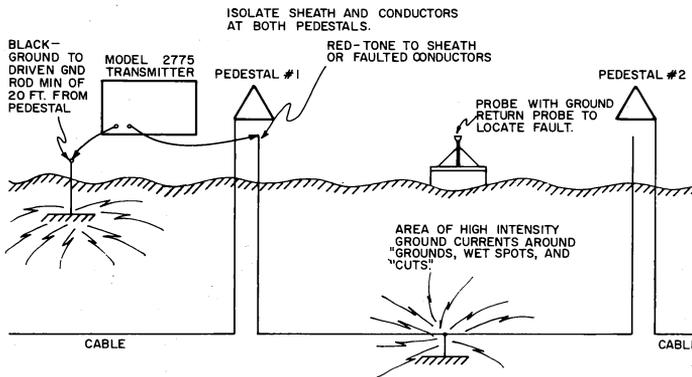
Typical Faults and Methods of Applying Tone

FIGURE 4



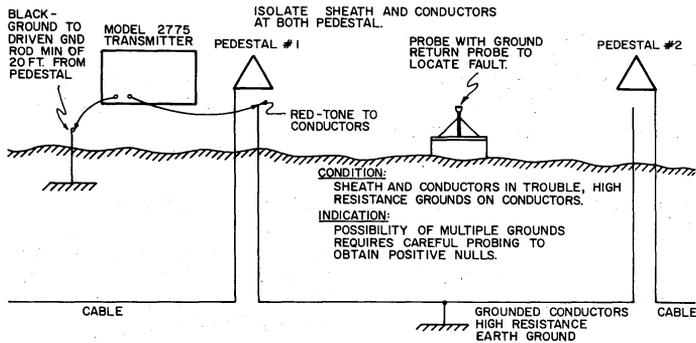
Cable Plant with Shorted Conductors

FIGURE 5



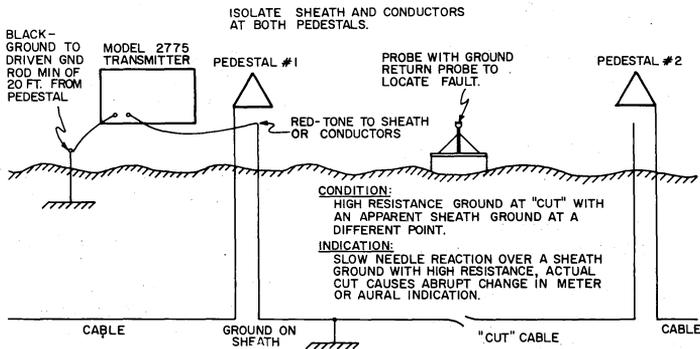
Return Ground Currents Path in "Wets," "Grounds" or "Cuts" and Connection Data

FIGURE 6



Test and Probing Procedure for High Resistance "Grounds" and "Wets"

FIGURE 7



Test and Probing Procedure for "Cuts" with Other "Grounds" (High Resistance)

FIGURE 8

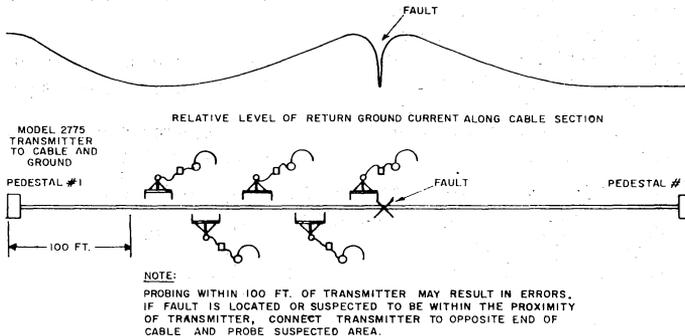


FIGURE 9

2.16 Location of Grounds and Wet Spots

Utilizing the Return Ground Probe, grounds or wet spots may be located within inches. Figure 5, 6, 7, and 8 illustrate a section of buried cable for a ground or wet spot. Figures 9 and 10 illustrate the ground return current flowing when a ground or wet spot exists.

