

**SYSTEM CENTURY®
DIGITAL CENTRAL OFFICE**

**WIRE CHIEFS TEST SET
(814451-018 AND 814451-118)
DESCRIPTION, INSTALLATION, TEST PROCEDURES, OPERATION, AND MAINTENANCE**

CONTENTS

Par.		Page	Par.		Page
1.	Introduction	2	10.	Calibration	56
2.	Related Information	2	10.01	Meter Calibration/ Operational Check	56
2.01	General	2	10.02	Calibration of Meter for Resistance Readings	57
2.02	Related Publications	2	10.03	Calibration of Meter for Ac Voltage Readings	58
2.03	Related Drawings	2	10.04	Calibration of Meter for Current Readings	58
	PART I. GENERAL		10.05	Calibration of Meter for Capacitance Readings	58
3.	Preliminary Information	4	11.	Tests Using Office Line	59
3.01	Purpose and Use	4	11.01	Placing Call With Hand Test Telephone	59
3.02	System Application	4	11.02	Answering Incoming Call	59
3.03	Capabilities	4	12.	Tests Using Test Ports	59
3.04	Physical Description	5	12.01	General	59
3.05	Technical Characteristics	5	12.02	Line Testing	59
4.	Test Equipment Needed	5	12.03	Testing Outside Plant	60
	PART II. INSTALLATION AND PRECUTOVER TEST PROCEDURES		12.04	Testing Inside Plant	60
5.	Mounting Instructions	6	13.	Testing Through Test Shoe	60
6.	Wiring Instructions	6	13.01	Test Connection	60
7.	Prerequisite Tests	6	13.02	Preliminary (Monitoring) Test	60
8.	Operational Tests	6	13.03	Testing Outside Plant	60
8.01	Input Power Check and Lamp Test	6	13.04	Testing Inside Plant Bypassing Heat Coils	60
8.02	Meter Test	9	13.05	Testing Inside Plant Through Heat Coils	60
8.03	Coin Collect and Coin Return Test	20	13.06	Outgoing Call Through Outside Plant	60
8.04	Primary Test Path Test	24	13.07	Originating Call Through Dial Equipment-Regular Lines or Trunks	61
8.05	Secondary Test Path Test	30	13.08	Originating Calls to PBX Lines or Special Lines	61
8.06	Office Line Test	36	13.09	Originating Calls Through Incoming Ringdown Trunks	61
8.07	MDF Access Test	40			
8.08	Miscellaneous Function Test	46			
	PART III. OPERATING INSTRUCTIONS				
9.	Controls and Indicators	50			

Par.	Contents (Cont)	Page
13.10	Originating Calls Through Incoming Common-Battery Trunks	62
14.	Testing Through Binding Posts	62
14.01	General	62
14.02	Potential Tests	62
14.03	Ringling	62
14.04	Transmission Battery	62
14.05	Dialing	63
15.	Heat Coil Test	63
16.	Testing for Negative Battery on Tip or Ring Lead	63
17.	Measuring Line Battery Voltage	63
18.	Testing for Foreign Ac Voltage on Line	63
19.	Testing for Ground on Tip or Ring Lead	64
20.	Measuring Line Loop Resistance and Leakage	64
21.	Measuring Line Capacitance	64
21.01	Tip-to-Ground Capacitance	64
21.02	Ring-to-Ground Capacitance	64
21.03	Loop Capacitance	64
22.	Receiver Off-Hook Notification Using Generator Ground Cutoff	65
23.	Receiver Off-Hook Tone (Howler) Usage	65
24.	Paystation Testing	65
24.01	General	65
24.02	Coin-Return Test	65
24.03	Coin-Collect Test	65

PART IV. FUNCTIONAL DESCRIPTION

25.	General	66
26.	Pushbutton/Relay Operation	66
26.01	Typical Operation	66

PART V. MAINTENANCE

27.	Performance Routines	70
28.	Repair and Replacement	70

ILLUSTRATIONS

Fig.		Page
1.	Wire Chiefs Test Set Orientation Diagram	4
2.	Controls and Indicators	50
3.	Typical Pushbutton/Relay Circuit	66
FO-1.	Wire Chiefs Test Set, Block Diagram	71

1. INTRODUCTION

1.01 This section provides a general description, installation instructions, precutover test procedures, operating instructions, a circuit description, and maintenance information for the wire chiefs test set used with the SYSTEM CENTURY Digital Central Office (DCO).

1.02 This section is reissued to revise the functional description of the MDF button in table 1, to change the meter readings in paragraph 10.05, and to change the sequence of procedures in paragraph 13.06.

2. RELATED INFORMATION

2.01 General.

A Sales and Instructional Literature Index of latest available publications can be obtained from your Stromberg-Carlson sales representative or from Publications Services, Stromberg-Carlson Corporation, P.O. Box 1698, Sanford, Florida 32771.

2.02 Related Publications.

The following publications are recommended for use with this document:

01-015-10	Flow Chart Symbols and Interpretations
01-025-05	Glossary of Digital Switching Terms and Abbreviations
23-001-20	SYSTEM CENTURY DCO, Installation Instructions
23-001-25	SYSTEM CENTURY DCO, Precutover Test Plan
23-001-53	SYSTEM CENTURY DCO, Fault Printout Interpretation
75-089-10	Multiline Telephone Test Set, Description, Operation, and Maintenance

2.03 Related Drawings.

a. The schematic diagram and description of each circuit listed below is recommended for use with this document. Each circuit is identified by a six-digit base number. A schematic or circuit description is

identified by prefixing a base number with S- or DS- respectively.

<u>BASE NUMBER</u>	<u>NAME</u>
814451	Wire Chiefs Test Panel
814452	Wire Chiefs Test Panel Transformer Card
814453	Wire Chiefs Test Panel Card 1
814454	Wire Chiefs Test Panel Card 2
814455	Wire Chiefs Test Panel Card 3

b. One or more of the following drawings are needed when installing the wire chiefs test set:

207521-023	Wall Mounting Locator
E-49977-105	Wire Chief Mounting Assembly to CDF

c. One of the following drawings is required when ordering and replacing parts, depending on model being used:

814451-018	Wire Chiefs Test Panel Assembly
814451-118	Wire Chiefs Test Panel Assembly

PART I. GENERAL

3. PRELIMINARY INFORMATION

3.01 Purpose and Use.

The wire chiefs test set provides access to subscriber lines, both outward to the subscriber and inward at the DCO. Access to E&M leads is also provided. Calls can be originated or terminated at the test set. Jacks are provided on the test set for the connection of external test equipment.

3.02 System Application.

A block diagram illustrating the application of the wire chiefs test set in a DCO is shown in figure 1 and is described in the following paragraphs.

a. Test Access Selectors.

Access to subscriber lines is through the DCO test access selector switching network, which provides access to primary and secondary tip and ring and E&M leads.

b. Office Line.

The office line is assigned a directory number and functions as a subscriber line. The test set uses this directory number to receive and originate calls through the DCO.

c. Test Shoe.

The test set contains a test shoe circuit. The test shoe permits testing, without going through the

switching equipment, of all lines and trunks that terminate on the protector blocks of the main distributing frame (MDF). The test shoe must be manually inserted into the protector of the line or trunk to be tested.

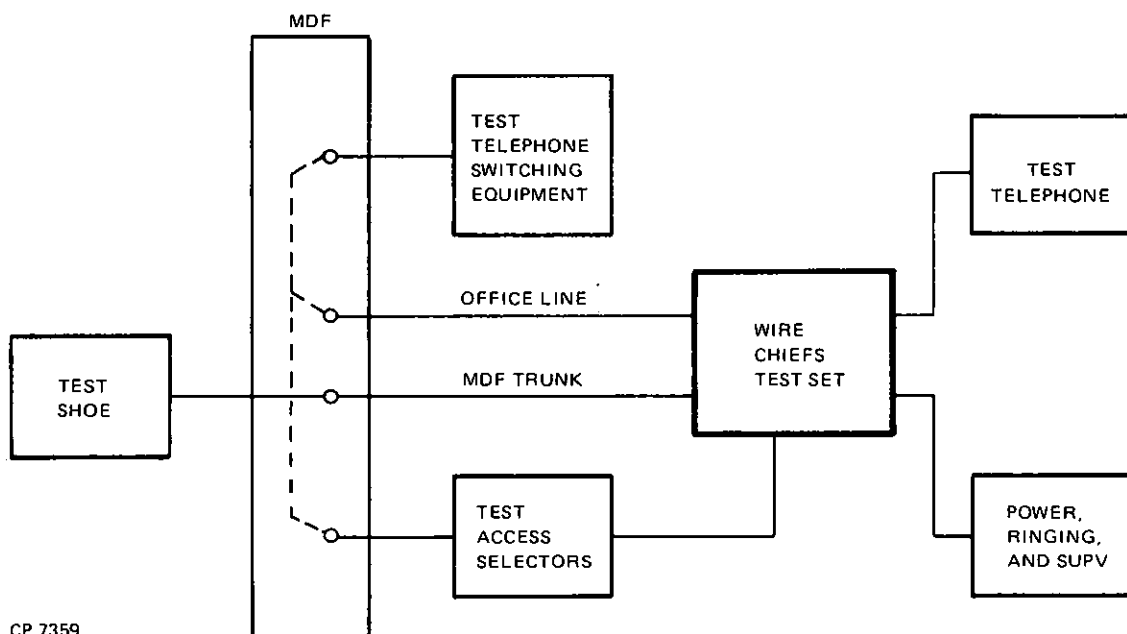
d. Power, Ringing, and Supervisory.

These elements are provided by the DCO.

3.03 Capabilities.

Testing facilities for the following principal functions are available:

- a. Tip, ring, and loop capacitance.
- b. Tip, ring, and loop ground.
- c. Loop resistance.
- d. Tip and ring battery.
- e. Loop current.
- f. Ringing.
- g. Howler with automatic cut-off and restoration of service.
- h. Reversal of test leads.



CP 7359

Figure 1. Wire Chiefs Test Set, Orientation Diagram

- i. Dial pulsing.
- j. Talking path.
- k. Monitoring at MDF heat coils.

3.04 Physical Description.

The test set is housed in a metal cabinet with the controls and indicators mounted on a hinged front panel. Mounting holes in the rear of the cabinet allow for mounting on the end of the MDF or on a wall. The test set can also be placed on a cart and used as a portable unit. Dimensions of the test set are as follows:

- a. Height: 17-3/4 inches (45.1 cm)
- b. Width: 19-3/16 inches (48.7 cm)
- c. Depth: 10-3/4 inches (27.3 cm)
- d. Weight: 44 pounds (20 kg)

3.05 Technical Characteristics.

- a. Battery voltage: 44 to 54 volts dc.
- b. Rotary dial operation:
Speed 8 to 12 pps
Percent make 33 to 45%

c. Dual-tone multifrequency operation.

The tone pairs used for DTMF signaling are as follows, with allowable variation in frequency of 1.5 percent:

LOW FREQUENCY (Hz)	HIGH FREQUENCY (Hz)		
	1209	1336	1477
697	1	2	3
770	4	5	6
852	7	8	9
941	*	0	#

NOTE. Valid tone pulses are present for at least 40 milliseconds and the levels of the two tones do not differ by more than 18 dB. Interdigital time intervals are not less than 40 milliseconds.

d. Voltohmmeter:

Full-scale deflection current 0.00075 ampere. Internal resistance 130 ohms, maximum. Scale readings:

Dc volts (lower scale) 0 to 150
Ohms (upper scale) 0 to infinity

4. TEST EQUIPMENT NEEDED

4.01 The following test equipment, or equivalent, is needed to test and maintain the wire chiefs test set:

<u>DESCRIPTION</u>	<u>S-C STOCK NO.</u>	<u>QTY</u>
Digital voltohmmeter	207245-514	1
Multiline telephone test set	419109-018	1
Resistor, 10-ohm, 1-watt	554003-100	1
Resistor, 510-ohm, 1-watt	554003-511	1
Resistor, 51-kilohm, ±5%, 1-watt	554003-513	1
Capacitor, 2-μF +38%, -0%, 200-Vdcw	202886-865	1
Battery, dry cell, Type D, 1.5-volt	_____	1
Clip lead	_____	2
Power supply, Heathkit model IP-17		1
Transformer, variable, RCA model WP27A		1

**PART II. INSTALLATION AND
PRECUTOVER TEST PROCEDURES**

5. MOUNTING INSTRUCTIONS

5.01 The wall mounting locator drawing (207521-023) shows the location of the required holes to be drilled in the wall for wall mounting. For MDF mounting, details are provided on the wire chief mounting assembly to CDF drawing (E-49977-105).

6. WIRING INSTRUCTIONS

6.01 The wire chiefs test set is connected to the system using three cables. Connect the cables between connectors J1, J2, and J3 on the test set and the miscellaneous block on the MDF.

7. PREREQUISITE TESTS

7.01 Most precutover test procedures must be done in the progressive order indicated in the section titled *SYSTEM CENTURY DCO, Precutover Test Plan*, referenced in paragraph 2.02. Verify that all prerequisite tests have been completed before starting this test.

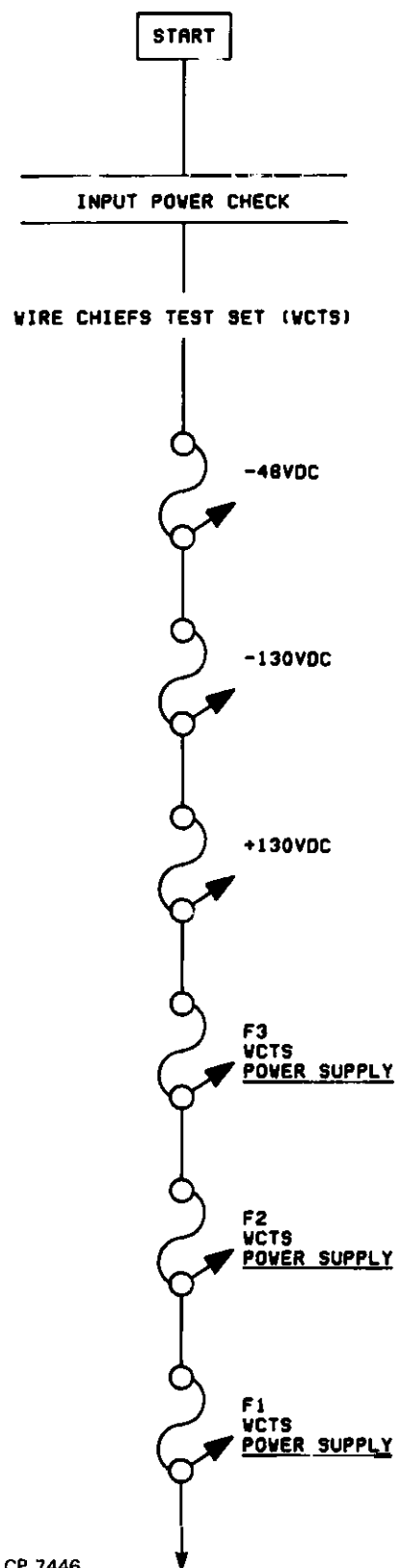
8. OPERATIONAL TESTS

8.01 Input Power Check and Lamp Test.

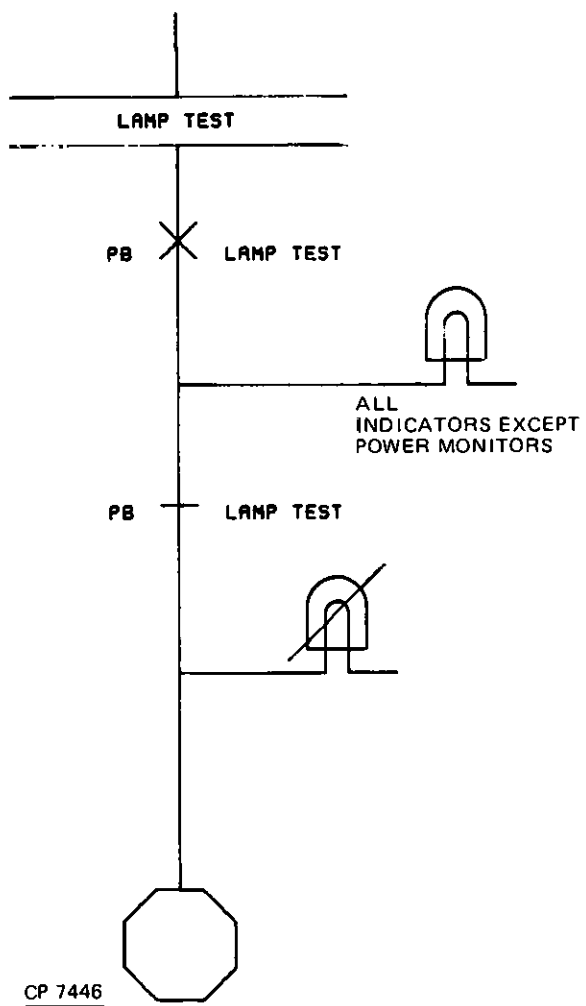
a. Purpose.

The following test sequence applies input voltages to the wire chiefs test set and verifies that all light emitting diodes light.

b. Test Sequence.

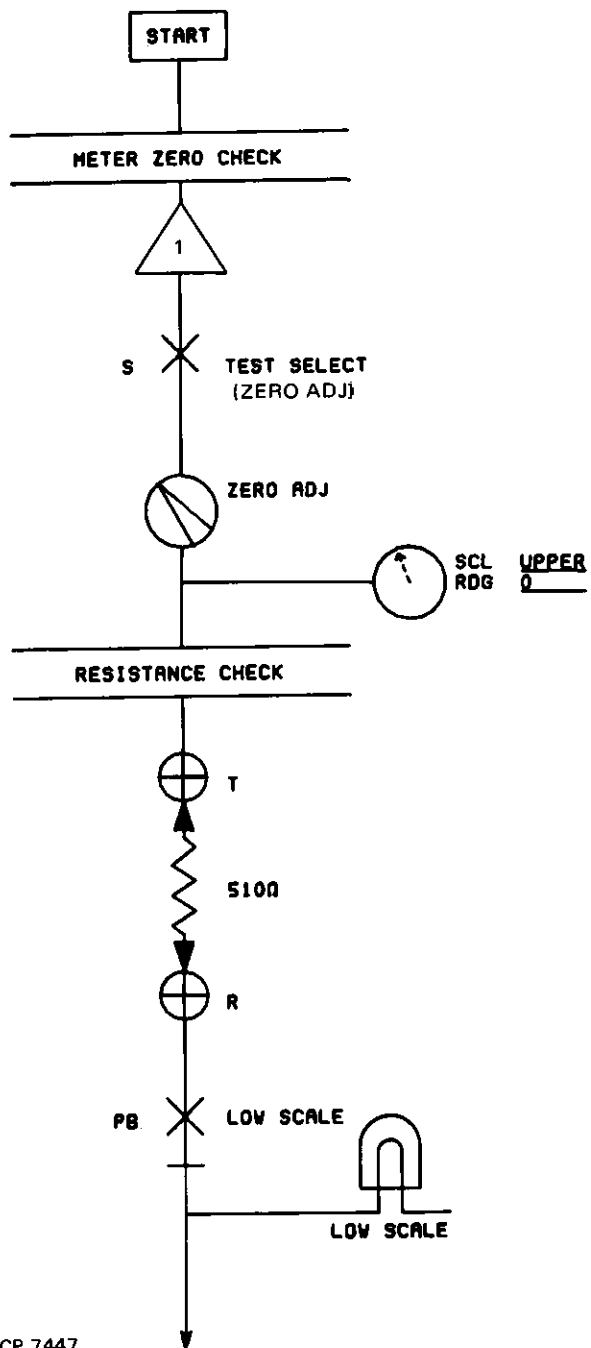


CP 7446



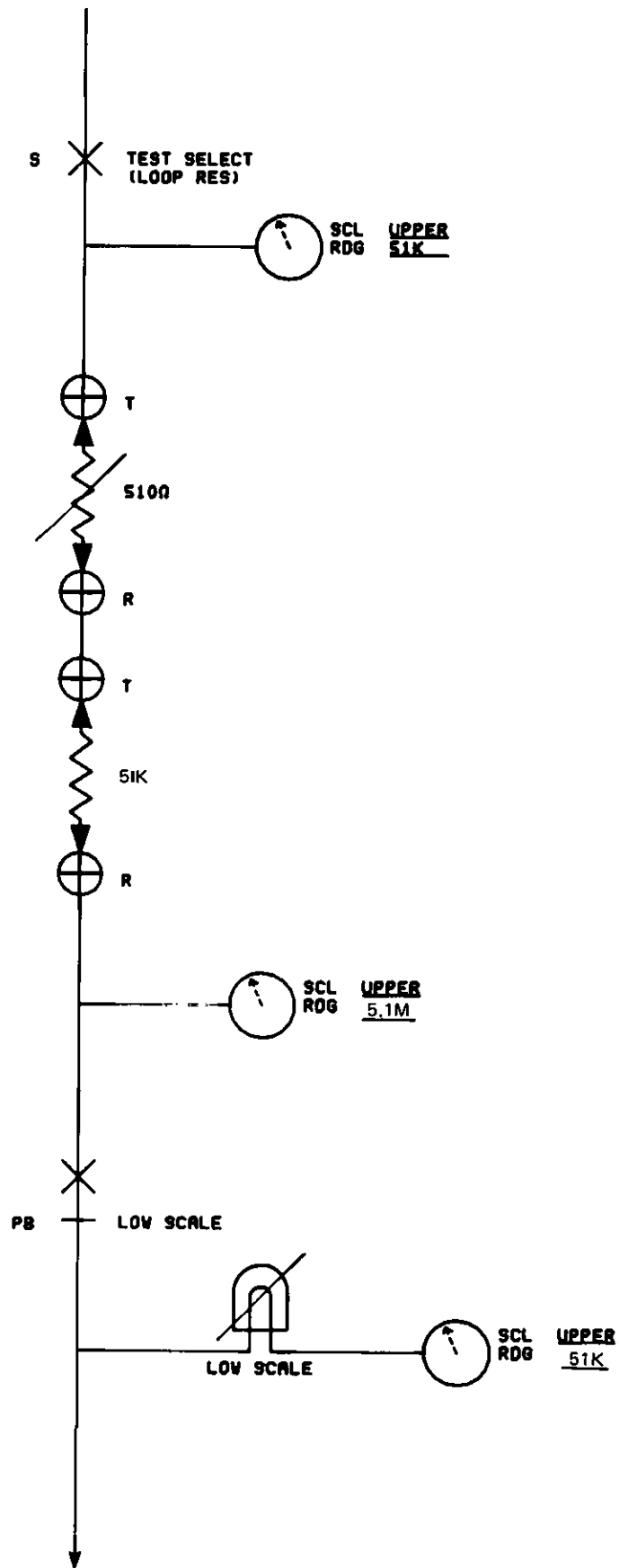
8.02 Meter Test.**a. Purpose.**

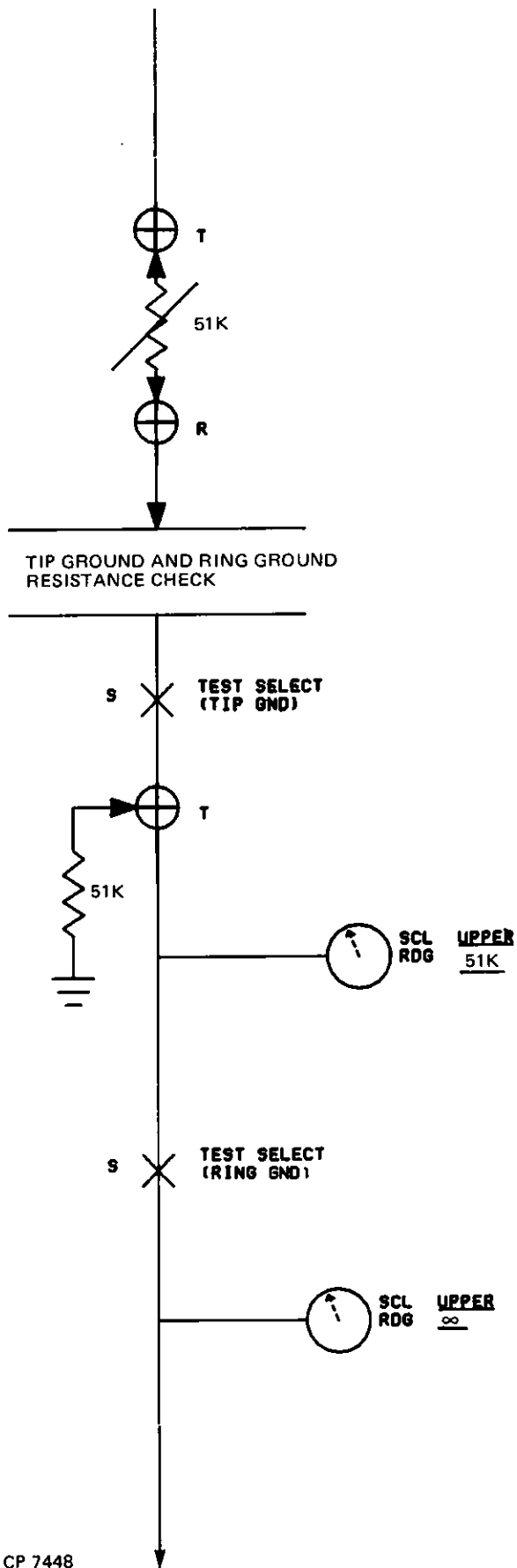
The following test sequence provides a precutover test to verify proper operation of the wire chiefs test set voltohmmeter.

