

# TECHNICAL INFORMATION

FOR

## WIRE CHIEF TEST PANEL

100010

Approved: *[Signature]*

Issue 2 9/25/81

Issue 3 2/26/82

Issue 4 7/28/82

WIRE CHIEF TEST PANEL

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## WIRE CHIEF TEST PANEL

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**WIRE CHIEF TEST PANEL****SECTION I - INTRODUCTION****1. GENERAL**

- 1.01** The ITEC WIRE CHIEF TEST PANEL is a self contained circuit used to test subscribers' lines and equipment.
- 1.02** This Technical Manual is applicable to WIRE CHIEF TEST PANEL serial #020 and subsequent. Previous units may be operated in accordance with this manual except for references to common control and buzzer.

**2. DESIGN FEATURES**

- 2.01** The WIRE CHIEF TEST PANEL can access a subscriber line via the test distributor or a shoe plugged into the MDF. When the test distributor is used, the person testing may remain at the test panel to prepare for and perform tests.
- 2.02** The TEST PANEL permits line tests for:
- Foreign EMF bridged between tip and ring.
  - +/- battery on tip or ring.
  - Open circuits in line loop.
  - Short circuits in line loop.
  - Ground on tip or ring.
  - Bridged or grounded capacitance.
  - Resistance of line loop.
  - Leak resistance to ground.
  - Line leak resistance.
  - Crosses with other lines.
- 2.03** Connecting circuits to the WIRE CHIEF can be any of the following:
- Test Distributor.
  - Subscriber's line circuit.
  - Test jack box on MDF.
  - Graduated Howler.
  - Ringing Generator.
  - Dial speed test set.
  - Transmission test set.
  - Central office WC line.

**2.04 Additional functions of the TEST SET include:**

- Establishing a test connection to a line through the test distributor.
- Establishing a test connection to a line through a shoe or test clips at the MDF.
- Taking a line circuit out of lockout through the test distributor.
- Applying the howler through the test distributor or the MDF.
- Removing the howler and restoring a line to service when the subscriber replaces the handset.
- Monitor.
- Supply talking battery.
- Perform tests on central office equipment associated with line.
- Measure exchange battery voltage.
- Originate a call via a regular subscriber's line circuit.
- Give access to a dial speed test set.
- Give access to a transmission test set.
- Ring "Off Hook" station.
- Ring a subscriber through the test distributor or MDF.
- Test heat coils.

**3. WARRANTY**

**3.01** ITEC, Inc. unconditionally warrants these units to be free of defect in material or workmanship for five years from date of shipment. Any units found defective during the first year will be repaired or replaced at no charge when returned prepaid to our Huntsville facility. During the remaining four years of the warranty, a handling fee will be charged for this service. Any abuse or improper installation will void this warranty.

**3.02** A Return Material Authorization (RMA) must be obtained from the Customer Service Department (205-881-5759) prior to shipping. The following information should be included with the shipment:

1. RMA Number
2. Return shipping address
3. Contact name, and telephone number
4. Specific failure or trouble

Ship via UPS or Parcel Post to:  
 ITEC, Inc.  
 P.O. Box 4147  
 520 Green Cove Road  
 Huntsville, Alabama 35802

Adherence to this procedure will facilitate the prompt repair and return of your material.

## WIRE CHIEF TEST PANEL

## SECTION II - ENGINEERING &amp; INSTALLATION

## 1. GENERAL

1.01 This section contains detailed instructions for the installation of the ITEC WIRE CHIEF TEST PANEL.

## 2. SPECIFICATIONS

2.01 The WIRE CHIEF TEST PANEL specifications are listed in Table 2-1.

TABLE 2-1. SPECIFICATIONS

SPECIFICATION	DESCRIPTION
FUNCTIONAL:	
Voltage Measurement	0 - 60 volts scale
Resistance Measurement	Ohms scale Ohms x 100 scale (100K Ohms meter internal resistance)
Temperature	10° to 120° F.
Humidity	20% to 90%
ELECTRICAL:	
Voltages	Self-contained batteries: 90v Eveready 266 9v Eveready 490 -44 to -56vdc Office Power
Battery Life	2 years Shelf Life minimum: 4.8v for 9v battery 54v for 90v battery
MECHANICAL:	
Height	15"
Width	17" (Including Handset)
Depth	9"
Weight	28 lbs.

## 3. ORDERING INFORMATION

3.01 The WIRE CHIEF TEST PANEL is a complete unit, (order #100010) including handset and batteries. Parts may be ordered from TABLE 2-2. Connectorized cables are shown in TABLE 2-3. Two cables are required. The open ends are tinned. The WIRE CHIEF TEST Miscellaneous Block shown in Figure 2-3 is ITEC part #100239.

TABLE 2-2. PARTS LIST

ITEM #	PART #	DESCRIPTION	MTD.ON	QTY.
1	PD-1074	Cabinet	1	1
2	160324-L	Key	1	11
3	16006-L	Key	1	1
4	160312-L	Key	1	5
5	160312D-L	Key	1	2
6	160024-L	Key	1	1
7	160312	Key	1	1
9	LT-49	Lamp Jack	1	17
10	LT-50-01	Red Lamp Cap	9	6
11	LT-50-03	Green Lamp Cap	9	3
12	LT-50-05	White Lamp Cap	9	4
13	LT-50-13	Clear Lamp Cap	9	3
14	55C	Switch Board Lamp	9	17
15	HLT	Fuse Holder	1	3
16	GMT 3	Fuse	15	1
17	GMT 1	Fuse	15	2
18	53-C1	2.5K Pot.	1	1
19	95459	Meter	1	1
20	4200 O.P.G.	Tone Dial Keypad	1	1
21	Type 10A	Rotary Dial	1	1
22	9-140	Jones T.B.	1	1
23	1MF-600	Network	5	1
24	65-C	Handset	1,25	1
25	14412G	Handset Cradle	1	1
26	75335	Network Assy.	1	1
27	7 x 12	Penta. T.B.	50	1
28	7-140	Jones T.B.	1	2
29	13-G	Res. Lamp	49	3
30	ARK1H	Relay	49	2
31	1111 $\pm$ 1% 5W	Res.	49	1
32	4-140	Jones T.B.	26	1
33	25 $\pi$ 10W	Res.	29	2
33	MN-114B	Phone Jack	1	3
34	1275 XX	Binding Post (Red)	1	2
35	1275 XX	Binding Post (Black)	1	2
36	73731	Terminal	22,28,34,35	27
37	DPST	Toggle Switch	1	1
38	1"	Grommet	1	1
39	97070	Knob	18	1

TABLE 2-2. PARTS LIST (Cont.)

ITEM #	PART #	DESCRIPTION	MTD.ON	QTY.
40	2MF	Cap.	34	2
41	1.2K	Res.	34	1
42	1N4004	Diode	34	2
43	.25MF	Cap.	34	2
44	D3-050	Snap Type Batt. Conn.	45,46	2
45	266	ER 90V Batt.		1
46	490	ER 9V Batt.		1
47	PD-1070	Key Spacer Strip	1	1
48	PD-1070-1	Spacer	1	2
49	PD-1071	Mtg. Plate	51	1
50	PD-1072	Mtg. Bracket	1	1
51	PD-1073	Mtg. Plate Support	1	2
52	PD-1034	Mtg. Bracket	1	2
53	4X40X5/8	PHMS	21,52	5
54	#4 Lock Washer		21,52, 15	11
55	4X40	HHMSN	21,52	5
56	6X32X3/4	PHMS	22,28,26	8
57	6X32	HHMSN	22,28,26, 31	9
58	#6 Lock-Washer		22,28,26, 31	9
59	8X32X5/16	RHMS	51	5
60	8X32	HHMSN	51	2
61	12X24X1/2	RHMS	50	2
62	#8X3/4	SMS	1	2
63	LT-50-04	Blue Lamp Cap	9	1
64	A-30112-A	T.B. Assy.	49	1
65	PD-1076	Batt. Holder	1	1
66	147(HB1) 470	Bell	1	1
67	SE7F	Buzzer	1	1
68	A50B-5ft.	Cable	1&27	2
69	F-7264	Rubber Feet	1	4
70	1/4"	Rivet	1&65	4
71	CF-1082	Cable Form		1
72	94-013-82	Extended Handset Cord	24	1
73	13-A	Resistance Lamps	49	2
74	540	Stop Plate		4
75	545	Stop Plate		3
76	3K2W $\pm 5\%$	Res.	64	1
77	1.2K2W $\pm 5\%$	Res.	64	1
78	AK1AG	Relay	49	1
79	1/2"	Grommet	1	1
80	6X32X1/2"	RHMS	25, 31	5
81	#6	Star Washer	25, 31	5
82	4X40X3/4"	RHMS	15	6
83	#8	Lockwasher	64, 49	3
84	T.S. 4 pt.	4 pt cinch Terminal Strip	49	1
85	1K 3W $\pm 3\%$	Res.	64	2

TABLE 2-3. CONNECTORIZED CABLES

CABLE LENGTH (FEET)	PART #
25	651025
50	651050
75	651075
100	651100
125	651125
150	651150
200	651200

#### 4. MECHANICAL MOUNTING

- 4.01 The TEST PANEL is designed to mount on the end guard of the CDF, or it can be wall mounted if desired. Four mounting holes are provided in the back panel. Mounting hardware is not included and should be obtained locally. Toggle bolts (4ea. 3/16") should be used for wall mounting. Conduit clamps (3/4") may be used if mounting to the Main Frame. Rubber feet are on the bottom of the unit to allow setting up on any level surface where permanent mounting is not necessary.

