V1 AND V3 TELEPHONE REPEATERS

ASSOCIATED EQUIPMENT TESTS AND ADJUSTMENTS

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1. GENERAL

1.01 This section describes the methods of testing and adjusting the equipment associated with V1 and V3 amplifiers in telephone repeater service.

1.02 This section is reissued to correct Table II on Page 4. This change was previously covered in Issue 1 of the addendum.

1.03 Tests and adjustment procedures for the V1 and V3 amplifiers as well as patching and monitoring methods are to be found in their respective sections. Singing point tests have been deleted in this issue as they are now described in Section 332-015-500.

1.04 With the exception of the amplifier units, repeaters utilizing either V1 or V3 amplifiers may have identical circuit configurations. These repeaters usually consist of two amplifiers and associated line equipment which may include hybrids, regulating networks, equalizers, filters, etc.

1.05 Testing procedures for repeaters involving V3 amplifiers will differ according to whether or not a repeater jack field is provided. If no jack field is provided, certain tests of this section will require the use of the auxiliary test panel. A method of patching the working amplifiers to this auxiliary test panel is described in another section on the V3 amplifier.

1.06 A momentary break in the circuit continuity of intertoll trunks employing single frequency signaling (other than on a ringdown basis) may cause the seizure of switching equipment. With intertoll trunks employing dial switching equipment at both ends, a more serious service reaction results when only one side of the trunk is opened than when both sides are opened. When one side only is opened, the receiving office, after approximately a 10-second break, will send back a reorder signal (120 IPM) causing seizure and release of a sender link and controller circuit at the rate of 120 IPM at the other office.

1.07 Interruptions to single frequency signaling trunks may be avoided by the use of a repeater switching circuit.

1.08 At regulating repeater offices, in order to avoid having the value of a regulating network change during the progress of a test where line equipment is involved, it will be necessary to note the step on which the regulator is operating, to set the manual control dial at this value (or whatever value is indicated by a particular test), and to transfer the operation of the regulating network circuit to the manual control dial for the duration of the test by operating the TRANSFER key. This will apply to transmission measurements made from the EQ IN jacks.

1.09 It is very important to identify accurately the correct location of the V3 units wanted before any one is removed from its socket or before monitoring cords are connected to the pin jacks of the units. The repeater numbers for the rows of units are given on the designation cards on the vertical channels but within a given row of units the proper location of the pair of units associated with a given circuit is determined only by counting. Hence, it is very important to make certain that the correct units are selected before performing any operations that might interfere with service on working circuits and it is very important to identify the units removed with respect to their correct odd and even sockets so that no error will be made when they are inserted again. Detailed instructions for the removal of V3 units from their sockets are covered in other practices on this subject.

1.10 When a V3 amplifier unit is to be out of its socket for more than the normal testing time interval, some form of substitute load should be inserted into the socket in order to avoid increasing the heater current in the other tubes on the same supply. The 360D plug of the 4P22A cord provides such a substitute heater load, as do the 360B and 360C plugs, which are used for patching line to line and for patching 600-ohm terminations onto both lines coming into the socket, respectively. When a single amplifier unit is to be removed from its socket for but a short interval, as, for example, for a cathode activity test, it is satisfactory to omit the substitute load on the heater supply.

2. 2-WIRE EQUIPMENT

(A) Input Equipment Losses

2.01 In order to check the equipment losses, measurements between 600 ohms may be used, bearing in mind that such losses are for test purposes only and do not necessarily correspond to the losses used in circuit layout procedure. For these tests the line balancing networks should be replaced by 600 ± 1 ohms and the equalizers and filters should be left in the normal condition. At regulating points if the group of circuits (on which the three repeaters under control of the same set of regulating relays are operating) may be taken out of service, the regulating network is transferred to manual control and put on step +10. For tests where the group is not taken out of service, such as repeater section transmission measurements, the step of the pilot wire regulator should be noted, the manual control dial should be placed on the corresponding step, and the regulating network should be transferred to the manual control during the tests. The input equipment loss then will be increased by the loss of the regulating network on the operating step. The additional loss may be obtained from Table I or Table II.

2.02 Fig. 1 shows a schematic layout of the equipment and the jack arrangements for testing this equipment.

2.03 Apparatus:

1 - 217D (600-ohm) Plug
2 - 2P13A Cords or equivalent

2.04 Procedure:

(1) Select two transmission measuring trunks between the measuring set and the primary testboard or two TBRR trunks between the testboard and repeater bay and measure the loss of these trunks looped together at the testboard.

