LOCAL TEST CABINET NO. 2
OPERATING AND TESTING METHODS

CONTENTS

1. GENERAL

1.01 This section describes the method of operation of the Local Test Cabinet No. 2 for making tests of subscriber line and trunk plant.

1.02 The various locations of the cabinet and the arrangements of the keys, jacks and terminals in the cabinet together with the various cords, plugs and testing batteries required are covered in the descriptive section "Local Test Cabinet No.2."

2. PREPARATION

Battery and Ground Supply

2.01 When testing battery (either a dry cell battery or the central office battery) is not wired directly into the test cabinet but to a separate battery supply jack, make battery and ground connections by using a patching cord connected between the BAT G jack of the cabinet and the battery supply jack.

Note: To avoid possible grounding of the battery supply leads, connect the cord to the test set first and when disconnecting, remove the cord from the test set last.

2.02 Where a 45-volt dry cell block is located close to the test cabinet and a W2M cord equipped with test clips is used to connect this battery to the test cabinet, insert the No. 110 plug of the cord into the BAT G jack and then connect the clip of the white conductor to the positive battery terminal and that of the red conductor to the negative battery terminal. Connect the negative terminal of the dry cell testing battery to a convenient ground. For this ground connection, a No. 760 cord may be used.

Method of Establishing Connections for Ringing, Talking and Testing

Manual Common Battery or Multiple Magneto Switchboards

2.03 Connect a patching cord between the TST jack and a switchboard jack of the line under test.

Note: In case the local test cabinet is used in the terminal room, see 2.07.

2.04 To afford facility for talking or ringing on the line under test, to provide a busy condition and, where necessary, to operate the cutoff relay so that battery and ground will be removed from the line, plug a calling (front) cord at the switchboard into the TLK jack of the test cabinet.

Non-Multiple Magneto Switchboards

2.05 Connect a patching cord equipped with No. 47 plugs between jack MF1 and the line jack of the line under test.

2.06 To afford facility for ringing and talking, when required, plug a calling (front) cord into jack MF2.

Dial Offices and Wherever Cabinet is Located in Terminal Room

2.07 Connect an MDF cord between jacks MF of the test cabinet and the protector of the line under test. When inserting the No. 152 plug into jacks MF, have the ridged side to the left, that is, on the side corresponding to jack MF1. In the case of unridged plugs, have the side with the cord

tie ring toward the bottom of the cabinet. The effect of inserting this plug the wrong way is to transpose the tip and ring between the test circuit and the line under test and also to transpose the tip and ring leads of the path into the test set for ringing and talking.

3. METHOD

(A) Checking Test Battery Voltages

General

3.01 The condition of dry cell testing batteries, which are maintained on the basis of tests made at the local test cabinet, is determined on the basis of voltage measurements made when the battery has been subjected for a period of 10 seconds to a drain through a specified resistance. In all cases it is necessary to provide a circuit from the battery under test through the testing circuit to ground (See 3.02). The test drain can be provided by holding the VS key operated except in the case of a 100-volt test battery or when testing its component 22-1/2-volt battery blocks. To provide the drains for these battery tests the use of a separate test resistance is required as, due to the presence of a protective resistance lamp in the circuit, holding the VS key would not give a sufficiently definite drain for an accurate measurement of the battery voltage.

Note: Maintenance of the test battery voltage within close limits is desirable in order that voltmeter readings will correspond closely to the values of resistance or capacity as given in Tables 1 to 5.

3.02 In order to make measurements of test battery voltages, the necessary path from the test battery through the testing circuit of the cabinet may be established in any of the following ways, depending upon the patching cords or plugs available.

(a) Plug a 3-conductor cord into jack TST. Operate the REV key. Touch the tip of the plug at the opposite end of the cord to the sleeve of the BAT G jack or to any other convenient ground.

(b) Insert into jack TST a plug with crossed tip and ring. Operate the G key.

(c) Where "Y" wiring is provided, insert into jack MF1 a solid plug or a plug with crossed tip and sleeve. Operate the G key.

(d) Where "X" wiring is provided, insert into jacks MF an MDF cord in which the two contacts of the plugs which normally connect to the cable conductors are connected together. Operate the G key.