#### 5. ELECTRICAL WIRING

- 5.01 The WIRE CHIEF TEST PANEL has two connectorized cable butt ends coming from the back panel (Fig. 2-4). Connectorized cables selected from TABLE 2-3. are connected to the butt ends and run to the WIRE CHIEF TEST Miscellaneous Block mounted on the MDF (Fig. 2-3).
- 5.02 The Office Battery and GRD are both run in the connectorized cable requiring no additional wiring to the WIRE CHIEF TEST PANEL. Office Battery (-48vdc) from the Miscellaneous Block should be run to a fuse distribution panel using a minimum of 20 gauge wire. If an ITEC Alarm Sending & Check Circuit is used, -BATT should come from pin B42 to the WIRE CHIEF.
- 5.03 In an installation using ITEC EMS switching equipment, many of the alarm lines will connect to an ITEC Alarm Sending & Check Circuit and Distributor. Refer to Figure 2-5 for a typical EMS and WIRE CHIEF TEST SET installation. For further information on the Alarm Sending & Check circuit and Test Distributor circuit refer to Circuit Drawings C600151, C600152 and C600154, also I-3005 (EMS-1 Supervisory and Miscellaneous Circuit Interconnections).

**6. STRAPPING OPTIONS**

- 6.01** The WIRE CHIEF TEST PANEL contains no internal strapping necessary for normal use. A terminal block (Fig. 5-5) and two Jones strips (Fig. 5-6) are available for unique application modifications and trouble-shooting the WIRE CHIEF.
- 6.02** The WIRE CHIEF contains two batteries, which are shipped uninstalled. Mount the batteries as shown in Fig. 2-2 and ensure proper polarity of the battery clips. The batteries have normal shelf life of two years. Replace the batteries at least every two years, or a minimum of 4.8 volts for the 9 volt and 54 volts for the 90 volt battery.

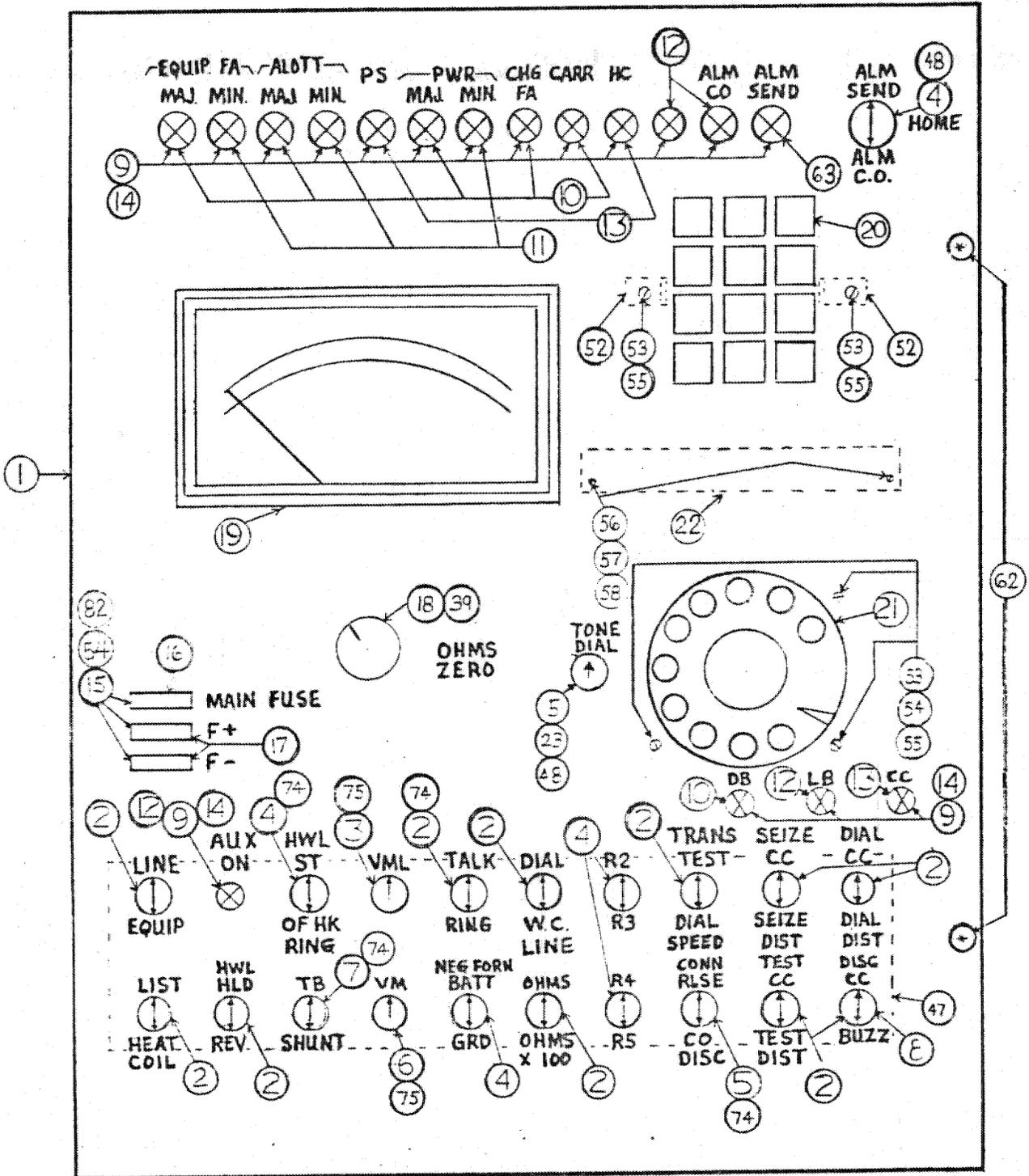


Figure 2-1. Front Panel



A	B	C	D	
T-Line	R-Line	T-EQ	R-EQ	1
T-HC	R-HC	(+)Test	(-)Test	2
(+)Line	(-)Line	P-Line	RST	3
T	R	(+)Line	(-)Line	4
(+)EQ	(-)EQ	A	B	5
T	R	A	B	6
T	R	A	B	7
1-SW	2-SW	3-SW	4-SW	8
T-A	R-A	S-A		9
T-B	R-B	S-B		10
T-Test	R-Test	S-Test		11
-BATT	-BATT			12
+GRD	+GRD			13
EO-Maj-Lp		EO-Min-Lp		14
Alt-Maj-Lp		Alt-Min-Lp		15
PS-Lp		Pwr-Maj-Lp		16
Pwr-Min-Lp		Chg-Fa-Lp		17
Carr-Lp		HC-Lp		18
Alm-CO-Lp				19
1-Alm-S	2-Alm-S	3-Alm-S	7-Alm-CO	20
8-Alm-CO	9-Alm-CO	Aud-Alm		21
T (CC)	R (CC)		S (CC)	22
BUZZ	BUZZ		Mach-St	23
GEN-1	+GRD	GEN-2	+GRD	24
GEN-3	+GRD	GEN-4	+GRD	25
GEN-5	+GRD			26

CABLE  
#1

CABLE  
#2

100239

4 x 26

NOTE: Wire straight color code. Reference Figure 2-4 on next page.