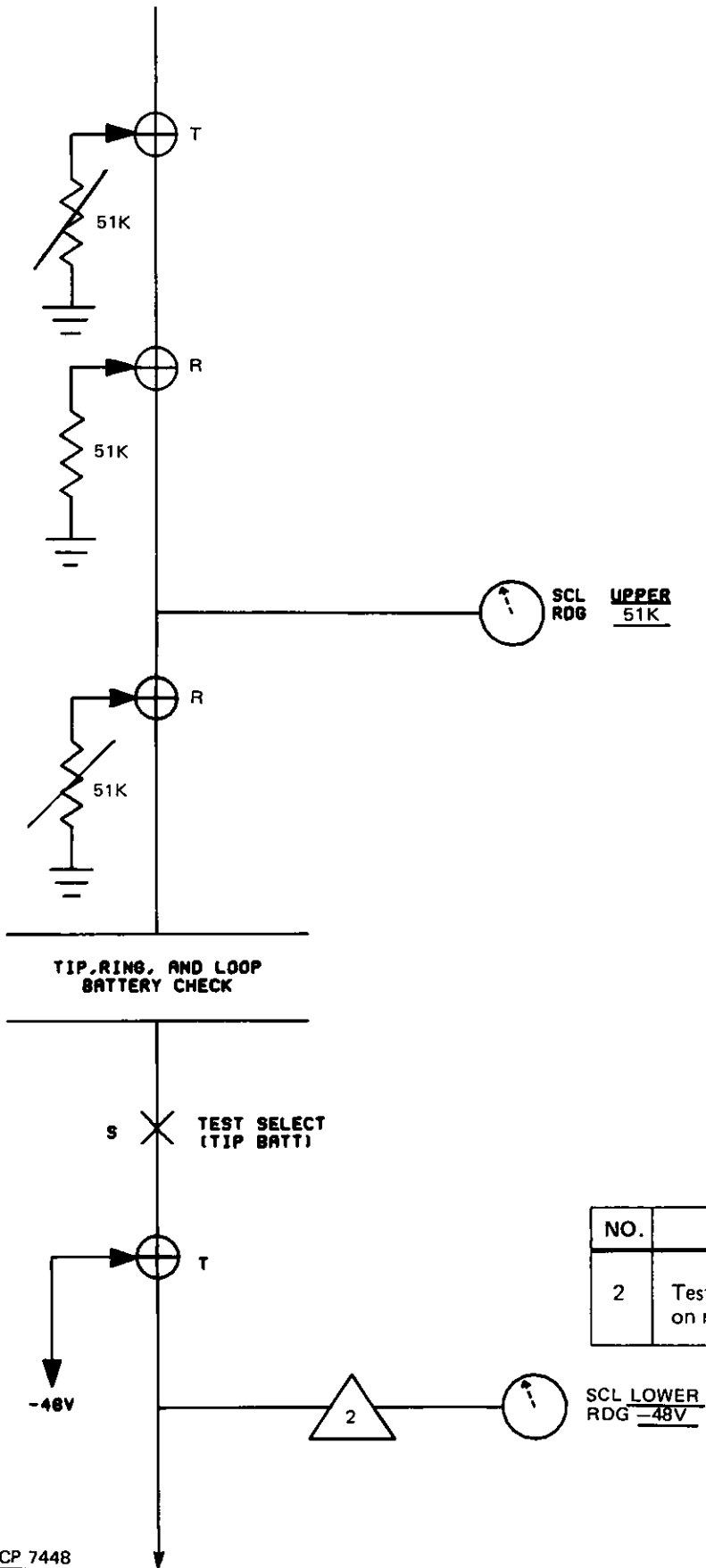
b. Test Sequence.

CP 7447

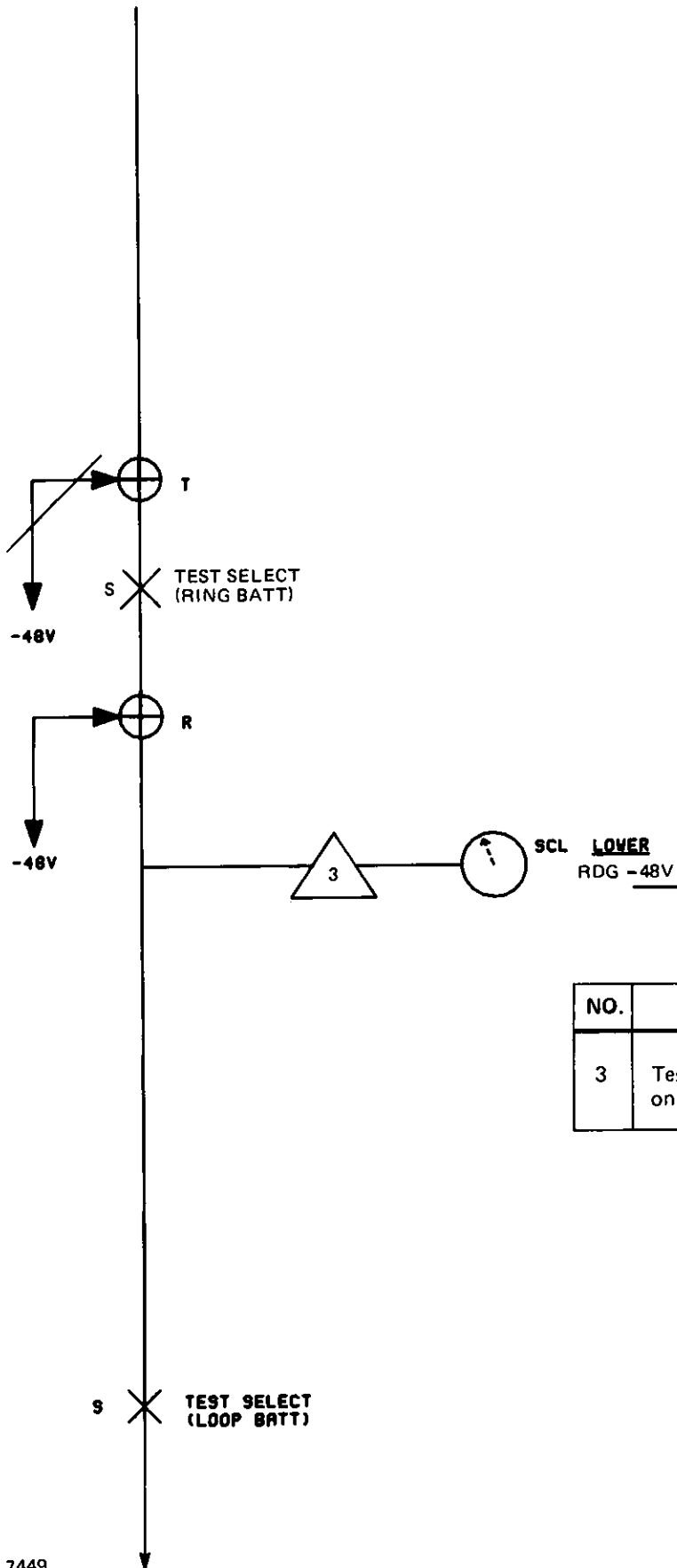
NO.	REMARKS
1	Verify calibration according to paragraph 10.



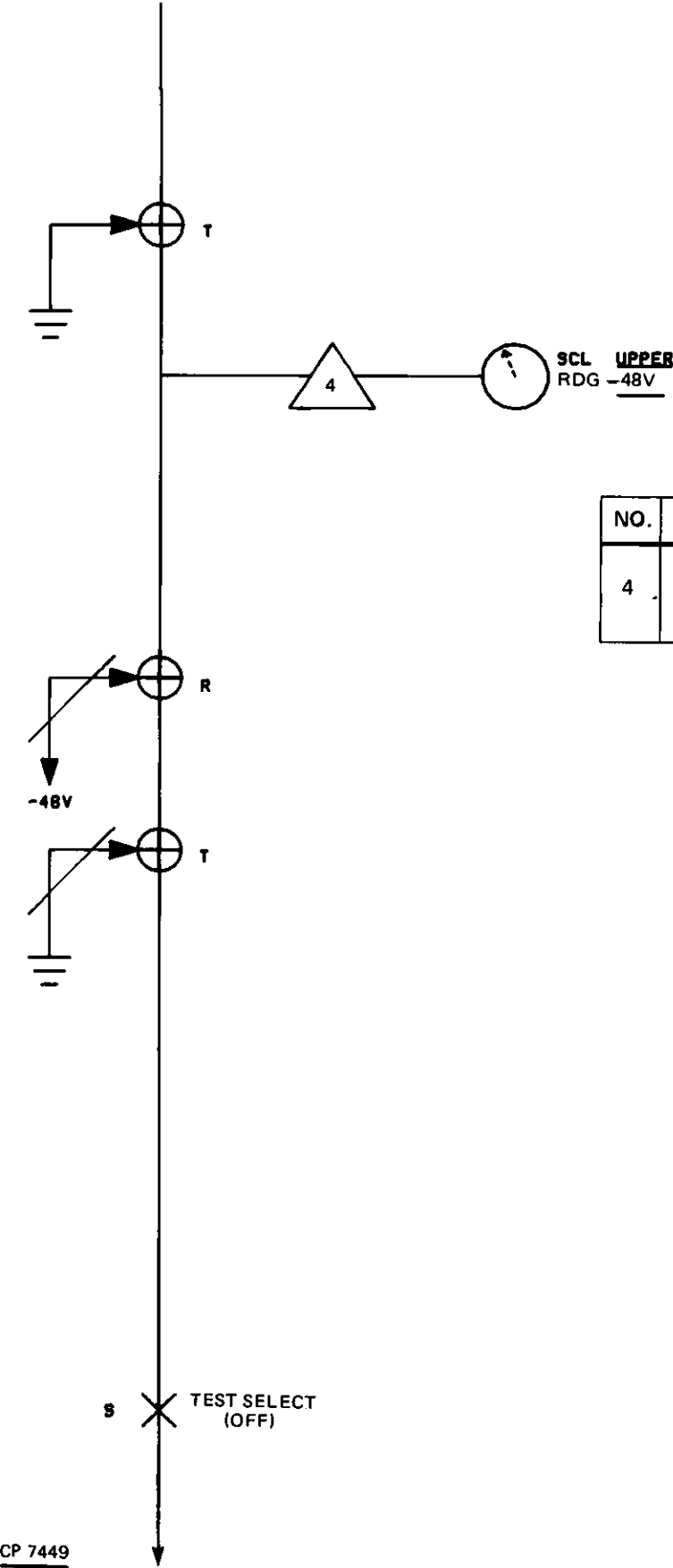




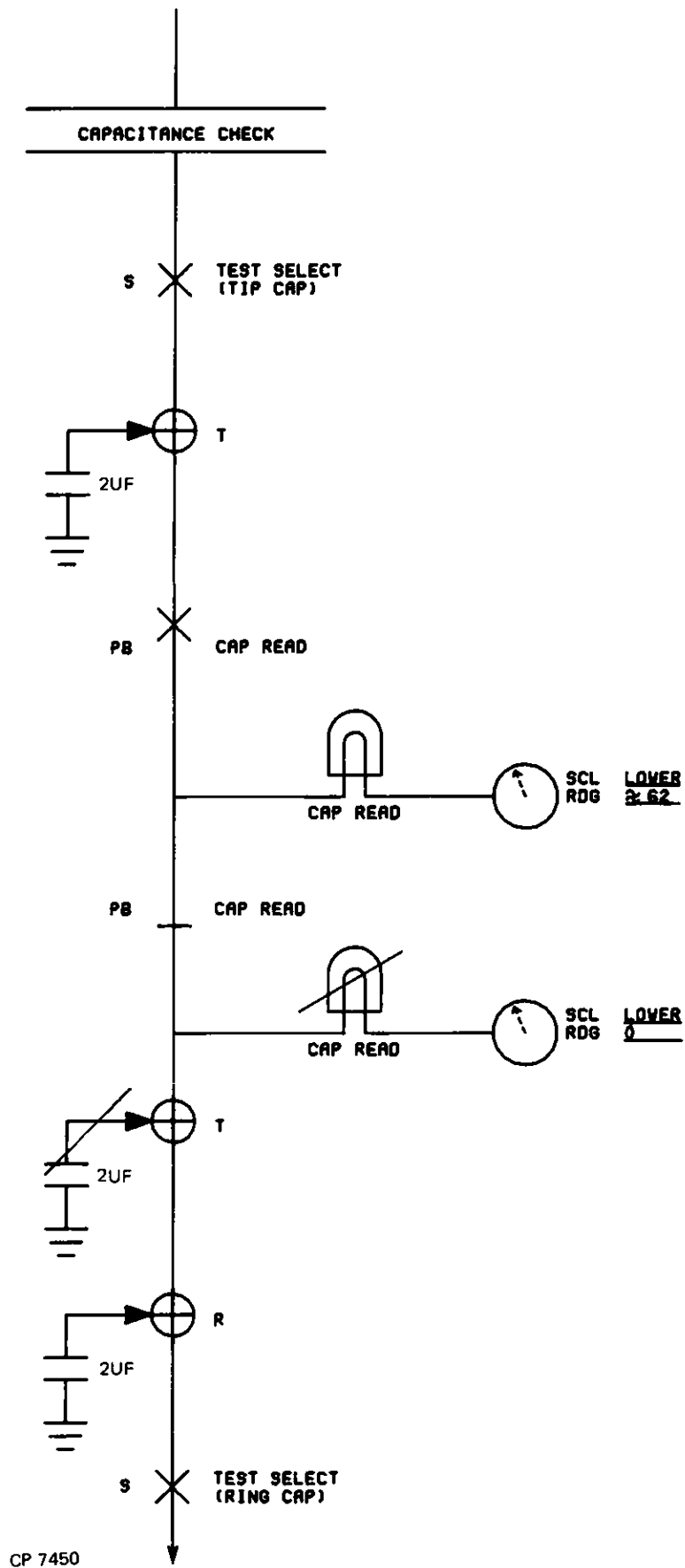
NO.	REMARKS
2	Test set meter indicates same voltage as meter on main discharge control panel (if equipped).

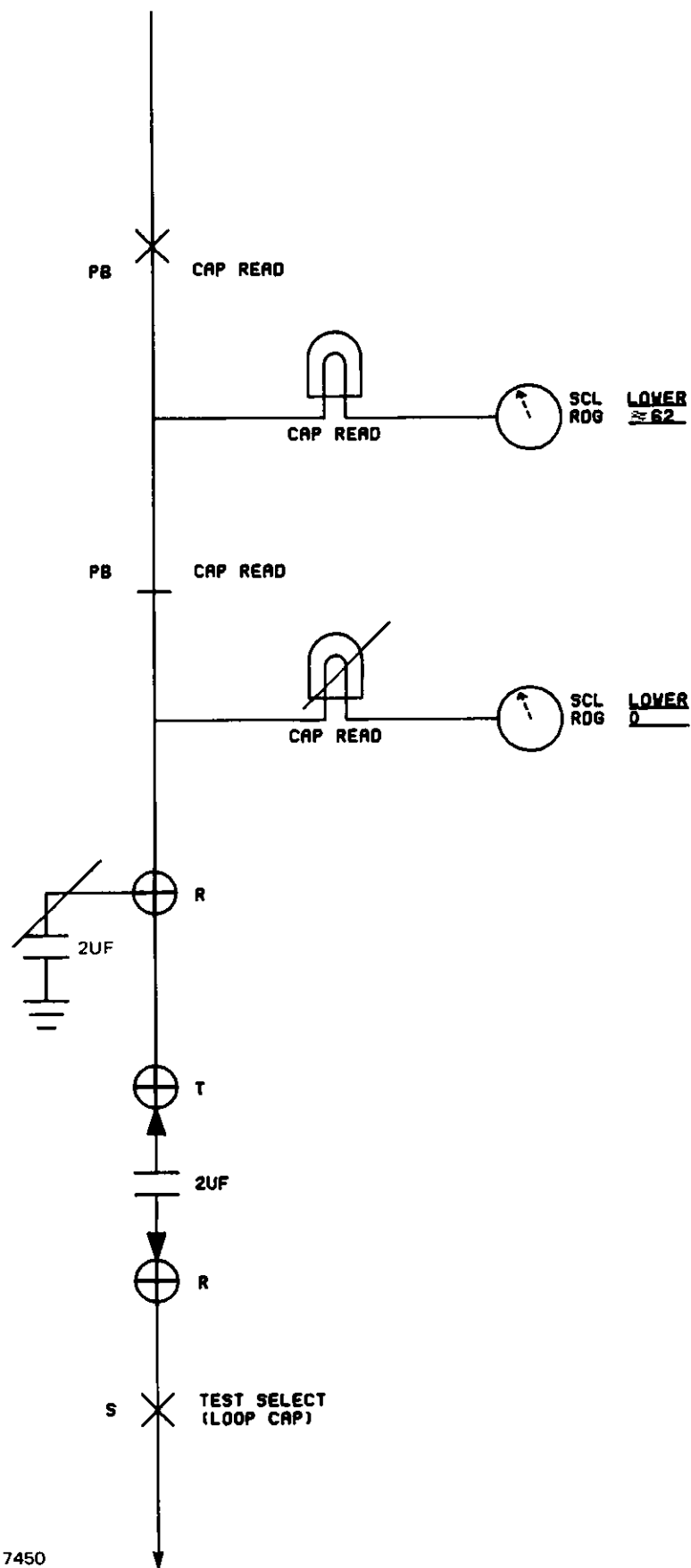


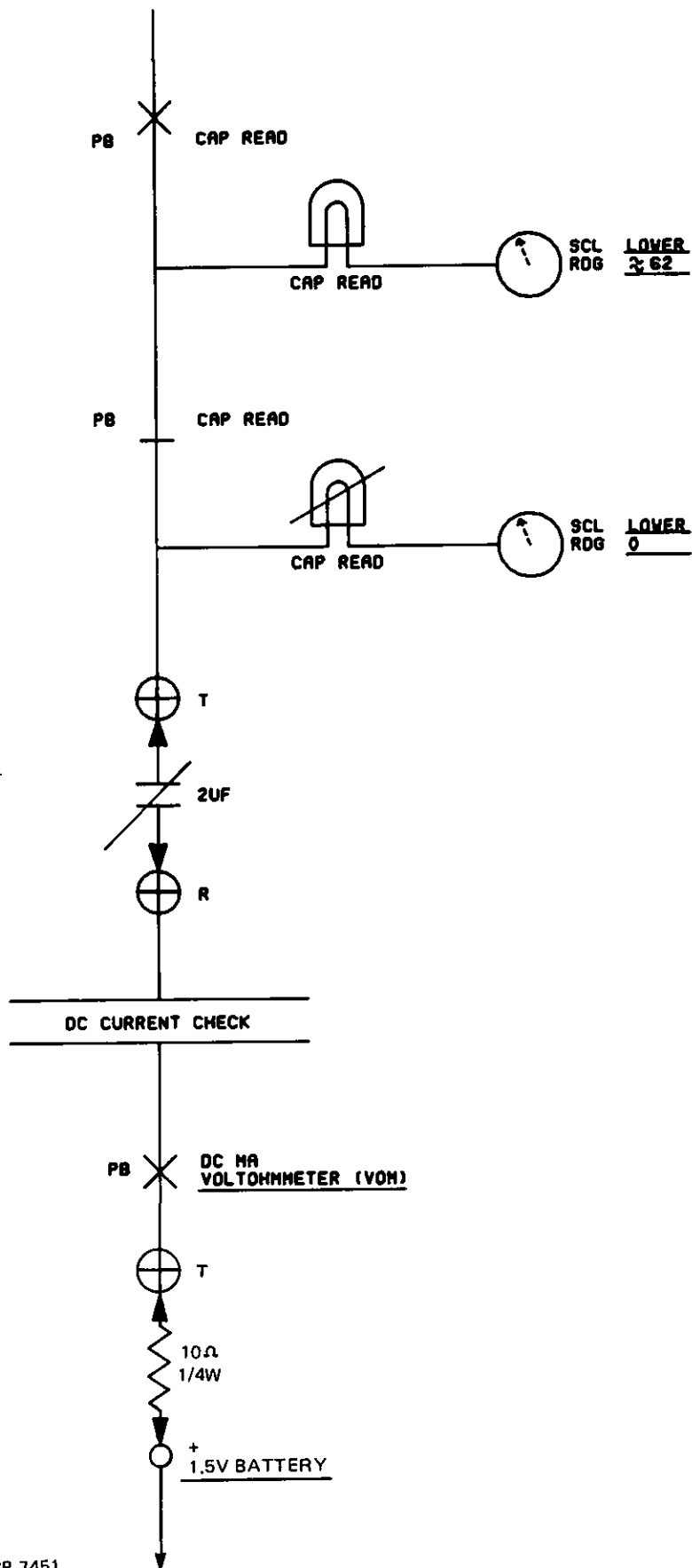
NO.	REMARKS
3	Test set meter indicates same voltage as meter on main discharge control panel (if equipped).



