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IDENTIFICATION OF CABLES AND CABLE PAIRS

1 GENERAL This Instruction describes the methods of identifying cables and cable pairs using the Tester 132B and Tester 137A described in A1001.

These testers detect a tone from a low power oscillator applied across a pair in a cable.

Tester 132B comprises a low-power oscillator, and receiving apparatus incorporating inductive and capacitive probes. The inductive probe detects the magnetic field set up by the tone connected to a cable pair, and can operate outside the cable sheath. It is thus effective for identifying cables or tracing the route of cable pairs without disturbing the sheath. The capacitive probe detects the electric field and is effective for identifying pairs in an open joint, or at assemblies or terminal blocks.

Tester 137A comprises receiving equipment with a capacitive probe only. It is used for pair identification when tone is applied by apparatus in an exchange or by an oscillator forming part of a separate tester.

*2 PRINCIPLES OF OPERATION The oscillator (Oscillator No. 87...) supplies a 1 kHz audio - frequency tone which can be made continuous or interrupted for easy recognition. When this or some similar oscillator is connected across the A and B wires of a pair, surrounding electric and magnetic fields are set up along the length of the pair. The induction into other pairs balances itself out giving negligible crosstalk, but one field or the other can be detected when the capacitive probe (Probe No. 5B) or inductive probe (Search Coil No. 2B) is held close to the pair. The detected signal is then amplified and heard in the receiver.

The Search Coil No. 2B detects the magnetic field set up by the flow of current in each wire of the pair, the currents in the two wires being in opposite directions. To obtain a strong magnetic field the pair must be short-circuited at the far end. The metal sheath or barrier foil in a cable does not shield the magnetic field to any great extent, neither do the conductors of surrounding pairs. Steel armouring wires or tapes reduce the field outside the cable.

The pencil probe (Probe No. 5B) detects the electric field resulting from the voltage across the pair, each wire having an opposite polarity. To obtain a strong electric field the pair should be open-circuited at the far end. The electric field (ie the difference in alternating potential between the two wires) decreases as a short circuited end is approached. The field will be strongest on a disconnected pair and the loudest signal will be heard when the probe is held close to one wire of the pair or when the metallic probe tip touches one of the conductors. The metal sheath or barrier foil in a cable forms a screen to the electric field, as to some extent do the conductors of surrounding pairs. For this reason the pencil probe is not generally effective outside the cable sheath.

The equipment enables cables and pairs to be identified quickly in all local networks regardless of length and sizes of cables used, providing these are in good condition. Results are uncertain with wet cables or where the pair is subject to short circuits, contacts or disconnections.

*3 **IDENTIFYING CABLES** To identify a cable at a distant point, the cable should first be identified at a known point, the MDF, cabinet, etc. A spare pair should be selected, preferably in an outer layer or unit if the cable is large. If a spare pair is not available a working pair should be selected and the subscriber advised of the proposed work and probable duration. The oscillator should be connected across the pair, and the output adjusted to give an interrupted tone. To minimise induction of the tone into other pairs, the oscillator must be connected to the A and B wires of the pair and not between wires and earth. To obtain good results, the pair should be looped at a point such that the cable section on which the probes are to be used lies between the points where the oscillator and the loop are connected. At the point where the cable is required to be identified, a Search Coil No. 2B should be connected to an Amplifier No. 109... by a Cord Connecting No. 2/12A. The coil should then be passed along or around the cable sheath until the tone is heard. It may be necessary to search along the sheath as the tone will fade every 300 mm or so, due to the twists in the pair. The loudest tone will be heard when the coil is held with one of its sides parallel to the cable and touching the sheath. If the selected pair has an open circuit at the far end, the radiated signal will weaken with distance and may fade within a few hundred metres of the oscillator end. If the pair has a high resistance connexion or one wire is disconnected somewhere along its length, the signal may not fade completely but may be heard faintly beyond the fault. Normally a cable can be readily identified under these conditions particularly when the far end is short circuited, but if the results are uncertain, a good pair should be substituted for the faulty one. When two or more cables are lying close together extra care should be taken that the required cable has been positively identified.

NB: Extra care must be exercised if a loud 50 Hz hum is detected since this may indicate the presence of a nearby electricity cable. Positive location of electricity cables is described in A1002.

4 **TRACING CABLE PAIRS** The route followed by a cable pair can be traced using similar methods to those used for identifying cables. Tests will normally be made at the points where the cable route divides so that the branch followed by the pair at each point may be determined. In most cases the destination of the pair will not be known and it will not be possible to loop the distant end. On this account tracing the last length may sometimes present difficulty. If the tests reveal faults on the pair being traced, it may be prudent, before proceeding further, to consider whether the cost of rectifying the faults is likely to be justified.