Figure 2-3. MDF Block

## CABLE #1

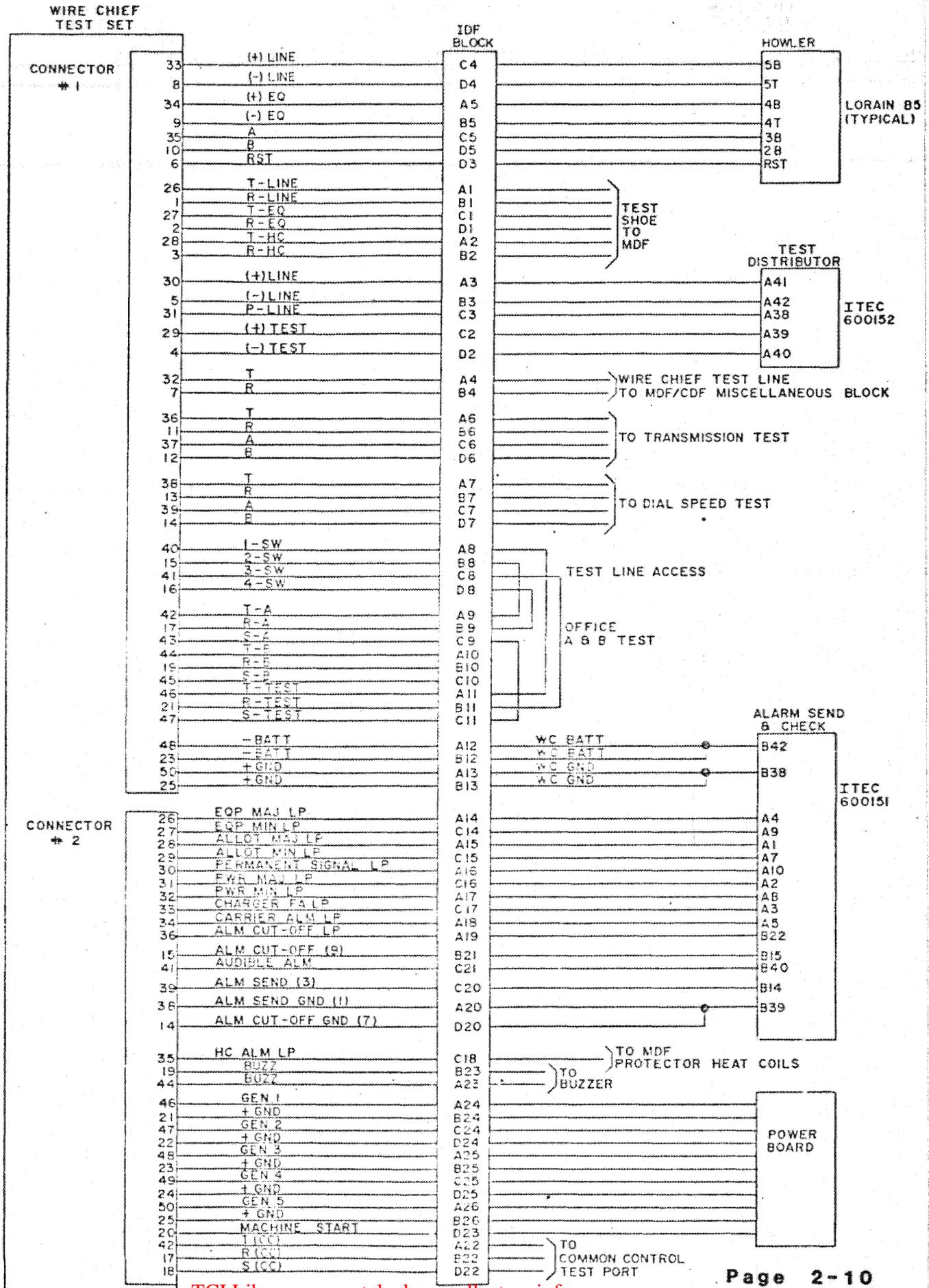
<u>IDF Block</u>	<u>Color Code</u>				<u>Color Code</u>	<u>IDF Block</u>	
A1	WHT-BLU	T-LINE	26	1	R-LINE	BLU-WHT	B1
C1	WHT-ORN	T-EQ	27	2	R-EQ	ORN-WHT	D1
A2	WHT-GRN	T-HC	28	3	R-HC	GRN-WHT	B2
C2	WHT-BRN	(+)TEST	29	4	(-)TEST	BRN-WHT	D2
A3	WHT-SL	(+)LINE	30	5	(-)LINE	SL-WHT	B3
C3	RED-BLU	P-LINE	31	6	RST	BLU-RED	D3
A4	RED-ORN	T	32	7	R	ORN-RED	B4
C4	RED-GRN	(+)LINE	33	8	(-)LINE	GRN-RED	D4
A5	RED-BRN	(+)EQ	34	9	(-)EQ	BRN-RED	B5
C5	RED-SL	A	35	10	B	SL-RED	D5
A6	BLK-BLU	T	36	11	R	BLU-BLK	B6
C6	BLK-ORN	A	37	12	B	ORN-BLK	D6
A7	BLK-GRN	T	38	13	R	GRN-BLK	B7
C7	BLK-BRN	A	39	14	B	BRN-BLK	D7
A8	BLK-SL	1-SW	40	15	2-SW	SL-BLK	B8
C8	YEL-BLU	3-SW	41	16	4-SW	BLU-YEL	D8
A9	YEL-ORN	T-A	42	17	R-A	ORN-YEL	B9
C9	YEL-GRN	S-A	43	18		GRN-YEL	D9
A10	YEL-BRN	T-B	44	19	R-B	BRN-YEL	B10
C10	YEL-SL	S-B	45	20		SL-YEL	D10
A11	VIO-BLU	T-TEST	46	21	R-TEST	BLU-VIO	B11
C11	VIO-ORN	S-TEST	47	22		ORN-VIO	D11
A12	VIO-GRN	-BATT	48	23	-BATT	GRN-VIO	B12
C12	VIO-BRN		49	24		BRN-VIO	D12
A13	VIO-SL	+GRD	50	25	+GRD	SL-VIO	B13

## CABLE #2

<u>IDF Block</u>	<u>Color Code</u>				<u>Color Code</u>	<u>IDF Block</u>	
A14	WHT-BLU	EQ-MAJ-LP	26	1	BLU-WHT	B14	
C14	WHT-ORN	EQ-MIN-LP	27	2	ORN-WHT	D14	
A15	WHT-GRN	ALT-MAJ-LP	28	3	GRN-WHT	B15	
C15	WHT-BRN	ALT-MIN-LP	29	4	BRN-WHT	D15	
A16	WHT-SL	PS-LP	30	5	SL-WHT	B16	
C16	RED-BLU	PWR-MAJ-LP	31	6	BLU-RED	D16	
A17	RED-ORN	PWR-MIN-LP	32	7	ORN-RED	B17	
C17	RED-GRN	CHG-FA-LP	33	8	GRN-RED	D17	
A18	RED-BRN	CARR-LP	34	9	BRN-RED	B18	
C18	RED-SL	HC-LP	35	10	SL-RED	D18	
A19	BLK-BLU	ALM-CO-LP	36	11	BLU-BLK	B19	
C19	BLK-ORN	SPARE LP	37	12	ORN-BLK	D19	
A20	BLK-GRN	1-ALM-S	38	13	2-ALM-S	GRN-BLK	B20
C20	BLK-BRN	3-ALM-S	39	14	7-ALM-CO	BRN-BLK	D20
A21	BLK-SL	8-ALM-CO	40	15	9-ALM-CO	SL-BLK	B21
C21	YEL-BLU	AUD ALM	41	16		BLU-YEL	D21
A22	YEL-ORN	T (CC)	42	17	R (CC)	ORN-YEL	B22
C22	YEL-GRN		43	18	S (CC)	GRN-YEL	D22
A23	YEL-BRN	BUZZ	44	19	BUZZ	BRN-YEL	B23
C23	YEL-SL		45	20	MACH-ST	SL-YEL	D23
A24	VIO-BLU	GEN-1	46	21	+GRD	BLU-VIO	B24
C24	VIO-ORN	GEN-2	47	22	+GRD	ORN-VIO	D24
A25	VIO-GRN	GEN-3	48	23	+GRD	GRN-VIO	B25
C25	VIO-BRN	GEN-4	49	24	+GRD	BRN-VIO	D25
A26	VIO-SL	GEN-5	50	25	+GRD	SL-VIO	B26

**Figure 2-4. Connectorized Cables**

Figure 2-5. Typical Installation



## WIRE CHIEF TEST PANEL

## SECTION III - OPERATING PROCEDURES

## 1. GENERAL

1.01 All tests performed at the WIRE CHIEF TEST PANEL are the same regardless of the access, ie; CC, TEST DIST or MDF shoe. Only the setup method differs.

1.02 Testing via the EMS-1 or SXS Test Distributor or the Common Control Test trunk is performed in the same manner. When testing via a Test Distributor all setup keys are operated down. When testing via a Test Trunk, all keys are operated up. See Summary of Key Operations in TABLE 3-1. for more information.

## 2. TESTING VIA TEST DISTRIBUTOR OR TEST TRUNK

2.01 Observe that DB is not lighted indicating that Test Distributor is idle. Operate **SEIZE DIST** and **DIAL DIST** keys and dial number desired. The DB lamp will light indicating you have busy-ed the Distributor.

Flashing LB lamp or steady LB lamp and busy tone indicates connector busy condition. When above signal is removed, connector has become idle and dialing may proceed.

Steady LB lamp without tone indicates line busy condition. Restore key **DIAL DIST** and operate keys **LIST** and **TEST DIST** to monitor line to determine whether conversation is taking place or if line fault has caused the busy condition.

Lamp LB will extinguish when line becomes free. Line will be seized by test train and may then be tested. Key **TEST DIST** closes the circuit to the TEST leads.

## 2.02 MONITORING

Restore **DIAL DIST** and operate **LIST** to monitor conversation on line being tested.

## 2.03 REMOVING LINE FROM LOCK-OUT

If lamp LB lights and it is known that the line is in lockout, it can be taken out of lockout by operating the **TEST DIST** and **SHUNT** keys. When the line goes out of lockout, the LB lamp will extinguish. If the lamp does not extinguish, the line loop of the particular subscriber is probably too short and the line circuit cannot be taken out of lockout via the Test Distributor. This line will have to be accessed via the MDF.

TABLE 3-1. SUMMARY OF KEY OPERATIONS

TEST	SWITCH	FUNCTION
TEST DISTRIBUTOR (EMS or SXS Systems).	SEIZE DIST	Seize Test Distributor
	DIAL DIST	Dial Test Distributor
	CONN RLSE	Release Test Connector
	CO DISC	Release Cut-Off Relay
	TEST DIST	Close Ckt. to TEST leads
	HWL HOLD	Place Distributor in Control of Howler
TEST TRUNK (Common Control Systems).	SEIZE CC	Seize Test Trunk
	DIAL CC	Dial Test Trunk
	DISC CC	Release Test Trunk
	CO DISC	Release Cut-Off Relay
	TEST CC	Close Ckt. to Tip and Ring for test
	HWL HOLD	Place Test Trunk in Control of Howler
BUZZER	BUZZ (TEST CC or TEST DIST)	Place Buzzer across Tip and Ring In Test Trunk, or +Test and -Test in Test Dist Ckt.
VOLTMETER LINE TEST with LINE KEY OPERATED	VM	Leakage between Tip and Ring
	VM,GRD,REV	Ground on Ring
	VM,GRD,REV	Ground on Tip
	NEG. FOR'N BATT	Negative foreign battery on Ring
	NEG. FOR'N BATT,REV	Negative foreign Tip
	VM REV	Capacitance between Tip and Ring (Rapidly operate and restore REV key.)
	VM	Capacitance from Ring to ground
	VM, REV	Capacitance from Tip to ground

TABLE 3-1. SUMMARY OF SWITCH OPERATIONS (Cont.)