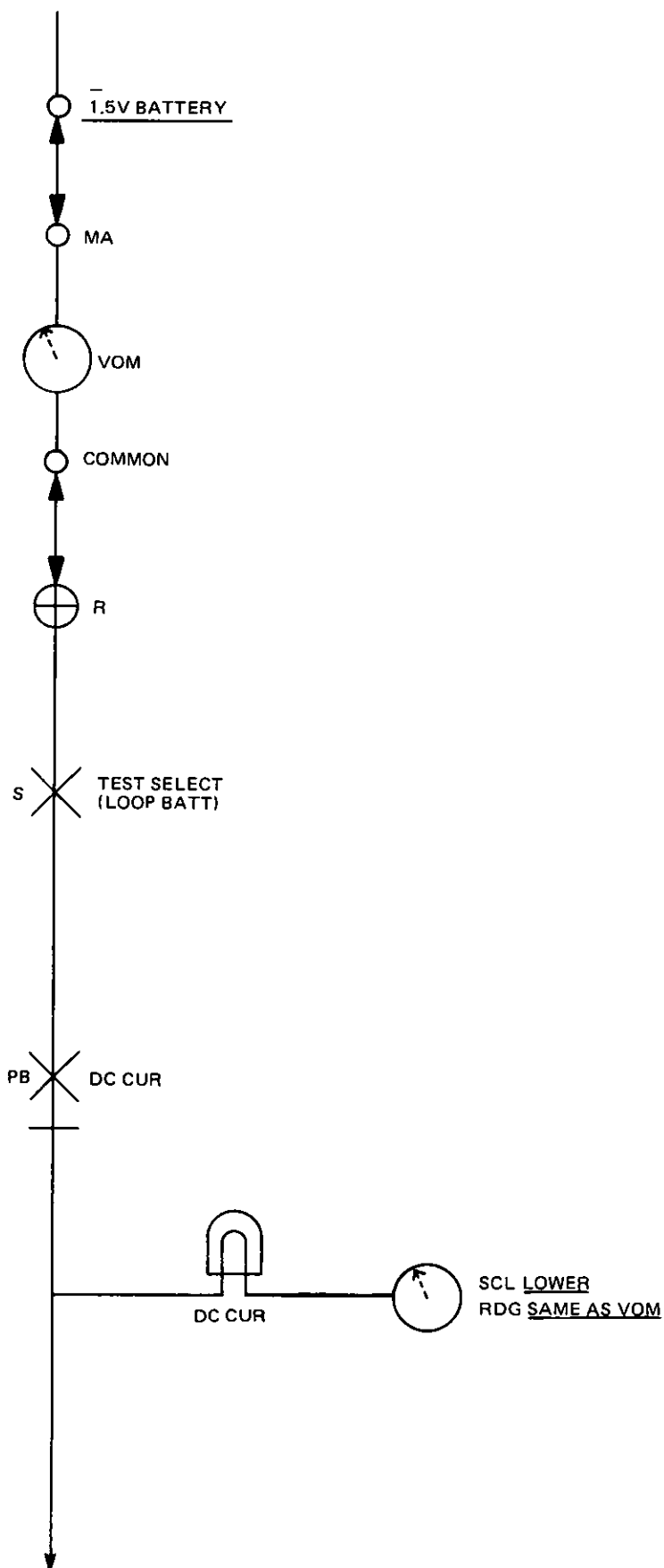
NO.	REMARKS
4	Test set meter indicates same voltage as meter on main discharge control panel (if equipped).

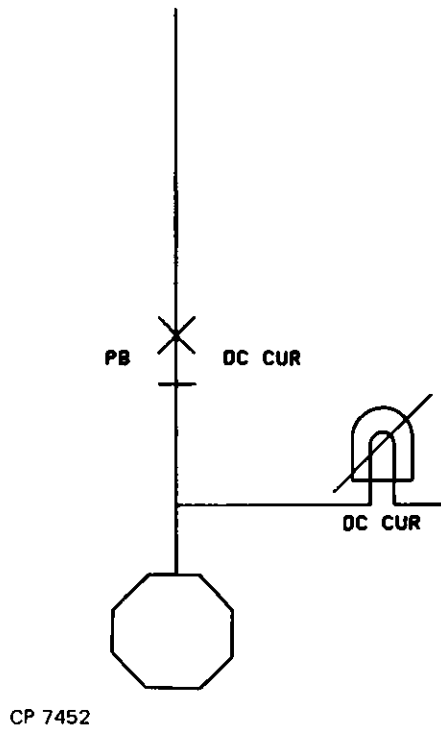






CP 7451



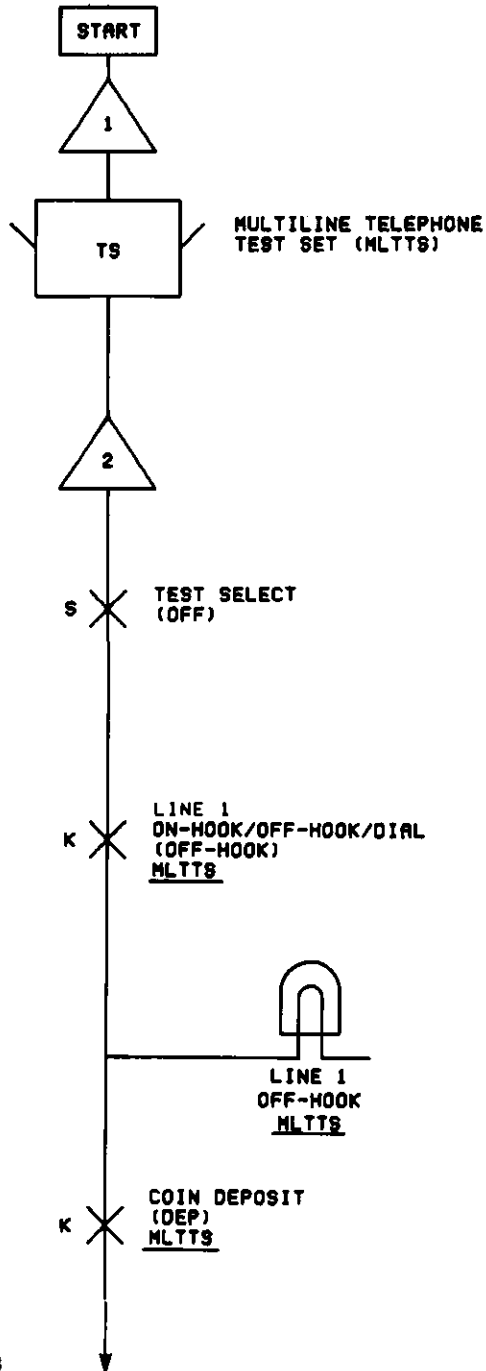


8.03 Coin Collect and Coin Return Test.

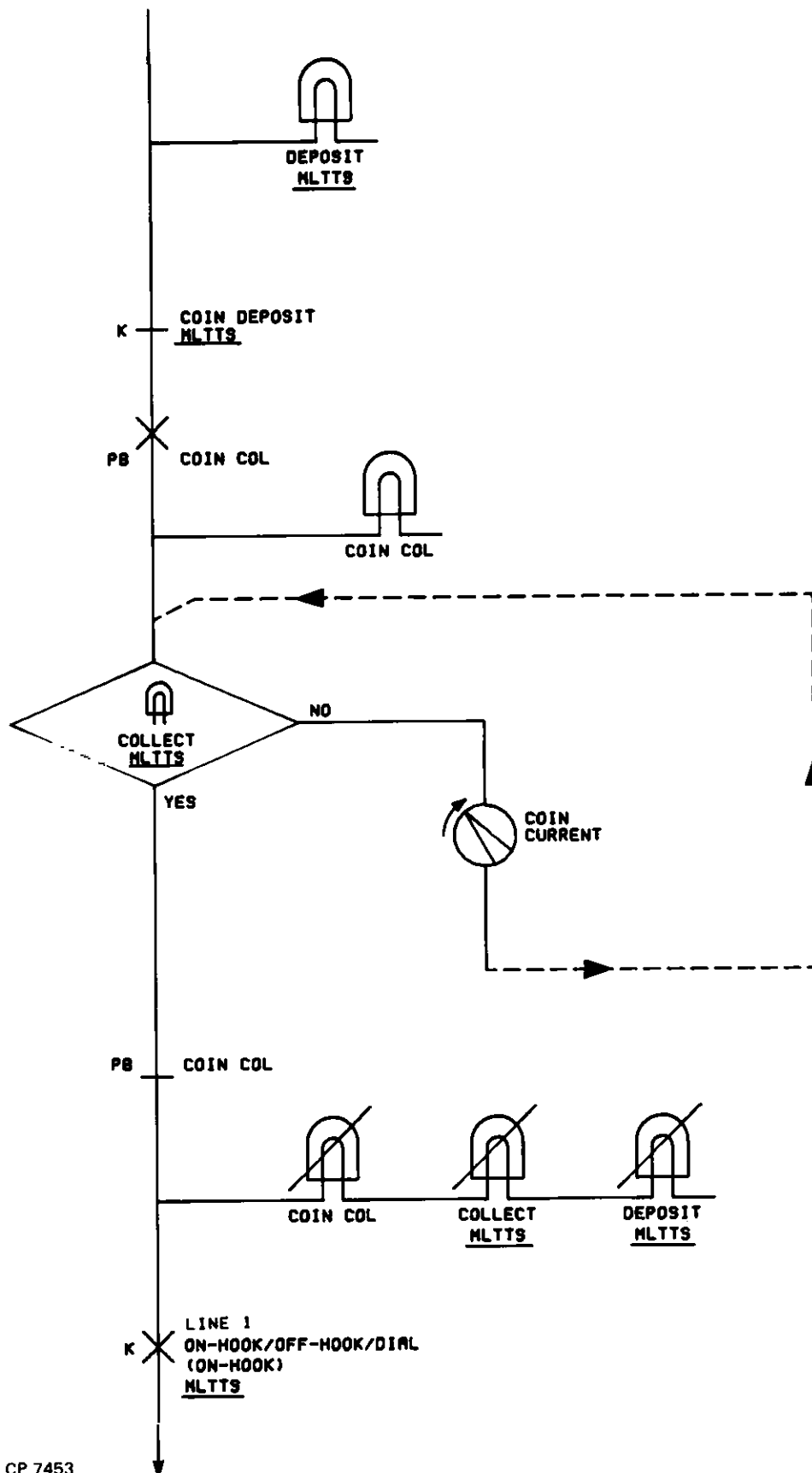
a. Purpose.

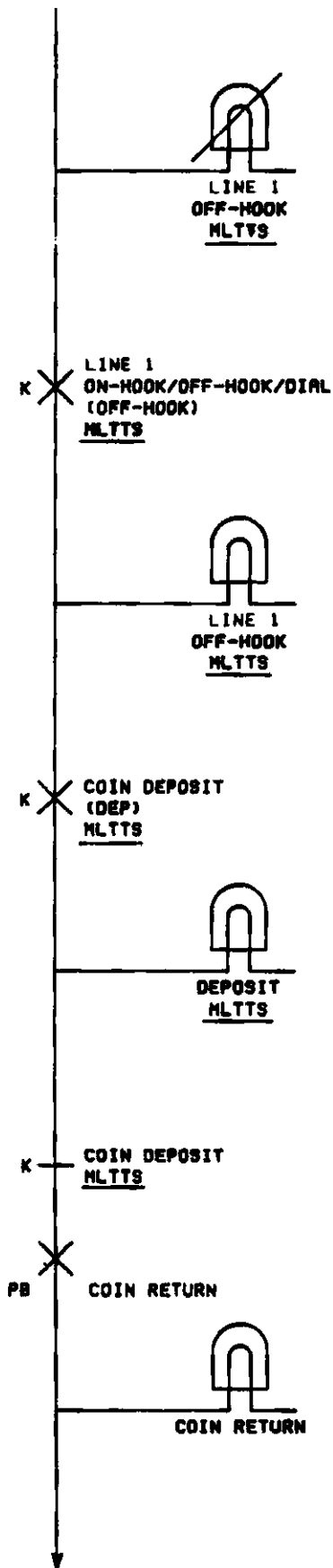
The following test sequence provides a precutover test to verify proper operation of the wire chiefs test panel coin-collect and coin-return test functions.

b. Test Sequence.

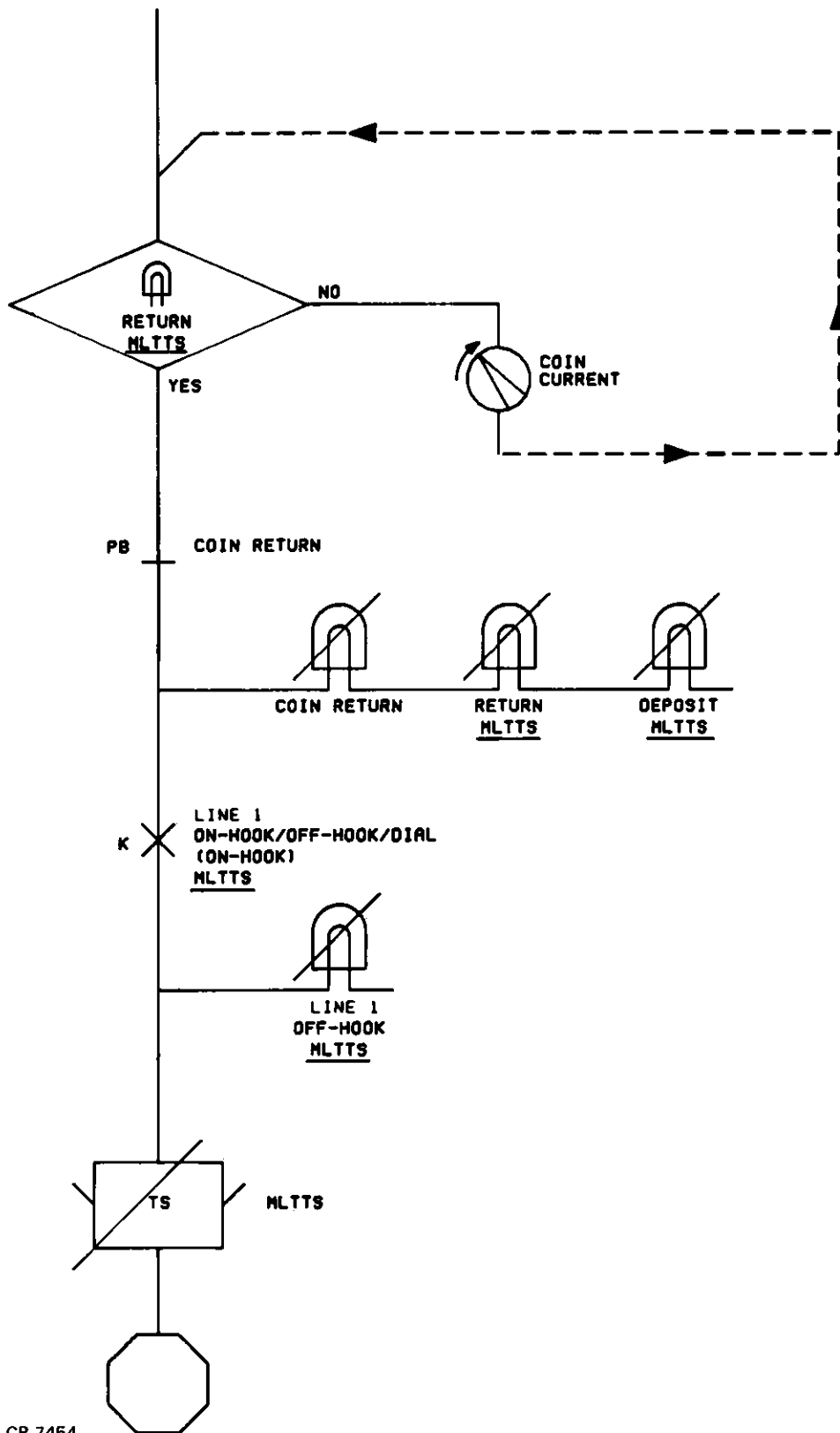


NO.	REMARKS
1	Connect plug end of power cord 202154-889 (supplied with multiline telephone test set, MLTTS) to POWER jack on MLTTS; connect T clip to fused -48 volts and S clip to ground.
2	Connect plug end of patch cord 200291-590 (supplied with MLTTS) to LINE SELECTION jack for line 1 on MLTTS; connect clips to T and R binding posts on wire chiefs test set.





CP 7454

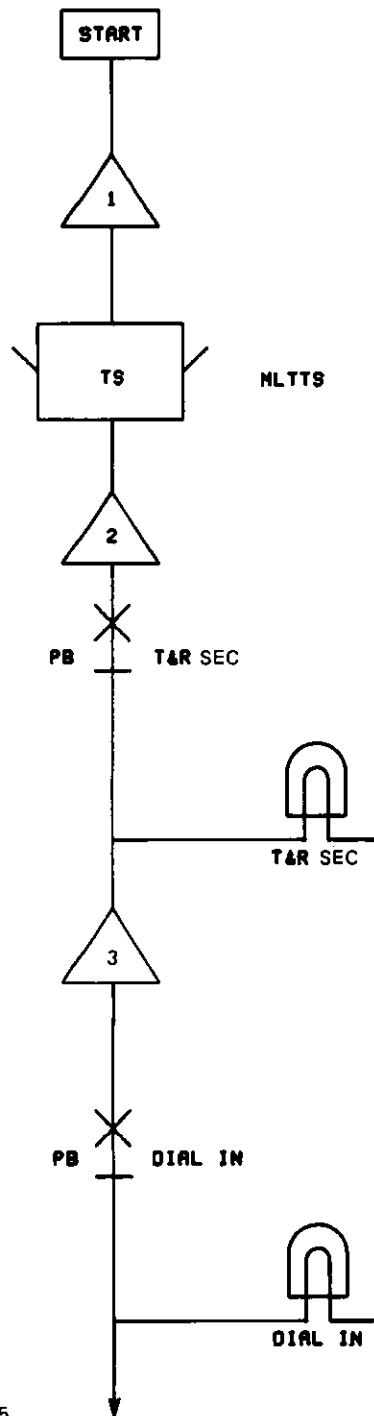


8.04 Primary Test Path Test.

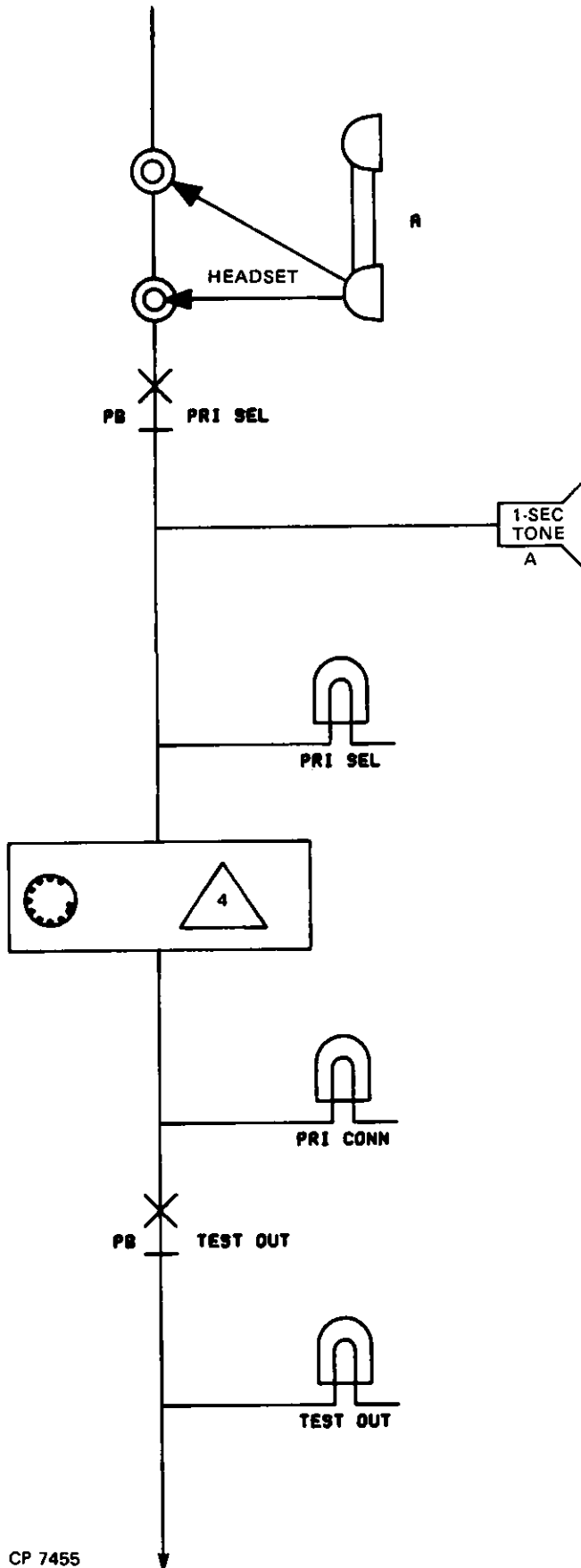
a. Purpose.

The following test sequence provides a precutover test to verify that all features of the primary test path function properly.

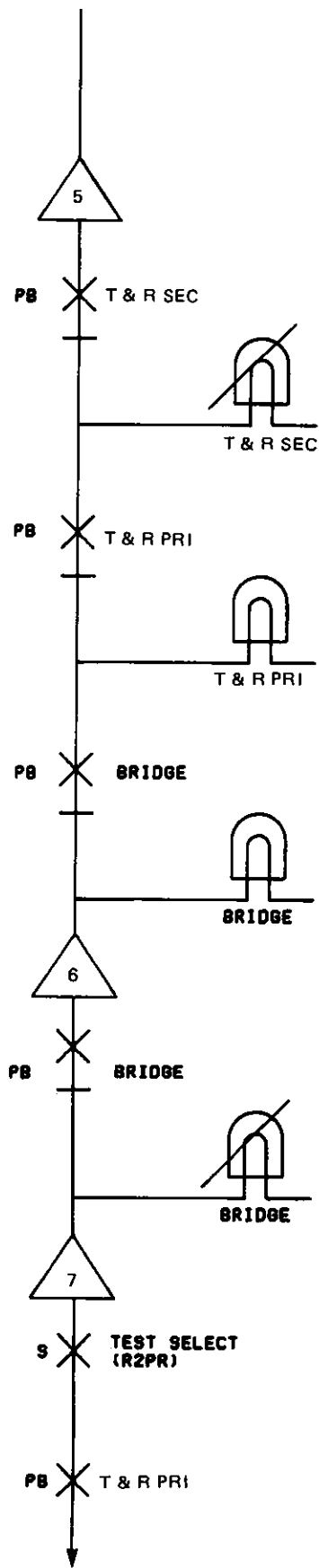
b. Test Sequence.



