BELL SYSTEM PRACTICES
AT&TCo Provisional

Task Oriented Practice
(TOP)

NO. 3 ESS POWER EQUIPMENT

NOTE

Before using TOP for the first time, complete the TOP-USER Plant Training Course–PTC No. 278.

A short version of PTC No. 278 is in the back of this volume.

Issue 2	JUL 1980
233-144-100	TPG
TITLE PAGE	

ITEM	ISSUE	ITEM	ISSUE	ITEM	ISSUE	ITEM	ISSUE	ITEM	ISSUE	ITEM	ISSUE
● CHECKLIST		TAP-194		● DLP-507		DLP-556		● DLP-691			
● RTL-001		TAP-195		● DLP-508		DLP-557		□ DLP-692			
RTP-002		TAP-196		● DLP-509		● DLP-560		DLP-693			
● RTP-003		TAP-197		DLP-511		● DLP-561		● DLP-695			
□ RTP-004		● TAP-198		● DLP-512		● DLP-562		● DLP-696			
● RTP-005		● TAP-199		DLP-513		DLP-563		DLP-698			
RTP-006		● ISD-200		DLP-514		DLP-564		● DLP-699			
● RTP-007		● TAP-201		DLP-515		● DLP-565		● DLP-700			
● RTP-008		● TAP-202		● DLP-516		DLP-566		● DLP-701			
● RTP-009		TAP-203		DLP-517		DLP-567		● DLP-702			
● RTP-010		● TAP-204		DLP-518		DLP-568		● DLP-703			
● RTP-011		TAP-205		□ DLP-519		DLP-569		● DLP-704			
● RTP-012		□ TAP-207		□ DLP-520		DLP-570		● DLP-705			
● RTP-013		● TAP-209		□ DLP-521		● DLP-575		● DLP-710			
● ATL-030		● TAP-210		● DLP-522		● DLP-576		● DLP-711			
● ATP-031		□ TAP-212		● DLP-523		● DLP-577		● DLP-712			
● ATP-032		● TAP-215		● DLP-525		● DLP-578		● DLP-714			
● ATP-033		TAP-230		● DLP-526		DLP-579		● DLP-715			
● ATP-034		TAP-231		DLP-527		DLP-580		● DLP-716			
● ATP-035		● TAP-232		● DLP-528		DLP-581		● DLP-717			
● ATP-036		TAP-233		DLP-530		● DLP-582		● DLP-718			
● ATP-037		TAP-234		● DLP-540		DLP-610		● DLP-719			
● ATP-038		TAP-236		● DLP-541		DLP-611		● DLP-720			
COL-050		● TAP-237		● DLP-542		DLP-612		□ DLP-721			
TAP-134		● TAP-238		● DLP-543		● DLP-613		● IXL-890			
TAP-180		● TAP-239		● DLP-544		● DLP-614					
TAP-181		● TAP-240		● DLP-545		● DLP-615					
TAP-182		● TAP-241		● DLP-546		DLP-616					
TAP-183		DLP-500		● DLP-547		● DLP-617					
TAP-184		● DLP-501		DLP-550		DLP-618					
TAP-185		● DLP-502		DLP-551		DLP-620					
● TAP-190		● DLP-503		● DLP-552		□ DLP-685					
TAP-191		● DLP-504		● DLP-553		□ DLP-686					
ISD-192		DLP-505		● DLP-554		DLP-687					
● TAP-193		DLP-506		● DLP-555		DLP-689					

● REVISED OR ADDED ITEM □ CANCELED ITEM

Issue 2 | JUL 1980

233-144-100 | CKL

CHECKLIST

PAGE 1 of 1 | 000

ROUTINE TASKS	PROCEDURE NUMBER
SCHEDULED	
Check Output of 151A Power Plant	RTP-006
Maintain –48V Battery Equipment	RTP-009
Inspect –48V Battery Equipment	RTP-010
Measure Individual Cell Voltage	DLP-576
Check KS-20816 L2 Inverter	RTP-002
Check Miscellaneous Power Units	RTP-003
Check 151A Power Plant	RTP-005
Check Side 0 – 881A Ringing and Tone Plant	RTP-007
Check Side 1 – 881A Ringing and Tone Plant	RTP-008
Check and Adjust 400A Tone Generator	DLP-560
Test Ringing Distribution Fuse Alarms	DLP-561
Check ITT-North KS-20493 48V Rectifier	RTP-011
Check Lorain KS-20493 48V Rectifier	RTP-012
Check J87437A 48V Rectifier	RTP-013
RESPONSE TO REQUESTS	
Remove Side 0 of Ringing and Tone Plant From Service	DLP-550
Remove Side 1 of Ringing and Tone Plant From Service	DLP-540
Turn Up and Restore to Service Side 0 of Ringing and Tone Plant	DLP-557
Turn Up and Restore to Service Side 1 of Ringing and Tone Plant	DLP-547

ITEM	SUBTASKS	PROCEDURE NUMBER
	NOTE 1: There is a normal time delay of 30-50 seconds when operating the **INVERTER TEST** switch	
1	Obtain Support Apparatus or Equivalent • Digital Multimeter KS-20599, L4 • Frequency Counter Hewlett-Packard Model 779C • Jewelers Screwdriver R1005	–
2	Loosen Fastener Screws on Upper Front of Cover; Pull Cover Forward and Down	–
3	Check DC Input Voltage	DLP-612
4	Check AC Output Voltage	DLP-613
5	Calibrate Panel Voltmeter	DLP-614
6	Check AC Output Frequency	DLP-615
7	Close Cover; Tighten Fastener Screws	–
8	Check Inverter Transfer and Alarm Circuit	DLP-610

ITEM	SUBTASKS	PROCEDURE NUMBER
1	Obtain Support Apparatus or Equivalent • Digital Multimeter KS-20599, L4 • Jewelers Screwdriver R1005 • Test Cord W1AY Cord • Test Pick 411C Tool • Cord Tip 141 Cord Tip • Voltage Pickup Tool 720A Tool	–
2	Prepare Fuse Alarm Test Cord	DLP-513
3	Check 188A Power Unit (+24V Converter) Power Alarm	DLP-691
4	Check 188A Power Unit (+24V Converter) No Power Alarm	DLP-693
5	Check/Adjust 188A Power Unit (+24 Volt Converter) DC Output Voltage	DLP-687
6	Repeat Items 3, 4, and 5 for Each Additional Individual 188A Power Unit	–
7	Check 184A Power Unit (+48V Converter) Output	DLP-695
8	Repeat Item 7 for Each Additional Individual 184A Power Unit	–
9	Remove Side 0 of Ringing and Tone Plant From Service	DLP-550
10	Check 184A Power Unit (+48V Converter) Fuse Alarm – Side 0	DLP-696
11	Restore Side 0 of Ringing and Tone Plant to Service	DLP-557
12	Remove Restore Side 1 of Ringing and Tone Plant From Service	DLP-540
13	Check 184A Power Unit (148V Converter) Fuse Alarm – Side 1	DLP-696
14	Restore Remove Side 1 of Ringing and Tone Plant to Service	DLP-547
15	Check 184B Power Unit (±130V Converter) Output	DLP-698
16	Check 184B Power Unit (±130V Converter) Fuse Alarms	DLP-699
17	Repeat Items 15 and 16 for Each Additonal Individual 184B Power Unit	–

CHECK MISCELLANEOUS POWER UNITS

ITEM	SUBTASKS	PROCEDURE NUMBER
1	Obtain Support Apparatus or Equivalent • Digital Multimeter KS-20599, L4 • Jewelers Screwdriver R1005 • Jumper Cord W1AP • Test Cord W1AY Cord • Test Pick 411C Tool • Cord Tip 141 Cord Tip • Voltage Pickup Tool 720A Tool	–
2	Check Battery Bus Voltage and 48V Rectifier Output Current	DLP-504
3	Calibrate 151A Power Plant Voltmeter	DLP-505
4	Prepare Fuse Alarm Test Cord	DLP-513
5	Check 151A Power Plant Fuse Alarms	DLP-506
6	Check Lorain or ITT-North KS-20493 48V Rectifier Failure Alarms	DLP-507
7	Check 151A Power Plant High Voltage (HVM) Shutdown Circuit	DLP-508
8	Check 151A Power Low Voltage (LV1 and LV2) Monitors	DLP-509
9	Check Battery Bus Voltage and 48V Rectifier Output Current	DLP-504

ITEM	SUBTASKS	PROCEDURE NUMBER
1	Obtain Support Apparatus or Equivalent • Digital Multimeter KS-20599, L4	–
2	Check Battery Bus Voltage and 48V Rectifier Output Current	DLP-504

ITEM	SUBTASKS	PROCEDURE NUMBER
1	Obtain Support Apparatus or Equivalent • Digital Multimeter — Hickok Model 3310 (ITE 5356) • Frequency Counter — General Radio Model 1159 • Test Cord — W1AY Cord • Test Pick — 411C Tool • Cord Tip — 141 Cord Tip • Voltage Pickup Tool — 720A Tool	–
2	Isolate DMM From Ground	DLP-720
3	Prepare Fuse Alarm Test Cord	DLP-513
4	Remove Side 0 From Service	DLP-550
	CAUTION: Tone voltages to be measured are complex ac waveforms. A True RMS indicating voltmeter is required to accurately adjust voltage levels. Peak and average ac voltmeters produce inaccurate readings	
5	Check Tone Oscillators (350, 440, 480, and 620) – Side 0	DLP-552
6	Check Tone Amplifiers (TT, AR, BT, MT, and HT) – Side 0	DLP-553
7	Test Low Voltage Monitors (TTLVO, ARLVO, BTLVO, MTLVO, and HTLVO) – Side 0	DLP-554
8	Check 20-Hz Inverter – Side 0	DLP-555
9	Test 48-Volt Distribution Fuse Alarms – Side 0	DLP-556
10	Turn Up and Restore to Service Side 0	DLP-557

CHECK SIDE 0 – 881A RINGING AND TONE PLANT

ITEM	SUBTASKS	PROCEDURE NUMBER
1	Obtain Support Apparatus or Equivalent • Digital Multimeter — Hickok Model 3310 (ITE 5356) • Frequency Counter — General Radio Model 1159 • Test Cord — W1AY Cord • Test Pick — 411C Tool • Cord Tip — 141 Cord Tip • Voltage Pickup Tool — 720A Tool	–
2	Isolate DMM From Ground	DLP-720
3	Prepare Fuse Alarm Test Cord	DLP-513
4	Remove Side 1 From Service	DLP-540
	CAUTION: Tone voltage to be measured are complex ac waveforms. A True RMS indicating voltmeter is required to accurately adjust voltage levels. Peak and average ac voltmeters produce inaccurate readings	
5	Check Tone Oscillators (350, 440, 480, and 620) – Side 1	DLP-542
6	Check Tone Amplifiers (TT, AR, BT, MT, and HT) – Side 1	DLP-543
7	Test Low Voltage Monitors (TTLV1, ARLV1, BTLV1, and HTLV1) – Side 1	DLP-544
8	Check 20-Hz Inverter – Side 1	DLP-545
9	Test 48-Volt Distribution Fuse Alarms – Side 1	DLP-546
10	Turn Up and Restore to Service Side 1	DLP-547

CHECK SIDE 1 – 881A RINGING AND TONE PLANT

ITEM	SUBTASKS	PROCEDURE NUMBER
1	Obtain Support Apparatus or Equivalent • Syringe-Type Hydrometer KS-5499, L1305 • Thermometer KS-5499, L1352 or L1353 • Goggles R-4501 • Rubber Acid Gloves R-3034 • Rubber Apron R-3043 • Digital Multimeter KS-20599, L4 • 1/4 Lb Table Soda or 1/8 Lb. Washing Soda – • Clean Cloth – • Clean Water –	–
	DANGER: Protective equipment such as rubber gloves, rubber aprons, and splash-proof goggles should be worn when performing maintenance on batteries. Rings, wrist watches, metal bracelets, necklaces, belt buckles, etc, should be removed	
2	Measure Individual Cell Voltage (2.13 to 2.22 Volts) for All Cells	DLP-576
3	Maintain Electrolyte Level	DLP-579
4	Maintain Battery Terminals and Connectors	DLP-577
5	Inspect and Clean Antiexplosion Device	DLP-582
6	Clean Battery Jars	DLP-581
7	Clean Racks and Stands	DLP-580

ITEM	SUBTASKS			PROCEDURE NUMBER
1	Obtain Support Apparatus or Equivalent			–
	• Thermometer	KS-5499, L1352 or L1353	X	
	• Pinlight Flashlight	–	X	
	• Goggles	R-4501	X	
	• Rubber Acid Gloves	R-3034	X	
	• Rubber Apron	R-3043	X	
	DANGER: Protective equipment such as rubber gloves, rubber aprons, and splash-proof goggles should be worn when performing maintenance on batteries. Rings, wrist watches, metal bracelets, necklaces, belt buckles, etc, should be removed			
2	Check Electrolyte Temperature			DLP-578
3	Inspect Individual Cells for Crystals			DLP-575

ITEM	SUBTASKS	PROCEDURE NUMBER
1	Place ITT-North KS-20493 48V Rectifier in Test Mode	DLP-710
2	Check ITT-North KS-20493 48V Rectifier Output Voltage	DLP-711
3	Check ITT-North KS-20493 48V Rectifier Current Limiting Adjustment	DLP-712
4	Check ITT-North KS-20493 48V Rectifier TR Shutdown	DLP-714
5	Check ITT-North KS-20493 48V Rectifier HV Shutdown	DLP-715
6	Check ITT-North KS-20493 48V Rectifier Automatic Restart	DLP-716
7	Power Up Individual North KS-20493 48V Rectifier	DLP-717

ITEM	SUBTASKS	PROCEDURE NUMBER
1	Power Down Individual Lorain 48V Rectifier	DLP-500
2	Check Lorain 48V Rectifier Output Voltage	DLP-501
3	Check Lorain 48V Rectifier Current Limit Circuit	DLP-502
4	Power Up Individual Lorain 48V Rectifier	DLP-503

CHECK LORAIN KS-20493 48V RECTIFIER

ITEM	SUBTASKS	PROCEDURE NUMBER
1	Power Down Individual J87437A 48V Rectifier	DLP-701
2	Check J87437A 48V Rectifier Output Voltage	DLP-702
3	Power Up Rectifier	DLP-704
4	Check Adjustment of J87437A Rectifier Current Limit and Regulator Circuit	DLP-703

CHECK J87437A 48V RECTIFIER

ACCEPTANCE TASKS	PROCEDURE NUMBER
Accept 151A Power Plant	ATP-031
Accept Miscellaneous Power Units	ATP-032
Accpet 881A Ringing and Tone Plant	ATP-033
Accept KS-20816 L2 Inverter	ATP-034
Accept KS-20472 Battery	ATP-035
Accept Individual North KS-20493 48V Rectifier	ATP-036
Accept Individual Lorain KS-20493 48V Rectifier	ATP-037
Accept Individual J87437A 48V Rectifier	ATP-038

ITEM	SUBTASKS	PROCEDURE NUMBER
	NOTE 1: Refer trouble to installation group whenever indications in this procedure are not obtained	–
1	Obtain Support Apparatus or Equivalent • Digital Multimeter — KS-20599, L4 • Jewelers Screwdriver — R1005 • 3-Inch C Screwdriver — – • Jumper Cords (2) — W1AP • Test Cord — W1AY Cord • Test Pick — 411C Tool • Cord Tip — 141 Cord Tip • Voltage Pickup Tool — 720A Tool	
2	Check Battery Bus Voltage and 48V Rectifier Output Current	DLP-504
3	Calibrate 151A Power Plant Voltmeter	DLP-505
4	Prepare Fuse Alarm Test Cord	DLP-513
5	Check 151A Power Plant Fuse Alarms	DLP-506
6	Check 48V Rectifier Failure Alarms	DLP-507
7	Check 151A Power Plant High Voltage (HVM) Shutdown Circuit	DLP-508
8	Check 151A Power Plant Low Voltage (LV1 and LV2) Monitors	DLP-509
9	Check Battery Bus Voltage and 48V Rectifier Output Current	DLP-504

ITEM	SUBTASKS	PROCEDURE NUMBER
	NOTE 1: Refer trouble to installation group whenever indications in this procedure are not obtained	
1	Obtain Support Apparatus or Equivalent • Digital Multimeter KS-20599, L4 • Jewelers Screwdriver R1005 • Test Cord W1AY Cord • Test Pick 411C Tool • Cord Tip 141 Cord Tip • Voltage Pickup Tool 720A Tool	–
2	Prepare Fuse Alarm Test Cord	DLP-513
3	Check 188A Power Unit (+24V Converter) Power Alarm	DLP-691
4	Check 188A Power Unit (+24V Converter) No Power Alarm	DLP-693
5	Check/Adjust 188A Power Unit (+24 Converter) DC Output Voltage	DLP-687
6	Repeat Items 3, 4, and 5 for Each Additonal Individual 188A Power Unit	–
7	Check 184A Power Unit (+48V Converter) Output	DLP-695
8	Repeat Item 7 for Each Additional Individual 184A Power Unit	–
9	Remove Side 0 of Ringing and Tone Plant From Service	DLP-550
10	Check 184A Power Unit (+48V Converter) Fuse Alarms (Side 0)	DLP-696
11	Restore Side 0 of Ringing and Tone Plant to Service	DLP-557
12	Remove Side 1 of Ringing and Tone Plant From Service	DLP-540
13	Check 184A Power Unit (+48V Converter) Fuse Alarms (Side 1)	DLP-696
14	Restore Side 1 of Ringing and Tone Plant to Service	DLP-547
15	Check 184B Power Unit (±130V Converter) Output	DLP-698
16	Check 184B Power Unit (±130V Converter) Fuse Alarms	DLP-699
17	Repeat Items 15 and 16 for Each Additional Individual 184B Power Unit	–

ACCEPT MISCELLANEOUS POWER UNITS

ITEM	SUBTASKS	PROCEDURE NUMBER
	NOTE 1: Refer trouble to installation group whenever indications in this procedure are not obtained	
1	Obtain Support Apparatus or Equivalent • Frequency Counter — General Radio Model 1159 • Digital Multimeter — Hickok Model 3310 • Test Cord — W1AY Cord • Test Pick — 411C Tool • Cord Tip — 141 Cord Tip • Voltage Pickup Tool — 720A Tool	–
2	Prepare Fuse Alarm Test Cord	DLP-513
3	Isolate DMM From Ground	DLP-720
4	Remove Side 0 From Service	DLP-550
5	Measure –48 and +48 Volt Input Voltages – Side 0	DLP-551
6	Check Tone Oscillators (350, 440, 480, and 620) – Side 0	DLP-552
7	Check Tone Amplifiers (TT, AR, BT, MT, and HT) – Side 0	DLP-553
8	Test Low Voltage Monitors (TTLV0, ARLV0, BTLV0, MTLV0, and HTLV0) – Side 0	DLP-554
9	Check 20-Hz Inverter – Side 0	DLP-555
10	Test 48-Volt Distribution Fuse Alarms Side 0	DLP-556
11	Turn Up and Restore to Service Side 0	DLP-557
12	Remove Side 1 from Service	DLP-540
13	Measure –48 and +48 Volt Input Voltages – Side 1	DLP-541
14	Check Tone Oscillators (350, 440, 480, and 620) – Side 1	DLP-542
15	Check Tone Amplifiers (TT, AR, BT, MT, and HT) – Side 1	DLP-543
16	Test Low Voltage Monitors (TTLV1, ARLV1, BTLV1, MTLV1, and HTLV1) – Side 1	DLP-544
17	Check 20-Hz Inverter – Side 1	DLP-545

ITEM	SUBTASKS	PROCEDURE NUMBER
18	Test 48-Volt Distribution Fuse Alarms – Side 1	DLP-546
19	Turn Up and Restore to Service Side 1	DLP-547
20	Check and Adjust 400A Tone Generator	DLP-560
21	Test Ringing Distribution Fuse Alarms	DLP-561

ITEM	SUBTASKS	PROCEDURE NUMBER
	NOTE 1: Refer trouble to installation group whenever indications in this procedure are not obtained	
	NOTE 2: There is a normal time delay of 30-50 seconds when operating the **INVERTER TEST** switch	
1	Obtain Support Apparatus or Equivalent • Volt-Ohm-Milliammeter KS-20538 • Frequency Counter 779C Hewlett Packard	–
2	Remove From Service and Turn Down KS-20816 L2 Inverter	DLP-617
3	Loosen Fastener Screws on Upper Front of Cover; Pull Cover Forward and Down	–
4	Visually Inspect Inverter for Proper Mounting in Frame	–
5	Visually Check Inverter for Loose Wires or Connections	–
6	Restore KS-20816 L2 Inverter to Service	DLP-611
7	Check DC Input Voltage	DLP-612
8	Check AC Input Voltage	DLP-616
9	Calibrate Panel Voltmeter	DLP-614
10	Check AC Output Voltage	DLP-613
11	Check AC Output Frequency	DLP-615
12	Close Cover; Tighten Fastener Screws	–
13	Check Inverter Transfer and Alarm Circuits	DLP-610

ITEM	SUBTASKS	PROCEDURE NUMBER
	NOTE 1: Refer trouble to installation group whenever indications in this procedure are not obtained	
1	Obtain Support Apparatus or Equivalent • Digital Multimeter — KS-20599, L4 • Syringe-Type Hydrometer — KS-5499, L1305 • Thermometer — KS-5499, L1352 or L1353 • Goggles — R-4501 • Rubber Acid Gloves — R-3034 • Rubber Apron — R-3043	–
	DANGER: Protective equipment such as rubber gloves, rubber aprons, and splash-proof goggles should be worn when performing maintenance on batteries. Rings, wrist watches, metal bracelets, necklaces, belt buckles, etc, should be removed	
2	Measure Individual Cell Voltage (2.13 to 2.22 Volts)	DLP-576
3	Maintain Electrolyte Level	DLP-579
4	Check Electrolyte Temperature	DLP-578
5	Inspect Individual Cells for Crystals	DLP-575

ITEM	SUBTASKS	PROCEDURE NUMBER
1	Place ITT-North KS-20493 48V Rectifier in Test Mode	DLP-710
2	Check ITT-North KS-20493 48V Rectifier Output Voltage	DLP-711
3	Check ITT-North KS-20493 48V Rectifier Current Limiting Adjustment	DLP-712
4	Check ITT-North KS-20493 48V Rectifier TR Shutdown	DLP-714
5	Check ITT-North KS-20493 48V Rectifier HV Shutdown	DLP-715
6	Check ITT-North KS-20493 48V Rectifier Automatic Restart	DLP-716
7	Power Up Individual North KS-20493 48V Rectifier	DLP-717

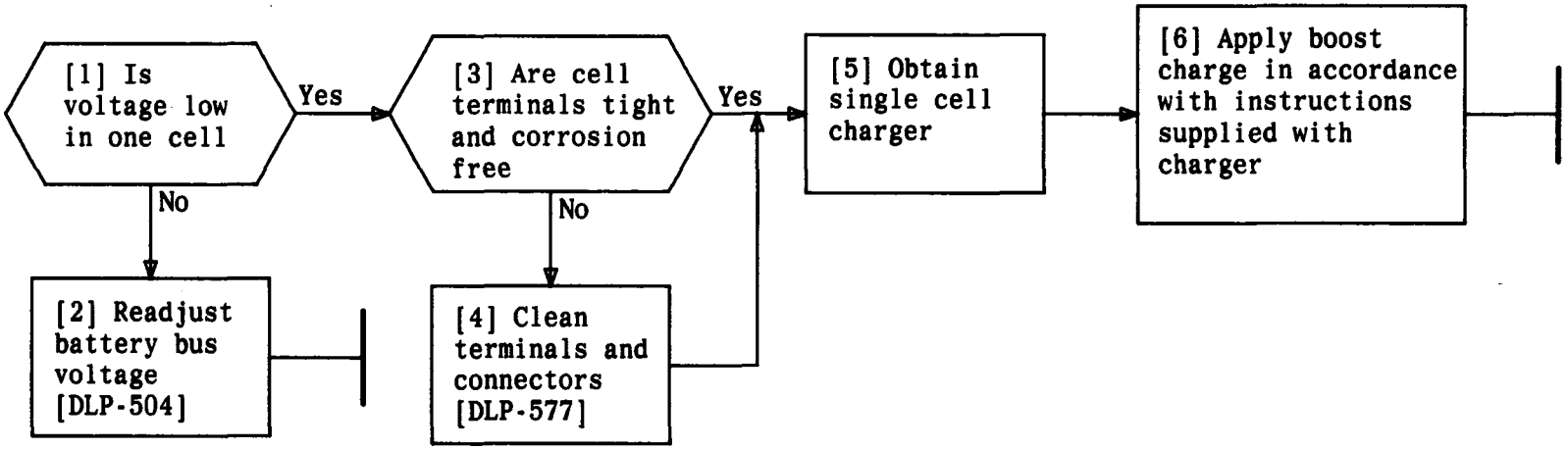
ITEM	SUBTASKS	PROCEDURE NUMBER
1	Power Down Individual Lorain 48V Rectifier	DLP-500
2	Check Lorain 48V Rectifier Output Voltage	DLP-501
3	Test Lorain 48V Rectifier Current Limit Circuit	DLP-502
4	Power Up Individual Lorain 48V Rectifier	DLP-503

ITEM	SUBTASKS	PROCEDURE NUMBER
1	Power Down Individual J87437A 48V Rectifier	DLP-701
2	Check J87437A 48V Rectifier Output Voltage	DLP-702
3	Power Up Rectifier	DLP-704
4	Check Adjustment of J87437A 48V Rectifier Current Limit and Regulator Circuit	DLP-703

ACCEPT J87437A 48V RECTIFIER

COMPANY ORDER TASKS	PROCEDURE NUMBER
None Required	

COMPANY ORDER TASK LIST — NO. 3 ESS POWER EQUIPMENT



CLEAR STORAGE BATTERY TROUBLE

[1] At **TST** frame on rear of **INVERTER**, move TTY and any other protected equipment power cords to a service receptacle

[2] Condition DMM to measure 60 Vdc

[3] See DANGER 1 and FIG. 1. Connect DMM across dc input terminals **1** and **2**

AND

Ready to check input dc voltage

[4] Does DMM indicate between -42 and -56 volts

No → TAP-183

Yes

[5] Disconnect DMM → Page 2

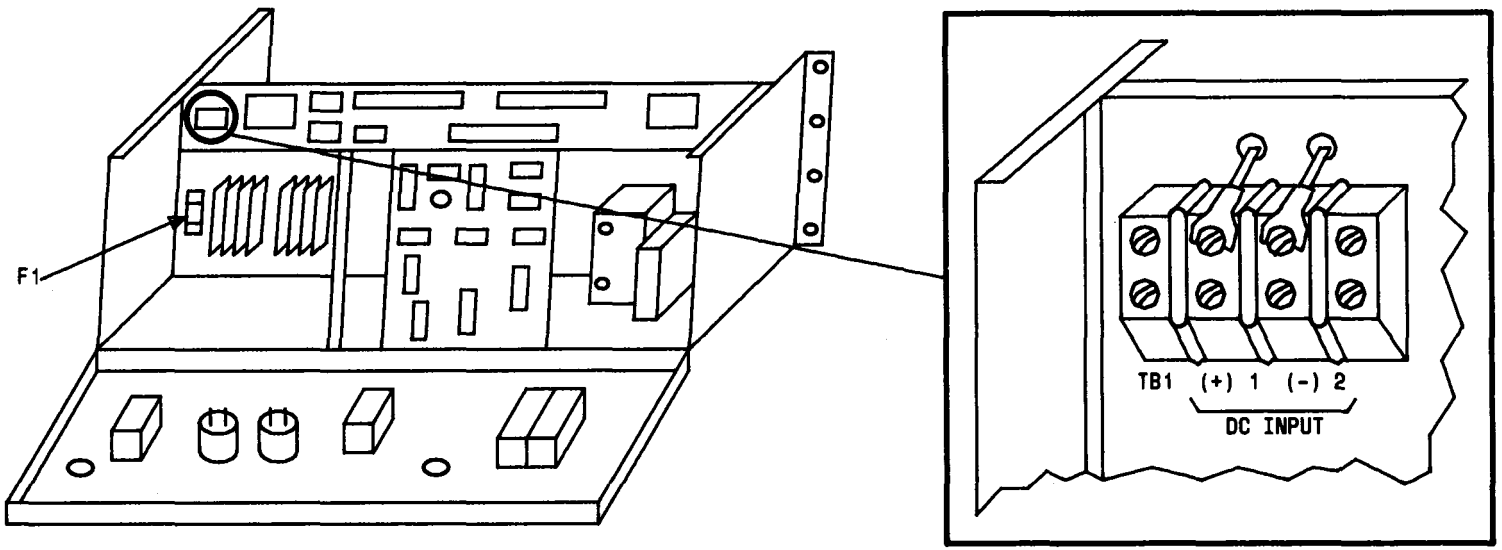


FIG. 1

DANGER 1

Voltages inside INVERTER cabinet are over 400 volts to ground

Issue 2	JUL 1980
233-144-100	TAP
PAGE 1 of 3	180

CLEAR TROUBLE IN INVERTER AC OUTPUT

[6] See FIG. 2. Set protected equipment circuit breakers to **OFF**

[7] Set **INVERTER ON-OFF** switch to **OFF**

[8] At commercial AC input power panel, set **ESS INVERTER** circuit breaker to **OFF**

[9] See DANGER 2. Remove fuse **F1** and check for continuity with DMM. Replace if necessary

AND

[10] At commercial AC input power panel, set **ESS INVERTER** circuit breaker to **ON**

[11] Set **INVERTER ON-OFF** switch to **ON**

AND

Page 3

[12] Depress and hold **TEST** switch

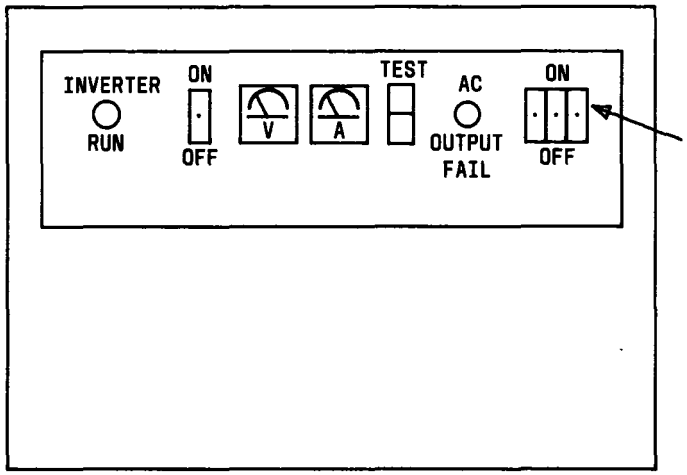
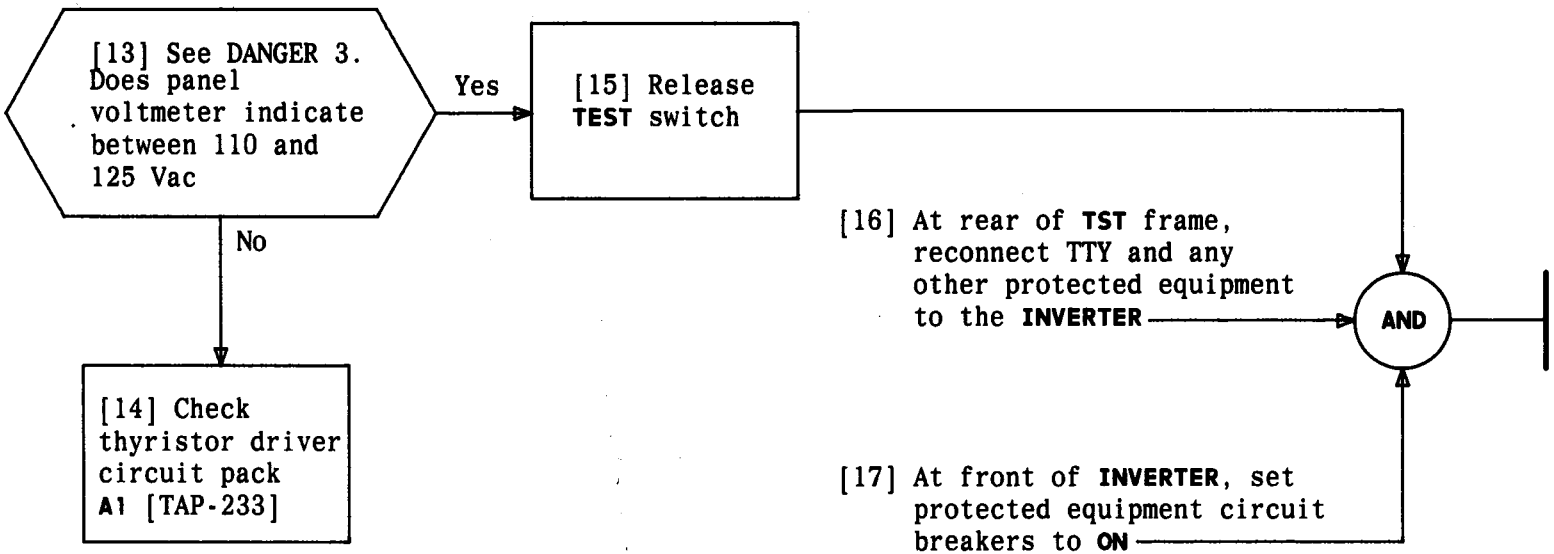


FIG. 2

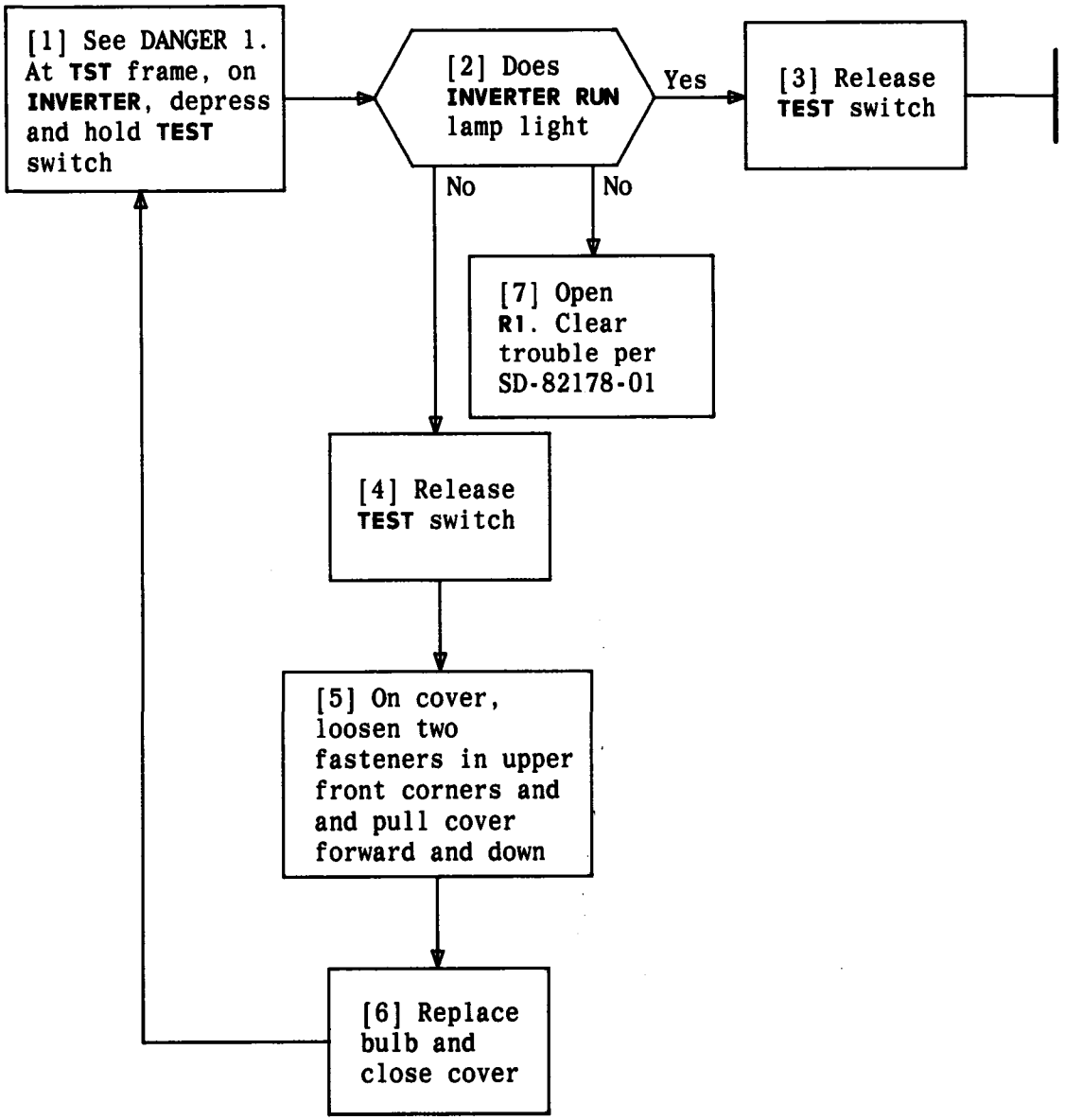
DANGER 2
Voltages inside INVERTER cabinet are over 400 volts to ground

CLEAR TROUBLE IN INVERTER AC OUTPUT



CLEAR TROUBLE IN INVERTER AC OUTPUT

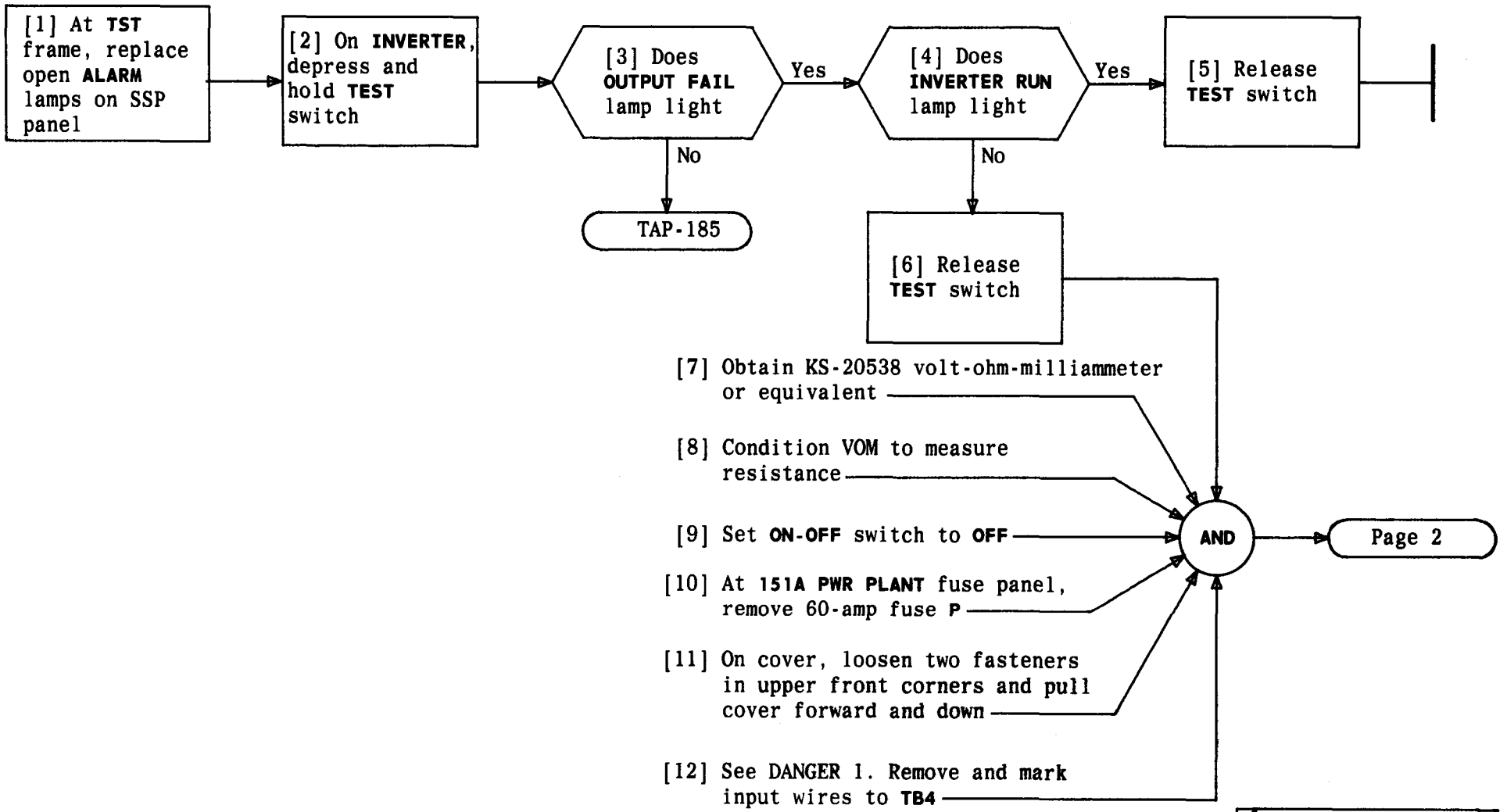
DANGER 3
Voltages inside INVERTER cabinet are over 400 volts to ground



CLEAR INOPERATIVE INVERTER RUN LAMP

DANGER 1
Voltages inside INVERTER cabinet are over 400 volts to ground

Issue 2	JUL 1980
233-144-100	TAP 181
PAGE 1 of 1	



DANGER 1
Voltages inside INVERTER cabinet are over 400 volts to ground

Issue 2	JUL 1980
233-144-100	TAP
PAGE 1 of 3	182

CLEAR TROUBLE IN INVERTER TRANSFER ALARM CIRCUIT

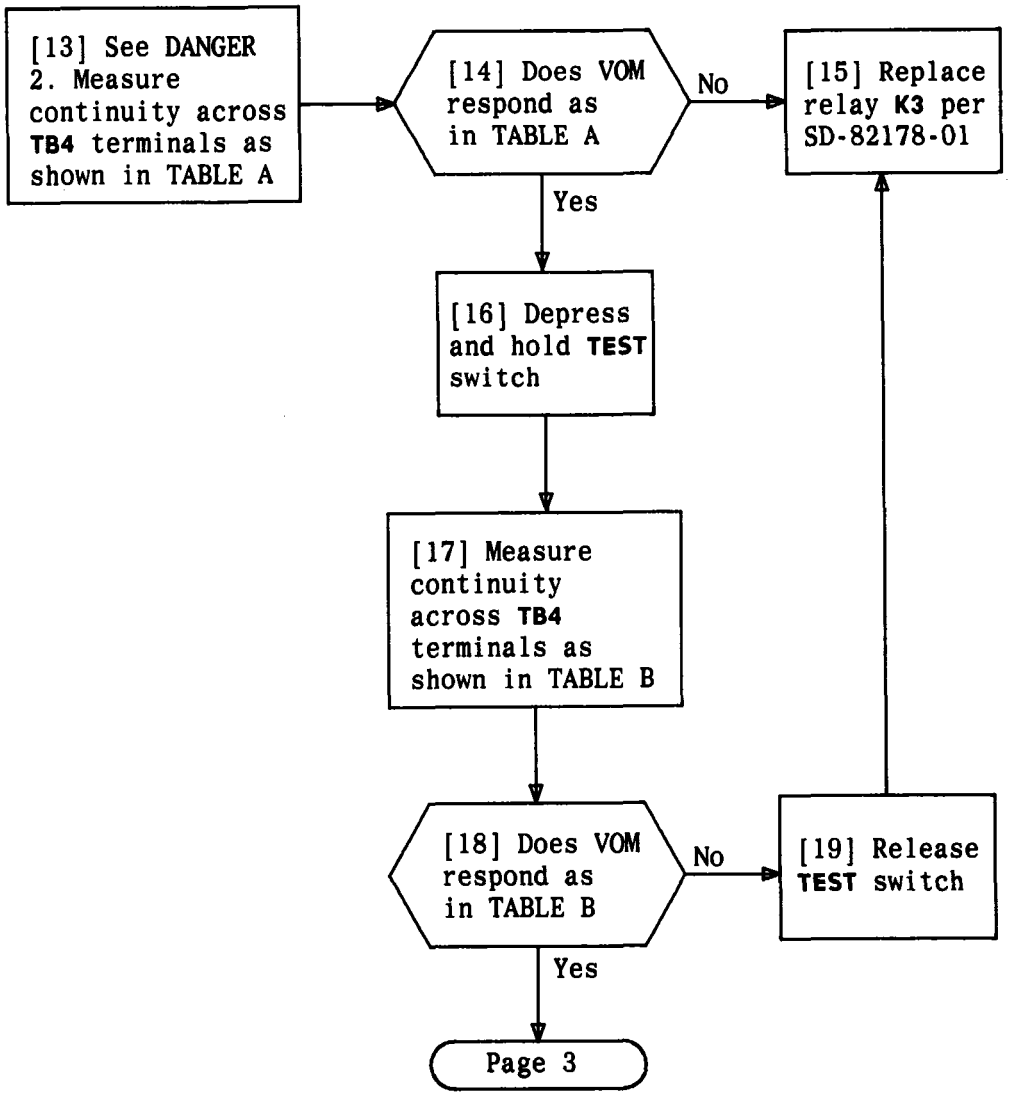


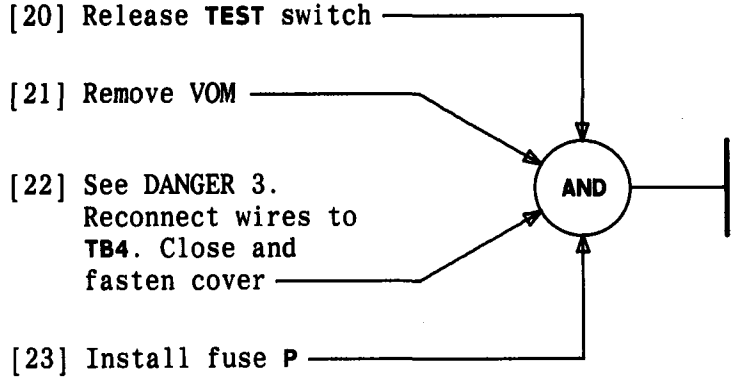
TABLE A	
TEST SWITCH RELEASED	
CONNECT VOM TO TB4 BETWEEN TERMINALS	VOM RESPONSE
1 and 2	0 Ohms
2 and 3	Open circuit
4 and 5	0 Ohms
5 and 6	Open circuit

TABLE B	
TEST SWITCH OPERATED	
CONNECT VOM TO TB4 BETWEEN TERMINALS	VOM RESPONSE
1 and 2	Open circuit
2 and 3	0 Ohms
4 and 5	Open circuit
5 and 6	0 Ohms

DANGER 2
Voltages inside INVERTER cabinet are over 400 volts to ground

Issue 2	JUL 1980
233-144-100	TAP 182
PAGE 2 of 3	

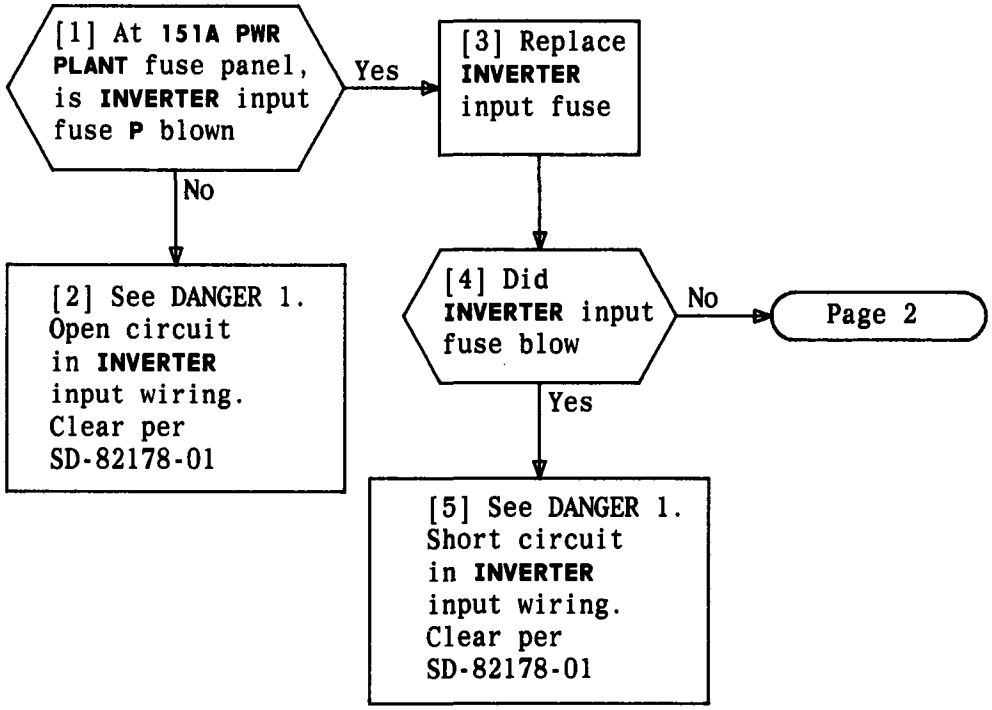
CLEAR TROUBLE IN INVERTER TRANSFER ALARM CIRCUIT



DANGER 3
Voltages inside **INVERTER** *cabinet are over 400 volts to ground*

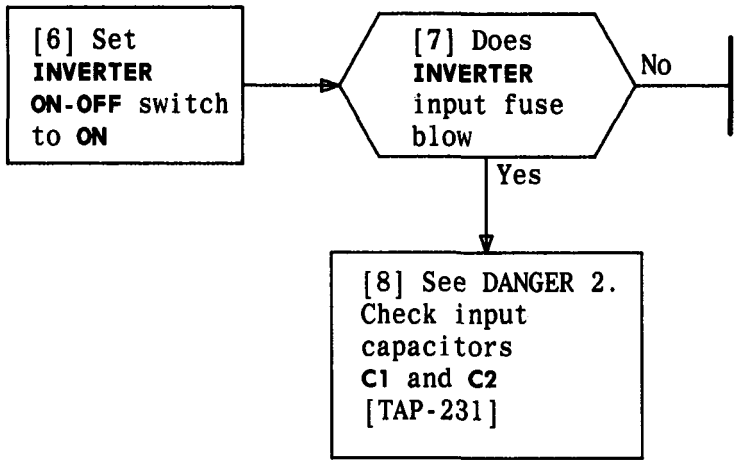
Issue 2	JUL 1980
233-144-100	TAP 182
PAGE 3 of 3	

CLEAR TROUBLE IN INVERTER TRANSFER ALARM CIRCUIT



CLEAR TROUBLE IN INVERTER –48 VOLT DC CIRCUIT

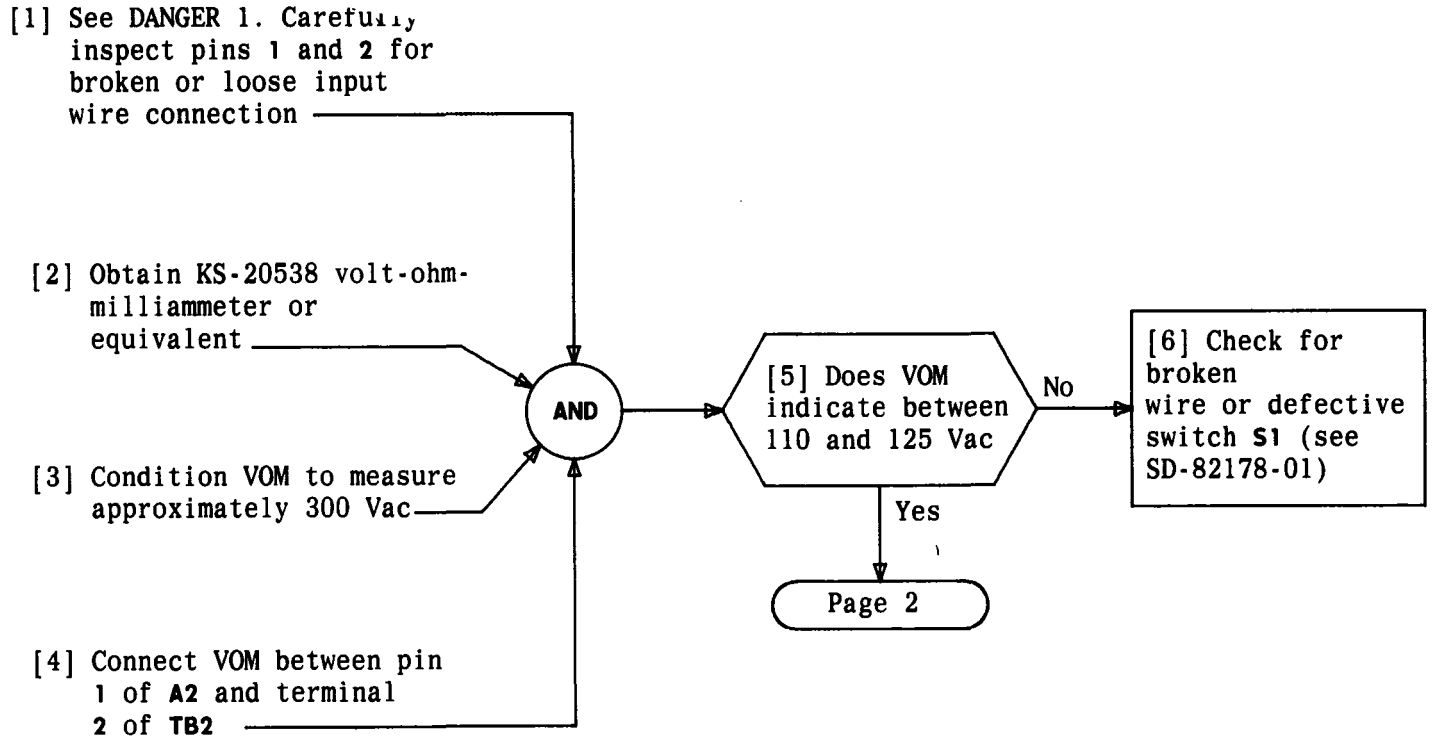
DANGER 1
Voltages inside INVERTER cabinet are over 400 volts to ground