TEST	SWITCH	FUNCTION
TEST KEY FUNCTIONS	LIST	Monitor
	LINE, TALK	Talk
	LINE, RING, REV, R2, R3, R4, R5	Ring
	DIAL	Dialing Test
	HEAT COIL	Heat Coil Test
	VM NEG. FOR'N BATT	Check Exchange Battery voltage
	WC LINE	Originate Call via Auto. Eqpt.
	EQPT	Test Eqpt. Associated with Line
	HWL ST, HWL HLD	Connecting Howler Tone to the Line (Operate ST first, then HLD)
	OF'HK RING, REV, R2, R3, R4, R5	Ringing "off-hook" telephone (Divided Ringing Only)
	DIAL SPEED	Perform Dial Speed Tests
	TRANS TEST	Perform Transmission Tests
	SHUNT, TEST DIST	Take Line Circuit out of Lockout

**2.04 DIAL SPEED TEST**

The dial speed test requires a separate dial speed test unit. Only the access is provided by the WIRE CHIEF TEST PANEL.

Operate **DIAL SPEED** key. The tip and ring is extended to binding posts. The dial speed test set is now connected to the WIRE CHIEF and the subscribers' dial can be tested.

**2.05 TRANSMISSION TEST**

Operate **TRANS TEST** key. The tip and ring is extended to binding pots. An oscillator may now be connected to the WIRE CHIEF and transmitted to line under test. Testing can be done at the subscribers' telephone.

**2.06 LEAKAGE TEST - VOLTMETER METHOD**

Operate the **GRD** key. A permanent deflection of the voltmeter indicates the leakage (all or part of) was between the ring and ground. If the meter restores to zero, the leakage was solely between the tip and ring.

The amount of leakage can be computed from the following formula:

$$R = (V-E)/E \times 100,000 \text{ ohms}$$

where: V = exchange voltage  
E = meter reading with **VM** key operated.  
R = total leakage resistance.

**2.07 LEAKAGE TEST - OHMMETER METHOD**

Operate the **VM**, **OHMS x 100** and **NEG FOR'N BATT** key and adjust the **OHMS ZERO** rheostat until the meter reads zero. Restore the **NEG FOR'N BATT** key to read the resistance between tip and ring or ring and ground direct. Operate **GRD** key. If meter does not change, it indicates leakage was between ring and ground. If the meter reads high resistance after operation of the **GRD** key, this indicates the leakage was between the tip and ring, or there is a combination of tip to ring and ring to ground leakage.

The same two tests mentioned above can be performed on the tip side of the line by operation of the **REV** key.

If the resistance being measured is low, the meter can be switched to the low scale by operating of the **OHMS** key restoring the **OHMS x 100** key. The meter must be adjusted to zero again by operating **NEG FOR'N BATT** key and adjusting the **OHMS ZERO** rheostat.

**2.08 BRIDGED CAPACITANCE TEST**

Operate the **VM** key. A momentary deflection of the meter, returning to zero after a short period, indicates capacitance such as condensers in the subscriber's ringer circuit between the tip and ring or between the ring and ground. The deflection of the meter is proportional to the capacitance.

Operate **REV** key. A momentary deflection of the meter indicates capacitance between the tip and ring or between tip and ground.

Rapidly restore and operate the **REV** key several times. A steady meter deflection indicates capacitance bridged between the tip and ring.

If the indicated capacitances are satisfactory and no permanent deflection is observed in making the above tests, the outside line is in satisfactory condition.

**2.09 TEST FOR NEGATIVE FOREIGN POTENTIAL**

Restore the **VM**, **GRD** and **REV** keys

Operate the **NEG FOR'N BATT** key. A sustained deflection of the meter indicates a foreign negative potential is connected to the ring.

Operate the **REV** key. A sustained deflection of the meter indicates a foreign negative potential is connected to the tip.

**2.10 TEST FOR CROSSES BETWEEN TWO LINES**

Disconnect the central office equipment from one line at the MDF. Ground the tip side of the line and test for ground on the other line. Transfer the ground to the ring side of the line and again test for ground on the other line.

**2.11 CHECK OF EXCHANGE BATTERY VOLTAGE**

Operate the **VM** and **NEG FOR'N BATT** keys. The meter indicates the exchange battery voltage.

**2.12 TALKING**

Operate the **TALK** key to talk on the line. Operate the **TB** key to supply talking battery to the other party, if necessary.

**2.13 RINGING, RINGING OFF-HOOK**

Operate the **LINE** key, then the non-locking **RING** key to signal a subscriber whose ringer is connected between the tip and ring or between the ring and ground.

Operate the **REV** key before operating the **RING** key to signal a subscriber whose ringer is connected between the tip and ground.

To signal a subscriber on a party line where multi-frequency ringing is used, operate the appropriate frequency selecting key **R2**, **R3**, **R4**, or **R5** before operating the non-locking **RING** key.

To ring an off-hook telephone, divided ringing only, operate the **OF'HK RING** key and ring as described above.

**2.14 APPLYING HOWLER**

Before applying Howler, make certain that the line has been taken out of lock-out.

Operate **HWL ST** key and hold operated while the **HWL HLD** is operated. BE certain that the **HWL ST** key is operated first, otherwise the switch train to the distributor will be dropped. Release **HWL ST** key after the **HWL HLD** is operated. The **AUX ON** lamp and pilot lamp on the Howler will operate. The **WIRE CHIEF** may be left in this condition and the subscriber, when replacing the receiver, will be restored to service and the Howler turned off. When the subscriber hangs up, the connection and the distributor will be released.

**2.15 SELECTING ANOTHER LINE ON THE SAME LEVEL (SXS Equipment)**

After a connection is made to a line through the test distributor as explained in 2.01 another line can be seized without dropping the test train.

Operate **DIAL DIST** key. Dial a digit corresponding to the number of steps the connector is to take. The connector may be stepped from terminal to terminal by repeatedly dialing digit "1".

**LB** lamp indicates line busy.

**2.16 SELECTING ANOTHER LINE ON DIFFERENT LEVEL OF THE TEST CONNECTOR (SXS Equipment)**

With **EMS** equipment the connector does not have to be released. All terminals from 01 to 96 can be accessed by dialing additional digits as required.

Operate **CONN RLS** momentarily to release connector. With **DIAL DIST** key operated, dial last two digits (or three digits for three digit connectors) of the number of the desired line.

**LB** lamp indicates line busy.

### 2.17 **RELEASING CUT-OFF RELAY - TESTING INWARD**

If line is in lock-out, operate **SHUNT** key, then **CO DISC** while holding **SHUNT** key. To seize line, release **SHUNT** key then operate **DIAL** key after **CO DISC** to seize line and dial.

If line is not in lock-out or busy, operate **CO DISC** key then **DIAL** key to seize line and dial. The cut-off relay of the line under test will release and the central office equipment associated with the line may be tested by initiating a call back into the office via the tested line circuit.

### 2.18 **RELEASING TEST DISTRIBUTOR TRAIN**

Restore **SEIZE DIST** key.

## 3. **TESTING VIA THE MDF**

### 3.01 When tests are made via the MDF, the **TEST DIST** key should be released.

The test connection is made by plugging a test shoe into the protector of the line to be tested at the MDF. The test shoe separates the **LINE**, **EQPT**, and **HEAT COIL** leads to enable the person testing to isolate one from the other during tests.

Some protectors require pulling of the module and using a test cord with a plug to replace the module, or the use of test clips.

### 3.02 **TESTS ON OUTSIDE LINE EQUIPMENT**

Operation of **LINE** key removes the office equipment from the outside line and places the line on the test leads of the **WIRE CHIEF TEST PANEL**. Tests may now be conducted on the line.

### 3.03 APPLYING HOWLER THROUGH MDF

When the Howler is applied thru the MDF, the **LINE** must be normal. Operate the **HWL ST** key followed by the operation of the **HWL HLD** key. The **HWL ST** should be released after the **HWL HLD** is operated. The lamp on the Howler will light indicating the Howler is transmitting tone. The **AUX ON** lamp lights indicating an auxiliary equipment key is thrown. The WIRE CHIEF may be left in this condition unattended. When the subscriber replaces the receiver, the **LINE** and **EQPT** leads will be reconnected by a relay within the Howler unit and the subscriber restored to service. When the Howler pilot lamp extinguishes, the **HWL HLD** may be restored and further tests conducted.

### 3.04 TESTS ON OFFICE EQUIPMENT

Operate the **EQPT** key, thus disconnecting the outside line and connecting the voltmeter to the tip and ring of the line under test. The voltmeter reading indicates battery is being supplied to the line. Volt-ohmmeter tests for leakage, foreign potential, etc., can be made as desired.

