

BELL SYSTEM PRACTICES
Outside Plant Construction
and Maintenance

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CABLE TESTING

APPARATUS FOR CROSSTALK POLING TESTS

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1. GENERAL

1.01 This section describes the testing apparatus required for poling side-to-side crosstalk on 19-gauge cable quads to be used for type K carrier systems. Since the poling is done at a frequency of 850 ± 50 cycles, existing voice-frequency apparatus units are used, in so far as possible. The three new units which are required are the D-99461 terminating network, the D-99462 conductance unbalance attachment, and the D-156721 filter.

2. APPARATUS REQUIRED

2.01 For poling tests, measurements indicative of side-to-side far-end crosstalk coupling are required. In measurements of this type one end of the cable section under test is designated the sending end and the other end is designated the measuring end. The apparatus units required at these two ends are as follows:

Sending End

8A, 13A, 17B or Similar Type Variable
Frequency Oscillator
D-99461 Terminating Network

Measuring End

3A or 4A Capacity Unbalance Set
D-99462 Conductance Unbalance Attachment
D-156721 Filter
4B or 107A Amplifier
528 or Similar Type Telephone Receivers

3. SENDING END APPARATUS

Oscillator

3.01 The 8A, 13A, 17B or any similar type variable frequency oscillator covering the range from about 800 to 900 cycles and capable of an output of about +26 db above 1 milliwatt is satisfactory.

D-99461 Terminating Network

3.02 The D-99461 terminating network is a network whose impedance is designed to match the impedance of non-loaded 19-gauge cable pairs at about 850 cycles, i.e., an impedance of about $374-j345$ ohms. The network consists of two 187-ohm resistances and a .54 mf. condenser connected in series as indicated in Fig. 1.

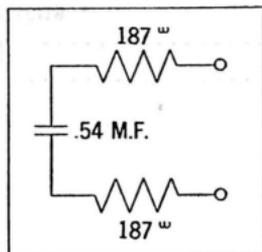


Fig. 1

3.03 The network is housed in a molded plastic box about 5-1/2" long, 3-11/16" wide and 3-1/16" deep, including the binding posts to which the network is connected. The resistances and condenser are mounted on a bracket attached to the underside of a fibre panel and the two binding posts are

mounted on the face of this panel which forms the cover of the box. The weight of the assembled network is about 1 pound.

3.04 If a network appears to be in trouble, it can be checked, of course, by measurements with an impedance bridge. If such measurements show that the resistance component of the impedance at 850 cycles is not approximately 374 ± 5 ohms and the capacitance component 345 ± 12 ohms, the resistances can be checked by means of a Wheatstone bridge and the condenser by means of a capacitance bridge.

4. MEASURING END APPARATUS

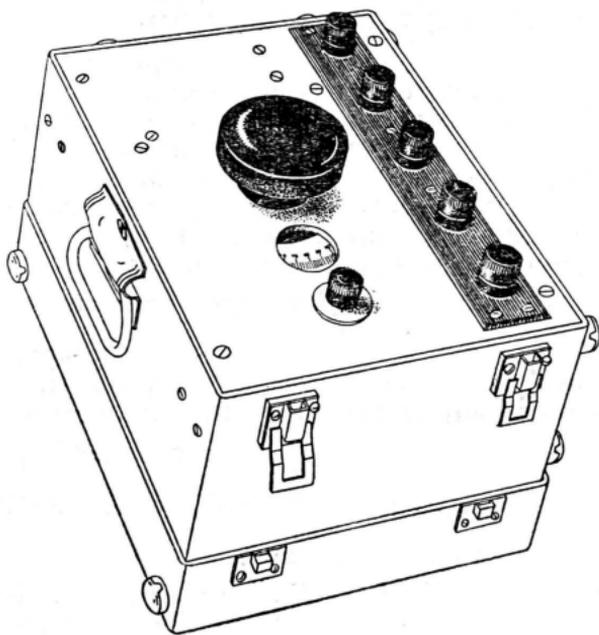
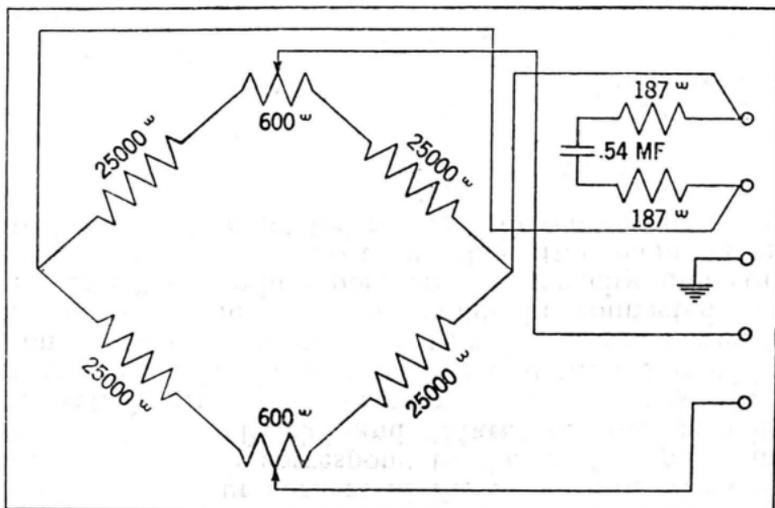
Capacity Unbalance Set