DANGER 2
Voltages inside INVERTER cabinet are over 400 volts to ground

Issue 2	JUL 1980
233-144-100	TAP 183
PAGE 2 of 2	

CLEAR TROUBLE IN INVERTER –48 VOLT DC CIRCUIT

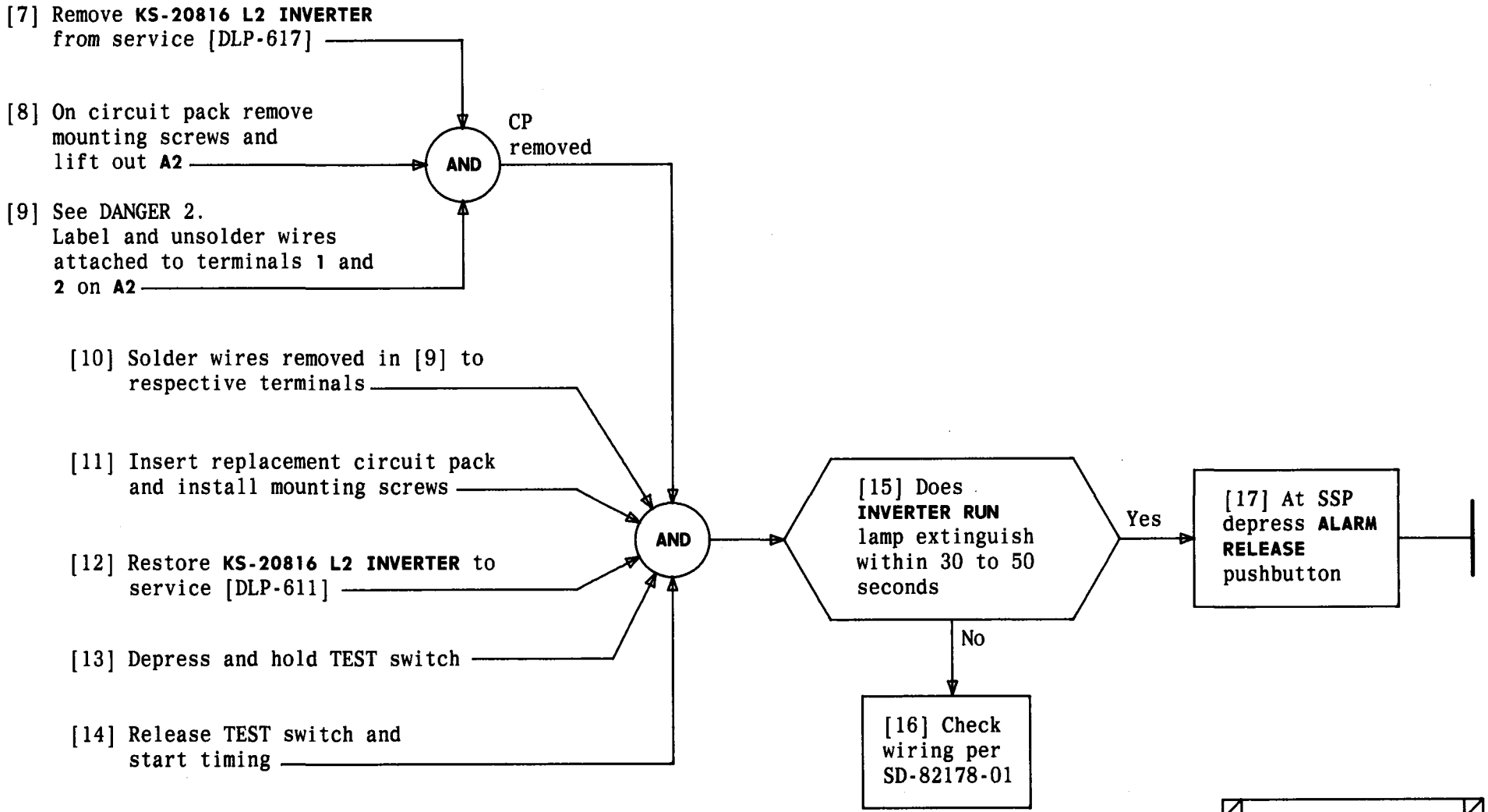


DANGER 1

Voltages inside INVERTER cabinet are over 400 volts to ground

Issue 2	JUL 1980
233-144-100	TAP
PAGE 1 of 2	184

CLEAR TROUBLE IN INVERTER AC TIMER CIRCUIT PACK A2

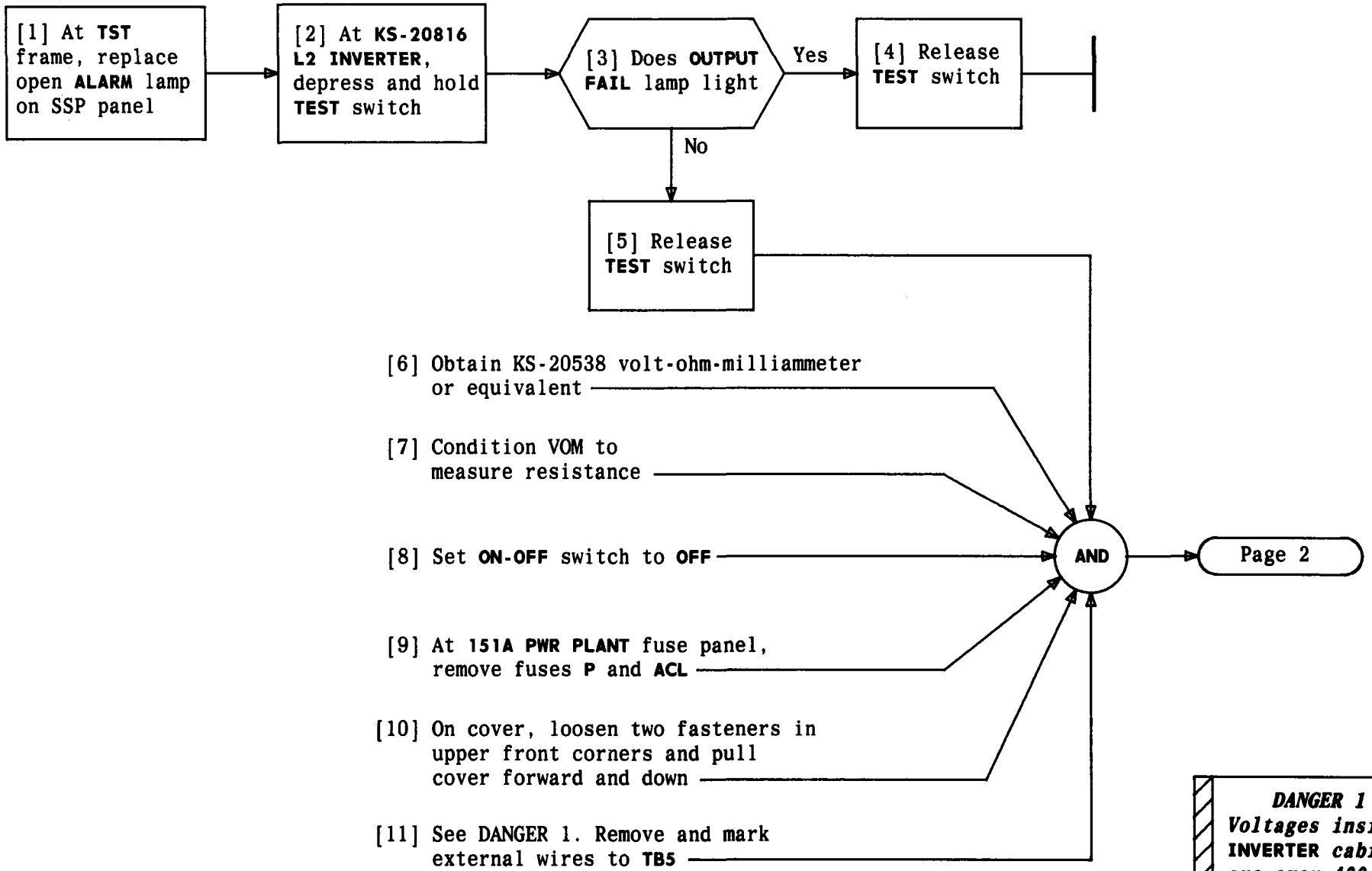


DANGER 2

Voltages inside INVERTER cabinet are over 400 volts to ground

Issue 2	JUL 1980
233-144-100	TAP
PAGE 2 of 2	184

CLEAR TROUBLE IN INVERTER AC TIMER CIRCUIT PACK A2



DANGER 1
Voltages inside INVERTER cabinet are over 400 volts to ground

Issue 2	JUL 1980
233-144-100	TAP
PAGE 1 of 3	185

CLEAR TROUBLE IN INVERTER OUTPUT FAIL ALARM CIRCUIT

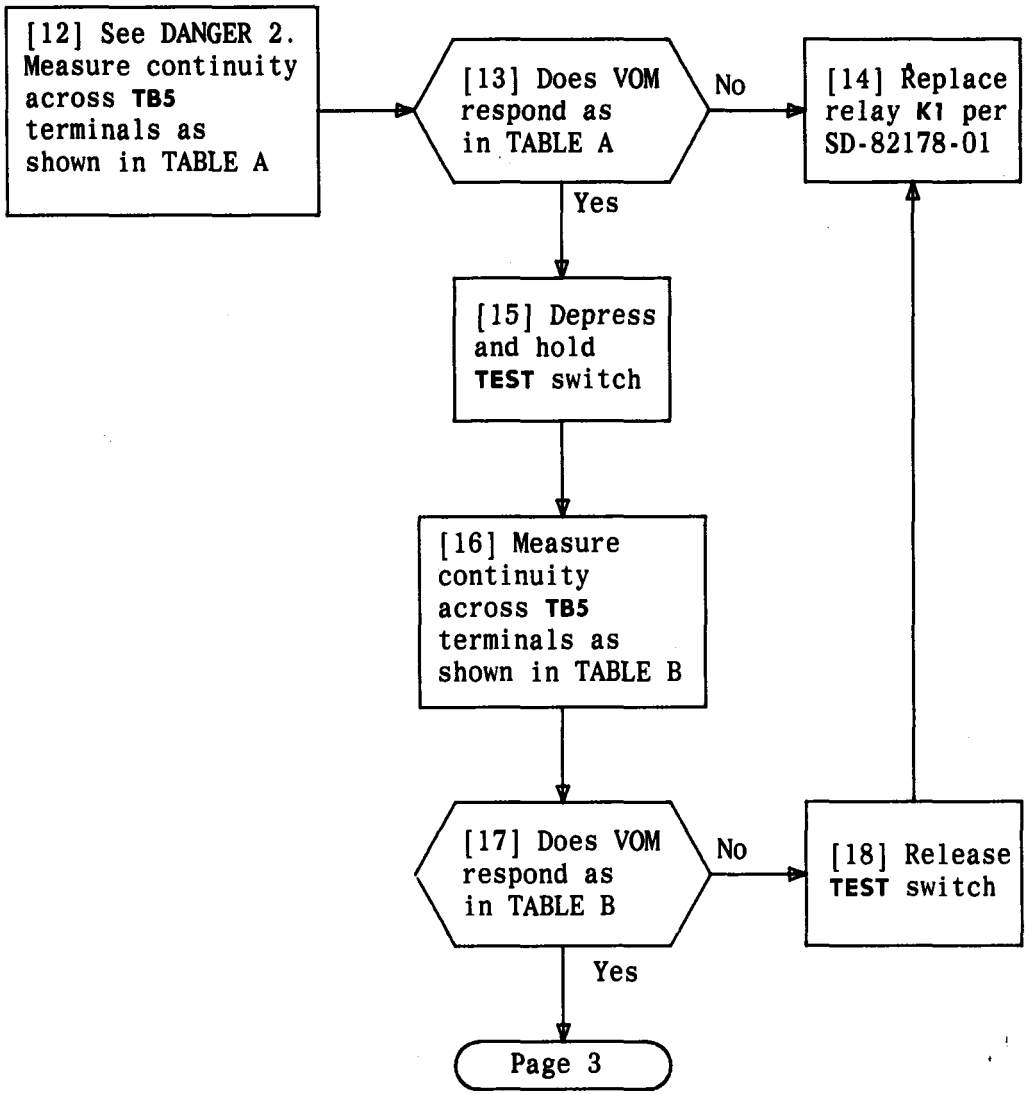
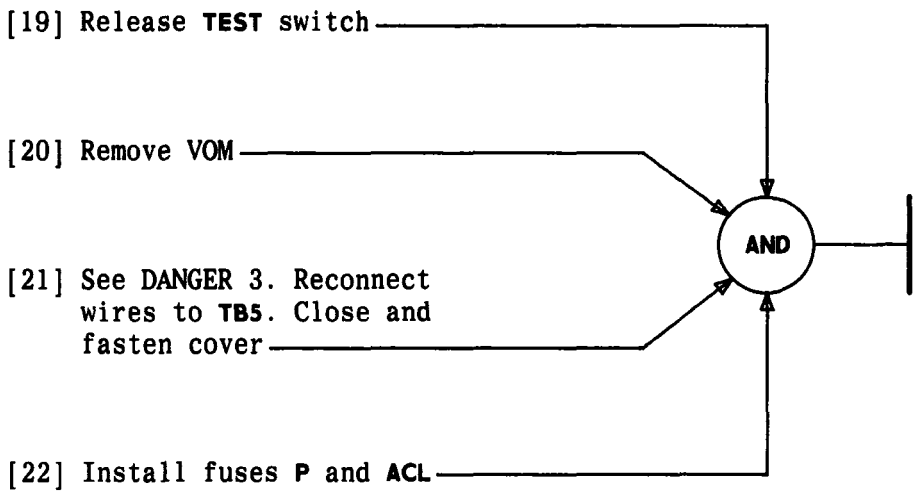


TABLE A	
TEST SWITCH RELEASED	
CONNECT VOM TO TB5 BETWEEN TERMINALS	VOM RESPONSE
1 and 2	0 Ohms
2 and 3	Open circuit
4 and 5	0 Ohms
5 and 6	Open circuit
7 and GRD	Open circuit

TABLE B	
TEST SWITCH OPERATED	
CONNECT VOM TO TB5 BETWEEN TERMINALS	VOM RESPONSE
1 and 2	Open circuit
2 and 3	0 Ohms
4 and 5	Open circuit
5 and 6	0 Ohms
7 and GRD	0 Ohms

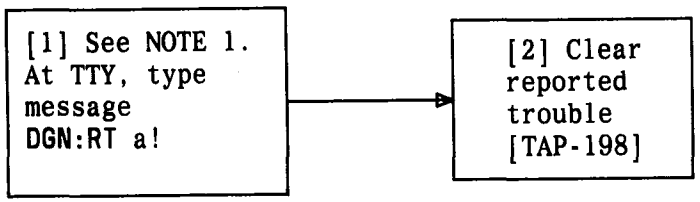
DANGER 2
Voltages inside INVERTER cabinet are over 400 volts to ground

CLEAR TROUBLE IN INVERTER OUTPUT FAIL ALARM CIRCUIT



CLEAR TROUBLE IN INVERTER OUTPUT FAIL ALARM CIRCUIT

DANGER 3
Voltages inside INVERTER cabinet are over 400 volts to ground



NOTE 1
Plant has two sides (0 and 1). Small letter "a" is variable for "0" or "1". Use "0" or "1" as appropriate for side under test

CLEAR TROUBLE – SYSTEM CONTROL WILL NOT REMOVE SIDE OF PLANT FROM SERVICE

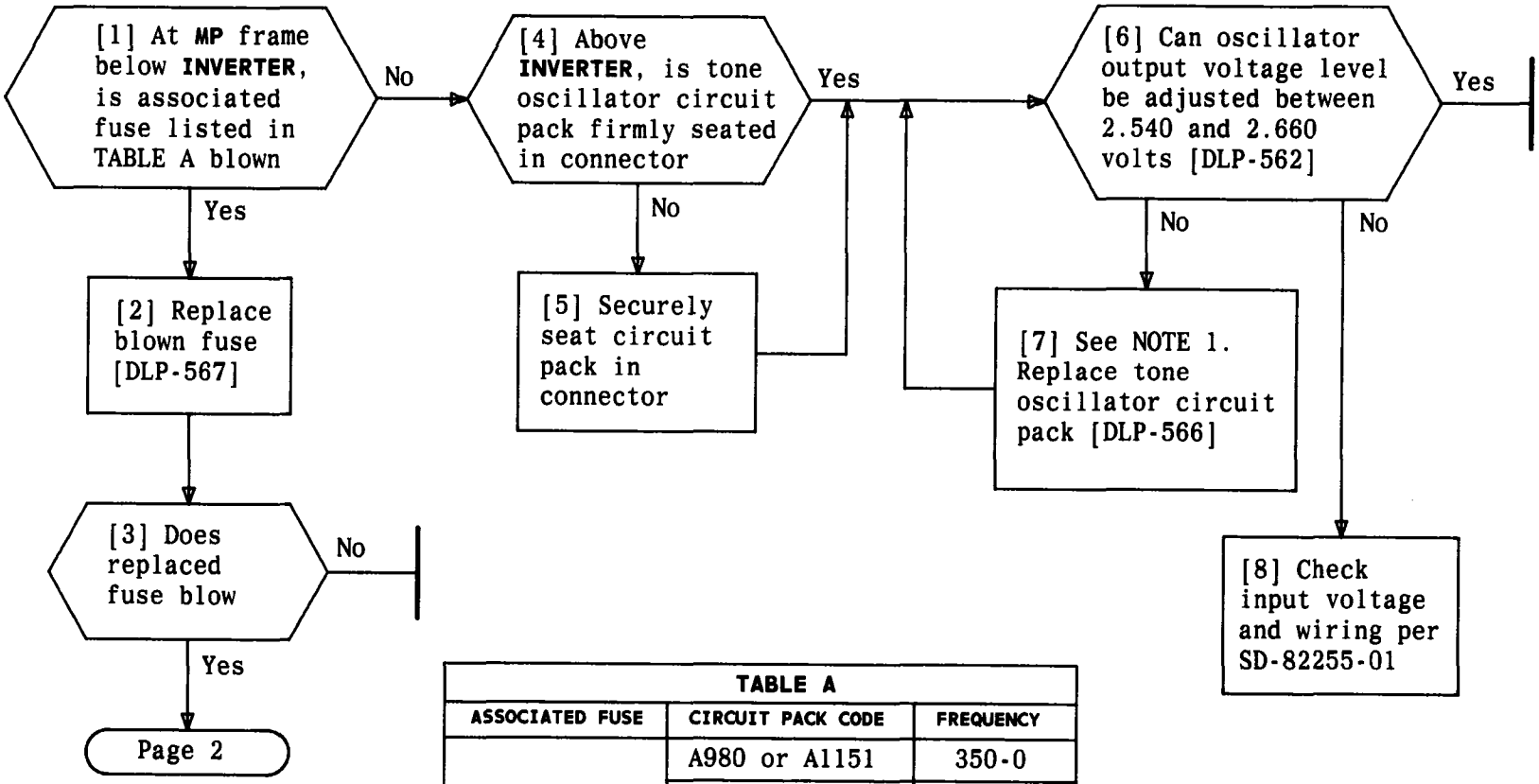
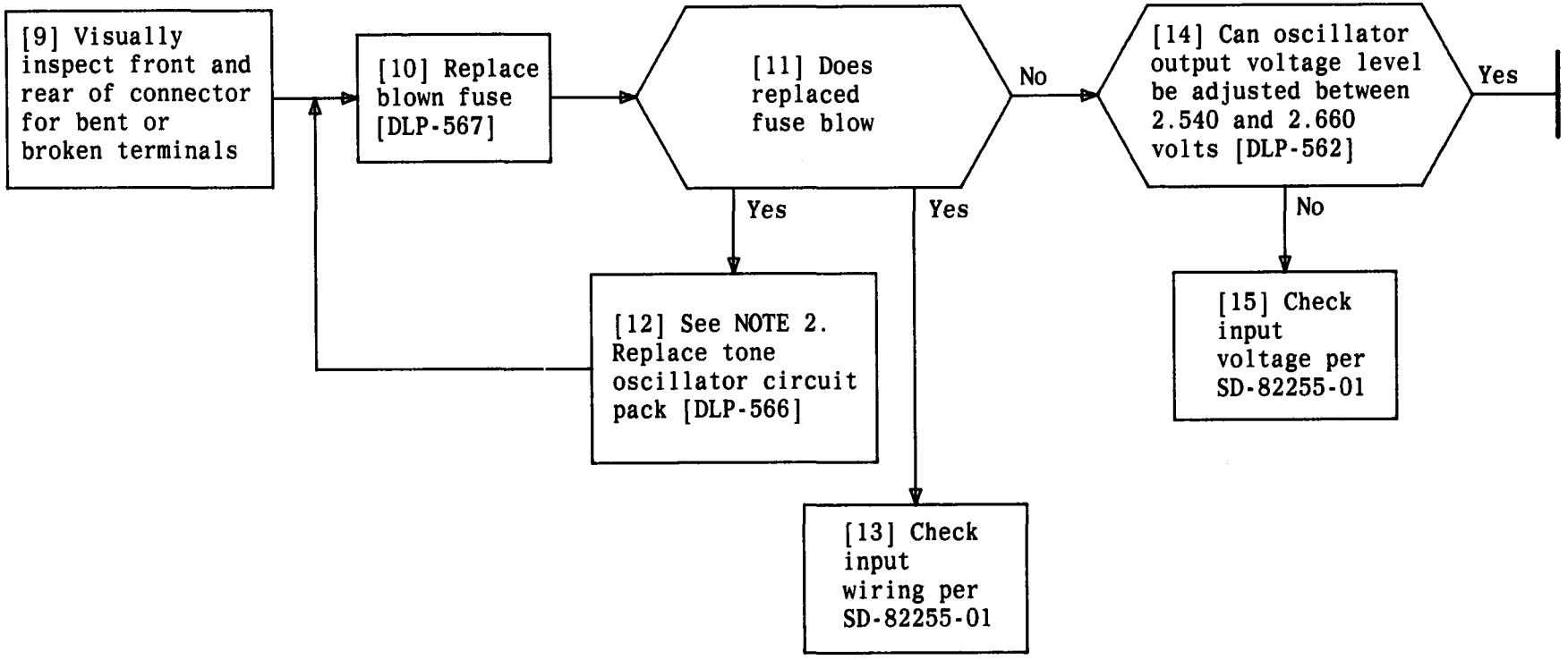


TABLE A

ASSOCIATED FUSE	CIRCUIT PACK CODE	FREQUENCY
F4 (−48 volt)	A980 or A1151	350-0
	A981 or A1152	440-0
	A982 or A1153	480-0
	A983 or A1154	620-0
F12 (−48 volt)	A980 or A1151	350-0
	A981 or A1152	440-0
	A982 or A1153	480-0
	A983 or A1154	620-0

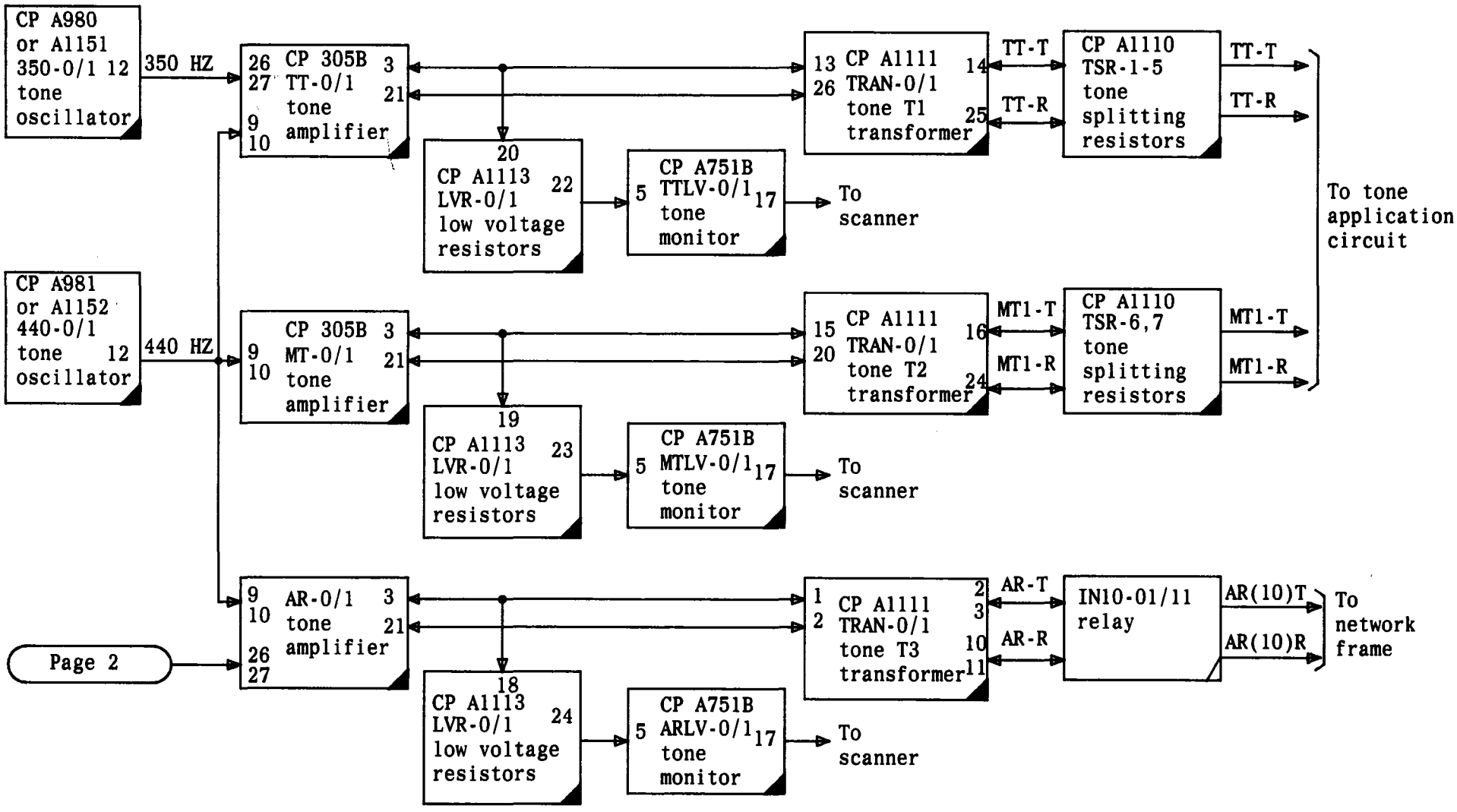
NOTE 1
Trouble clearing procedures require original circuit pack be reinstalled if replacement does not correct trouble

CLEAR TONE OSCILLATOR TROUBLE



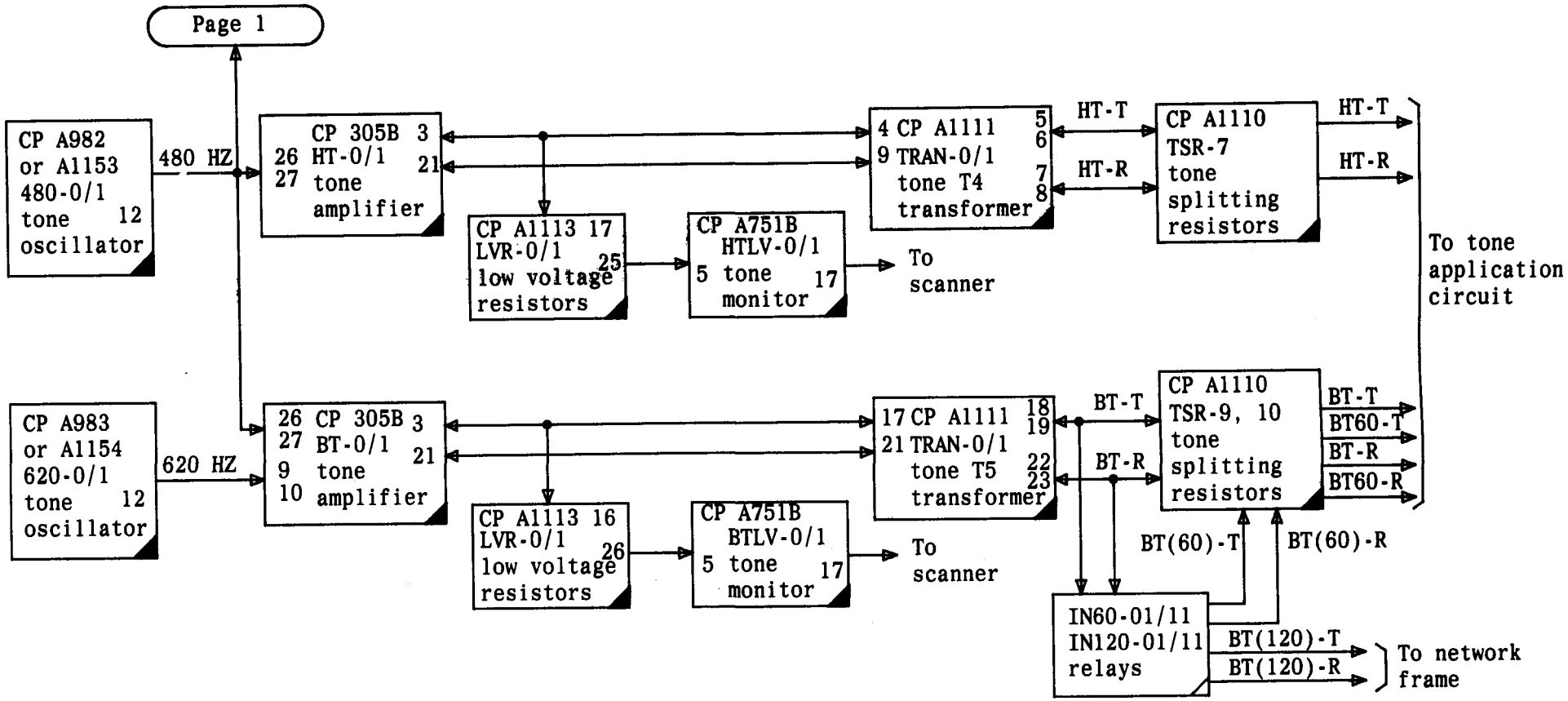
NOTE 2
Trouble clearing procedures require original circuit pack be reinstalled if replacement does not correct trouble

CLEAR TONE OSCILLATOR TROUBLE



TONE GENERATION

Issue 2	JUL 1980
233-144-100	ISD 192
PAGE 1 of 2	



TONE GENERATION

[1] See WARNING 1 and CAUTION 1. Obtain equipment in TABLE A

[2] See NOTE 1. At **MP** frame on **RINGING & TONE** panel, depress **OFF-0** (or **OFF-1**) pushbutton

PWR OFF lamp lighted

[3] See FIG. 1 and NOTE 2. Use 723B circuit pack puller to remove amplifier and low voltage monitor circuit packs for tone being checked

[4] Use 158A circuit pack adapters to extend amplifier circuit pack and low voltage monitor circuit group

AND

Circuit pack extended

Page 2

TABLE A	
EQUIPMENT REQUIRED	RECOMMENDED TYPE
Digital multimeter (DMM)	Hickok Model 3310 (ITE-5356)*†
Circuit pack puller	723B tool†
Circuit pack extender	158A adapter†
Jewelers screwdriver	R1005 tool†
(2) Connecting clips	EZ hook†
* DMM must be true RMS † Or equivalent	

NOTES
1. Information enclosed in parentheses refers to side 0 or to side 1
2. For example, remove TT-0 amplifier and TTLV-0 monitor for TT tone on side 0

WARNING 1
Erroneous reading and damage to equipment may result if DMM is not isolated from ground

CAUTION 1
Tone voltages to be measured are complex ac waveforms. A True RMS indicating voltmeter is required to accurately adjust voltage levels. Peak and average ac voltmeters produce inaccurate readings

CLEAR TROUBLE – TONE AMPLIFIER AND LOW VOLTAGE MONITOR CIRCUIT

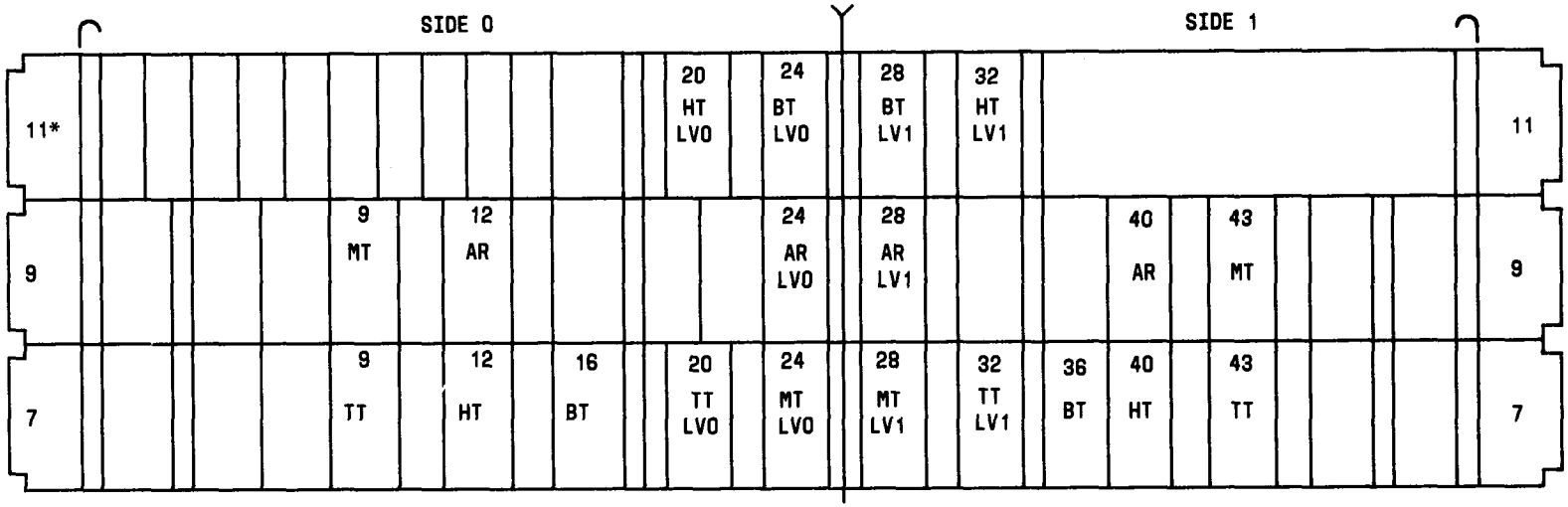
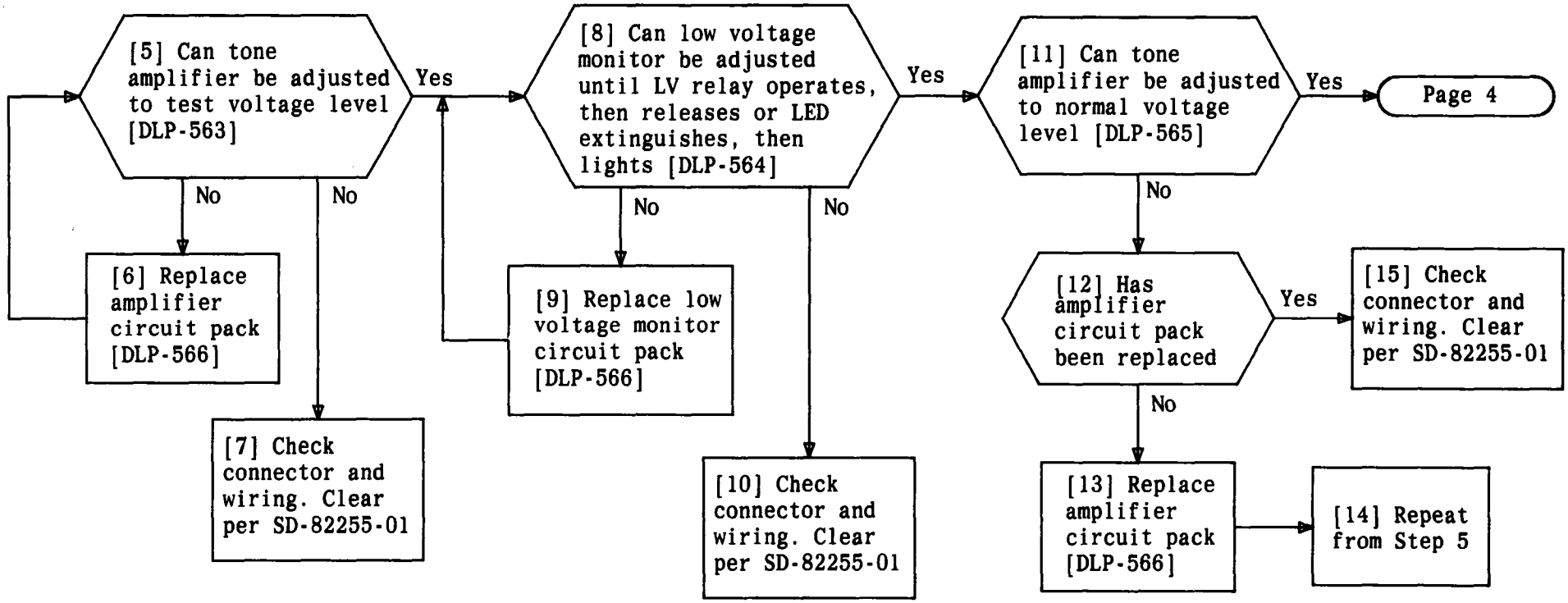


FIG. 1 – Tone Amplifier and Low Voltage Monitor Circuit Pack Arrangement – Front View

CLEAR TROUBLE – TONE AMPLIFIER AND LOW VOLTAGE MONITOR CIRCUIT



CLEAR TROUBLE-TONE AMPLIFIER AND LOW VOLTAGE MONITOR CIRCUIT

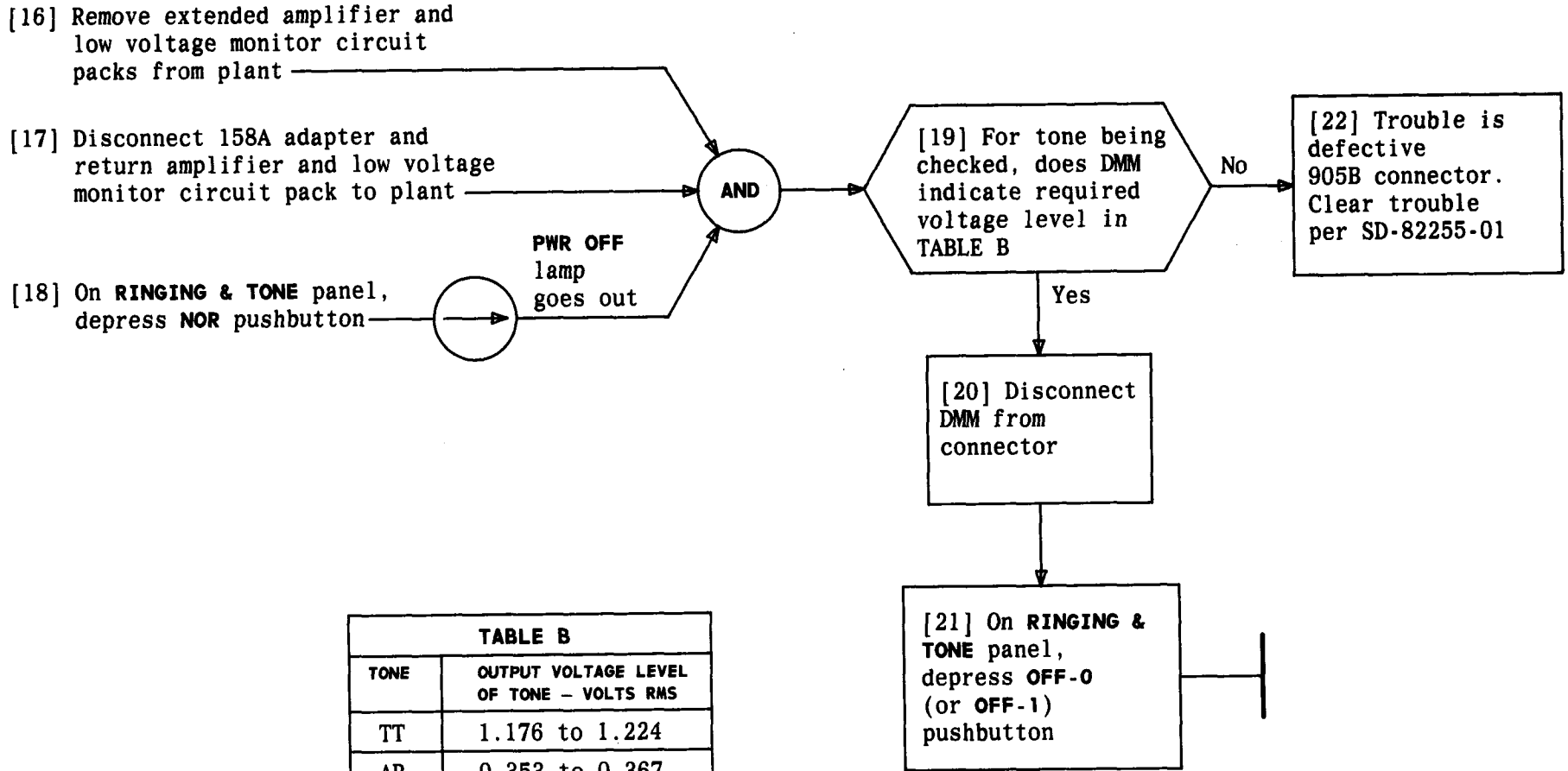
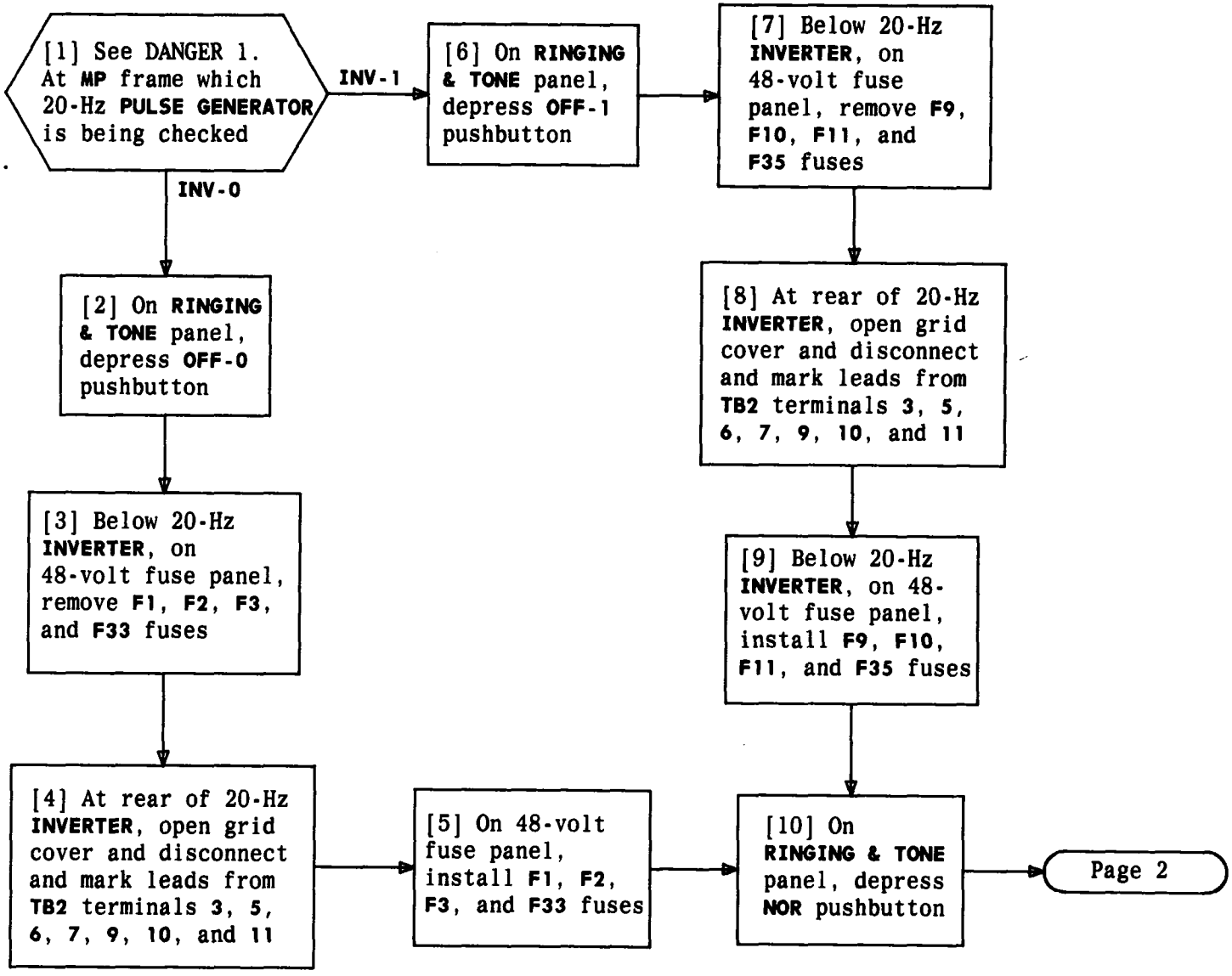


TABLE B	
TONE	OUTPUT VOLTAGE LEVEL OF TONE – VOLTS RMS
TT	1.176 to 1.224
AR	0.353 to 0.367
BT	0.196 to 0.204
MT	0.442 to 0.518
HT	0.267 to 0.313

CLEAR TROUBLE-TONE AMPLIFIER AND LOW VOLTAGE MONITOR CIRCUIT



CLEAR TROUBLE IN 20-HZ PULSE GENERATOR

DANGER 1
Voltages inside INVERTER cabinet are over 200 volts to ground

Issue 2	JUL 1980
233-144-100	TAP
PAGE 1 of 6	194

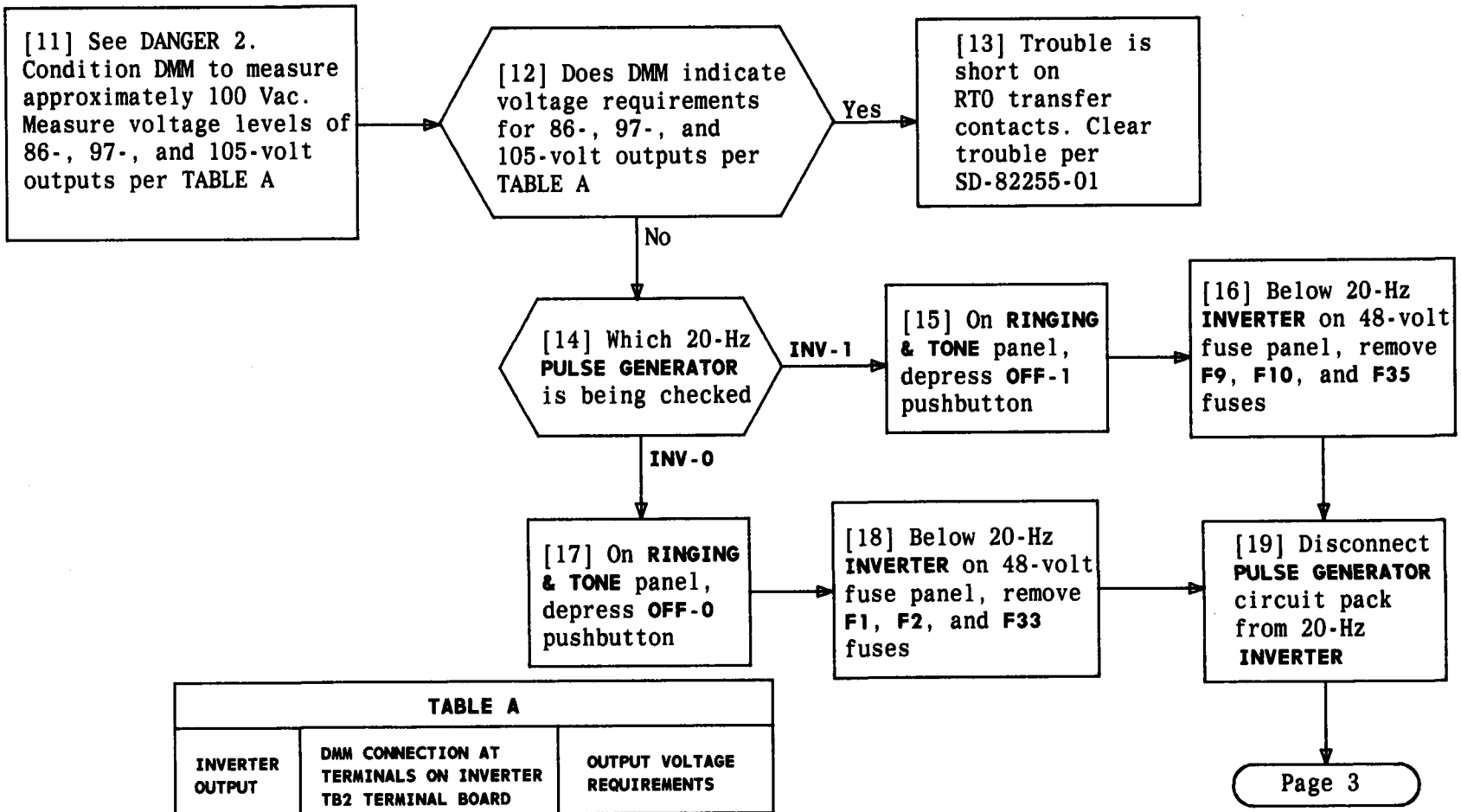


TABLE A

INVERTER OUTPUT	DMM CONNECTION AT TERMINALS ON INVERTER TB2 TERMINAL BOARD	OUTPUT VOLTAGE REQUIREMENTS
86(A) 86(B)	8 and 9 4 and 5	84.5 to 88.0
97(A) 97(B)	8 and 10 4 and 6	94.5 to 101.0
105(A) 105(B) 105(C)	8 and 11 4 and 5 1 and 3	103.0 to 110.0

DANGER 2
Voltages inside INVERTER cabinet are over 200 volts to ground

CLEAR TROUBLE IN 20-HZ PULSE GENERATOR

[20] See DANGER 3 and FIG. 1. At **Q1** and **Q2** transistors, disconnect emitter lead

[21] Condition DMM to measure approximately KΩ X1

[22] Are forward and reverse resistance requirements met for **Q1** and **Q2** transistors as given in TABLE B

Yes

[24] Reconnect **Q1** and **Q2** emitter leads

Page 4

No

[23] Replace defective transistor

TABLE B	
DMM CONNECTION ACROSS TRANSISTOR TERMINAL	DMM INDICATION REQUIREMENT
Emitter to collector	High resistance in forward and reverse direction
Emitter to base	High resistance in one direction and low resistance in opposite direction
Collector to base	