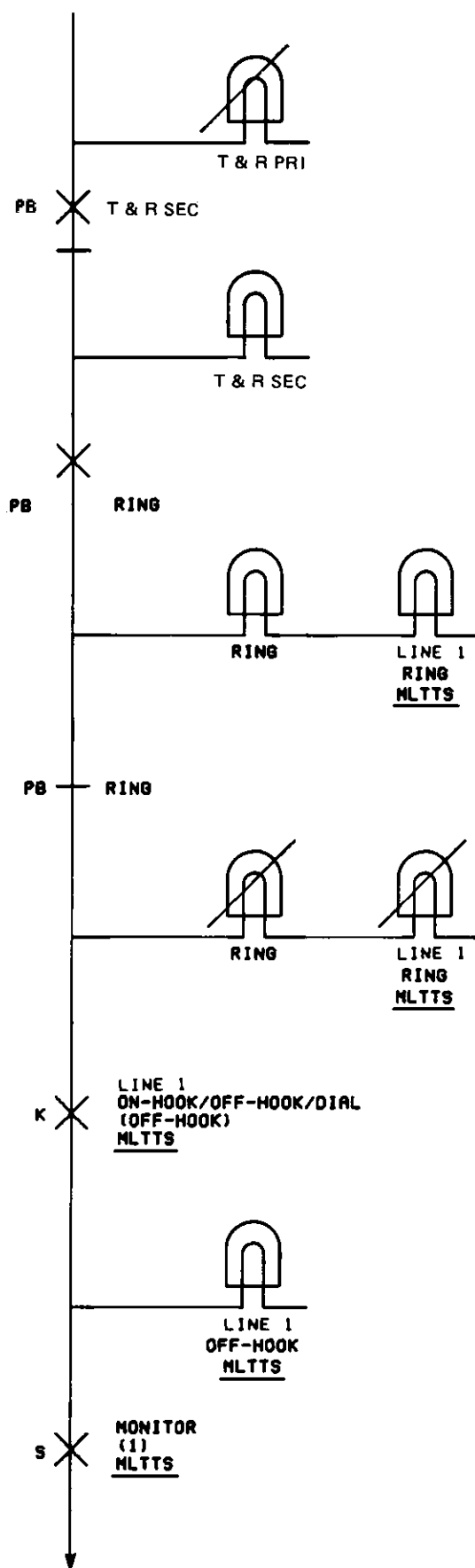
NO.	REMARKS
1	Connect plug end of power cord 202154-889 (supplied with MLTTS) to POWER jack on MLTTS; connect T clip to fused -48 volts and S clip to ground.
2	Connect plug end of patch cord 200291-590 (supplied with MLTTS) to LINE SELECTION jack for line 1 on MLTTS; connect clips to tip and ring appearance on MDF of line circuit to be used for test.
3	Operating T & R SEC pushbutton separates tip and ring primary leads from tip and ring secondary leads so that primary circuit can be tested.



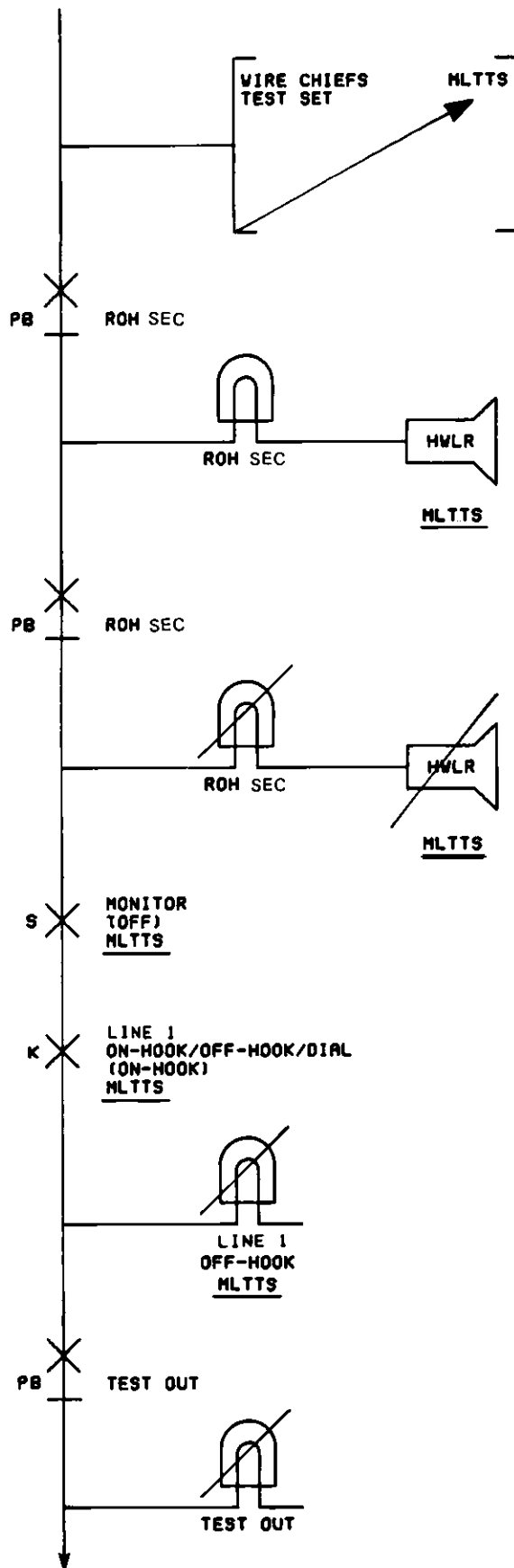
NO.	REMARKS
4	Dial five-digit identification number of port to which MLTTS is connected: common control (0 through 3) + timeslot interchange PWBA (0 through 7) + port group (0 through 7) + port (00 through 29). ¹

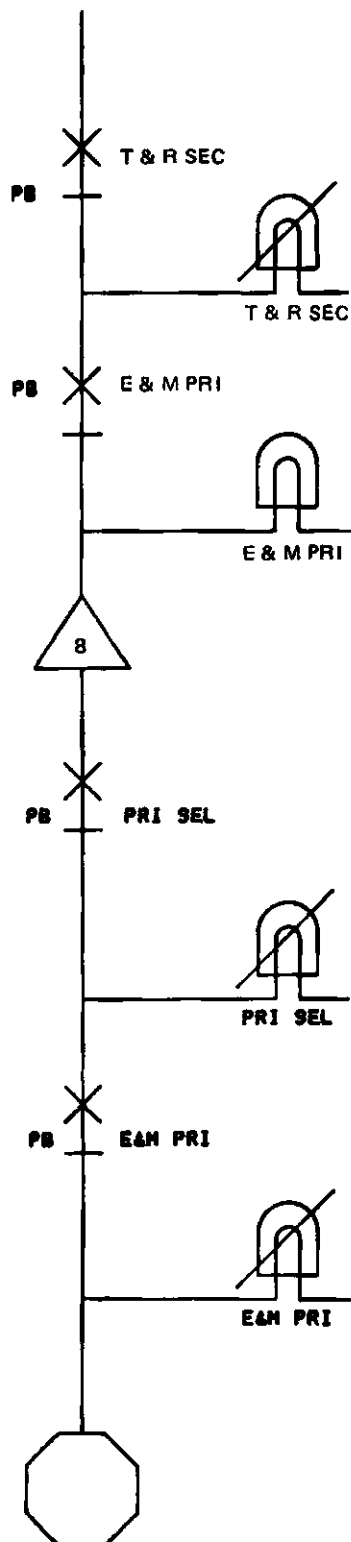


NO.	REMARKS
5	Use VOM to check continuity of tip and ring leads between TR IN and TR OUT jacks on test panel and primary tip and ring in and primary tip and ring out, respectively, on MDF.
6	Use VOM to check continuity between T in and T out and between R in and R out at MDF.
7	Use VOM to check that continuity is broken between T in and T out and between R in and R out at MDF.



CP 7456



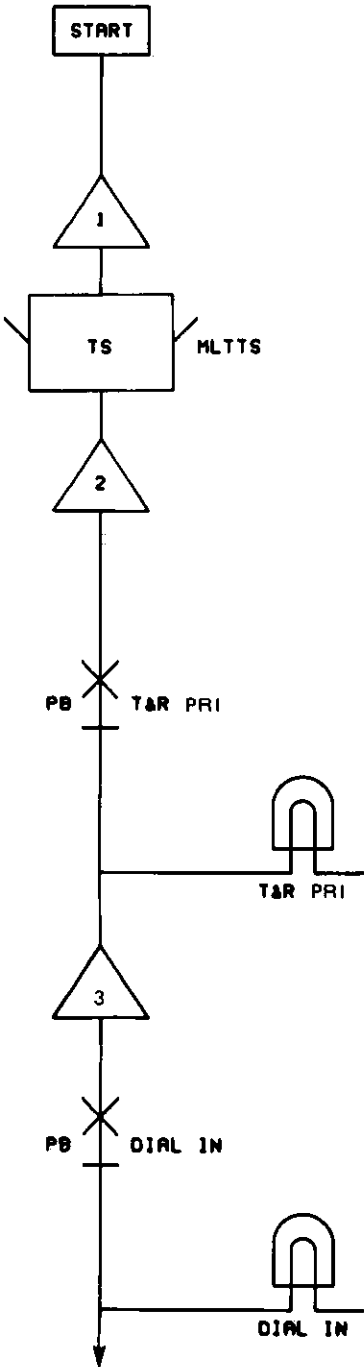


CP 7457

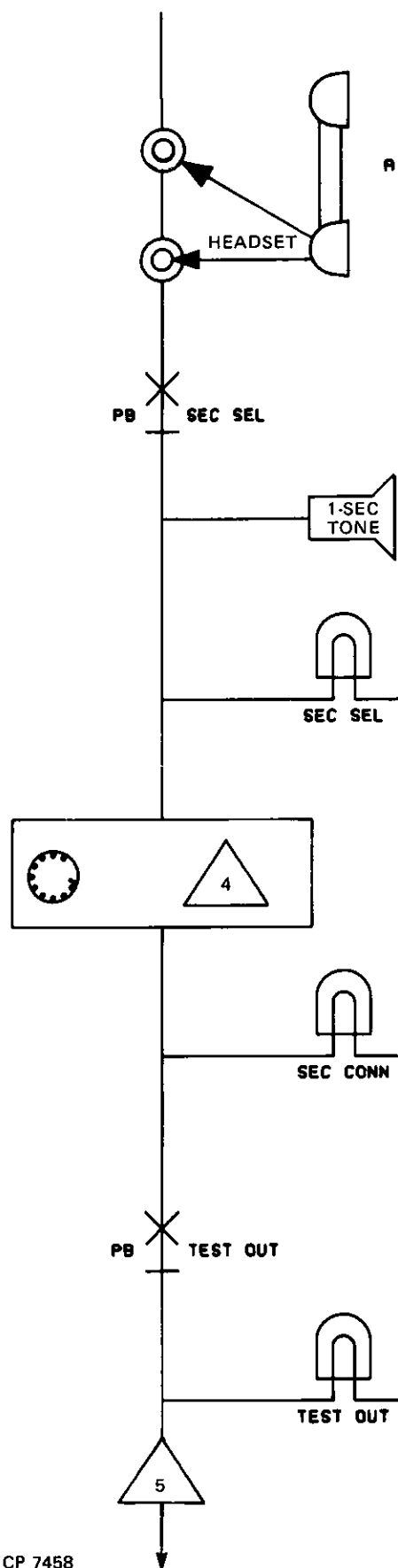
NO.	REMARKS
8	Use VOM to check continuity of E & M leads between EA IN, EB IN, MA IN, MB IN, EA OUT, EB OUT, MA OUT, and MB OUT jacks on test panel and primary EA IN, EB IN, MA IN, MB IN, EA OUT, EB OUT, MA OUT, and MB OUT, respectively, on MDF.

8.05 Secondary Test Path Test.

- a. Purpose.
The following test sequence provides a precutover test to verify that all features of the secondary test path function properly.
- b. Test Sequence.

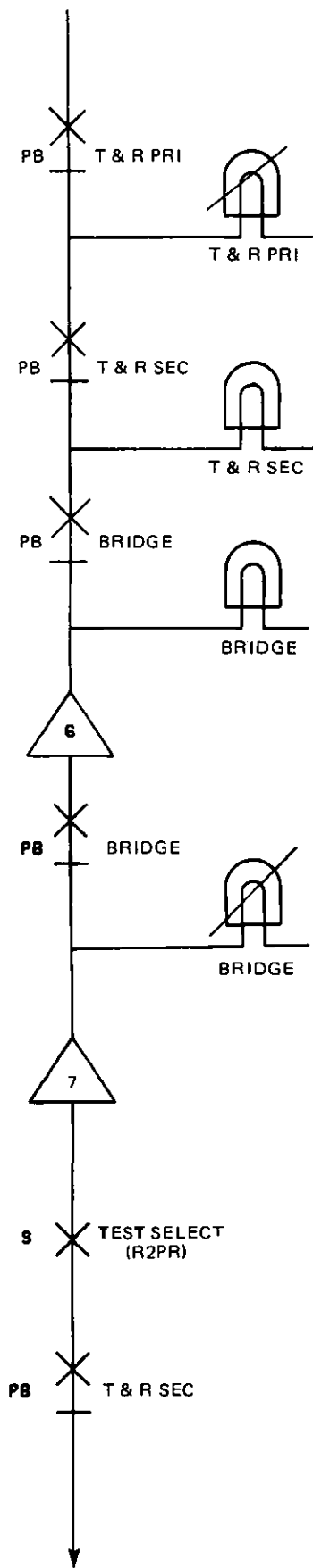


NO.	REMARKS
1	Connect plug end of power cord 202154-889 to POWER jack on MLTTS; connect T clip to fused -48 volts and S clip to ground.
2	Connect plug end of patch cord 200291-590 to LINE SELECTION jack for line 1 on MLTTS; connect clips to tip and ring appearance, on MDF, of line circuit to be used for test.
3	Operating T&R PRI button separates tip and ring primary leads from tip and ring secondary leads so that secondary circuit can be tested.

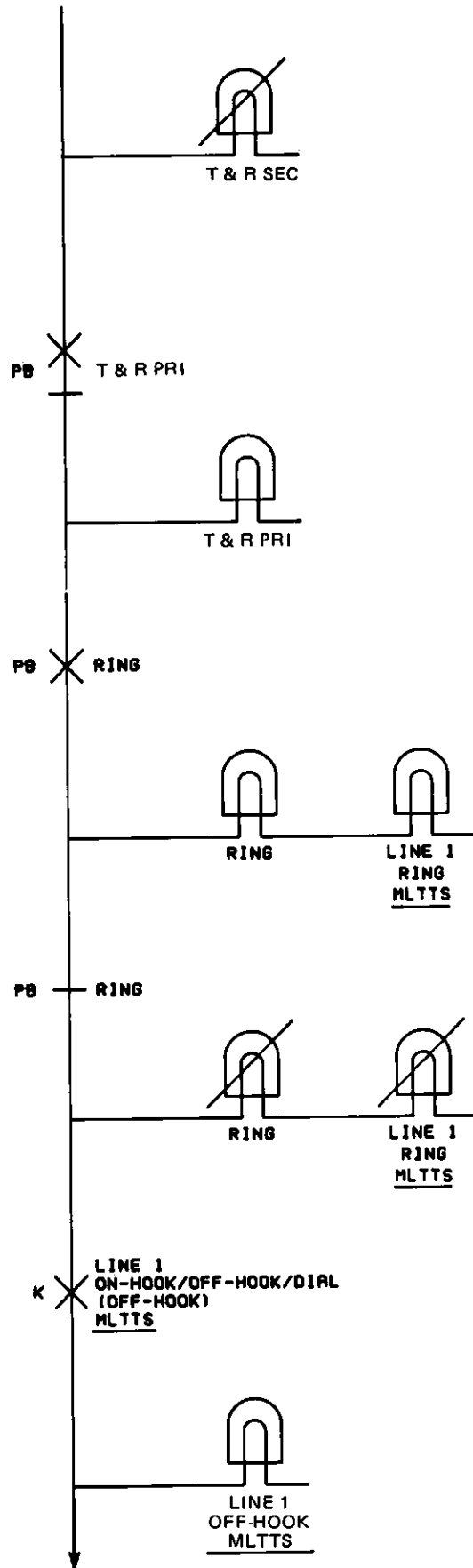


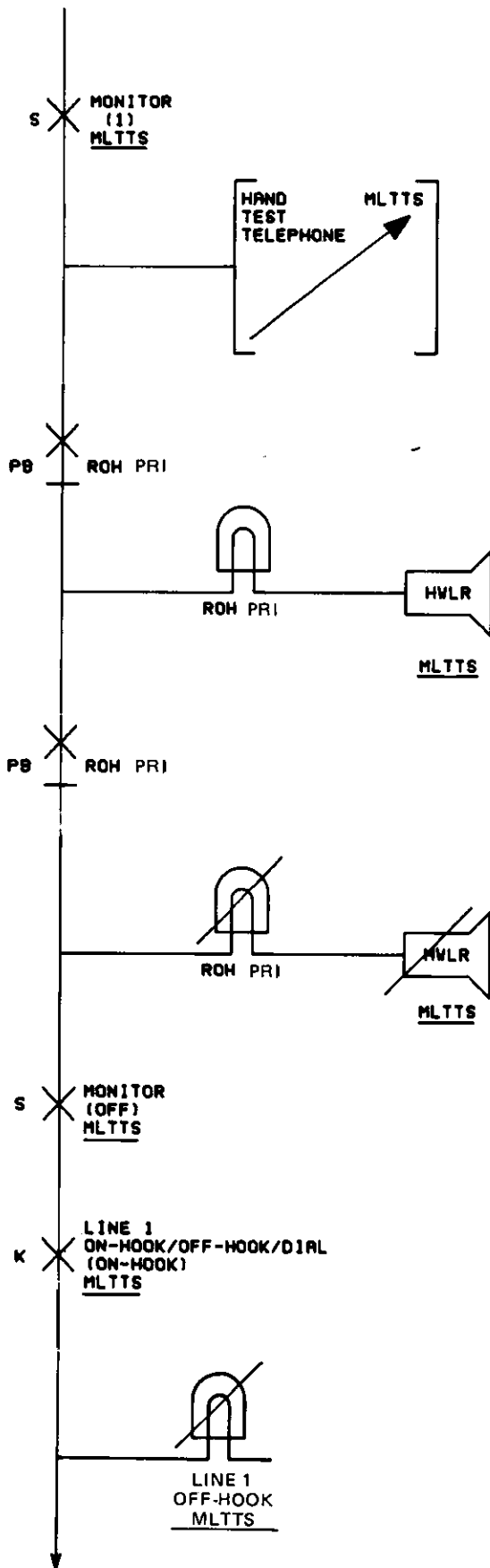
CP 7458

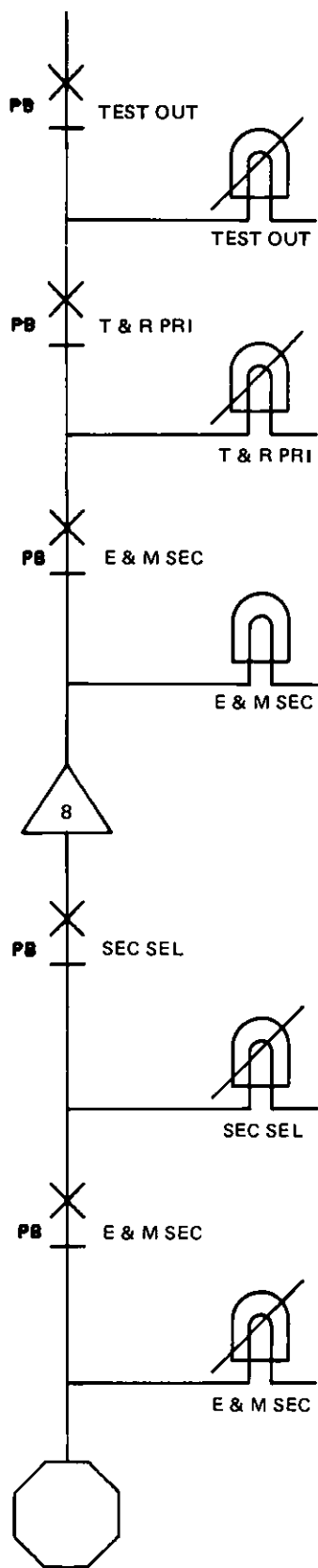
NO.	REMARKS
4	Dial five-digit identification number of port to which MLTTS is connected: common control (0 through 3) + timeslot interchange PWBA (0 through 7) + port group (0 through 7) + port (00 through 29).
5	Use VOM to check continuity of tip and ring leads between TR IN and TR OUT jacks on test set and secondary tip and ring in and secondary tip and ring out, respectively on MDF.



NO.	REMARKS
6	Use VOM to check continuity between T in and T out and between R in and R out at MDF.
7	Use VOM to check that continuity is broken between T in and T out and between R in and R out at MDF.







CP 7460

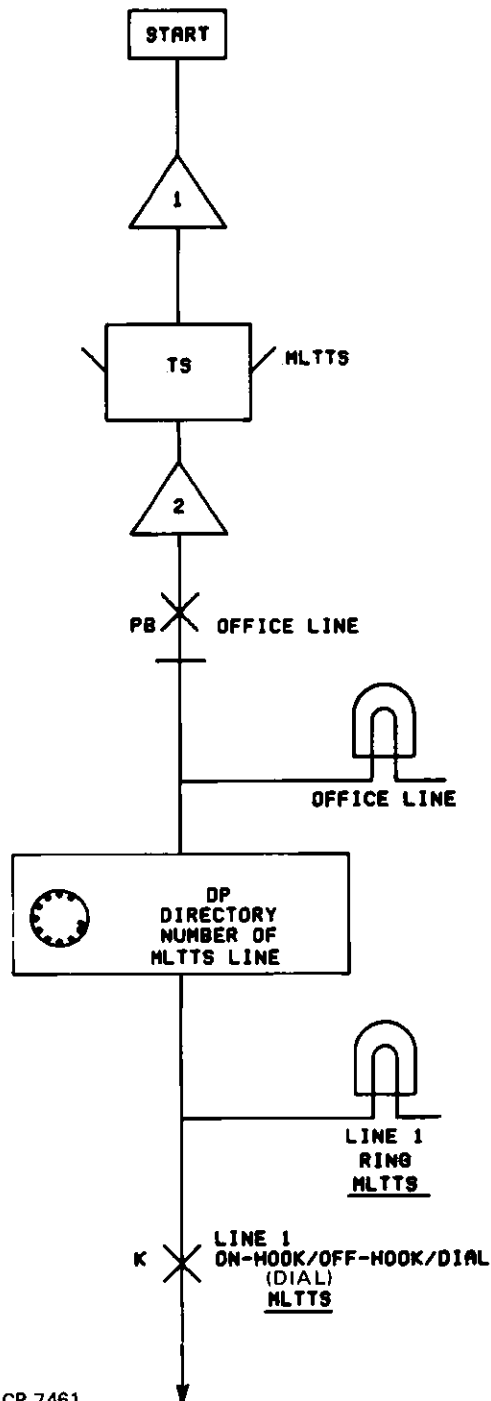
NO.	REMARKS
8	Use VOM to check continuity of E&M leads between EA IN, EB IN, MA IN, MB IN, EA OUT, EB OUT, MA OUT and MB OUT jacks on test panel and secondary EA IN, EB IN, MA IN, MB IN, EA OUT, EB OUT, MA OUT, and MB OUT, respectively on MDF.