40-Volt Test Battery

3.03 With connections made as in 3.02, note the reading of the voltmeter. Change taps to reduce the voltage if it is higher than 41 volts. Hold the VS key operated for 10 seconds and again read the voltmeter just before releasing the key. If the meter reading falls below 38 volts, shift one of the battery leads to a higher tap, if available, in order to adjust the voltage so that under the conditions of this paragraph it will remain within the range 38 to 41 volts. If higher taps which would give the necessary voltage are not available, replace the battery.

Note: A repeat test should not be made until the battery has at least 5 minutes for depolarization.

100-Volt Test Battery

3.04 Test batteries associated with a local test desk should be maintained on the basis of tests made at the test desk rather than the test cabinet. When necessary, however, to determine the condition of a 100-volt dry cell test battery from the local test cabinet, proceed as follows:

3.05 Establish a path from the test battery through the testing circuit as covered in 3.02 and note the reading of the voltmeter. By means of the battery taps, make such adjustments as may be necessary to bring the voltage within the range of 99 to 101 volts.

3.06 Bridge a test resistance of 5000 ohms (as, for example, the No. 18EW or No. 18FJ resistance) between the negative terminal and the positive terminal of the 100-volt battery. After 10 seconds read the meter and disconnect the test resistance.

3.07 If the meter reading fell below 95 volts, each of the 22-1/2-volt dry cell blocks should be tested individually.

Individual 22-1/2-Volt Dry Cell Blocks

3.08 When it is necessary to test the individual dry cell blocks of a 100-volt or 200-volt test battery, connect each 22-1/2-volt block, in turn, in place of the 100-volt battery. Follow the procedure of 3.06 except that the test resistance used should have a value of only 1000 ohms (as, for example, the No. 18BH or No. 18BM resistance). If in this test, the voltage of a block falls below 17 volts, that block should be replaced.

Breakdown Test Battery

3.09 If the 200-volt test battery is not maintained on the basis of tests made at a local test desk, operate the BT-RG key, close a circuit through the test cir-

cuit as in 3.02 and read the voltmeter. Change taps of dry cell blocks in the upper half of the battery as necessary to bring the reading up into the range 99 to 101 volts. The voltmeter reading is one-half of the breakdown test voltage as, with the BT-RG key operated, an external resistance equal to the resistance of the voltmeter is connected in series with it. Bridge a test resistance of 5000 ohms across the terminals of the upper 100-volt portion of the 200-volt battery. After 10 seconds, read the meter and disconnect the resistance. If the reading is less than 97, the individual dry cell blocks of the upper half of the 200-volt battery should be tested as in 3.08 and replacements made as required. Restore operated keys.

(B) Voltmeter Tests for Line Condition

Subscriber Lines with Ringing Condensers, Trunks and Unassigned Pairs

3.10 General Procedure: With connections made as covered under PREPARATION and with each conductor of the pair to be tested free from any other connection, unless it be through a condenser, proceed as follows:

(1) Operate the G Key - Disregard any throw (ballistic deflection) of the voltmeter needle or any small steady deflection.

(2) Operate the REV Key - Observe the throw of the voltmeter needle and the steady deflection (if any). The steady deflection indicates the insulation resistance of the tip side of the line.

(3) Restore the REV Key - Observe the throw of the voltmeter needle and the steady deflection (if any). The steady deflection here, or in (1) above, indicates the insulation resistance of the ring side of the line.

(4) Restore the G Key.

3.11 The insulation resistance of the tip and ring conductors may be determined from the above steady deflections by referring to Table 1 at the end of this section. The insulation resistance should meet the requirements prescribed locally. Tables 2 to 5 at the end of this section show the amount of ballistic deflection for lines of different insulation resistance and equipped with various subscriber set types and combinations. When the proper voltmeter throws are obtained and the steady deflections show that the insulation resistance is sufficient to meet the requirements prescribed locally, the test indicates that the line is O.K.

3.12 Steady Deflections: If, during the voltmeter tests of 3.10, the steady deflection received exceeded the limits prescribed locally, proceed as follows:

(1) Restore any Operated Keys to Normal - A steady voltmeter deflection approximately equal to the test battery voltage indicates a ground on the ring side of the line. A voltmeter deflection less than the test battery voltage indicates a resistance ground on the ring side of the line. The resistance of the ground may be determined by reading the meter (with the VS key momentarily operated in the case of relatively low resistances) and referring to Table 1 at the end of this section. Unless the central office battery is used for test battery supply, a voltmeter deflection greater than the test battery voltage indicates that the ring side of the line is crossed with the central office battery. A cross with a foreign potential may also give a voltmeter reading greater than that of the test battery voltage.