To make a dialing test of the subscriber's central office equipment with the outside line disconnected, operate the **VM** and **NEG FOR'N BATT** keys to disconnect the voltmeter from the line and operate the **DIAL** key to connect the dial and telephone circuit to the line. When dial tone is received, dial a working level at the first selector and observe that dial tone is removed.

### 3.05 TESTING HEAT COILS

Operate the **HEAT COIL** key with the **LINE-EQPT** key in the normal position, thus connecting the voltmeter to the tip and ring of the line through the heat coils. A voltmeter reading very close to the exchange battery voltage indicates that continuity is being obtained through the heat coils. If it is desired to measure the resistance of the heat coils, the **DIAL SPEED** or **TRANS TEST** key may be operated and a shorting strap connected between the respective tip and ring. By operating the **VM, OHMS & HEAT COIL** keys, the ohmmeter is connected across a closed loop through the test set which has the heat coils in series with it. The ohmmeter reads the resistance of the short loop and heat coils directly.

**WIRE CHIEF TEST PANEL****SECTION IV - FUNCTIONAL DESCRIPTION****1. GENERAL**

- 1.01** The WIRE CHIEF TEST PANEL is a multi-functional test box with universal test capability. It can simulate the various line conditions found in all offices and measure those requiring actual meter readings. Although designed for permanent installation in an office, the WIRE CHIEF may be moved and set up in another office with very little problem due to the connectorized cabling and self-contained features.
- 1.02** Once set up for the particular test interface, ie; common control, test distributor or MDF shoe, all test performed on the WIRE CHIEF will operate as described in the following sections. When a test is to be performed on a line via the test distributor or test trunk, the MDF cord must be disconnected. For specific set-up and operating instructions refer to **Section III - Operating Procedures.**
- 1.03** Alarm Lamps are provided for the following functions:
- Equipment Fuse Alarm=Maj., Min.
  - Allotter Failure=Maj., Min.
  - Permanent Signal
  - Power=Maj., Min., Fa.
  - Carrier=Maj.
  - MDF Protector Heat Coil
  - Spare connect as Required
  - Alarm Sender & Alarm Cutoff key & Guard Lamp
- 1.04** Resistance lamps RL2 and RL3 protect the exchange battery and dry battery against an accidental short circuit.
- 1.05** Condensers RQ1 and RQ2 protect the telephone circuit from any direct voltage which might be present on a line under test.
- 1.06** Resistance lamp RL1 protects the ringing generators on accidental short circuits.
- 1.07** Resistance lamps RL4 and RL5 and resistors in parallel provide a low resistance path for the shunt current and protect against accidental grounds or foreign EMF on lines.
- 1.08** Lamp **AUX ON** indicates when one of the auxiliary equipment test keys is out of normal position.

## 2.05 LINE BUSY

If the dialed line is busy, a steady reverse battery signal without busy tone will be received from the test distributor. Steady lighting of lamp **LB** will indicate this condition to the person testing.

The person testing monitors over the +TEST and -TEST by restoring key **DIAL DIST** and operating keys **LIST** and **TEST DIST** to determine whether a conversation is taking place or if a trouble condition exists on the line.

If a trouble condition exists on the line, the person testing may proceed with whatever line tests are necessary. Key **TEST DIST** closes the testing circuit to the TEST leads.

If conversation is taking place, the person testing may hold the connection until the dialed line becomes idle or may disconnect. If the person testing waits, the line will be immediately seized by the test train when it becomes idle. Lamp **LB** will extinguish due to removal of the reverse battery signal when this occurs.

## 2.06 TAKING LINE OUT OF LOCKOUT

If the line is busy and is in lockout, the line may be taken out of lockout by operation of **TEST DIST** and **SHUNT** keys. The **SHUNT** key applies low resistance ground and battery to the +TEST and -TEST leads to shunt down the line relay in the line and group circuit.

After the line relay releases, it is prevented from re-operating by the automatic operation of the cut-off relay in the line and group circuit. The cut-off relay operates from ground on the "P" lead from the Test Distributor in the normal manner of an outgoing call.

In shunting down a relay in lockout, the shunt current must "steal" current from the line relay in order to release it. If the line loop is short, the line relay will be operating by heavy current. In this case, the shunting current must "steal" a large current in order to cause release of the line relay. For this reason, line loops of 200 ohms or less will not allow the line relay to release by this shunting method. Under this condition, the line will have to be plugged at the MDF.

After the line circuit is taken out of lockout, a metallic path, free of all bridges, is established to the subscriber's line. The Howler may then be applied or tests performed as required.

## 2.07 APPLYING HOWLER

After the line circuit has been taken out of lockout, the Howler may be applied to the line by operation of the Howler start key, **HWL ST**, followed by the operation of the Howler hold key, **HWL HLD**. It is necessary to operate the **HWL ST** key first and hold it operated while the **HWL HLD** key is operated. The **HWL ST** key may then be released after operation of **HWL HLD**.

The **HWL ST** key places ground on the RST lead to operate a control relay within the Howler. Operation of the **HWL HLD** key places the subscribers' loop in series with the Howler control relay via leads -LINE and +LINE. When the **HWL ST** key is released, the Howler control relay is in direct control of the subscribers' line loop. The Howler then applies a tone (varying from 1Khz to 8Khz while increasing in volume) on the +LINE and -LINE leads to be transmitted to the subscribers' receiver.

When the subscriber restores the receiver, the loop is opened and the Howler control relay releases. The tone is removed and the Howler is turned off automatically.

Leads A and B are wired to a "make" contact of the Howler control relay. When the **HWL HLD** key is operated, energizing the control relay, the distributor switch train is held seized by the closed contacts of the Howler control relay. When the control relay releases due to the subscriber hanging up, the loop from +LINE and -LINE to the test distributor is opened and the distributor is released. This removes the connection to the line circuit, removes ground from the P lead holding the cut-off relay operated, and restores the line to service. The subscriber may initiate a call immediately after restoring the handset.

## 2.08 TESTING OUTWARD

After the line is seized and taken out of lockout, tests on the line from the line and group circuit can be made. **LINE** key must be operated.

## 2.09 LEAKAGE TESTS - VOLTMETER

Operation of the **LINE** key connects the +TEST and -TEST leads from the distributor across the voltmeter. Operation of the **VM** key connects exchange battery via RL2 to the negative (-60v) terminal of the voltmeter and connects ground to the tip(+) side of the line. The ring(-) side of the line is then connected to the +C terminal of the meter. A sustained deflection of the meter indicates leakage between the tip and ring or leakage from ring to ground. If subsequent tests reveal that the ring is not grounded the reading obtained at this time indicates leakage between the tip and ring.

The reading of the voltmeter can be used to compute the leakage in ohms by substituting in the following formula:

$$R = (V-E)/E \times 100,000$$

Where: V = exchange voltage  
 E = meter reading  
 R = total resistance between the tip and ring

## 2.10 LEAKAGE TESTS - OHMMETER METHOD

Zero Set - Before using the ohmmeter, it is necessary to adjust the zero setting. To do this, operate keys **VM**, **OHMS x 100** and **NEG. FOR 'N BATT** and adjust the **OHMS ZERO** rheostat until the meter reading is zero on the OHMS x 100 scale. The **VM** and **OHMS x 100** keys connect negative 90 volts dry battery to the negative (-60v) terminal of the meter and shunt the **OHMS ZERO** rheostat across the moving coil element of the meter. The **NEG. FOR 'N BATT** key connects the +C terminal of the meter to direct ground. Adjustment of the rheostat varies the sensitivity of the meter so that a full scale deflection (zero reading on the OHMS scale) is obtained.

Since the internal resistance of the meter is 100,000 ohms, a half scale reading will be obtained if the meter is connected in series with an external resistance of 100,000 ohms at this rheostat setting. Thus, the OHMS x 100 scale is calibrated to read 100,000 ohms at midscale.

If the resistance to be measured is less than approximately 10,000 ohms, the **OHMS** key should be operated instead of the **OHMS x 100** key as described above. The zero setting must be reset for each scale. The **VM** and **OHMS** keys connect negative 9 volt dry battery to the "-6" volt terminal of the meter and shunt 1,111 ohms across the meter so that the effective internal resistance of the meter is 1,000 ohms. The midscale reading of the OHMS scale is, effectively calibrated to 1,000 ohms.

Resistance Measurement - with keys **LINE**, **VM** and **OHMS x 100** or **OHMS** operated, the ohmmeter is connected to the ring(-) side of the line and ground is connected to the tip(+) side of the line. The leakage resistance between the tip and ring or from ring to ground may be read directly from the **OHMS x 100** or **OHMS** scale of the meter. If subsequent tests reveal that the ring is not grounded, the reading obtained at this time indicates leakage between the tip and ring.

#### **2.11 TEST FOR GROUND ON RING SIDE OF LINE**

Operation of the **GRD** key removes the ground from the tip. With the **VM** key operated, a sustained deflection of the meter indicates that the ring is grounded. The total resistance from the point of test to ground over the ring can be computed using the same formula as explained under paragraph 2.09, or it can be measured directly by also operating the **OHMS x 100** or **OHMS** key as explained in paragraph 2.10.

#### **2.12 TEST FOR GROUND ON TIP SIDE OF LINE**

Operation of the **REV** key reverses the tip and ring. With the **VM** and **GRD** keys operated, the exchange battery is connected to the negative terminal of the meter. The positive terminal of the meter is connected to the tip. A sustained deflection of the meter indicates that the tip is grounded. The total resistance to ground over the tip can be computed by using the formula in paragraph 2.09, or it can be measured directly by also operating the **OHMS x 100** or **OHMS** key as explained in paragraph 2.10.