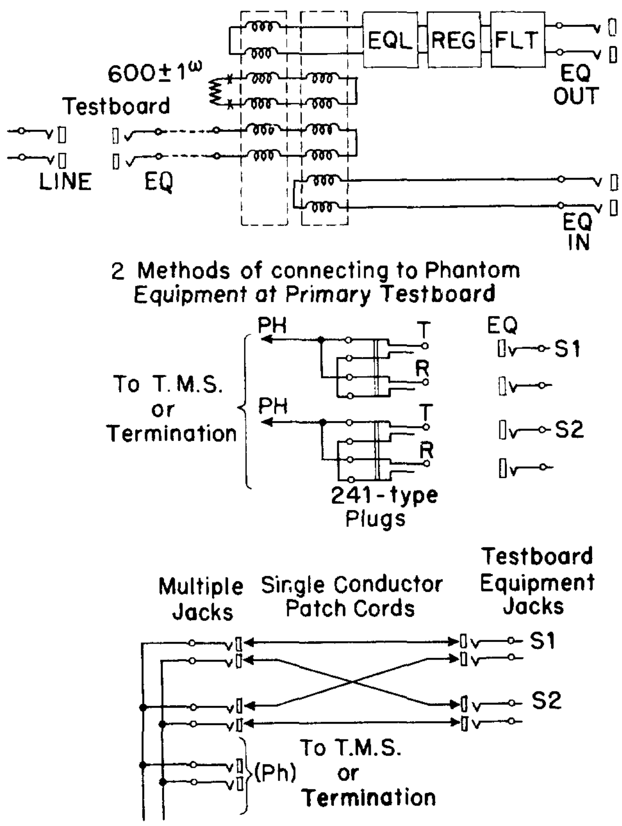


Fig. 1 2-Wire Equipment Jack Arrangements

(2) Patch one of these trunks to the EQ jacks at the testboard and to the SEND terminal of the measuring set (second trunk no longer used).

(3) Patch the REC terminals of the measuring set to the EQ OUT jacks in the jack field at the repeater bay (or in the jack field of the V3 auxiliary test panel patched to the working sockets).

(4) Terminate the corresponding EQ IN jacks in a 217D (600-ohm) plug.

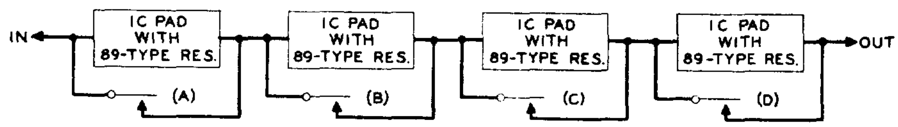
(5) Measure the equipment plus trunk loss and subtract the loss measured in Item (1). The resulting value is the input equipment loss measured between 600 ohms. This assumes that the loss of the second trunk (measured in Item (1)) is roughly equivalent to the loss of the office cabling between the primary board and the transformer hybrid.

Requirements: The requirements are given in Tables III and IV.

TABLE I

Regulating Network for Long Regulator Sections

SINGLE LINE SCHEMATIC



PILOT WIRE REGULATOR STEP	REGULATING NETWORK STEP	RELAYS OPERATED	PADS IN	LOSS IN DB													
				19 GA H88S	19 GA H50P	19 GA B88S	19 GA B50P	16 GA H44S	16 GA H25P	19 GA H172S	19 GA H63P	19 GA H44S	19 GA H25P	SEE NOTE			
+10 +9.5	+5	A,B,C,D	NONE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+9 +8.5 +8 +7.5	+4	B,C,D	A	1.5	1.25	1.0	.75	1.0	.75	1.0	1.0	2.0	1.5	1.25	1.5	1.75	1.75
+7 +6.5 +6 +5.5	+3	A,C,D	B	2.75	2.5	2.25	1.5	2.0	1.5	2.25	2.25	3.75	3.25	2.5	3.0	3.5	3.5
+5 +4.5 +4 +3.5	+2	C,D	A,B	4.25	3.75	3.25	2.25	3.0	2.25	3.25	3.25	5.75	4.75	3.75	4.5	5.25	5.25
+3 +2.5 +2 +1.5	+1	B,D	A,C	5.75	4.75	4.25	3.25	4.0	3.25	4.25	4.25	7.75	6.25	5.25	6.0	6.75	7.25
+1 +0.5 0 -0.5	0	A,D	B,C	7	6	5.5	4.0	5.0	4.0	5.5	5.5	9.5	8	6.5	7.5	8.5	9.0
-1 -1.5 -2 -2.5	-1	D	A,B,C	8.5	7.25	6.5	4.75	6.0	4.75	6.5	6.5	11.5	9.5	7.75	9.0	10.25	10.75
-3 -3.5 -4 -4.5	-2	A,B	C,D	9.75	8.25	7.75	5.75	7.0	5.75	7.75	7.75	13.25	11.25	9.25	10.5	11.75	12.75
-5 -5.5 -6 -6.5	-3	B	A,C,D	11.25	9.5	8.75	6.5	8.0	6.5	8.75	8.75	15.25	12.75	10.5	12.0	13.5	14.5
-7 -7.5 -8 -8.5	-4	A	B,C,D	12.50	10.75	10.0	7.25	9.0	7.25	10.0	10.0	17.0	14.5	11.75	13.5	15.25	16.25
-9 -9.5 -10	-5	NONE	A,B,C,D	14	12	11	8.0	10	8.0	11	11	19	16	13	15	17	18