(2) Operate the REV Key - The voltmeter will then indicate the condition of the tip side of the line in the same manner as described under (1) for the ring side.

(3) If no trouble was indicated under conditions (1) or (2), operate the G key. A steady deflection approximately equal to the test battery voltage indicates a short.

(4) Restore the G key and the REV key.

3.13 Ballistic Deflections: If the line resistance is high, the throws of the voltmeter needle which are associated with the operation and restoration of the REV key depend primarily upon the manner in which the ringing condensers at such stations as are connected and upon the capacity of such condensers. If, however, the line insulation resistance is relatively low, that part of the deflection resulting from charging the line capacity becomes small as compared with the steady deflection due to line leakage. The action of the voltmeter under the various arrangements of station ringing condensers gives indications as follows:

(a) No Stations Connected: When no station is connected as in the case of toll trunks or unassigned pairs, little if any ballistic deflection should be observed. When testing an unassigned pair, if there should be an appreciable ballistic deflection, it is probable that a "left in station" is connected to the pair.

(b) Station Ringing Condensers Connected Between Tip and Ring: When the REV key is operated or restored, the ballistic deflection obtained is an

approximate measure of the total capacity of ringing condensers at the station, or stations. (See Tables 2 to 5.) If no appreciable ballistic deflection is obtained, the line is open.

(c) Station Ringing Condensers Connected Between Each Line Conductor and Ground: The ballistic deflection obtained when the REV key is operated is an approximate measure of the total capacity of the condensers on the tip side of the line, and the ballistic deflection obtained when the REV key is restored is an indication of the total capacity of the condensers on the ring side of the line. (See Tables 2 to 5.) If no appreciable ballistic deflection is obtained when the REV key is operated, either no tip station is connected or the tip conductor of the line is open. When the REV key is restored, absence of an appreciable ballistic deflection indicates either an open ring conductor or that no ring station is connected.

3.14 A simplified schematic showing as much of the testing circuit as is involved in voltmeter tests is shown in Fig. 1.

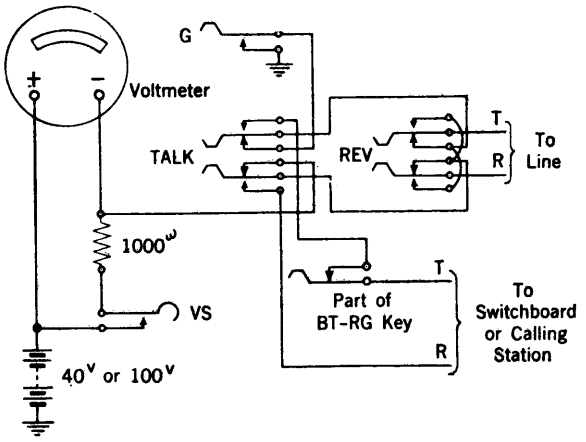

Fig. 1 - Simplified Schematic of Voltmeter Test Circuit.

Subscriber Lines Without Ringing Condensers

3.15 Lines with Bridged Ringers: With connections made as covered under PREPARATION and all keys normal, a steady deflection (if any) of the voltmeter needle indicates the insulation resistance of the line (See Table 1) and should be within the limits prescribed locally. A deflection approximately equal to the test battery voltage indicates that the line is grounded. A steady deflection of less than the test battery voltage indicates a resistance ground. A deflection greater than the test battery voltage indicates a cross with the central office battery (unless the central office battery is used as test battery) or with a foreign potential.

(1) Operate the G Key - A deflection approximately equal to the test battery voltage indicates that the line is not open between the test cabinet and the nearest station.

(2) Restore the G Key.

3.16 Lines with Ringers Connected to Ground: With connections made as covered under PREPARATION and all keys normal, a deflection approximately equal to the test battery voltage indicates that one or more station ringers are connected to the ring side of the line. Absence of an appreciable deflection indicates that the ring side of the line is open or no station ringers are connected to the ring.

(1) Operate the REV Key - A deflection approximately equal to the test battery voltage indicates that one or more station ringers are connected to the tip side of the line. Absence of an appreciable deflection indicates that the tip side of the line is open or no station ringers are connected to the tip.

(2) Restore the REV Key.