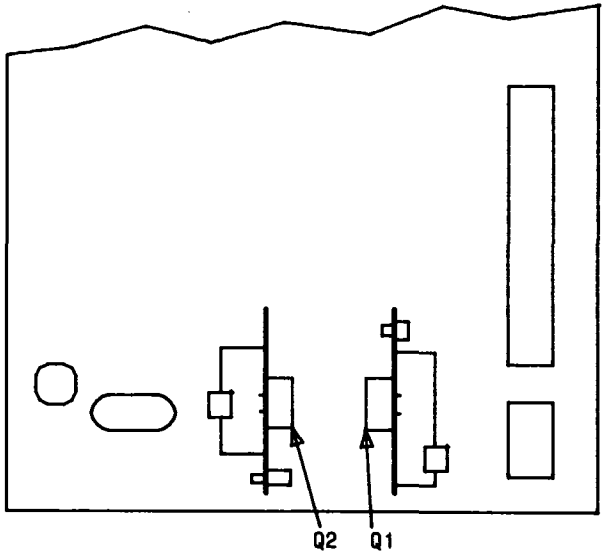


FIG. 1

DANGER 3
Voltages inside INVERTER cabinet are over 200 volts to ground

CLEAR TROUBLE IN 20-HZ PULSE GENERATOR

[25] See DANGER 4 and FIG. 2. Disconnect one lead from **CR2**, **CR3**, **CR4**, and **CR5**

[26] Are forward and reverse resistance requirements met for **CR2**, **CR3**, **CR4**, and **CR5** as given in TABLE C

Yes

No

[27] Replace defective diode

[28] Reconnect leads at **CR2**, **CR3**, **CR4**, and **CR5**

[29] See NOTE 1. Replace **PULSE GENERATOR** circuit pack with new circuit pack and install in inverter

[30] Which 20-Hz **PULSE GENERATOR** is being checked

INV-1

INV-0

[31] At 48-volt fuse panel, install **F9**, **F10**, and **F35** fuses

[32] At 48-volt fuse panel, install **F1**, **F2**, and **F33** fuses

[33] On **RINGING & TONE** panel, depress **NOR** pushbutton

Page 5

TABLE C

DMM CONNECTION ACROSS DIODE TERMINALS	DMM INDICATION REQUIREMENT
Anode to cathode	High resistance in one direction and low resistance in opposite direction
Cathode to anode	

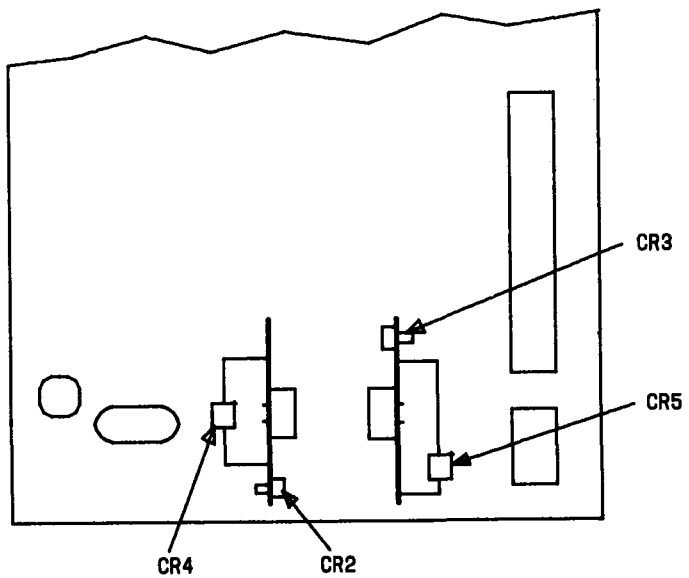


FIG. 2

NOTE 1
Trouble clearing procedure requires original circuit pack be returned to unit if replacement does not correct trouble

DANGER 4
Voltages inside* INVERTER *cabinet are over 200 volts to ground

CLEAR TROUBLE IN 20-HZ PULSE GENERATOR

[34] See DANGER 5. Condition DMM to measure approximately 100 Vac

[35] Does DMM indicate voltage requirements for 86-, 92-, and 105-volt outputs as given in TABLE D

Yes

[37] Disconnect DMM

No

[36] Trouble is defective ferroresonant circuit. Replace **PULSE GENERATOR** [DLP-569]

[38] See FIG. 3. Condition frequency counter

TABLE D		
INVERTER OUTPUT	DMM CONNECTION AT TERMINALS ON INVERTER TB2 TERMINAL BOARD	OUTPUT VOLTAGE REQUIREMENTS
86(A) 86(B)	8 and 9 4 and 5	84.5 to 88.0
97(A) 97(B)	8 and 10 4 and 6	94.5 to 101.0
105(A) 105(B) 105(C)	8 and 11 4 and 5 1 and 3	103.0 to 110.0

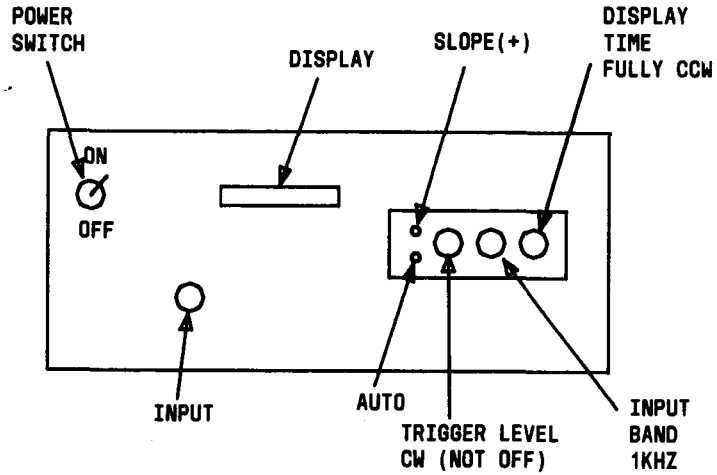


FIG. 3

[39] Does frequency counter indicate between 19.95 and 20.05 Hz when connected across **INVERTER TB2** terminals **8** and **9**

No

[40] Trouble is defective ferroresonant circuit. Replace **PULSE GENERATOR** [DLP-569]

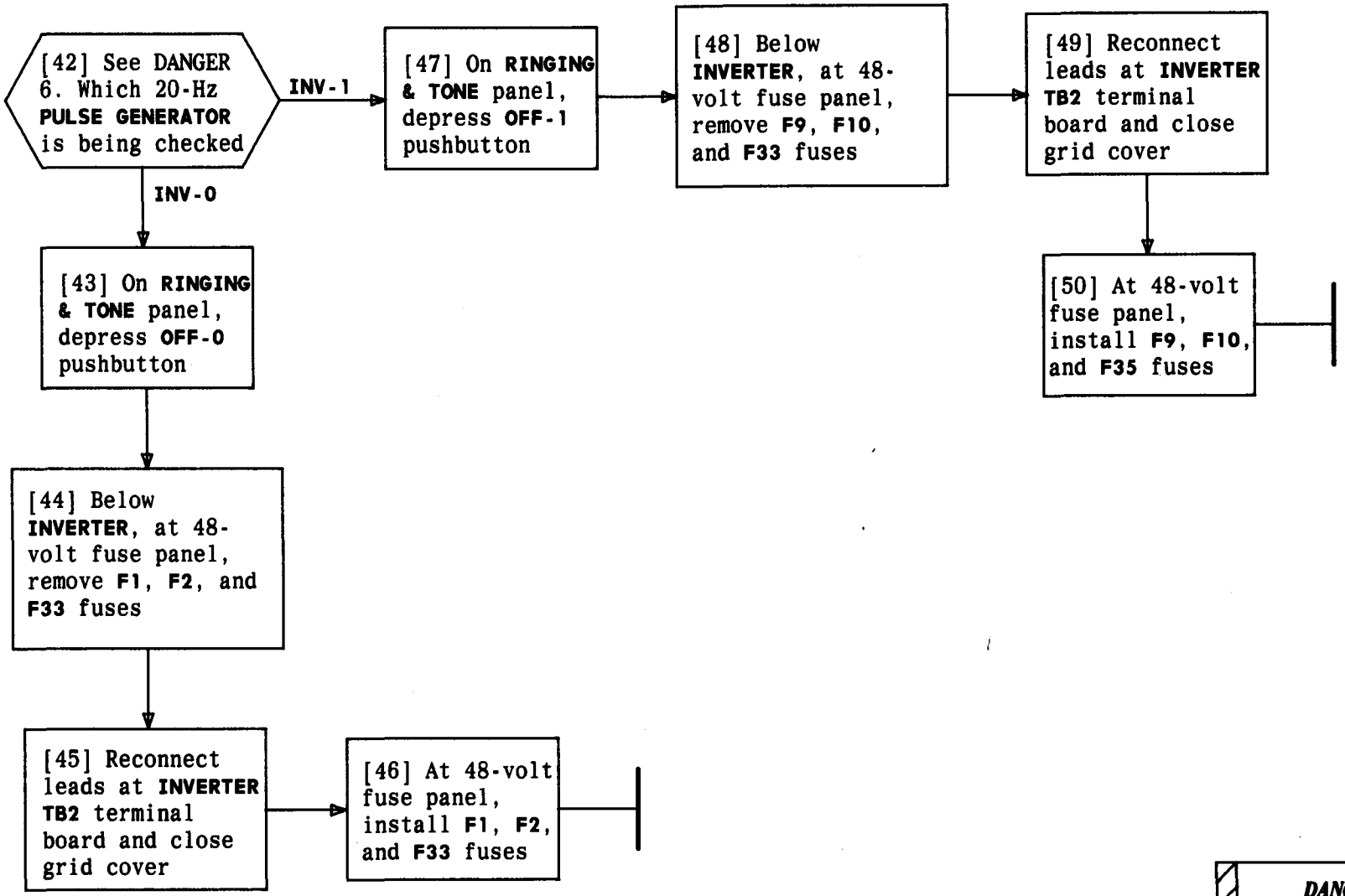
Yes

[41] Disconnect frequency counter

Page 6

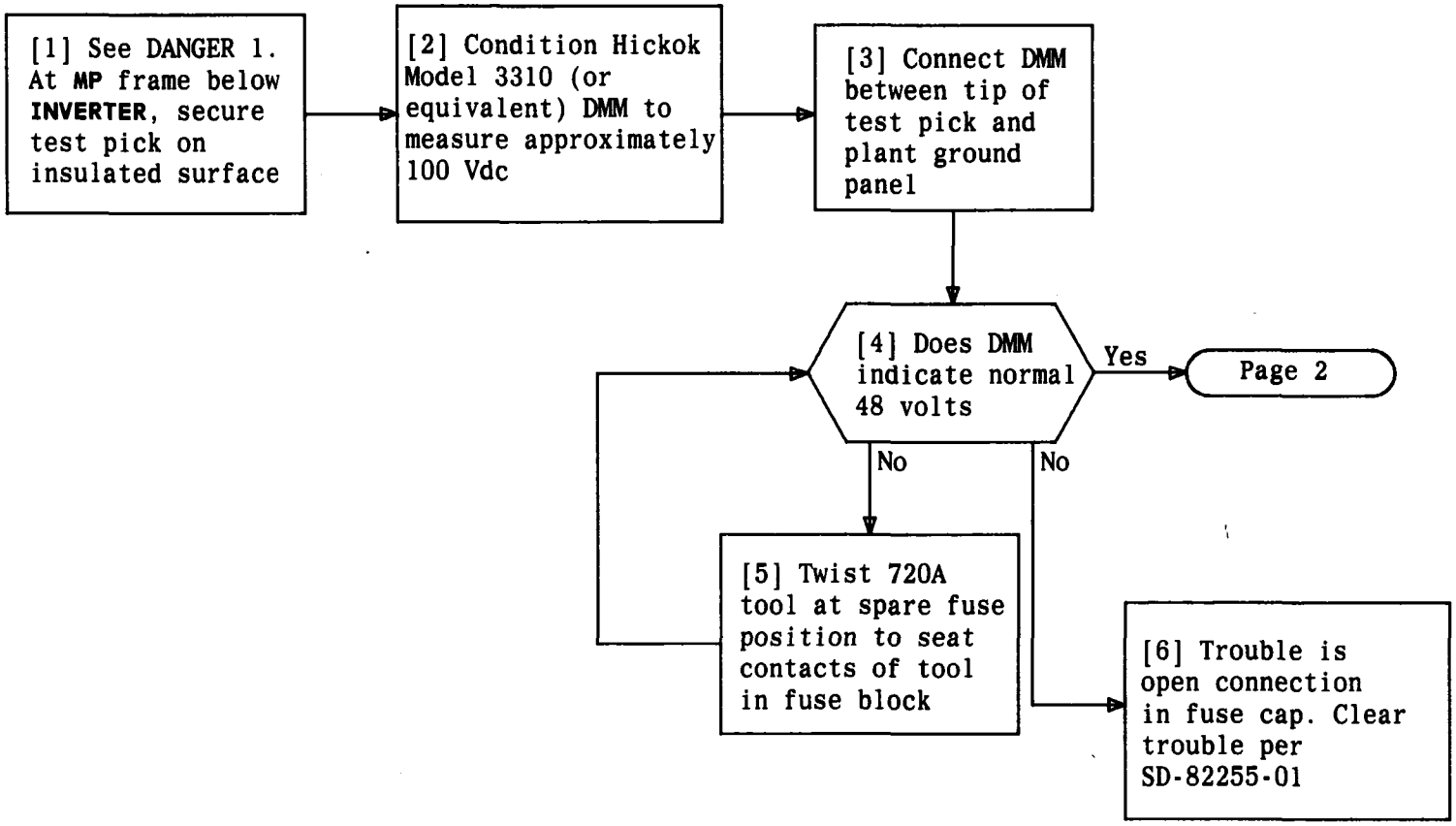
DANGER 5
Voltages inside INVERTER cabinet are over 200 volts to ground

CLEAR TROUBLE IN 20-HZ PULSE GENERATOR



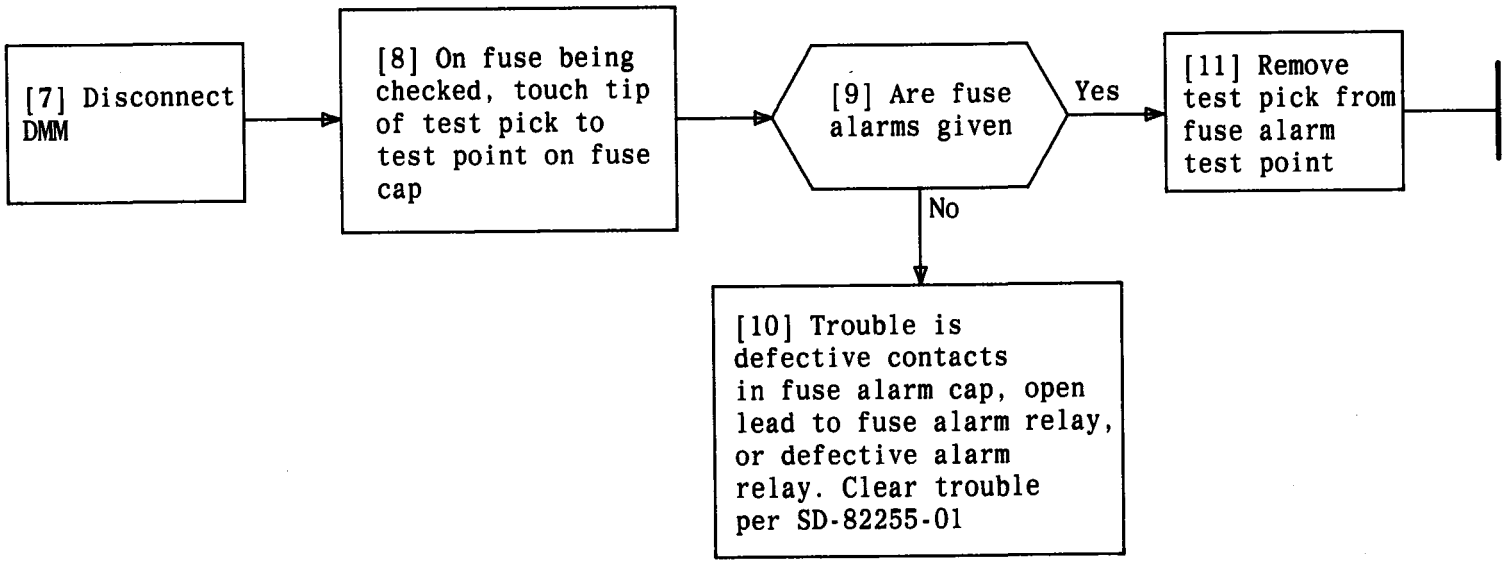
CLEAR TROUBLE IN 20-HZ PULSE GENERATOR

DANGER 6
Voltages inside INVERTER cabinet are over 200 volts to ground

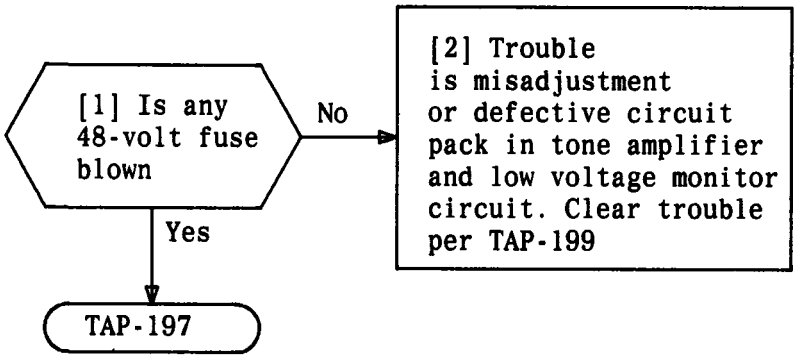


CLEAR TROUBLE IN 48-VOLT FUSE ALARM CIRCUIT

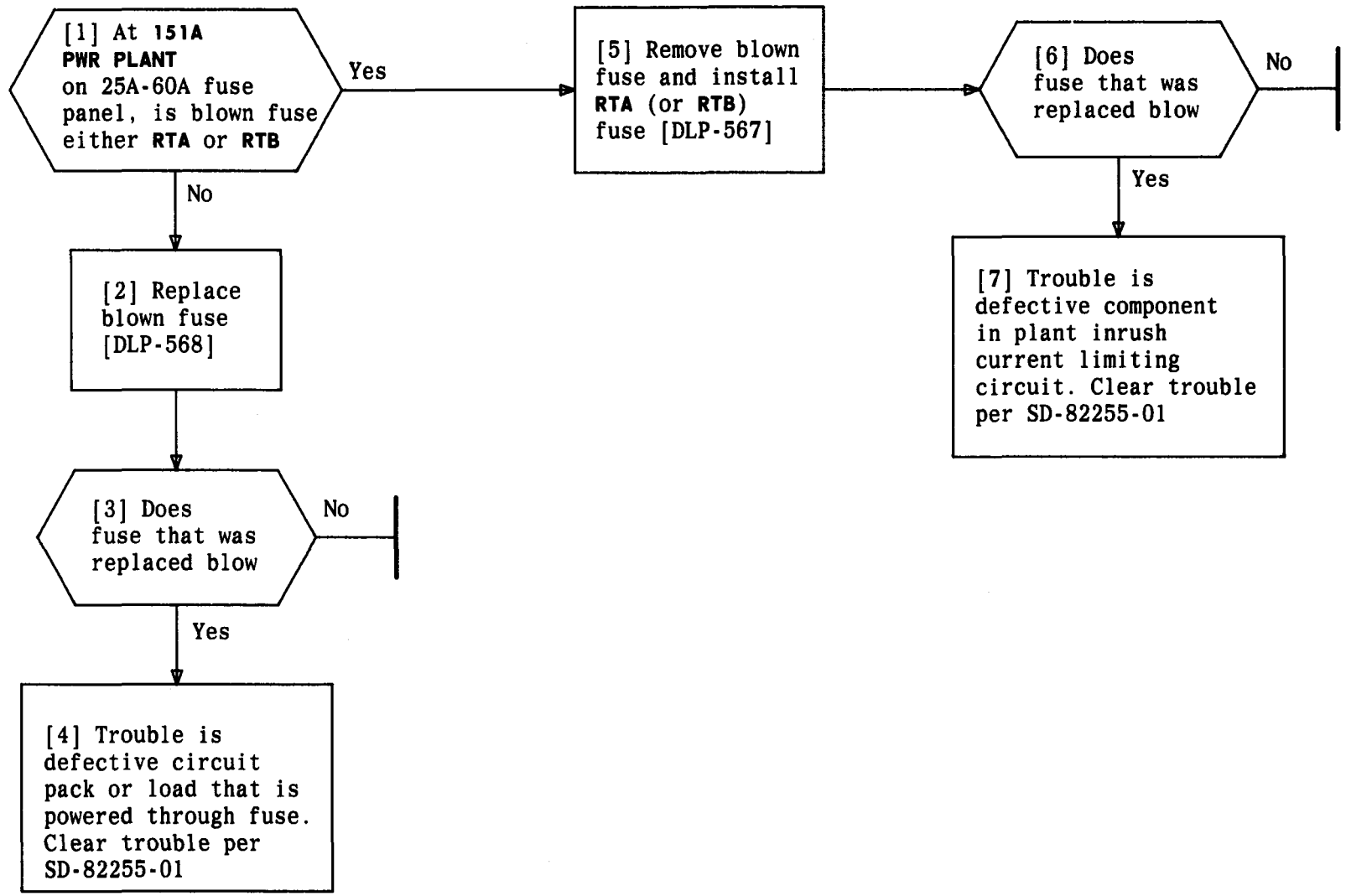
DANGER 1 *48-volt potential is present on tip of test pick*	
Issue 2	JUL 1980
233-144-100	TAP 195
PAGE 1 of 2	



CLEAR TROUBLE IN 48-VOLT FUSE ALARM CIRCUIT



CLEAR TROUBLE- SYSTEM CONTROL WILL NOT RESTORE PLANT TO SERVICE

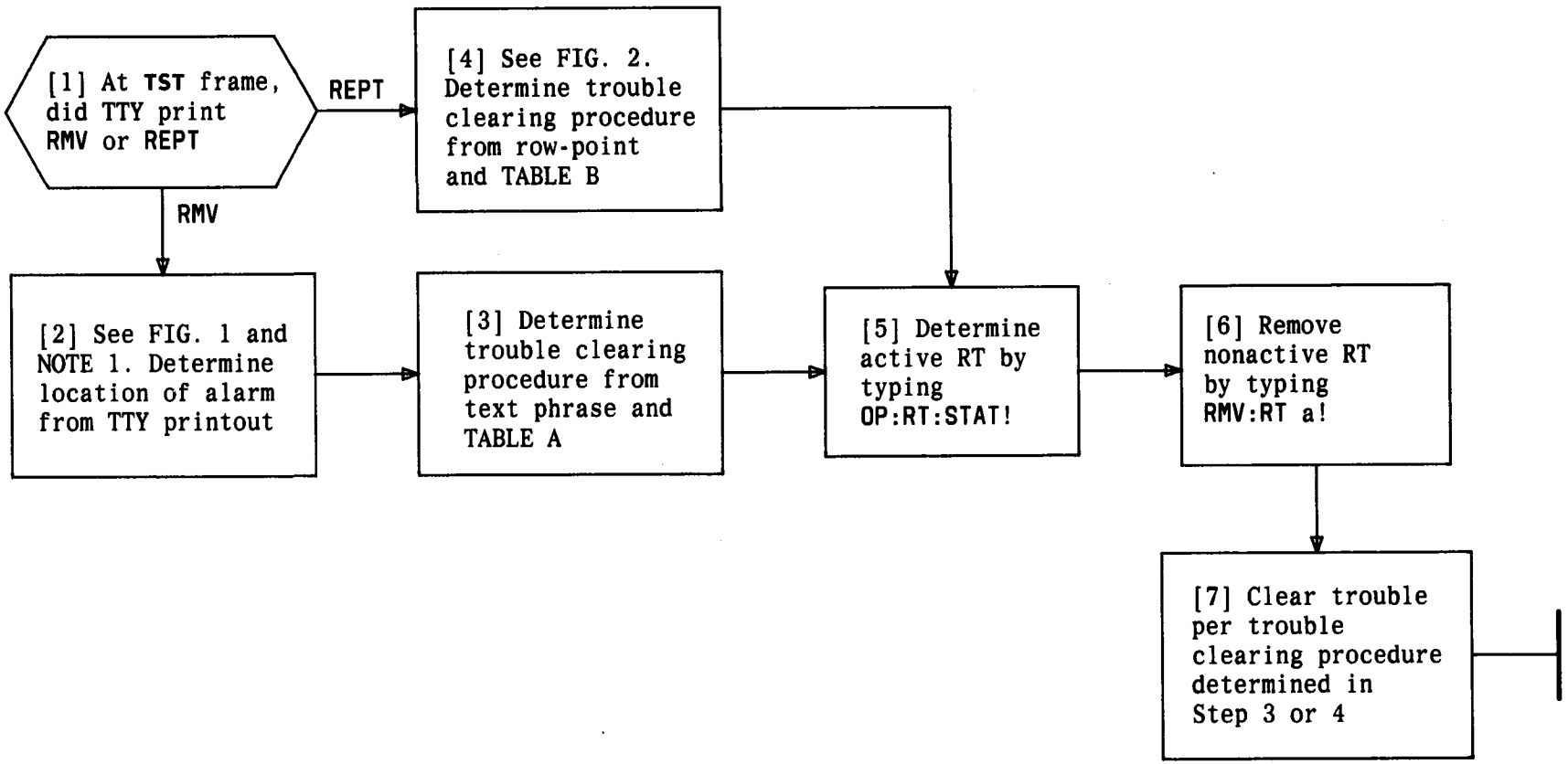


CLEAR BLOWN FUSE

TABLE A		
TEXT PHRASE	MEANING	TROUBLE CLEARING PROCEDURE
0000	MANUAL OFF	TBS
0001	FUSE ALARM	TAP-197
0010	INV FAIL	TAP-194
0011	TTLV	TAP-199
0100	BTLV	TAP-199
0101	ARLV	TAP-199
0110	HTLV	TAP-199
0111	MTLV	TAP-199
1000	GROUND	TBS
1001	+48V CONV	TAP-230
1010	+48V CONV	TAP-230
1011	+48V CONV	TAP-230
1100	INT FAIL	TBS
1101	BUS TRANS TO NETWORK	TBS
1110	RT FAIL DIAGNOSTICS	TBS

TABLE B					
SIDE 0		SIDE 1		MEANING	TROUBLE CLEARING PROCEDURE
ROW	POINT	ROW	POINT		
22	03	16	11	MANUAL OFF	TBS
22	04	16	12	FUSE ALARM	TAP-197
22	05	16	13	INV FAIL	TAP-194
22	06	16	14	TTLV	TAP-199
22	07	16	15	BTLV	TAP-199
23	03	17	11	ARLV	TAP-199
23	04	17	12	HTLV	TAP-199
23	05	17	13	MTLV	TAP-199
23	06	17	14	GROUND	TBS
NONDUPLICATED					
ROW		POINT			
17		04		ROH FAIL	DLP-560
18		04		RING DISTRIBUTION FUSE ALARM	TAP-197

ANALYZE TTY TROUBLE MESSAGE FOR RINGING AND TONE PLANT



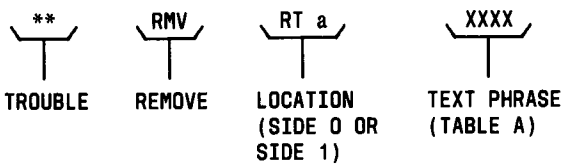


FIG. 1

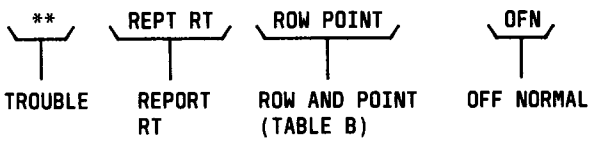
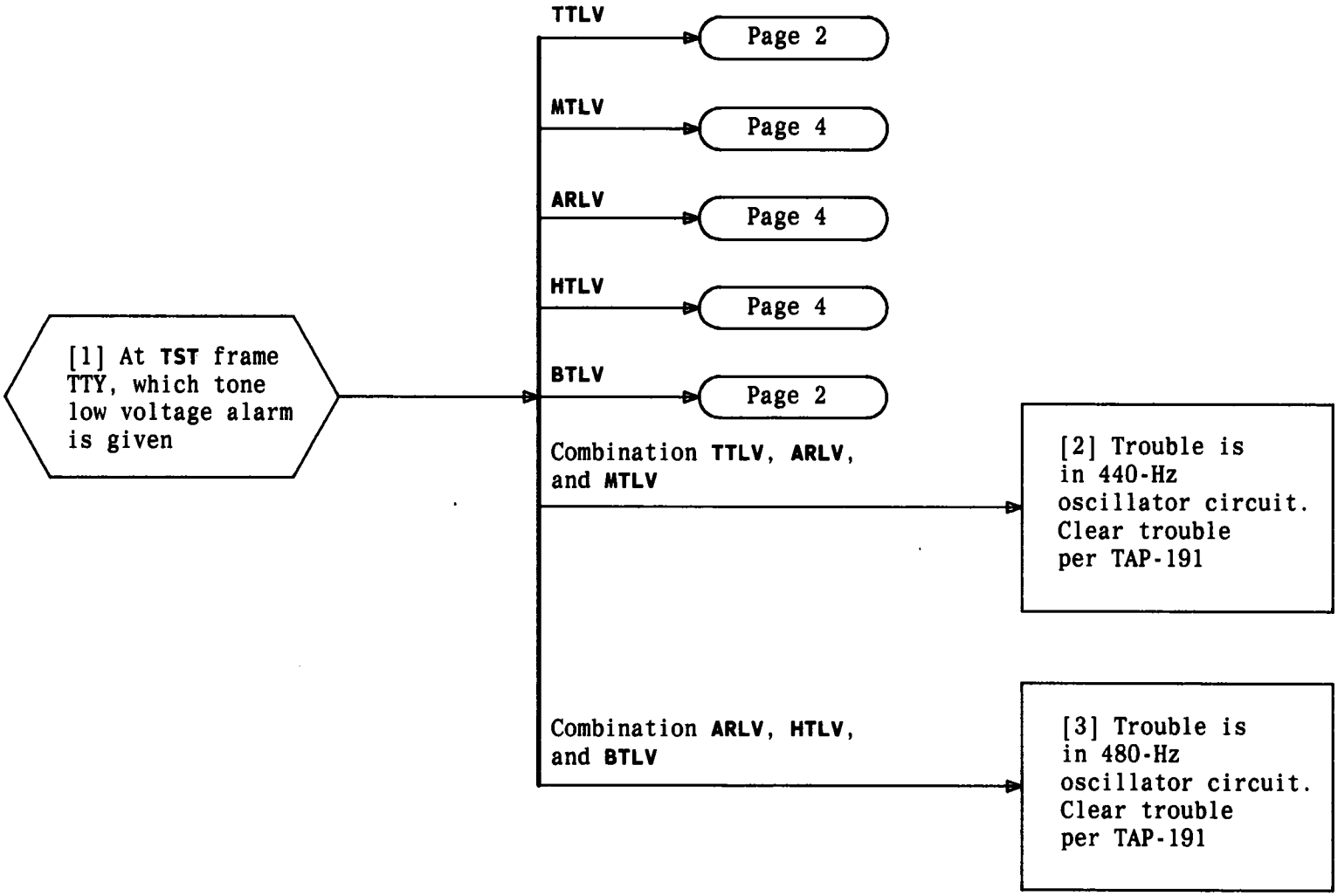


FIG. 2

NOTE 1
Plant has two sides (0 and 1). Small letter "a" is variable for "0" or "1". Use "0" or "1" as appropriate for side under test

ANALYZE TTY TROUBLE MESSAGE FOR RINGING AND TONE PLANT



CLEAR TONE FAULT

[4] See DANGER 1 and WARNING 1. Isolate DMM from ground [DLP-720] and condition to measure approximately 1V rms

[5] At TTY, which tone low voltage alarm is given

TTLV

BTLV

[6] See CAUTION 1 and FIG. 1. At rear of A1111 (0 or 1) circuit pack connector, connect DMM at terminals given in TABLE A

[7] Does DMM indicate voltage level in TABLE A

No

Yes

[8] Trouble is in BTLV low voltage monitor circuit. Clear trouble per TAP-193

[9] See CAUTION 1 and FIG. 1. At rear of A1111 (0 or 1) circuit pack connector, connect DMM at terminals given in TABLE A

[10] Does DMM indicate voltage level in TABLE A

Yes

[11] Trouble is in TTLV low voltage monitor circuit. Clear trouble per TAP-193

No

[12] Disconnect DMM

Page 3

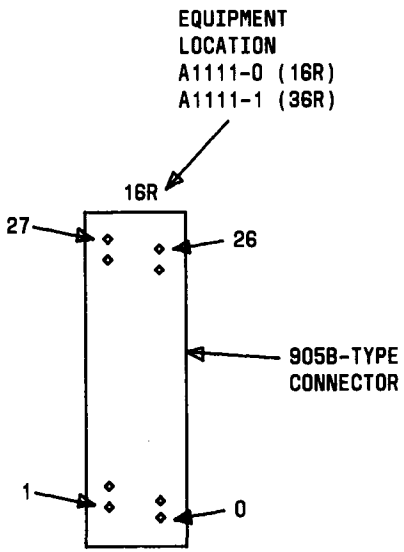


FIG. 1 – A1111 Connector – Rear View

TABLE A

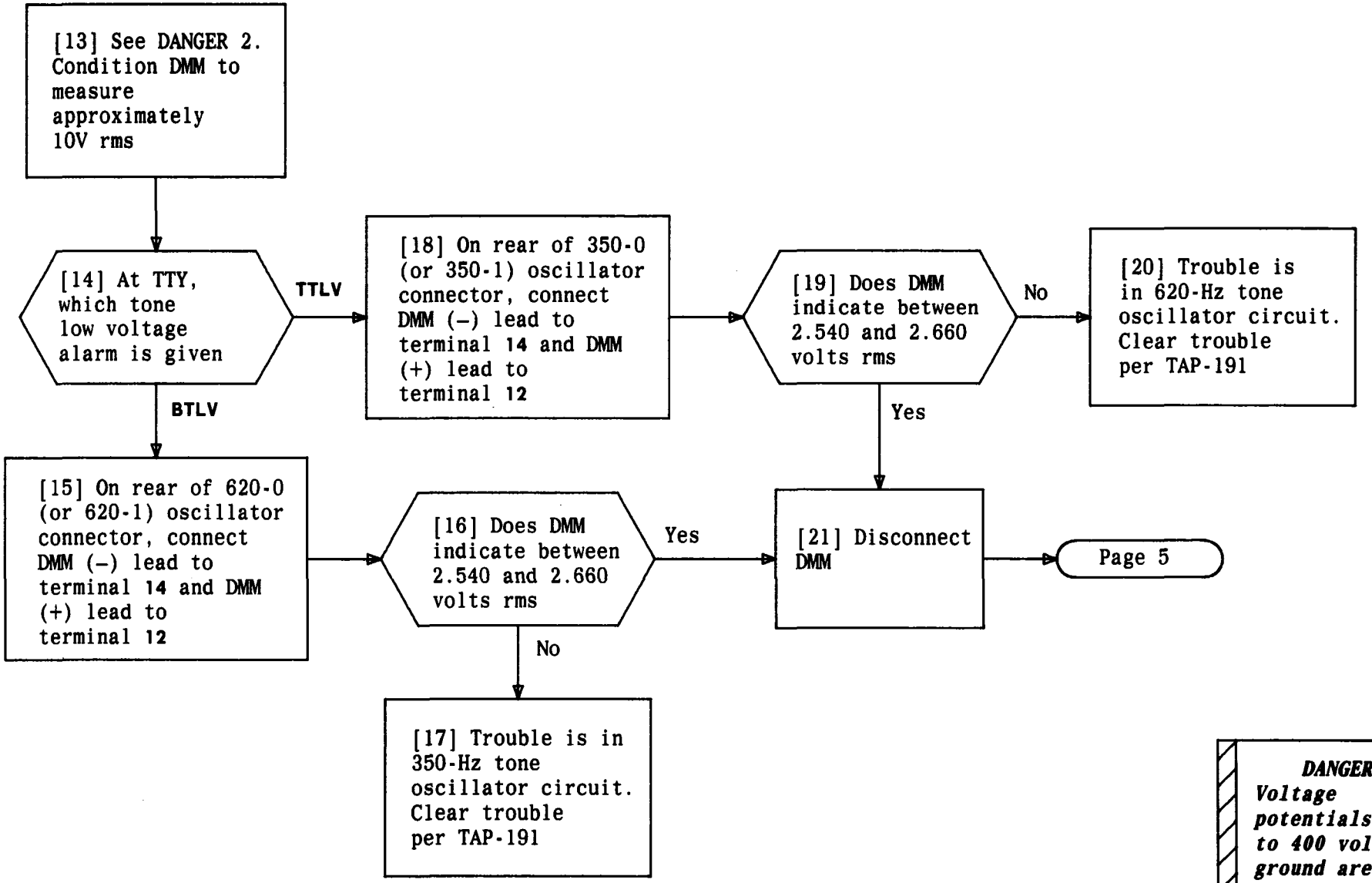
TONE LOW VOLTAGE ALARM	DMM CONNECTION AT A1111 CONNECTOR	VOLTAGE RANGE-VOLTS RMS
TTLV	14 and 25	1.02 to 1.38
BTLV	18 and 22	0.170 to 0.230

WARNING 1
Erroneous reading and damage to equipment may result if DMM is not isolated from ground

CAUTION 1
Tone voltages to be measured are complex ac waveforms. A True RMS indicating voltmeter is required to accurately adjust voltage levels. Peak and average ac voltmeters produce inaccurate readings

DANGER 1
Voltage potentials of up to 400 volts to ground are present at rear of plant

CLEAR TONE FAULT



DANGER 2
Voltage potentials of up to 400 volts to ground are present at rear of plant

CLEAR TONE FAULT

[22] See DANGER 3 and WARNING 2. Condition to measure approximately 1V rms

[23] See CAUTION 2. At rear of A1111 (0 or 1) circuit pack connector, connect DMM at terminals in TABLE B for low voltage alarm that is given

[24] Does DMM indicate voltage level in TABLE B

Yes

[25] Trouble is in low voltage monitor circuit. Clear trouble for voltage alarm that is given per TAP-193

No

[26] Disconnect DMM

Page 5

TABLE B		
TONE LOW VOLTAGE ALARM	DMM CONNECTION AT A1111 CONNECTOR	VOLTAGE RANGE-VOLTS RMS
MTLV	16 and 24	0.408 to 0.552
ARLV	2 and 10	0.306 to 0.414
HTLV	5 and 7	0.246 to 0.334

WARNING 2
Erroneous reading and damage to equipment may result if DMM is not isolated from ground

CAUTION 2
Tone voltages to be measured are complex ac waveforms. A True RMS indicating voltmeter is required to accurately adjust voltage levels. Peak and average ac voltmeters produce inaccurate readings

DANGER 3
Voltage potentials of up to 400 volts to ground are present at rear of plant

CLEAR TONE FAULT

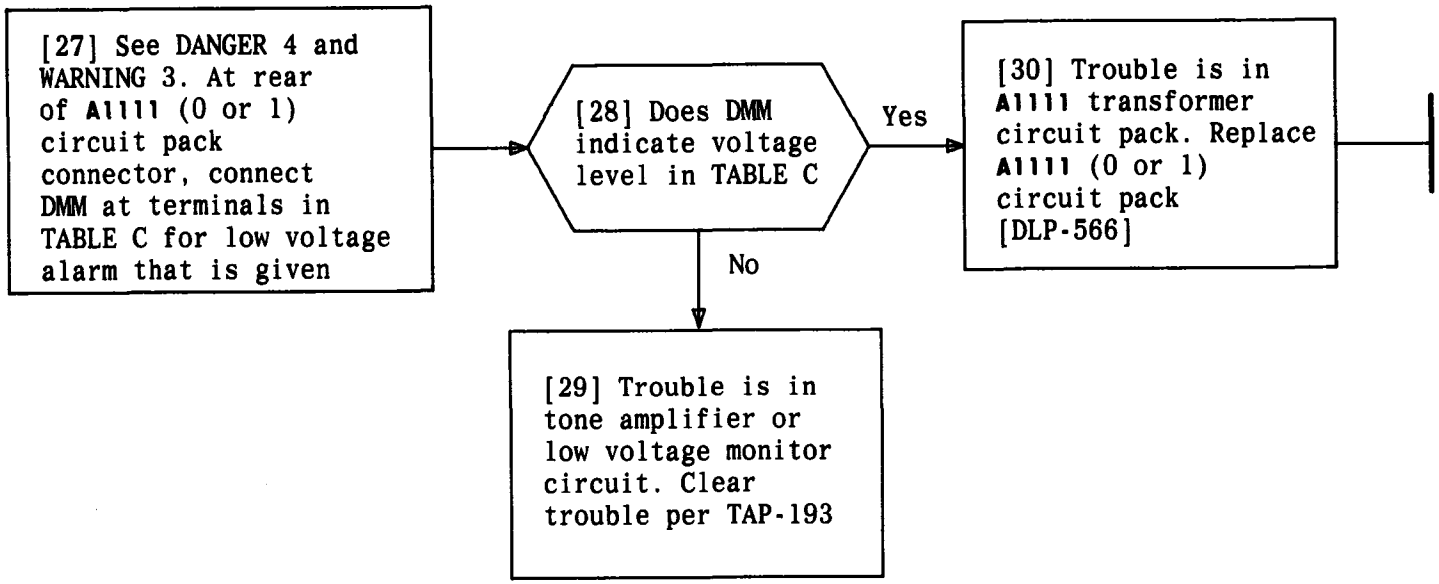


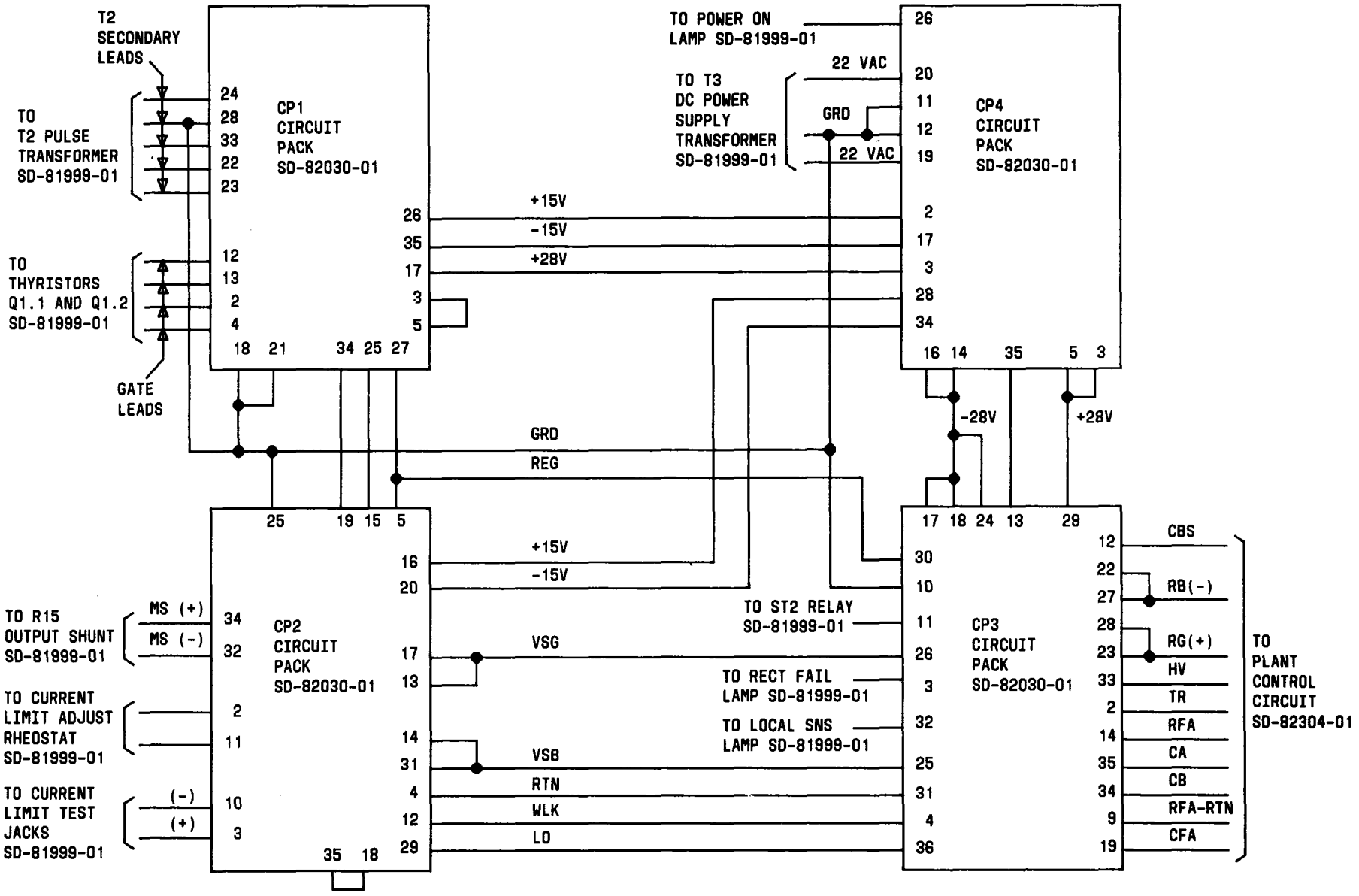
TABLE C

TONE LOW VOLTAGE ALARM	DMM CONNECTION AT A1111 CONNECTOR	VOLTAGE RANGE-VOLTS RMS
TTLV	13 and 26(GRD)	4.35 to 4.65
MTLV	15 and 20(GRD)	4.35 to 4.65
ARLV	1 and 12(GRD)	4.35 to 4.65
HTLV	4 and 9(GRD)	4.35 to 4.65
BTLV	17 and 21(GRD)	4.35 to 4.65

WARNING 3
DMM(−) lead must be connected to terminal designated GRD as given in TABLE C

DANGER 4
Voltage potentials of up to 400 volts to ground are present at rear of plant

CLEAR TONE FAULT



Issue 1	JUL 1980
233-144-100	ISD 200
PAGE 1 of 1	

LORAIN RECTIFIER CONTROL CIRCUIT

[1] Obtain test equipment in TABLE A

[2] At **151A PWR PLANT**, turn off **48V RECTIFIER** by depressing **POWER ON-POWER OFF** pushbutton and remove rectifier front panel

[3] Remove **RB** fuse associated with rectifier from plant

[4] Set **EXTERNAL-CHARGE** circuit breaker associated with rectifier to **OFF**

[5] See DANGER 1. Remove circuit pack front cover and **CP4** circuit pack from rectifier

[6] Connect **CP4** to **CP5** extender board

[7] Observe arrows and **UP** stamping on **CP5** extender, then install extender at **CP4** connector

AND

CP4 extended

[8] Condition DMM to measure approximately 100 Vdc

On rectifier:

[9] Connect DMM across **OUTPUT VOLTS** (+) and (–) test jacks

[10] See WARNING 1. Turn on rectifier by depressing **POWER ON-POWER OFF** pushbutton, record indication on DMM then turn **OFF** rectifier by depressing pushbutton

AND

Rectifier output voltage measured

Page 2

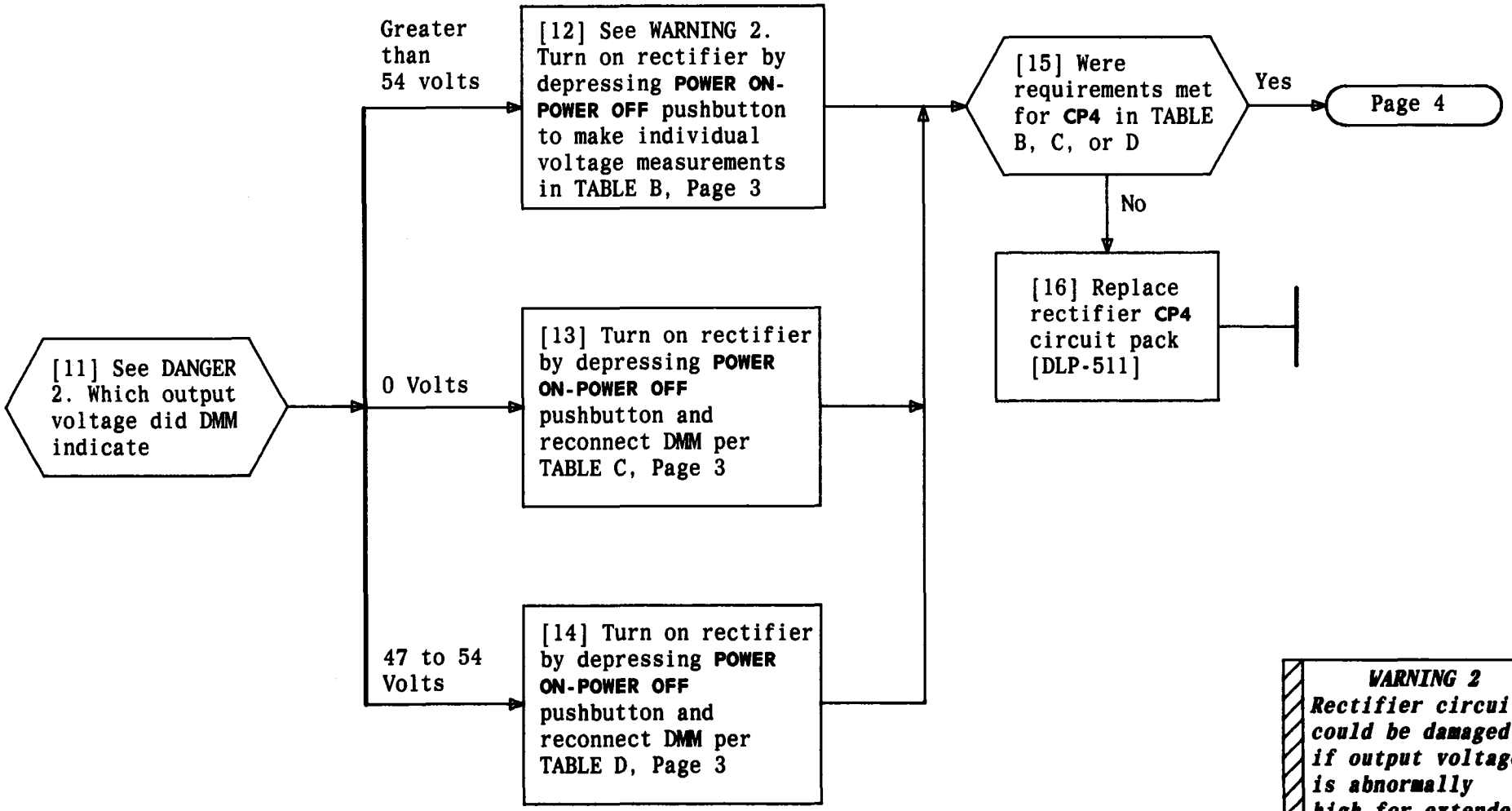
TABLE A

EQUIPMENT REQUIRED	RECOMMENDED TYPE
Extender board (CP5)	KS-20618, L10
Digital multimeter (DMM)	KS-20599, L4*
Oscilloscope	Tektronix 545B*
Voltage probe	Tektronix P6006*
* Or equivalent	

WARNING 1
Rectifier circuit could be damaged if output voltage is abnormally high for extended period of time

DANGER 1
Voltages inside rectifier cabinet are over 400 volts to ground

CLEAR DEFECTIVE LORAIN 48V RECTIFIER CIRCUIT PACK



WARNING 2
Rectifier circuit could be damaged if output voltage is abnormally high for extended period of time

DANGER 2
Voltages inside rectifier cabinet are over 400 volts to ground

CLEAR DEFECTIVE LORAIN 48V RECTIFIER CIRCUIT PACK

TABLE B	
DMM CONNECTED FROM TP12 (GRD) ON EXTENDER TO FOLLOWING TEST POINTS (FIG. 1)	DMM INDICATION IF CP4 IS GOOD
(A) TP28 on extender	+13.5 to 16.5 Vdc
(B) TP11 on CP4	-5.0 to 9.0 Vdc
(C) TP8 on CP4	+13.5 to 16.5 Vdc