#### **2.13 TEST FOR BRIDGED OR GROUNDED CAPACITY**

The **VM** key is operated to test for capacitance between the tip and ring or between the ring and ground. As the line condensers are charged by the battery, the meter will give a momentary deflection proportional to the capacitance, then return to zero.

#### **2.14 TEST FOR FOREIGN POTENTIAL**

With only the **LINE** key operated, the positive terminal of the voltmeter is connected to the tip and the negative terminal to the ring. The voltmeter indicates any foreign potential bridged across the line. The **REV** key is operated if a negative or no reading is observed.

Operation of the **NEG FOR'N BATT** key connects ground to the positive terminal of the voltmeter. The negative terminal of the voltmeter is connected to the ring. A sustained deflection of the meter indicates that the ring is connected to a foreign negative potential.

Operation of the **NEG FOR'N BATT** and **REV** keys connects ground to the positive terminal of the voltmeter and connects the negative terminal of the voltmeter to that tip. A sustained deflection of the meter indicates that the tip is connected to foreign negative potential.

If any of the above voltage readings are below 6 volts, the **VOLTS-LOW** key may be operated to obtain a more accurate reading. With this key operated, a full-scale deflection is obtained with 6 volts instead of 60 volts.

The **VOLTS-LOW** key should be used with caution as potentials in excess of 6 volts may damage the meter on the low voltage scale.

## 2.15 TEST FOR CROSSES WITH OTHER LINES

To test for a cross between the line under test and a second line, the exchange equipment of the second line is disconnected at the main frame, the tip of the second line is grounded, and a test is made on the first line for ground as described in paragraph 2.11 and 2.12. The ground is then transferred from the tip to the ring of the second line and the test for ground on the first line is repeated.

## 2.16 TALKING

Operation of the **TALK** key with the **LINE** key operated connects the operator's telephone circuit to the tip and ring of the line through condensers RQ1 and RQ2 and connects battery and ground through battery feed coil BF-2 to the telephone circuit to provide transmitter battery.

Operation of the **TB** key connects battery and ground through battery feed coil BF-1 to the tip and ring of the line to provide transmitter battery for the subscriber or repairman.

## 2.17 RINGING

Operation of the non-locking **RING** key with the **LINE** key operated connects uninterrupted ringing current to the ring, and ground to the tip to operate the ringer connected between the tip and ring or between the ring and ground on an individual line.

Operation of the **REV** key reverses the tip and ring so that ringing current is applied to the tip in order to operate a ringer connected between the tip and ground.

Operation of one of the locking frequency selecting keys **R2, R3, R4, or R5** replaces frequency #1 by one of the other frequencies on the contacts of the **RING** key so that any party may be rung.

### **2.18 MONITORING**

Operation of the **LIST** key connects the operator's telephone circuit to the line under test through condensers **RQ3** and **RQ4**.

### **2.19 DIAL SPEED TEST**

Operation of **DIAL SPEED** key extends the tip and ring to terminals or a jack to be used by a dial speed test set. The subscriber or repairman may then dial digits into the office and they can be tested through this key by the dial speed test set.

### **2.20 TRANSMISSION TEST SET**

Operation of the **TRANS TEST** key extends the tip and ring to terminals or a jack in order to connect a transmission test set to the **WIRE CHIEF**. A 1,000 Hertz generator may be applied to the line and measured by the repairman at the subscriber's phone.

### **2.21 TESTING INWARD**

Operation of locking key **CO DISC** connects ground to the **-LINE** lead and opens the loop to the test distributor train. This signal causes the line cut-off relay to be released. By operating the **DIAL** key, the person testing may operate the line relay of the dialed line and may, by dialing, initiate a call back into the exchange, simulating a call from a subscriber on the line under test. Operation of the **VM** and **FOR'N BATT** keys removes the voltmeter from the test circuit.

### **2.22 SELECTING ANOTHER LINE ON THE SAME LEVEL OF THE TEST CONNECTOR**

When testing of a line has been completed, the test connector may be advanced to another line on the same level by re-operating the **DIAL DIST** key and dialing the digit corresponding to the number of steps the connector must take to reach the desired line. The new line will be tested for idle or busy as before.

## 2.23 SELECTING ANOTHER LINE ON A DIFFERENT LEVEL OF THE TEST CONNECTOR

When testing of a line has been completed, the test connector may be released by a momentary operation of the non-locking **CONN RLS** key. The test connector restores but remains busy to other switches and may be stepped to a new level and line by re-operating key **DIAL DIST** and dialing the last two (or three, if required) digits of the desired number.

## 2.24 TESTING VIA COMMON CONTROL

The Wire Chief can access via 3-wire common control allowing the person doing the testing to remain at the test set to prepare for and perform tests.

2.25 All tests as explained for testing via Test Distributor in **Section III**, paragraph 2. are applicable to testing via common control except the following keys will operate in up position:

- **TEST CC**
- **SEIZE CC**
- **DIAL CC**
- **DISC CC**

## 2.26 TEST VIA SHOE MDF - "PLUGGING UP LINE"

During tests through the MDF, the **TEST DIST** key must be restored. The same basic tests can be performed via the MDF as those via the Test Distributor. The important difference is that by "plugging up" the line, the office equipment can be isolated from the outside line equipment.

## 2.27 TESTING OUTWARD

By operating the **LINE** key, the outside plant is removed from the equipment of the office. Tests can then be performed on the line as explained in paragraphs 2.09 through 2.20.

## 2.28 TESTING INWARD

Operation of the **EQPT** key disconnects the outside line and connects the voltmeter across the tip and ring of the equipment under test. The voltmeter indicates the battery impressed on the line through the line relay.

## 2.29 VOLTMETER TESTS

The central office wiring and equipment can be tested for ground, foreign battery, etc., as described.

## 2.30 DIALING TEST (Tone Dial)

Operation of the **DIAL** key connects the operator's telephone circuit and Tone Dial to the tip and ring of the line under test. Operation of the **VM** and **NEG FOR'N BATT** key removes the voltmeter from the circuit as described in paragraph 2.02. The line is seized through the Tone Dial and the operator's telephone circuit. When dial tone is heard, the Tone Dial is operated to establish a connection. Tones from the key set will be transmitted on the same path as dial pulses.

## 2.31 DIAL TEST (Rotary Dial)

Operation of the **DIAL** key connects the operator's telephone circuit to the tip and ring of the line under test. Operation of the **VM** and **NEG FOR'N BATT** key removes the voltmeter from the circuit as described in paragraph 2.03. The line is seized through the dial network and operator's telephone circuit. When dial tone is heard, the **ROTARY DIAL** key is operated and the dial is dialed to establish a connection. When all numbers are dialed the **ROTARY DIAL** key is restored putting the handset back across tip and ring.

## 2.32 CONTINUITY TESTING

Continuity of Tip and Ring in a Test Trunk circuit is with a buzzer (Fig. 5-9) by operation of the **BUZZ** and **TEST CC** keys. +Test and -Test leads in the Test Distributor are checked by buzzer with the **BUZZ** and **TEST DIST** keys. When using test clips, only the **BUZZ** key is operated. An external buzzer is required. (Not supplied with the **WIRE CHIEF**).

## 2.33 2-WAY WIRE CHIEF LINE

Operation of the **WIRE CHIEF LINE** key connects the rotary dial or the **TONE DIAL** key pad, via the **TONE DIAL** key, and telephone circuit to the tip and ring of a regular subscriber's line circuit. When dial tone is heard in the receiver, the **TONE DIAL** key pad or rotary dial is operated to establish a connection. When the tone dial is used, the **TONE DIAL** key must be operated during dialing and then restored for conversation. When the call is answered, conversation can take place.

An incoming call to the WIRE CHIEF is signaled by a telephone ringer. To answer, operate the WIRE CHIEF **LINE** key and the ringer is removed from the WIRE CHIEF line and conversation can take place. Upon completion of the conversation, the WIRE CHIEF **LINE** key must be restored.

#### 2.34 CHECKING THE EXCHANGE VOLTAGE

Operation of the **NEG FOR'N BATT** and **VM** keys connect ground to the positive terminal of the meter and connect the exchange battery through resistance lamp RL2 to the negative terminal of the meter. The meter indicates the exchange battery voltage.

#### 2.35 TESTING HEAT COILS

Operation of the **HEAT COIL** key connects the voltmeter to the tip and ring of the line through the heat coils. The voltmeter indicates the battery impressed on the line through the line relay.

#### 2.36 CONNECTING THE HOWLER

When the subscriber inadvertently leaves the handset off-hook, the Howler can be placed on the line through the MDF. Operation of the **HWL ST** and **HWL HLD** key disconnects the line from the equipment side and connects the -LINE and +LINE leads of the Howler to the tip and ring of the line. The Howler will then transmit tone on the tip and ring. The subscriber's closed loop will hold the Howler control relay operated within the Howler. When the subscriber restores the hand set, the control relay will release and connect -LINE to -EQPT and +LINE to +EQPT. The subscriber's line circuit is immediately reconnected to the equipment leads to restore service. After the control relay releases, a Howler pilot lamp located on the Howler unit will extinguish. The WIRE CHIEF operator upon observing that the Howler has stopped may then restore the **HWL HLD** and/or remove the shoe from the MDF. When the Howler is applied through the MDF, the A and B leads to the Howler have no function. These leads are necessary only when the Howler is applied via the test distributor.