(C) Insulation Breakdown Test

3.17 To test the condition of the insulation of the ring side of the line, including the ringing condensers at ring party stations, operate the BT-RG key to connect the 200-volt battery through a 100,000-ohm resistance and the 100,000-ohm voltmeter to the ring conductor of the line and ground to the tip conductor. After a few seconds delay to permit the line capacity to charge through this 200,000-ohm resistance so that bell tapping will be unlikely to occur, operate the VS key to shunt this resistance by 1000 ohms. If under this condition the meter reading is approximately zero, the line insulation is satisfactory. An appreciable deflection, however, indicates that insulation breakdown has occurred. See Fig. 2.

Note: The maximum reading on the breakdown test occurs when the insulation breaks down sufficiently to ground the line and is in the order of 30 volts.

3.18 To make an insulation breakdown test of the tip conductor, including the ringing condensers at tip party stations, operate the REV key and follow the procedure of 3.17.

Note: The breakdown test is not applicable to lines having ringers or ringing relays if such ringers or relays are not equipped with condensers.

3.19 A simplified schematic showing the parts of the testing circuit involved

in the insulation breakdown test is shown in Fig. 2.

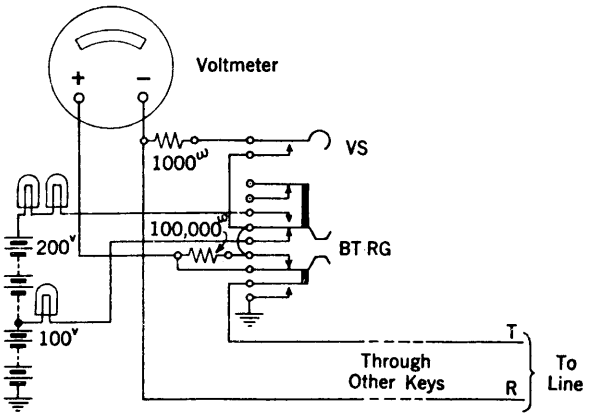

Fig. 2 - Simplified Schematic of Breakdown Test Circuit.

(D) Ringing and Talking Tests

Test Cabinet at the Switchboard

3.20 Ringing Under Normal Conditions: With the TALK key in the test cabinet operated, call the station on the line under test over the cord plugged into the TLK jack. (See 2.03 to 2.06.) This call may be made either from the switchboard, using the operator's telephone circuit, or it may be made from any convenient station, in which case connection is made in the regular way through the switchboard to the TLK jack of the local test cabinet.

3.21 Talking: When the called station answers, talk over the line and observe that the conversation in each direction is distinct.

3.22 If the test is being made on a party line, ring the other parties on the line if necessary and when the subscribers answer, note that the proper stations have been rung, talk over the line and observe that the conversation in each direction is distinct.

3.23 Ringing Under "Receiver Off Hook" Condition:

(a) Individual Lines: With connections made in accordance with 2.03 to 2.06 and the TALK key of the test cabinet operated, ring on the line using a manual ringing cord at the switchboard. When the cord circuit ringing key is operated, the subscriber's attention may be called to the telephone by the tinkling of the bell or by clicks heard in the receiver which has been left off.

(b) Party Lines: When in the case of a line having grounded ringing, it appears that a receiver has been left off the hook, stations may be called by ringing on the ring side of the line while the test cabinet TALK key and BT-RG key are both operated. This should cause all bells on the line to operate but those at ring party stations will usually receive the higher ringing voltage. To favor similarly the bells at tip party stations, ring with the REV key also operated.

Note: Restore the BT-RG key immediately after ringing, so that both sides of the line will be closed through for talking, and challenge on the line. Since ringing with the ground removed by operation of the BT-RG key should cause the subscribers at corresponding party stations on each side of the line to answer, advise each subscriber upon answering of the conditions causing the call and, unless appreciable time has elapsed since ringing, wait for the possible answer of the other subscriber also.

Test Cabinet in the Terminal Room

3.24 Calling Under Normal Conditions: With connections made as covered in 2.07 and the TALK key in the test cabinet operated, call the line under test from any convenient station, or using a hand test set connected to the terminals of another line, originate a call through the office to the line under test. Make a talking test as covered in 3.21.

(E) Resistance Measurements

3.25 Resistance values in ohms corresponding to voltmeter readings are given in Table 1. Measurements of relatively high resistances are obtained with the VS (voltmeter shunt) key normal. When, however, resistances are to be measured which are low enough so that the reading of the voltmeter is well up toward the full voltage of the test battery, use should be made of the VS key to secure a more exact measurement.