TABLE C	
DMM CONNECTED FROM TP12 (GRD) ON EXTENDER TO FOLLOWING TEST POINTS (FIG. 1)	DMM INDICATION IF CP4 IS GOOD
(A) (Use DMM ACV scale) TP20 on extender	18 to Vac
(B) (Use DMM ACV scale) TP19 on extender	18 to 22 Vac
(C) TP5 on extender	+22 to 28 Vdc
(D) TP14 on extender	-22 to 28 Vdc
(E) TP3 on extender	+13.5 to 16.5 Vdc
(F) TP16 on extender	-13.5 to 16.5 Vdc
(G) TP28 on extender	+13.5 to 16.5 Vdc
(H) TP34 on extender	-13.5 to 16.5 Vdc
(I) TP11 on CP4	-5.0 to 9.0 Vdc
(J) TP8 on CP4	+13.5 to 16.5 Vdc
(K) TP6 on CP4	-22 to 28 Vdc

TABLE D	
DMM CONNECTED FROM TP12 (GRD) ON EXTENDER TO FOLLOWING TEST POINTS (FIG. 1)	DMM INDICATION IF CP4 IS GOOD
(A) TP34 on extender	-13.5 to 16.5 Vdc
(B) TP11 on CP4	-5.0 to 9.0 Vdc
(C) TP8 on CP4	+13.5 to 16.5 Vdc

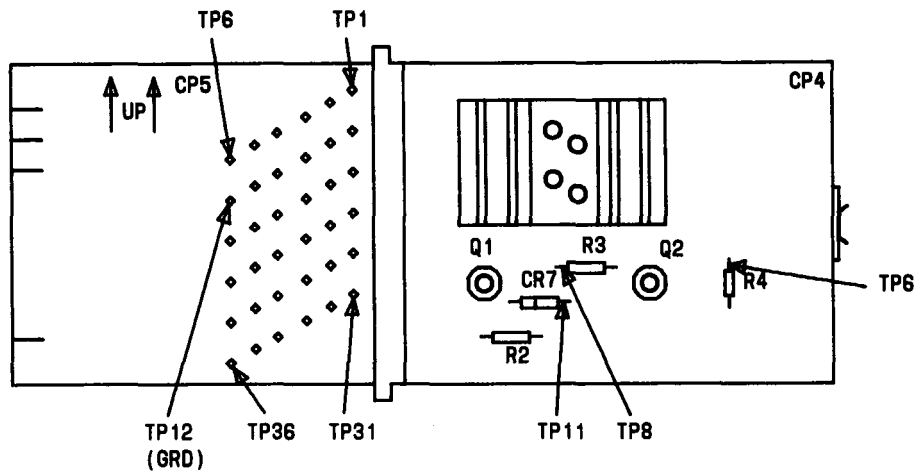
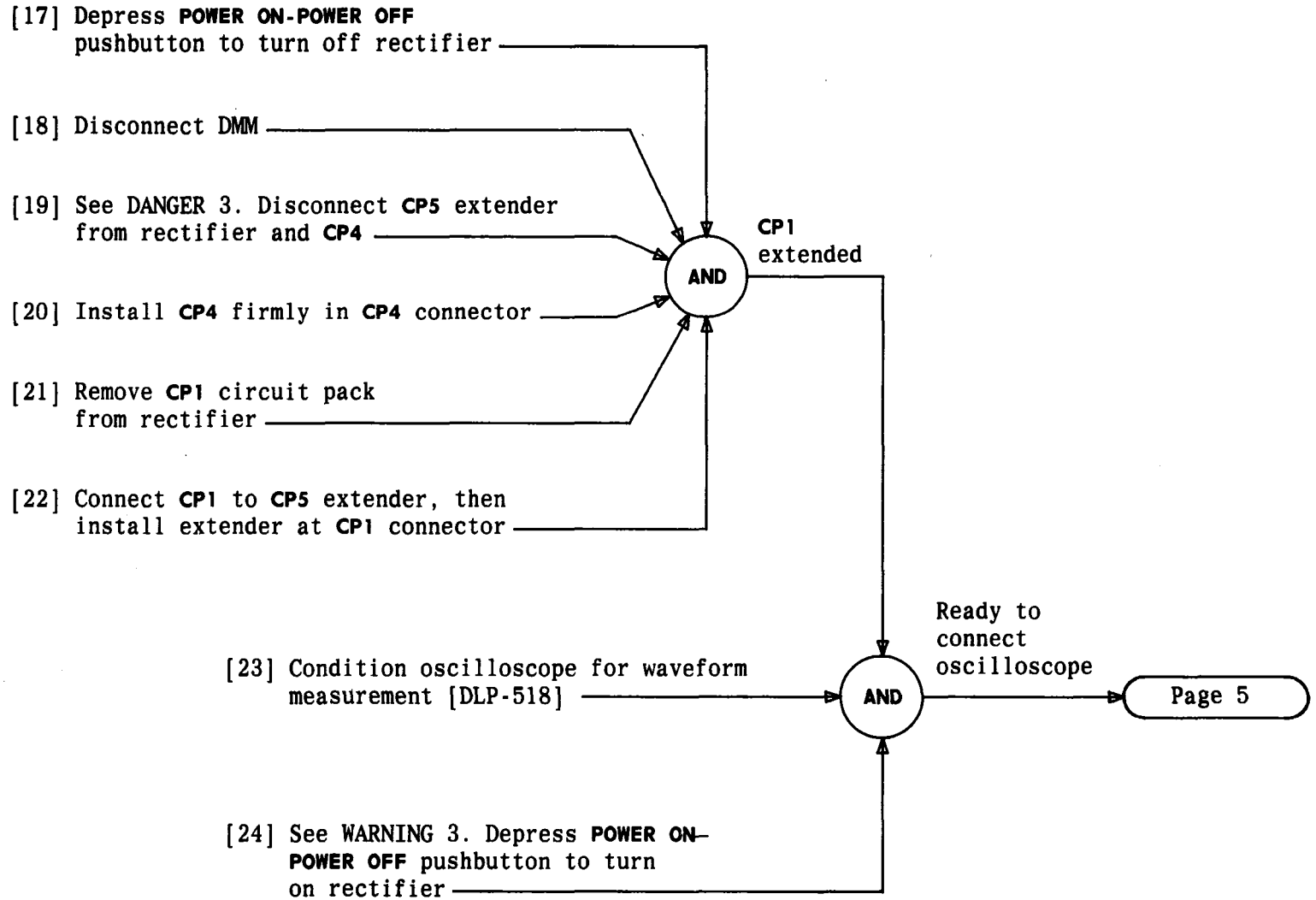


FIG. 1

CLEAR DEFECTIVE LORAIN 48V RECTIFIER CIRCUIT PACK



WARNING 3
Rectifier circuit could be damaged if output voltage is abnormally high for extended period of time

DANGER 3
Voltages inside rectifier cabinet are over 400 volts to ground

CLEAR DEFECTIVE LORAIN 48V RECTIFIER CIRCUIT PACK

[25] See DANGER 4, WARNING 4, and FIG. 2. Connect voltage probe at test point **TP1** as given in TABLE E

[26] Observe waveform on oscilloscope

AND

[27] Is waveform in accordance with FIG. 3

Yes

[29] At each additional test point in TABLE E, is required waveform displayed

Yes

Page 6

No

[28] Replace rectifier **CP1** circuit pack [DLP-511]

No

[30] Replace rectifier **CP1** circuit pack [DLP-511]

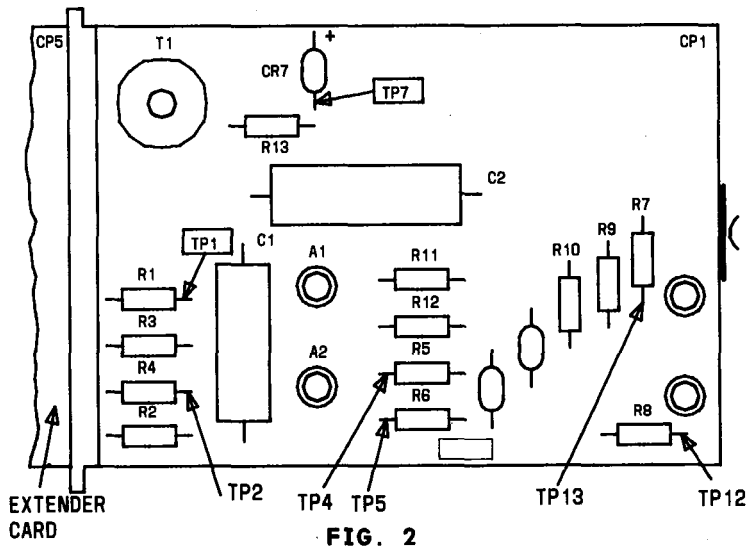


FIG. 2

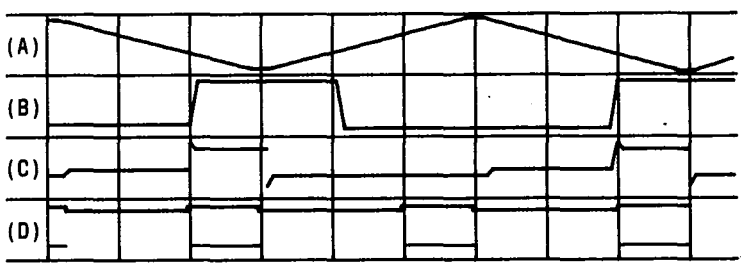


FIG. 3

TABLE E			
VOLTAGE PROBE CONNECTION	WAVEFORM FIG. 3 IF CP1 IS GOOD	VOLTS/CM	VOLTS
TP1 TP2	(A)	5	4 to 6
TP4 TP5	(B)	50	20 to 28
TP12 TP13	(C)	50	13.5 to 16.5
TP7	(D)	50	24 to 30

WARNING 4
Use properly grounded oscilloscope. Connect only voltage probe to test points. Do not connect ground lead of oscilloscope to rectifier

DANGER 4
Voltages inside rectifier cabinet are over 400 volts to ground

CLEAR DEFECTIVE LORAIN 48V RECTIFIER CIRCUIT PACK

[31] Depress **POWER ON-POWER OFF** pushbutton to turn off rectifier

[32] Disconnect voltage probe

[33] Disconnect **CP5** extender from rectifier and **CP1**

[34] Install **CP1** firmly in **CP1** connector

[35] Remove **CP2** circuit pack from rectifier

[36] Connect **CP2** to **CP5** extender, then install extender at **CP2** connector

AND → **CP2** extended → Page 7

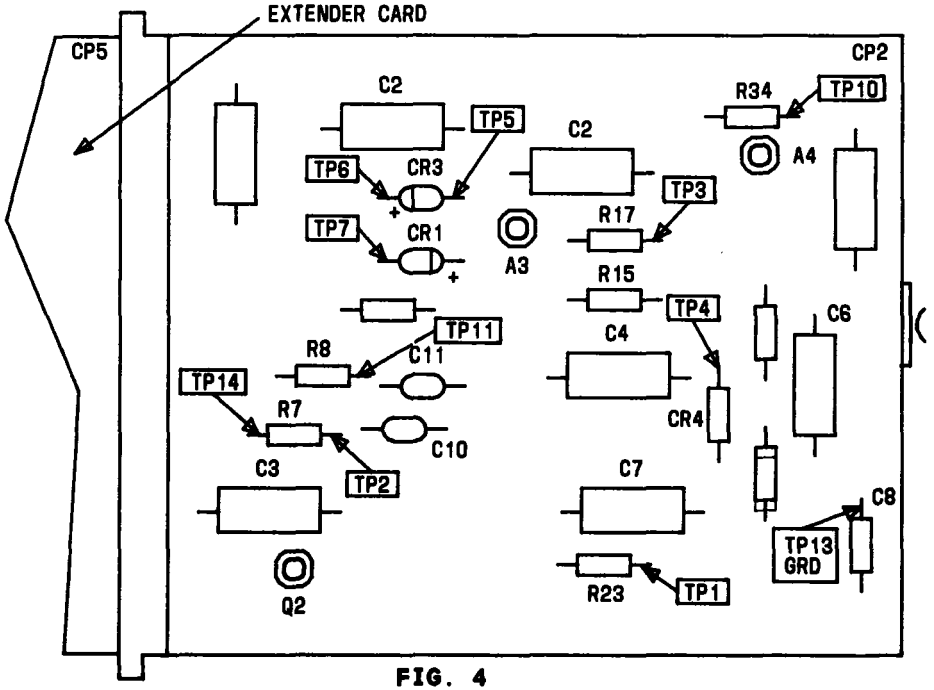
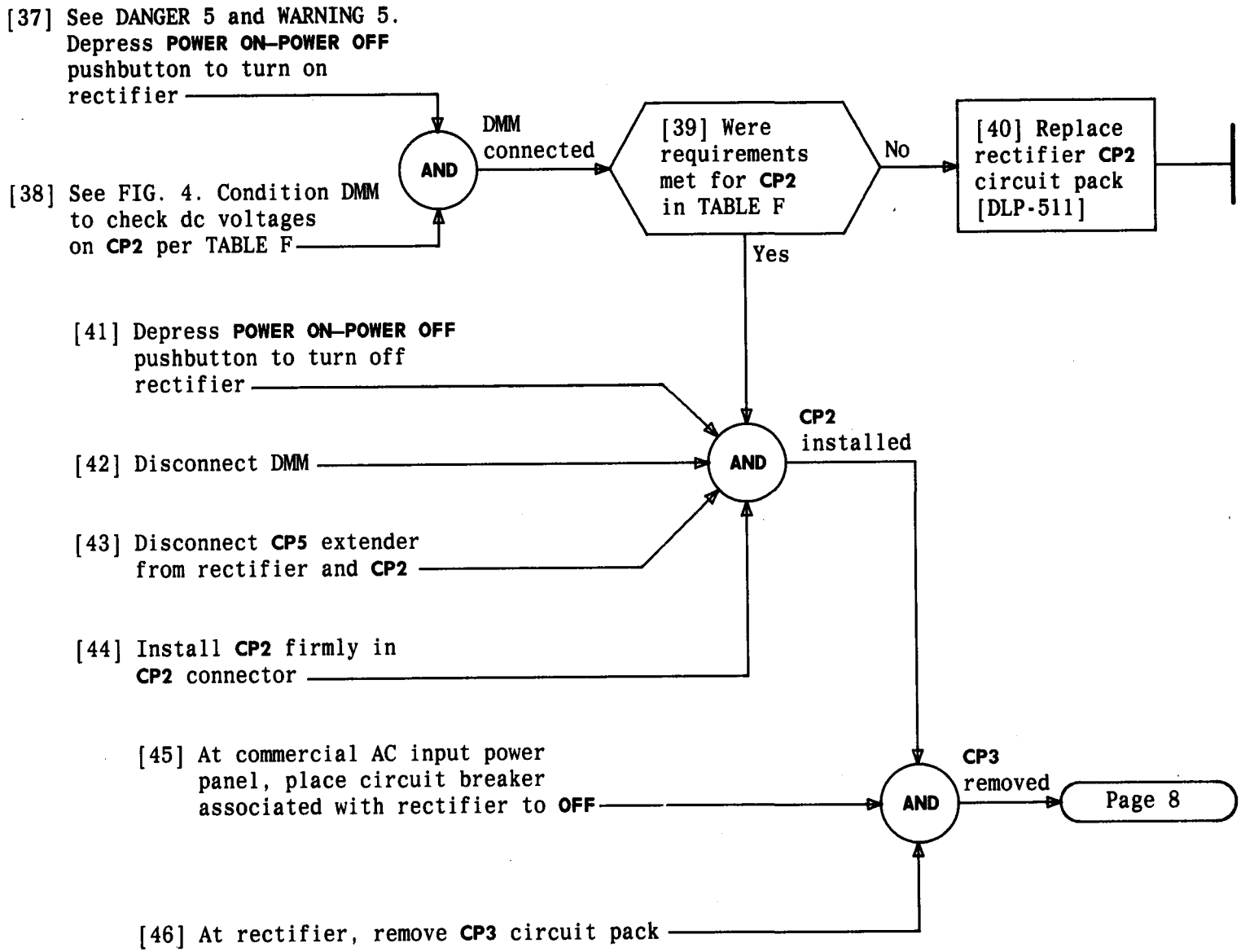


FIG. 4

TABLE F	
DMM CONNECTED FROM TP13 (GRD) ON CP2 TO FOLLOWING TEST POINTS [FIG. 4]	DMM INDICATION IF CP2 IS GOOD
TP1	–0.01 to 0.05 Vdc
TP2	+13.5 to 16.5 Vdc
TP3	–1.6 to 2.0 Vdc
TP4	–9.0 to 11.0 Vdc
TP5	–10.0 to 14.0 Vdc
TP6	–0.1 to 1.5 Vdc
TP7	0.0 to 1.0 Vdc
TP10	–10.0 to 14.0 Vdc
TP11	–13.5 to 16.5 Vdc
TP29 on extender	+22.0 to 28.0 Vdc
TP14	+8.5 to 9.5 Vdc

CLEAR DEFECTIVE LORAIN 48V RECTIFIER CIRCUIT PACK



WARNING 5
Rectifier circuit could be damaged if output voltage is abnormally high for extended period of time

DANGER 5
Voltages inside rectifier cabinet are over 400 volts to ground

CLEAR DEFECTIVE LORAIN 48V RECTIFIER CIRCUIT PACK

[47] On **CP3** [FIG. 5], verify connection of jumper wire between pins **B1** to **C1**, and pins **B2** to **C2**

[48] Connect **CP3** to **CP5** extender

[49] Place **CP3** with extender on suitable insulated test surface

[50] Condition DMM to KΩ X 1 range

[51] Condition DMM to check continuity on **CP3** per TABLE G

AND

DMM connected

Page 9

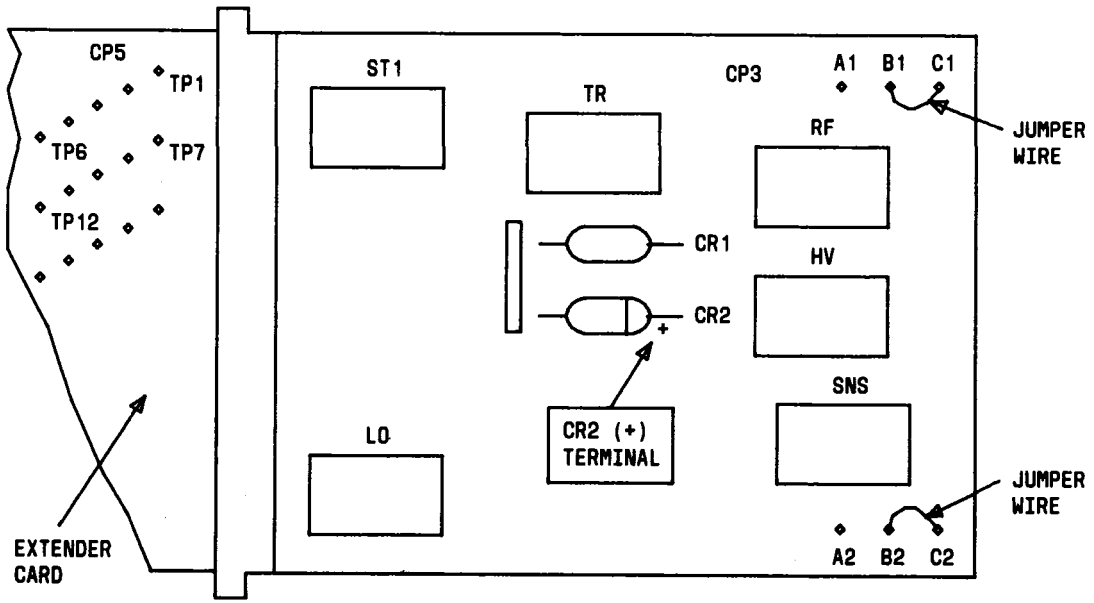


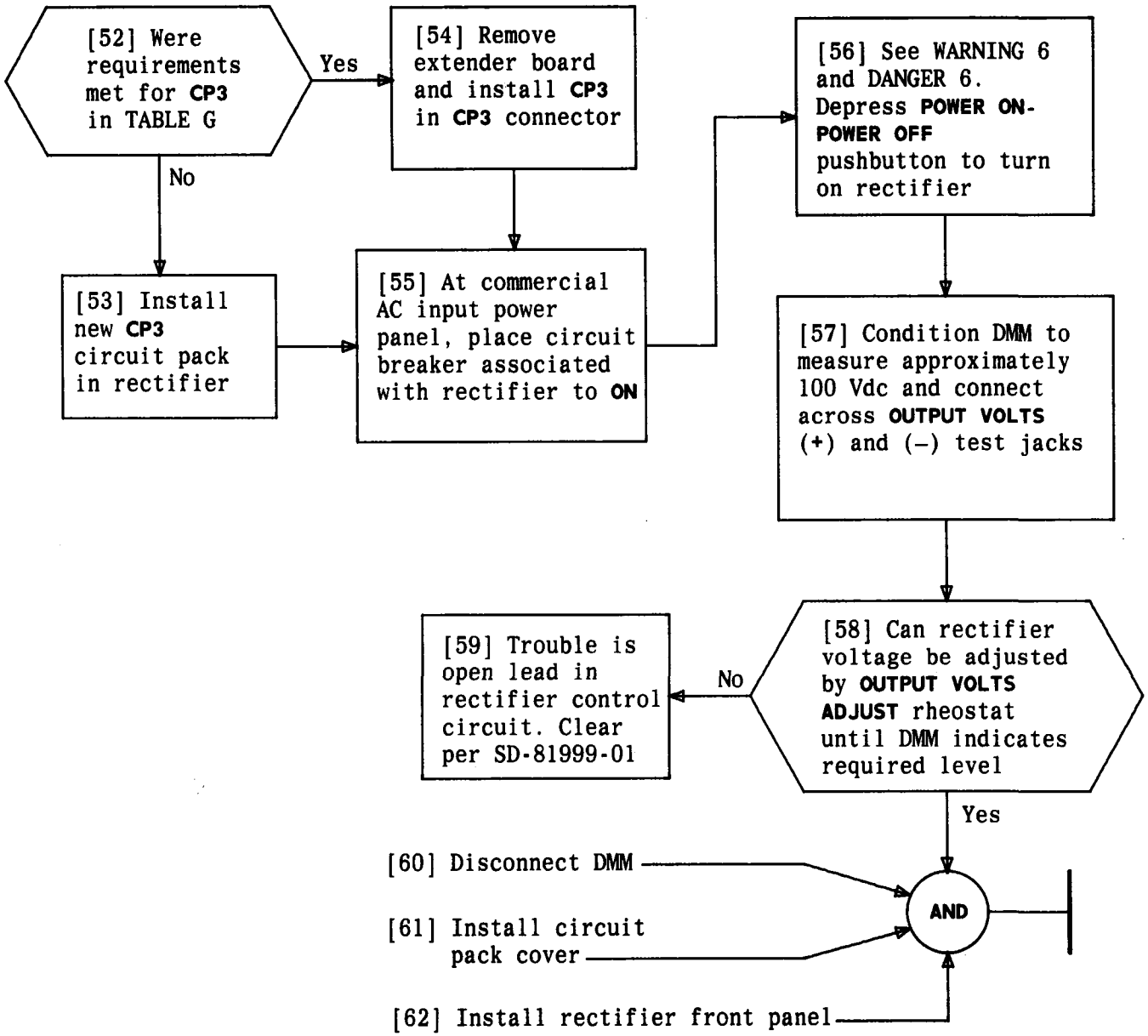
FIG. 5

TABLE G			
OHMMETER CONNECTION AT FOLLOWING TEST POINTS ON EXTENDER	DMM INDICATION		
	RELAY	RELAY RELEASED	RELAY MANUALLY OPERATED *
TP10 to TP4	ST1	Short	Open
TP10 to TP14		Short	Open
TP10 to TP11		Open	Short
TP12 to TP3		Short	Open
TP17 to (+) terminal of CR2 on CR3 [FIG. 5]	RF	Open	Short
TP3 to TP12 **		Open	Short
TP10 to TP14 **		Open	Short
TP18 to (+) terminal of CR2 on CP3 [FIG. 5]	HV	Open	Short
TP10 to TP26	SNS	Short	Open
TP24 to TP25		Short	Open
TP30 to TP31		Short	Open
TP32 to TP29		Short	Open
TP26 to TP28		Open	Short
TP25 to TP27		Open	Short
TP34 to TP35	LO	Open	Short

* Relay is manually operated by pressing downward on relay armature

Both **ST1 and **TR** relays must be manually operated for this test

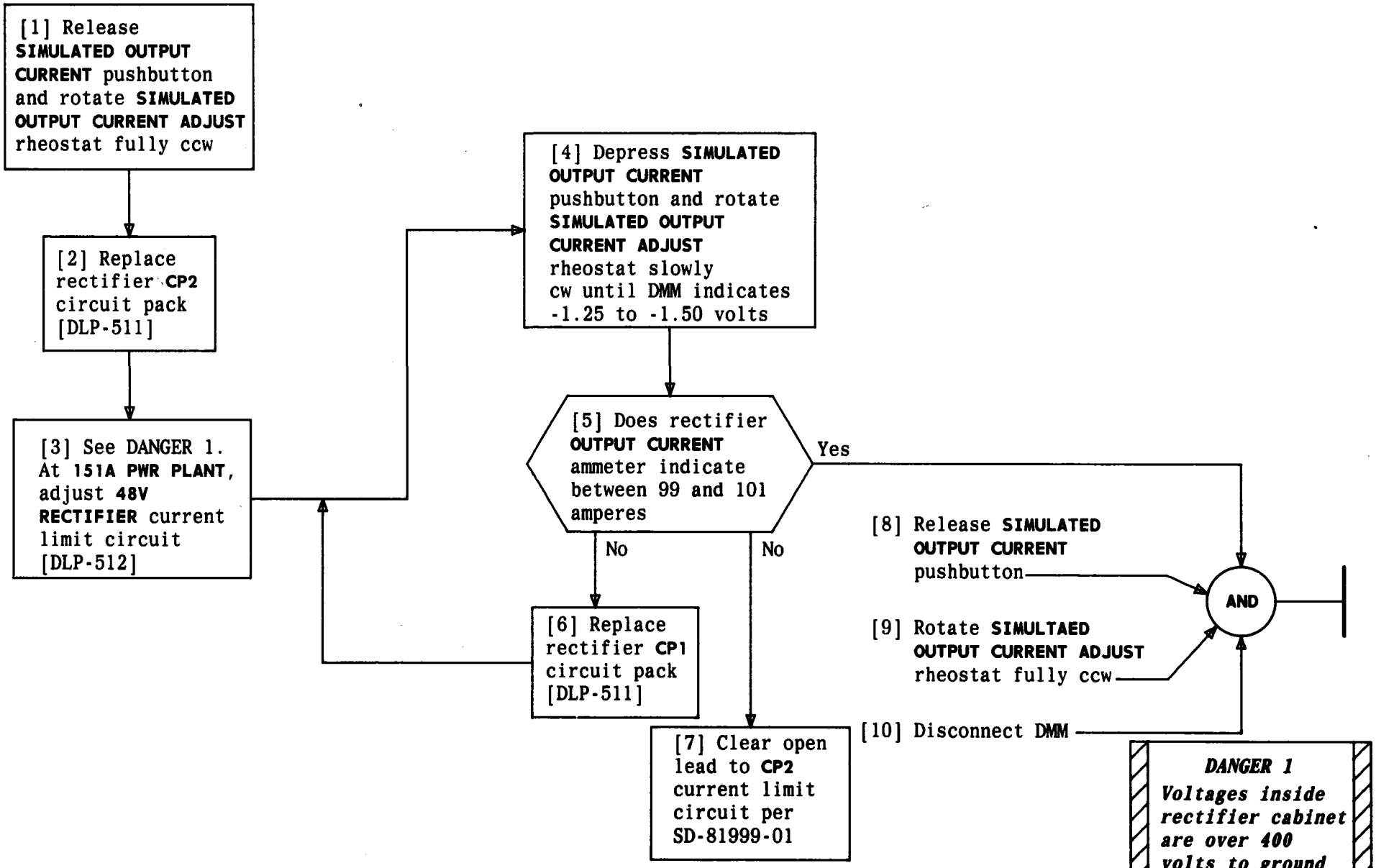
CLEAR DEFECTIVE LORAIN 48V RECTIFIER CIRCUIT PACK



WARNING 6
Rectifier circuit could be damaged if output voltage is abnormally high for extended period of time

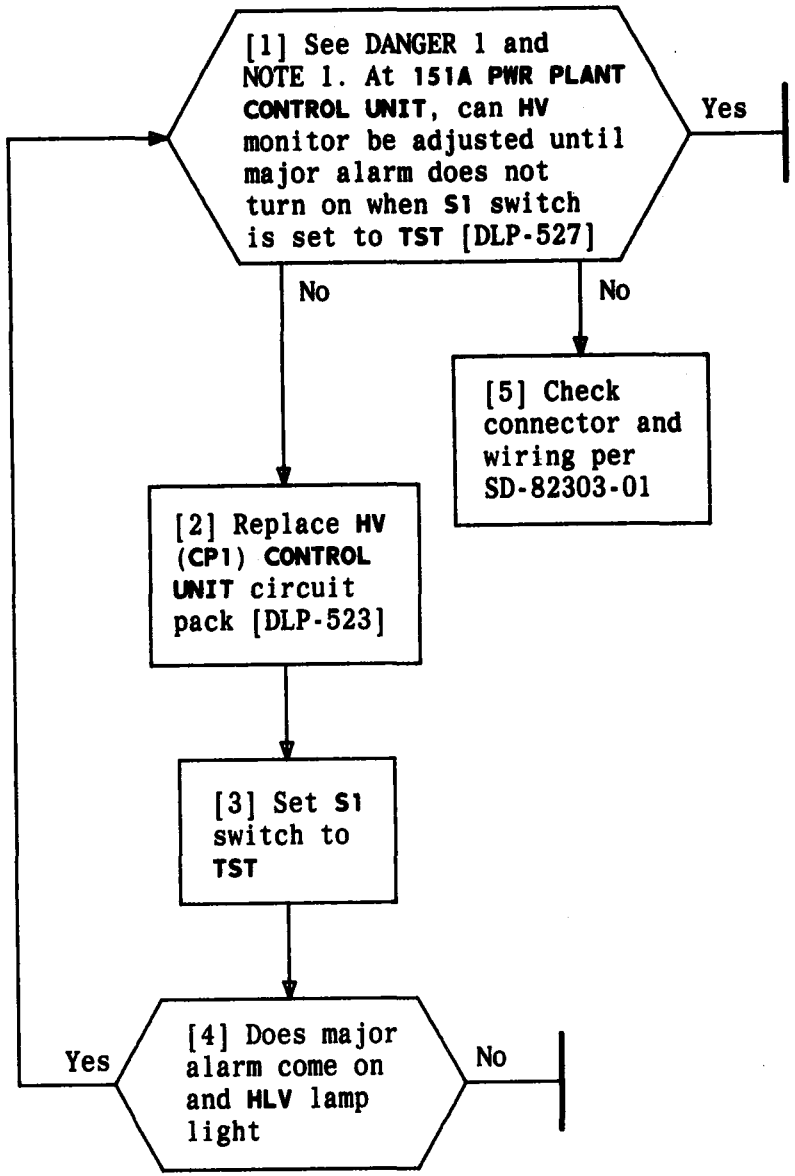
DANGER 6
Voltages inside rectifier cabinet are over 400 volts to ground

CLEAR DEFECTIVE LORAIN 48V RECTIFIER CIRCUIT PACK



CLEAR TROUBLE IN 48V RECTIFIER CURRENT LIMIT CIRCUIT

Issue 2	JUL 1980
233-144-100	TAP 202
PAGE 1 of 1	

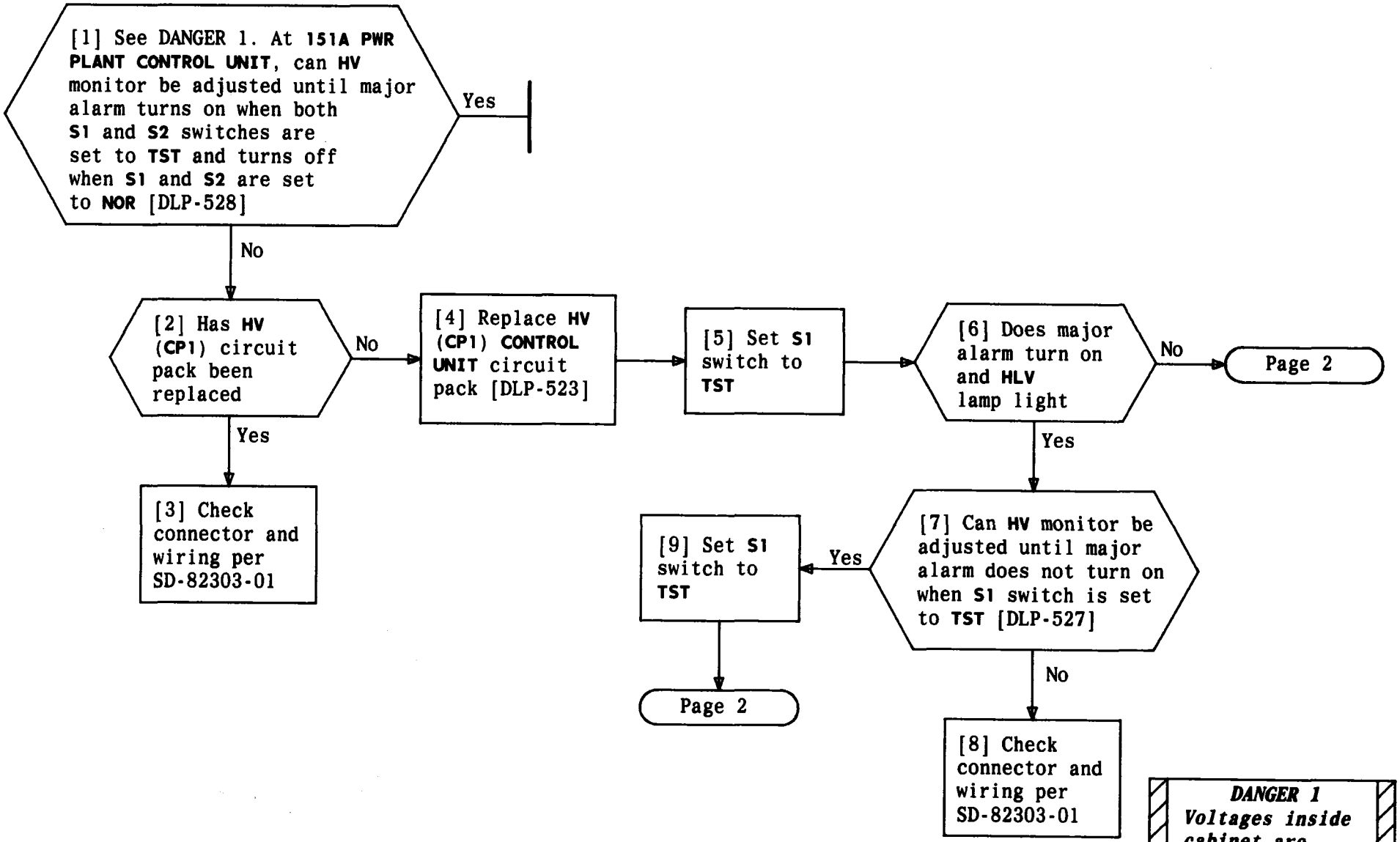


NOTE 1
Major alarms should not turn on when only S1 switch is operated

DANGER 1
Voltages inside cabinet are over 50 volts to ground

Issue 2	JUL 1980
233-144-100	TAP 203
PAGE 1 of 1	

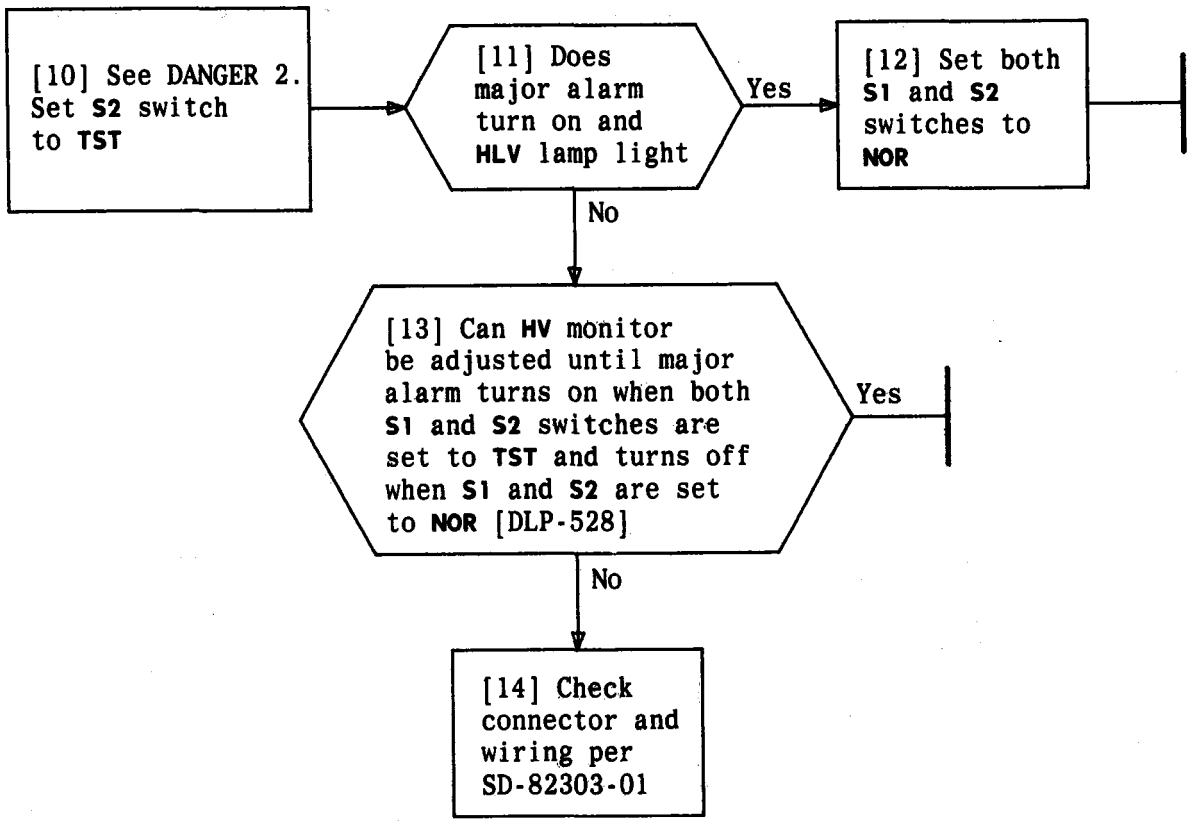
CLEAR TROUBLE IN HV MONITOR – SHUTDOWN LEVEL LOW



DANGER 1
Voltages inside cabinet are over 50 volts to ground

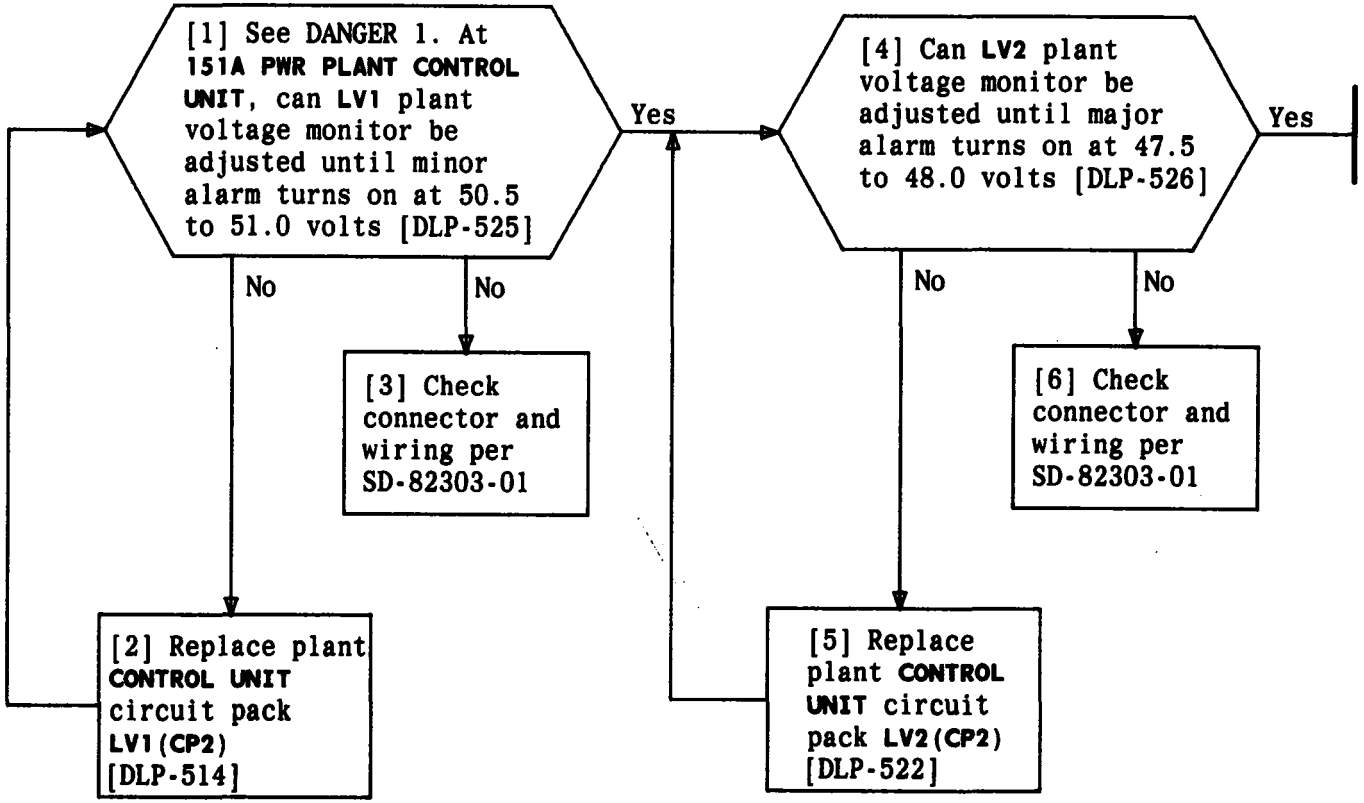
Issue 2	JUL 1980
233-144-100	TAP
PAGE 1 of 2	204

CLEAR TROUBLE IN HV MONITOR – SHUTDOWN LEVEL HIGH



CLEAR TROUBLE IN HV MONITOR – SHUTDOWN LEVEL HIGH

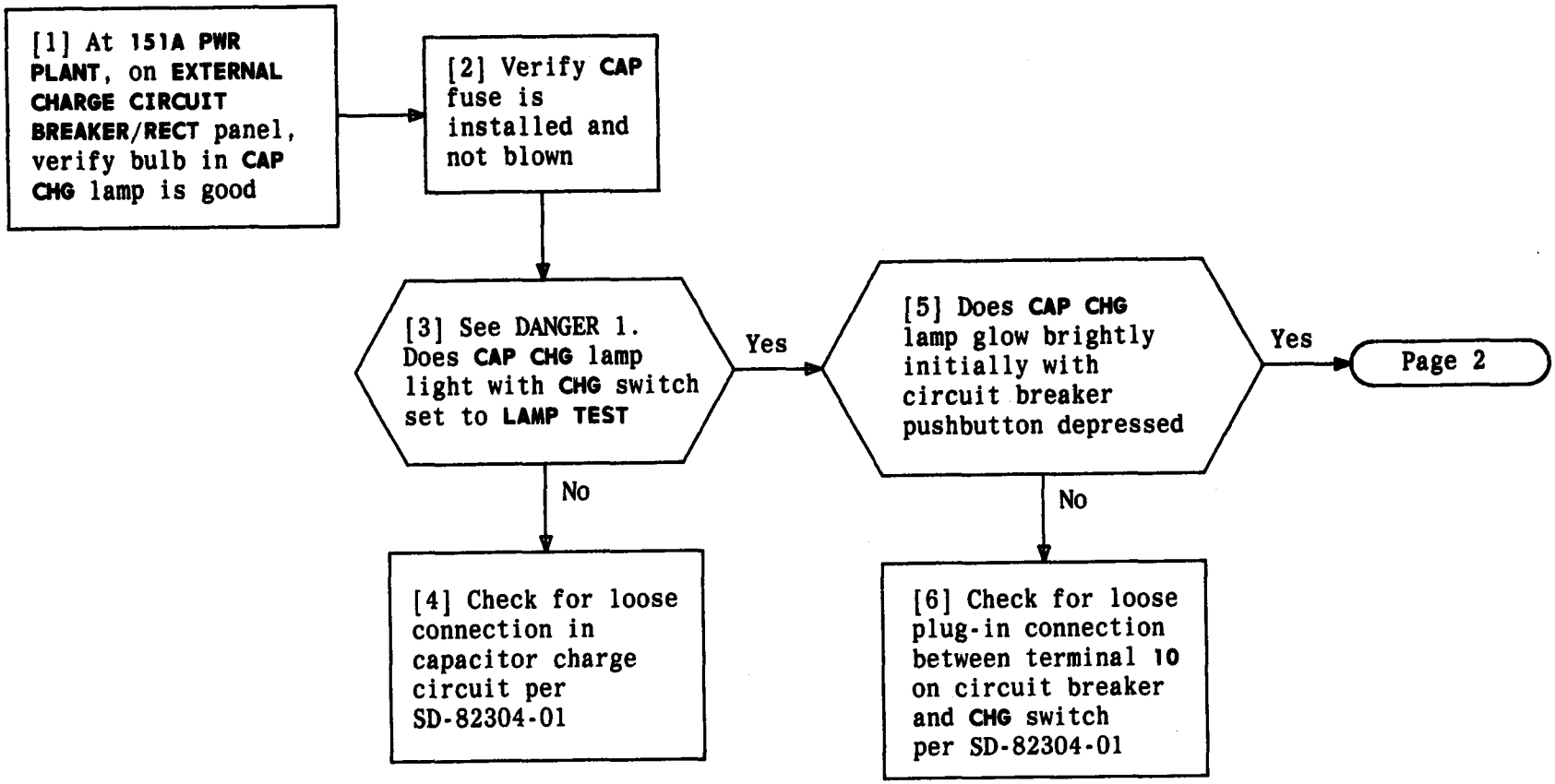
DANGER 2
Voltages inside cabinet are over 50 volts to ground



DANGER 1
Voltages inside cabinet are over 50 volts to ground

Issue 2	JUL 1980
233-144-100	TAP
PAGE 1 of 1	205

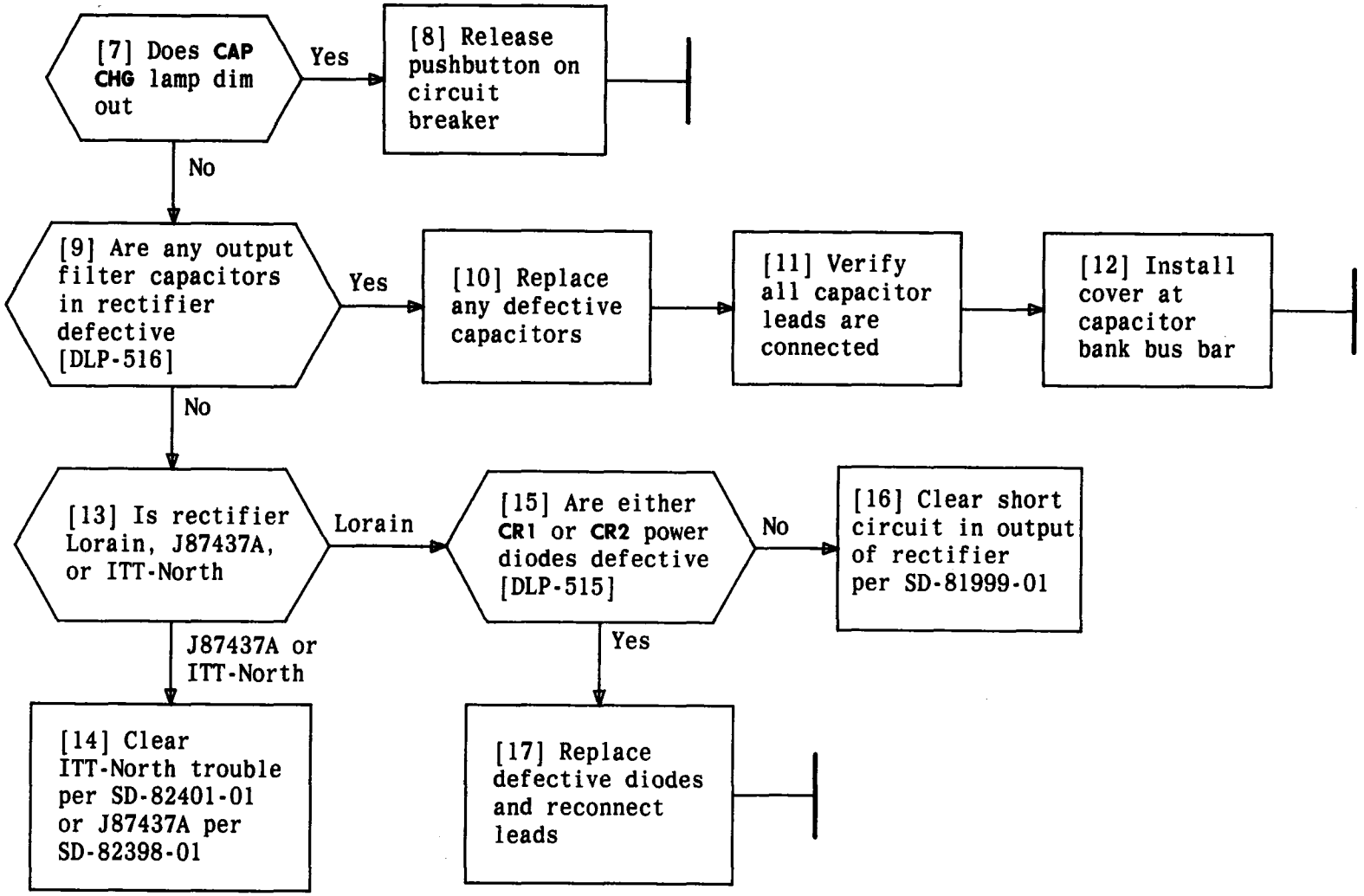
CLEAR TROUBLE IN LOW VOLTAGE (LV1 AND LV2) MONITORS



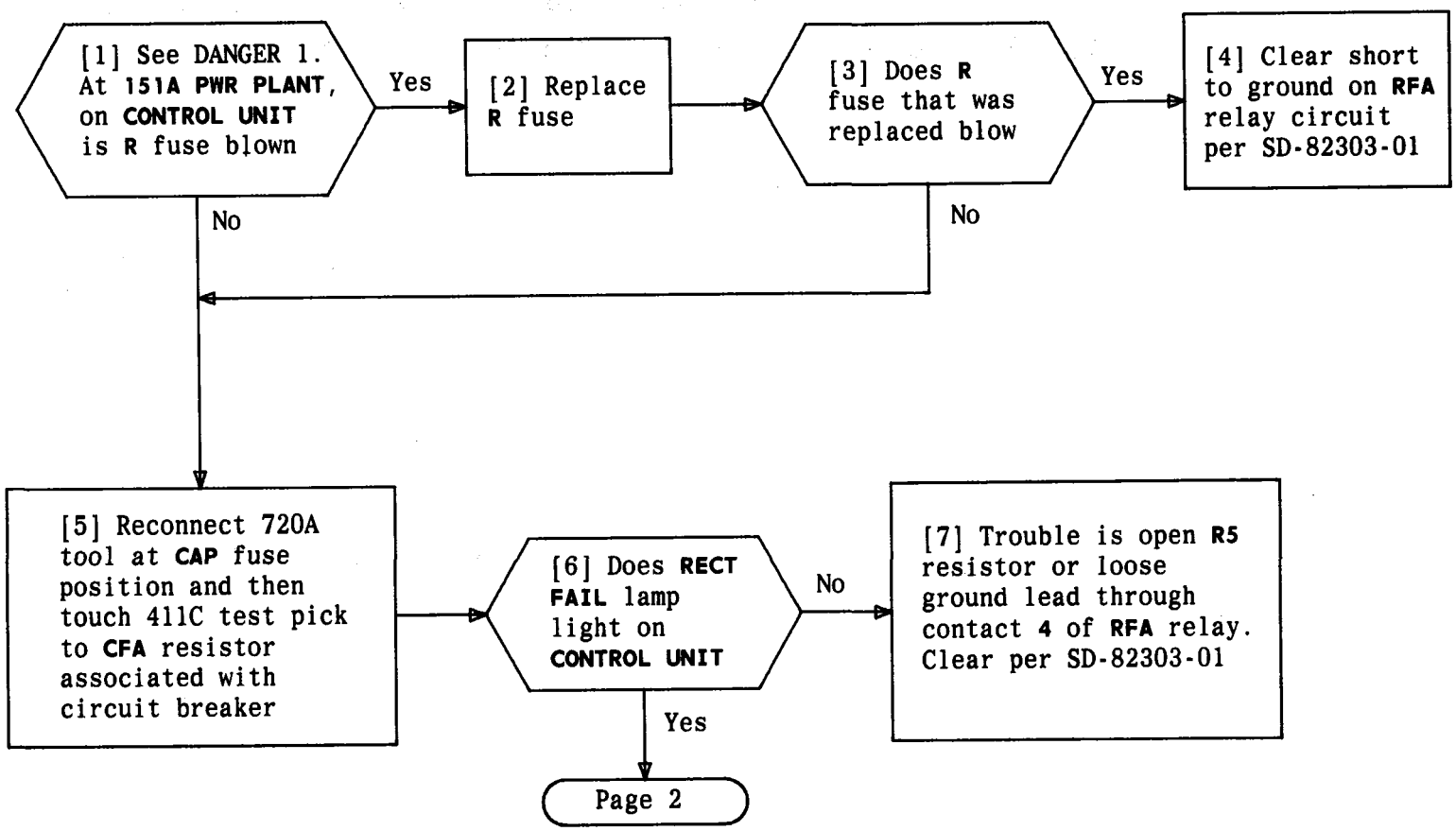
DANGER 1
Extremely high current potential present in this circuit