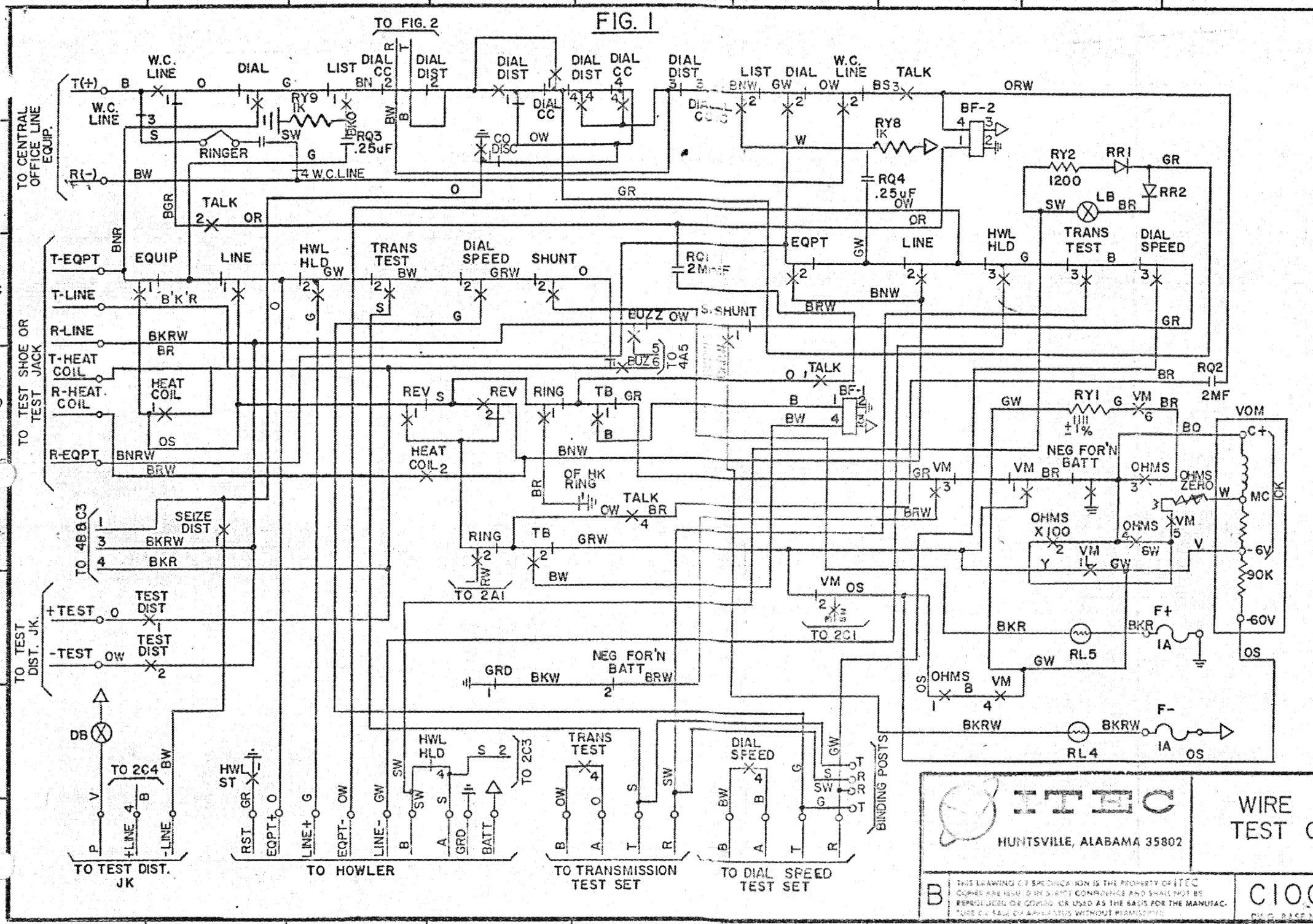
#### 2.37 RINGING "OFF-HOOK" TELEPHONE

If the subscriber fails to hang up, the "off-hook" telephone may be rung. Operation of key **OF HK RING** disconnects the ground return path for the ringing generator and allows the telephone to be rung.

2/5/82

WIRE CHIEF TEST PANELSECTION V - DRAWINGSWire Chief Test Circuit      C100010

Figure	Description	Page
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5-2	Rotary Dial. . . . .	5-2
5-3	Alarm Lamps & Co Key .	5-2
5-4	Test Line Access . . .	5-2
5-5	Terminal Block . . . . .	5-3
5-6	Jones Strips . . . . .	5-3
5-7	Connectors . . . . .	5-3
5-8	Common Control Relay .	5-4
5-9	Buzzer . . . . .	5-4



CHANGES	APPD.
ISSUE 1	
MLR 1-4-80	A
ADDED RINGER & CHANGED OGT KEY TO W.C. LINE	MLR 2-21-80
REMOVED RES. ACROSS RL4 & RL5 & CHANGED LAMPS TO 13A ISS. 4	MLR 7-2-80
CHG. PER ITEC ECO NO 1762 ISS. 5	MLR 2-13-81
ADDED CC FEATURE FIG. 8 & 9 SH. 4 ISS. 6 8-18-81	MLR 8-18-81
CHG. PER ITEC ECO NO 2199 ISS. 7 2-3-82	
CHG. KEY PAD TO 4200 O.P.G., ADDED RY8 & RY9. ADDED FIG. 10. ISS. 8 8-5-82	


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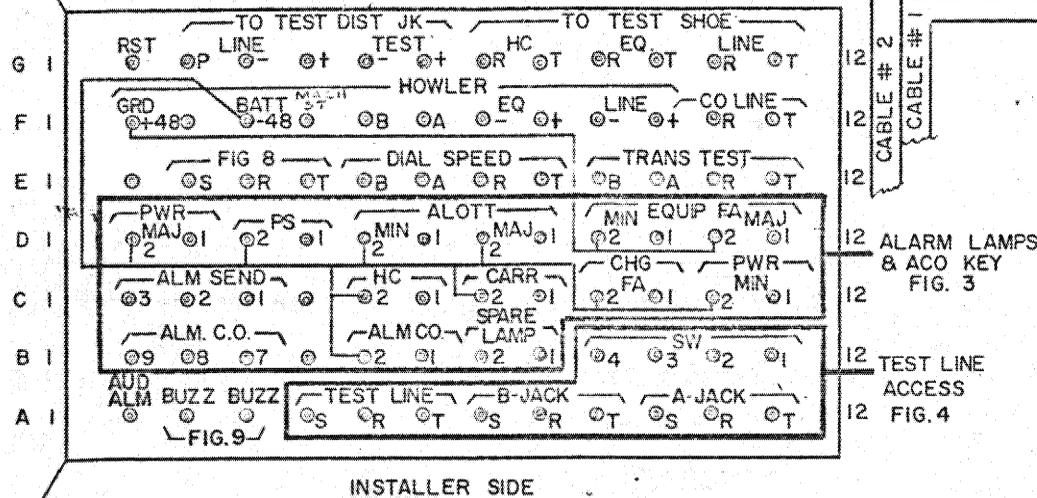
**WIRE CHIEF  
 TEST CIRCUIT**