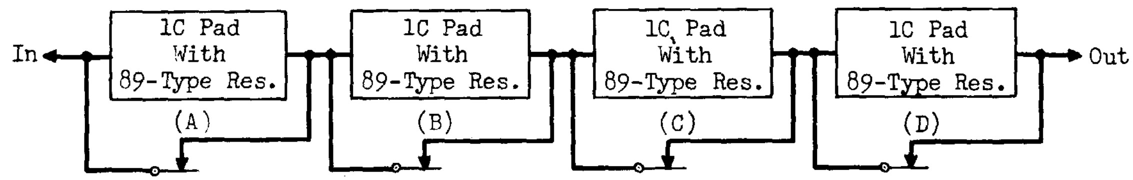
RESISTANCE DESIGNATION	RESISTANCE CODE													
A	89G	89F	89E	89D	89E	89D	89E	89E	89J	89G	89F	89G	89H	89H
B	89M	89L	89K	89G	89J	89G	89K	89K	89S	89P	89L	89N	89R	89R
C	89U	89R	89P	89L	89N	89L	89P	89P	89AD	89Y	89T	89W	89AA	89AC
D	89AC	89Y	89W	89P	89T	89P	89W	89W	89AL	89AG	89AB	89AE	89AH	89AK

NOTE:
THESE COLUMNS COVER LOSS RANGES NOT REQUIRED FOR STANDARD FACILITIES. THEY MAY BE USED FOR SPECIAL CASES, WHEN SUITABLE.

TABLE II

Regulating Network for Average Regulator Sections

Single Line Schematic



Pilot Wire Regulator Step	Regulating Network Step	Relays Operated	Pads In	Loss in DB												
				19 Ga. H88S	19 Ga. H50P	19 Ga. B88S	19 Ga. B50P	16 Ga. H44S	16 Ga. H25P	19 Ga. H172S	19 Ga. H63P	19 Ga. H44S	19 Ga. H25P	See Note		
+10 to +6	+6	None	None	0	0	0	0	0	0	0	0	0	0	0	0	0
+5.5, +4.5	+5	A	A	0.75	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1	0.75	0.25	0.25	0.75
+4, +3.5	+4	B	B	1.5	1.25	1	0.75	1	0.75	1	1	2	1.5	0.5	0.75	1.75
+3, +2.5	+3	A,B	A,B	2.25	1.75	1.5	1.25	1.5	1.25	1.5	1.5	3	2.25	0.75	1	2.5
+2, +1.5	+2	C	C	2.75	2.5	2.25	1.75	2	1.75	2.25	2.25	3.75	3.25	1	1.25	3.5
+1, +0.5	+1	A,C	A,C	3.5	3	2.75	2.25	2.5	2.25	2.75	2.75	4.75	4	1.25	1.5	4.25
0, -0.5	0	B,C	B,C	4.25	3.75	3.25	2.5	3	2.5	3.25	3.25	5.75	4.75	1.5	2	5.25
-1, -1.5	-1	A,B,C	A,B,C	5	4.25	3.75	3	3.5	3	3.75	3.75	6.75	5.5	1.75	2.25	6
-2, -2.5	-2	C,D	C,D	5.5	4.75	4.5	3.25	4	3.25	4.5	4.5	7.5	6.5	2.0	2.5	7
-3, -3.5	-3	A,C,D	A,C,D	6.25	5.25	5	3.75	4.5	3.75	5	5	8.5	7.25	2.25	2.75	7.75
-4, -4.5	-4	B,C,D	B,C,D	7	6	5.5	4	5	4	5.5	5.5	9.5	8	2.5	3.25	8.75
-5 to -10	-5	A,B,C,D	A,B,C,D	7.75	6.5	6	4.5	5.5	4.5	6	6	10.5	8.75	2.75	3.5	9.5

Resistance Designation	Resistance Code											
A	89D	89C	89C	89C	89C	89C	89C	89C	89E	89D	89CH	89CH	89D
B	89G	89F	89E	89D	89E	89D	89E	89E	89J	89G	89C	89D	89H
C	89M	89L	89K	89H	89J	89H	89K	89K	89S	89P	89E	89F	89R
D	89M	89K	89K	89G	89J	89G	89K	89K	89S	89P	89E	89F	89R

Note: These columns cover loss ranges not required for standard facilities. They may be used for special cases, when suitable.

