170-TYPE BURIED SERVICE WIRE TEST SET DESCRIPTION AND USE

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1. GENERAL

1.01 This section covers the 170A and 170B test sets used to trace service wires and to pinpoint shield or conductor grounds in the service wire.

1.02 The reasons for reissuing this section are listed below. Since this reissue is a general revision, no revision arrows have been used to denote significant changes.

(a) Change Fig. 1, 2, 4, 8, 9, 10, and 11

(b) Add reference to the 170B test set

(c) Add new figures for Fig. 5 and 6.

1.03 The AT-8681 B ground probe (or equivalent) is required to locate and pinpoint ground faults in the service wire.

1.04 When testing buried service wires, many factors affect the tracing distance. These factors include but are not limited to buried service wire length, type of wire and grounding, existence of laterals, whether wire is joint buried with other facilities such as power, and how the test set transmitter is grounded. The 170A and 170B test sets are designed for testing buried service wire up to 400 feet or less. Actual tracing distance may be up to 1000 feet depending upon factors listed above. The pinpointing signal will give a meter indication over much longer distances, but cable location and fault direction information is lost when the test set operator can no longer hear the tracing tone. The tracing tone normally becomes weak near the ungrounded far end.

1.05 The 170A test set is rated Mfr Disc. but is retained in this section due to the number of test sets in use.

1.06 The 170B test set is identical to the 170A test set except the 171B receiver replaces the 171A receiver.

2. PRECAUTIONS AND WARNINGS

2.01 Exercise care to protect the test set from water as it is ***not*** waterproof.

2.02 The open circuit voltage between the red and black lead is approximately 400 volts in the pinpoint mode. Though the output is current limited to a very low level, a mild shock may be received. Care should be exercised in handling these leads.

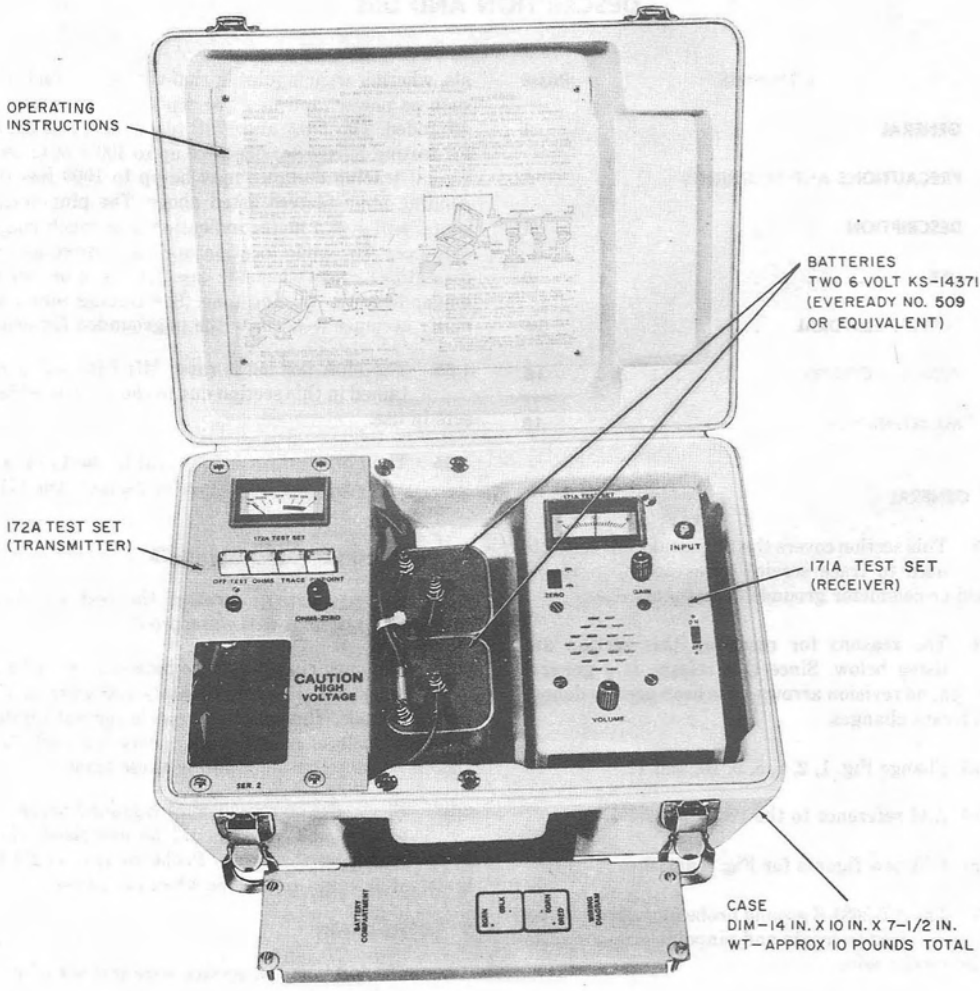
2.03 Electrodes on the AT-8681 B ground probe are pointed and care should be exercised when using or storing the probe. Probe covers should be installed over the electrodes when not in use.

3. DESCRIPTION

3.01 The 170A buried service wire test set (Fig. 1) consists of:

- 171A test set (receiver)
- 172A test set (transmitter).

TRANSMITTER BATTERY TEST: TO TEST THE BATTERIES DEPRESS THE OFF STATION OF THE TRANSMITTER MODE SWITCH ALL THE WAY DOWN. IF THE METER DEFLECTION IS NOT IN THE GREEN BAND TURN THE SET OFF AND REPLACE THE BATTERIES.



NOTE:

IF THE METER DOES NOT READ ZERO WITH THE SWITCH IN THE OFF POSITION, REFER TO MAINTENANCE, 6.02, FOR MECHANICAL ADJUSTMENT PROCEDURE.