Issue 2	JUL 1980
233-144-100	TAP 209
PAGE 1 of 2	

CLEAR TROUBLE IN 48V RECTIFIER OUTPUT CAPACITOR CHARGE CIRCUIT



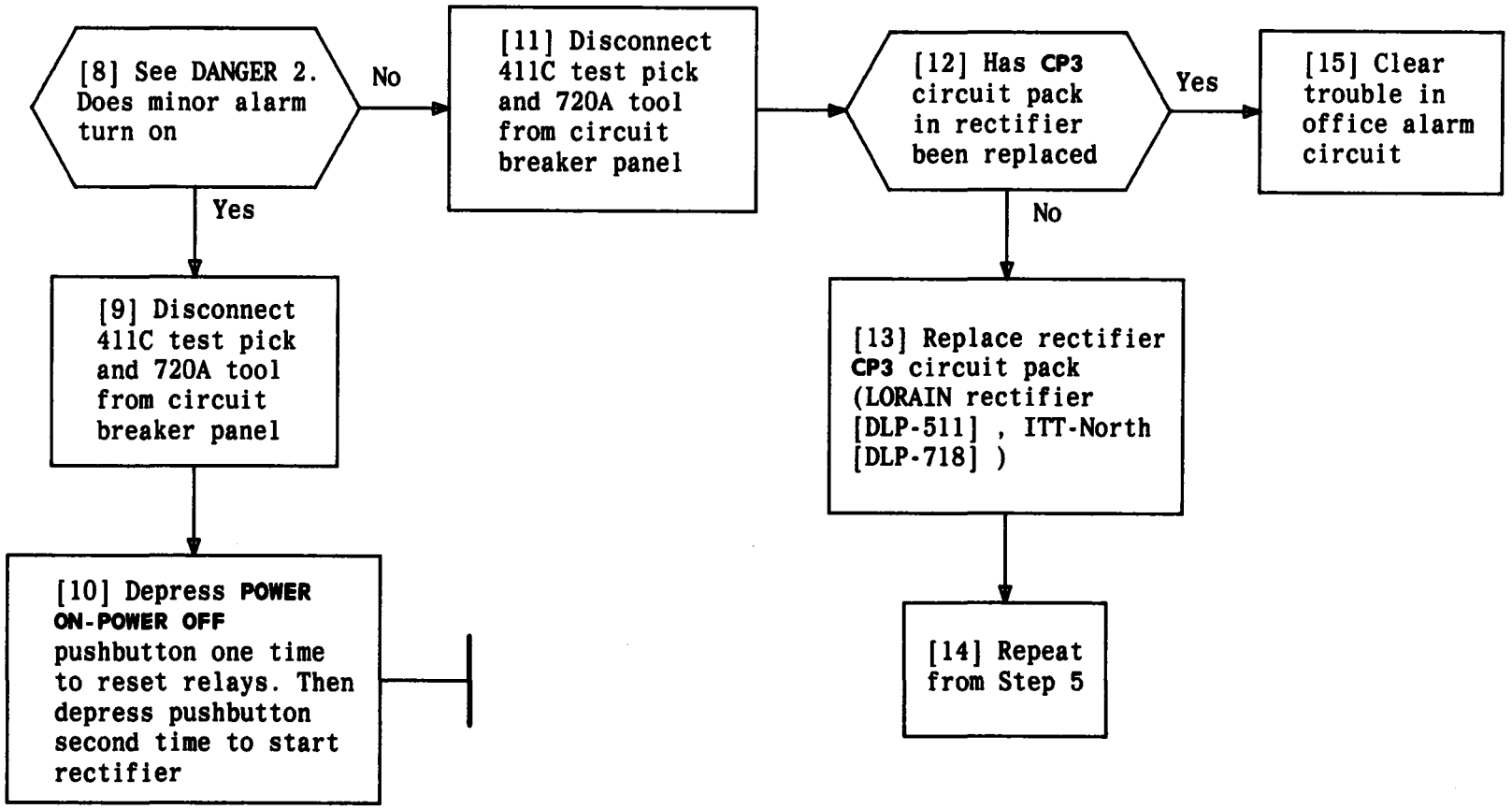
CLEAR TROUBLE IN 48V RECTIFIER OUTPUT CAPACITOR CHARGE CIRCUIT



CLEAR TROUBLE IN LORAIN OR ITT-NORTH KS-20493 48V RECTIFIER MINOR ALARM CIRCUIT

DANGER 1
Extremely high current potential present in this circuit

Issue 2	JUL 1980
233-144-100	TAP 210
PAGE 1 of 2	



CLEAR TROUBLE IN LORAIN OR ITT-NORTH KS-20493 48V RECTIFIER FAIL MINOR ALARM CIRCUIT

DANGER 2 *Extremely high current potential present in this circuit*	
Issue 2	JUL 1980
233-144-100	TAP
PAGE 2 of 2	210

[1] See DANGER 1. At **151A PWR PLANT**, on **48V RECTIFIER** depress **POWER ON-POWER OFF** pushbutton to turn off rectifier. Loosen 4 corner screws and remove front panel from rectifier

[2] See FIG. 1 and FIG. 2. Disconnect **J1** connector from **P2** plug

[3] Condition DMM to measure approximately 100 Vdc

[4] Connect DMM (+) lead to **VM CAL** (+) test jack on **CONTROL UNIT**

[5] On **J1** connector [FIG. 1], connect DMM (–) lead to terminal **14**

[6] Reconnect 720A tool at **CAP** fuse position then touch 411C test pick to **CFA** resistor associated with rectifier circuit breaker

AND

[7] Does DMM indicate bus voltage

No

[8] Clear open **CFA** lead in plant circuit per SD-82304-01

Yes

Page 2

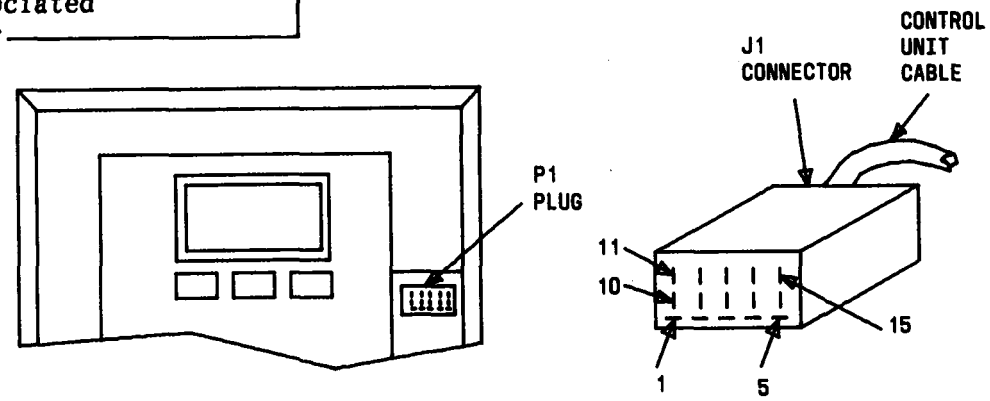


FIG. 1 – Lorain Rectifier Only

DANGER 1
Extremely high current potential present in this circuit

Issue 2	JUL 1980
233-144-100	TAP 215
PAGE 1 of 2	

CLEAR TROUBLE IN LORAIN OR ITT-NORTH KS-20493 48V RECTIFIER FAILURE (RF) CIRCUIT

[9] See DANGER 2. Disconnect 411C test pick and 720A tool from circuit breaker panel

[10] Disconnect DMM and reconnect J1 connector to P1 plug

[11] Replace rectifier CP3 circuit pack (Lorain rectifier [DLP-511], ITT-North [DLP-718]

AND

[12] Reconnect 720A tool at CAP fuse position, then touch 411C test pick to CFA resistor associated with rectifier circuit breaker

[13] Does RECT FAIL lamp light on rectifier and does rectifier shut down and lock out

No

[14] Disconnect 411C test pick and 720A tool from circuit breaker panel

[15] Check wiring per SD-82304-01

Yes

[16] Install front panel on rectifier

[17] Disconnect 411C test pick and 720A tool from circuit breaker panel

AND

[18] Depress POWER ON-POWER OFF pushbutton one time to reset relays, then depress pushbutton second time to start rectifier

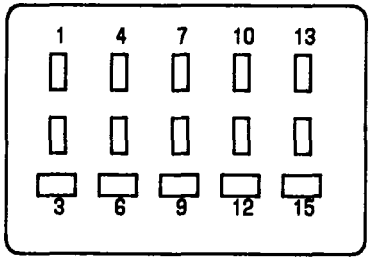


FIG. 2 – P1 Pin Location – North Rectifier Only

DANGER 2
Extremely high current potential present in this circuit

CLEAR TROUBLE IN LORAIN OR ITT-NORTH KS-20493 48V RECTIFIER FAILURE (RF) CIRCUIT

SUMMARY

Reset high voltage shutdown circuit or replace power unit

[1] See FIG. 1. At **MP** frame, is **ALM** LED on **POWER UNIT** lighted

Yes

[2] Set **ON-OFF** switch to **OFF**, then to **ON**

[3] Condition DMM to measure approximately 60 Vdc

[4] At connector on back of **POWER UNIT**, connect DMM to terminals **14** (+) and **18** (–)

Page 2

No

TAP-232

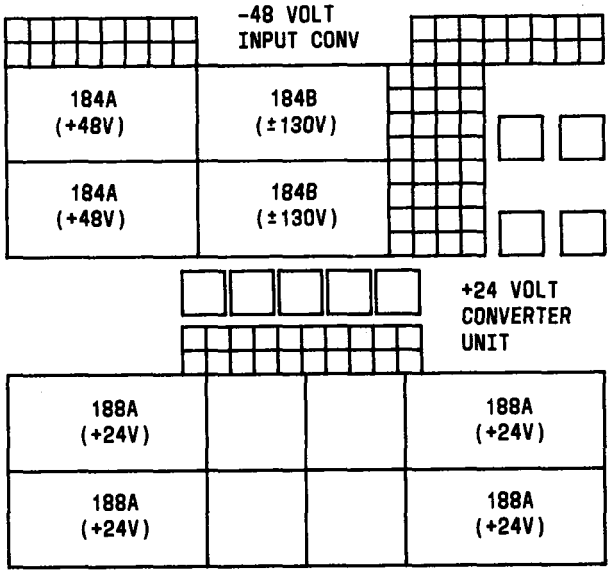
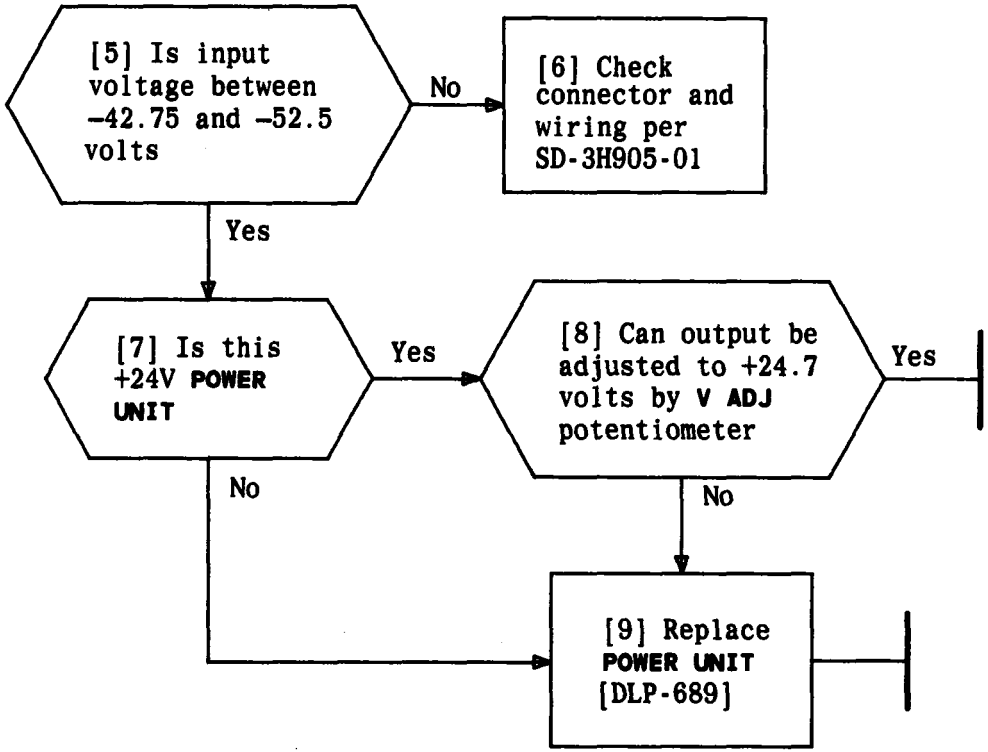
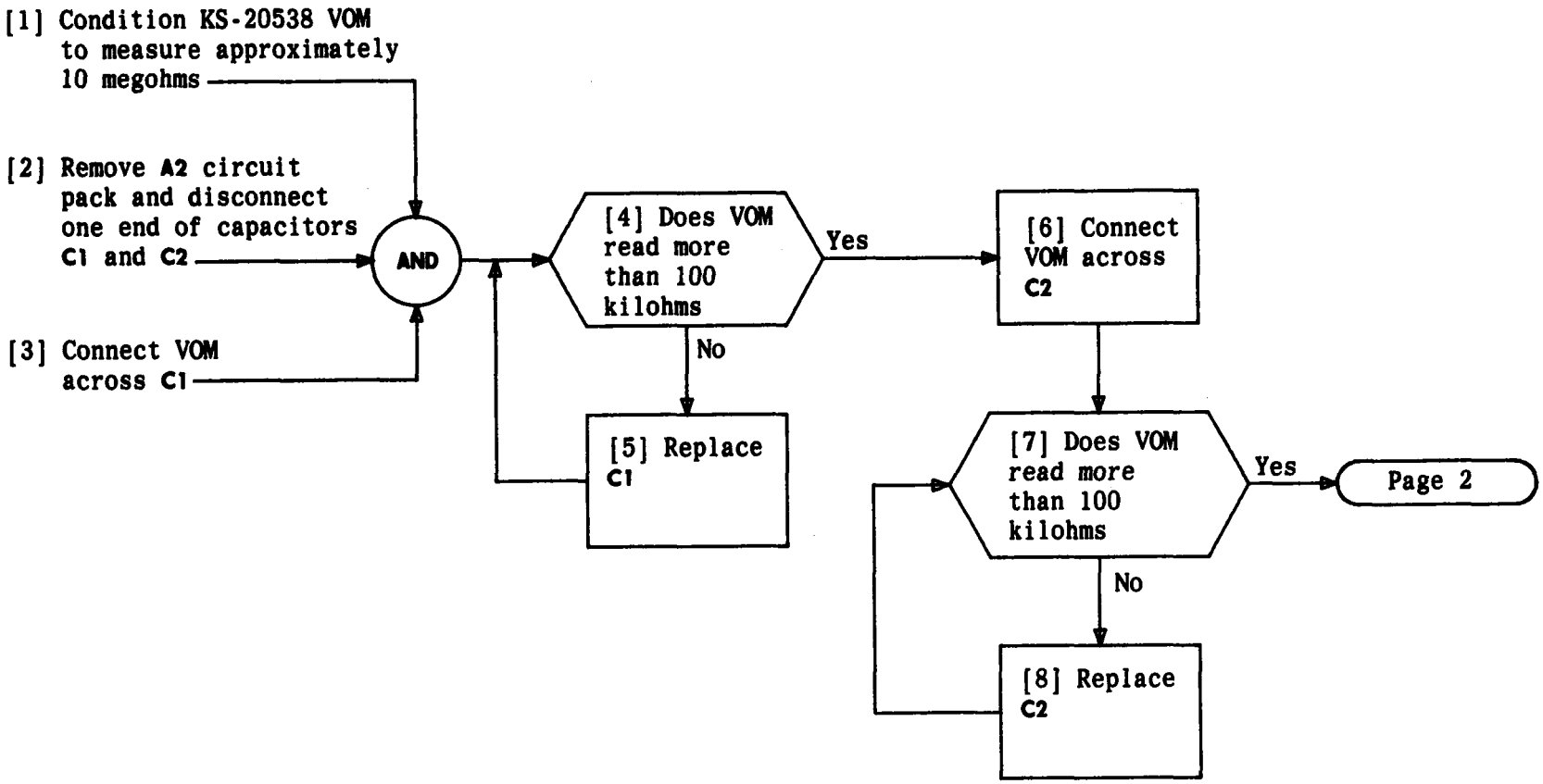


FIG. 1 – Top of Miscellaneous Power Frame

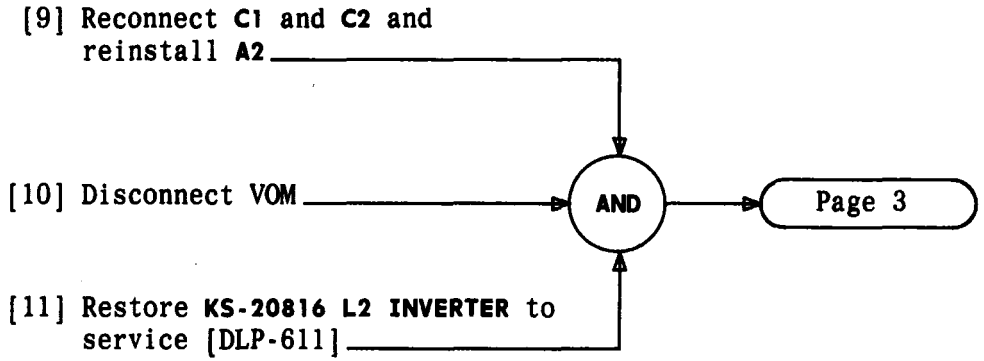
CLEAR POWER UNIT NO-OUTPUT CONDITION



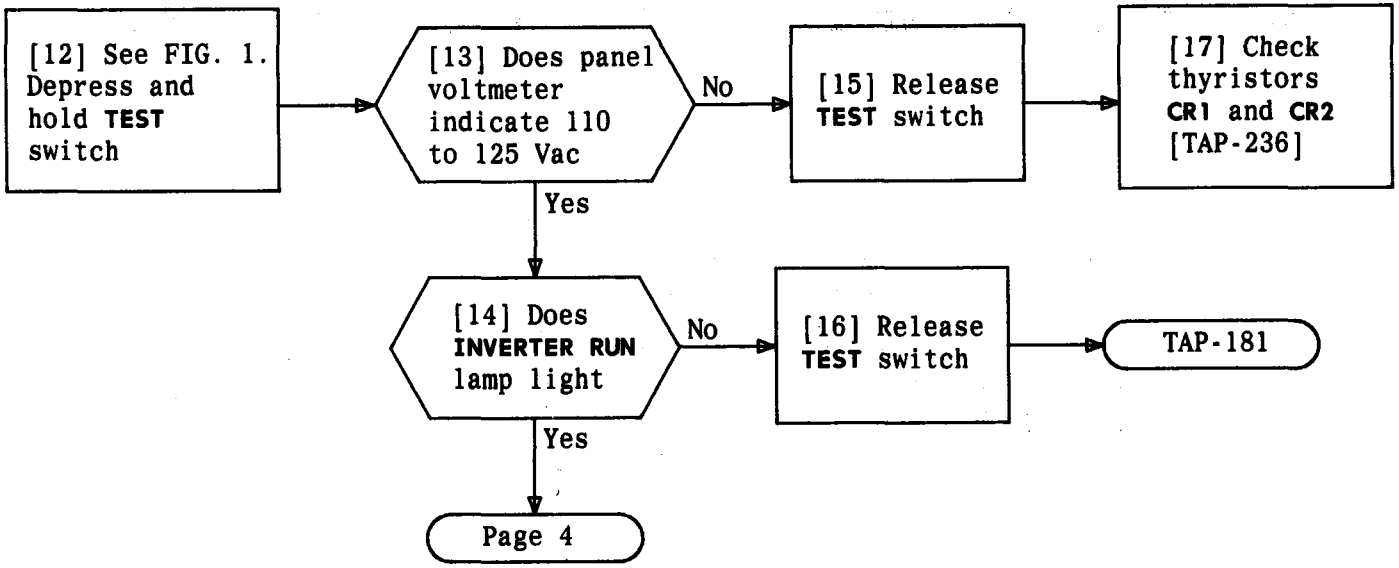
CLEAR POWER UNIT NO-OUTPUT CONDITION



CLEAR TROUBLE IN INVERTER INPUT CAPACITOR CIRCUIT PACK A2



CLEAR TROUBLE IN INVERTER INPUT CAPACITOR CIRCUIT PACK A2



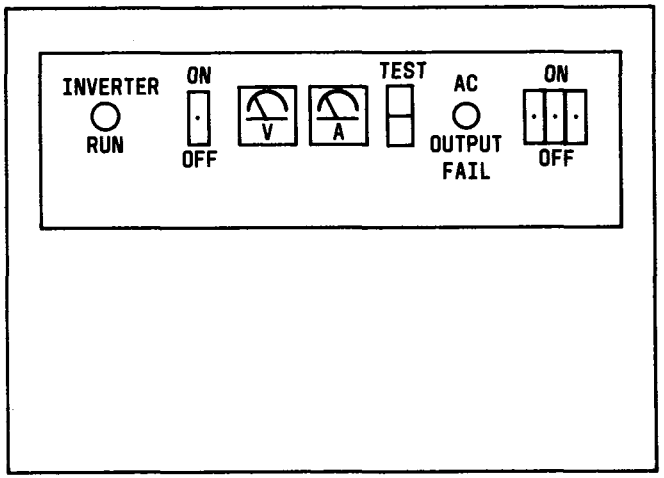


FIG. 1

CLEAR TROUBLE IN INVERTER INPUT CAPACITOR CIRCUIT PACK A2

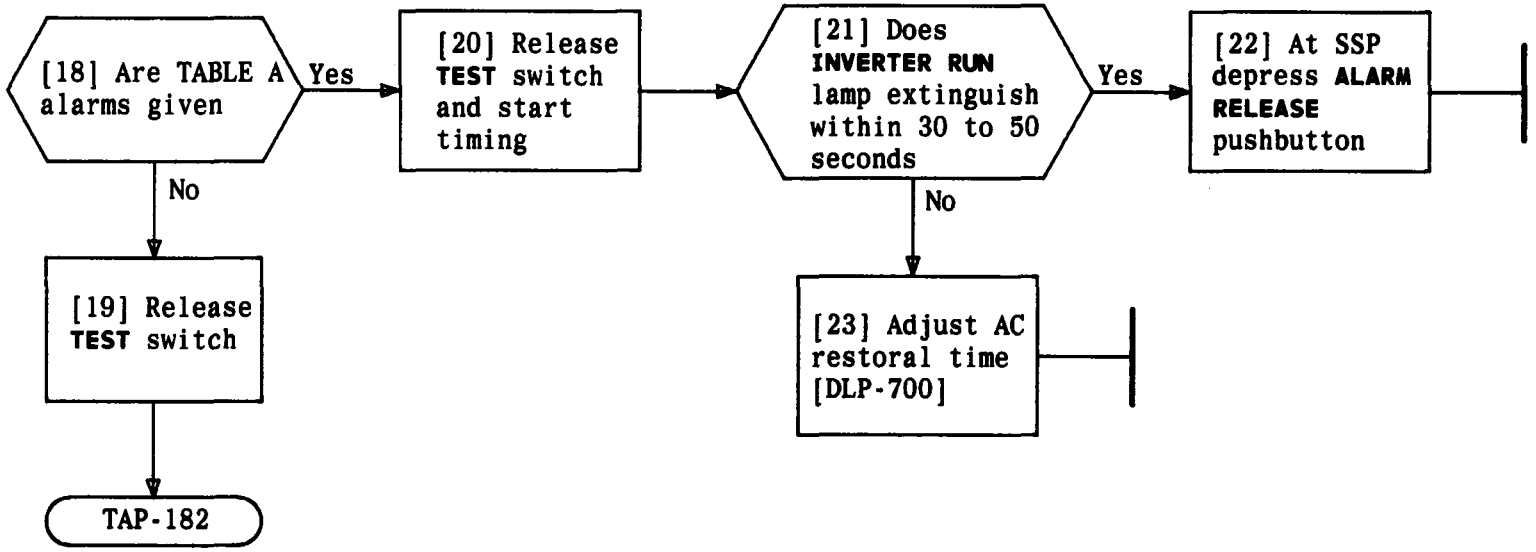


TABLE A
POWER ALARMS

LOCATION	INDICATION
1. SSP	Major (red) Major power (red) Alarm release (red)
2. TTY	** REPT MISCA 25 12 OFN
3. BUILDING	Major audible
4. INVERTER	Inverter run (amber)

CLEAR TROUBLE IN INVERTER INPUT CAPACITOR CIRCUIT PACK A2

SUMMARY

Replace POWER UNIT, check connector and wiring per SD-3H905-01.

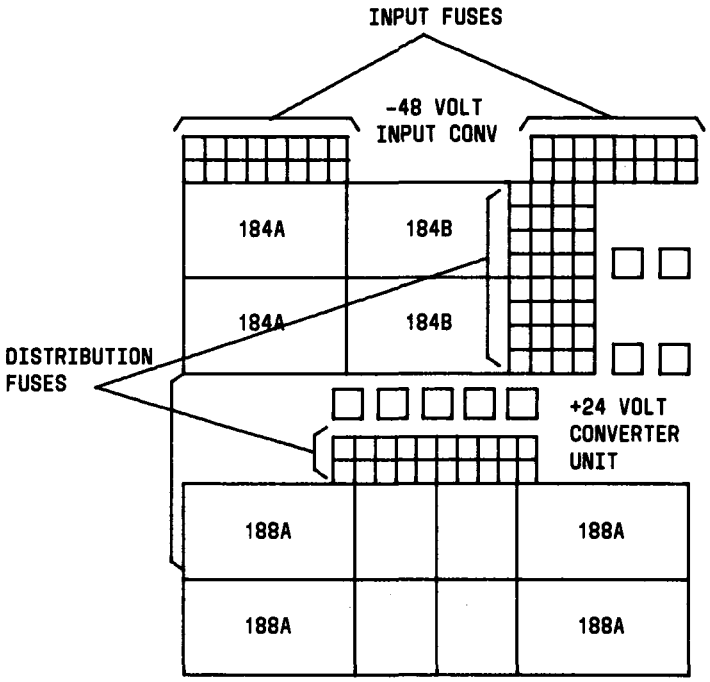


FIG. 1 – Top of Miscellaneous Power Frame

[1] See FIG. 1. At **MP** frame is **POWER UNIT** input or distribution fuse blown

Input

Distribution

[2] Check wiring per SD-3H905-01

[3] Replace **POWER UNIT** [DLP-689]

[4] Replace fuse

AND

[5] Did fuse blow

No

Yes

[6] Check connector and wiring per SD-3H905-01

CLEAR POWER UNIT FUSE CONDITION

Issue 2	JUL 1980
233-144-100	TAP
PAGE 1 of 1	232

[1] Condition DMM to measure approximately 100 Vdc

[2] Connect DMM across pins 1 and 2 of A1. See FIG. 1

AND

[3] Does DMM indicate between +14 and +16 Vdc

Yes

No

[4] Disconnect DMM

[5] Check components of **INVERTER** providing power to A1 [TAP-234]

[6] Disconnect DMM

[7] Condition DMM to measure approximately 10 Vac

[8] Connect DMM across pins 3 and 5 of A1

[9] Depress and hold **TEST** switch

AND

Page 2

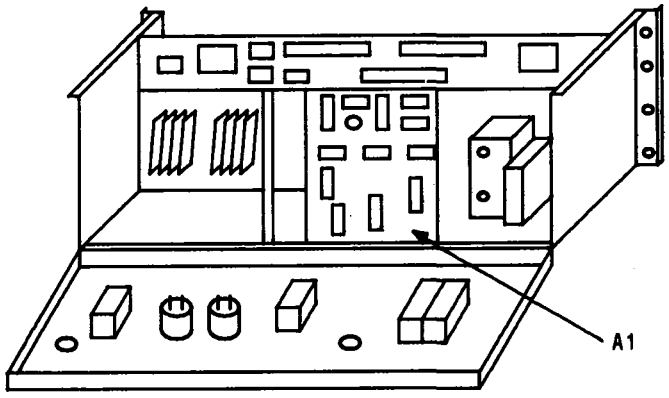
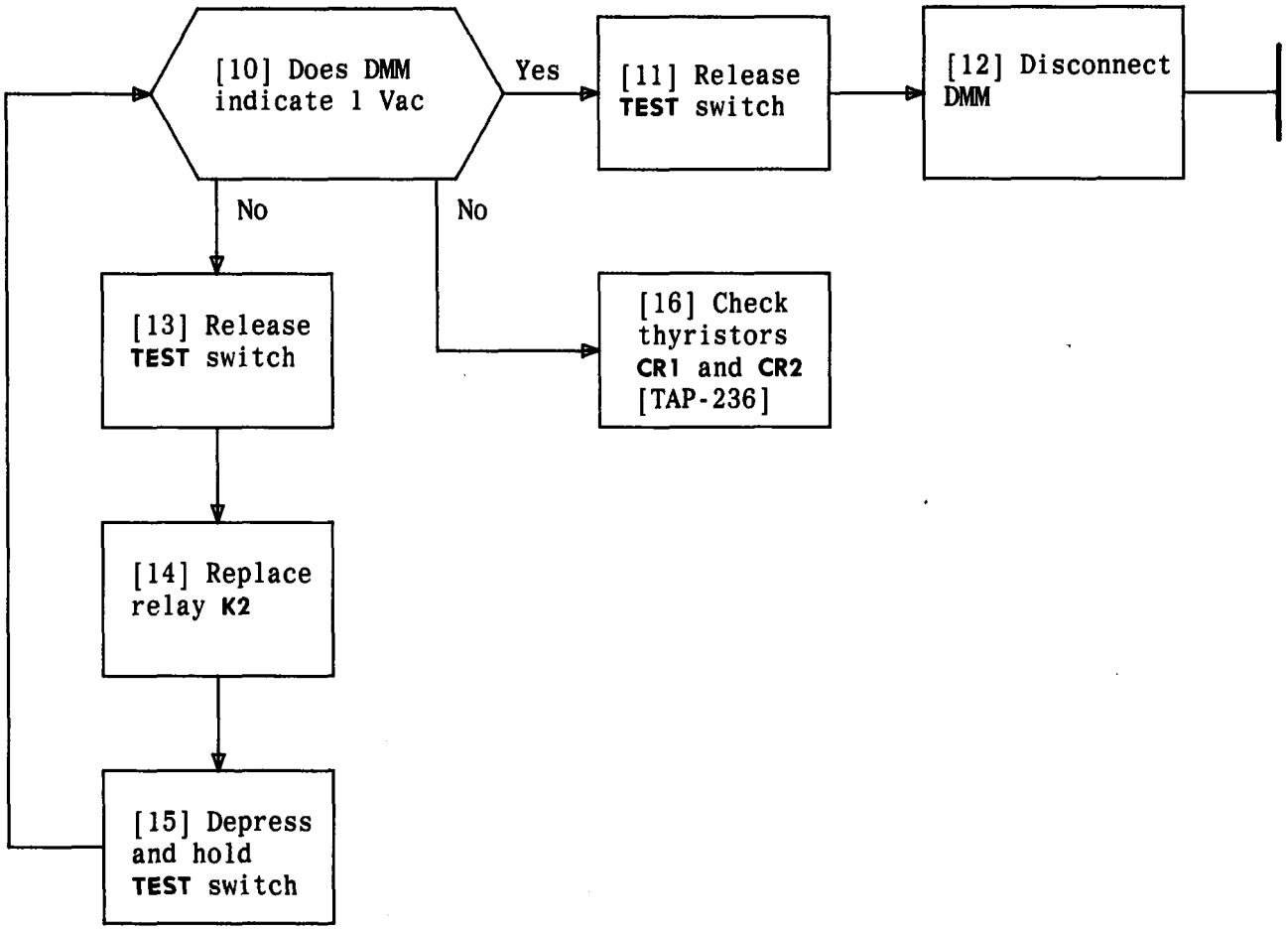


FIG. 1

CHECK THYRISTOR DRIVER CIRCUIT PACK A1



CHECK THYRISTOR DRIVER CIRCUIT PACK A1

[1] Condition KS-20538 VOM to measure approximately 90 ohms

[2] Connect VOM across R1. See FIG. 1

AND

[3] Does VOM indicate between 60 and 90 ohms

Yes

No

No

[4] Replace R1

[5] Check components per SD-82178-01

[6] Reconnect VOM across pins 1 and 2 of A1

[7] Condition VOM to measure approximately 10 megohms

AND

[8] Does VOM indicate more than 100 kilohms

Yes

[15] Disconnect VOM

No

No

[14] Check components per SD-82178-01

[9] Temporarily disconnect one lead of capacitor C3

[10] Does VOM show more than 1000 ohms

Yes

[11] Replace C3

No

[12] Replace CR5

[13] Repeat from Step 8

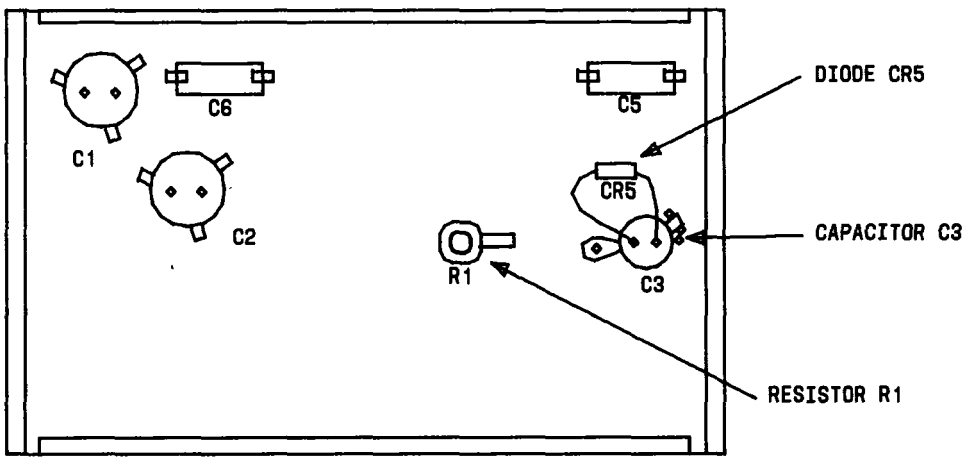


FIG. 1

Issue 2	JUL 1980
233-144-100	TAP 234
PAGE 1 of 1	

CHECK COMPONENTS OF INVERTER PROVIDING POWER TO A1

[1] Disconnect thyristors **CR1** and **CR2**

[2] Condition KS-20538 VOM to the 1000-ohm scale

[3] Connect VOM from anode to cathode of **CR1**. See FIG. 1

AND

[4] Does meter indicate more than 1000 ohms

Yes

[10] Measure resistance between gate and cathode of **CR1**. Note resistance

No

No

[5] Replace **CR1**

[6] Remove **INVERTER** from rack [DLP-620]

[11] Reverse leads and measure resistance between gate and cathode. Compare with Step 10

[7] Replace **INVERTER** [DLP-618]

[12] Does resistance measure above 1000 ohms in one direction and below 1000 ohms in reverse direction

Yes

Page 2

[8] Restore **INVERTER** to service [DLP-611]

[9] Repeat from Step 4

No

[13] Replace **CR1**

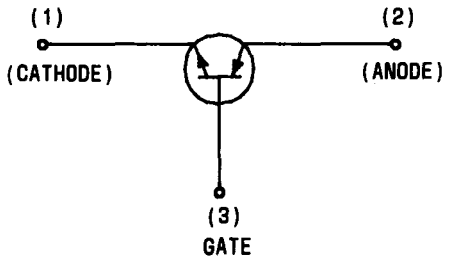
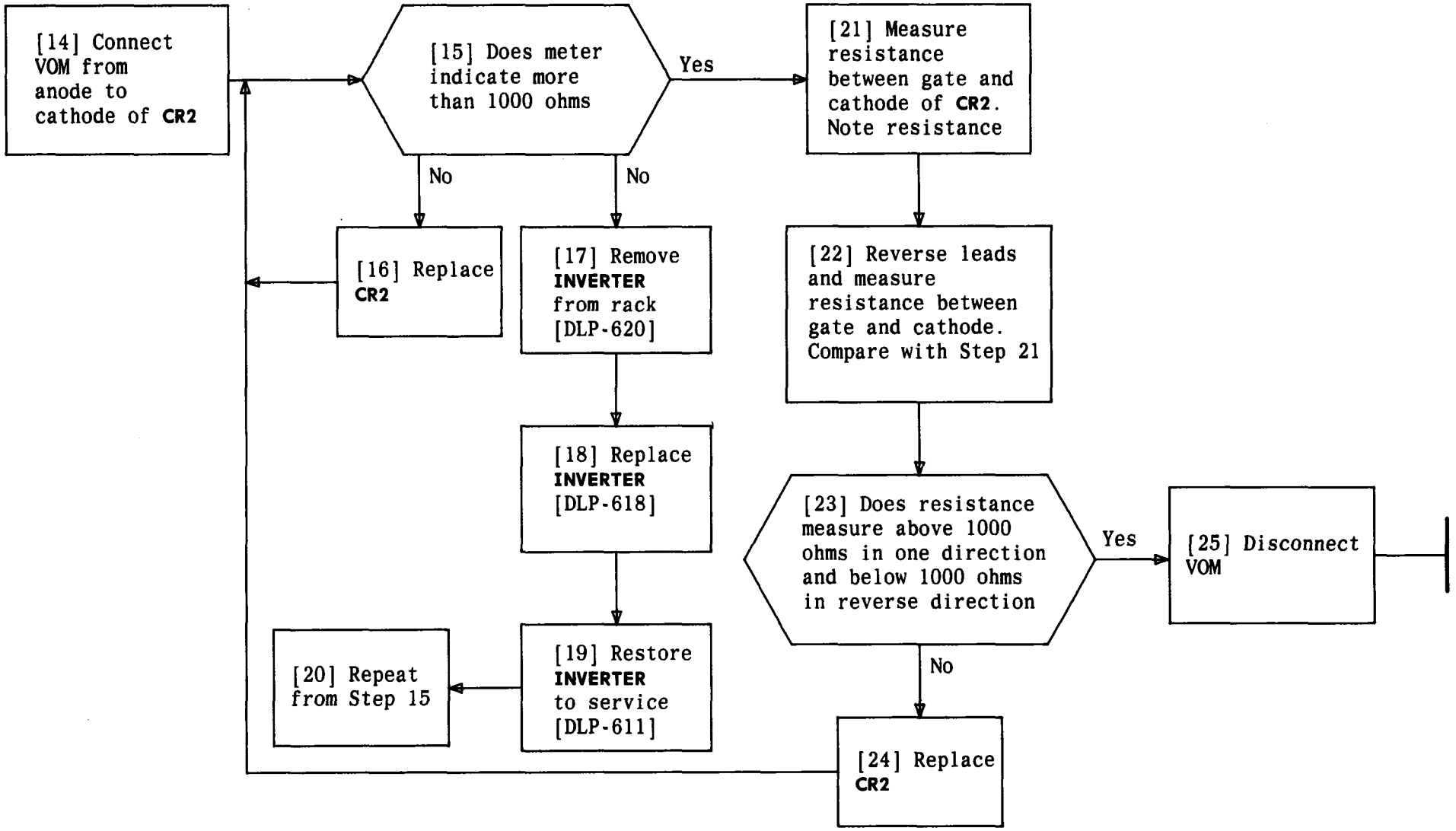


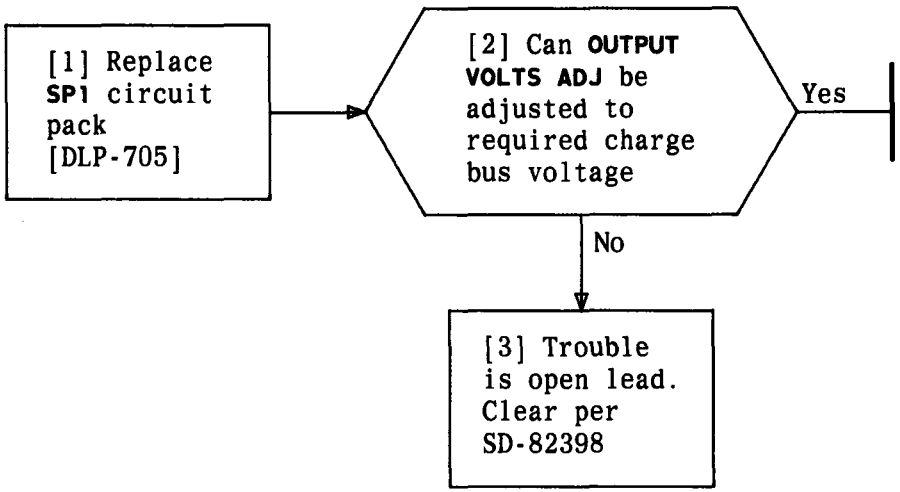
FIG. 1

CLEAR TROUBLE IN INVERTER THYRISTOR CIRCUIT PACK A1

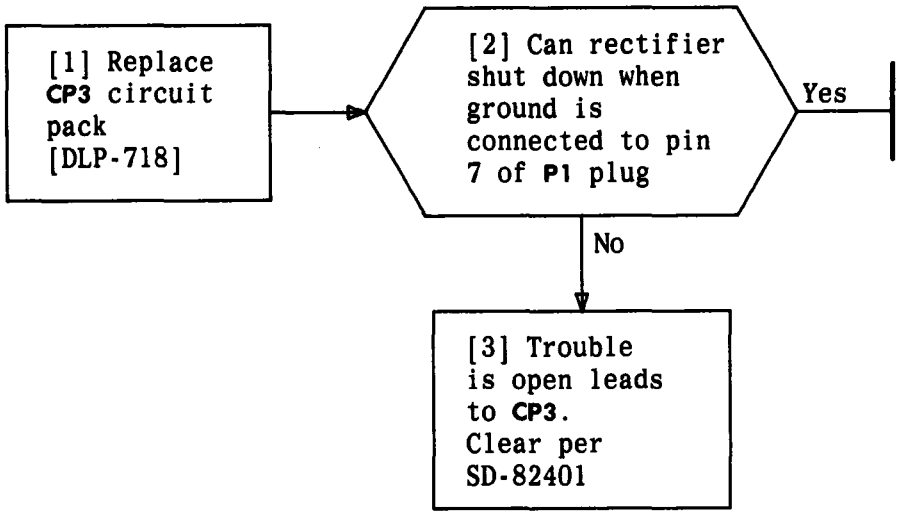
Issue 2	JUL 1980
233-144-100	TAP 236
PAGE 1 of 2	



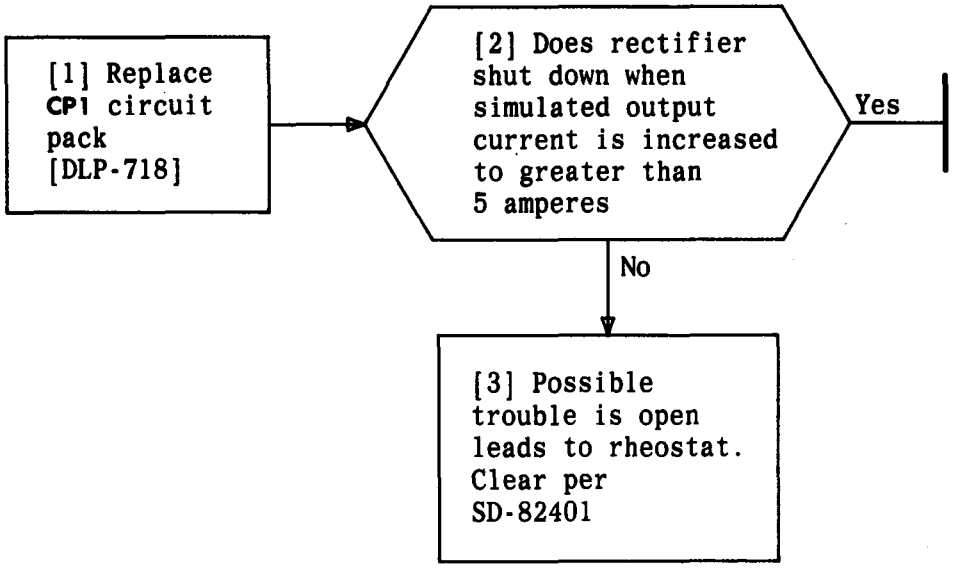
CLEAR TROUBLE IN INVERTER THYRISTOR CIRCUIT PACK A1



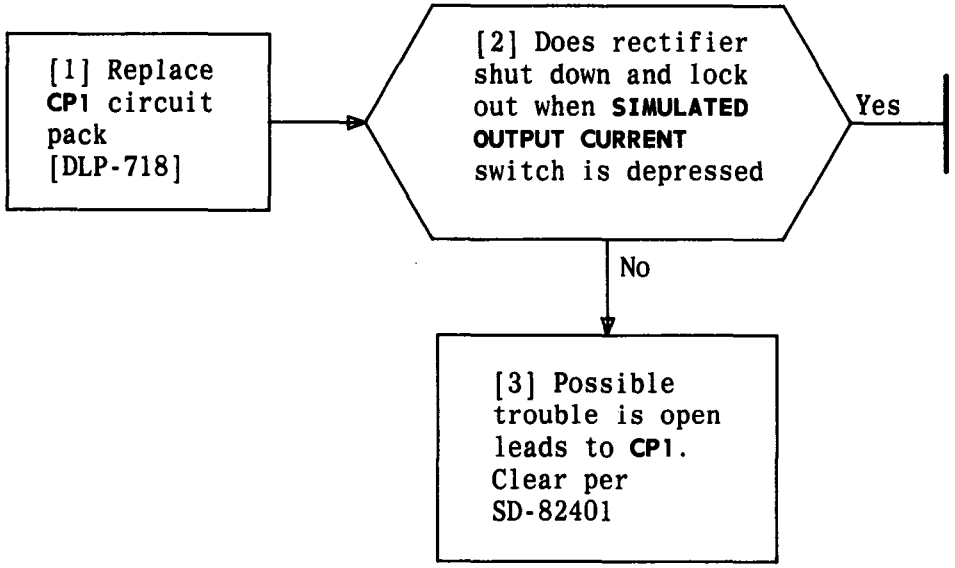
CLEAR J87437A 48V RECTIFIER OUTPUT VOLTAGE ADJUSTMENT TROUBLE



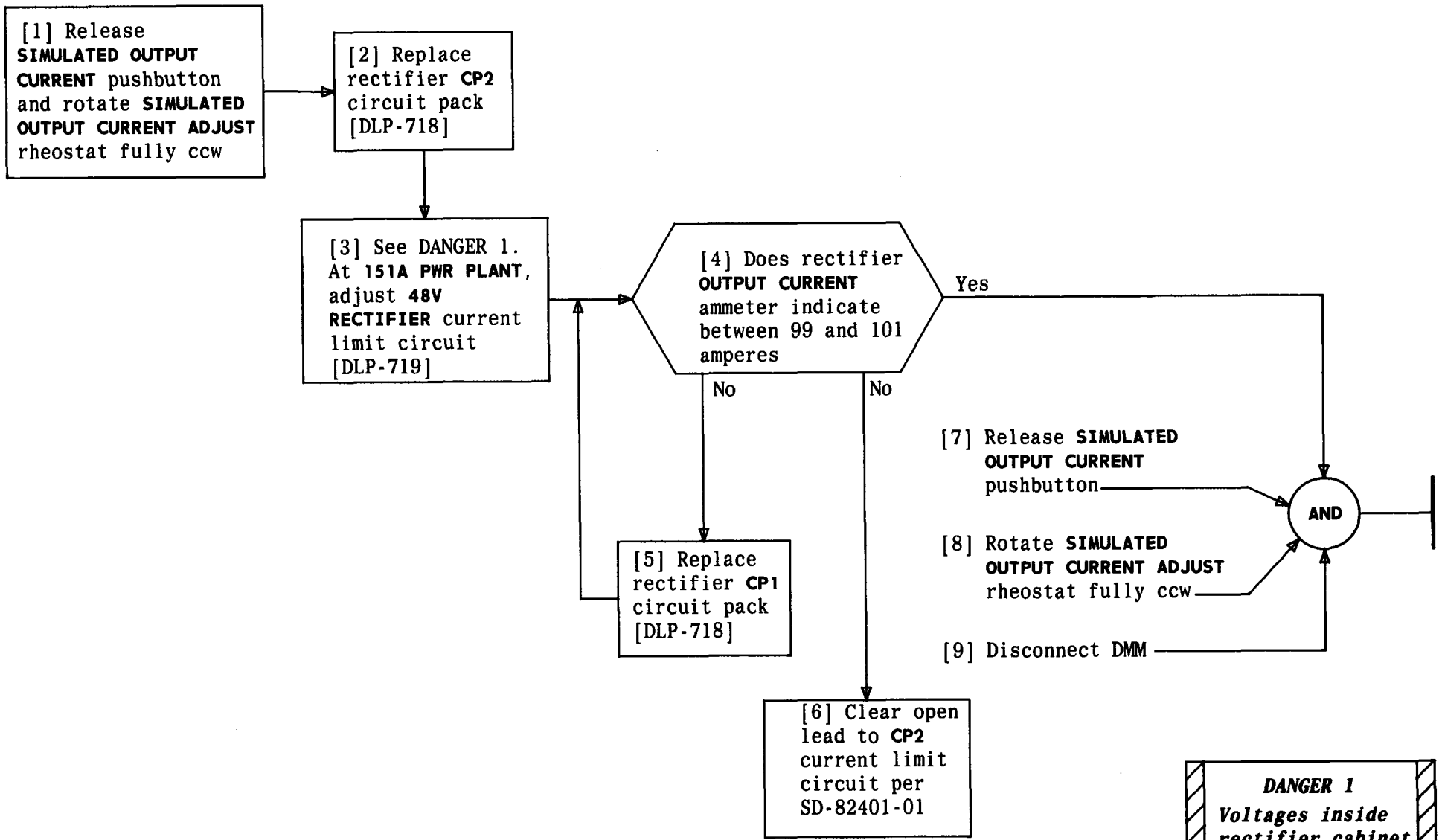
CLEAR ITT-NORTH KS-20493 48V RECTIFIER TR SHUTDOWN TROUBLE



CLEAR ITT-NORTH KS-20493 48V RECTIFIER HV SHUTDOWN TROUBLE



CLEAR ITT-NORTH KS-20493 48V RECTIFIER AUTOMATIC RESTART TROUBLE



DANGER 1

Voltages inside rectifier cabinet are over 400 volts to ground

CLEAR TROUBLE IN ITT-NORTH KS-20493 48V RECTIFIER CURRENT LIMIT CIRCUIT

SUMMARY

See WARNING 1. Depress **POWER ON–POWER OFF** pushbutton to turn off rectifier. Remove **RB** fuse, and set circuit breaker on **EXTERNAL CHARGE CIRCUIT BREAKER/RECT** panel to **OFF**