TABLE III

1000-Cycle 2-Wire Input Equipment Losses between 600 Ohms

	Open Wire Side Circuits					
	20-Cycle Signaling			135- or 1000-Cycle or S.F. Signaling		
	Min.	Av.	Max.	Min.	Av.	Max.
Non-composited	4.7	5.5	6.2	5.7	6.5	7.2
Composited	-	-	-	5.5	6.3	7.0
	Open Wire Phantom Circuits					
	20-Cycle Signaling on Phantom			135- or 1000-Cycle or S.F. Signaling on Phantom		
	Min.	Av.	Max.	Min.	Av.	Max.
20-Cycle Signaling on Sides	3.3	4.0	4.7	4.9	5.6	6.3
135- or 1000-Cycle or S.F. Signaling on Sides	6.2	6.9	7.6	6.2	6.9	7.6

Note: At regulating points, regulator network losses must be added (see Par. 2.01).

(B) Output Equipment Losses

2.05 Apparatus:

1 - 217D (600-ohm) Plug
2 - 2P13A Cords or equivalent

2.06 Procedure:

(1) Select two transmission measuring trunks between the measuring set and the primary testboard and measure the loss of these trunks looped together at the testboard.

(2) Patch the SEND terminals of the measuring set to the EQ IN jacks in the repeater bay (or in the jack field of the V3 auxiliary test panel patched to the working sockets).

(3) Patch the REC terminals of the measuring set to one end of the measuring trunk and to the testboard end of this trunk patch the EQ jacks at the testboard.

(4) Terminate the corresponding EQ OUT jacks in the repeater bay (or V3 auxiliary test panel jack field) in a 217D (600-ohm) plug.

(5) Measure the loss and subtract the loss measured in Item (1). The resulting value is the output equipment loss measured between 600 ohms. This assumes that the loss of the second trunk measured in Item (1) is roughly equivalent to the loss of the office cabling from the primary board to the transformer hybrid.

Requirements: The requirements to be met are contained in Tables V and VI.

TABLE V

1000-Cycle 2-Wire Output Equipment Losses (db) between 600 Ohms
Open Wire

	Min.	Av.	Max.
Side Circuits	3.1	3.6	4.1
Phantom Circuits			
Side Ckts. Non-composited	3.4	3.9	4.4
Side Ckts. Composited	3.5	4.0	4.5

TABLE VI

1000-Cycle 2-Wire Output Equipment Losses (db) between 600 Ohms
Cable

	Side Circuits			Phantom Circuits		
	Min.	Av.	Max.	Min.	Av.	Max.
Toll Cable						
16 H-44-25	3.1	3.6	4.1	3.4	3.9	4.4
16 or 19 H-172-63	4.1	4.6	5.1	3.4	3.9	4.4
19 B-88-50	4.1	4.6	5.1	3.7	4.2	4.7
16 or 19 H-88-50	3.5	4.0	4.5	3.3	3.8	4.3
19 D-88 (Cap. 0.84 MF/mi.)	3.5	4.0	4.5	3.3	3.8	4.3
16 H-88 Pr. (0.062 MF/mi.) in coaxial cable	3.3	4.0	4.7			
19 H-135 Pr. (0.040 MF/mi.) in coaxial cable	3.9	4.6	5.3			
19 H-88 Pr. (0.040 MF/mi.) in coaxial cable	3.9	4.6	5.3			
19 H-44-25	3.0	3.7	4.4	3.4	4.0	4.6
16 or 19 H-174-106	3.9	4.6	5.3	3.6	4.3	5.0
Exchange Area Cable Loaded:						
M-88, H-88 or H-135	3.5	4.0	4.5			
H-172, H-175, B-88, B-135 or B-175	4.1	4.6	5.1			