8.06 Office Line Test.

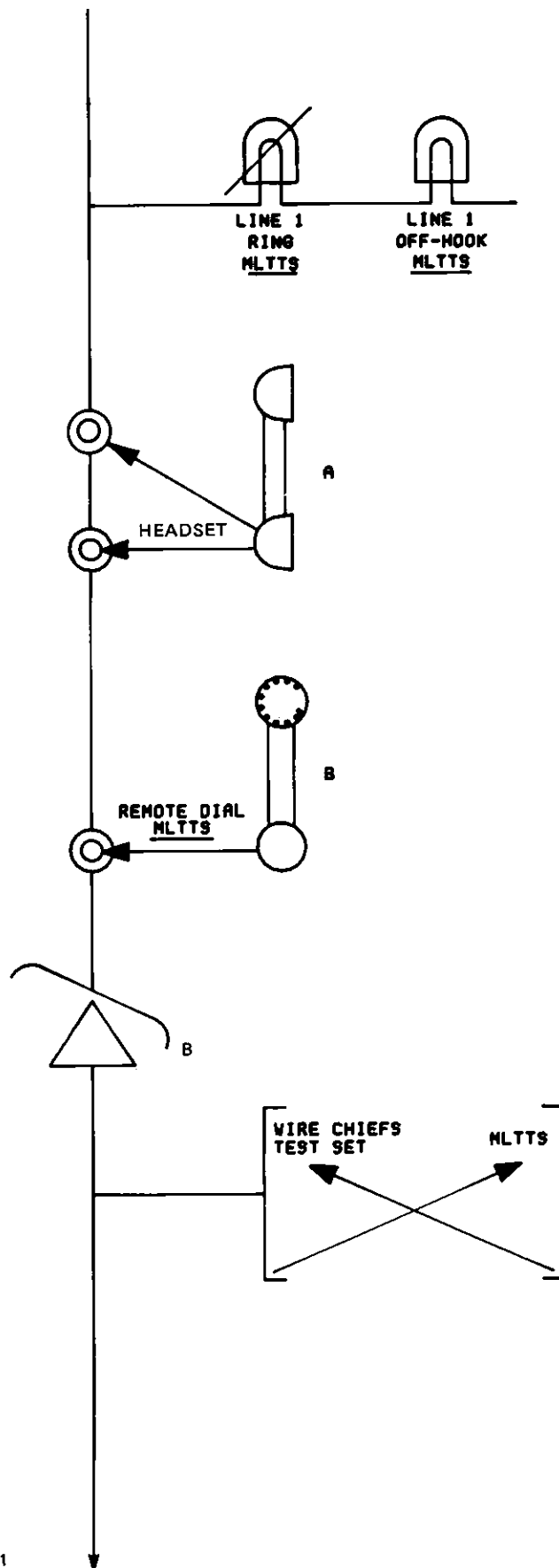
a. Purpose.

The following test sequence provides a precutover test to verify proper operation of the wire chiefs test set office line.

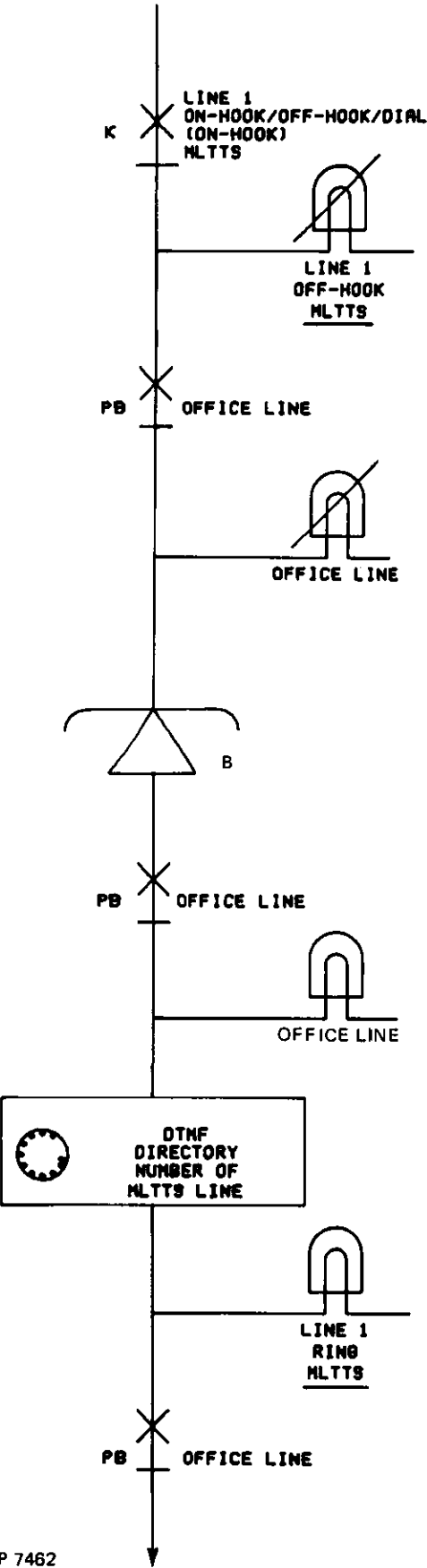
b. Test Sequence.



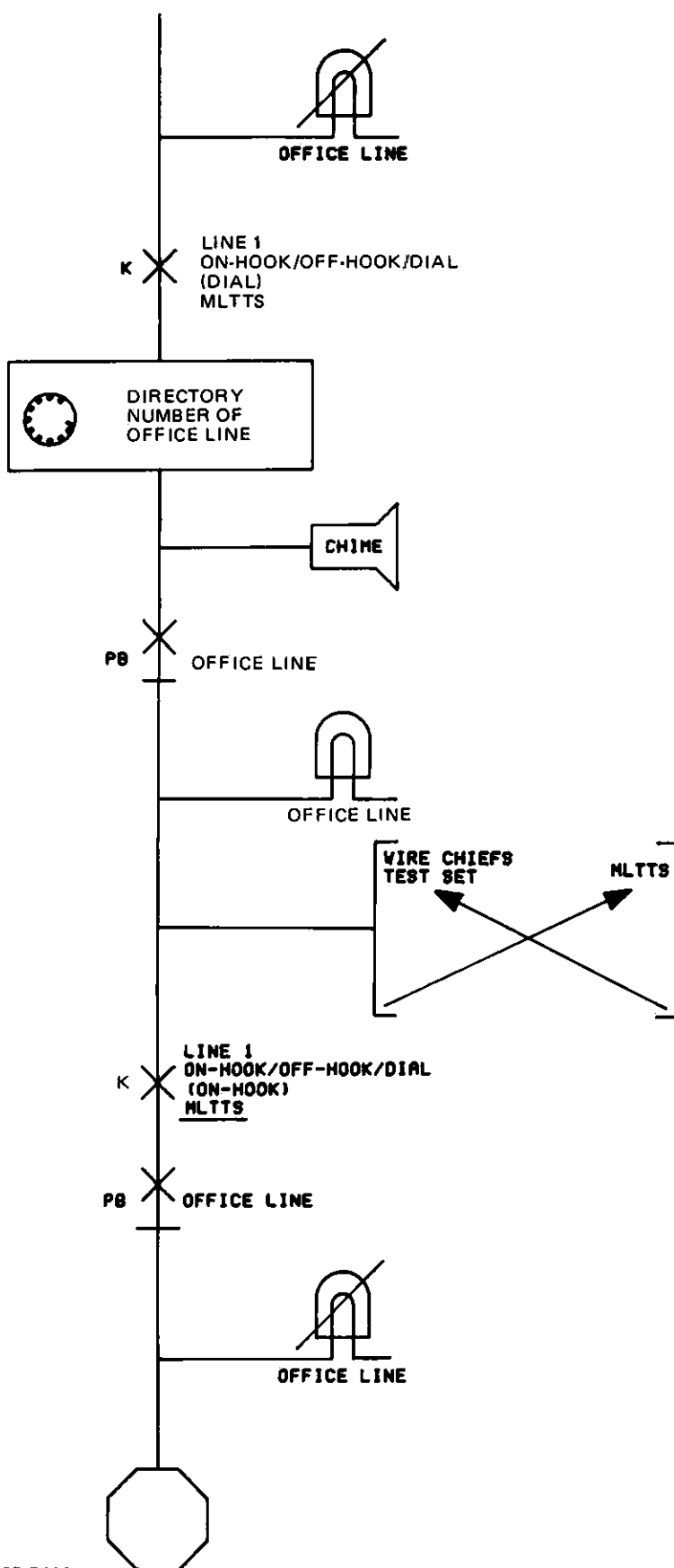
NO.	REMARKS
1	Connect plug end of power cord 202154-889 to POWER jack on MLTTS; connect T clip to fused -48 volts and S clip to ground.
2	Connect plug end of patch cord 200291-590 to LINE SELECTION jack for line 1 on MLTTS; connect clips to tip and ring appearance on MDF of line circuit to be used for test.



CP 7461



CP 7462

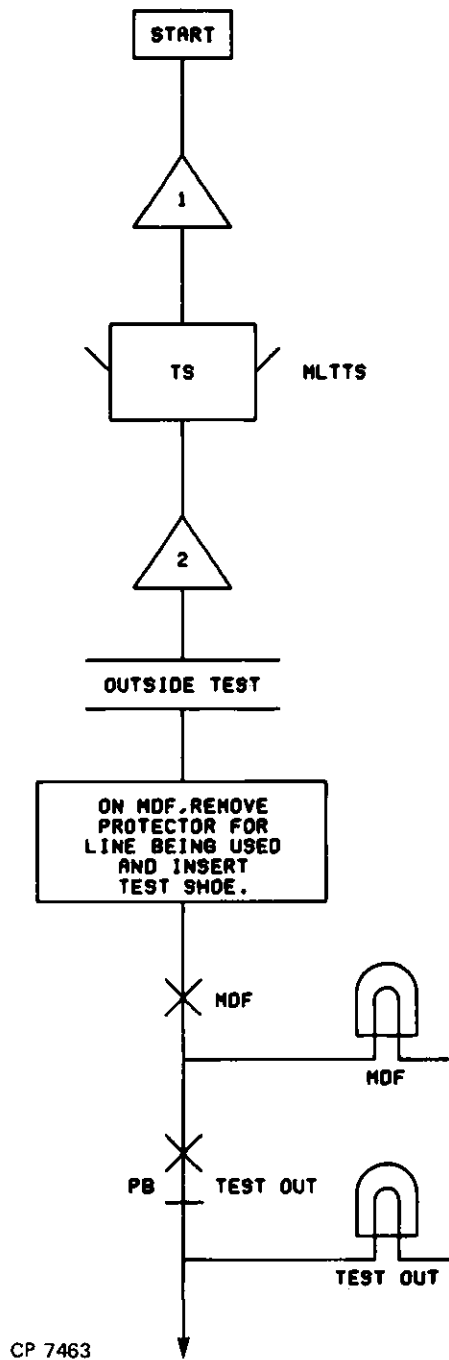


CP 7462

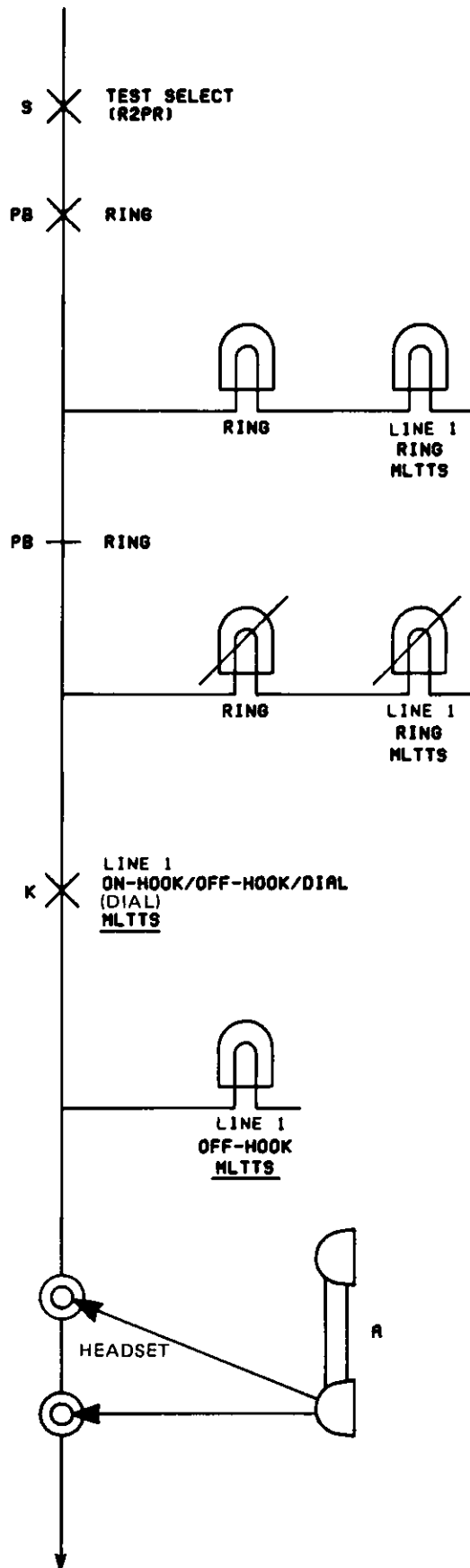
8.07 MDF Access Test.

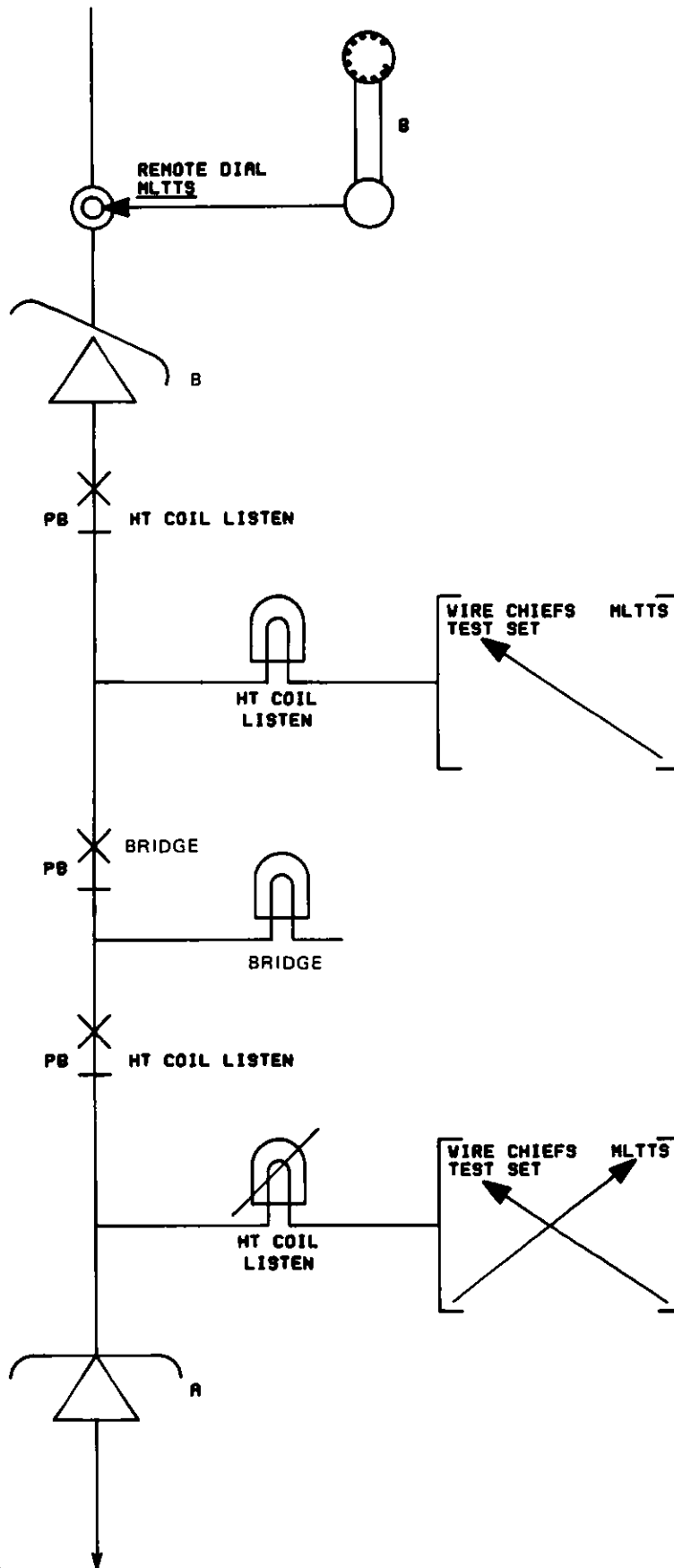
- a. Purpose.
- The following test sequence provides a precutover test to verify that the wire chiefs test set can access a line through the MDF test shoe.

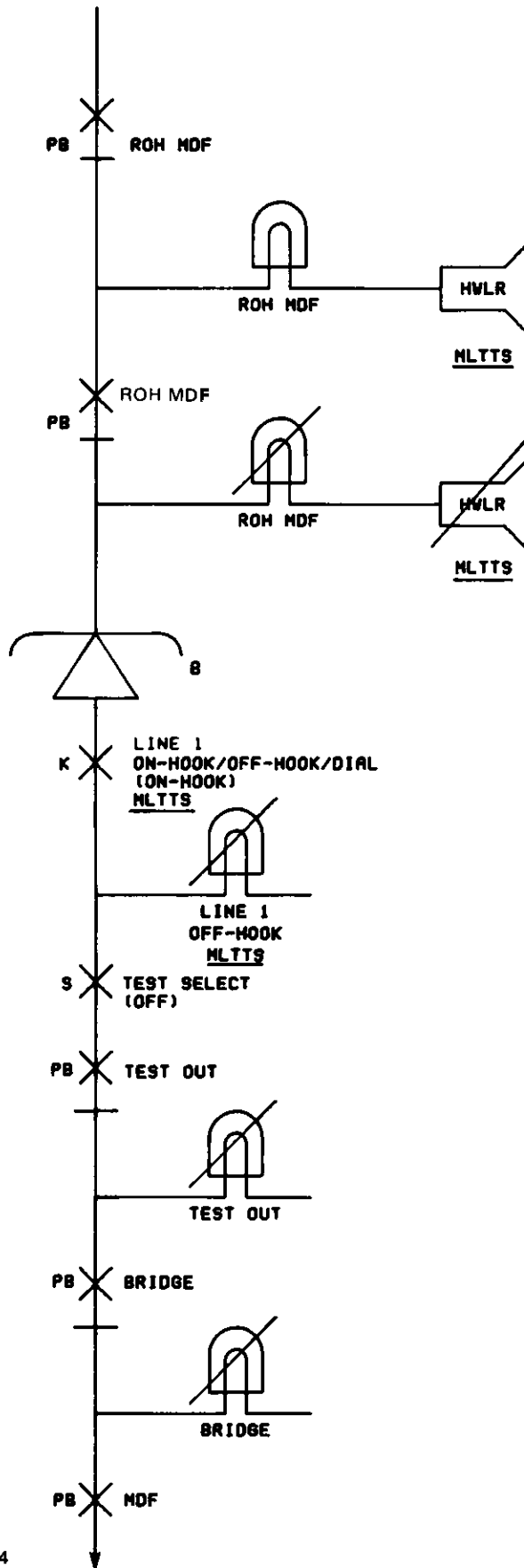
b. Test Sequence.



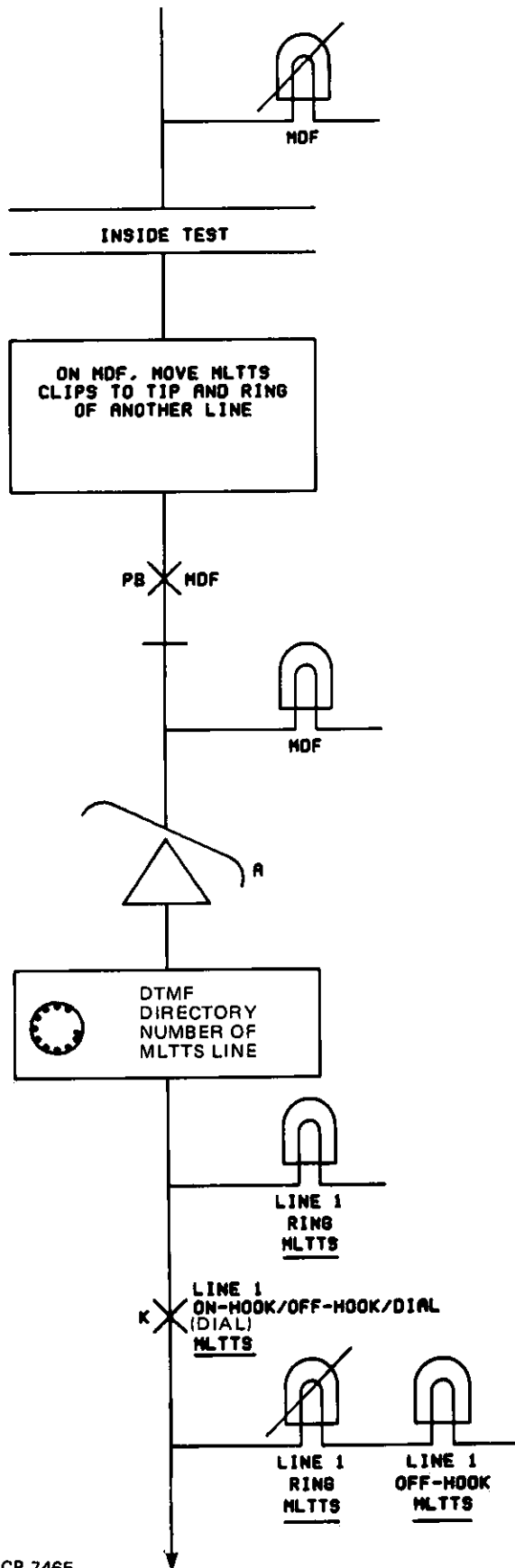
NO.	REMARKS
1	Connect plug end of power cord 202154-889 to POWER jack on MLTTS; connect T clip to fused -48 volts and S clip to ground.
2	Connect plug end of patch cord 200291-590 to LINE SELECTION jack for line 1 on MLTTS; connect clips to tip and ring appearance on MDF of line circuit to be used for test.