Fig. 1—170A Test Set

A. Transmitter

3.02 Figure 2 illustrates the 172A test set.

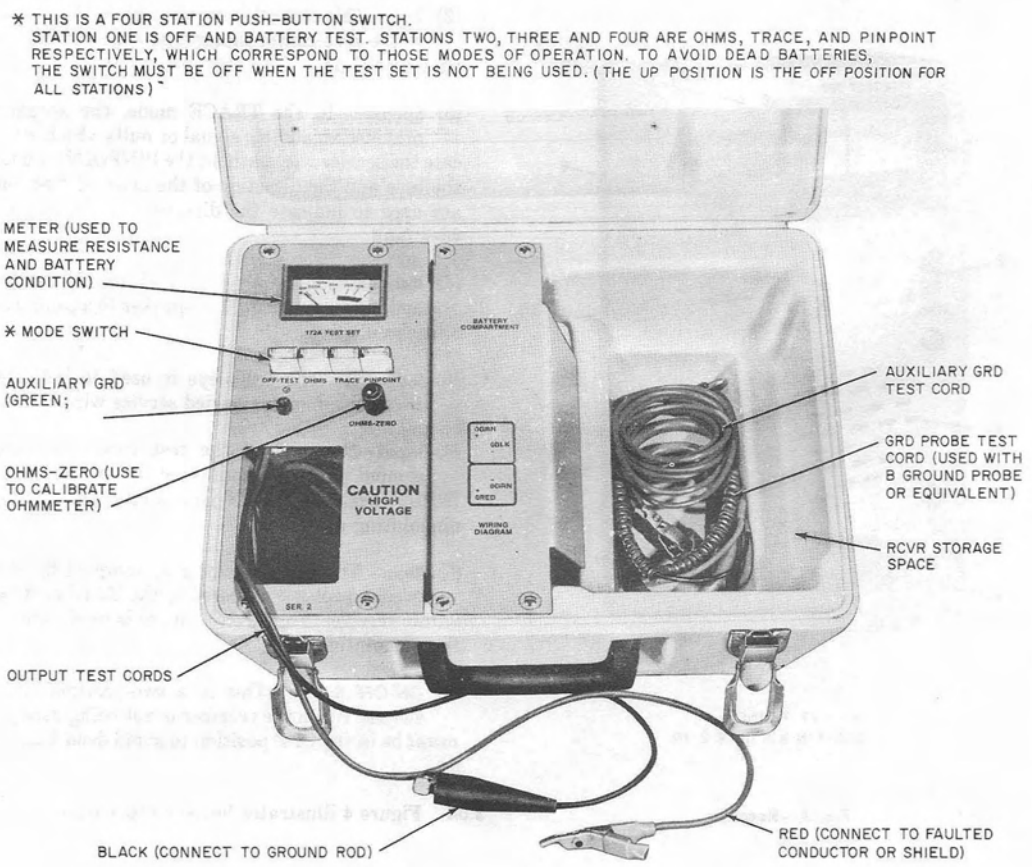
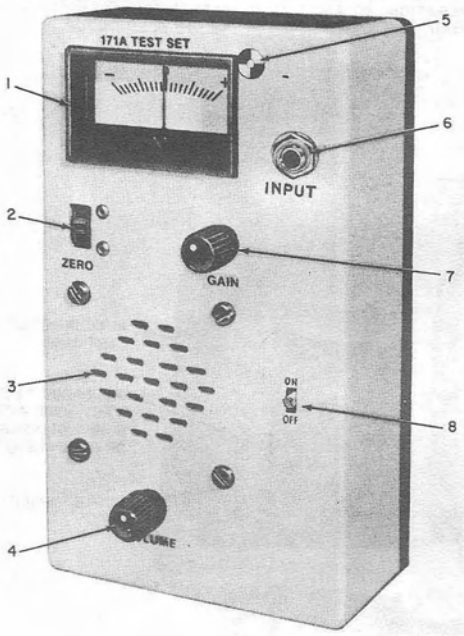


Fig. 2—Transmitter Front Panel

B. Receiver

3.03 Figure 3 illustrates the 171A test set. It is designed to be hand held in the horizontal plane.



WT-1 1/2 POUNDS
DIM-7 IN. X 4 IN. X 2 IN.

Fig. 3—Receiver

(1) **Meter**—The meter is used in the pinpointing mode. It is a zero-center type. In the pinpoint mode, the meter deflection (positive or negative) is used to indicate the direction to the fault.

(2) **Zero**—This control is used to adjust the needle of the zero-center meter when the receiver is first turned on.

(3) **Speaker**—In the TRACE mode, the speaker provides an audible signal or nulls which indicate the service wire path. In the PINPOINT mode, the tone and the direction of the meter deflection are used to indicate the direction to the service wire fault.

(4) **Volume**—This control is used to adjust the audible volume from the speaker to a comfortable signal level.

(5) **Bull's-Eye**—The bull's-eye is used to indicate the position of the buried service wire.

(6) **Input**—One end of the test cord from the ground probe is connected to the receiver INPUT jack. The INPUT jack is used only in the pinpointing mode.

(7) **Gain**—The voltage, which is sampled by the ground probe, is adjusted by the GAIN control on the receiver. The GAIN control is used only in the pinpointing mode.

(8) **ON-OFF Switch**—This is a two-position slide switch. When the receiver is not being used, it ***must*** be in the OFF position to avoid dead batteries.