- a. Isolate the faulted conductor and sheath at both pedestals.
- b. Connect the faulty conductors or sheath to terminal of transmitter.
- c. Connect a lead from driven ground rod (about 20 feet from pedestal) to block terminal on transmitter (2775-1).
- d. Complete transmitter (2775-1) adjustment procedures covered in Paragraph 2.11.
- e. Insert the plug of the RETURN GROUND PROBE into the JACK marked HIGH of the Receiver (2775-5)
- f. Complete receiver (2775-5) adjustment procedures covered in Paragraph 2.14.
- g. Probe along the path of cable as shown in Figures 9 and 10; probing in this manner results in a nominal meter reading and aural indication of tone. This level should remain constant until the area of fault is encountered. At the fault area a sharp increase in the level will be noted due to increased ground current flowing. Continued probing will reflect an area of high current (high tone and meter indication) dropping off sharply with slight probe movement. This is the fault area and fault will be found directly under the probe. The sharp null, if apparent, that exists about the fault would also serve as an indication. The location of a null is somewhat more difficult to perform under the many varying field and soil conditions encountered.

- h. Before digging for fault, check the remaining distance to far pedestal for other sheath breaks that could be present.

2.17 Method of Probing for Return Ground Current in Grounds and Wet Spots.

3. CABLE PATH AND DEPTH DETERMINATION

3.01 Utilizing the Snooper Probe, the path and depth of a buried cable may be determined accurately. Figure 11, illustrates a typical extended cable plant and notes the connections which should be made to prepare plant for probing and depth finding. The following steps are those shown in the illustration and must be completed before the test is made.

3.02 The ability to trace a cable is directly related to the amount of tracing current which can be induced into the cable.

3.03 Whenever possible the following steps will greatly increase the accuracy with which you can trace cable path and determine depth. (See Figure 11.)

- a. Isolate the cable from ground at the near (transmitter) end. (See Figure 11.)

a-1 Cables which are difficult to trace

Where grounds cannot be removed (as in buried splices) from pedestal or valve points, a reduction in electromagnetic field around the cable will be experienced at each grounded point and difficulty in tracing the path will accrue.

- b. Ground the far end of the cable. (See Figure 11.)
- c. Always place the transmitter ground rod as far off the cable path as possible.
- d. Look for a moist area, and if necessary use an extra ground rod.

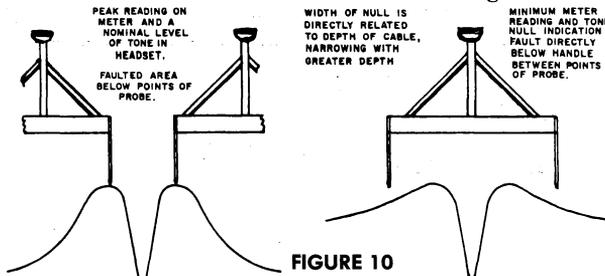
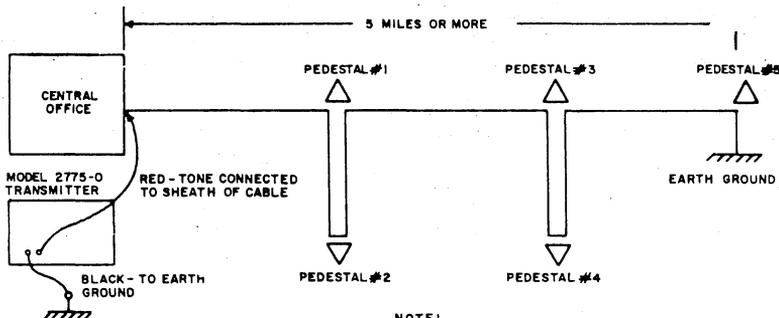


FIGURE 10



REMOVE SHEATH AT PEDESTALS 1 THROUGH 5, TIE THROUGH ON PEDESTALS 1 THROUGH 4, AND GROUND SHEATH AT PEDESTAL 5. RETURN GROUND CURRENT IS VIA THE EARTH GROUND TO TRANSMITTER. FOLLOW CABLE PATH WITH SNOOPER PROBE OR LOCATOR WHEEL PROBE. OBSERVE METER AND LURAL INDICATION FOR NULL.

FIGURE 11

- e. An alternative is to use two or three ground rods spaced several feet apart and bonded together.
- f. **CAUTION:** Never use water pipe as substitute for ground rod.