TABLE IV

1000-cycle 2-wire Input Equipment Losses (db) between 600 Ohms

Cable Facilities

(a) Without Cx Sets or with Type E Cx Sets

Facility	Side Circuits (A)			Side Circuits (B)			Phantom Circuits (C)			Phantom Circuits (D)			Phantom Circuits (E)			Phantom Circuits (F)		
	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.
Toll Cable																		
16 H-44-25	4.7	5.5	6.2	5.7	6.5	7.2	6.3	7.1	7.8	4.9	5.7	6.4	4.9	5.7	6.4	6.2	6.9	7.6
16 or 19 H-172-63	5.8	6.5	7.2	5.8	6.5	7.2	4.3	5.0	5.7	4.3	5.0	5.7	4.1	4.8	5.5	4.1	4.8	5.5
19 B-88-50	5.2	6.0	6.7	5.2	6.0	6.7	4.9	5.6	6.3	4.9	5.6	6.3	4.7	5.4	6.1	4.7	5.4	6.1
16 or 19 H-88-50) 16 or 19 H-86-31) 19 D-88 (Cap. 0.084 MF/mi.))	4.5	5.3	6.0	4.5	5.3	6.0	4.0	4.7	5.4	4.0	4.7	5.4	3.8	4.5	5.2	3.8	4.5	5.2
16 H-88 Pr. (0.062 MF/mi.) in Coaxial Cable	6.7	7.4	8.1	see Note 2														
19 H-135 Pr.(0.04 MF/mi.) in Coaxial Cable	8.7	9.4	10.1	see Note 2														
19 H-88 Pr. (0.04 MF/mi.) in Coaxial Cable	6.5	7.2	7.9	see Note 2														
19 H-44-25	5.5	6.5	7.4	5.7	6.6	7.4	6.1	7.1	8.0	6.1	7.1	8.0	6.1	7.1	8.0	6.1	7.1	8.0
16 or 19 H-174-106	5.6	6.5	7.4	5.6	6.5	7.4	5.2	6.1	7.0	5.2	6.1	7.0	5.0	5.9	6.8	5.0	5.9	6.8
Exchange Area Cable Loaded																		
M-88 or H-135	5.2	6.0	6.7	5.0	5.8	6.5												
H-88	4.8	5.5	6.3	4.8	5.5	6.3												
H-172, H-175,) B-88, B-135 or.B-175)	5.8	6.5	7.2	5.8	6.5	7.2												

(A) = 20-cycle or CX Sig., or 135- or 1000-cycle with Telegraph
(B) = 135- or 1000-cycle Sig. or S.F. Sig. without Telegraph
(C) = 20-cycle Sig. Sides and Phantoms
(D) = 20-cycle Phantom, 135- or 1000-cycle or S.F. Sig. Sides
(E) = 135- or 1000-cycle or S.F. Sig. Phantom; Sides: 20-cycle; or 135- or 1000-cycle with Teleg.; or CX Sig. Also CX Sig. Sides and Phantom
(F) = 135- or 1000-cycle or S.F. Sig. Sides and Phantoms

(b) With Type C Cx Sets

(Not including loss of Cx Set)

Facility	Side Circuits			Phantom Circuits: Cx on Sides			Phantom Circuits: Cx on Phantom		
	Min.	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.
16 H-44-25	5.5	6.3	7.0	4.9	5.7	6.4	6.3	7.1	7.8
16 or 19 H-172-63	5.8	6.5	7.2	4.1	4.8	5.5	4.1	4.8	5.5
19 B-88-50	5.2	6.0	6.7	4.7	5.4	6.1	4.7	5.4	6.1
16 or 19 H-88-50) 19 D-88 (Cap. 0.084 MF/mi.))	4.5	5.3	6.0	3.8	4.5	5.2	3.8	4.5	5.2
19 H-44-25 (135-cycle Sig.)	5.5	6.5	7.4						
(1000-cycle Sig.)	4.5	5.5	6.4						
(135 or 1000-cycle S & Ph)				6.1	7.1	8.0	6.1	7.1	8.0

Note 1: At regulating points, regulator network losses must be added (see Paragraph 2.01).

Note 2: These losses hold for typical equalizer adjustments for 60 miles of both 16 H-88 (0.062 MF cable) and 19 H-135 (0.04 MF cable) and for 50 miles of 19 H-88 (0.04 MF cable).

(C) Terminating Set Losses

2.07 Terminating set loss measurements, in general, necessitate connections to the equipment at either the secondary testboard or the toll switchboard. In measuring these losses the switch pad (if used) should be out of the circuit.

2.08 Fig. 2 shows a simplified schematic of a 4-wire terminating set (Circuit Layout Code 4TP).

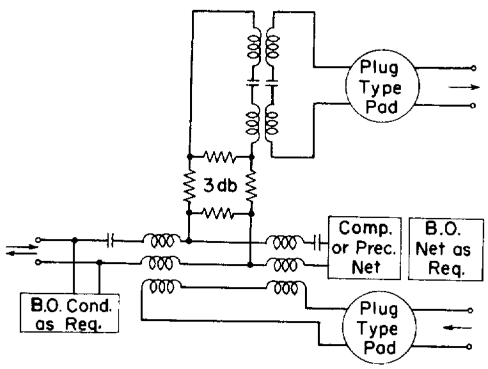


Fig. 2 - 4-Wire Term. Set (4TP)

2.09 The 1000-cycle loss measurement procedure for the terminating set of Fig. 2 is similar to that described in Paragraphs 2.04 and 2.06 except that a measuring trunk to the secondary toll testboard is required and the 2-wire drop is patched to this trunk at the testboard. The loss is measured between the 2-wire appearance and the EQ IN or EQ OUT jacks while the corresponding EQ OUT or EQ IN jacks are terminated in a 217D plug.

Requirements:

1000-Cycle Loss (db)*	Min.	Max.
Transmitting	6.5	7.5
Receiving	2.9	3.9

* With 0 db plug type pads inserted.