3.04 Figure 4 illustrates battery replacement.

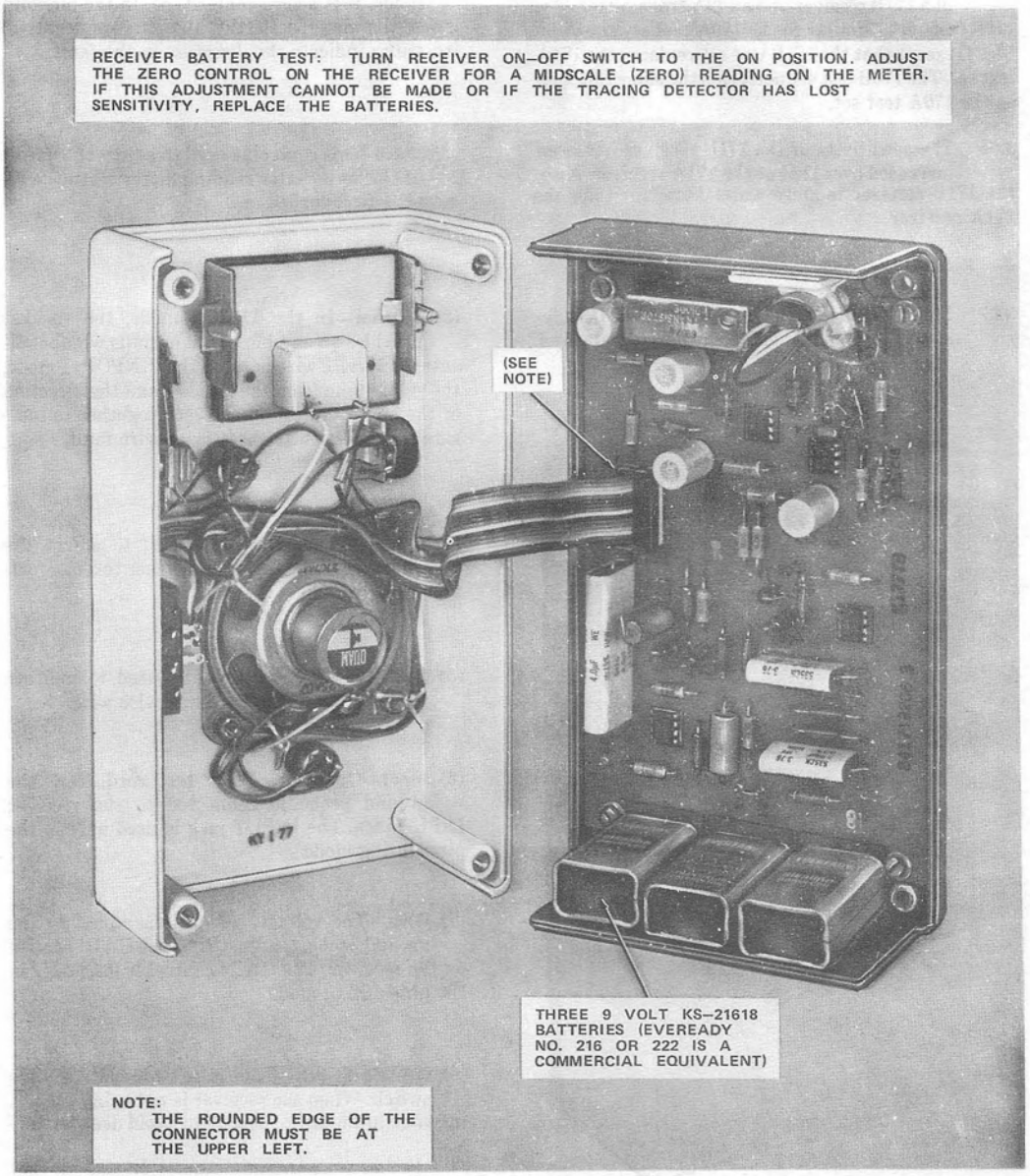


Fig. 4—Receiver Batteries

3.05 The 170B buried service wire test set consists of a 171B receiver and a 172A transmitter. The 170B test set is similar to the 170A test set shown in Fig. 1, except that the 171B test set replaces the 171A test set. The 170B test set performs the same function as the 170A test set.

3.06 The sensitivity of the 171B receiver has been increased over that of the 171A receiver. Also, the 171B receiver is more water resistant than the 171A receiver.

C. Receiver

3.07 Figure 5 illustrates the 171B test set. It is designed to be hand held in the horizontal plane.

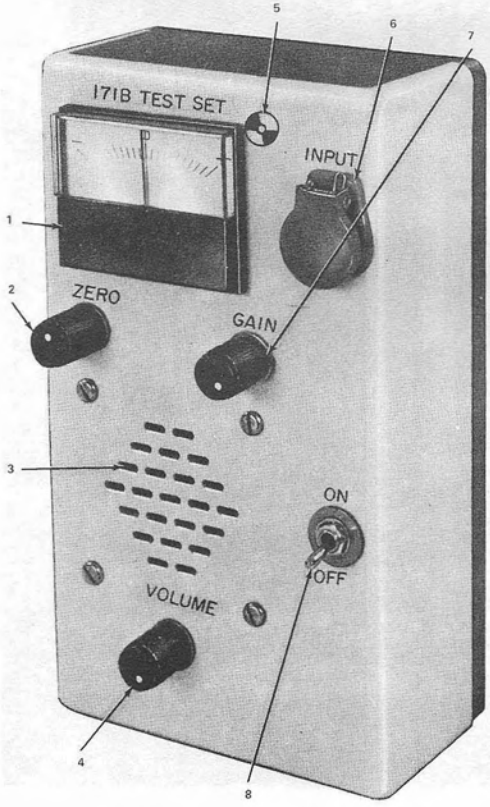


Fig. 5—Receiver

(1) **Meter**—The meter is used in the pinpointing mode. It is a zero-center type. In the pinpoint mode, the meter deflection (positive or negative) is used to indicate the direction to the fault.

(2) **Zero**—This control is used to adjust the needle of the zero-center reading meter when the receiver is first turned on.

(3) **Speaker**—In the TRACE mode, the speaker provides an audible signal or nulls which indicate the service wire path. In the PINPOINT mode, the signal tone from the speaker and the direction of the meter deflection are used together to indicate the direction to the service wire fault.