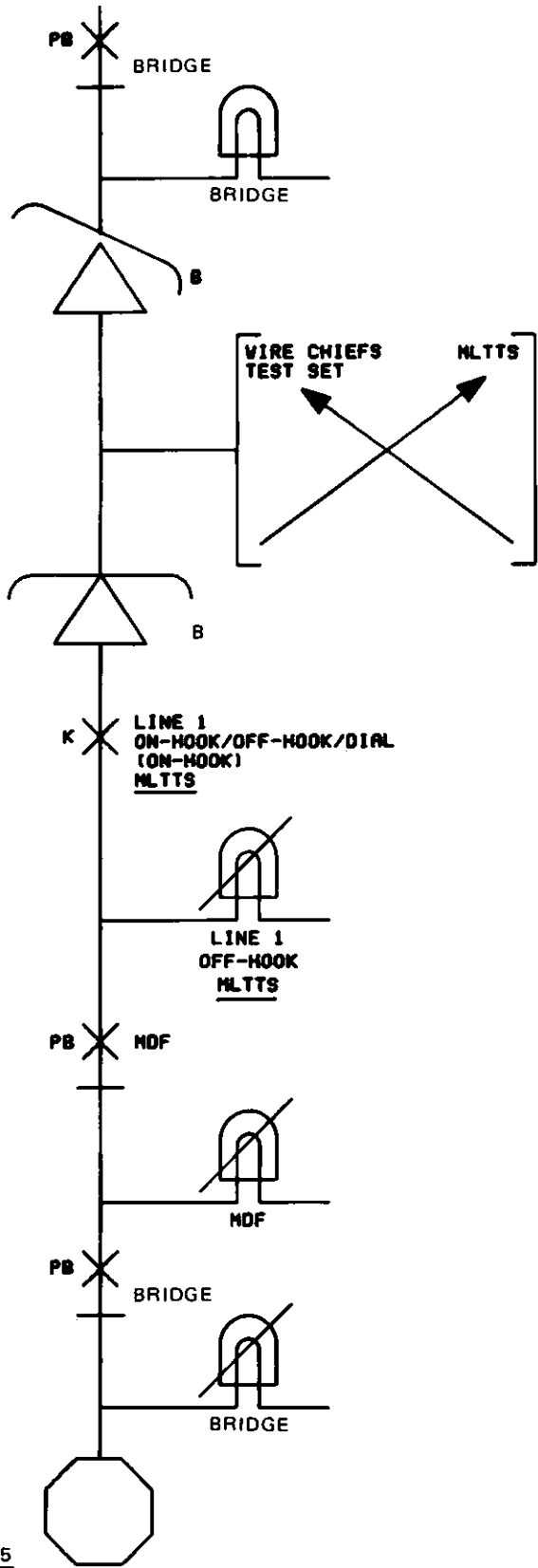




CP 7464



CP 7465

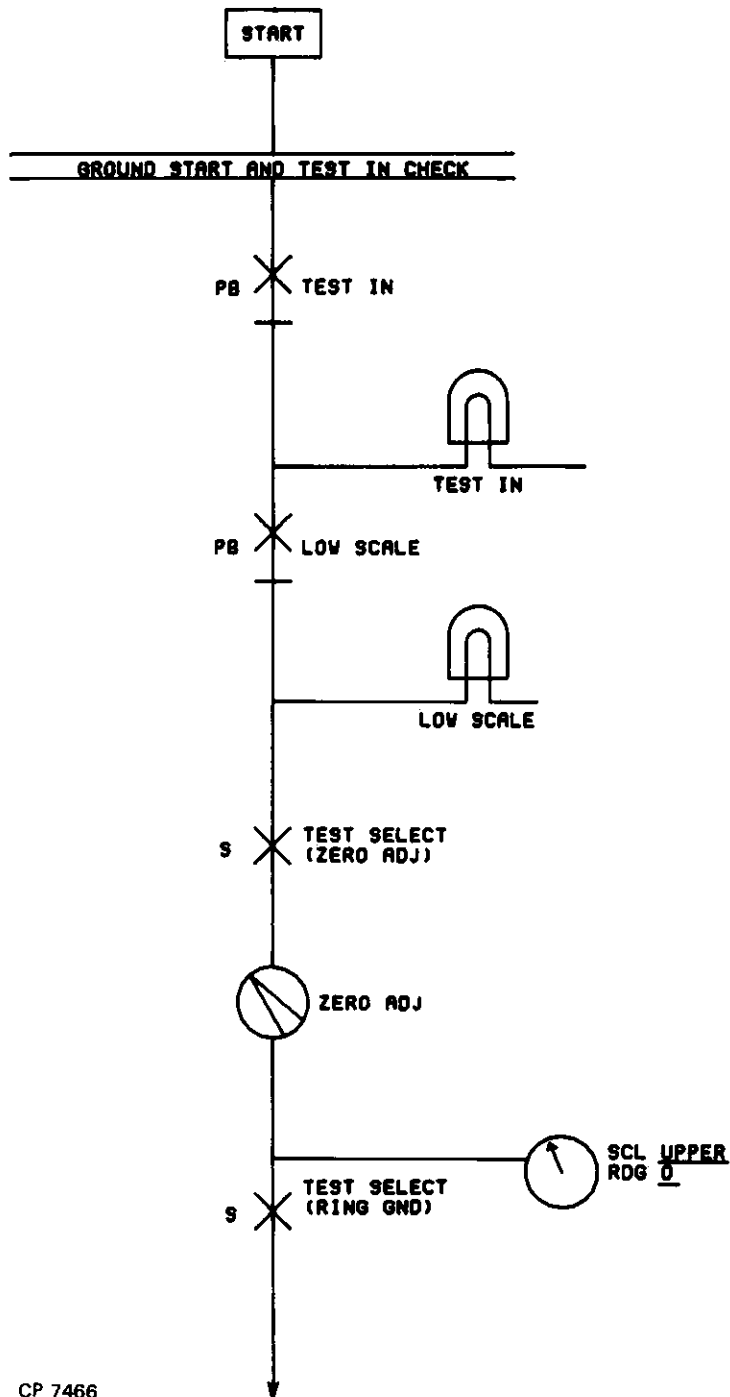


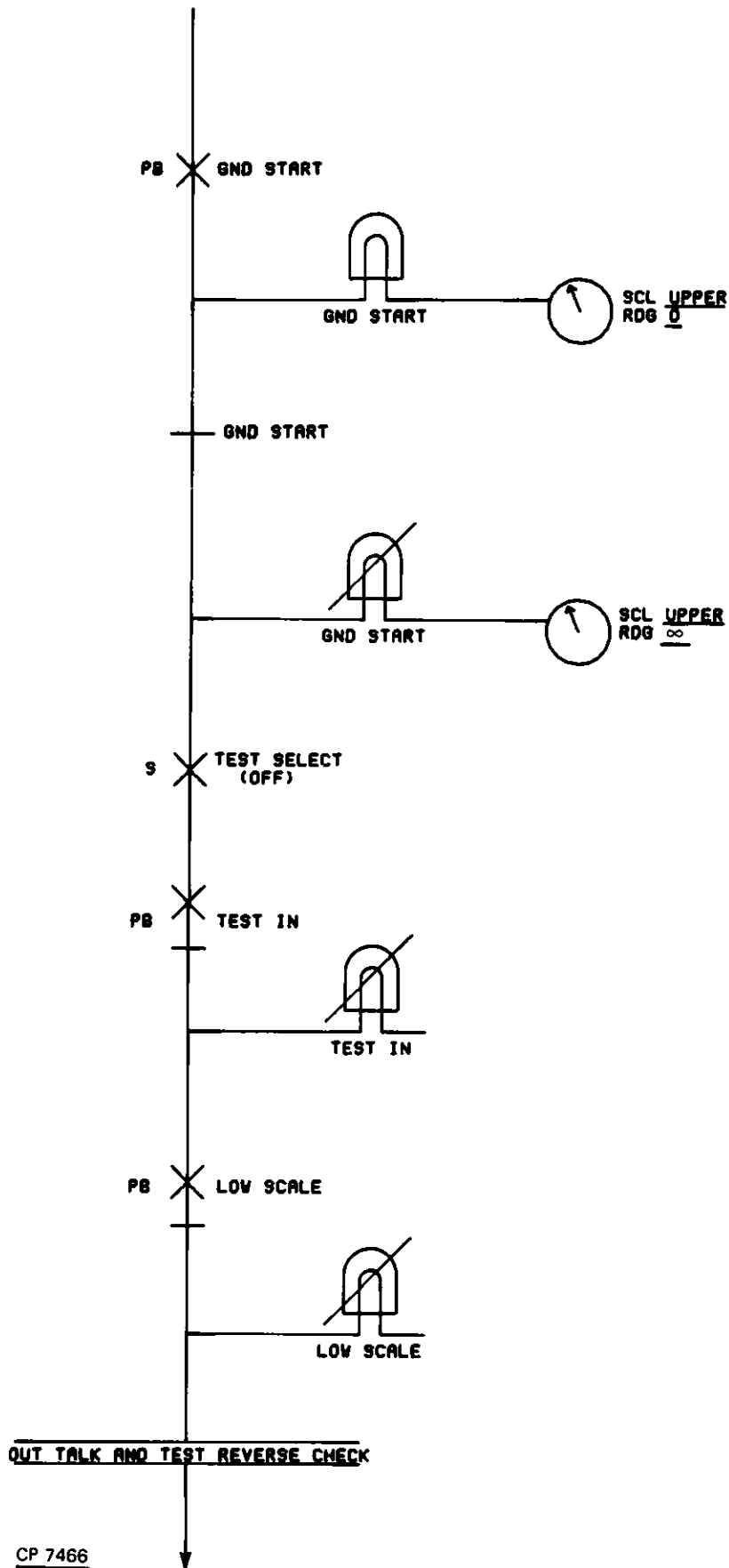
8.08 Miscellaneous Function Test.

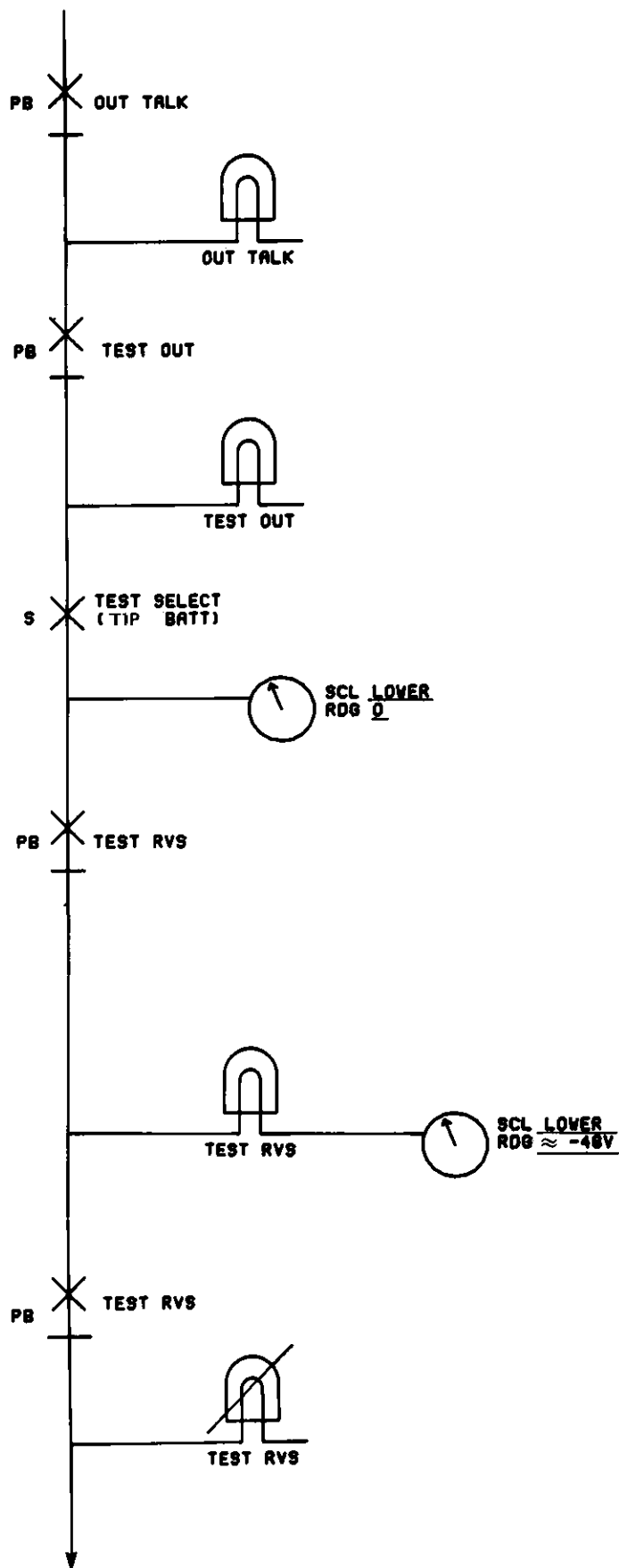
a. Purpose.

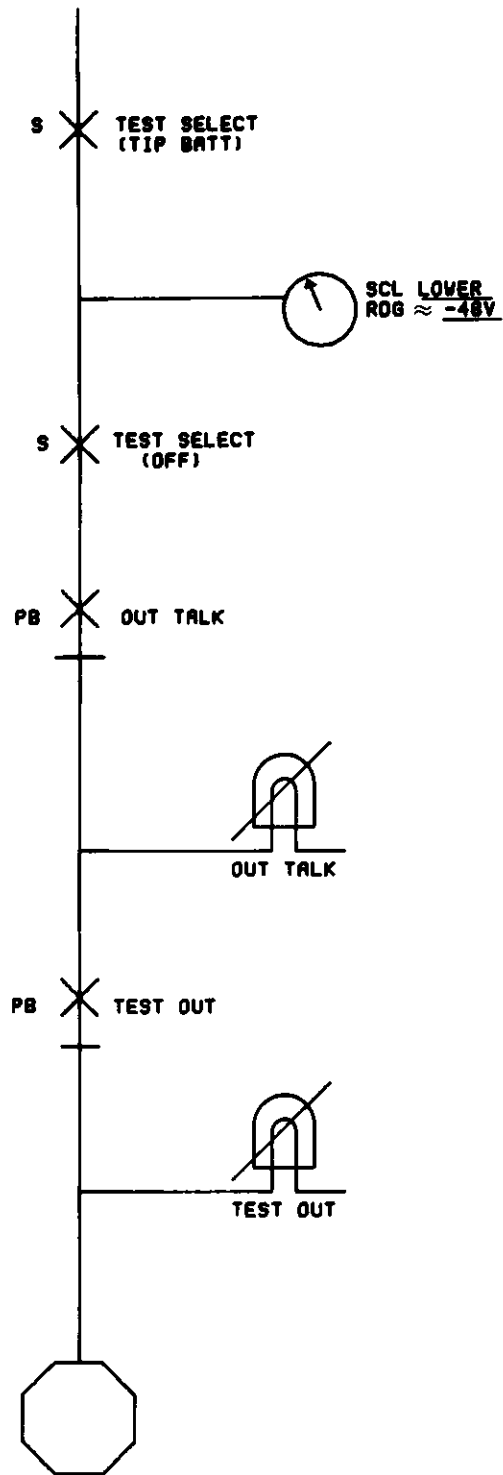
The following test sequence provides a precutover test of the ground start, test in, bridge, out talk, and test reverse features of the wire chiefs test set.

b. Test Sequence.







CP 7467

PART III. OPERATING INSTRUCTIONS

9. CONTROLS AND INDICATORS

9.01 The controls and indicators on the wire chiefs test set (fig. 2) are listed in table 1; a brief functional description of each is also provided.

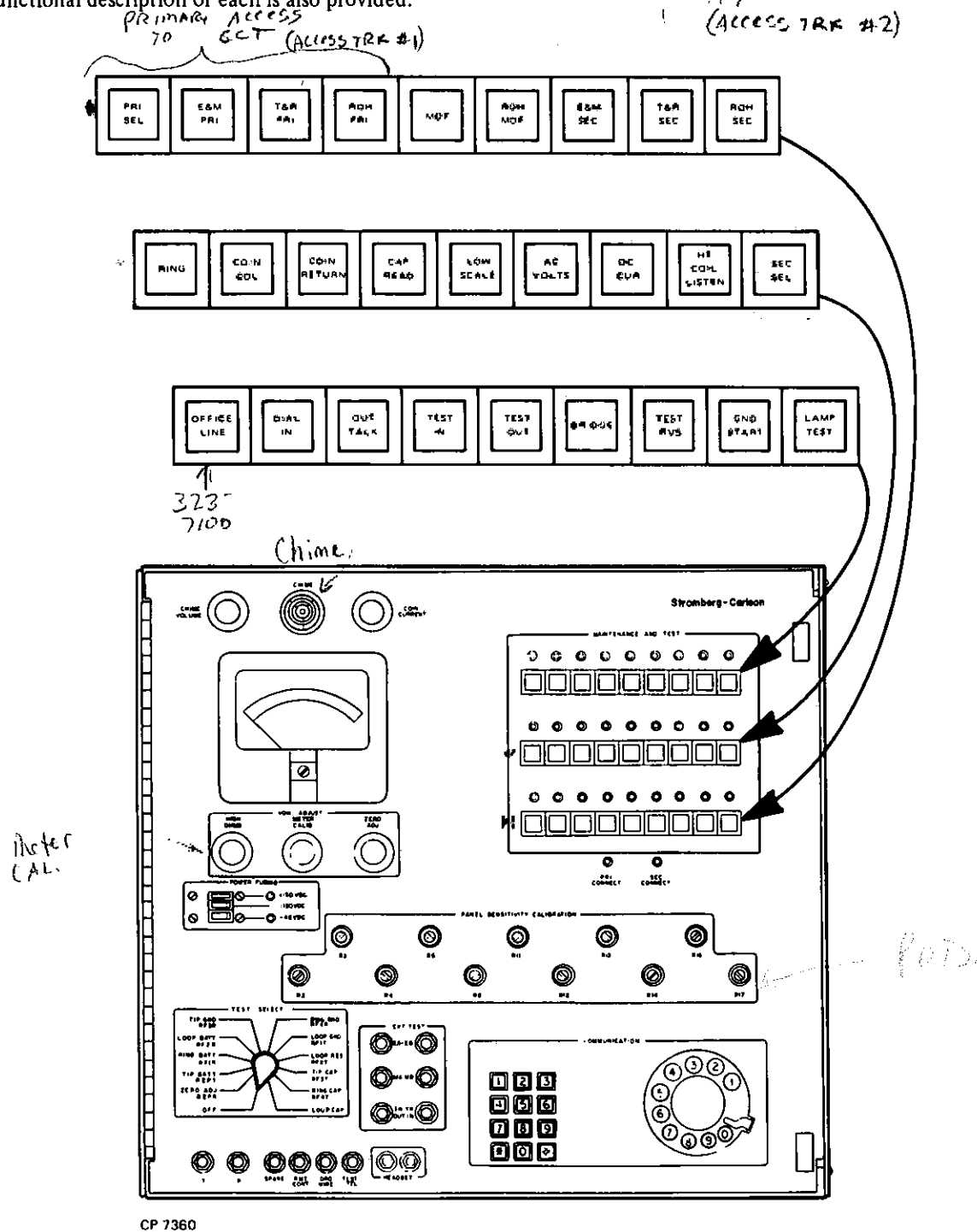


Figure 2. Controls and Indicators

Table 1. Wire Chiefs Test Set Controls and Indicators

<i>CONTROL OR INDICATOR</i>	<i>TYPE</i>	<i>FUNCTION</i>
CHIME	—	Indicates incoming call to test set.
CHIME VOLUME	Potentiometer	Used to adjust volume of chime.
COIN CURRENT	Potentiometer	Used to adjust coin current when MAINTENANCE AND TEST COIN COL or COIN RETURN button is operated. Current can be monitored on test set meter by setting TEST SELECT switch to OFF position.
COMMUNICATION		
DTMF Keypad	12-button keypad	Used for originating DTMF signaling over office line (T and R leads) subscriber line, or primary and secondary test ports.
Rotary Dial	—	Used for dial pulse signaling over office line (E&M leads), subscriber line, or primary and secondary test ports.
EXT TEST		
EA-EB, MA-MB	Jacks	Permit external test equipment to be connected to selected E & M leads (primary or secondary)
TR IN, TR OUT	Jacks	Permit external test equipment to be connected to unselected tip and ring leads (primary or secondary).
HEADSET	Jacks	Permit connection of headset to test set for monitoring office line or subscriber line.
MAINTENANCE AND TEST		
PRI SEL	Button, nonlocking	When pressed, permits code to be sent from rotary dial or DTMF keypad to make primary connection to port selected by code. Pressing again disables function. LED above button lights when function is activated.
E & M PRI	Button, nonlocking	When pressed, connects primary E & M leads from test access selector to EXT TEST jacks on test set. Pressing again disables function. LED above button lights when function is activated.

Table 1. Wire Chiefs Test Set Controls and Indicators (Cont)

<i>CONTROL OR INDICATOR</i>	<i>TYPE</i>	<i>FUNCTION</i>
T & R PRI	Button, nonlocking	When pressed, connects tip and ring leads of primary test circuit to T and R binding posts. Secondary circuit is automatically connected to EXT TEST jacks. Pressing button again disables function. LED above button lights when function is activated.
ROH PRI	Button, nonlocking	When pressed, ROH tone is applied to primary tip and ring leads. Pressing again silences tone. LED above button lights when tone is activated.
MDF	Button, nonlocking	When pressed, connects leads from MDF test shoe to meter and to binding posts and disconnects leads from test access circuits. Pressing again disables function. LED above button lights when function is activated.
ROH MDF	Button, nonlocking	When pressed, receiver off-hook (ROH) tone is applied to line through MDF test shoe. Pressing again silences tone. LED above button lights when tone is activated.
E & M SEC	Button, nonlocking	Similar to E & M PRI, except secondary E & M leads are used.
T & R SEC	Button, nonlocking	When pressed, connects tip and ring leads of secondary test circuit to T and R binding posts. Primary circuit is automatically connected to EXT TEST jacks. Pressing button again disables function. LED above button lights when function is activated.
ROH SEC	Button, nonlocking	Similar to ROH PRI, except tone is applied to secondary leads.
RING	Button, nonlocking	When pressed while TEST SELECT switch is in any ringing position (R2PR, etc.), applies ringing to line under test. LED above button lights while button is pressed.
COIN COL	Button, nonlocking	When pressed while TEST OUT button is operated, applies coin-collect voltage (+130 v) to line. Releasing button disables function. LED above button lights while button is pressed.
COIN RETURN	Button, nonlocking	Similar to COIN COL, except coin-return voltage (-130 v) is applied.

Table 1. Wire Chiefs Test Set Controls and Indicators (Cont)

<i>CONTROL OR INDICATOR</i>	<i>TYPE</i>	<i>FUNCTION</i>
CAP READ	Button, nonlocking	When pressed while TEST SELECT switch is in any CAP position, meter deflection is proportional to capacitance of line. LED above button lights while button is pressed.
LOW SCALE	Button, nonlocking	When pressed, divides meter voltage scale by 10 and resistance scale by 100. It also removes generator ground from ringing circuit to permit ringing certain types of off-hook telephones. Pressing again disables function. LED above button lights when function is activated.
AC VOLTS	Button, nonlocking	When pressed, connects meter across tip and ring leads of line under test to check for foreign voltage. Pressing again disables function. LED above button lights when function is activated.
DC CUR	Button, nonlocking	When pressed while TEST SELECT switch is in LOOP BATT position, allows meter to indicate dc loop current. Pressing again disables function. LED above button lights when function is activated.
HT COIL LISTEN	Button, nonlocking	When pressed, permits listening through heat coils of subscriber line to check continuity of coils. Pressing again disables function. LED above button lights when function is activated.
SEC SEL	Button, nonlocking	Similar to PRI SEL, except primary test circuit is used.
OFFICE LINE	Button, nonlocking	When pressed, connects test set rotary dial, DTMF keypad, and TEST TEL jack to line circuit allocated to test set. Pressing again disables function. LED above button lights when function is activated and to indicate incoming call on office line.
DIAL IN	Button, nonlocking	When pressed, permits dialing by test set rotary dial or DTMF keypad or by a test telephone connected to TEST TEL jack. Pressing again disables function. LED above lights when function is activated.
OUT TALK	Button, nonlocking	When pressed, applies transmission battery to line under test. Pressing again disables function. LED above button lights when function is activated.

Table 1. Wire Chiefs Test Set Controls and Indicators (Cont)

<i>CONTROL OR INDICATOR</i>	<i>TYPE</i>	<i>FUNCTION</i>
TEST IN	Button, nonlocking	When pressed, connects T IN and R IN leads of test access circuitry to meter and to T and R binding posts. Tip and ring path through port circuit is broken. Pressing again disables function. LED above button lights when function is activated.
TEST OUT	Button, nonlocking	When pressed, connects T OUT and R OUT leads of test access circuitry to meter and to T and R binding posts. Tip and ring path through port circuit is broken. Pressing again disables function. LED above button lights when function is activated.
BRIDGE	Button, nonlocking	When pressed while TEST OUT button is operated, connects T IN and R IN leads to T OUT and R OUT leads, respectively. Pressing again disables function. LED above button lights when function is activated.
TEST RVS	Button, nonlocking	When pressed, reverses tip and ring test connections to line under test. Pressing again disables function. LED above button lights when leads are reversed.
GND START	Button, nonlocking	When pressed, applies ground to ring lead to simulate ground-start trunk operation. LED above button lights while button is pressed.
LAMP TEST	Button, nonlocking	When pressed, tests all LEDs on test set. (Faulty LEDs stay dark).
ORD WIRE	Jack	Provides connection to maintenance communications facilities.
PANEL SENSITIVITY CALIBRATION	Potentiometers	Used for test set calibration. <i>Do not adjust unless instructed to do so in paragraph 10.</i>
PRI CONNECT	LED, red	Lights when test connection is made through primary circuit.
R	Binding post	Used with T binding post to permit external test equipment to be connected to selected tip and ring leads (primary or secondary)
RMT CONT	Jack	Permits remote control of line or function.
SEC CONNECT	LED, red	Lights when test connection is made through secondary circuit.