*5 **IDENTIFYING CABLE PAIRS** To identify a cable pair at an open joint, the oscillator should be connected to the pair at a point where its identity is known, and the output adjusted to give an interrupted tone. *The oscillator should be connected to the A and B wires of the pair and not between wires and earth, to minimise induction of tone into other pairs.* At the distant open joint, a Probe No. 5B and Cord Connecting 2/12A, together with a Receiver Headgear No. 16T-Black should be plugged into an Amplifier No. 109... and the probe held amongst the pairs. If the wanted pair appears at the joint, a faint tone will be heard and its position should then be found by selecting a section of the joint having the loudest tone. Groups of pairs and finally individual pairs should be eliminated by selection until one pair is found to have the loudest tone. A loud tone will be heard when the probe is placed alongside one wire of the pair, whereas the tone will be faint when the probe is held midway between the two wires. The loudest tone will be heard when the metal tip of the probe touches the individual conductors of the wanted pair. The amplifier gain control should be set to give a minimum recognisable signal, otherwise the weak tone induced into other pairs may tend to confuse the selection.

6 **CONFIRMING THE WANTED PAIR** In order to confirm that the correct pair has been identified, the ends of the conductors should be short circuited and a check made that a reduced level of tone is received. It is important that the insulation of the conductors is not damaged during this operation, *on no account should the insulation be pierced using a knife or cutting pliers.* The following procedures should be carried out with the different types of joints listed:-

6.1 **Jointed Conductors:-**

6.1.1 **Twisted Wire Joints** The insulating sleeves should be slid clear of the twisted conductors, which can then be short circuited to make the check.

6.1.2 **Joints Using Connectors Wire Insulated** A suitably modified Clip Test No. 23A, or a loop of wire, should be inserted into the two Connectors Wire Insulated and the check for the reduced level of tone made.

6.2 **Non-jointed Conductors:-**

6.2.1 **Stumped Joint** The insulation should be stripped from the ends of the conductors which can then be short circuited to make the check.

6.2.2 **Continuous through Joint** The wires should be cut and the insulation stripped from the cut ends which can then be short-circuited. Should the confirmation prove negative, the pair should be restored by piecing-in short lengths of wire.

7 **MONITORING** A monitoring facility is provided on the oscillator which may be used when two jointers are working together, eg when an appreciable number of pairs have to be identified. A faint monitoring tone will be heard on a receiver plugged into the monitoring jack of the oscillator, which will be considerably increased as the ends of the conductors are short circuited in confirming the wanted pair as in par 6. This increase in signal may be used as an advice to the jointer at the sending end to transfer the tone onto the next pair to be identified, for example, by the jointer at the identifying end short circuiting the pair in a pre-arranged manner such as three short taps. When a speaker pair is required in addition to the above monitoring facility, in order to reduce time spent in listening to the monitoring receiver, a telephone should be connected to the line as well as the oscillator. The oscillator and telephone should be connected in *PARALLEL* across the line. At the other end, after the pair has been identified in the normal manner, it may be connected to a second telephone with ringing facilities to call the first. The oscillator should be disconnected or switched off before speech is commenced.

*8 **IDENTIFICATION OF THE A AND B WIRES OF A PAIR** When it is necessary also to identify the A and B wires of a pair, a DC method should be used since the tone equipment currently available does not cater for this facility. The procedure described in par 5 should be followed except that a $1\frac{1}{2}$ volt cell should be connected in *SERIES* with the oscillator at the point of connexion to the cable pair (Positive battery terminal to the A wire of the pair and negative to one side of the oscillator).

The pair should be identified at the far end using the amplifier and Probe No. 5B in normal manner. A Tester SA9083 (0-5 V range) or a Meter Multi-Range No. 12A (0-2.5 volt range) connected across the pair will detect the DC Voltage from the cell, thus proving the pair. With the meter connected to give a positive indication on the scale, the wire connected to the positive terminal will be the 'A' wire, and that connected to the negative terminal will be the 'B' wire.

9 **IDENTIFICATION OF WIRES IN WORKING QUAD-TYPE CABLES** For the identification of quads and individual wires in working quad type cables, without interruption to service, use should be made of the Tester No. 159A in conjunction with the Tester No. 132B. A full description of Tester No. 159A and its method of use is given in E3 F1906.

For service difficulties contact THQ/Sv5.1.1

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