(4) **Volume**—This control is used to adjust the audible volume from the speaker to a comfortable signal level.

(5) **Bull's-Eye**—The bull's-eye is used to indicate the position of the buried service wire.

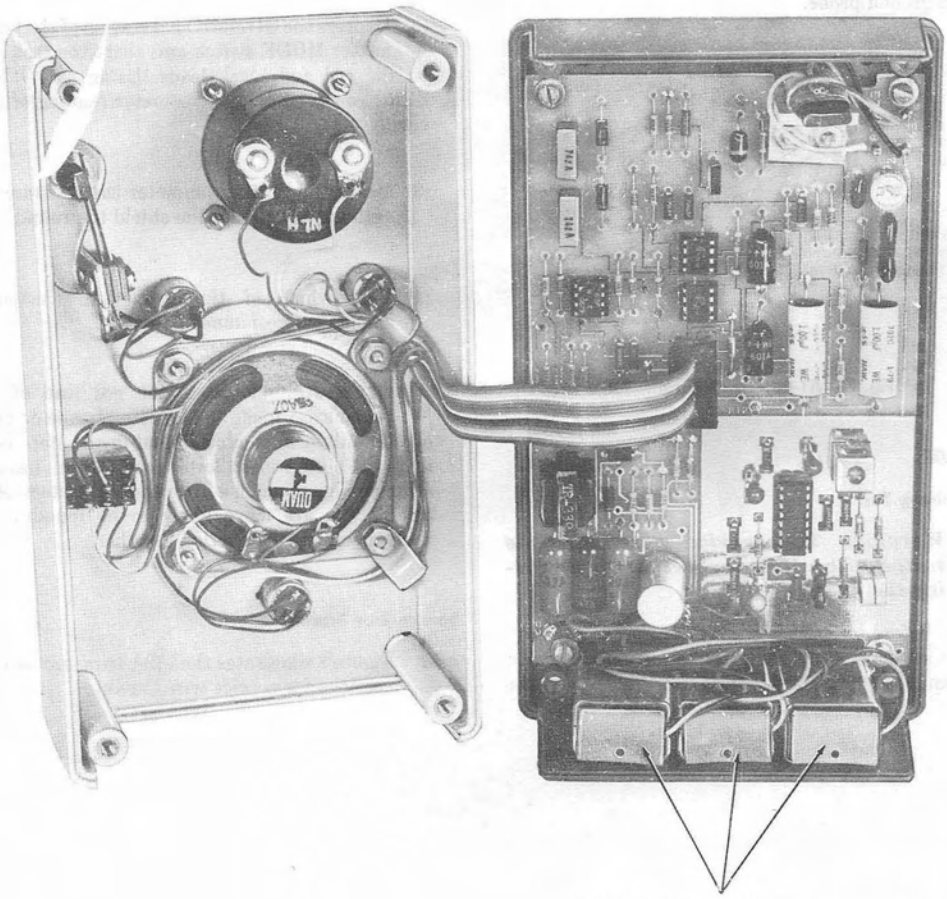
(6) **Input**—One end of the test cord from the ground probe is connected to the receiver INPUT jack. The INPUT jack is used only in the pinpointing mode.

(7) **Gain**—The voltage, which is sampled by the ground probe, is adjusted by the GAIN control on the receiver. The GAIN control is used only in the pinpointing mode.

(8) **ON-OFF Switch**—This is a two-position slide switch. When the receiver is not being used, it ***must*** be in the OFF position to avoid dead batteries.

3.08 Figure 6 illustrates battery replacement.

RECEIVER BATTERY TEST: TURN RECEIVER ON–OFF SWITCH TO THE ON POSITION. ADJUST THE ZERO CONTROL ON THE RECEIVER FOR A MIDSCALE (ZERO) READING ON THE METER. IF THIS ADJUSTMENT CANNOT BE MADE OR IF THE TRACING DETECTOR HAS LOST SENSITIVITY, REPLACE THE BATTERIES.



THREE 9-VOLT BATTERIES
KS-21618 (EVERYREADY NO. 216 OR 222
IS A COMMERCIAL EQUIVALENT)

Fig. 6—Receiver Batteries

C. AT-8681 B Ground Probe

3.07 Figure 7 illustrates the AT-8681 B ground probe. The ground probe, or an equivalent, must be used in the PINPOINT mode of operation. Section 634-220-505 covers the description and use of the B ground probe.

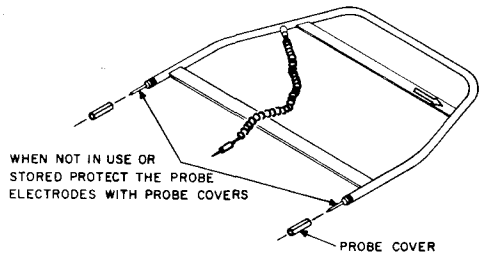


Fig. 7—AT-8681 B Ground Probe

4. USE

Preliminary Test

Warning: The service wire must be tested with a 188A test set before removing the ground.

4.01 Before connecting the transmitter of the buried service wire test set to a faulted service wire and attempting to pinpoint these faults, certain tests are required to determine whether the conductors and/or shield is grounded. These tests are:

(1) Disconnect the service wire conductors and shields from the pedestal and protector block.

(2) Depress the OHMMETER station of the transmitter MODE switch and short the test clips on the red and black leads. Using the OHMS-ZERO control, adjust for a meter reading of zero ohms.