2.10 The 1000-cycle loss of the miniature terminating set (Circuit Layout Code 4TT) is measured by the method of Paragraph 2.09. A simplified schematic is shown in Fig. 3.

Requirements:

1000-Cycle Loss (db)*	Min.	Max.
Transmitting	2.7	3.6
Receiving	5.0	6.0

* With REC and TRSG potentiometers in their extreme clockwise position.

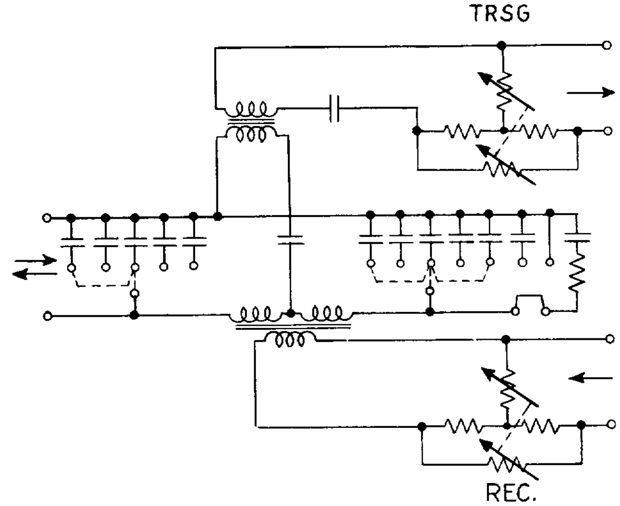


Fig. 3 - Miniature 4-Wire Term. Set

2.11 The resistor hybrid arrangement (Circuit Layout Code 4TR) shown in Fig. 4 may replace the transformer hybrid at repeatered terminals. Loss measurements may be made by the method indicated in Paragraph 2.09.

Requirements:

1000-Cycle Loss (db)	Min.	Max.
Trans. or Rec.	10.3	11.1

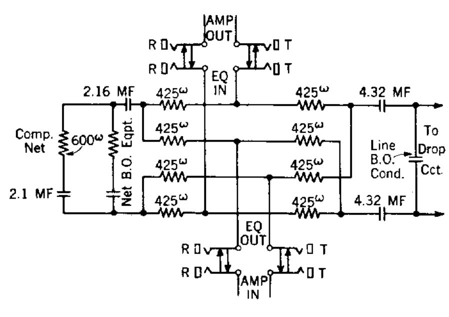


Fig. 4 - Schematic of Resistor Hybrid Arrangement for 2-wire Terminals

2.12 At non-repeatered terminals the line may be terminated in one of the transformer arrangements of Fig. 5. The equipment loss is measured from the line side to the drop side by methods similar to those given in Paragraphs 2.04 and 2.06.

Requirements: The requirements to be met are contained in Table VII.

TABLE VII

1000-Cycle Equipment Losses (db) between 600 Ohms Transformer Arrangement per:

Fig. 5 (a) or (b)

Transformer Type	Side Ckts. Min.	Side Ckts. Max.	Ph. Ckts. Min.	Ph. Ckts. Max.
173E or 173A	0.1	1.1	0.3	1.3
173B	0.7	1.7	0.9	1.9
173C	1.2	2.2	-	-
173D	-	-	0.2	1.2

Fig. 5 (c)

Transformer Type	Line to Drop Ratio	1000-Cycle Loss - db Min.	1000-Cycle Loss - db Max.
173E or 173A	0.5 : 1	0.5	1.5
	2 : 1	0.6	1.6
173B	0.845 : 1	0.2	1.2
	3.38 : 1	1.6	2.1
173C	1.15 : 1	0.2	1.2
	4.6 : 1	2.6	3.6
173D	0.3 : 1	1.3	2.3
	1.2 : 1	0.2	1.2

3. 4-WIRE EQUIPMENT

(A) Input Equipment Losses

3.01 At regulating points, transfer the regulating network to manual control (see Par. 2.01).

3.02 Apparatus:

2 - 2P13A Cords or equivalent

3.03 Procedure:

(1) Select two transmission measuring trunks between the measuring set and the primary testboard and measure the loss of these trunks looped together at the testboard.

(2) Patch one of these trunks to the EQ jacks at the testboard and to the SEND terminals of the measuring set (second trunk no longer used).

(3) Patch the REC terminals of the measuring set to the EQ OUT jacks in the jack field at the repeater bay (or in the jack field of the V3 auxiliary test panel patched to the working sockets).