4.01 A 4A capacity unbalance set is the most suitable set for this purpose but a 3A set can be used if a 4A set is not available.

D-99462 Conductance Unbalance Attachment

4.02 The D-99462 conductance unbalance attachment is designed to be used with the capacity unbalance set to form a complete bridge for measuring the admittance unbalances, which define the crosstalk coupling, between the two sides of a quad or between any two pairs of conductors. The capacitance unbalance set, of course, provides the capacitance arms and the conductance unbalance attachment the conductance arms of the bridge.

4.03 The bridge arrangement of the D-99462 attachment, as shown on Fig. 2, consists of four fixed non-inductive wire wound 25,000-ohm resistances, matched to within ± 25 ohms, and two uniform 600-ohm slide wire potentiometers on a single dial. The four corners of the bridge are wired to four binding posts, which correspond to the binding posts marked "White," "Mate," "Black" and "Mate" on the capacity unbalance set. When the attachment is used for crosstalk poling measurements it should be placed so that these sets of binding posts on the two apparatus units are adjacent and corresponding binding posts of the two units should be connected by short straps. The "G" binding post on the capacity unbalance set and the corresponding post on the attachment should be strapped also and connected to the cable sheath or ground.



Figs. 2 and 3

4.04 This attachment also contains a terminating network electrically identical to the D-99461 terminating network, which is wired so as to terminate the receiving end of

the sending pair, i.e., the network is wired to the binding posts corresponding to the "White" and "Mate" posts of the capacity unbalance set.

4.05 The apparatus is mounted on a metal panel contained in an aluminum alloy box, approximately 12" long, 9" wide and 4.5" deep; the box being provided with a removable cover, 12" x 9" x 2.5". The weight (assembled) of the attachment is about 9 pounds. When the attachment is used, the cover should be removed and placed on its face, the box being set into the cover so as to rest upon the four angles welded to the inside corners of the cover. A face view of the apparatus with the cover removed is shown in Fig. 3. The dimensions of the box and cover are such, by design, that the panel of the attachment when used in this way will be on a level with the panel of the capacity unbalance set. The box is provided with a carrying handle, with 2 snap-locks on each end for securing the cover for transportation purposes and with 4 resilient feet. The cover is similarly provided with feet on the surfaces used for support.

4.06 On the face of the panel is a hard rubber binding post strip holding the 5 binding posts referred to previously. The scale of the potentiometer is read through a circular glass window, approximately 1.25" in diameter, set into the panel. This glass window contains a hair line which serves as the index. Just above the window is a knob, approximately 2.75" in diameter, for operating the potentiometer. Just below the window is a knob, approximately 5/8" in diameter, which operates the index adjuster for setting the "zero" of the potentiometer. The zero adjustment is made by loosening the adjustment knob, i.e., by turning the knob in a counter-clockwise direction, and sliding the index to the right or left as required. After the zero adjustment, the adjustment knob must be re-tightened by turning it in a clockwise direction.

4.07 Readings on the conductance unbalance attachment are differential in character as in the capacity unbalance sets and similarly, readings on the red portion are minus and those on the black portion plus. The scale is calibrated in terms of hundredths of a micromho, i.e., the dial reading divided by 100 equals micromhos. There are long scale divisions for each 10 units and short scale divisions for each 2 units, so that it is possible to read to the nearest unit by interpolation.