3.04 Once a fault such as a sheath break is located, it is often desirable to determine the cable

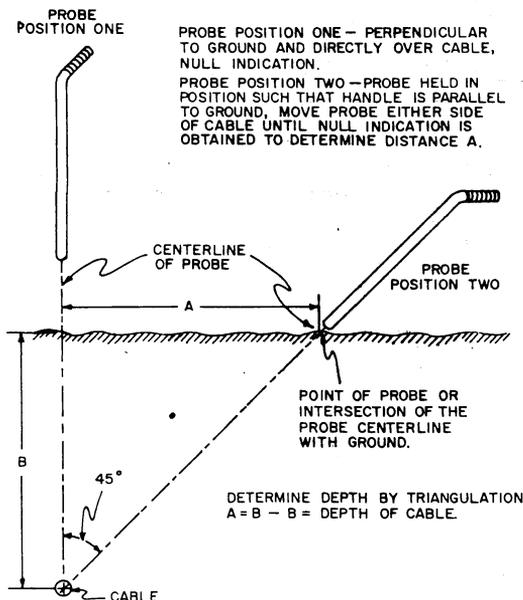


FIGURE 12

depth and exact position before excavating. (See Figure 12.) Depth reading at the exact fault location can often be misleading due to the relatively strong conductor signal caused by the fault. It is therefore recommended that the depth of the cable be determined by means of readings taken a few feet on the transmitter side of the suspected fault.

3.05 The method of connecting and adjusting a Rycom 2775A test set for path and depth location in buried or underground cables is described below:

- a. Attach red cord clip to metal shield or sheath of cable.
- b. Attach black cord clip to ground rod which should be driven in the earth as far from cable path as lead permits (approx. 20 feet).
- c. For transmitters adjustment see Paragraph 2.11.
- d. Connect Snooper probe to **Receiver** and plug in to Jack marked **LOW**.
- e. For receiver adjustment see Paragraph 2.14.
- f. As cable under test is crossed at a 90 degree angle with Snooper probe in a vertical position, a sharp signal will be observed on each side of the cable. The null between these peaks defines its location.

g. After cable has been located and path marked, the depth may be determined by holding the Snooper probe 45 degrees from vertical at 90 degrees in reference to the cable path with its points at the marked surface. A sharp signal will be noted, which diminishes as the Snooper probe is drawn back from this spot in the same 45 degree and 90 degree altitude. This signal will diminish and build up again as Snooper probe is moved back. Mark the spot

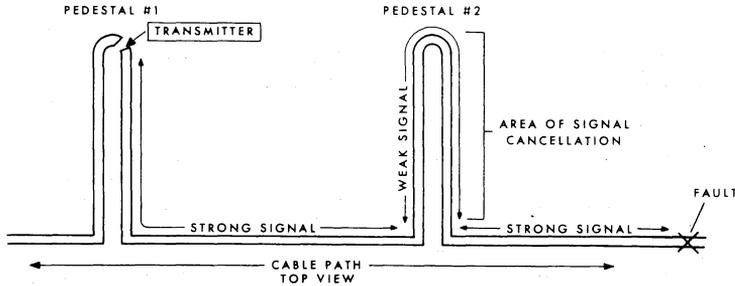
at which lowest signal is observed. The distance between the two marks represents the depth of the cable.

h. In tracing underground cables between manholes, do not remove cable bonds. Place transmitter tone on sheath in question between the two manholes. Proceed as directed on Item 3 in locating path and depth.

Signal Cancellation:

When pedestals are located off the main buried cable path it is often the practice to route an "in and out" cable to each of the pedestals. In the majority of cases this cable loop will be in a common trench which will tend to cancel the apparent signal in the area between the pedestal and the cable path.

Be particularly careful when searching for faults in the immediate vicinity of a pedestal or in areas when the cable "doubles back" on itself. If a fault is suspected near one of the pedestals, the cable should be electrically isolated as necessary at the pedestal in order to eliminate this problem.



In the above sketch, the transmitter has been connected to the cable at Pedestal #1. Note that a strong signal appears along the cable path **except** in the area where the two cables are located in a common trench.

FIGURE 13