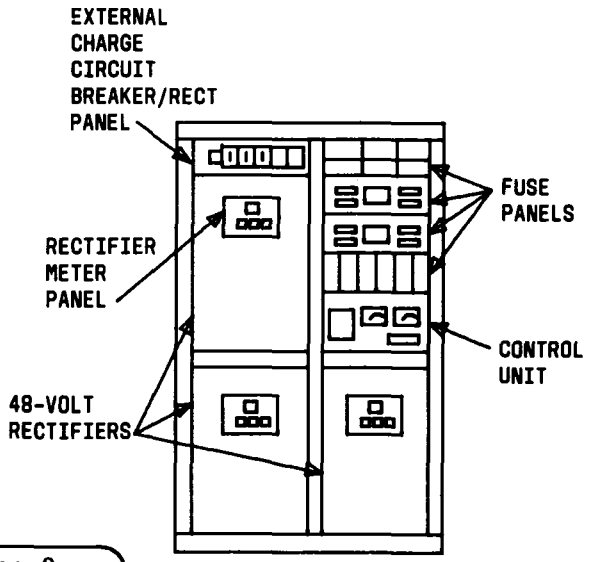


FIG. 1

[1] See FIG. 1. At **151A PWR PLANT**, on **48V RECTIFIER** meter panel, depress **POWER ON–POWER OFF** pushbutton

[2] Do **POWER OFF** and **RECT FAIL** lamps light

Yes

[5] See WARNING 1. On **CONTROL UNIT**, remove **RB** fuse associated with rectifier

Page 2

No

No

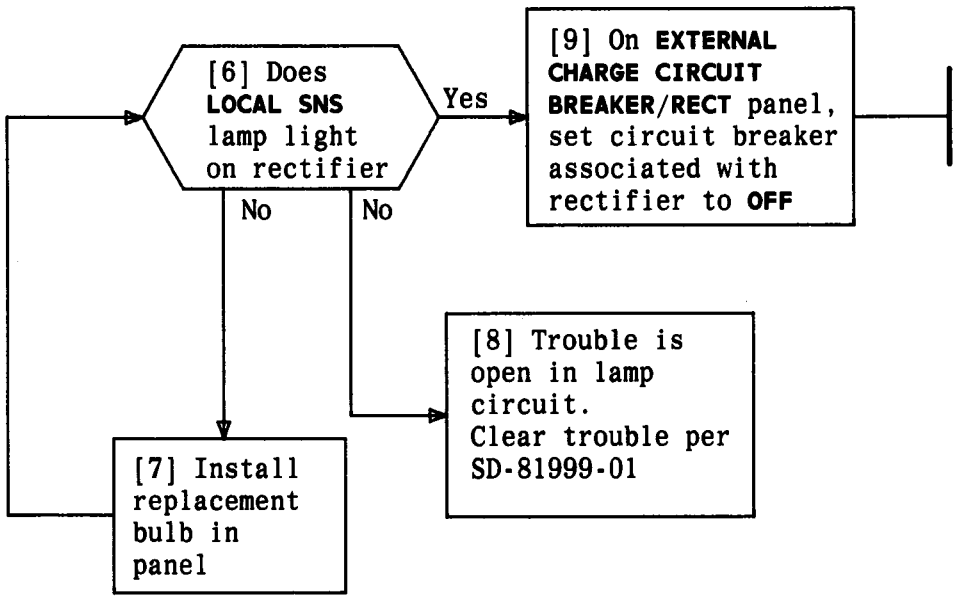
[4] Trouble is open in lamp circuit. Clear trouble per SD-81999-01

[3] Install replacement bulb in panel

WARNING 1

Rectifier circuit could be damaged when rectifier is turned on if* RB *fuse is installed and* EXTERNAL CHARGE *circuit breaker is set to* OFF. *When* RB *fuse is removed, rectifier may be turned on to operate in test mode

POWER DOWN INDIVIDUAL LORAIN KS-20493 48V RECTIFIER



POWER DOWN INDIVIDUAL LORAIN KS-20493 48V RECTIFIER

SUMMARY

See NOTE 1. DMM connected across **OUTPUT VOLTS** test jacks indicates desired output level. Rotate **OUTPUT VOLTS ADJUST** rheostat until DMM indicates desired output level

[1] Condition DMM to measure approximately 100 Vdc

[2] At **151A PWR PLANT** on **48V RECTIFIER** [FIG. 1], Connect DMM across **OUTPUT VOLTS** (+) and (–) test jacks

[3] Depress **POWER ON–POWER OFF** pushbutton to turn on rectifier

POWER ON lamp lights. **POWER OFF** and **RECT FAIL** lamps go out

AND

DMM connected across output

[4] See NOTE 1. Does DMM indicate required charge bus voltage

Yes

No

Page 2

[5] Verify locking device is secure on **OUTPUT VOLTS ADJUST** rheostat

[6] Disconnect DMM

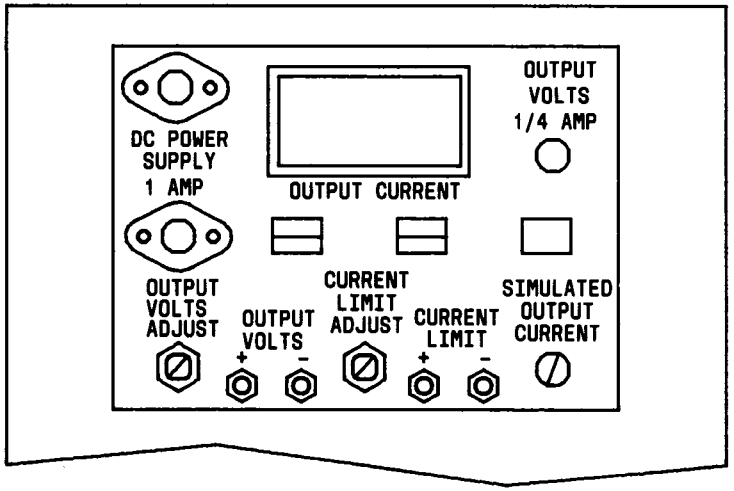
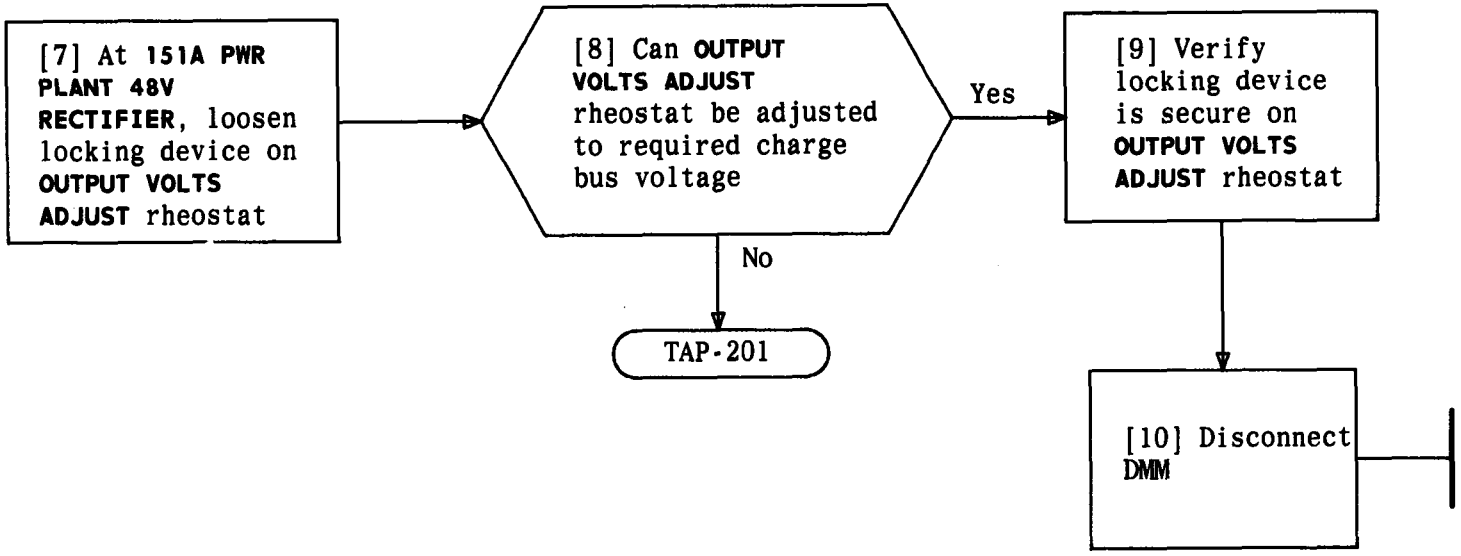


FIG. 1

NOTE 1

Charge voltage is determined by local requirements. Refer to office records for exact setting. In absence of local requirements, charge voltage is at a level that produces 52.08 Vdc measured at battery bus

CHECK LORAIN KS-20493 48V RECTIFIER OUTPUT VOLTAGE



CHECK LORAIN KS-20493 48V RECTIFIER OUTPUT VOLTAGE

SUMMARY

See NOTE 1. Connect DMM at **CURRENT LIMIT** test jacks. DMM should indicate approximately −12 to −15 Vdc. Depress and hold **SIMULATED OUTPUT CURRENT** pushbutton. Rotate **SIMULATED OUTPUT CURRENT** rheostat slowly cw until DMM indicates −1.25 to −1.50 volts. **OUTPUT CURRENT** ammeter should indicate 100 amperes. Release **SIMULATED OUTPUT CURRENT** pushbutton and rotate **SIMULATED OUTPUT CURRENT** rheostat fully ccw.

[1] Condition DMM to measure approximately 100 Vdc

[2] At **151A PLANT** on **48V RECTIFIER** [FIG. 1], connect DMM at **CURRENT LIMIT** (+) and (−) test jacks

DMM indicates approximately −12 to −15 Vdc

AND

DMM connected

[3] Verify **SIMULATED OUTPUT CURRENT** rheostat is rotated fully ccw

[4] Depress and hold **SIMULATED OUTPUT CURRENT** pushbutton

SIMULATED OUTPUT CURRENT lamp lights

AND

Page 2

[5] See NOTE 1. Rotate **SIMULATED OUTPUT CURRENT** rheostat slowly cw until indication on DMM decreases to −1.25 to −1.50 volts

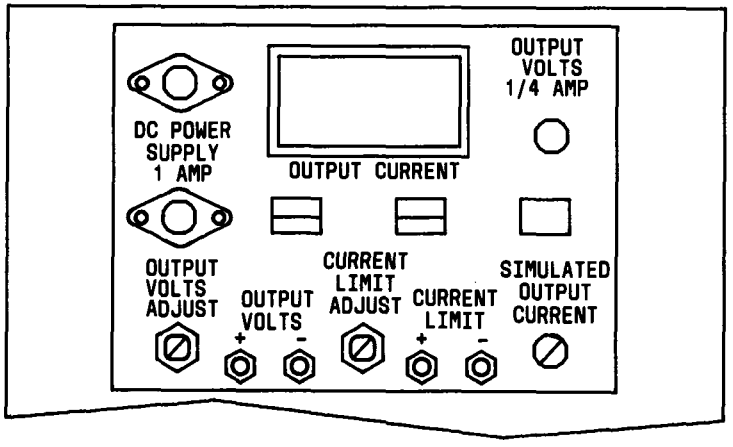
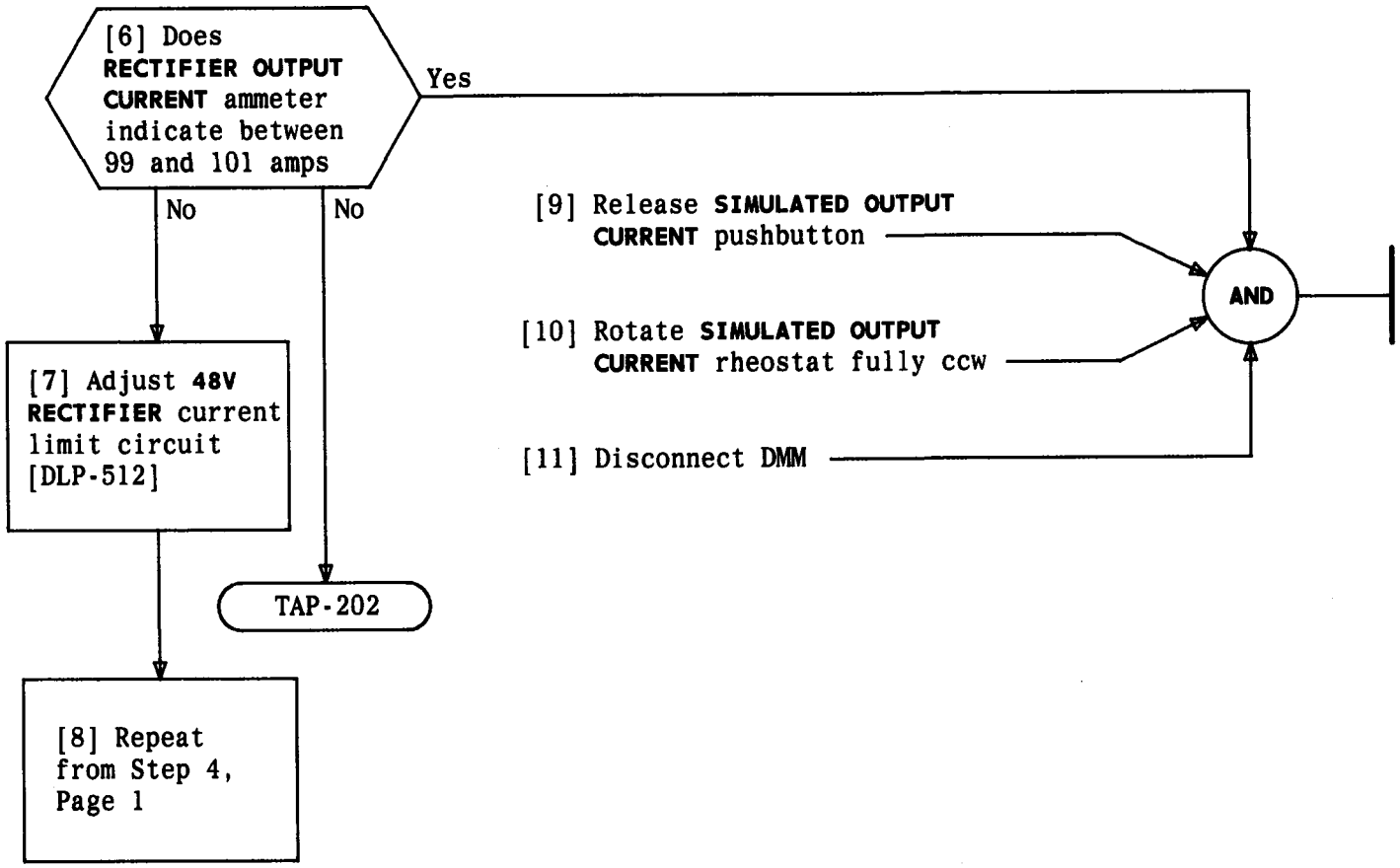


FIG. 1

NOTE 1

Voltage changes from approximately −15 volts at no load toward approximately −1.5 volts at current limit. Further increase in simulated load would result in voltage change through 0 volts toward a (+) level

TEST LORAIN KS-20493 48V RECTIFIER CURRENT LIMIT CIRCUIT



TEST LORAIN KS-20493 48V RECTIFIER CURRENT LIMIT CIRCUIT

SUMMARY

See WARNING 1. Turn off rectifier. Install **RB** fuse. Charge rectifier output filter capacitors and set circuit breaker to **ON**. Turn on rectifier

At **151A PWR PLANT**:

[1] On **48V RECTIFIER**, depress **POWER ON-POWER OFF** pushbutton to turn off rectifier

[2] At **CONTROL UNIT**, install **RB** fuse associated with rectifier → **LOCAL SNS** lamp off

[3] Charge rectifier output filter capacitors [DLP-517]

[4] See WARNING 1. On **EXTERNAL CHARGE CIRCUIT BREAKER/RECT** panel set to **ON** circuit breaker associated with rectifier

[5] Depress **POWER ON-POWER OFF** pushbutton to turn on rectifier → TTY message REPT PWR B 16 a 000000 NORM given

AND

POWER UP INDIVIDUAL LORAIN KS-20493 48V RECTIFIER

WARNING 1

Circuit breaker damage may occur if capacitors are not charged before operating circuit breaker to ON

SUMMARY

See NOTES 1 and 2. In **BATTERY** and **DISCHARGE** position. **DMM** should indicate 52.08 volts dc at **VM CAL** test jacks. Ammeter on each rectifier should indicate some load current.

[1] Condition DMM to measure approximately 100 Vdc

[2] At **151A PWR PLANT CONTROL UNIT** [FIG. 1], connect DMM across **VM CAL** (+) and (–) test jacks

[3] Set plant voltmeter selector switch to **BATTERY**

AND

DMM connected

[4] See NOTE 1. Does **OUTPUT CURRENT** ammeter on each rectifier indicate some load current

Yes → Page 2

No → [5] Adjust battery bus voltage and rectifier output current [DLP-530]

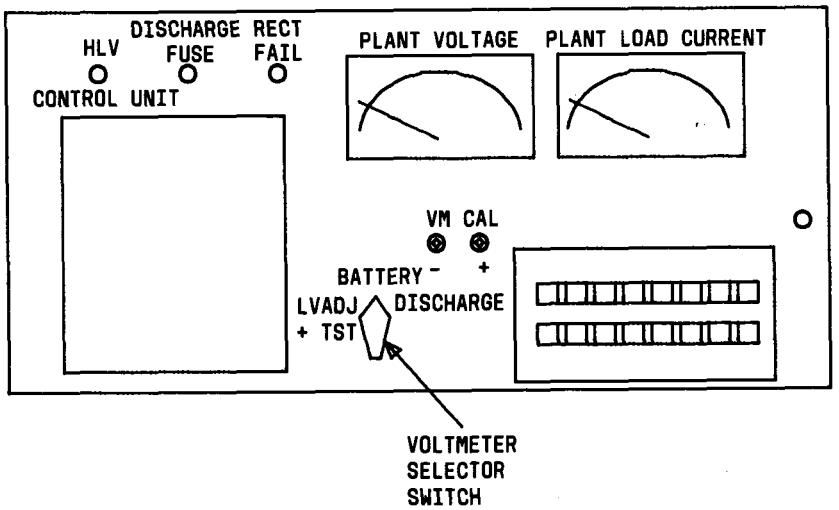
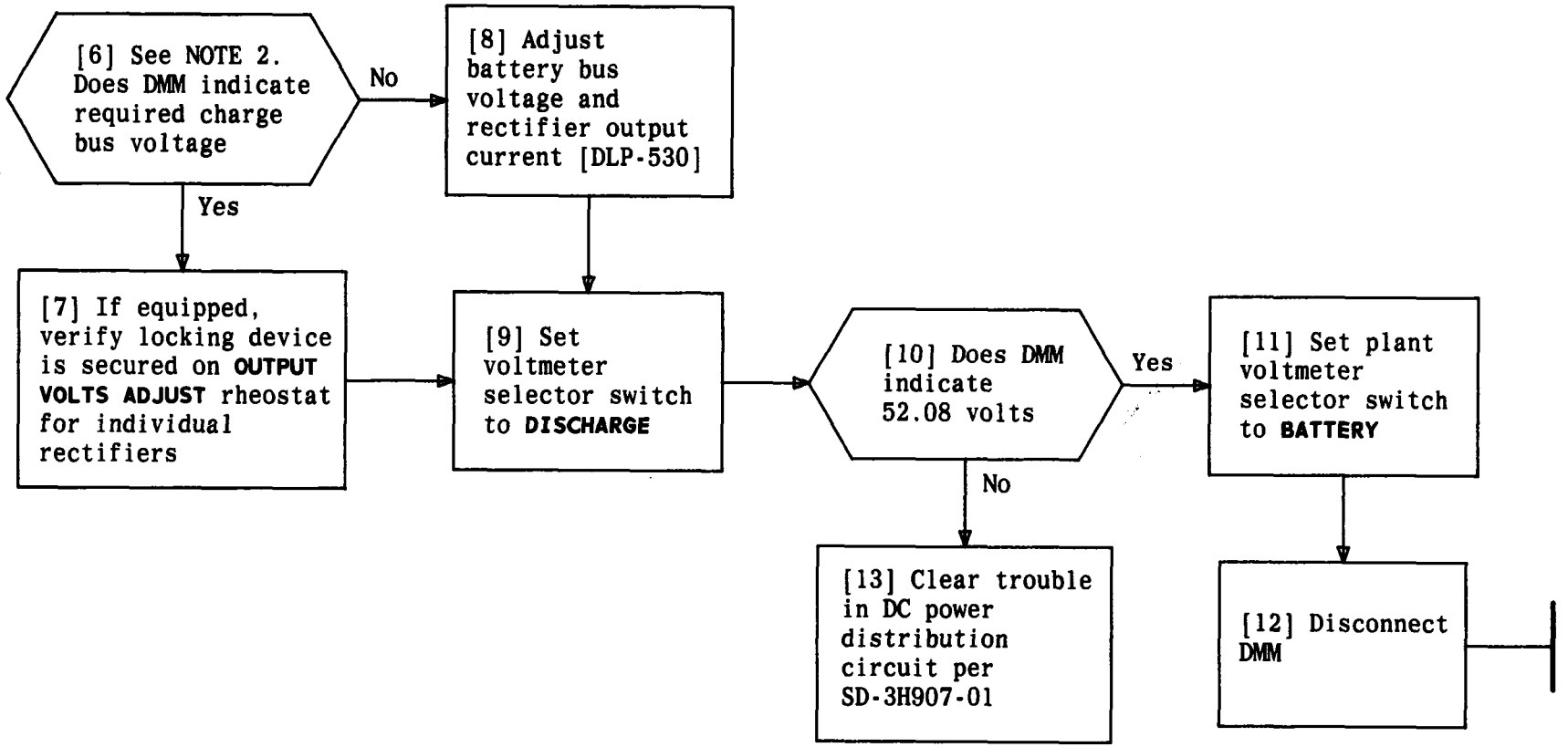


FIG. 1

NOTE 1
Rectifiers are not required to share plant load equally

Issue 2	JUL 1980
233-144-100	DLP
PAGE 1 of 2	504

CHECK BATTERY BUS VOLTAGE AND 48V RECTIFIER OUTPUT CURRENT



NOTE 2
Charge voltage is determined by local requirements. Refer to office records for exact setting. In absence of local requirements, charge voltage is at a level that produces 52.08 Vdc measured at battery bus

CHECK BATTERY BUS VOLTAGE AND 48V RECTIFIER OUTPUT CURRENT

SUMMARY
Calibrate plant voltmeter to match indication on DMM.

[1] Condition DMM to measure approximately 100 Vdc

[2] At **151A PWR PLANT CONTROL UNIT** [FIG. 1], connect DMM across **VM CAL** (+) and (–) test jacks

AND

DMM connected

[3] Does **PLANT VOLTAGE** meter indicate within 0.25 voltage of DMM

Yes

[5] Disconnect DMM

[6] Update office records

No

[4] Using jewelers screwdriver, adjust calibration screw on **PLANT VOLTAGE** meter until indication on **PLANT VOLTAGE** meter equals indication on DMM

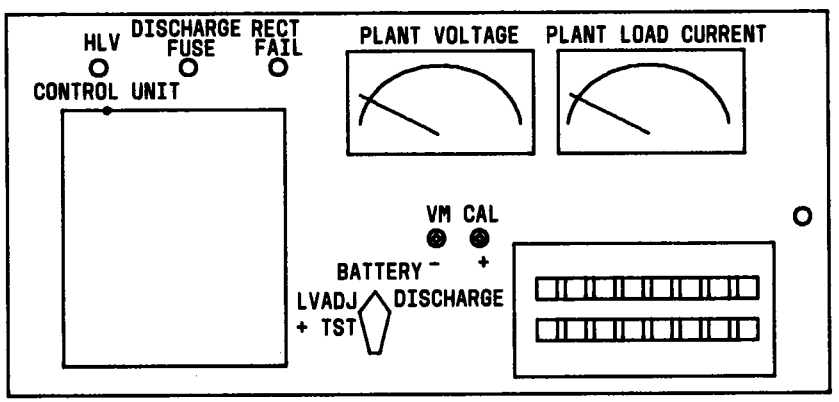


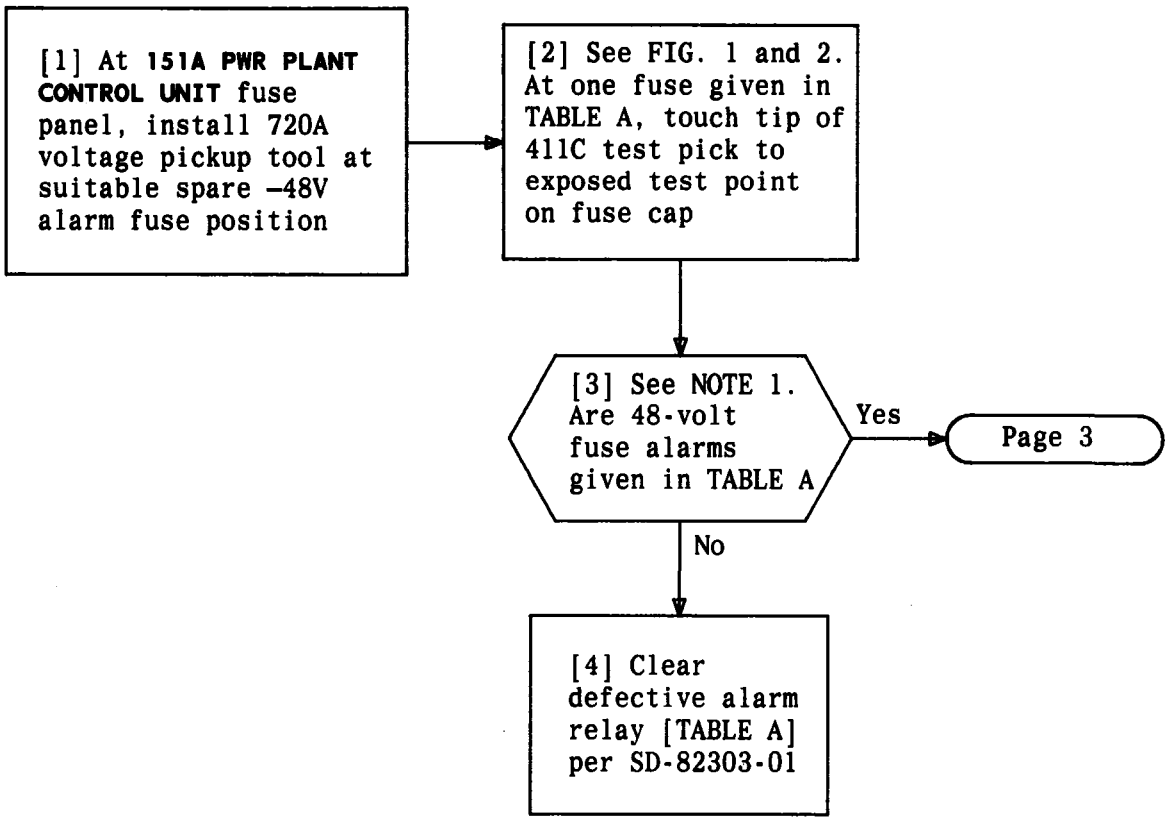
FIG. 1

CALIBRATE 151A POWER PLANT VOLTMETER

Issue 2	JUL 1980
233-144-100	DLP
PAGE 1 of 1	505

SUMMARY

See NOTE 1. Use test cord to connect −48 volt battery to test point on alarm fuse cap. Fuse alarms are given



NOTE 1

TTY message REPT PWR B18 1 OFN is given for all fuses except **DISCHARGE** fuse. For **DISCHARGE** fuse, TTY message REPT PWR B26 8 000000 OFN is given

CHECK 151A POWER PLANT FUSE ALARMS

TABLE A FUSE ALARMS			
FUSE	FUSE ALARM RELAY OPERATES	PLANT ALARM LAMP LIGHTS	SYSTEM STATUS PANEL LAMPS LIGHT
RB1, RB2, RB3, RB4, RB5	FAN	RECT FAIL	MINOR *FUSE
TEST INV (-48) (discharge)	FAJ	DISCHG FUSE	MAJOR *FUSE
C1, C2 (filter fuse)	FAN	RECT FAIL	MINOR *FUSE
CBS, R	FAN	RECT FAIL	MINOR *FUSE
HVM	FAN	RECT FAIL	MINOR *FUSE
VM	FAN	RECT FAIL	MINOR *FUSE
VM2	FAN	RECT FAIL	MINOR *FUSE
LVB1	FAN	RECT FAIL	MINOR *FUSE
LVB2	FAN	RECT FAIL	MINOR *FUSE

* FUSE lamp on System Status Panel extinguishes when test pick is removed from fuse cap

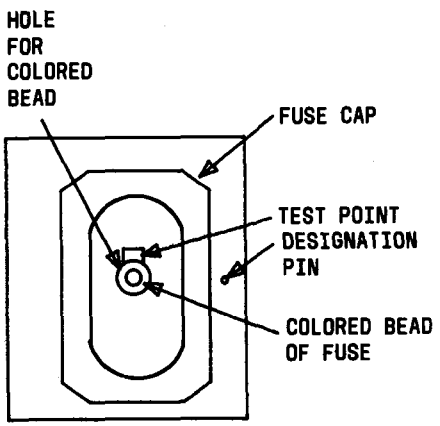


FIG. 1 – Alarm Fuse Cap – Typical

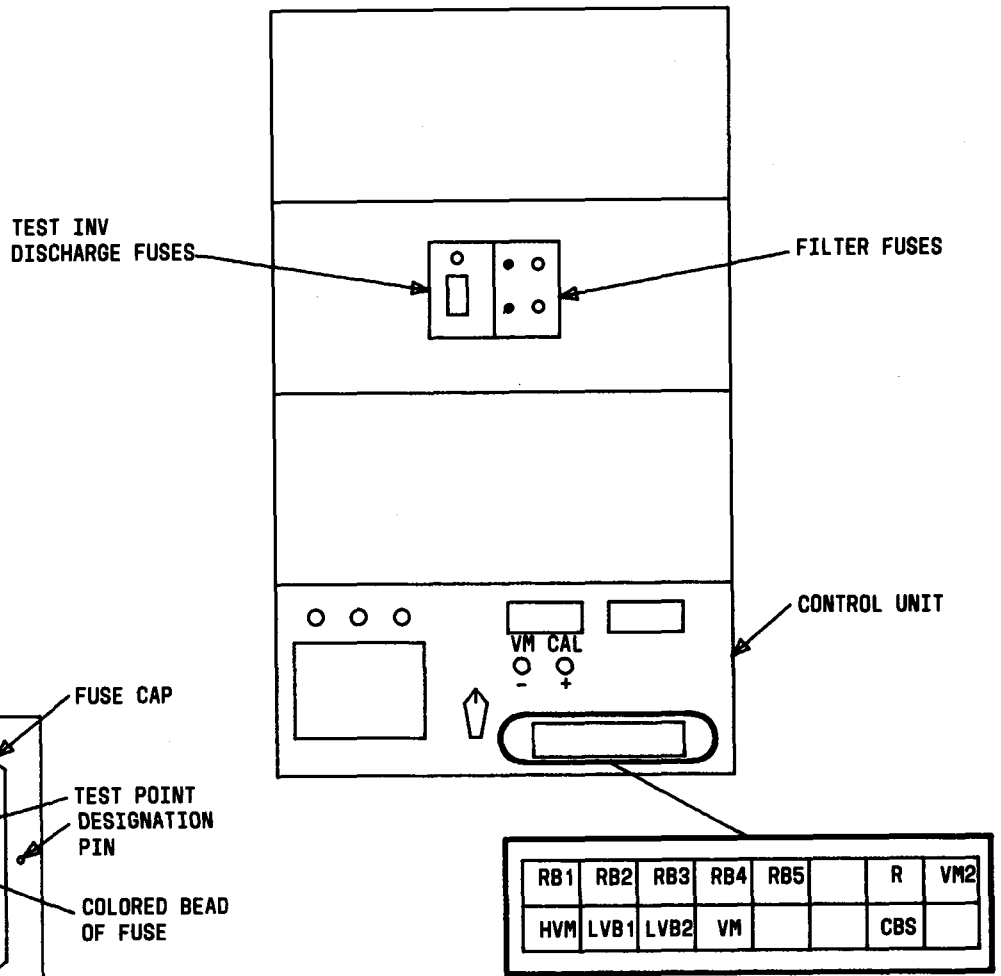


FIG. 2 – Fuse Location

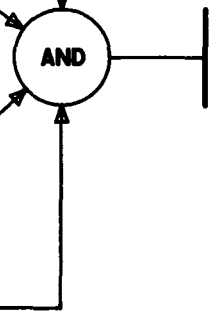
CHECK 151A POWER PLANT FUSE ALARMS

[5] Remove test pick from fuse cap and observe that alarms turn off

[6] On SSP depress **ALARM RELEASE** pushbutton

[7] Repeat from Step 2 for each additional fuse given in TABLE A

[8] Disconnect 720A tool from spare fuse positions and install fuse cap



CHECK 151A POWER PLANT FUSE ALARMS

[1] At **151A PWR PLANT** on **EXTERNAL CHARGE CIRCUIT BREAKER/RECT** panel, remove screws from circuit breaker cover

[2] Remove circuit breaker cover

[3] See FIG. 1. Remove **CAP** fuse from fuse block

[4] Using fuse alarm test cord, install 720A tool at **CAP** fuse position

[5] See DANGER 1. At one **CFA** resistor [FIG. 1], use 411C test pick to touch rear terminal of **CFA** resistor

AND → Page 2

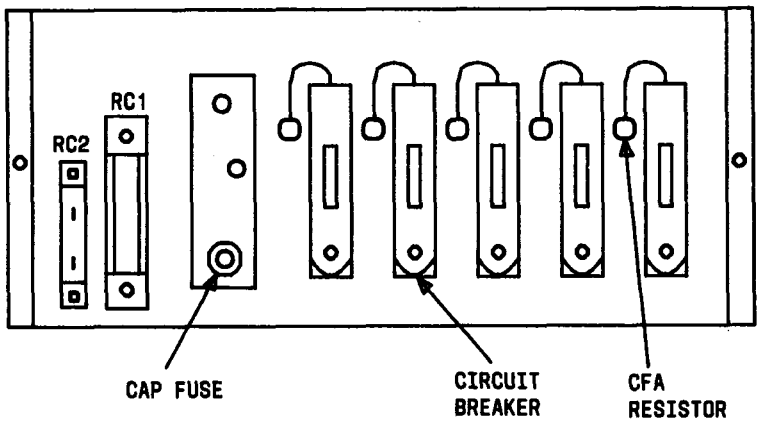
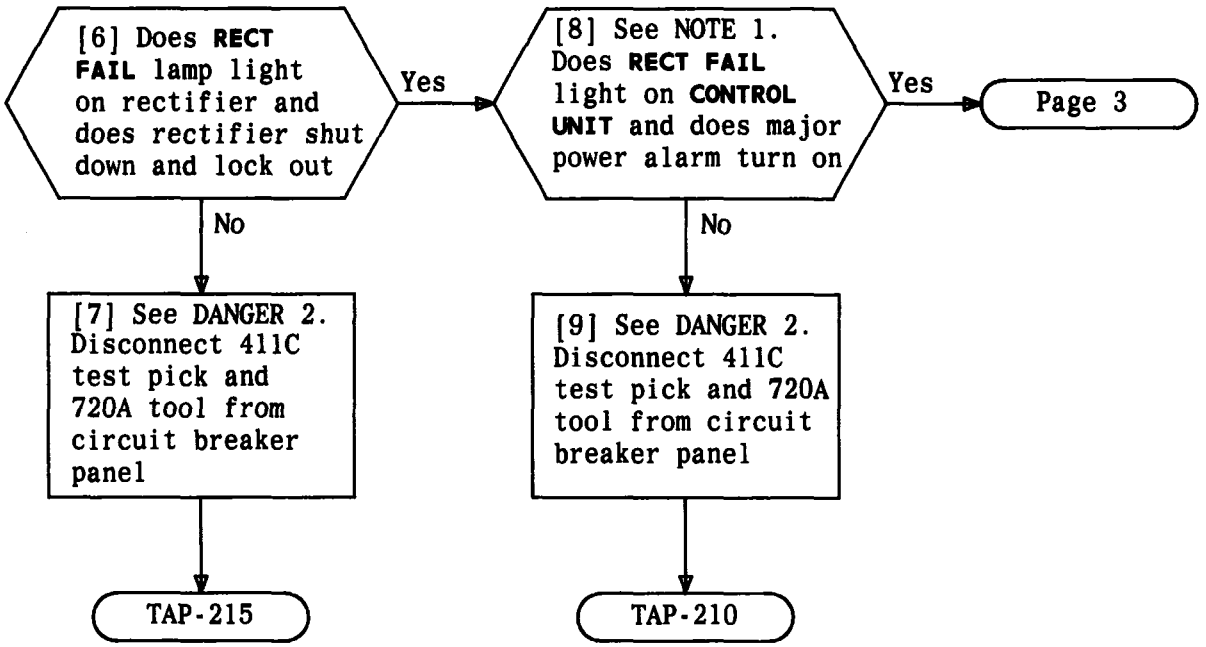


FIG. 1

DANGER 1
Extremely high current present in this circuit.

CHECK LORAIN OR ITT-NORTH KS-20493 48V RECTIFIER FAILURE ALARMS



NOTE 1
TTY message
**REP PWR B 16 a
000000 OFN and
*REP PWR B 18
1 000000
is given

DANGER 2

Extremely high current potential present in this circuit

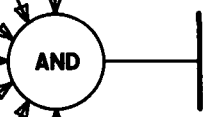
CHECK LORAIN OR ITT-NORTH KS-20493 48V RECTIFIER FAILURE ALARMS

[10] See DANGER 3.
Remove 411C test pick from **CFA** resistor

[11] On rectifier that shut down, depress **POWER ON–POWER OFF** pushbutton one time to reset relays, then depress pushbutton second time to start rectifier

[12] On SSP depress **ALARM RELEASE** pushbutton

[13] Repeat from Step 5, Page 1 for each additional circuit breaker in turn



[14] Disconnect 720A from fuse block

[15] Install **CAP** fuse

[16] Install circuit breaker cover and screws

DANGER 3
Extremely high current potential present in this circuit

Issue 2	JUL 1980
233-144-100	DLP
PAGE 3 of 3	507

CHECK LORAIN OR ITT-NORTH KS-20493 48V RECTIFIER FAILURE ALARMS

CHECK 151A POWER PLANT HIGH VOLTAGE (HVM) SHUTDOWN CIRCUIT

SUMMARY

See NOTE 1 and NOTE 2. Remove **CBS** fuse. Set **S1** switch on **HV** circuit pack to **TST**, **HLV** lamp should not come on. Set **S2** switch to **TST**, **HLV** lamp comes on. Set **S1** and **S2** to **NOR**. Install **CBS** fuse.

[1] At **151A PWR PLANT CONTROL UNIT**, open circuit pack door [FIG. 1]

[2] On **HVM** circuit pack, verify both **S1** and **S2** switches are set to **NOR**

[3] Remove **CBS** fuse from **CONTROL UNIT** fuse panel

[4] On **HVM** circuit pack, set **S1** switch to **TST**

AND

[5] See NOTE 1. Does **HLV** lamp light on **CONTROL UNIT**

Yes → TAP-203

No → Page 2

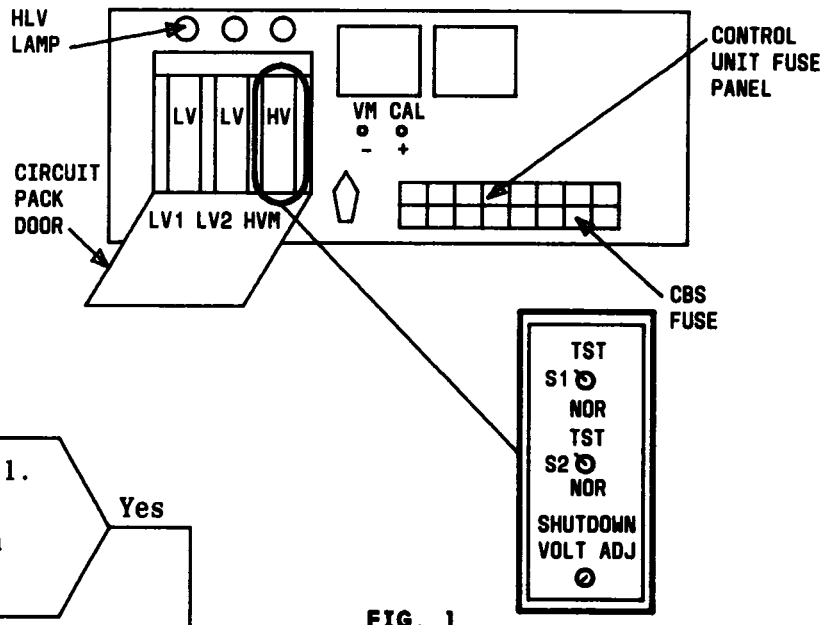
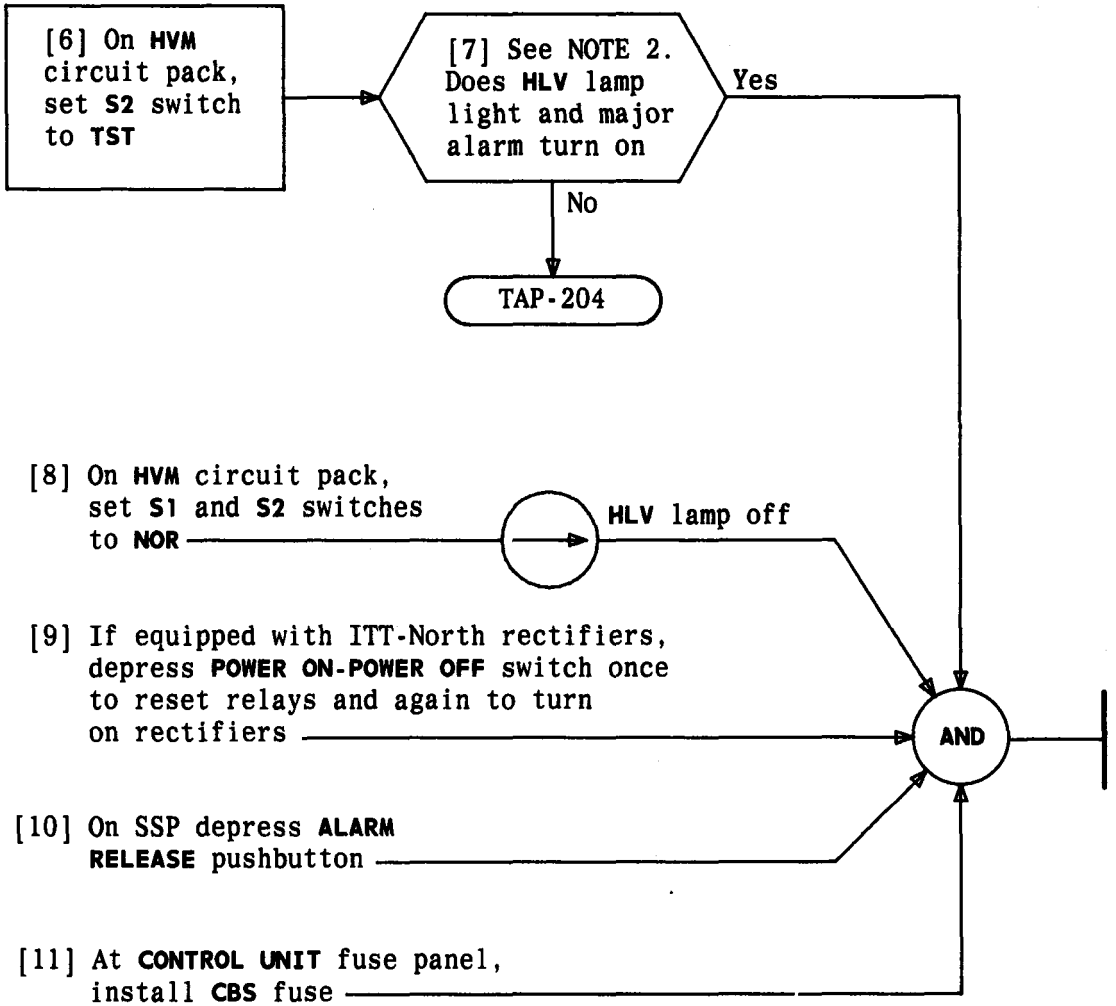


FIG. 1

NOTE 1

If high voltage monitor is properly adjusted, **HLV** lamp should NOT light with only **S1** operated

Issue 2	JUL 1980
233-144-100	DLP
PAGE 1 of 2	508



NOTE 2
Plants equipped with ITT-North rectifiers will encounter rectifier shutdown and **RECT FAIL** light at this time

Issue 2	JUL 1980
233-144-100	DLP
PAGE 2 of 2	508

CHECK 151A POWER PLANT HIGH VOLTAGE (HVM) SHUTDOWN CIRCUIT

SUMMARY

See NOTE 1 and FIG. 1. Connect DMM across **VM-CAL** test jacks, set plant voltmeter selector switch to **LV-ADJ**. Set **LV-CAL** switch to **CAL**, rotate **LV-ADJ** cw to verify **HLV** lamp lights at low setting and major alarm turns on at low-low setting. Rotate **LV-ADJ** fully ccw, set **LV-CAL** switch to **BAT**, set plant **VOLTMETER SELECTOR** switch to **BATTERY**

[1] At **151A PWR PLANT CONTROL UNIT** [See NOTE 1 and FIG. 1], open circuit pack door and verify **LV-ADJ** potentiometer is rotated fully ccw

[2] Set plant voltmeter selector switch to **LV ADJ & TST**

[3] Condition DMM to measure approximately 100 Vdc

[4] Connect DMM across **VM CAL** (+) and (–) test jacks

[5] Set **LV-CAL** switch to **CAL**

[6] Slowly rotate **LV-ADJ** cw until **HLV** lamp lights and minor alarms turn on or until DMM indication drops to 50.0 volts maximum. See NOTE 2

AND

[7] Did **HLV** lamp light when DMM indicated between 50.50 and 51.0 volts

No → TAP-205

Yes → Page 2

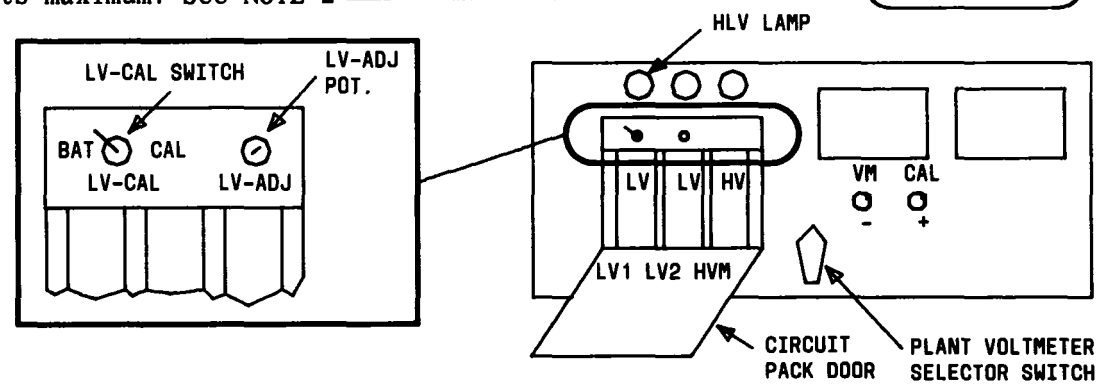
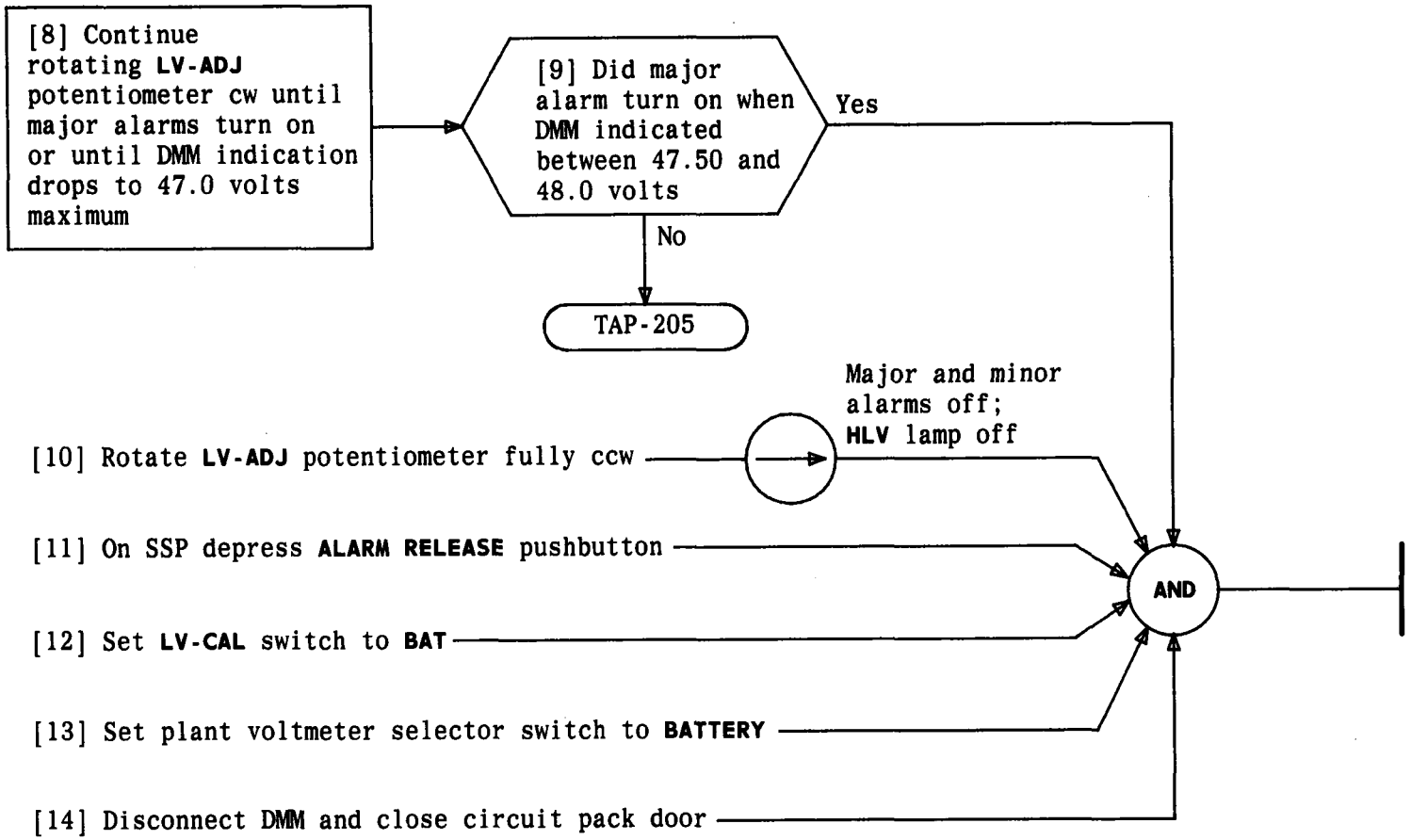


FIG. 1

NOTES

1. **LV ADJ** is 10 turn pot. Equipped with ratchet slip at end of travel
2. Alarm may be reported as a major alarm in some offices

CHECK 151A POWER PLANT LOW VOLTAGE (LV1 AND LV2) MONITORS



CHECK 151A POWER PLANT LOW VOLTAGE (LV1 AND LV2) MONITORS

[1] At **151A PWR PLANT** on **48V RECTIFIER** [FIG. 1], depress **POWER ON-POWER OFF** pushbutton to turn off rectifier