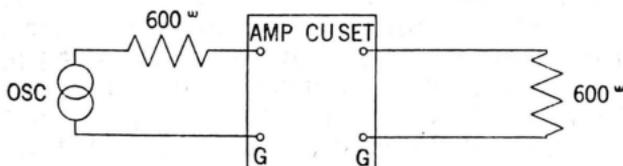
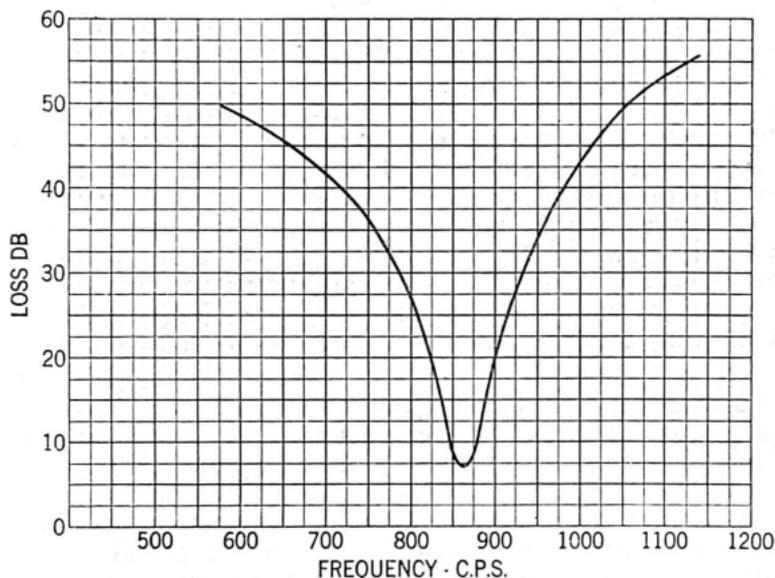
4.08 If trouble is suspected in a D-99462 conductance unbalance attachment, the various resistances can be checked by means of a Wheatstone bridge. The termination can be checked in the manner outlined in paragraph 3.04. Instructions for cleaning and lubricating of the potentiometers are given in Bell System Practices covering the maintenance of slide-wires.

D-156721 Filter

4.09 In order to provide discrimination against noise in the voice-frequency range from operating circuits in the cable being measured, the design of the D-156721 filter is such that least loss, as the filter is used, is presented at about 850 cycles and increasingly greater losses as the frequency increases or decreases. The insertion loss-frequency characteristic of a typical D-156721 filter as measured between 600-ohm resistances is shown on Fig. 4.

INSERTION LOSS OF D-156721 FILTER MEASURED BETWEEN 600 OHM RESISTANCES

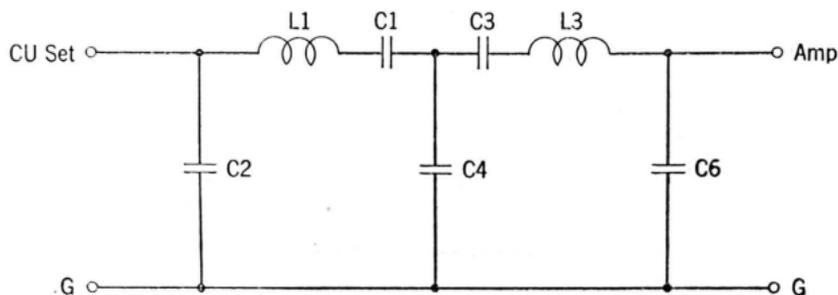
NOTE: This characteristic does not represent the operating condition as this filter is designed to operate between 600^w and 100^w



NOTE: Input current must not exceed 1 ma. where loss is less than 20db.

Fig. 4

4.10 As shown on Fig. 5 the D-156721 filter consists of a network of 5 condensers and 2 retardation coils, which is potted in a can about 5-3/16" long, 3-7/16" wide and 5-1/8" high including the binding posts on which the filter is terminated. The weight of the filter is about 5-1/2 pounds. The 4 binding posts, which are marked "CU Set" and "G" (ground) at one end of the filter and "Amp." and "G" (ground) at the other end of the filter, are mounted on a phenol fibre panel set into an opening, about 3-3/4" x 2-7/8", in the cover of the can.



UNIT		CODE NO.
Retard Coil	L1	D156722
	L3	D156723
Condenser	C1	D99977
	C2	D99980
	C3	D99976
	C4	D99979
	C6	D99978

Fig. 5

4.11 If trouble is suspected in a filter, it can be checked by measuring its insertion loss-frequency characteristic and comparing this with the characteristic shown on Fig. 4. If the measured loss deviates from this characteristic by more than about 2 db at any frequency, the filter should be returned to the Western Electric Company for repair.

Amplifier

4.12 To raise the volume of the test frequency sufficiently at the measuring end an amplifier is required. The 107A amplifier or the 4B amplifier, commonly used in fault location work, is satisfactory for this purpose.

Telephone Receivers

4.13 No. 528 telephone receivers or any other standard type of telephone receiver, such as normally used with the 4A capacity unbalance set, are satisfactory. To eliminate the effects of "room" noise as much as possible, a pair of receivers rather than a single receiver should be used.