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**C100010**  
 SH 1 OF 4

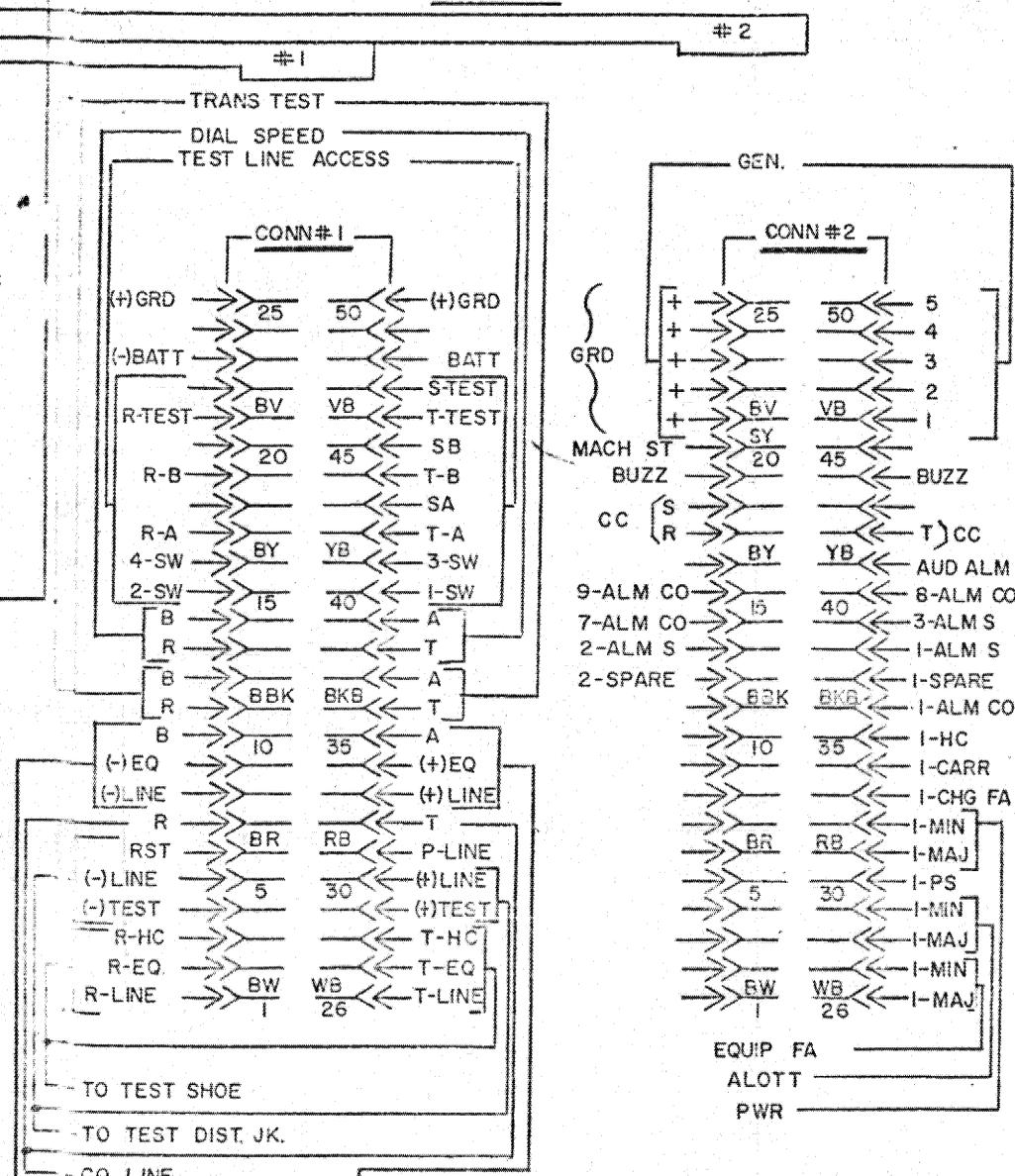


**FIG. 5**  
TERMINAL BLOCK

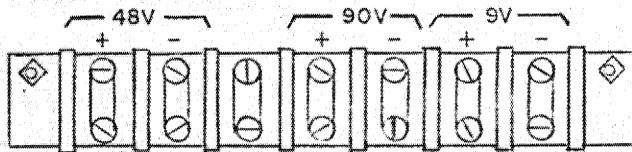


INSTALLER SIDE

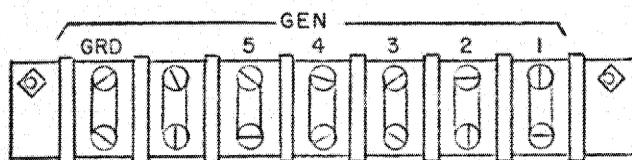
**FIG. 7** CONNECTORS



**FIG. 6** JONES STRIPS

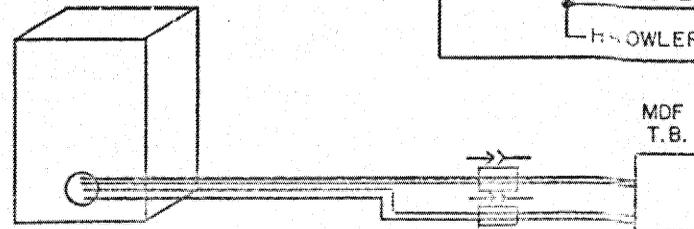


INSTALLER SIDE



INSTALLER SIDE

**CABLING SCHEME**



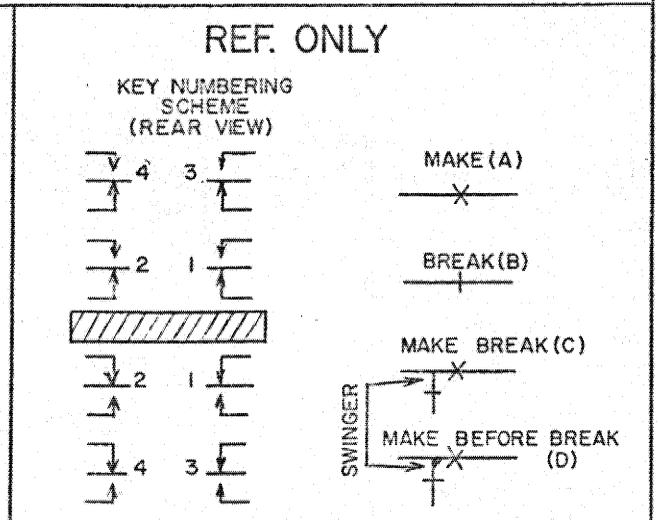
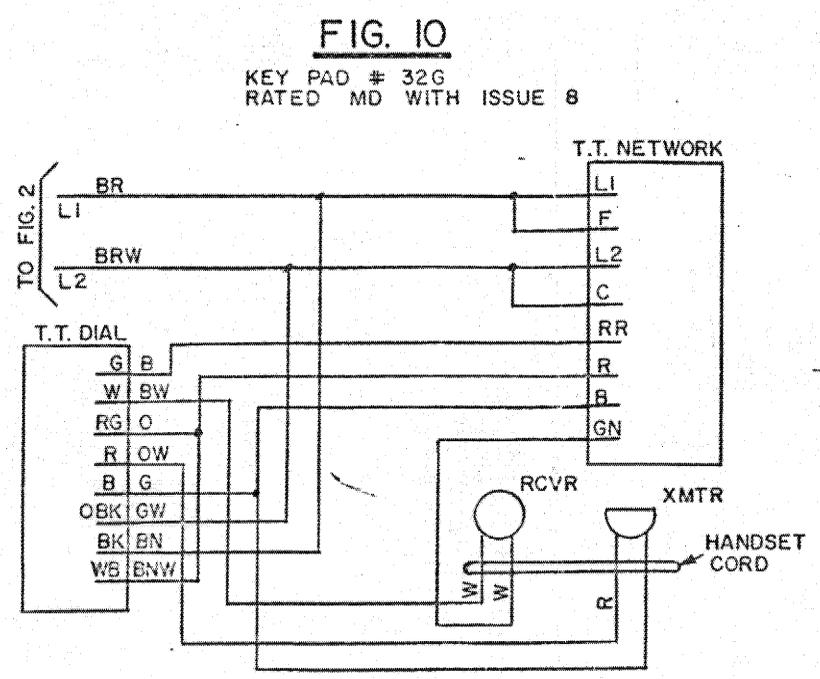
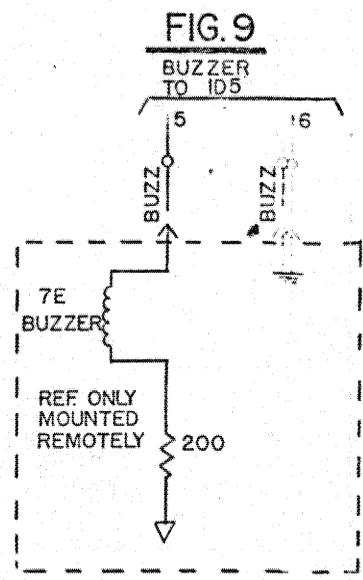
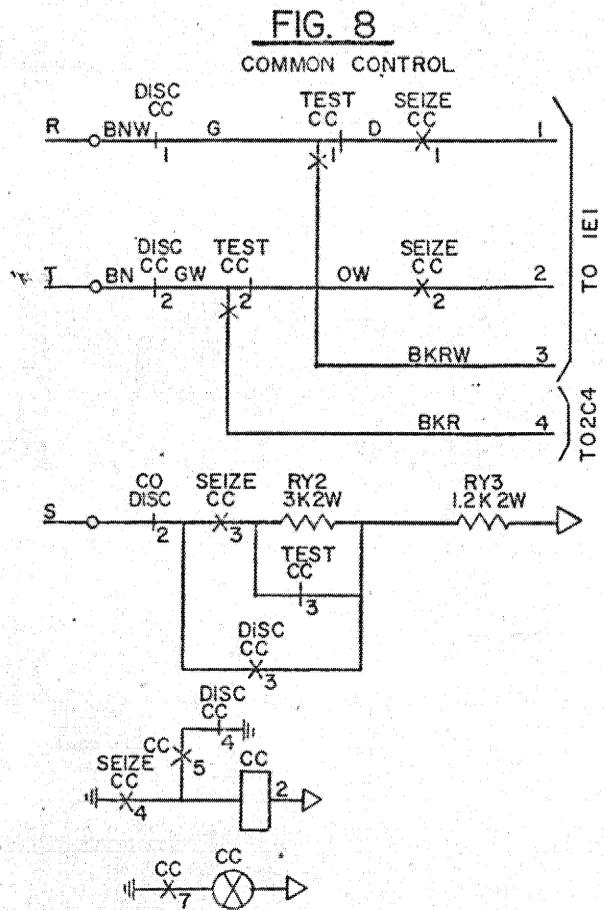
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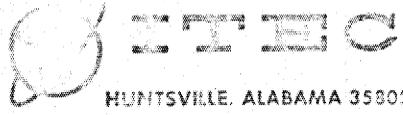
WIRE CHIEF  
TEST CIRCUIT

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REARRANGED & ADDED SPARE LAMPS 1 & 2 ALSO ADDED FIG. 7	MLR 2-26-80
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ISS.4	MLR 7-2-80
ISS.5	MLR 2-13-81
ISS.6	MLR 8-18-81
ISS.7	
ISS.8	





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TEST CIRCUIT

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