(4) Measure the loss and subtract the loss measured in Item (1). The resulting value is the input equipment loss measured between 600 ohms. This assumes that the loss of the second trunk measured in Item

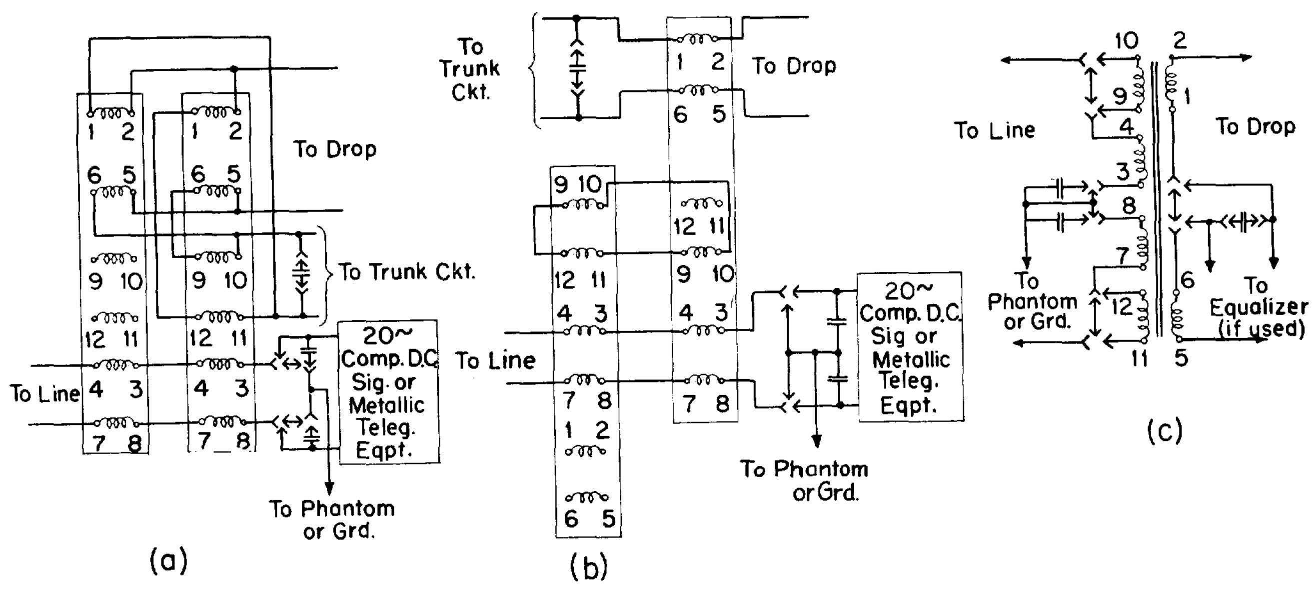


Fig. 5 - Transformer Arrangements for Non-repeatered Terminal

(1) is roughly equivalent to the loss of the office cabling from the primary board to the input line transformer.

Requirements: The input equipment loss requirements are given in Table VIII.

(B) Output Equipment Losses

3.04 Apparatus:

2 - 2P13A Cords or equivalent

3.05 Procedure:

(1) Select two transmission measuring trunks between the measuring set and the primary testboard and measure the loss of these trunks looped together at the testboard.

(2) Patch the SEND terminals of the measuring set to the EQ IN jacks in the repeater bay (or in the jack field of the V3 auxiliary test panel patched to the working sockets).

(3) Patch the REC terminals of the measuring set to one end of the measuring trunk and to the testboard end of this trunk patch to the EQ jacks at the testboard.

(4) Measure the loss and subtract the loss measured in Item (1). The resulting value is the output equipment loss measured between 600 ohms. This assumes that the loss of the second trunk measured in Item (1) is roughly equivalent to the loss of the office cabling from the primary board to the output line transformer.

Requirements: The requirements to be met are contained in Table VIII. The values listed apply for nominal equalizer settings.

TABLE VIII

1000-Cycle Losses of Line Equipment For 4-Wire Circuits

Equipment Loss Measured		1000-Cycle Loss - db: Side Circuit Min.	Side Circuit Max.	Phantom Min.	Phantom Max.
19H44-25 Cable - 173-Type Repeating Coils					
Non-composited	- Input	2.9	4.3	2.7	4.1
	- Output	0.2	1.2	0.3	1.3
Composited	- Input	2.7	4.1	2.7	4.1
	- Output	0.3	1.3	0.3	1.3
19H88-50 Side and Phantom Circuits and 19H86-31 Side Circuit - 173-Type Repeating Coils					
Non-composited	- Input	2.2	3.6	2.4	3.8
	- Output	0.6	1.6	0.3	1.3
Composited	- Input	2.3	3.7	2.5	3.9
	- Output	0.7	1.7	0.3	1.3
19H44-25 Cable 62 and 93-Type Repeating Coils					
Non-composited	- Input	2.6	4.0	2.8	4.2
	- Output	0.2	1.2	0.2	1.2
Composited	- Input	2.7	4.1	2.8	4.2
	- Output	0.2	1.2	0.2	1.2
Order Wires on Non-phantomed 19H44 Cable					
Local Order Wire at Auxiliary Stations					
	Input	0.2*	1.2*		
	Output	0.2	1.2		
Local Order Wire at Main Stations					
	Input	3.4*	4.8*		
	Output	0.2	1.2		
Express Order Wire					
	Input	2.9*	4.3*		
	Output	0.2	1.2		
Order Wires on 16H44 Side Circuits or 16H44 Core Pairs in Coaxial Cables - 173-Type Repeating Coils (60 Mi. Sections)					
	Input	3.4	5.0		
	Output	0.2	1.2		
19H86-31 Phantoms - 173-Type Repeating Coils (For Side Ckts. See Req. for 19H88-50 Side Ckt.)					
Non-composited	- Input	3.8	5.2		
	- Output	0.3	1.3		
Composited	- Input	3.6	5.0		
	- Output	0.3	1.3		
Order Wires for Type N Carrier					
Non-composited 16 or 19H172S					
	Input	6.0	7.7		
	Output	6.0	7.7		