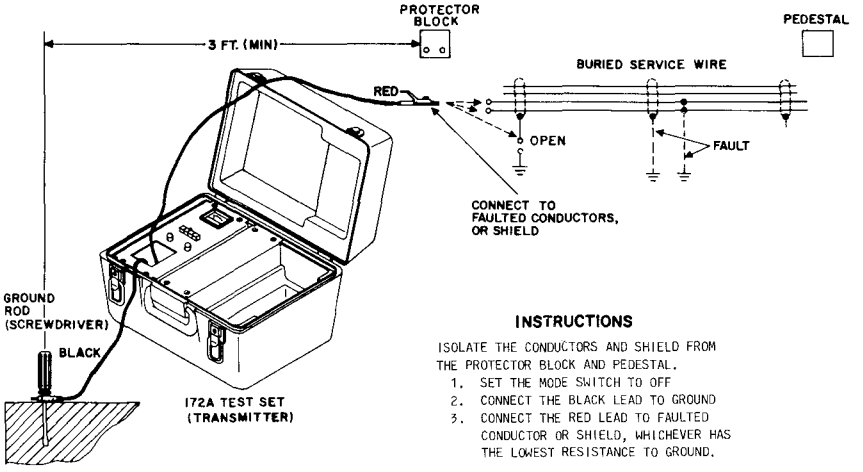
(3) Measure with the ohmmeter the resistance of each conductor and the shield to ground.

(4) Note which of the conductors (including shield) has resistance to ground.

(5) For fault pinpointing, the red lead of the transmitter must be connected to one or more of the faulted conductors found in the step listed above. Faults with lower resistance have a stronger signal which will be easier to detect. Multiple faults are more likely to be found if all faulted conductors are tied together.

Service Wire Tracing

4.02 Figure 8 illustrates the 172A transmitter connections for service wire tracing.



INSTRUCTIONS

ISOLATE THE CONDUCTORS AND SHIELD FROM THE PROTECTOR BLOCK AND PEDESTAL.

1. SET THE MODE SWITCH TO OFF
2. CONNECT THE BLACK LEAD TO GROUND
3. CONNECT THE RED LEAD TO FAULTED CONDUCTOR OR SHIELD, WHICHEVER HAS THE LOWEST RESISTANCE TO GROUND.

WARNING: THE OPEN CIRCUIT VOLTAGE BETWEEN THE RED AND BLACK LEAD IS APPROXIMATELY 400 VOLTS IN THE PINPOINT MODE. THOUGH THE OUTPUT IS CURRENT LIMITED TO A VERY LOW LEVEL, A MILD SHOCK MAY BE RECEIVED. CARE SHOULD BE EXERCISED IN HANDLING THESE LEADS.

NOTE:
THE TRANSMITTER MAY BE CONNECTED AT THE PROTECTOR BLOCK (AS SHOWN) OR THE PEDESTAL.

Fig. 8—Transmitter Connections

SERVICE WIRE TRACING (Fig. 9)

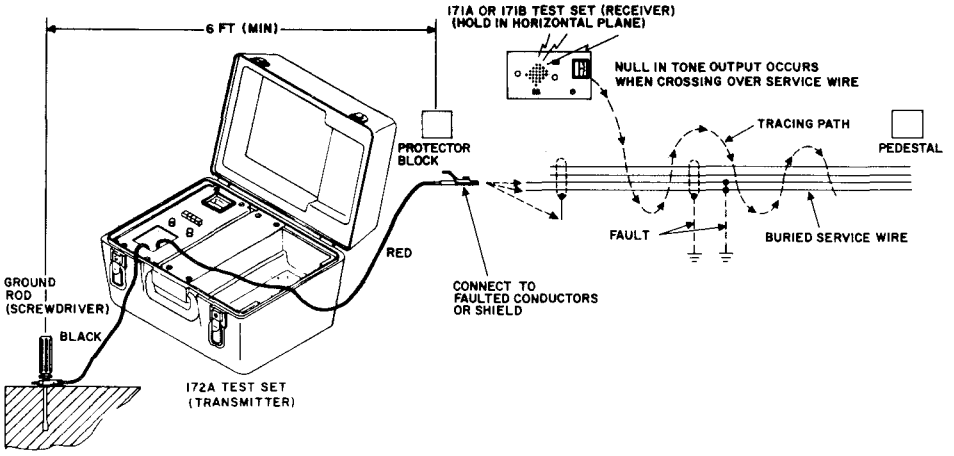


Fig. 9—Service Wire Tracing

4.03 ***To trace the path of the service wire:***

(1) Connect black cord of transmitter to ground rod at least three feet away from pedestal in a direction opposite to service wire. (A distance of six feet is suggested where conditions permit.)

(2) Connect red cord of transmitter to service wire shield and/or conductors which are faulted as determined in paragraph 4.01.

Note: If the set is being used to trace ***only***, the red lead can be connected to any conductor(s) and/or shield. Also, it is not necessary to disconnect the FAR end of the cable.

(3) Connect the green cord to a separate ground (such as pedestal ground, protection ground, or manhole cover on ground) and to the green terminal on the transmitter. The green lead is used to increase tracing distance by providing an additional ground for the tracing signal while leaving the pinpointing signal grounded at the ground rod (black cord).

Note: Do not use the green cord when another conductor runs in the same trench such as a bare power neutral which is connected to the pedestal or protector ground. Connecting the green lead to the same ground may reduce the tracing signal.

(4) Depress the TRACE station of transmitter MODE switch.

(5) Set the receiver ON-OFF switch to the ON position.

(6) Adjust the receiver VOLUME control to a comfortable level.

Note: The receiver meter, INPUT jack, GAIN and ZERO controls are not used in the TRACE MODE.

(7) Hold the receiver horizontally and walk in the suspected direction of the service wire path.

(8) Try to walk first on one side of the service wire path and then the other side.

(9) When crossing over the wire, a null or sharp decrease in the level of the tone will be noted. ***Keep the receiver horizontal.***

(10) At the position where the null occurs, the service wire (Fig. 9) is located directly below the bull's-eye.

(11) Mark, or be sure to remember for future reference, the path of the buried service wire as it is being traced.

4.04 In tracing the service wire path, apparent earth disturbances may be noticed and the fault could be at that location. Proceed to pinpoint the fault.