[2] Loosen screws and remove front panel from rectifier

[3] Remove circuit pack cover

[4] Remove circuit pack from connector

Circuit pack removed

AND

[5] Install replacement circuit pack firmly in connector

[6] Install circuit pack cover

[7] Install front panel on rectifier

AND

[8] Depress **POWER ON-POWER OFF** pushbutton to turn on rectifier

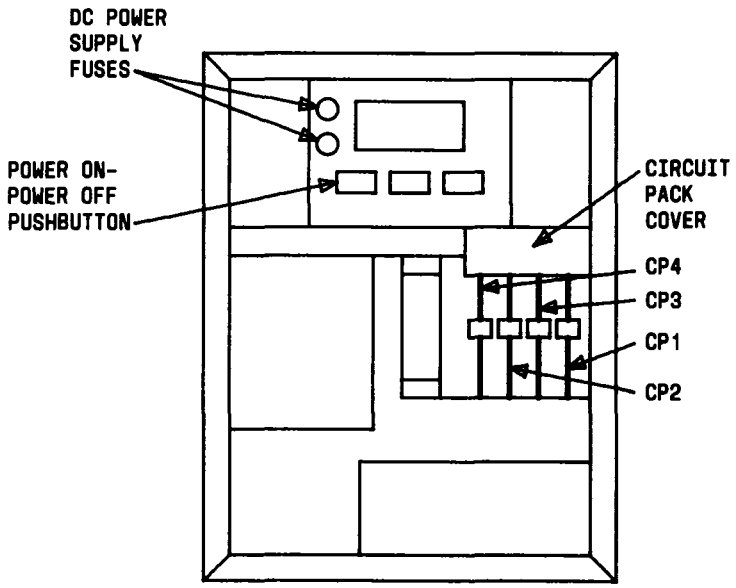
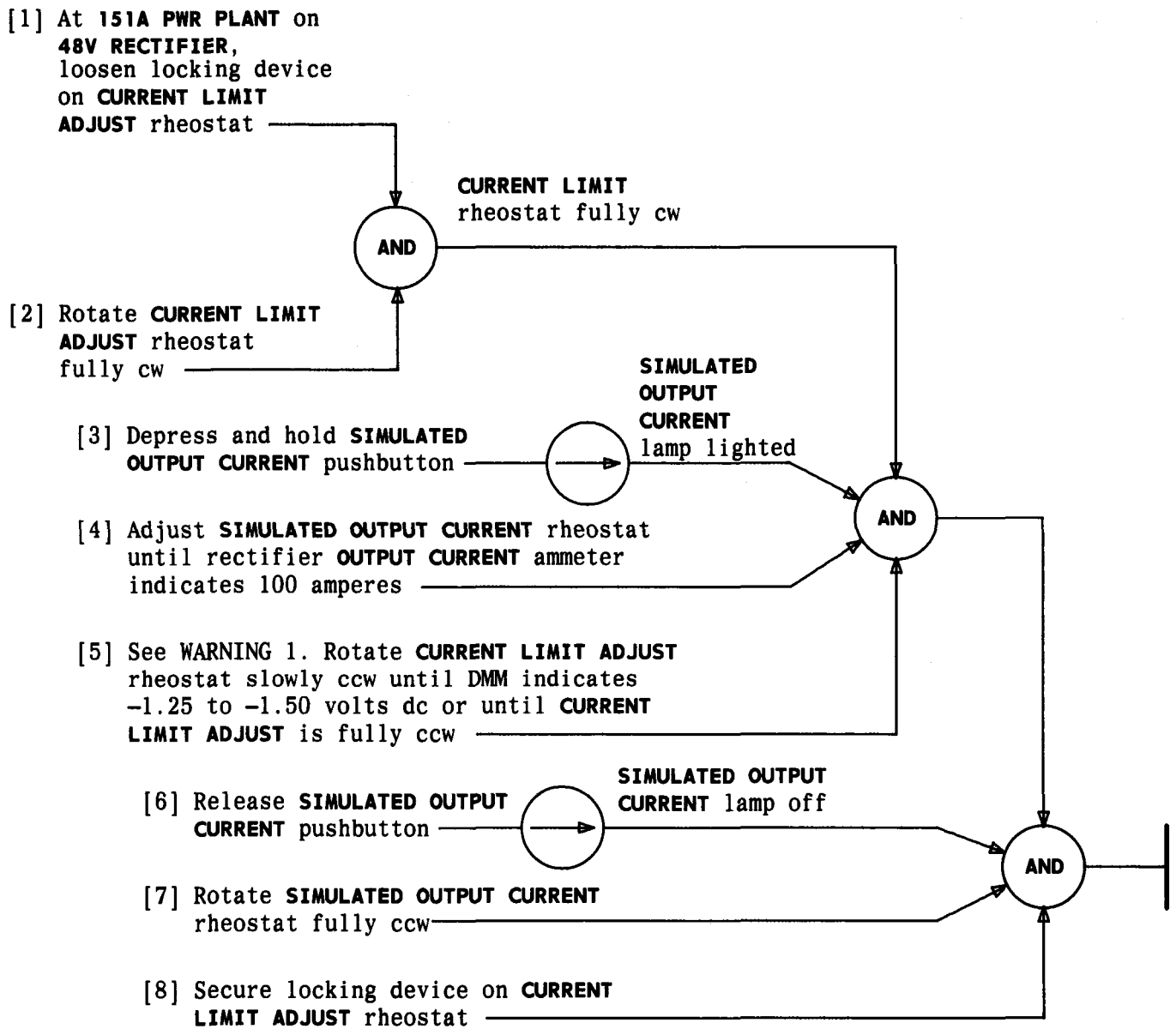


FIG. 1

REPLACE LORAIN 48V RECTIFIER CIRCUIT PACK

Issue 2	JUL 1980	
233-144-100		DLP
PAGE 1 of 1		511



ADJUST 48V RECTIFIER CURRENT LIMIT CIRCUIT

WARNING 1
Current limit level of 1.25 to 1.50 volts dc must be negative (–) polarity

Issue 2	JUL 1980
233-144-100	DLP
PAGE 1 of 1	512

[1] See FIG. 1. Connect W1AY cord to 720A voltage pickup tool using 141 cord tip

[2] On 411C tool, loosen knurled knob and remove test pick

[3] Connect test pick to 360A tool attached to end of W1AY cord

[4] Insert test pick into 411C tool and extend 1 inch

[5] Tighten knurled knob on 411C tool

[6] Verify that 720A tool is equipped with 70F 1/4 ampere fuse

AND

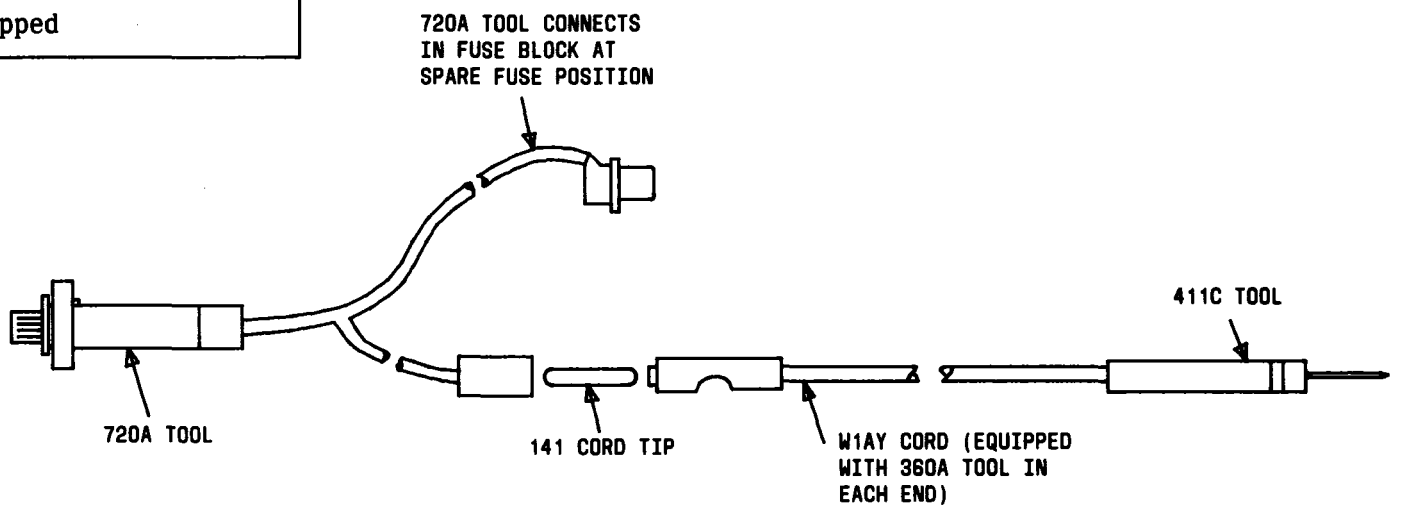
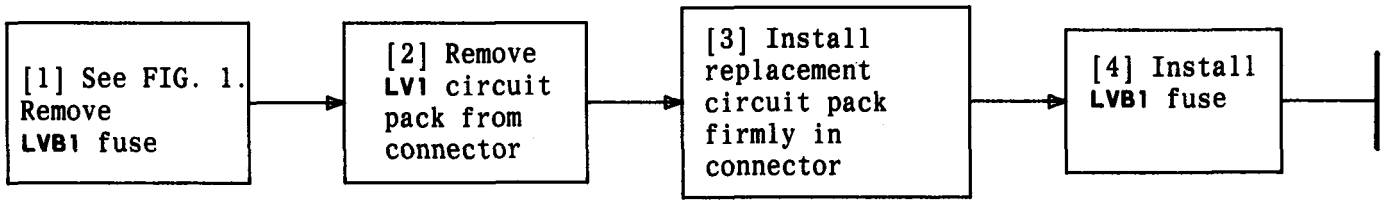


FIG. 1 - Fuse Alarm Test Cord - Assembly

PREPARE FUSE ALARM TEST CORD



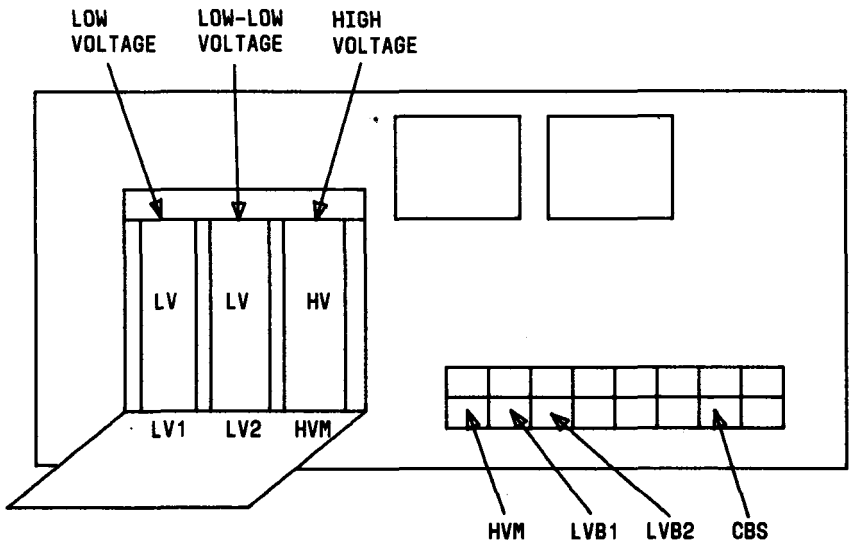


FIG. 1

REPLACE 151A POWER PLANT CONTROL CIRCUIT PACK

Issue 2	JUL 1980	
233-144-100		DLP
PAGE 1 of 1		514

[1] At **151A PWR PLANT** turn off **48V RECTIFIER** by depressing **POWER ON-POWER OFF** pushbutton

[2] At commercial AC input power panel, set **RECTIFIER** circuit breaker to **OFF**

[3] Condition DMM to KΩ X 10 range

At **48V RECTIFIER** [FIG. 1]:

[4] Disconnect leads from power diodes **CR1** and **CR2**

[5] Connect DMM across anode and cathode of diode and then reverse DMM across diode

AND

[6] Does DMM indicate high resistance in one direction and low resistance in opposite direction

No

[7] Diode is defective

Yes

[8] Disconnect DMM and reconnect leads at power diodes

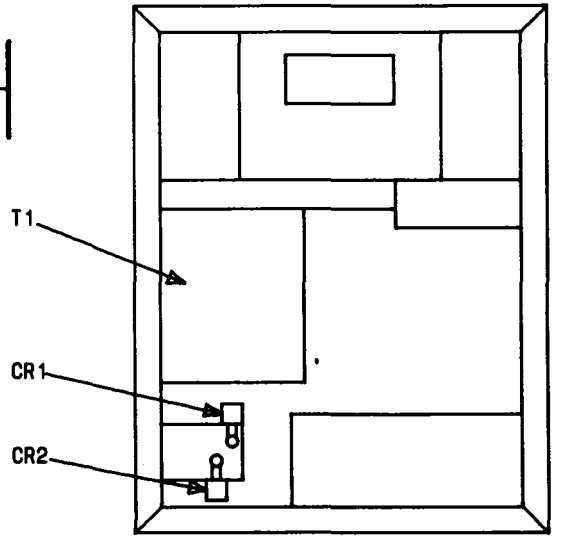


FIG. 1

CHECK 48V RECTIFIER POWER DIODES (CR1 AND CR2)

CHECK OUTPUT FILTER CAPACITOR BANK

[1] At **151A PWR PLANT** on **EXTERNAL CHARGE CIRCUIT BREAKER/RECT** panel, set **48V RECTIFIER** circuit to **OFF**

[2] At commercial AC input power panel, set rectifier circuit breaker to **OFF**

See DANGER 1 and FIG. 1. At rectifier **C2** output capacitor bank:

[3] Remove cover from capacitor bank bus bars

[4] Obtain 100-ohm, 10-watt resistor and temporarily connect resistor across filter capacitor **POS** and **NEG** bus bars

[5] Disconnect capacitor fuse wires

[6] With KS-20538 VOM set on Ω X 100 range, observe proper polarity and connect VOM across capacitor **POS** and **NEG** bus bars

AND

[7] Does VOM indicate low resistance initially, then increase in resistance to greater than 100 KΩ as capacitor(s) charge

Yes → Page 2

No → [8] Disconnect individual capacitors from bus bars and check each capacitor with ohmmeter

No → [9] Capacitor is defective

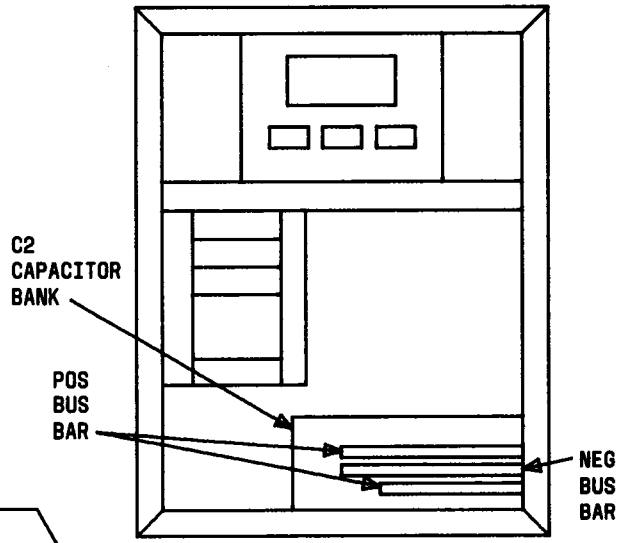


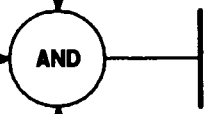
FIG. 1 – Lorain Rectifier Only

DANGER 1
Extremely high current potential present in this circuit

[10] See DANGER 2. Disconnect VOM and verify all capacitor leads are connected

[11] Verify that fuse wires are not defective, then reconnect fuse wires to capacitors

[12] Install cover at capacitor bank bus bar



CHECK OUTPUT FILTER CAPACITOR BANK

DANGER 2
Extremely high current potential present in this circuit

Issue 2	JUL 1980
233-144-100	DLP
PAGE 2 of 2	516

[1] See FIG. 1. At **151A PWR PLANT** on **EXTERNAL CHARGE CIRCUIT BREAKER/RECT** panel, set **CHG** switch to **LAMP TEST**

[2] Does **CAP CHG** lamp light

No → [3] Release **CHG** switch → TAP-209

Yes

[4] Release **CHG** switch → [5] On circuit breaker associated with rectifier, depress and hold pushbutton → [6] Does **CAP CHG** lamp glow brightly initially

No → [8] Release pushbutton → TAP-209

Yes → [7] Does **CAP CHG** lamp dim out within approximately 15 to 45 seconds

No → [8] Release pushbutton → TAP-209

Yes → [9] Set circuit breaker to **ON** and release pushbutton

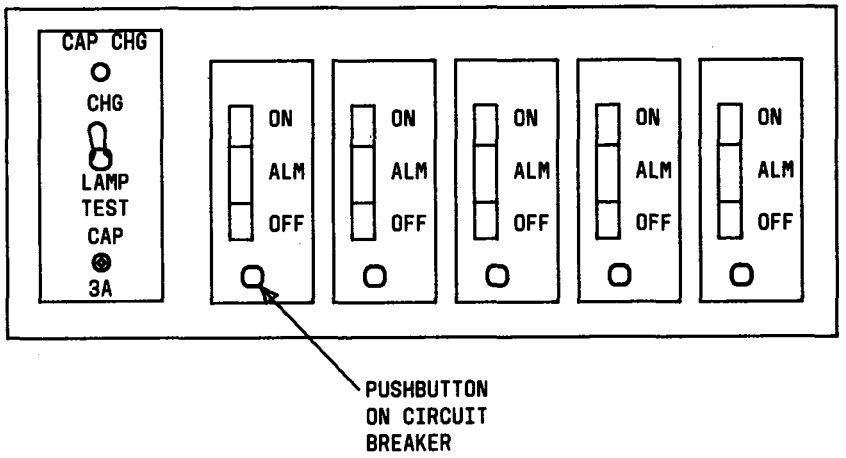


FIG. 1 – External Charge Circuit Breaker/Rect Panel

CHARGE 48V RECTIFIER OUTPUT FILTER CAPACITORS

Issue 2	JUL 1980
233-144-100	DLP
PAGE 1 of 1	517

[1] Obtain test equipment in TABLE A

On oscilloscope:

[2] Set **POWER ON-OFF** switch to **OFF**

[3] Connect service cord at suitable AC outlet

[4] Verify that oscilloscope is properly grounded

[5] Connect voltage probe at input **A** connector

Voltage probe connected

AND

[6] Set **INPUT** selector switch to **DC**

[7] Set **HORIZONTAL** display to **A**

[8] Set **TIME BASE A** to **3 MILLISECONDS/CM**

[9] Set **MILLIVOLTS/CM** selector to **50 VOLTS**

[10] Set **TRIGGER** to **INTERNAL**

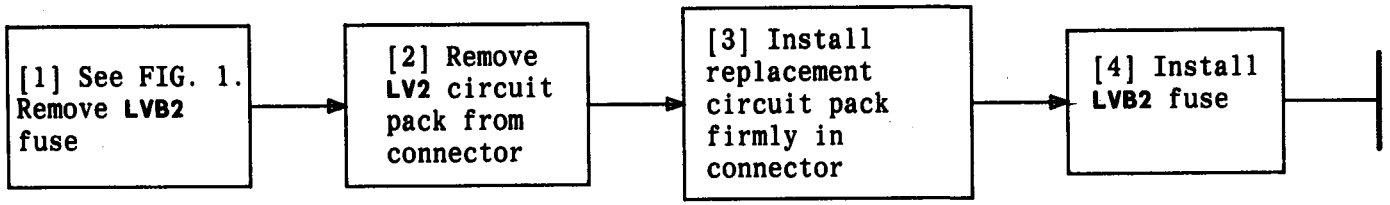
[11] See NOTE 1. Set **POWER ON-OFF** to **ON**

AND

TABLE A	
EQUIPMENT REQUIRED	RECOMMENDED TYPE
Oscilloscope	Tektronix 545B*
Voltage probe	Tektronix P6006*
* Or equivalent	

NOTE 1
After voltage probe is connected in test circuit, adjustment of sweep control may be required to display waveform

CONDITION OSCILLOSCOPE



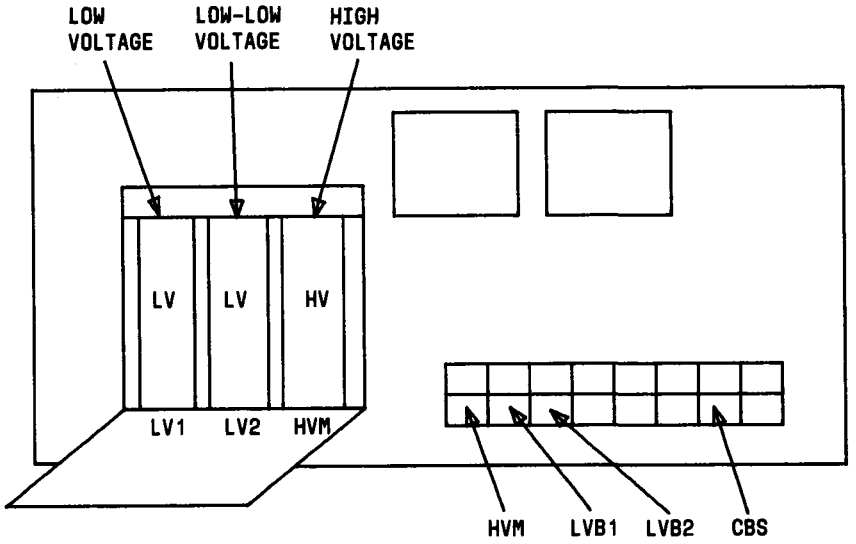


FIG. 1

REPLACE 151A POWER PLANT CONTROL CIRCUIT PACK

Issue 2	JUL 1980
233-144-100	DLP
PAGE 1 of 1	522

[1] See FIG. 1 Verify **CBS** fuse is removed

[2] Remove **HVM** fuse

[3] Remove **HV (CP1) CONTROL UNIT** circuit pack from connector [FIG.1]

[4] Install replacement **HV (CP1) CONTROL UNIT** circuit pack firmly in connector

[5] On replacement of **HV (CP1) CONTROL UNIT** circuit pack, set **S1** and **S2** switches to **NOR**

[6] Install **HVM** fuse

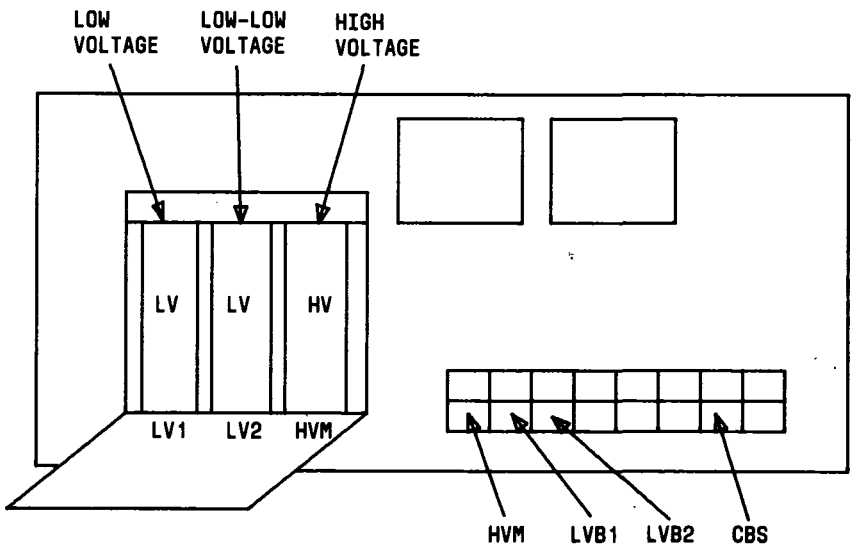


FIG. 1

REPLACE 151A POWER PLANT CONTROL CIRCUIT PACK

At **151A PWR PLANT CONTROL UNIT:**

[1] See NOTE 1 and FIG 1. Open circuit pack door and rotate **LV-ADJ** potentiometer fully ccw

Minor Alarm turns off, **HLV** lamp goes out

[2] Set **LV-CAL** switch to **CAL**

AND

Ready to adjust **LV1**

[3] Set plant voltmeter selector switch to **LV ADJ & TST**

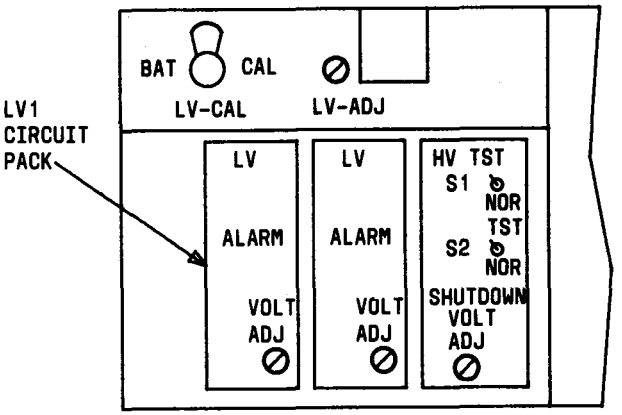


FIG. 1

[4] On **LV1** circuit pack, rotate **VOLT ADJ** potentiometer fully cw

[5] Rotate **LV-ADJ** potentiometer cw until plant voltmeter indicates 50.75 volts

AND

LV1 adjusted

[6] Slowly rotate **VOLT ADJ** potentiometer ccw until minor alarm just turns on

HLV lamp lights

[7] Rotate **LV-ADJ** potentiometer fully ccw

HLV lamp goes out, minor alarm turns off

[8] Set **LV-CAL** switch to **BAT**

AND

[9] At SSP depress **ALARM RELEASE** pushbutton

[10] Set plant voltmeter selector switch to **BATTERY**

NOTE 1
LV-ADJ is 10 turn pot. equipped with ratchet slip at end of travel

Issue 2	JUL 1980
233-144-100	DLP
PAGE 1 of 1	525

ADJUST LV1 PLANT VOLTAGE MONITOR

At **151A PWR PLANT CONTROL UNIT:**

[1] See NOTE 1 and FIG. 1. Open circuit pack door and rotate **LV-ADJ** potentiometer fully ccw

Major and minor Alarm turns off, **HLV** lamp goes out

[2] Set **LV-CAL** switch to **CAL**

AND

Ready to adjust **LV2**

[3] Set voltmeter selector switch to **LV ADJ & TST**

[4] On **LV2** circuit pack, rotate **VOLT ADJ** potentiometer fully cw

AND

LV2 adjusted

[5] See NOTE 2. Rotate LV-ADJ potentiometer cw until plant voltmeter indicates 47.75 volts

HLV lamp lights, minor alarm turns on

[6] Slowly rotate **VOLT ADJ** potentiometer ccw until major alarm just turns on

[7] Rotate **LV-ADJ** potentiometer fully ccw

HLV lamp goes out, major and minor alarms turn off

[8] Set **LV-CAL** switch to **BAT**

AND

[9] At SSP depress **ALARM RELEASE** pushbutton

[10] Set plant voltmeter selector switch to **BATTERY**

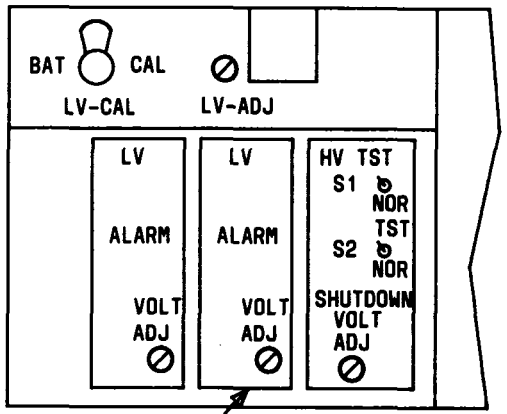


FIG. 1

NOTES

1. **LV-ADJ** is 10 turn pot. not equipped with stop
2. At approximately 50.75 volts, **LV1** low monitor should turn on to light **HLV** lamp and turn on minor alarm

Issue 2	JUL 1980
233-144-100	DLP
PAGE 1 of 1	526

ADJUST LV2 PLANT VOLTAGE MONITOR

ADJUST HV MONITOR TO INCREASE SHUTDOWN LEVEL

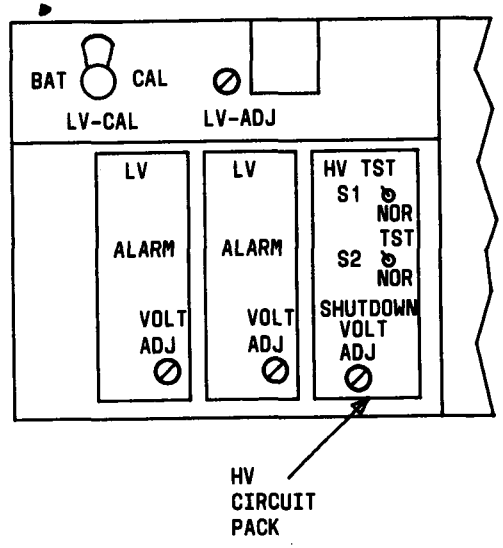


FIG. 1

At **151A PWR PLANT CONTROL UNIT:**

[1] See FIG. 1. Open circuit pack door and on **HV** circuit pack, set **S1** switch to **NOR**

Major alarm turns off, **HLV** lamp goes out

[2] Rotate **SHUTDOWN VOLT ADJ** potentiometer 1/4 turn cw

[3] Wait approximately 30 seconds

[4] Set **S1** switch to **TST**

AND

[5] Does major alarm turn on and **HLV** lamp light

No

[6] Set **S1** switch to **NOR**

Yes

[8] Repeat from Step 1

[7] On SSP depress **ALARM RELEASE** pushbutton

Issue 2	JUL 1980
233-144-100	DLP
PAGE 1 of 1	527

At **151A PWR PLANT CONTROL UNIT**:

[1] Open circuit pack door and on **HV** circuit pack set both **S1** and **S2** switches to **TST**

[2] Rotate **SHUTDOWN VOLT ADJ** potentiometer ccw until major alarm turns on

HLV lamp lights

[3] Rotate **SHUTDOWN VOLT ADJ** potentiometer additional 1/8 turn ccw

[4] Wait approximately 30 seconds

AND

[5] Set both **S1** and **S2** switches to **NOR**

HLV lamp goes out

[6] At SSP, depress **ALARM RELEASE** pushbutton

ADJUST HV MONITOR TO DECREASE SHUTDOWN LEVEL

Issue 2	JUL 1980	
233-144-100		DLP
PAGE 1 of 1		528

SUMMARY

See NOTES 1 and 2. Adjust rectifiers for DMM indication of 52.08 Vdc. Ammeter on each rectifier should indicate some load current.

[1] See NOTE 1. Does **OUTPUT CURRENT** ammeter on each rectifier indicate some load current

Yes

No

[2] On rectifiers with no current indication, if equipped, loosen locking device and rotate **OUTPUT VOLTS ADJUST** rheostat slowly cw until rectifier ammeter indicates some load current

[3] See NOTE 2. What voltage does DMM indicate

52.08V

[4] If equipped, tighten locking device on **OUTPUT VOLTS ADJUST** rheostat for individual rectifiers

More than 52.08V

[5] On rectifiers with highest current indication, if equipped, loosen locking device and rotate **OUTPUT VOLTS ADJUST** rheostat slightly ccw

[6] Repeat from Step 1 until battery bus voltage is set

Less than 52.08V

[7] On rectifiers with lowest current indication, if equipped, loosen locking device and rotate **OUTPUT VOLTS ADJUST** rheostat slightly cw

[8] Repeat from Step 1 until battery bus voltage is set

NOTES

1. Rectifiers are not required to share plant load current equally
2. Charge voltage is determined by local requirements. Refer to office records for exact setting. In absence of local requirements, charge voltage is at a level that produces 52.08 Vdc measured at battery bus

ADJUST BATTERY BUS VOLTAGE AND RECTIFIER OUTPUT CURRENT

SUMMARY

Ensure that Side 1 is nonactive and then remove from service

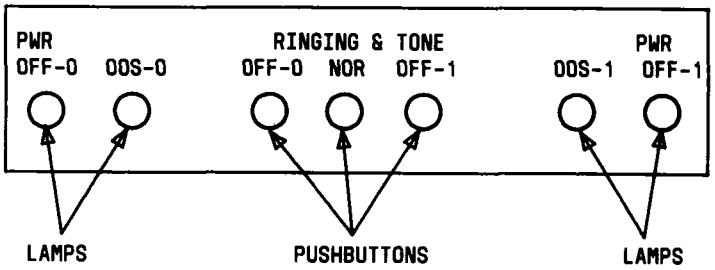


FIG. 1 – Ringing & Tone Panel

[1] At TTY type OP:RT:STAT!

[2] Is RT Side 0 or Side 1 nonactive

RT Side 1 Nonactive

RT Side 0 Nonactive

[3] At TTY type SW:RT!

[4] Does TTY indicate IP or NG

IP

NG

TAP-198

[5] Does TTY printout indicate REPT RT 0 ACT

No

Yes

[6] At TTY type RMV:RT 1!

[7] Does TTY printout indicate RMV RT 1

No

Yes

[8] See FIG. 1. Does **OOS-1** lamp light on **RINGING & TONE** panel

Yes

No

TAP-190

REMOVE RT SIDE 1 FROM SERVICE

Issue 2	JUL 1980
233-144-100	DLP
PAGE 1 of 1	540

SUMMARY

Connect DMM across -48 volt fuse load terminal and associated ground terminal strip [FIG. 1]. DMM should indicate between -48.0 and -52.5 Vdc. Connect DMM across +48 volt load terminal and associated ground terminal strip. DMM should indicate between +51.0 and +52 Vdc. Depress **OFF-1** pushbutton.

[1] Condition DMM to measure approximately 100 Vdc

[2] See FIG. 1. At **MP** frame on rear of 48-volt fuse panel below **INVERTER**, connect DMM across one fuse load terminal and associated ground terminal strip on **F9** to **F16** fuse block

AND

[3] Does DMM indicate between -48.0 and -52.2 Vdc

Yes → Page 2

No → [4] Trouble is in DC power distribution circuit. Refer trouble to installation group

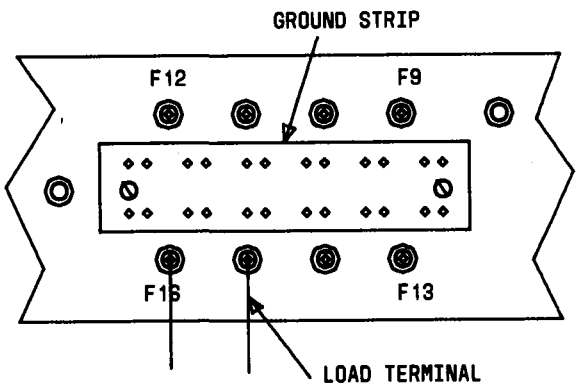
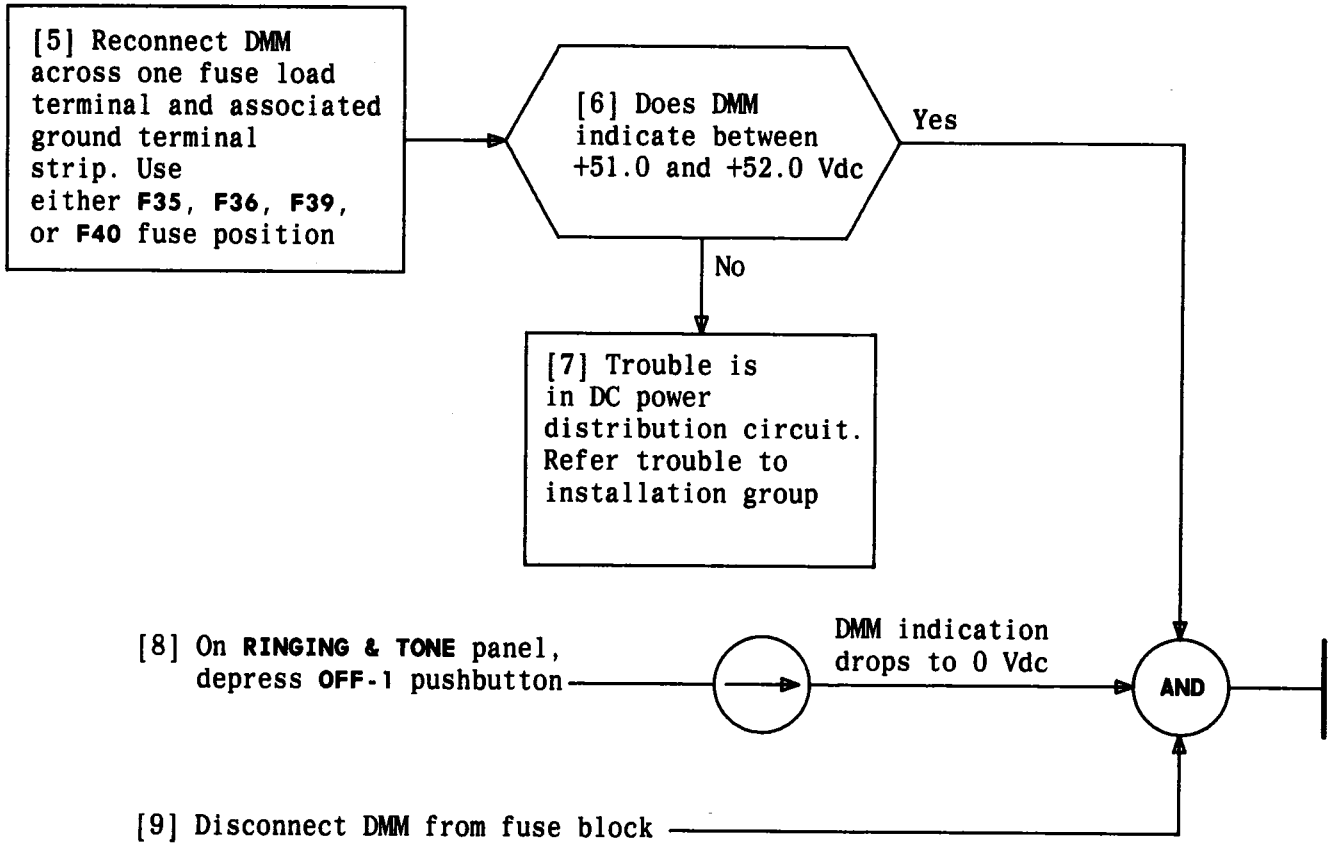


FIG. 1 - Fuse Block – Typical Connection – Rear View

MEASURE –48 VOLT AND +48 VOLT INPUT VOLTAGE – SIDE 1



MEASURE –48 VOLT AND +48 VOLT INPUT VOLTAGES – SIDE 1

SUMMARY

See DANGER 1, DANGER 2, CAUTION 1, and WARNING 1. Connect DMM between terminal 12(+) and 14(–) on rear of oscillator circuit pack connector. Depress **NOR** pushbutton. DMM should indicate 2.540 to 2.660 volts. Connect frequency counter between terminals 12(+) and 14(–). Output frequency is in accordance with TABLE B. Depress **OFF-1** pushbutton. Disconnect frequency meter. Repeat check for each oscillator.

[1] See CAUTION 1 and WARNING 1. Condition DMM to measure approximately 10V rms

[2] Connect one connecting clip to each DMM lead

At **MP** frame on rear of **RINGING & TONE** plant:

[3] See DANGER 1, DANGER 2, TABLE A, and FIG. 1. Use connecting clip to connect DMM(-) lead to terminal **14** (GRD) on oscillator connector

[4] Use connecting clip to connect DMM(+) lead to terminal **12** on oscillator connector

[5] On **RINGING & TONE** panel, depress **NOR** pushbutton

AND → Page 2

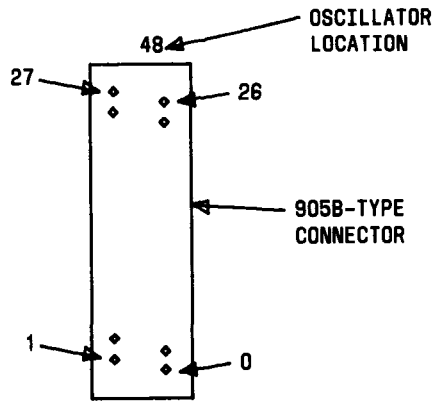


FIG. 1 - Oscillator Connector – Rear View

TABLE A		
CIRCUIT PACK CODE	CIRCUIT PACK LOCATION	OSCILLATOR BEING CHECKED
A980 or A1151	0-7-48	350-1
A981 or A1152	0-7-46	440-1
A982 or A1153	0-9-48	480-1
A983 or A1154	0-9-46	620-1

WARNING 1

Erroneous reading and damage to equipment may result if DMM is not isolated from ground

CAUTION 1

Tone voltages to be measured are complex ac waveforms. A True RMS indicating voltmeter is required to accurately adjust voltage levels. Peak and average ac voltmeters produce inaccurate readings

DANGERS

1. ***Voltage potentials of up to 400 volts to ground are present at rear of plant***
2. ***Isolation of DMM from ground creates potential hazard. Avoid bodily contact between test meter and other components, conductors, or ground***

CHECK TONE OSCILLATORS – SIDE 1

[6] Does DMM indicate between 2.540 and 2.660V rms

No → TAP-191

Yes

[7] Disconnect DMM from connector

[8] Set frequency counter controls per FIG. 2

[9] Connect one connecting clip to each frequency counter lead

AND

At rear of **RINGING & TONE** plant:

[10] Connect ground lead of frequency counter at terminal 14 on oscillator connector

[11] Connect frequency counter input lead (+) at terminal 12 on oscillator connector

AND → Page 3

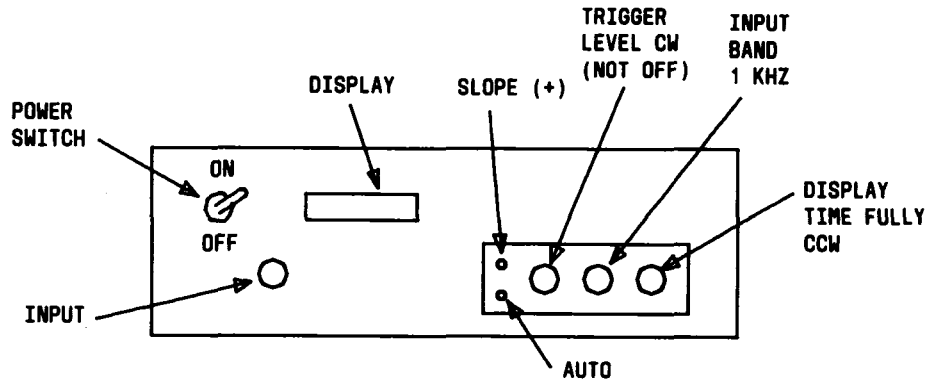


FIG. 2

CHECK TONE OSCILLATORS – SIDE 1

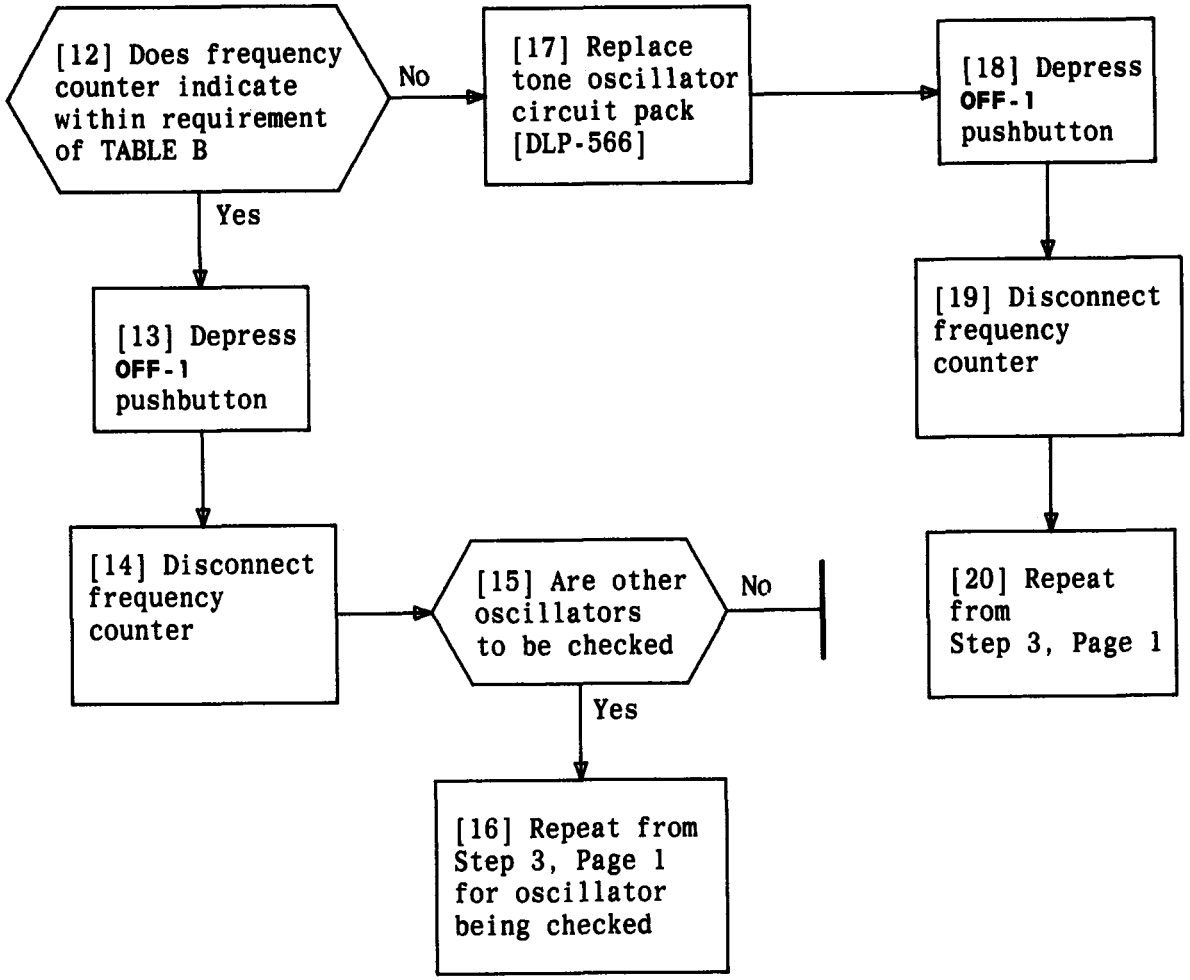


TABLE B

OSCILLATOR CIRCUIT PACK		FREQUENCY RANGE – HERTZ
CODE	FREQUENCY	
A980 or A1151	350	348.250 to 351.750
A981 or A1152	440	437.800 to 442.200
A982 or A1153	480	477.600 to 482.400
A983 or A1154	620	616.900 to 623.100

CHECK TONE OSCILLATORS – SIDE 1

SUMMARY

See DANGER 1, DANGER 2, CAUTION 1, and WARNING 1. Connect DMM across **A1111** connector terminals as given in TABLE A. Depress **NOR** pushbutton. DMM should indicate voltage level in TABLE B. Depress **OFF-1** pushbutton. Repeat check for each tone amplifier

[1] Condition DMM to measure appproximately 1 Vac

[2] See CAUTION 1 and WARNING 1. Connect one connecting clip to each DMM lead

[3] See DANGER 1, DANGER 2, and FIG. 1. At **MP** frame on rear of **RINGING & TONE** plant, use connecting clips to connect DMM leads across terminals of **A1111** circuit pack connector as given in TABLE A

[4] On **RINGING & TONE** panel, depress **NOR** pushbutton

AND

Page 2

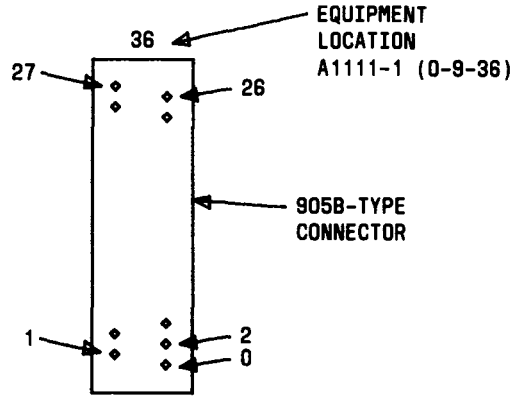


FIG. 1 - A1111 Connector – Rear View

WARNING 1

Erroneous reading and damage to equipment may result if DMM is not isolated from ground

CAUTION 1

Tone voltages to be measured are complex ac waveforms. A TRUE RMS indicating voltmeter is required to accurately adjust voltage levels. Peak and average ac voltmeters produce inaccurate readings.

DANGERS

1. ***Voltage potentials of up to 400 volts to ground are present at rear of plant***
2. ***Isolation of DMM from ground creates potential hazard. Avoid bodily contact between test meter and other components, conductors, or ground***

CHECK TONE AMPLIFIERS – SIDE 1

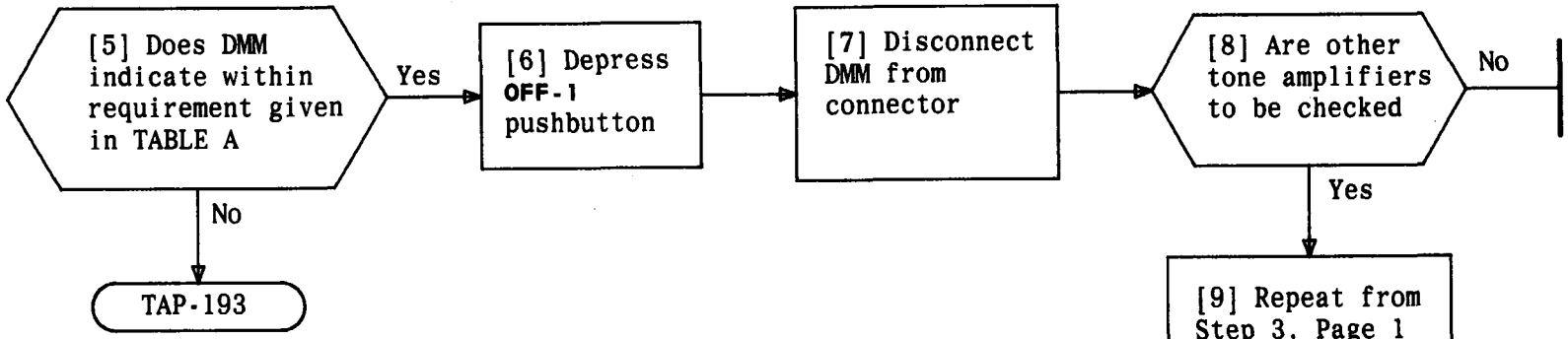


TABLE A		
TONE AMPLIFIER	DMM CONNECTIONS AT A1111 CONNECTOR	VOLTAGE RANGE-VOLTS RMS
TT	14 and 25	1.02 to 1.38
AR	2 and 10	0.306 to 0.414
BT	18 and 22	0.170 to 0.230
MT	16 and 24	0.408 to 0.552
HT	5 and 7	0.246 to 0.334

CHECK TONE AMPLIFIERS – SIDE 1

SUMMARY

Remove oscillator circuit pack associated with low voltage monitor as given in TABLE A. Depress **NOR** pushbutton. Restore Side 1 of plant to service. TTY printout should indicate low voltage alarm. Depress **OFF-1** pushbutton. Install oscillator circuit pack. Depress **NOR** pushbutton. Restore Side 1 of plant to service. TTY printout should indicate low voltage alarm has cleared. Remove Side 1 of plant from service. Depress **OFF-1** pushbutton. Repeat for each additional monitor in side of plant.

[1] At **MP** frame on **RINGING & TONE** plant, use 723B circuit pack puller to remove oscillator circuit pack as given in TABLE A for voltage monitor being checked

[2] On **RINGING & TONE** panel, depress **NOR** pushbutton

[3] At TTY, type message RST:RT 1;UCL!