(Table VIII continued)

Non-composited 16 or 19B88S

Input	4.0	5.8
Output	4.0	5.8

Note: At regulating points regulating network losses must be added to input equipment losses (see Par. 2.01).

* With zero loss in pad. If pad is not zero, add nominal loss of pad ± .2 db to the values given.

(C) Equalizer Adjustments

3.06 The equalizer used for 4-wire facilities is shown schematically in Fig. 6. The low-frequency elements are resistor R_1 in shunt with capacitor C_1. The high-frequency elements are resistor R_2, the 251B inductor and the .02 mf capacitor.

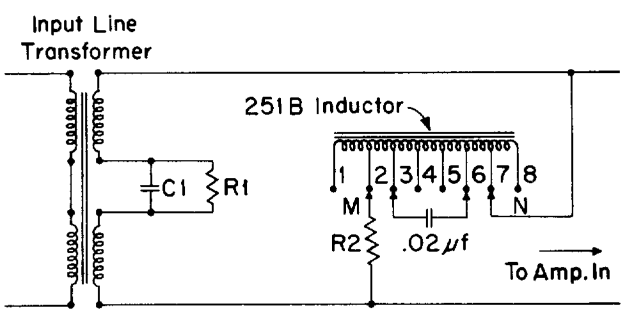


Fig. 6 - Equalizer for 4-Wire Circuits

3.07 Typical equalizer strappings for various line facilities are given in the application schematics for V1 and V3 repeaters. The information in the following paragraphs is included as a guide in equalizing repeaters used under conditions not covered by the application schematics.

3.08 The low-frequency equalizer has a small transmission loss at 1000 cycles. The equalizer loss increases as the frequency decreases below 1000 cycles. The shape of the loss frequency characteristic is determined by the relationship between C_1 and R_1. For example, if it is desired to change the shape of the characteristic to increase the loss at 200 cycles and decrease the loss at 500 cycles, C_1 should be decreased and R_1 should be increased. An increase in the value of C_1 and a decrease in the value of R_1 will have the opposite effect. When the equalizer is adjusted for a large low-frequency equalization, the loss at 1000 cycles becomes appreciable and some high-frequency equalization results.

3.09 The high-frequency equalizer consists of the resistor R_2 in series with an inductor resonated by an .02 mf capacitor. The normal frequency of resonance will be around 3000 cycles but may be shifted up or down by connecting the .02 mf capacitor across a smaller or larger inductance, respectively. The bridging loss of the equalizer at the resonant frequency is practically zero but increases as the frequency decreases until, at frequencies near 1000 cycles and below, the loss depends upon the value of resistor R_2. The shape of the loss frequency characteristic between 1000 cycles and the resonant frequency may be controlled to a limited extent by changing the connections of leads "M" and "N" on the taps of the inductor. As the value of the inductance connected between these leads decreases, the characteristic rises more sharply near the resonant frequency. The value or resistor R_2 also has a small effect on the low-frequency equalization. A decrease in the value of R_2 increases the effectiveness of the low-frequency equalizer.

4. 1000-CYCLE LOSS OF REGULATING NETWORKS

4.01 The regulating network, when used, is included in the input equipment. It consists of four 1C pads into which are plugged the appropriate 89-type resistors.

4.02 The procedure in testing the regulating network is identical with that described in Paragraph 2.04. The network is put on manual control by the operation of the TRANSFER key, and the input equipment loss is measured. (Note that for tests at other than on the operating step, this requires that three circuits, on which the three repeaters under control of the same set of regulating relays are operating, be taken out of service.) Unless some particular step or steps are being checked, in general the working range of the regulator steps should be included.

Requirements: The 1000-cycle loss introduced by the regulating network is shown in Table I or II, the tolerance being ± 0.3 db.