Note: The VS key is non-locking and should be held operated only long enough to secure a good reading. Unnecessary operation of the key is wasteful of testing battery.

3.26 In cases where a 40-volt testing battery is provided, when the VS key is operated, the resistance corresponding to the voltmeter reading is approximately 1 per cent. of that corresponding to the same voltage reading when the key is normal. That is, a voltmeter reading of 24 obtained

while the VS key is held operated, indicates an approximate resistance of 667 ohms whereas with the key normal, the indicated resistance is 66,700 ohms.

3.27 When the tip and ring of a subscriber line are shorted and the resistance as measured in 3.26 is in the approximate range between 100 ohms and 1000 ohms, it may be an indication that a receiver has been left off the hook.

4. REPORTS

4.01 The required record of these tests should be entered on the proper form.

TABLE 1

RESISTANCE MEASUREMENTS

Voltmeter Reading	Resistance in Ohms			
	40-Volt Test Battery	48-Volt Test Battery	100-Volt Test Battery	
	VS Key Normal*	VS Key Normal*	VS Key Normal	VS Key Operated
0	Infinite	Infinite	Infinite	Infinite
2	1,900,000	2,300,000	4,900,000	49,000
4	900,000	1,100,000	2,400,000	24,000
6	567,000	700,000	1,567,000	14,000
8	400,000	500,000	1,150,000	10,000
10	300,000	380,000	900,000	8,000
12	233,000	300,000	733,500	6,600
14	186,000	243,000	614,500	5,600
16	150,000	200,000	525,000	4,800
18	122,000	167,000	455,500	4,000
20	100,000	140,000	400,000	3,500
22	82,000	118,000	354,500	3,000
24	66,700	100,000	317,000	2,600
26	54,000	84,600	285,000	2,200
28	43,000	71,400	257,000	1,800
30	33,500	60,000	233,000	1,600
32	25,000	50,000	212,500	1,400
34	17,800	41,200	194,000	1,200
36	11,100	33,300	178,000	1,000
38	5,260	26,300	163,000	800
40	0	20,000	150,000	600
42		14,300	138,000	450
44		9,100	127,500	300
45		6,670	122,000	225
46		4,350	117,500	175
47		2,130	112,500	100
48		0	108,500	50
49			104,000	0
50			100,000	
55			81,820	
60			66,670	
65			53,850	
70			42,860	
75			33,330	
80			25,000	
85			17,650	
90			11,110	
95			5,263	
98			2,040	
100			0	

* With the VS key operated, the value of resistance is approximately one per cent. of that given.

TABLE 2

BALLISTIC DEFLECTIONS WITH 40-VOLT TEST BATTERY

These values are approximate only and are based on zero subscriber loop

Type of Line	Equipment on Line		Insulation Resistance of Line: Infinite Ohms	500,000 Ohms	200,000 Ohms	100,000 Ohms	50,000 Ohms
			Steady Deflection of Needle				
All Types	Condenser-equipped Subscriber Sets or none		0	7	13	20	27
			Ballistic Deflection of Needle				
Individual Line	No. 8A type ringer with 2 MF condenser bridged across line		41	38	36	35	34
Individual Line	No. 8A type ringer with 1 MF condenser bridged across line		30	29	28	29	31
Two-party Line	No. 8A type ringer in series with 2 MF condenser legged from one side of line to ground		21	23	25	27	30
Two-party Line	No. 8A, 8J, 8JA type ringer in series with 1 MF condenser legged from one side of line to ground		15	18	21	25	29
Two-party Line	No. 8J, 8JA type ringer in series with .5 MF condenser legged from one side of line to ground		9	13	17	22	27
Four-party Semi-Selective Line	No. 8A type ringer in series with 2 MF condenser, two stations legged from one side of line to ground		27	28	29	31	32
Four-party Semi-Selective Line	No. 8A, 8J, 8JA type ringer in series with 1 MF condenser, two stations legged from one side of line to ground		21	23	25	27	30
Four-party Semi-Selective Line	No. 8J, 8JA type ringer in series with .5 MF condenser, two stations legged from one side of line to ground		15	18	21	25	29
Four-party Full-Selective Line	No. 85 type relay with 2 MF condenser bridged across line	1 station	41	38	36	34	34
		2 stations	53	48	43	40	37
		3 stations	60	54	48	43	40
		4 stations	63	57	51	46	41
Four-party Full-Selective Line	No. 85 type relay with 1 MF condenser bridged across line	1 station	30	28	28	29	31
		2 stations	41	38	36	34	34
		3 stations	49	44	40	38	36
		4 stations	53	48	43	40	37
Four-party Full-Selective Line	No. 85 type relay in series with .5 MF condenser bridged across line	1 station	19	20	22	25	29
		2 stations	29	27	27	29	30
		3 stations	37	34	33	32	32
		4 stations	41	38	36	34	34
Eight and ten party Rural Line	No. 8J, 8JA type ringer or No. 85 type relay in series with .5 MF condenser legged from one side of line to ground	1 station	9	13	17	22	27
		2 stations	15	18	21	25	29
		3 stations	17	20	23	26	30
		4 stations	21	23	25	27	30
		5 stations	23	25	27	29	31