Table 1. Wire Chiefs Test Set Controls and Indicators (Cont)

<i>CONTROL OR INDICATOR</i>	<i>TYPE</i>	<i>FUNCTION</i>
T	Binding post	See R binding post.
TEST SELECT	Rotary switch, 12-position	
OFF		Disables meter.
ZERO ADJ/R2PR		a. Permits zero-set of meter by ZERO ADJ control. b. Causes frequency 1 of ringing generator to be applied to ring lead of two-party line when RING button is pressed.
TIP BATT/R2PT		a. Permits testing for battery on tip side of line. b. Causes frequency 1 of ringing generator to be applied to tip lead of two-party line when RING button is pressed.
RING BATT/RF1R		a. Permits testing for battery on ring side of line. b. Causes frequency 1 of ringing generator to be applied to ring lead of four-party line when RING button is pressed.
LOOP BATT/RF2R		a. Permits testing for battery across tip and ring leads of line. b. Causes frequency 2 to be applied to ring lead of four-party line when RING button is pressed.
TIP GND/RF3R		a. Permits testing for ground on tip side of line. b. Causes frequency 3 to be applied to ring lead of four-party line when RING button is pressed.
RING GND/RF4R		a. Permits testing for ground on ring side of line. b. Causes frequency 4 to be applied to ring lead of four-party line when RING button is pressed.
LOOP GND/RF1T		a. Permits testing for ground on line loop. b. Causes frequency 1 to be applied to tip lead of four-party line when RING button is pressed.
LOOP RES/RF2T		a. Permits measurement of line loop resistance. b. Causes frequency 2 to be applied to tip lead of four-party line when RING button is pressed.

Table 1. Wire Chiefs Test Set Controls and Indicators (Cont)

<i>CONTROL OR INDICATOR</i>	<i>TYPE</i>	<i>FUNCTION</i>
TIP CAP/RF3T	Jack	a. Permits capacitance measurement between tip side of line and ground. b. Causes frequency 3 to be applied to tip lead of four-party line when RING button is pressed.
RING CAP/RF4T		a. Permits capacitance measurement between ring side of line and ground. b. Causes frequency 4 to be applied to tip lead of four-party line when RING button is pressed.
LOOP CAP		Permits measurement of line loop capacitance.
TEST TEL		Permits connection of hand test telephone to test set for answering, monitoring, or placing calls on office line or subscriber line.
VOLTOHMMETER		Upper scale indicates resistance from 0 to infinity. Lower scale indicates dc voltage from 0 to 150 volts.
VOM ADJUST		
HIGH OHMS		Used to calibrate meter before making high resistance measurements.
METER CALIB		Used to calibrate meter before making voltage measurements.
ZERO ADJ	Potentiometer	Used to calibrate meter before making low resistance measurements.

10. CALIBRATION

10.01 Meter Calibration/Operational Check.

Although the meter is calibrated before leaving the factory, it is recommended that an operational check be made prior to initial use and as often as necessary thereafter. Before making each resistance measurement, zero-set the meter to ensure accuracy of the check. Procedures for zero-setting the meter are described in paragraph 10.01a. The telephone assigned to the test set office line must be on-hook and the hand test telephone plug removed from the jack on the front panel of the test set.

NOTE. If proper indications for resistance checks are not obtained, calibrate the meter as described in paragraph 10.02.

a. Resistance Check.

1. Place TEST SELECT switch in ZERO ADJ position.
2. Connect a known-accurate 51-kilohm resistor across T and R binding posts.

3. Set ZERO ADJ control to center of its range. Meter indicates 0 ohms.
 4. Place TEST SELECT switch in LOOP RES position. Meter deflects to approximately midscale (51K).
 5. Remove resistor from T and R binding posts. Rotate selector switch to OFF position.
- b. Voltage Check and Calibration.
1. Check that all test buttons are in normal position.
 2. Place TEST SELECT switch in LOOP BATT position.
 3. Set vacuum-tube voltmeter (VTVM) to dc voltage scale and connect to T and R binding posts.
 4. Set external power supply to lowest output and connect to T and R binding posts (+ to T and - to R). Adjust power supply for 7.5-volt dc output.
 5. Press LOW SCALE button on test set.
 6. Rotate R13 on test set clockwise to three-quarters of its range.
 7. Adjust R8 until test set meter deflects to middle of lower scale.
 8. Set external power supply for 15-volt dc output.
 9. If test set meter does not indicate 15 volts, adjust R8 and R13 accordingly.
 10. Adjust power supply to several voltages below 15 volts and monitor test set meter and VTVM for correct tracking.
 11. Press LOW SCALE button to inhibit low-scale function.
 12. Adjust power supply for 60-volt dc indication on VTVM.
 13. Adjust METER CALIB control on test set until test set meter indicates 60 volts.
 14. Decrease the power supply output and monitor test set meter and VTVM for proper tracking.
 15. Disconnect VTVM and power supply from test set.
- 10.02 Calibration of Meter for Resistance Readings.**
Calibration of the meter should not be necessary unless the operational check requirements in paragraph 10.01 cannot be met.
- a. Low-Resistance Calibration.
1. Place TEST SELECT switch in ZERO ADJ position.
 2. Connect a known-accurate 510-ohm resistor across T and R binding posts.
 3. Set R4 and ZERO ADJ controls to midrange.
 4. Press LOW SCALE button.
 5. Adjust R3 for 0-ohm indication on meter.
 6. Place TEST SELECT switch in LOOP RES position.
 7. Adjust R2 for midscale deflection (510 ohms).
 8. Alternately place TEST SELECT switch in ZERO ADJ and LOOP RES and adjust R3 and R2 for 0-ohm and 510-ohm indications, respectively.
 9. Press LOW SCALE button to inhibit low-scale function.
 10. Remove resistor from binding posts.
- b. High-Resistance Calibration.
1. Connect a known-accurate 51-kilohm resistor across T and R binding posts.
 2. Place TEST SELECT switch in ZERO ADJ position.

3. Adjust HIGH OHMS control for 0-ohm indication on meter.
4. Place TEST SELECT switch in LOOP RES position.
5. Adjust R6 for midscale deflection (51K) on meter.
6. Alternately place TEST SELECT switch in ZERO ADJ and LOOP RES positions and adjust HIGH OHMS and R6 for 0-ohm and 51-kilohm indications, respectively.
7. Place TEST SELECT switch in OFF position.
8. Remove resistor from binding posts.

10.03 Calibration of Meter for Ac Voltage Readings.

a. Low-Voltage Calibration.

1. Set VTVM to ac voltage scale and connect to T and R binding posts.
2. Set variable transformer to lowest output and connect to T and R binding posts.
3. Press LOW SCALE and AC VOLTS buttons.
4. Adjust transformer for 7.5-volt indication on VTVM.
5. Adjust R12 to obtain midscale deflection (7.5 volts) on test set meter.
6. Increase transformer output to 15 volts.
7. If test set meter does not deflect to full scale, adjust R12.
8. Press LOW SCALE button to inhibit low-scale function.

b. High-Voltage Calibration.

1. Increase ac input to 75 volts.
2. Adjust R11 to obtain midscale deflection (75 volts) on test set meter.

3. Set ac input to 0 volts.
4. Press AC VOLTS button.
5. Disconnect transformer and VTVM from binding posts.

10.04 Calibration of Meter for Current Readings.

- a. Place TEST SELECT switch in LOOP BATT position.
- b. Press DC CUR button.
- c. Connect a 10-ohm resistor between T binding post and + output of external dc power supply.
- d. Set VTVM for dc current and connect it between R binding post and negative output of dc power supply.
- e. Increase power supply output until current limiting occurs.
- f. Adjust R17 until test set meter reads same value as VTVM.
- g. Turn off dc power supply.
- h. Disconnect power supply, VTVM, and resistor from binding posts.
- i. Press DC CUR button.

10.05 Calibration of Meter for Capacitance Readings.

- a. Set TEST SELECT switch to LOOP CAP position.
- b. Connect 2- μ F capacitor across T and R binding posts.
- c. Press and release CAP READ button several times. Meter should indicate 48 on lower scale.
- d. Adjust R14 to obtain average reading of 48 when CAP READ button is pressed and released several times.
- e. Place TEST SELECT switch in OFF position.
- f. Remove capacitor from binding posts.

11. TESTS USING OFFICE LINE**11.01 Placing Call With Hand Test Telephone.**

- a. Press OFFICE LINE button.
- b. Insert plug of hand test telephone into TEST TEL jack.
- c. Listen to receiver of hand test telephone.
- d. When dial tone is heard, dial desired number using DTMF keypad on hand test telephone, or using rotary dial or DTMF keypad on test set.
- e. To place another call immediately after call is completed, press OFFICE LINE button. Press button again, listen for dial tone, and dial required number.
- f. If further calls are not desired, remove hand test telephone plug from TEST TEL jack and press OFFICE LINE button again.

11.02 Answering Incoming Call.

When chime sounds, it indicates incoming call. To answer call:

- a. Press OFFICE LINE button.
- b. Insert plug of hand test telephone into TEST TEL jack and talk to calling party.
- c. When call is completed, press OFFICE LINE button again and remove plug of hand test telephone from TEST TEL jack.

12. TESTS USING TEST PORTS**12.01 General.**

The test line is used to establish metallic access to ports from the EXT TEST jack when certain codes are dialed on the test panel rotary dial. The path can be set up over either the primary or the secondary test access selector circuits by operating the PRI SEL or SEC SEL button. The test equipment can be connected to the IN or OUT EXT TEST jacks to permit testing into the system or out to the subscriber. The following types of access can be made:

- a. Metallic access to a port, without ringing, by dialing a single digit to identify the office code and four directory number digits. For example, office code (7) + directory number (4138).
- b. Metallic access to a port, without ringing, by dialing a five-digit port identification number. For example, common control (0 through 3) + matrix switch (0 through 7), + port group (0 through 7) + port (00 through 29).
- c. Metallic access (for test equipment) to a port that is in conversation with the office line by dialing a single digit to indicate the office code, followed by the four-digit directory number of the office line. The first digit dialed determines the specific type of access that is enabled.

12.02 Line Testing.

Simultaneous line testing can be done by way of the primary and secondary test ports. One test port can be tested with the circuitry of the wire chiefs test panel and the other one can be tested with equipment connected to the EXT TEST jack. To set up test paths through the primary and/or secondary test ports, do the following:

- a. Restore all functions on the panel to normal (associated LEDs are dark).
- b. Press TEST OUT and either T&R PRI or T&R SEC button, depending on mode of testing to be done.
- c. Press either PRI SEL or SEC SEL button, depending on mode of testing.
- d. Dial required access digits for line to be tested.
- e. Select other test functions needed by pressing applicable buttons; the TEST OUT button must be restored when TEST IN is required.
- f. When testing is completed, restore all functions to normal. Restore the T&R PRI or T&R SEC button last.

12.03 Testing Outside Plant.

- a. Connect required test equipment to EXT TEST EA-EB and MA-MB or TR OUT jacks on panel.
- b. For tip and ring tests, either press PRI SEL button if *secondary* test circuit is to be used, or press SEC SEL button if *primary* test circuit is to be used. For E&M lead tests, either press PRI SEL button if *primary* test circuit is to be used, or press SEC SEL button if *secondary* test circuit is to be used.
- c. Use test panel rotary dial to dial required access digits; refer to office records to determine codes assigned for each port. When test connection is made to port, either PRI CONNECT or SEC CONNECT LED lights, depending on button pressed in step b.
- d. Do desired tests using test equipment that is connected to EXT TEST jacks.
- e. When testing is completed, restore all functions to normal (associated LEDs are dark) and disconnect test equipment from EXT TEST jacks.

12.04 Testing Inside Plant.

- a. Connect required test equipment to EXT TEST EA-EB and MA-MB or TR IN jacks.
- b. Do steps b through e described in paragraph 12.03.

13. TESTING THROUGH TEST SHOE

13.01 Test Connection.

Tests can be made from the test panel on all lines and trunks that are connected at the protector blocks of the main distributing frame (MDF) by using the test shoe. To connect the test panel to a line or trunk, first ensure that all functions on the test panel are normal (associated LEDs are dark), then insert the test shoe into the protector block of the line or trunk and press the MDF button.

13.02 Preliminary (Monitoring) Test.

Before making any test on a line or trunk, monitor the line or trunk to determine if it is in use. Proceed as follows:

- a. Operate the R switch on the hand test telephone and insert the telephone plug into TEST TEL jack (off-hook condition).

- b. Press HT COIL LISTEN button and listen to receiver.
- c. If line or trunk is busy, press HT COIL LISTEN button and go on-hook (remove hand test telephone from TEST TEL jack or press C switch).
- d. If line or trunk is idle, proceed as described for type of test required (paragraph 13.03 through 13.10).

13.03 Testing Outside Plant.

- a. Monitor line (paragraph 13.02), then go on-hook.
- b. Restore HT COIL LISTEN button.
- c. Press TEST OUT button.
- d. Do desired tests as described in paragraphs 14 through 24.
- e. When testing is completed, restore all functions to normal and remove test shoe.

13.04 Testing Inside Plant Bypassing Heat Coils.

- a. Monitor line (paragraph 13.02), then go on-hook.
- b. Operate TEST IN button.
- c. Do desired tests as described in paragraphs 14 through 24.
- d. When testing is completed, restore all functions to normal and remove test shoe.

13.05 Testing Inside Plant Through Heat Coils.

- a. Monitor line (paragraph 13.02), then go on-hook.
- b. Do desired tests as described in paragraphs 14 through 24.
- c. When testing is completed, restore all functions to normal and remove test shoe.

13.06 Outgoing Call Through Outside Plant.

- a. Monitor line (paragraph 13.02), then go on-hook.

- b. Restore HT COIL LISTEN button.
- c. Press TEST OUT button.
- d. Set TEST SELECT rotary switch to ringing frequency of party to be called (table 1).
- e. On lines requiring transmission battery, press OUT TALK button.
- f. Press RING button intermittently to produce desired ringing code.
- g. After approximately 3 seconds, repeat ringing code.
- h. Go to off-hook condition with hand test telephone.
- i. Press HT COIL LISTEN button and monitor line to determine if called party has answered.
- j. When called party answers, press HT COIL LISTEN button again.
- k. Proceed with conversation.
- l. When conversation is completed, restore all functions to normal.
- m. Go to on-hook condition with hand test telephone.
- n. Remove test shoe.

13.07 Originating Call Through Dial Equipment — Regular Lines or Trunks.

- a. Monitor line (paragraph 13.02).
- b. Restore HT COIL LISTEN button.
- c. Press DIAL IN button.
- d. Dial desired number using dial on hand test telephone.
- e. When dialing is completed, dial equipment rings called party.

f. When called party answers, dial equipment supplies transmission battery to hand test telephone and to called telephone.

g. Proceed with conversation.

h. When conversation is completed, restore all functions to normal.

i. Go to on-hook condition with test telephone.

j. Remove test shoe.

13.08 Originating Calls to PBX Lines or Special Lines.

When testing a PBX line circuit (or any other circuit that does not furnish ground on the tip side of the line), do the following:

- a. Connect ground to R binding post.
- b. Go to off-hook condition with hand test telephone.
- c. Press DIAL IN button.
- d. Press TEST IN button.
- e. When dial tone is heard, press TEST IN button again.
- f. Press TEST OUT button.
- g. Proceed as described in paragraph 13.07, steps d through i.
- h. Remove ground from R binding post.

13.09 Originating Calls Through Incoming Ringdown Trunks.

- a. Monitor trunk (paragraph 13.02), then go to on-hook condition.
- b. Restore HT COIL LISTEN button.
- c. Press TEST IN button.
- d. Press RING button.

- e. Go to off-hook condition with hand test telephone.
- f. When switchboard operator answers, proceed with conversation.
- g. When conversation is completed, restore all functions to normal.
- h. Go to on-hook condition with hand test telephone.
- i. Remove test shoe.

13.10 Originating Calls Through Incoming Common-Battery Trunks.

- a. Restore HT COIL LISTEN button.
- b. Press TEST IN button.
- c. Press DIAL IN button.
- d. When switchboard operator answers, proceed with conversation.
- e. When conversation is completed, restore all functions to normal.
- f. Go to on-hook condition with hand test telephone.
- g. Remove test shoe.

14. TESTING THROUGH BINDING POSTS

14.01 General.

The binding posts can be used for two different purposes: components or equipment can be connected to the binding posts, allowing tests to be made from the test panel; and external test equipment (Wheatstone bridge, dial-speed test set, etc.) can be connected to the binding posts, after the preliminary test path is set up through the test shoe, to increase the capability of the test panel for testing lines and equipment through the test shoe. When the test panel is used for testing components or equipment connected to the binding posts, do the following:

14.02 Potential Tests.

- a. Connect equipment to be tested to binding posts.
- b. Do desired tests as instructed in paragraphs 17 through 24.
- c. Disconnect equipment from binding posts when testing is completed.

14.03 Ringing.

- a. Set TEST SELECT rotary switch for required ringing condition.
- b. Connect equipment to be tested to binding posts.
- c. Press TEST OUT button
- d. Press RING button to apply required ringing frequency to equipment connected to binding posts.
- e. Restore RING button to remove ringing.
- f. Disconnect equipment from binding posts when testing is completed.

14.04 Transmission Battery.

- a. Connect equipment to be tested to binding posts.
- b. Go to off-hook condition with hand test telephone.
- c. Press OUT TALK button to connect battery and ground to component by way of R and T binding posts, respectively.
- d. Press OUT TALK button again to disconnect transmission battery supply.
- e. When testing is completed, go to on-hook condition with hand test telephone.
- f. Disconnect equipment from binding posts.

14.05 Dialing.

- a. Connect equipment to be dial pulsed to binding posts.
- b. Go to off-hook condition with hand test telephone.
- c. Press DIAL IN button.
- d. Press TEST IN button.
- e. Dial desired number on test set rotary dial to apply dial pulses to equipment connected to binding posts.
- f. Restore all functions to normal.
- g. Disconnect equipment from binding posts.

15. HEAT COIL TEST

15.01 To check the condition of the heat coils do the following:

- a. Set TEST SELECT rotary switch to OFF position.
- b. Go to off-hook condition with hand test telephone.
- c. Press HT COIL LISTEN button and listen to receiver. If line is busy, try again later.
- d. If there is no conversation on line, press TEST OUT and OUT TALK buttons.
- e. If dial tone is heard in receiver, heat coils are not open.

16. TESTING FOR NEGATIVE BATTERY ON TIP OR RING LEAD

CAUTION. If the meter needle moves off-scale (left) during the following procedure, immediately disconnect from the line being tested. A positive voltage is on tip or ring.

16.01 To test for negative battery, do the following:

- a. Set TEST SELECT rotary switch to TIP BATT/R2TP position for testing on tip lead. For testing on ring lead, set TEST SELECT rotary switch to RING BATT/RF1R position.
- b. Connect to line or trunk by using test shoe.
- c. If there is negative battery potential on lead, meter needle indicates voltage value on lower scale of meter.
- d. If meter needle does not move, lead is either open or free of battery potential.
- e. Upon completion of test, restore all functions to normal and disconnect test shoe.

17. MEASURING LINE BATTERY VOLTAGE

17.01 To measure the battery voltage across the T and R loop of a line, do the following:

- a. Set TEST SELECT rotary switch to LOOP BATT/RF2R position.
- b. Connect to line or trunk by using test shoe.
- c. If there is positive battery potential on line, meter needle indicates voltage value on lower scale of meter.
- d. If meter needle does not move, loop is either open or free of battery potential.
- e. Upon completion of test, restore all functions to normal and disconnect test shoe.

18. TESTING FOR FOREIGN AC VOLTAGE ON LINE

18.01 To test for foreign ac voltage on line, do the following:

- a. Connect to line by using test shoe.
- b. Press TEST OUT and AC VOLTS button.
- c. If there is foreign ac voltage on line, meter needle indicates voltage on lower scale.

- d. Upon completion of test, restore all functions to normal and disconnect test shoe.

19. TESTING FOR GROUND ON TIP OR RING LEAD

19.01 To test for ground on tip or ring lead, do the following:

- a. Before making resistance test, zero-set meter as described in the following steps to ensure accuracy of readings.

1. Set TEST SELECT rotary switch to ZERO ADJ/R2PR position.

2. If resistance below 5000 ohms is to be measured, operate LOW SCALE button.

3. Adjust ZERO ADJ control so that meter needle indicates 0 on resistance scale.

- b. Set TEST SELECT rotary switch to TIP GND/RF3R position for measuring ground on tip lead of line, or to RING GND/RF4R position for measuring ground on ring lead.

- c. Connect to line or trunk by using test shoe.

- d. If there is ground on line, resistance to ground is indicated on upper scale of meter.

- e. If meter needle does not move, it indicates that lead is either open or not grounded.

- f. Upon completion of test, restore all functions to normal and disconnect test shoe.

20. MEASURING LINE LOOP RESISTANCE AND LEAKAGE

20.01 To measure line loop resistance and leakage, do the following:

- a. Zero-set meter as described in paragraph 19.

- b. Set TEST SELECT rotary switch to LOOP RES/RF2T position.

- c. Connect to line or trunk by using test shoe.

- d. With telephone at distant end on-hook, meter reading indicates leakage resistance of line.

- e. Compare this reading with resistance shown on line record card to determine if line is faulty.

- f. With telephone at distant end off-hook, meter reading indicates loop resistance of line. If meter needle indicates 5000 ohms or less, press LOW SCALE button and divide meter indication by 100 to obtain actual loop resistance.

- g. Compare this reading with resistance shown on line record card to determine if line is faulty.

- h. Upon completion of test, restore all functions to normal and disconnect test shoe.

21. MEASURING LINE CAPACITANCE

NOTE. When testing the capacitance of a line, the telephone at the distant end should be on-hook.

21.01 Tip-to-Ground Capacitance.

- a. Set TEST SELECT rotary switch to TIP CAP/RF3T position.

- b. Connect to line or trunk by using test shoe.

- c. Rapidly press and release CAP READ button several times. Observe lower scale of meter and record maximum reading.

- d. Compare recorded reading with table 2 (DEFLECTION column) to obtain capacitance reading (CAPACITY column).

- e. Upon completion of this test, either proceed with other tests or restore all functions to normal.

21.02 Ring-to-Ground Capacitance.

The procedures for measuring ring capacitance are identical to those for measuring tip capacitance, except that the TEST SELECT rotary switch is set to RING CAP/RF4T position.

21.03 Loop Capacitance.

- a. Set TEST SELECT rotary switch to LOOP CAP position.

- b. Rapidly press and release CAP READ button several times. Observe lower scale of meter and record maximum reading.

Table 2. Conversion of Meter Deflection to Capacity Value

<i>DEFLECTION (IN VOLTS)</i>	<i>CAPACITY (IN μF)</i>	<i>DEFLECTION (IN VOLTS)</i>	<i>CAPACITY (IN μF)</i>	<i>DEFLECTION (IN VOLTS)</i>	<i>CAPACITY (IN μF)</i>
19	0.5	36	1.0	110	6.0
22	0.6	62	2.0	116	7.0
26	0.7	78	3.0	122	8.0
30	0.8	94	4.0	128	9.0
32	0.9	102	5.0	132	10.0

c. Subtract tip capacitance reading (paragraph 21.01) from loop capacitance reading given in step b above. Result is loop capacitance.

d. Compare recorded reading with table 2 (DEFLECTION column) to obtain capacitance reading (CAPACITY column).

e. Upon completion of this test, either proceed with other tests or restore all functions to normal.