SERVICE WIRE FAULT PINPOINTING (Fig. 10)

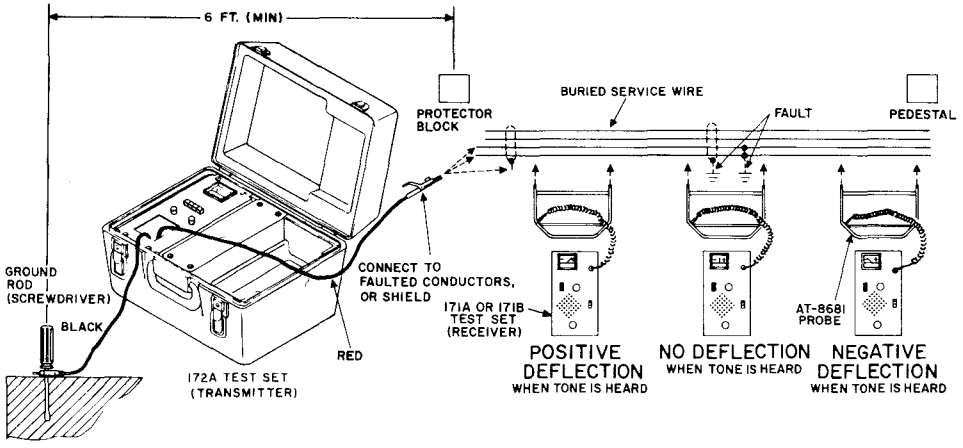


Fig. 10—Service Wire Fault Pinpointing

Pinpointing Fault

4.05 Depress the PINPOINT station of the transmitter MODE switch.

4.06 Connect the receiver to the AT-8681 ground probe using the cord furnished with the probe.

4.07 ***Adjust the receiver as follows:***

(1) Set ON-OFF switch to the ON position.

(2) Rotate GAIN control maximum counterclockwise.

(3) Adjust ZERO control for midscale meter reading. (Meter indicates approximately zero.)

(4) Adjust VOLUME control for comfortable tone level. (Note the interrupted tone.)

Warning: Care should be exercised in handling the ground probe after protection guards have been removed from the electrodes.

4.08 Place the AT-8681 ground probe into the ground. Position the probe about 1 foot away from the ground rod. The arrow on the probe frame should point ***away*** from the ground rod and in the general direction of the service wire path.

4.09 Initially, adjust the receiver GAIN control approximately 1/3 rotation clockwise or until a meter deflection of approximately four divisions is seen when the tone is heard. Later, the receiver GAIN control may need to be readjusted to give a more readable meter deflection. (See READ statement in paragraph 4.11.)

4.10 Note that the meter deflections on the receiver are positive when the tone first comes on.

4.11 Proceed along the path of the service wire inserting the AT-8681 ground probe into the ground at approximately 5-foot intervals.

The signal (meter deflection) will decrease as you move away from the transmitter. The signal will continue to decrease and may go to zero. But as the fault is approached the signal will increase, and as the fault is passed, the deflection will reverse sharply. If only one fault exists, the signal (meter deflection) will return to the same level to which adjusted in paragraph 4.09 when the fault is reached. It is not necessary to change the GAIN adjustment from the initial setting. When multiple faults exist, the signal is distributed between the faults and is weaker at each fault than at the initial level. It may be necessary to increase the GAIN to find multiple faults, but setting the GAIN too high can cause erratic meter movements.

Observe Direction of Meter Deflection

4.12 If the meter deflection is ***positive*** when the tone comes on, it indicates the ground probe is positioned between the fault and the transmitter. The fault is ahead of this position.

4.13 If the meter deflection is ***negative*** when the tone comes on, it indicates the ground probe is positioned beyond the fault in a direction away from the transmitter. The fault is back from this position.

4.14 If the fault is exactly straddled with the probe, the meter deflection is neither ***positive nor negative*** when the tone comes on indicating that the ground probe is positioned at the fault. The fault is located on a straight line which runs halfway between the ground probe electrodes and perpendicular to each side of the ground probe frame. Leave the ground probe standing upright or mark this position (Fig. 10 and 11).

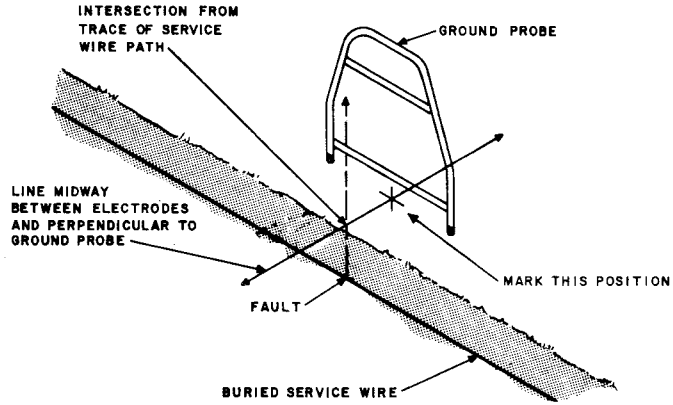


Fig. 11—Null Method to Determine Location of Fault

Before Digging

Warning: Follow the procedures outlined in Section 629-020-102 if joint buried with power.

4.15 The exact location of the fault may be determined by either the null method (paragraph 4.16) or the ground probe orientation method (paragraph 4.19).

Null Method

4.16 Hold the receiver horizontally. Sweep the receiver back and forth across the service wire path similar to the manner previously used to trace the service wire.

4.17 When crossing over the service wire, a null or sharp decrease in the level of the tone will be noted. At the null, the service wire is located below the bull's-eye.

Note: Do not be confused by the tone-off period. Trace while the tone is on. There will be short start and stop periods of tracing since both transmitter and receiver are in the pinpoint mode and the tone is on only periodically.