Resistance of ringers: 8A type 1000, 1400 or 1500 ohms; 8J type 3500 ohms; 8JA type 4300 ohms.

TABLE 3

BALLISTIC DEFLECTIONS WITH 48-VOLT TEST BATTERY

These values are approximate only and are based on zero subscriber loop

Type of Line	Equipment on Line		Insulation Resistance of Line: Infinite Ohms	500,000 Ohms	200,000 Ohms	100,000 Ohms	50,000 Ohms
			Steady Deflection of Needle				
All Types	Condenser-equipped Subscriber Sets or none		0	8	16	24	32
			Ballistic Deflection of Needle				
Individual Line	No. 8A type ringer with 2 MF condenser bridged across line		50	46	43	41	40
Individual Line	No. 8A type ringer with 1 MF condenser bridged across line		36	34	34	35	37
Two-party Line	No. 8A type ringer in series with 2 MF condenser legged condenser legged from one side of line to ground		25	27	29	32	36
Two-party Line	No. 8A, 8J, 8JA type ringer in series with 1 MF condenser legged from one side of line to ground		17	21	25	29	34
Two-party Line	No. 8J, 8JA type ringer in series with .5 MF condenser legged from one side of line to ground		11	15	21	27	32
Four-party Semi-Selective Line	No. 8A type ringer in series with 2 MF condenser, two stations legged from one side of line to ground		32	33	34	36	39
Four-party Semi-Selective Line	No. 8A, 8J, 8JA type ringer in series with 1 MF condenser, two stations legged from one side of line to ground		25	27	29	32	36
Four-party Semi-Selective Line	No. 8J, 8JA type ringer in series with .5 MF condenser, two stations legged from one side of line to ground.		17	21	25	29	34
Four-party Full-Selective Line	No. 85 type relay in series with 2 MF condenser bridged across line	1 station	50	46	43	41	40
		2 stations	65	59	53	49	45
		3 stations	71	65	59	53	48
		4 stations	75	69	62	55	50
Four-party Full-Selective Line	No. 85 type relay in series with 1 MF condenser bridged across line	1 station	36	34	34	35	37
		2 stations	50	46	43	41	40
		3 stations	59	53	49	45	43
		4 stations	65	59	53	49	45
Four-party Full-Selective Line	No. 85 type relay in series with .5 MF condenser bridged across line	1 station	22	24	26	28	34
		2 stations	35	34	33	34	36
		3 stations	43	41	39	38	39
		4 stations	50	46	43	41	40
Eight and ten party Rural Line	No. 8J, 8JA type ringer or No. 85 type relay in series with .5 MF condenser legged from one side of line to ground	1 station	11	15	21	27	32
		2 stations	17	21	25	29	34
		3 stations	21	24	27	31	35
		4 stations	25	27	29	32	36
		5 stations	27	29	31	33	37

Resistance of ringers: 8A type 1000, 1400 or 1500 ohms; 8J type 3500 ohms; 8JA type 4300 ohms.