22. RECEIVER OFF-HOOK NOTIFICATION USING GENERATOR GROUND CUTOFF

22.01 The LOW SCALE button controls generator ground cutoff. Generator ground cutoff is used on lines having subsets that do not remove ringers from the line when the phone is off-hook, or on lines having telephones equipped with varistors connected across the receiver.

22.02 To signal a subscriber who has left the telephone off-hook, the usual howler method is ineffective. To signal the subscriber, operate the LOW SCALE button and apply ringing to the line by operating the RING button. Operation of the LOW SCALE button removes the shunt across the ringer of the off-hook telephone so that the telephone can be rung without ringing current damaging the receiver.

23. RECEIVER OFFHOOK TONE (HOWLER) USAGE

23.01 Except as noted in paragraph 22, the howler is used in an attempt to alert a subscriber whose telephone is off-hook. To apply the howler over the primary or secondary test access circuit, operate the ROH PRI or ROH SEC button, respectively. To apply the howler through the test shoe, operate the ROH MDF button.

24. PAYSTATION TESTING

24.01 General.

The coin-collect and coin-return functions of a paystation telephone can be tested by applying coin-collect voltage (+130 V) or coin-return voltage (-130 V), to the line. Coin current, for the test, can be adjusted to determine the operating limits for the paystation.

24.02 Coin-Return Test.

- Send technician to paystation that is to be tested.
- Connect test panel to paystation line through test shoe.
- Press TEST OUT button.
- Have technician at paystation deposit coin.
- Press COIN RETURN button on test panel. Coin is returned at paystation. If not, press COIN RETURN button again and use COIN CURRENT control to increase current in an effort to release coin.
- If coin cannot be returned, further troubleshooting must be done.
- Restore all functions to normal and disconnect test shoe.
- Have technician at paystation go on-hook.

24.03 Coin-Collect Test.

Follow the procedure for the coin-return test, except use the COIN COL button instead of the COIN RETURN button.

PART IV. FUNCTIONAL DESCRIPTION

25. GENERAL

25.01 The functions performed by the wire chiefs test set are related directly to the MAINTENANCE AND TEST buttons on the front panel. These functions, therefore, are described through descriptions of these buttons. Figure FO-1 is a detailed block diagram of the logic and relay circuits that perform the various functions.

26. PUSHBUTTON/RELAY OPERATION

26.01 Typical Operation.

- a. The circuitry associated with a typical pushbutton on the test set is shown in figure 3. When a button is pressed, the normally open contact grounds the reset input to the latch, and the normally closed contact allows the +5-volt pull-up voltage to set the latch. The set output of the latch toggles the flip-flop to turn the LED in the optical coupler on or off. When turned on, the optical coupler allows transistor Q1 to pass sufficient current through the coil of relay 1 to operate the relay.
- b. When relay 1 operates, its normally open contacts close to operate relay 2. The contacts of relay 2

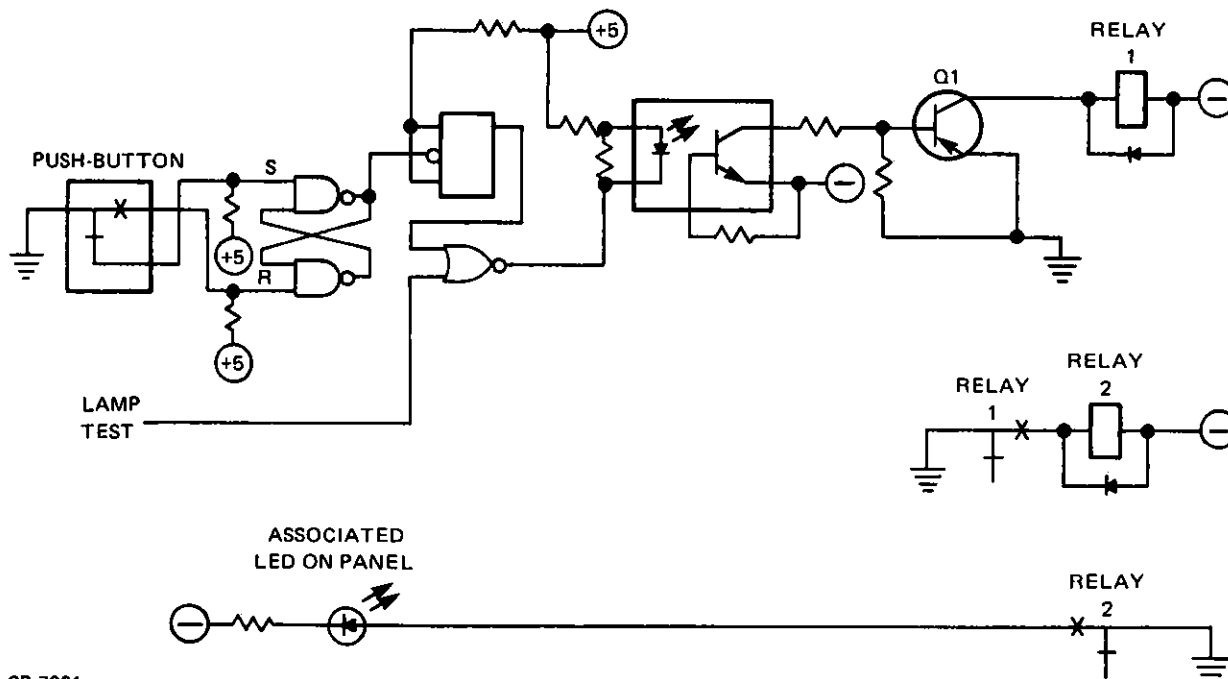
then perform the functions implied by the name of the associated pushbutton, including providing ground to turn on the LED above the pushbutton.

- c. When the pushbutton is released, the input conditions of the latch are reversed, resetting the latch. The flip-flop, however, does not change state. The next time the pushbutton is pressed, the latch is set and its set output causes the flip-flop to toggle, thus releasing the relays.

- d. Some of the function relays, such as ring, capacitance read, and ground start, must release when the associated pushbutton is released. For these functions, the set output of the latch and the +5-volt pull-up voltage is connected directly to the optical coupler, with no flip-flop involved.

26.02 AC VOLTS Button.

The AC VOLTS button operates the AC VOLTS relay (fig. FO-1) which connects the test tip (TT) and test ring (TR) leads to the rectifier and connects the rectifier output to the test set meter. This permits measurement of foreign ac line voltage on the dc panel meter.



CP 7361

Figure 3. Typical Pushbutton/Relay Circuit

26.03 BRIDGE Button.

When the TEST OUT button is activated, the T IN and R IN leads are disconnected from the T OUT and R OUT leads. Operation of the BRIDGE button and relay reconnects these leads, as shown in figure FO-1, and also inhibits the RING relay to prevent ringing on the T IN and R IN leads.

26.04 CAP READ Button.

While the CAP READ button is pressed, the CAP READ relay is operated. This removes a short from the TEST SELECT switch CAP positions to permit line capacitance to be indicated on the test set meter.

26.05 COIN COL Button.

The COIN COL button operates the COIN COL relay which applies coin collect voltage (+130 volts) to the TT and TR leads while the button is pressed. This voltage can be applied only if the TEST OUT button is activated and the BRIDGE and COIN RETURN buttons are not activated. Coin collect current can be adjusted with the COIN CURRENT potentiometer and/or measured on the meter by setting the TEST SELECT switch to the LOOP BATT position and activating the DC CUR button.

26.06 COIN RETURN Button.

The COIN RETURN button operates the COIN RETURN relay, which applies coin return voltage (~130 volts) to the TT and TR leads while the button is pressed. This voltage can be applied only if the TEST OUT button is activated and the BRIDGE and COIN COL buttons are not activated. Coin return current can be adjusted with the COIN CURRENT potentiometer and/or measured on the meter by setting the TEST SELECT switch to the LOOP BATT position and activating the DC CUR button.

26.07 DIAL IN Button.

The DIAL IN button operates the DIAL IN relay, which connects the tip and ring leads of the rotary dial, DTMF keypad, and TEST TEL jack to the dial tip and dial ring leads. This permits dialing from any of these devices to a subscriber line by way of the switched maintenance access network (SMAN).

26.08 E&M PRI Button.

The E&M PRI button operates the E&M PRI relay, which connects the primary E&M leads of the

SMAN to the EXT TEST EA-EB and MA-MB jacks on the test set. The E&M PRI button and relay are interlocked with the E&M SEC button and relay so that only one button (primary or secondary) can be operated at a time.

26.09 E&M SEC Button.

The E&M SEC button operates the E&M SEC relay, which connects the secondary E&M leads of the SMAN to the EXT TEST EA-EB and MA-MB jacks on the test set. The E&M SEC button and relay are interlocked with the E&M PRI button and relay so that only one button (primary or secondary) can be operated at a time.

26.10 GND START Button.

The GND START button operates the GND START relay, which applies ground to the dial ring (DR) lead. The DR lead is connected, through the MDF and T & R PRI or T & R SEC relays, to lead TRI of the SMAN. Because no latching circuit is associated with the GND START button, ground is applied only while the button is pressed.

26.11 HT COIL LISTEN Button.

The HT COIL LISTEN button operates the HT COIL LISTEN relay, which connects the heat coil tip (HCT) and heat coil ring (HCR) leads of the MDF test shoe to the DT and DR leads. This permits the subscriber loop to be monitored, through the heat coil, at the HEADSET jacks.

26.12 LOW SCALE Button.

The LOW SCALE button operates the LOW SCALE relay, which connects an alternate resistor configuration to the test set meter circuitry. This divides the voltage reading by 10 and the resistance reading by 100. Pressing the LOW SCALE button also disconnects the ground provided by the ringing generator to permit application of ringing to certain types of telephones while they are off-hook.

26.13 MDF Button.

The MDF button operates the MDF relay, which disconnects the SMAN tip and ring leads from the meter and from the T and R binding posts and connects in their place the tip and ring leads of the MDF test shoe.

26.14 OFFICE LINE Button.

The OFFICE LINE button operates the OFFICE LINE relay which connects the tip, ring, E, and M leads of the office line circuit to the rotary dial, DTMF keypad, TEST TEL jack, and HEADSET jacks. The connections are made so that DTMF signaling is sent on the tip and ring leads and dial pulse signaling is sent on the E lead; the M lead is used to indicate an incoming call on the office line. Applying -48 volts to the M lead lights the OFFICE LINE LED and sounds the chime. Pressing the OFFICE LINE button silences the chime, which is latched off as long as -48 volts remains on the M lead.

26.15 OUT TALK Button.

The OUT TALK button operates the OUT TALK relay, which applies ground and talking battery to the SMAN tip and ring leads, respectively.

26.16 PRI SEL Button.

- a. The PRI SEL button operates the PRI SEL relay, which connects the rotary dial to the primary test port E lead and the DTMF keypad to the primary test port tip and ring leads.
- b. A code can then be dialed to set up a test path through the primary SMAN. The code is converted by the test port to a supervisory sense bit pattern that is interpreted by the call processor. The call processor then informs the maintenance processor of the test path to be established and the maintenance processor operates the appropriate SMAN relays.
- c. When a primary test path has been established, ground is returned on the M lead from the primary test port to operate the PRI CONNECT relay. When operated, this relay opens the E, tip, and ring paths to the primary test port to prohibit any further primary SMAN codes from being sent until the current primary test path is released.

26.17 RING Button.

The RING button operates the RING relay, which applies ringing to the tip or ring lead as selected by the TEST SELECT switch. Ringing can be applied only if the TEST OUT button is activated and the BRIDGE button is not activated. While the RING relay is operated, the test set meter and the T and R binding posts are disconnected from the SMAN. Because no

latching circuit is associated with the RING button, ringing is applied only while the button is pressed.

26.18 ROH MDF Button.

The ROH MDF button operates the ROH MDF relay, which connects the ROH generator to the T OUT and R OUT leads of the MDF test shoe.

26.19 ROH PRI Button.

The ROH PRI button operates the ROH PRI relay, which connects the ROH generator to the TTO and TRO leads of the primary SMAN. The ROH PRI and ROH SEC buttons and relays are interconnected so that when one is activated the other is disabled.

26.20 ROH SEC Button.

The ROH SEC button operates the ROH SEC relay, which connects the ROH generator to the TTO and TRO leads of the primary SMAN. The ROH PRI and ROH SEC buttons and relays are interconnected so that when one is activated the other is disabled.

26.21 SEC SEL Button.

- a. The SEC SEL button operates the SEC SEL relay, which connects the rotary dial to the secondary test port E lead and the DTMF keypad to the secondary test port tip and ring leads.
- b. A code can then be dialed to set up a test path through the secondary SMAN. The code is converted by the test port to a supervisory sense bit pattern that is interpreted by the call processor. The call processor then informs the maintenance processor of the test path to be established and the maintenance processor operates the appropriate SMAN relays.
- c. When a secondary test path has been established, ground is returned on the M lead from the secondary test port to operate the SEC CONNECT relay. When operated, this relay opens the E, tip, and ring paths to the secondary test port to prohibit any further secondary SMAN codes from being sent until the current secondary test path is released.

26.22 T & R PRI Button

The T & R PRI button operates the T & R PRI relay, which connects the primary SMAN tip and ring leads to the test circuits and binding posts of the test

set. The T & R SEC button is interconnected with the T & R PRI relay so that when the primary SMAN leads are connected to the test circuits, the secondary SMAN leads can only be applied to the EXT TEST jacks through the normally-closed contacts of the T & R SEC relay.

26.23 T & R SEC Button.

The T & R SEC button operates the T & R SEC relay, which connects the secondary SMAN tip and ring leads to the test circuits and binding posts of the test set. The T & R PRI button is interconnected with the T & R SEC relay so that when the secondary SMAN leads are connected to the test circuits, the primary SMAN leads can only be applied to the EXT TEST jacks through the normally-closed contacts of the T & R PRI relay.

26.24 TEST IN Button.

The TEST IN button operates the TEST IN relay, which connects the SMAN TIN and RIN leads to the TT and TR leads through the TEST RVS relay. The TEST IN relay also places an impedance across the DT

and DR leads for use in ANI party testing. The TEST IN and TEST OUT buttons and relays are interconnected so that when one is activated the other is disabled.

26.25 TEST OUT Button.

The TEST OUT button operates the TEST OUT relay, which connects the SMAN TOUT and ROUT leads to the TT and TR leads through the TEST RVS relay. The TEST OUT relay also connects the TOUT and ROUT leads to the RING relay to allow ringing to be sent through the SMAN. When the TEST OUT relay is operated, the TIN and RIN leads are disconnected from the TOUT and ROUT leads. Operation of the BRIDGE button and relay reconnects these leads and also inhibits the RING relay to prevent ringing on the TIN and RIN leads.

26.26 TEST RVS Button.

The TEST RVS button operates the TEST RVS relay, which reverses the TT and TR leads. This allows battery reversal to be controlled through the test set during testing.

PART V. MAINTENANCE

27. PERFORMANCE ROUTINES

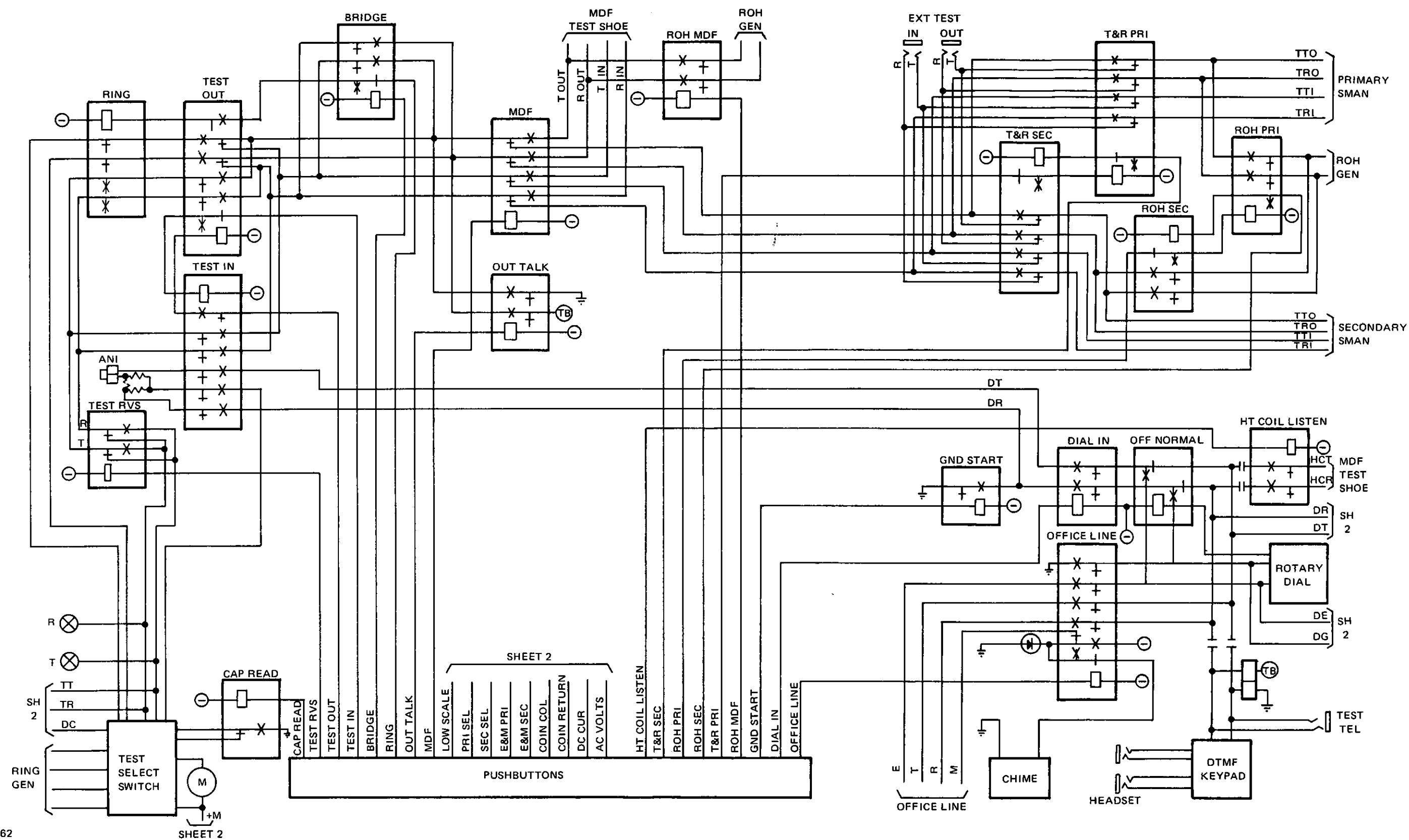
27.01 The precutover test procedures in paragraph 7 and 8 can be used to check the performance of the test set when it is suspected of being faulty.

28. REPAIR AND REPLACEMENT

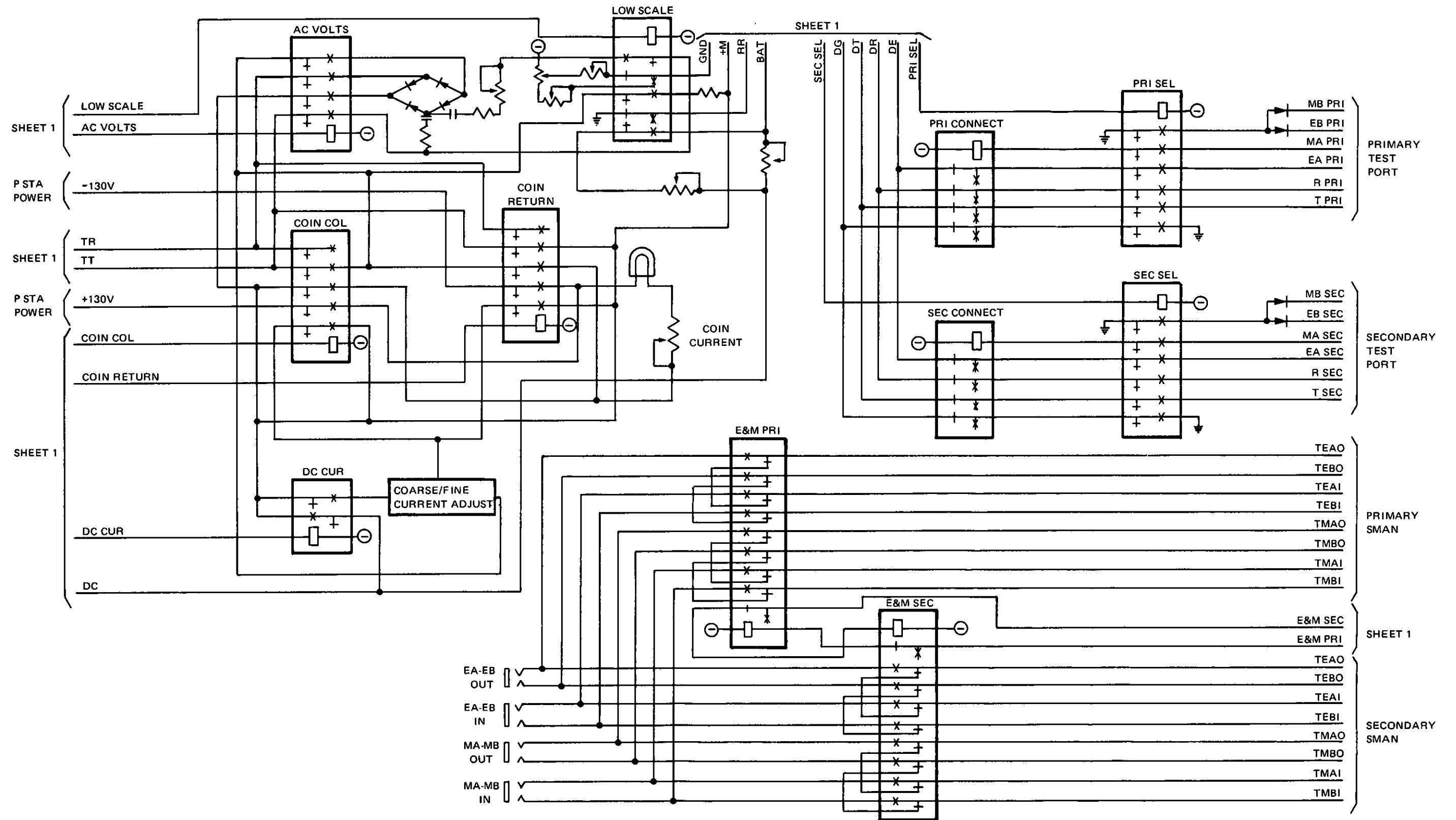
28.01 All of the logic circuitry and relays are contained on four plug-in printed wiring board assemblies (PWBA). If a PWBA is suspected of being

faulty, replace it with a known good one and return the faulty one to Stromberg-Carlson Corporation. Do not attempt to repair the PWBA.

28.02 The components mounted on the front panel can be replaced in the field. Ordering information for any replacement parts required is contained in the Wire Chiefs Test Panel Assembly drawing 814451-018.



FO-1. Wire Chiefs Test Set, Block Diagram (Sheet 1 of 2)



CP 7363

FO-1. Wire Chiefs Test Set, Block Diagram (Sheet 2 of 2)