4.18 The fault is pinpointed at the intersection of the line perpendicular to the ground probe, which was determined in paragraph 4.14 and the service wire path, traced in paragraph 4.17 (Fig. 11).

Ground Probe Orientation Method

4.19 Rotate the ground probe 90 degrees around a point halfway between the ground probe electrodes. This is the same position marked in paragraph 4.14.

4.20 Observe the direction of the meter deflection when the tone comes on and move the ground probe ahead or back in short increments. Use the same procedure as previously used in paragraphs 4.12 through 4.14.

4.21 After the ground probe has been positioned so that there is no (or very little) meter deflection, again rotate the ground probe 90 degrees around a point halfway between the ground probe electrodes. Repeat the procedure in paragraph 4.20, moving the ground probe in very short increments.

4.22 Repeat paragraph 4.21, if necessary, until there is no (or very little) meter deflection.

4.23 Mark the point halfway between the ground probe electrodes. This mark pinpoints the fault (Fig. 12).

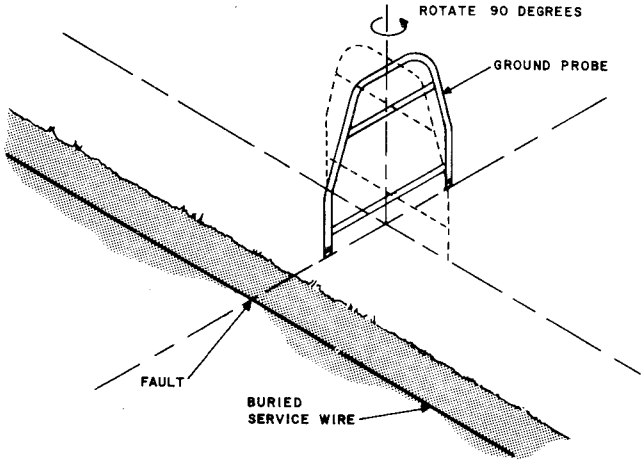


Fig. 12—Ground Probe Orientation Method to Determine Location of Fault

Depth Measurement

4.24 The following paragraphs (paragraphs 4.25 through 4.32), and Fig. 13, give a procedure for determining how deep the service wire is buried.

4.25 Hold the receiver close to the ground in a vertical position. Hold it so that the volume control is at the higher end and the meter is at the lower end just above the service wire path.

4.26 Slowly rotate the receiver around the vertical axis until the tone is nulled. See Fig. 13(A). The service wire path is perpendicular to the meter face.

4.27 Rotate the receiver (90 degrees around the meter) from the vertical position into the horizontal plane. All receiver controls should be in an upright position.

4.28 Keep the receiver in the horizontal plane and slowly move it (to the right or left) perpendicular to the service wire path until the tone is nulled.

4.29 This null indicates the bull's-eye is directly over the service wire. Place a marker on the ground, just below the bull's-eye, to indicate the position of the null. See Fig. 13(B).

4.30 Tilt the left side of the receiver up until it is 45 degrees with respect to the horizontal plane. See Fig. 13(C).

4.31 Keep the receiver at an angle of 45 degrees with respect to the horizontal plane. Move the receiver to the right along the surface of the earth, in a perpendicular direction away from the service wire path, until a null of the tone is detected. Place a second marker on the ground under the receiver, just below the bull's-eye, to indicate the position of this null. See Fig. 13(D).

4.32 The depth of the service wire below the surface of the earth is the same as the distance between the first marker (null) and the second marker (null). See Fig. 13(E).

SERVICE WIRE FAULT PINPOINTING—VARIABLE GROUND ELECTRODE SPACING

4.33 At times, the need may arise when the AT-8681 ground probe electrode spacing may not be appropriate for pinpointing service wire faults. This may occur while attempting to span a concrete sidewalk or a driveway, or if there is limited space available to insert the ground probe electrodes in the earth. For these situations, two discrete ground probe electrodes are used.

4.34 Select two ground electrodes (screw drivers, ground rods, or equivalent) and attach a single insulated conductor to each electrode.

4.35 Insert the ground electrodes into the earth.

4.36 Connect the other end of each conductor to a 347 plug. Always connect the ground electrode that is farthest away from the transmitter ground rod to the tip of the plug.

4.37 Proceed to pinpoint the fault as indicated in paragraphs 4.05 through 4.23.

4.38 If the meter deflection is ***positive*** when the tone comes on, it indicates the ground electrodes are positioned between the fault and the transmitter ground rod.

4.39 If the meter deflection is ***negative*** when the tone comes on, it indicates the ground electrodes are positioned beyond the fault in a direction away from the transmitter.

4.40 If the ground rods exactly straddle the fault, the meter deflection is neither ***positive*** nor ***negative*** when the tone comes on. The fault is located on a straight line midway between the two ground electrodes. This straight line is perpendicular to a line intersecting the ground electrodes.

> ***Note:*** Decreasing the ground electrode spacing lowers the signal level that can be detected and therefore requires an increase in receiver gain for readable meter indications.

5. SERVICE RESTORAL

> ***Warning: Follow the procedures outlined in Section 629-020-102 if joint buried with power.***