TABLE 4

BALLISTIC DEFLECTIONS WITH 100-VOLT TEST BATTERY

These values are approximate only and are based on zero subscriber loop

Type of Line	Equipment on Line		Insulation Resistance of Line: Infinite Ohms	500,000 Ohms	200,000 Ohms	100,000 Ohms	50,000 Ohms
			Steady Deflection of Needle				
All Types	Condenser-equipped Subscriber Sets or none		0	17	33	50	67
			Ballistic Deflection of Needle				
Individual Line	No. 8A type ringer with 2 MF condenser bridged across line		106	97	91	87	85
Individual Line	No. 8A type ringer with 1 MF condenser bridged across line		75	73	72	74	77
Two-party Line	No. 8A type ringer in series with 2 MF condenser from one side of line to ground		53	57	63	69	76
Two-party Line	No. 8A, 8J, 8JA ringer in series with 1 MF condenser legged from one side of line to ground		37	44	53	62	72
Two-party Line	No. 8J, 8JA type ringer in series with .5 MF condenser legged from one side of line to ground		23	33	44	57	69
Four-party Semi-Selective Line	No. 8A type ringer in series with 2 MF condenser, two stations legged from one side of line to ground		67	70	73	77	81
Four-party Semi-Selective Line	No. 8A, 8J, 8JA type ringer in series with 1 MF condenser, two stations legged from one side of line to ground		53	57	63	69	76
Four-party Semi-Selective Line	No. 8J, 8JA type ringer in series with .5 MF condenser, two stations legged from one side of line to ground		37	44	53	62	72
Four-party Full-Selective Line	No. 85 type relay in series with 2 MF condenser bridged across line	1 station	106	97	91	87	85
		2 stations	off scale	off scale	111	102	95
		3 stations	off scale	off scale	off scale	111	101
		4 stations	off scale	off scale	off scale	117	106
Four-party Full-Selective Line	No. 85 type relay in series with 1 MF condenser bridged across line	1 station	75	73	72	74	77
		2 stations	106	97	91	87	85
		3 stations	off scale	113	103	96	91
		4 stations	off scale	off scale	111	102	95
Four-party Full-Selective Line	No. 85 type relay in series with .5 MF condenser bridged across line	1 station	47	50	56	63	72
		2 stations	74	72	71	73	77
		3 stations	93	87	83	81	82
		4 stations	106	97	91	87	85
Eight and ten party Rural Line	No. 8J, 8JA type ringer or No. 85 type relay in series with .5 MF condenser legged from one side of line to ground	1 station	23	33	44	57	69
		2 stations	37	44	53	62	72
		3 stations	47	53	59	66	75
		4 stations	53	57	63	69	76
		5 stations	59	62	67	72	78

Resistance of 8A type ringer is 1000 ohms, 1400 ohms or 1500 ohms. Resistance of the 8J type ringer is 3500 ohms. Resistance of the 8JA type ringer is 4300 ohms.

TABLE 5

BALLISTIC DEFLECTIONS FOR OPEN LOOPS IN CABLE

Test Battery Voltage	Gauge of Cable	Length of Loop	Insulation Resistance of Line				
			Infinite Ohms	500,000 Ohms	200,000 Ohms	100,000 Ohms	50,000 Ohms
40 Volts	No. 19 and 22 Gauge Cable	5 miles	13	16	19	23	27
		10 miles	20	22	24	26	30
		15 miles	25	26	27	28	31
		20 miles	28	29	29	30	32
		25 miles	31	31	31	31	33
		30 miles	33	33	32	33	33
40 Volts	No. 24 Gauge Cable	5 miles	12	15	19	23	27
		10 miles	19	20	23	26	29
		15 miles	23	24	25	27	30
		20 miles	26	27	28	29	31
		25 miles	29	29	29	30	32
		30 miles	30	30	31	31	33
48 Volts	No. 19 and 22 Gauge Cable	5 miles	16	19	23	28	32
		10 miles	25	26	28	32	35
		15 miles	30	31	32	34	36
		20 miles	34	34	35	36	38
		25 miles	37	37	37	37	39
		30 miles	39	39	38	38	40
48 Volts	No. 24 Gauge Cable	5 miles	14	18	23	27	32
		10 miles	23	25	27	31	35
		15 miles	28	29	30	33	36
		20 miles	32	32	33	35	37
		25 miles	34	34	35	36	38
		30 miles	36	36	36	37	39
100 Volts	No. 19 and 22 Gauge Cable	5 miles	33	40	50	60	71
		10 miles	52	55	60	67	75
		15 miles	64	65	68	72	77
		20 miles	72	73	74	76	80
		25 miles	78	78	78	79	82
		30 miles	83	82	81	82	84
100 Volts	No. 24 Gauge Cable	5 miles	30	39	48	59	70
		10 miles	48	52	59	66	74
		15 miles	59	62	65	70	76
		20 miles	67	68	70	74	79
		25 miles	73	74	75	77	80
		30 miles	77	77	77	79	82