REPAIR

5.01 Repair the service wire according to local procedures.

5.02 Test the conductor pairs with the OHMMETER before reconnecting the service wire.

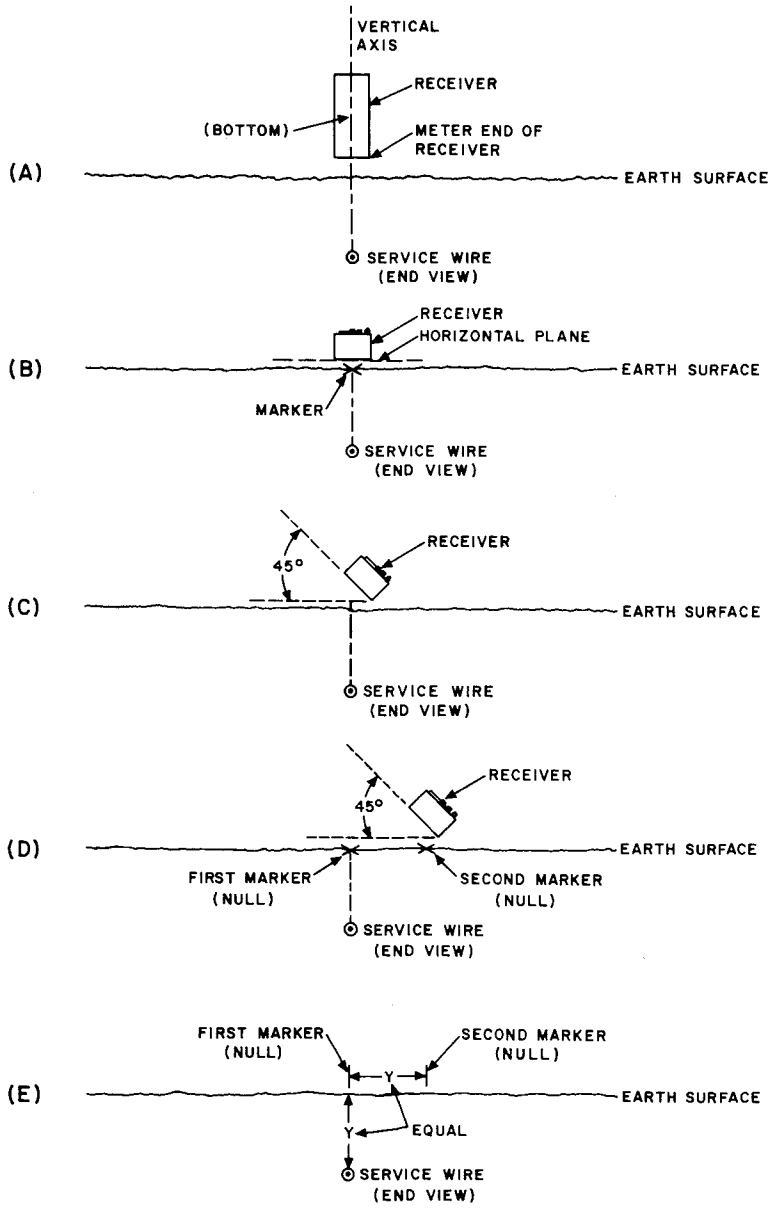


Fig. 13—Depth Measurement

RECONNECT

Warning: The service wire must be tested with a 188A test set before removing the ground or before reconnecting the ground.

5.03 Reconnect conductors appropriately at the pedestal and the protector block. Also connect the shield to ground at both access points.

5.04 Test the service wire to ensure service has been restored.

6. BURIED CLOSURES

Warning: Follow the procedures outlined in Section 629-020-102 if joint buried with power.

6.01 In out-of-sight plant, use a Dynatel* 710 or equivalent bridge to determine if the conductor fault is in the buried service wire or the distribution cable. If the bridge indicates the fault is in the service wire, proceed to pinpoint the fault with the 170A or 170B, per paragraph 6.02. If the fault is in the distribution cable, the 170A or 170B test sets will not pinpoint the fault.

6.02 If no bridge is available, the fault may still be pinpointed if it is in the buried service wire. To pinpoint the fault in the service wire, isolate the conductors and shield at the protector block. Also isolate the conductors at the serving area interface or cross-connect box. Using the ohmmeter, determine which conductor has the lowest resistance to ground. At the protector block, per paragraph 4.02, connect the red lead of the transmitter to the conductor (not shield) which has the lowest resistance to ground. The black lead is connected to a ground rod.

6.03 Trace the service wire path per paragraph 4.03.

6.04 Pinpoint the service wire fault per paragraph 4.05. If the service wire path has a resistive path-to-earth ground, the 170A or 170B will pinpoint the fault. If the conductor in the service wire is shorted to the shield at the fault, the test sets will not pinpoint the fault's location. The test set operator will be directed beyond the fault, even past the suspected end of the service wire.

6.05 If the conductor ground is in the distribution cable, the test set operator will be directed beyond the suspected end of the service wire. The test set will not pinpoint this type fault.

7. MAINTENANCE

7.01 Maintenance is limited to testing and replacement of batteries and adjusting the meters to mechanical zero.

7.02 To mechanically adjust the transmitter and receiver meters to zero, turn the sets off. Vary the adjustment screw on the meter until the needle is set to zero. This adjustment may be made by using the fingernail or a nonmagnetic screwdriver to turn the screw.

7.03 When replacing batteries, insert battery leads into the spring terminals as shown in Fig. 14. ***Do not attempt to insert leads into top of spring terminals.***

7.04 If the test set does not operate after replacing the batteries, return for repair in accordance with local routine.

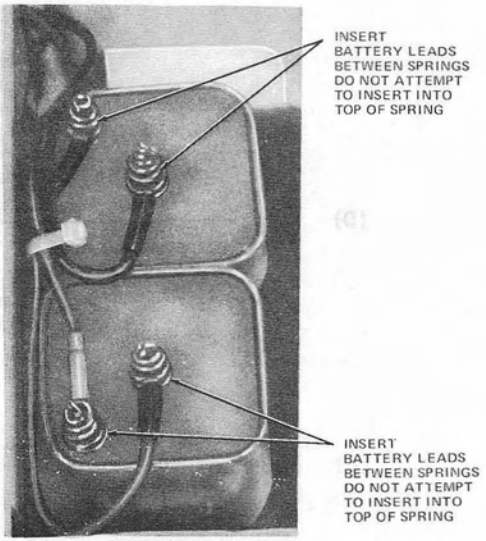


Fig. 14—Battery Lead Installation

*Trademark of Dynatel Corporation