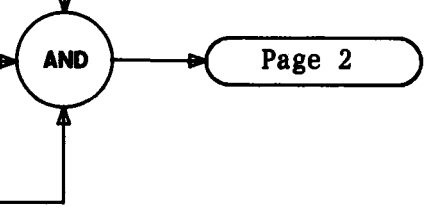


TABLE A

LOW VOLTAGE MONITOR BEING CHECKED	OSCILLATOR TO BE REMOVED	OSCILLATOR LOCATION	CIRCUIT PACK CODE
TTLV1	350-1	0-7-43	A980 or A1151
ARLV1	440-1	0-7-46	A981 or A1152
BTLV1	620-1	0-9-46	A983 or A1154
MTLV1	440-1	0-7-46	A981 or A1152
HTLV1	480-1	0-9-48	A982 or A1153

TEST LOW VOLTAGE MONITORS – SIDE 1

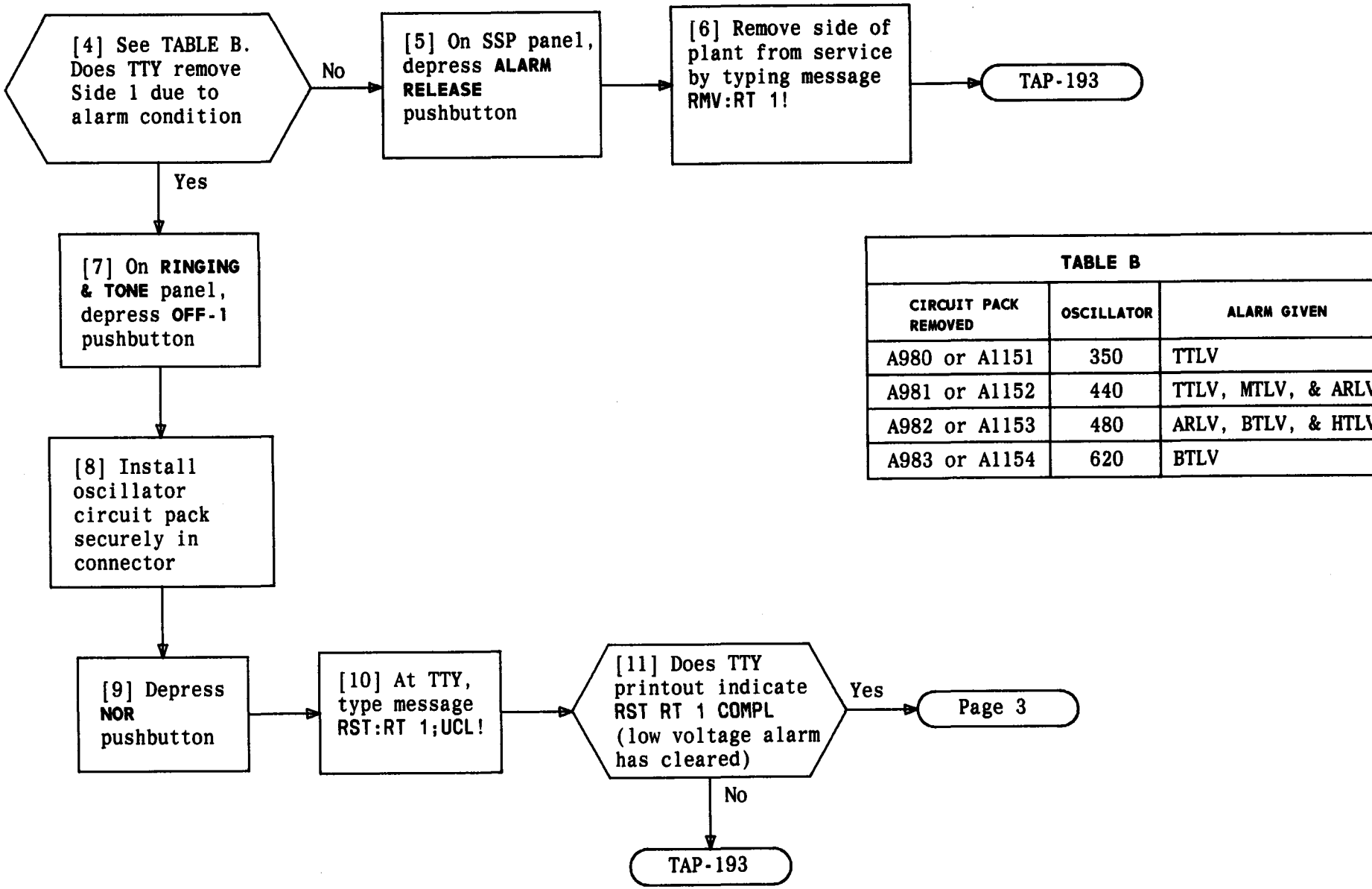


TABLE B		
CIRCUIT PACK REMOVED	OSCILLATOR	ALARM GIVEN
A980 or A1151	350	TTLV
A981 or A1152	440	TTLV, MTLV, & ARLV
A982 or A1153	480	ARLV, BTLV, & HTLV
A983 or A1154	620	BTLV

TEST LOW VOLTAGE MONITORS – SIDE 1

[12] Remove side of plant from service by typing message RMV:RT 1!

[13] On **RINGING & TONE** panel, depress **OFF-1** pushbutton

[14] On SSP panel, depress **ALARM RELEASE** pushbutton

[15] Which low voltage monitor is being checked

TTLV, ARLV, BTLV

MTILV, MTLV

[16] Is other low voltage monitor to be checked

No

Yes

[17] Repeat from Step 1, Page 1 for low voltage monitor to be checked

[18] Use 723B circuit pack puller to remove oscillator circuit pack as given in TABLE C for low voltage monitor being checked

[19] Depress **NOR** pushbutton

[20] At TTY, type message RST:RT 1;UCL!

[21] Does TTY remove Side 1 due to alarm condition [TABLE B, Page 2]

No

Yes

[22] Remove side of plant from service by typing message RMV:RT 1!

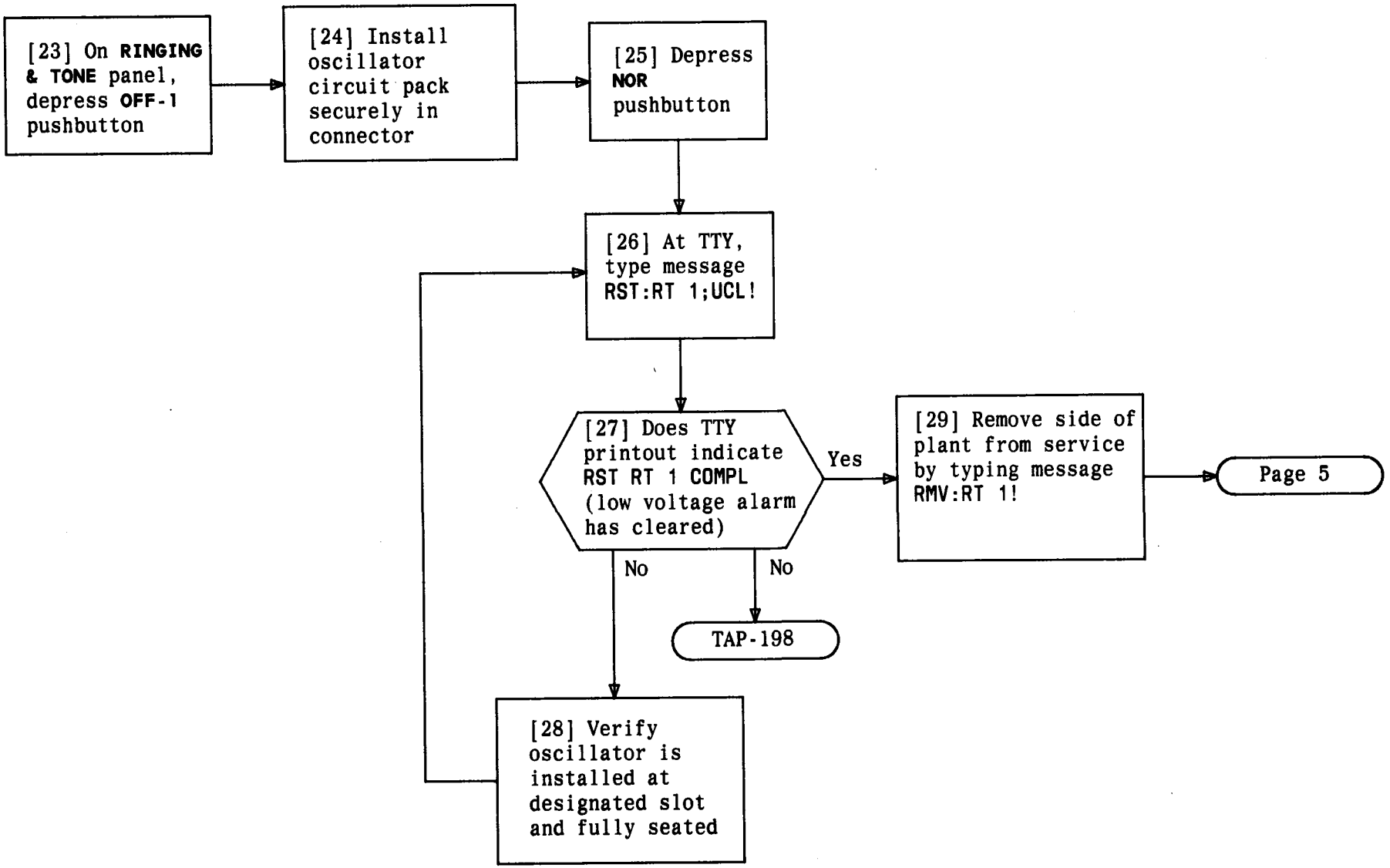
TAP-193

Page 4

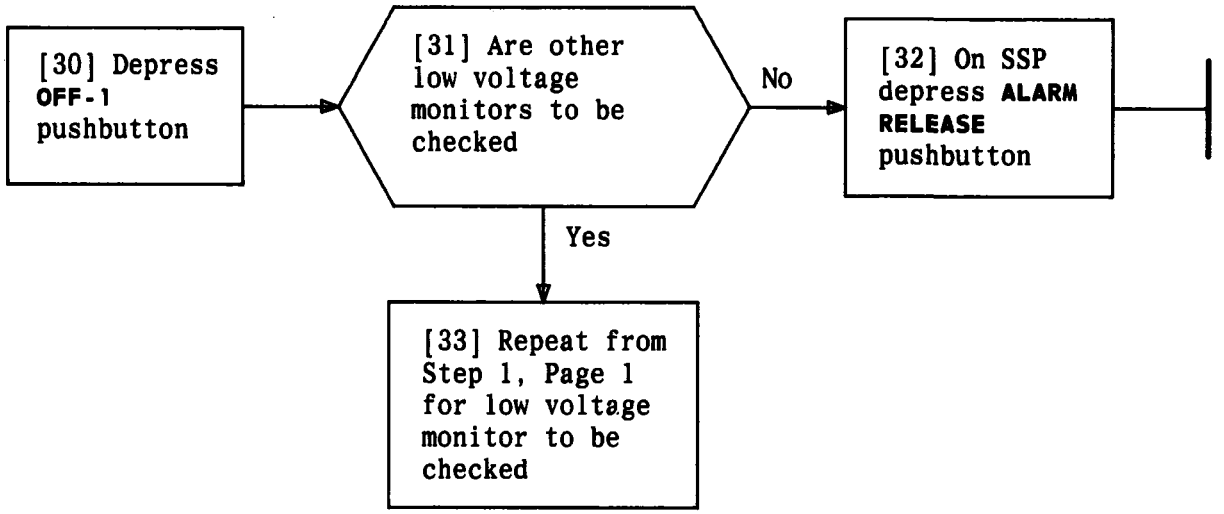
TABLE C

LOW VOLTAGE MONITOR BEING CHECKED	OSCILLATOR TO BE REMOVED	OSCILLATOR LOCATION	CIRCUIT PACK CODE
TTLV1	440-1	0-7-46	A981 or A1152
ARLV1	480-1	0-9-48	A982 or A1153
BTLV1	480-1	0-9-48	A982 or A1153

TEST LOW VOLTAGE MONITORS — SIDE 1



TEST LOW VOLTAGE MONITORS – SIDE 1



TEST LOW VOLTAGE MONITORS – SIDE 1

SUMMARY	
See DANGER 1, DANGER 2, and WARNING 1. Depress **NOR** pushbutton. Measure ac outputs as given in TABLE A. Voltage requirements should be met as given IN TABLE A.	Connect frequency counter at **INVERTER TB2** terminals **8** and **9**. Frequency should be 19.25 to 20.05 Hz. Depress **OFF-1** pushbutton.

[1] See WARNING 1. Condition DMM to measure approximately 100 Vac

[2] See DANGER 1, DANGER 2, and FIG. 1. At **MP** frame on rear of **RINGING & TONE** plant for inverter being checked, locate **TB2** terminal board and connect DMM per TABLE A

[3] On **RINGING & TONE** panel, depress **NOR** pushbutton

PWR OFF lamp off

AND

Page 2

TABLE A

INVERTER OUTPUT	DMM CONNECTION AT TERMINALS ON INVERTER TB2 TERMINAL BOARD	OUTPUT VOLTAGE REQUIREMENT
86(A)	8 and 9	84.5 to 88.0
86(B)	4 and 5	
97(A)	8 and 10	94.5 to 101.0
97(B)	4 and 6	
105(A)	8 and 11	103.0 to 110.0
105(B)	4 and 7	
105(C)	1 and 3	

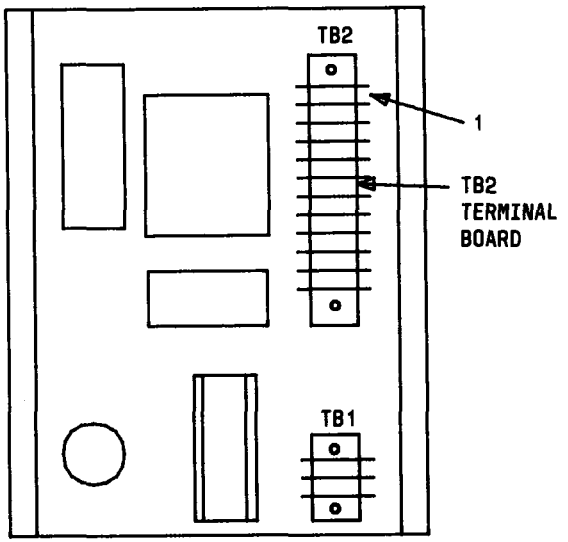


FIG. 1

WARNING 1

Erroneous reading and damage to equipment may result if DMM is not isolated from ground

DANGERS

1. ***Voltage potentials of up to 400 volts to ground are present at rear of plant***
2. ***Isolation of DMM from ground creates potential hazard. Avoid bodily contact between test meter and other components, conductors, or ground***

CHECK 20-HZ INVERTER – SIDE 1

[4] Are output voltage requirements met in TABLE A for inverter 86-, 97-, and 105-Volt outputs

Yes

No

TAP-194

[5] On **RINGING & TONE** panel, depress **OFF-1** pushbutton

[6] Disconnect DMM

[7] Set frequency counter controls per FIG. 2

[8] At **INVERTER TB2**, connect frequency counter across terminals **8** (common) and **9**

[9] Depress **NOR** pushbutton

AND

Page 3

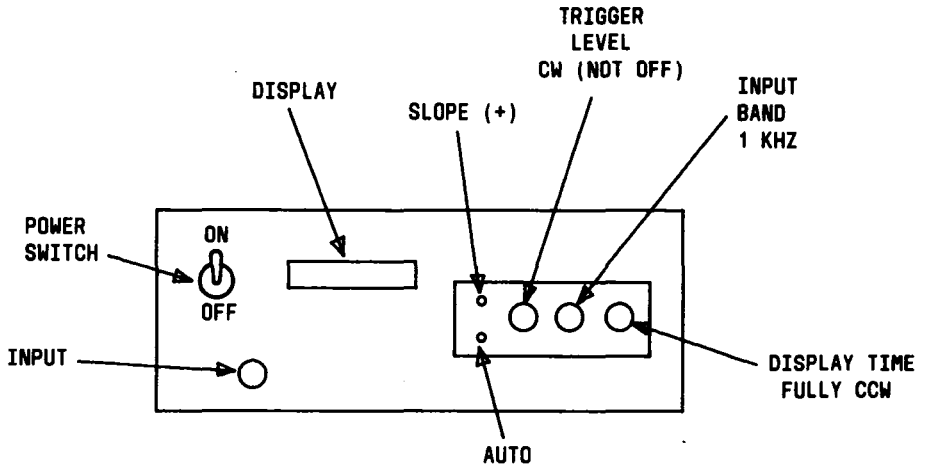
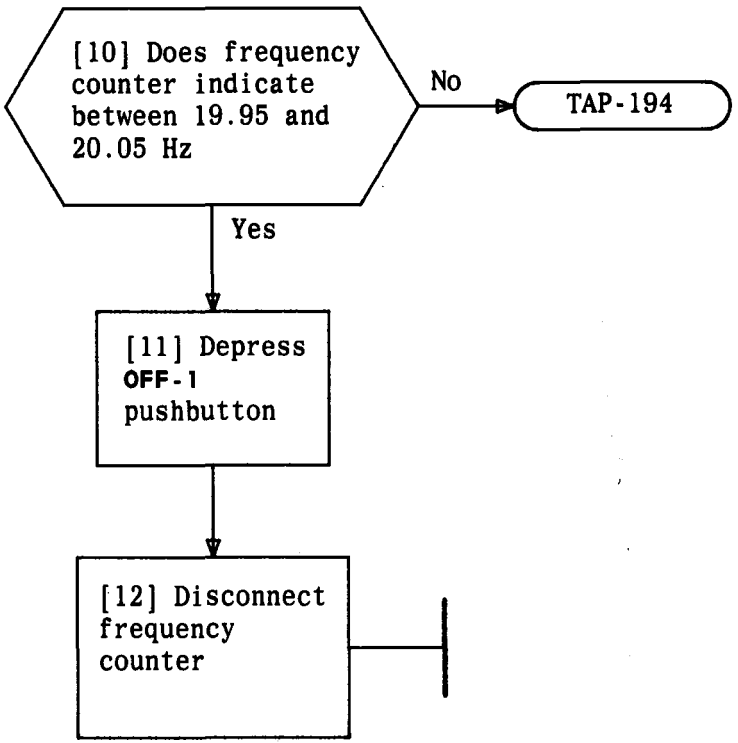


FIG. 2

CHECK 20-HZ INVERTER – SIDE 1



CHECK 20-HZ INVERTER – SIDE 1

SUMMARY

See DANGER 1, FIG. 1, and FIG. 2. Connect 720A voltage pickup tool at **F32** spare fuse position. Depress **NOR** pushbutton. Restore Side 1 of plant to service. Touch tip of 411C test pick to test point on fuse cap of **F9**. **OFF-1** lamp should light, TTY printout should indicate **RT** fuse alarm. Remove test pick from fuse cap. **OFF-1** lamp should go out. Depress **OFF-1** pushbutton, then depress **NOR** pushbutton. Restore Side 1 of plant to service. TTY should indicate that fuse alarm has cleared. Test remainder of fuses [TABLES A and B] by observing that **OFF-1** lamp lights and then goes out when test connection is made at fuse cap and then is released. Depress **OFF-1** pushbutton.

[1] See DANGER 1 and FIG. 1. At distribution fuse panel located at bottom of miscellaneous power frame, using fuse alarm test cord, install 720A tool at **F32** position

[2] On **RINGING & TONE** panel, depress **NOR** pushbutton

[3] At TTY type message RST:RT 1;UCL!

[4] See FIG. 2. At **F9** fuse, touch tip of 411C test pick to test point on fuse cap

AND → Page 2

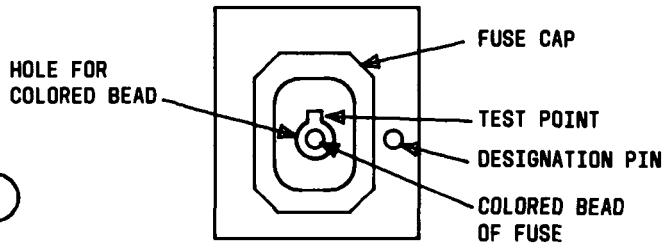


FIG. 2 – Alarm Fuse Cap – Typical

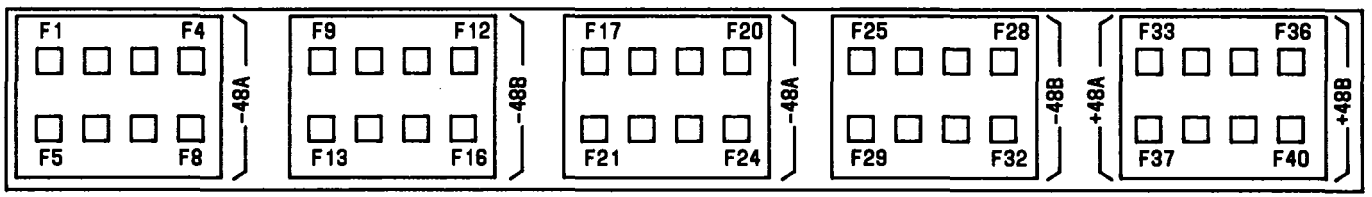
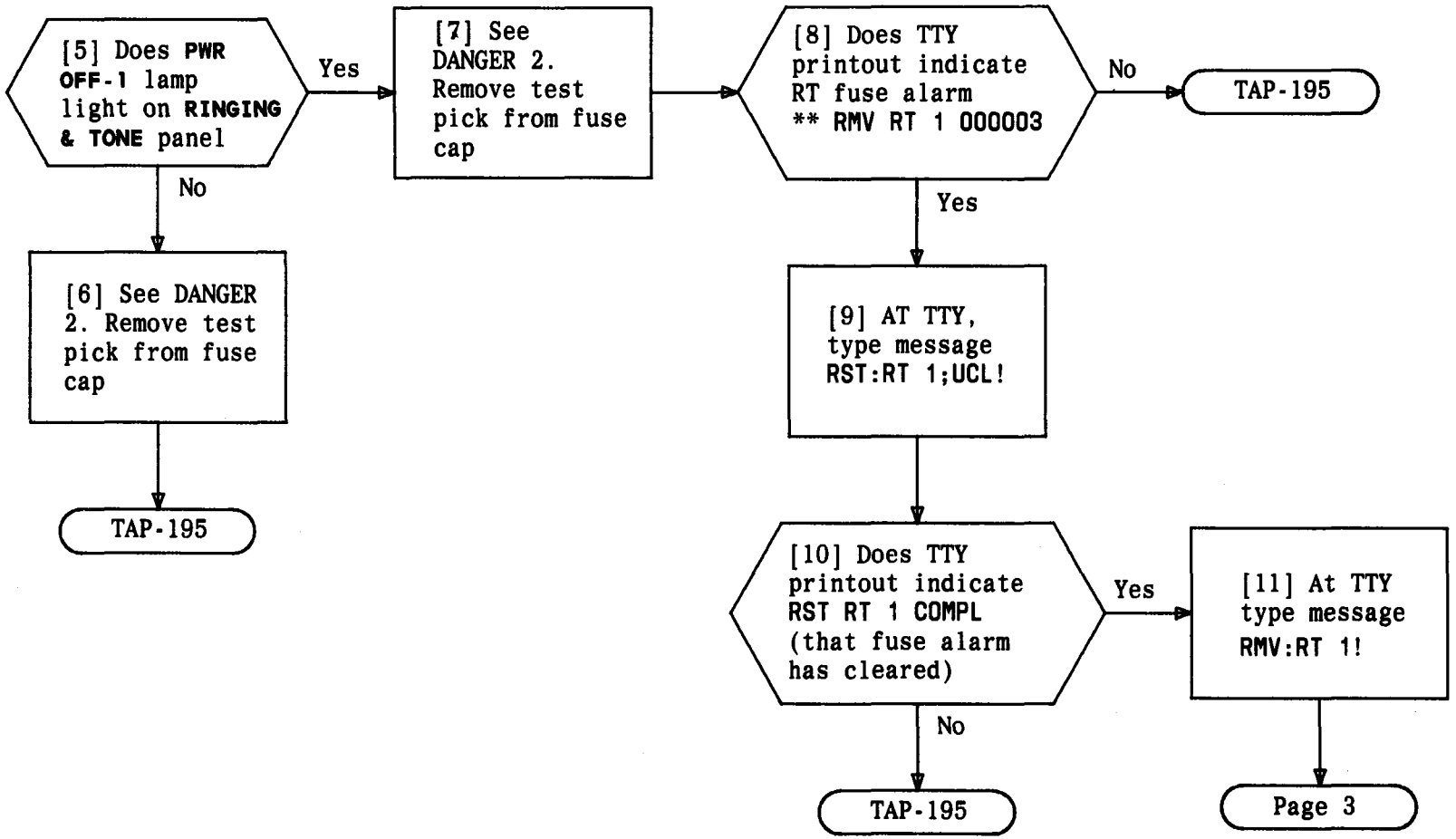


FIG. 1 - 48-Volt Distribution Fuse Panel

DANGER 1
When 720A tool is installed, 48-volt potential is present on tip of test pick

TEST 48-VOLT BATTERY DISTRIBUTION FUSE ALARMS – SIDE 1



DANGER 2
When 720A tool is installed, 48-volt potential is present on tip of test pick

Issue 2	JUL 1980
233-144-100	DLP
PAGE 2 of 4	546

TEST 48-VOLT BATTERY DISTRIBUTION FUSE ALARMS – SIDE 1

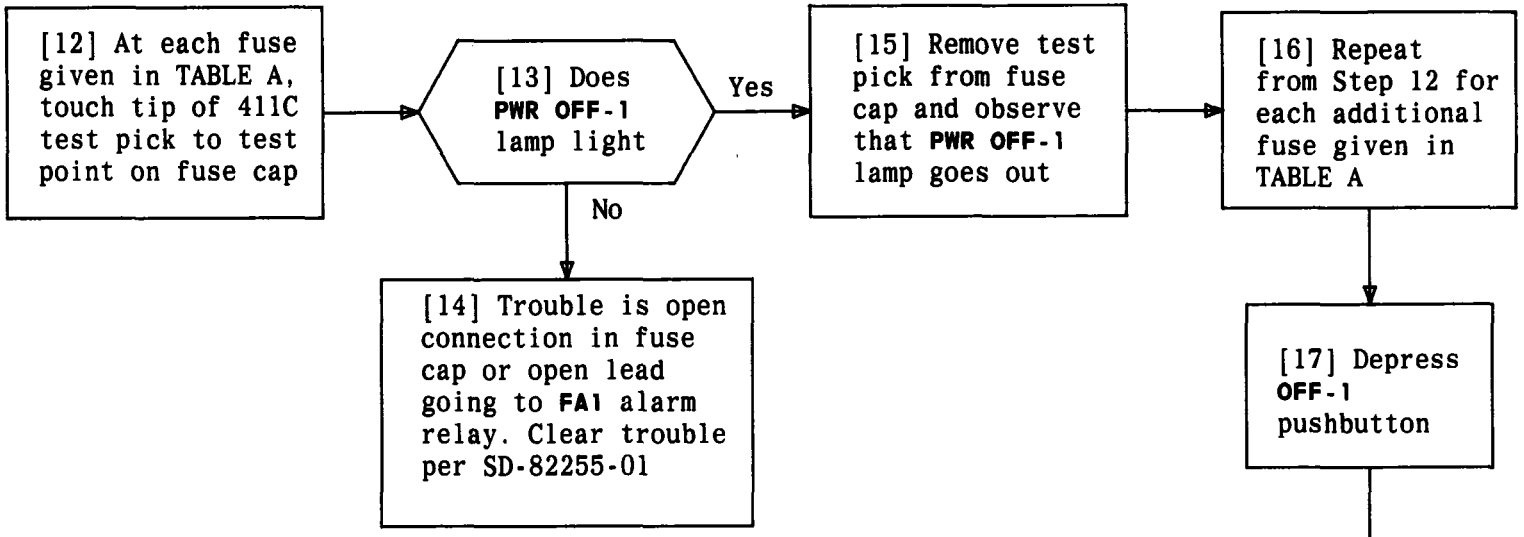


TABLE A

SPARE FUSE POSITION	FUSES ASSOCIATED WITH SPARE	ALARM RELAY
F32	F10 thru F16 F25 thru F31	FA1

TEST 48-VOLT BATTERY DISTRIBUTION FUSE ALARMS – SIDE 1

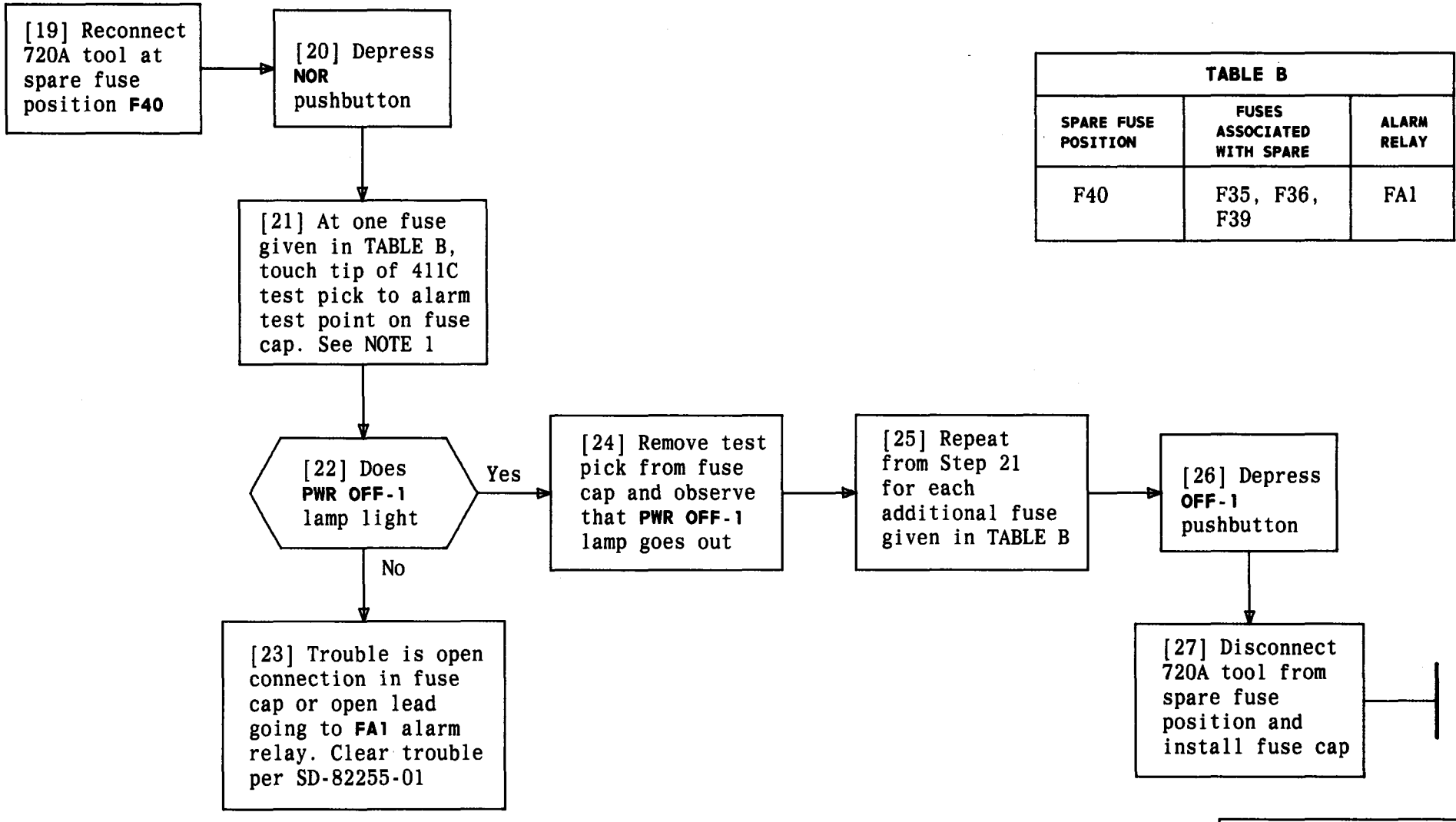


TABLE B

SPARE FUSE POSITION	FUSES ASSOCIATED WITH SPARE	ALARM RELAY
F40	F35, F36, F39	FA1

NOTE 1
F36 and F39 not equipped in all offices

TEST 48-VOLT BATTERY DISTRIBUTION FUSE ALARMS – SIDE 1

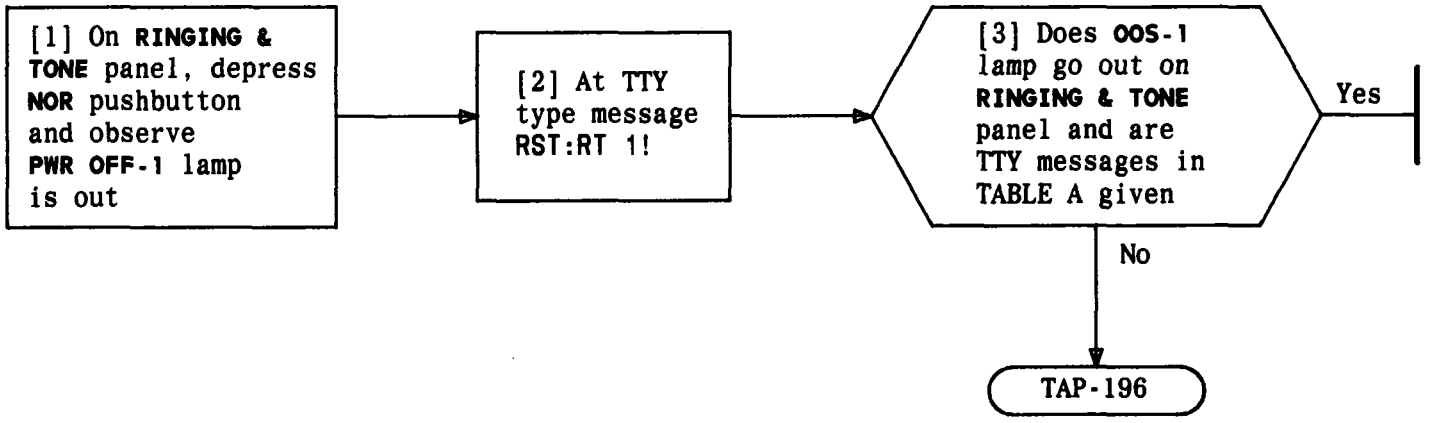


TABLE A
DGN RT1 ATP
RST RT1 COMPL

TURN UP AND RESTORE TO SERVICE RT SIDE 1

SUMMARY
Ensure that Side 0 is nonactive and then remove from service.

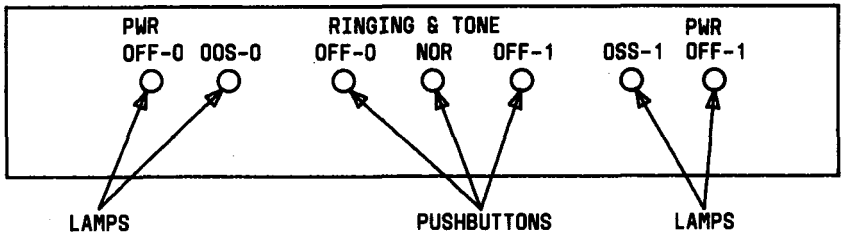


FIG. 1 – Ringing & Tone Panel

[1] At TTY type OP:RT:STAT!

[2] Is RT Side 0 or Side 1 nonactive

RT Side 0 Nonactive

RT Side 1 Nonactive

[3] At TTY type SW:RT!

[4] Does TTY printout indicate IP or NG

IP

NG

TAP-198

[5] Does TTY printout indicate REPT RT 1 ACT

No

Yes

[6] At TTY type RMV:RT 0!

[7] Does TTY printout indicate RMV RT 0

No

Yes

[8] See FIG. 1. Does **OOS-0** lamp light on **RINGING & TONE** panel

Yes

No

TAP-190

REMOVE RT SIDE 0 FROM SERVICE

SUMMARY

Connect DMM across -48 volt fuse load terminal and associated ground terminal strip [FIG. 1]. DMM should indicate between -48.0 and -52.5 Vdc. Connect DMM across +48 volt fuse load terminal and associated ground terminal strip. DMM should indicate between +51.0 and +52.0 Vdc. Depress **OFF-O** pushbutton.

[1] Condition DMM to measure approximately 100 Vdc

[2] See FIG. 1. At **MP** frame on rear of 48-volt fuse panel below **INVERTER**, connect DMM across one fuse load terminal and associated ground terminal strip on **F1** to **F8** fuse block

AND

[3] Does DMM indicate between -48.0 and -52.2 Vdc

Yes → Page 2

No → [4] Trouble is in DC power distribution circuit. Refer trouble to installation group

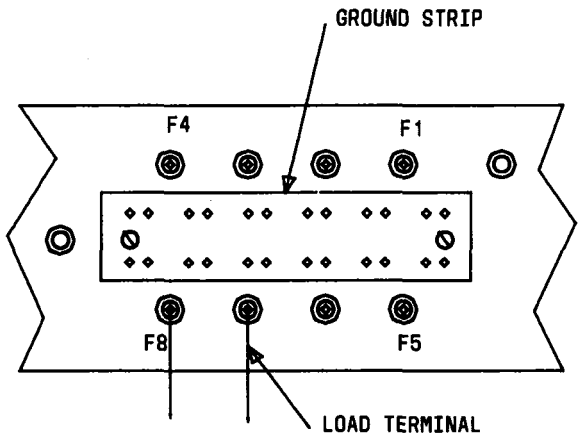
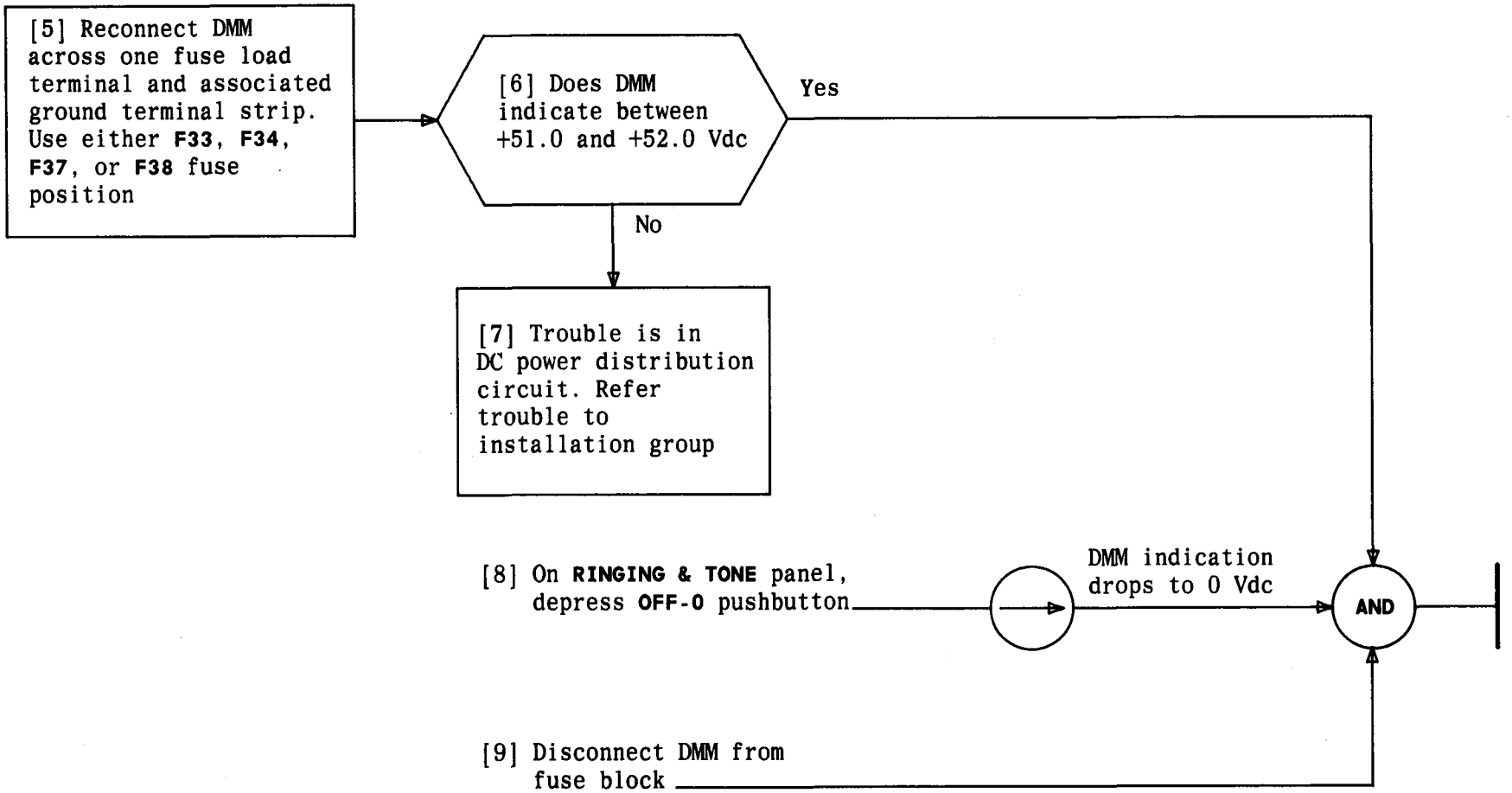


FIG. 1 – Fuse Block – Typical Connection – Rear View

MEASURE –48 VOLT AND +48 VOLT INPUT VOLTAGES – SIDE O



MEASURE –48 VOLT AND +48 VOLT INPUT VOLTAGES – SIDE 0

SUMMARY

See DANGER 1, DANGER 2, CAUTION 1, and WARNING 1. Connect DMM between terminal **12**(+) and **14**(-) on rear of oscillator circuit pack connector. Depress **NOR** pushbutton. DMM should indicate 2.540 to 2.660 volts rms. Connect frequency counter between terminals **12**(+) and **14**(-). Output frequency is in accordance with TABLE B. Depress **OFF-O** pushbutton. Repeat check for each oscillator.

[0] DEPRESS OFF-O PUSHBUTTON

[1] See CAUTION 1 and WARNING 1. Condition DMM to measure approximately 10V rms

[2] Connect one connecting clip to each DMM lead

At **MP** frame on rear of **RINGING & TONE** plant:

[3] See DANGER 1, DANGER 2, TABLE A, and FIG. 1. Use connecting clip to connect DMM(-) lead to terminal **14** (GRD) on oscillator connector

[4] Use connecting clip to connect DMM(+) lead to terminal **12** on oscillator connector

AND

Page 2

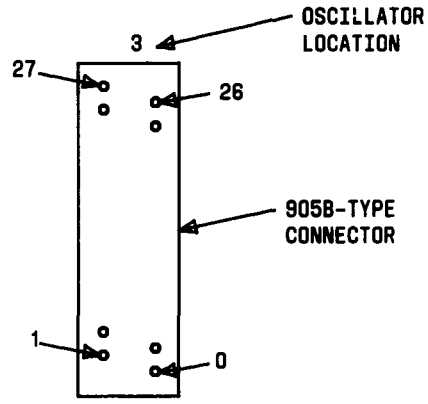


FIG. 1 – Oscillator Connector – Rear View

TABLE A		
CIRCUIT PACK CODE	CIRCUIT PACK LOCATION	OSCILLATOR BEING CHECKED
A980 or A1151	0-7-3	350-0
A981 or A1152	0-7-5	440-0
A982 or A1153	0-9-3	480-0
A983 or A1154	0-9-5	620-0

WARNING 1

Erroneous reading and damage to equipment may result if DMM is not isolated from ground

CAUTION 1

Tone voltages to be measured are complex ac waveforms. A True RMS indicating voltmeter is required to accurately adjust voltage levels. Peak and average ac voltmeters produce inaccurate readings

DANGERS

1. ***Voltage potentials of up to 400 volts to ground are present at rear of plant***
2. ***Isolation of DMM from ground creates potential hazard. Avoid bodily contact between test meter and other components, conductors, or ground***

CHECK TONE OSCILLATORS – SIDE 0

[5] On **RINGING & TONE** panel, depress **NOR** pushbutton

[6] Does DMM indicate between 2.540 and 2.660 volts rms

Yes

[7] Disconnect DMM from connector

No

TAP-191

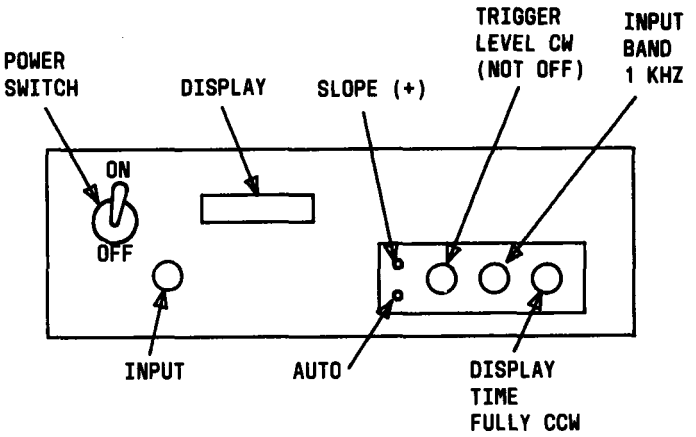


FIG. 2

[8] Set frequency counter controls per FIG. 2

[9] Connect one connecting clip to each frequency counter lead

AND

Frequency counter conditioned

At rear of **RINGING & TONE** plant:

[10] Connect ground lead of frequency counter at terminal 14 on oscillator connector

[11] Connect frequency counter input lead (+) at terminal 12 on oscillator connector

AND

Frequency counter connected

Page 3

CHECK TONE OSCILLATORS — SIDE 0

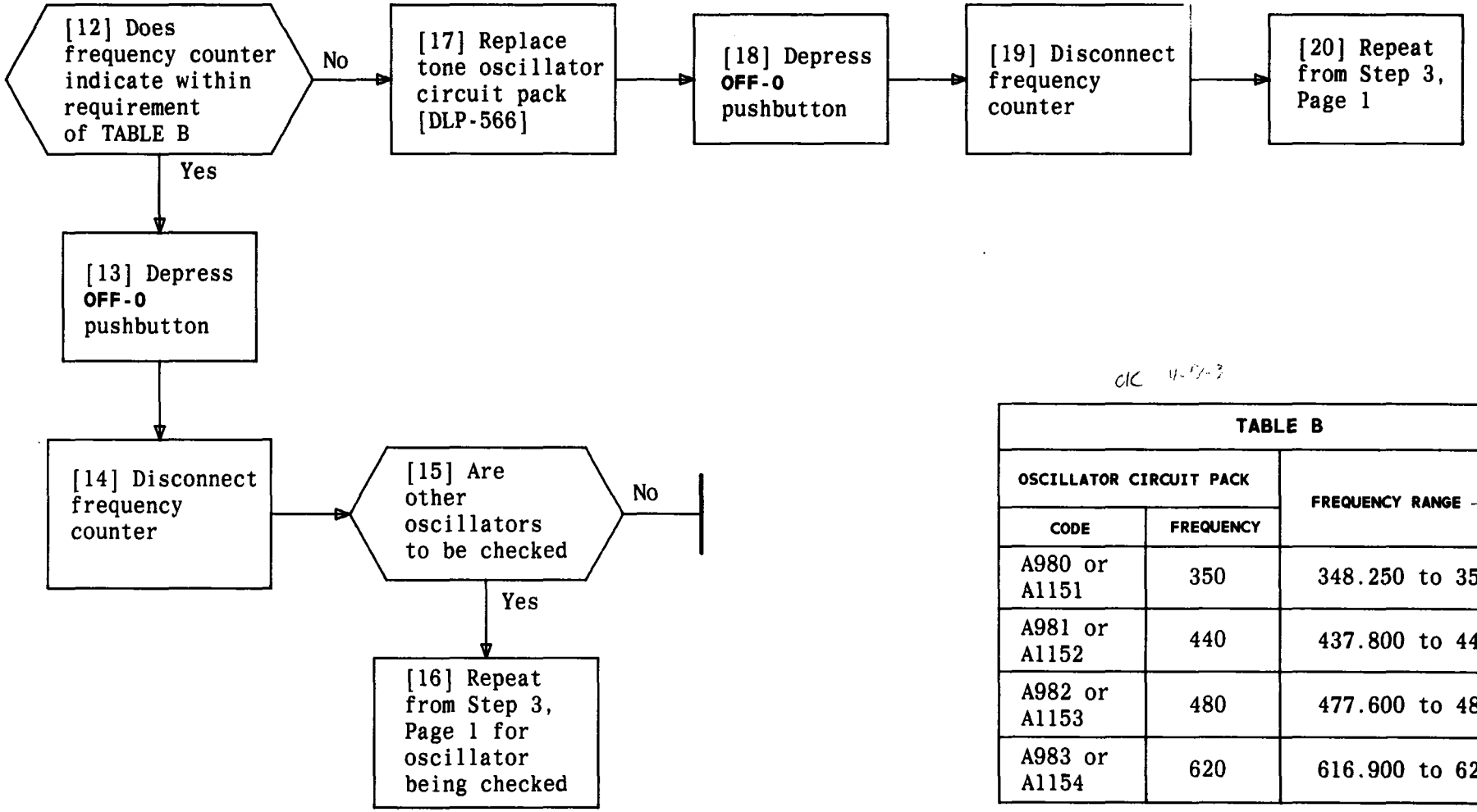


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TABLE B		
OSCILLATOR CIRCUIT PACK		FREQUENCY RANGE – HERTZ
CODE	FREQUENCY	
A980 or A1151	350	348.250 to 351.750
A981 or A1152	440	437.800 to 442.200
A982 or A1153	480	477.600 to 482.400
A983 or A1154	620	616.900 to 623.100

CHECK TONE OSCILLATORS – SIDE 0

SUMMARY

See DANGER 1, DANGER 2, CAUTION 1, and WARNING 1. Connect DMM across **A111** connector terminals as given in TABLE A. Depress **NOR** pushbutton. DMM should indicate voltage level in TABLE A. Depress **OFF-O** pushbutton. Repeat check for each tone amplifier.

[1] See CAUTION 1 and WARNING 1. Condition DMM to measure approximately 1V rms

[2] Connect one connecting clip to each DMM lead

AND

Page 2

[3] See DANGER 1, DANGER 2, and FIG. 1. At **MP** frame on rear of **RINGING & TONE** plant, use connecting clips to connect DMM leads across terminals of **A1111** circuit pack connector as given in TABLE A

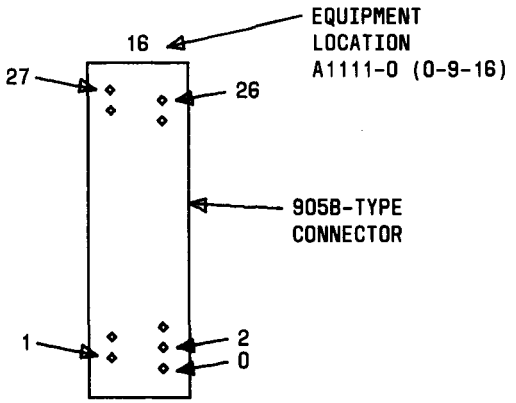


FIG. 1 – A1111 Connector – Rear View

WARNING 1

Erroneous reading and damage to equipment may result if DMM is not isolated from ground

CAUTION 1

Tone voltages to be measured are complex ac waveforms. A True RMS indicating voltmeter is required to accurately adjust voltage levels. Peak and average ac voltmeters produce inaccurate readings

DANGERS

1. ***Voltage potentials of up to 400 volts to ground are present at rear of plant***
2. ***Isolation of DMM from ground creates potential hazard. Avoid bodily contact between test meter and other components, conductors, or ground***

CHECK TONE AMPLIFIERS – SIDE 0

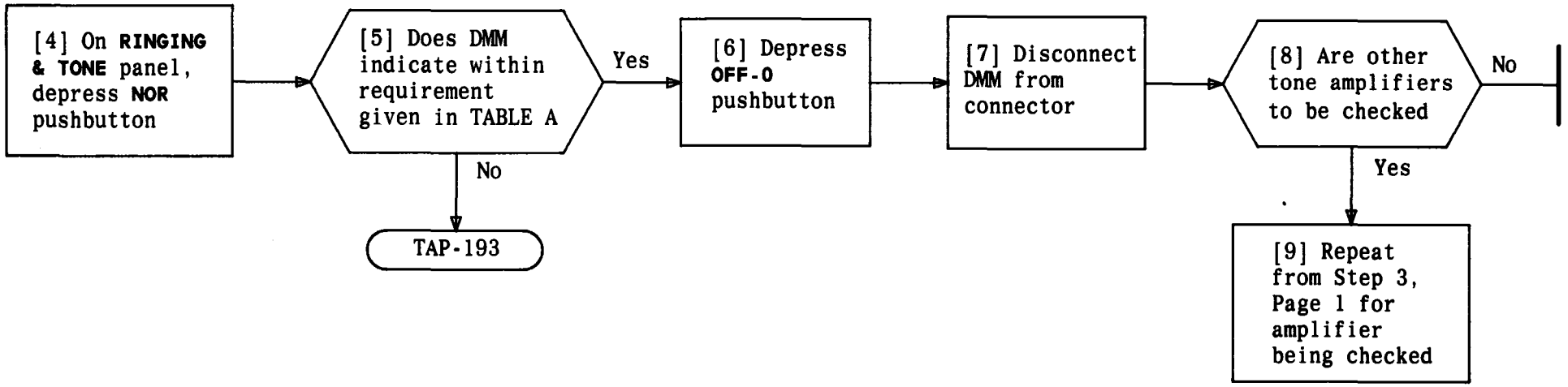


TABLE A		
TONE AMPLIFIER	DMM CONNECTION AT A1111 CONNECTOR	VOLTAGE RANGE-VOLTS RMS
TT	14 and 25	1.02 to 1.38
AR	2 and 10	0.306 to 0.414
BT	18 and 22	0.170 to 0.230
MT	16 and 24	0.408 to 0.552
HT	5 and 7	0.246 to 0.334

CHECK TONE AMPLIFIERS – SIDE 0

SUMMARY	
Remove oscillator circuit pack associated with low voltage monitor as given in TABLE A. Depress **NOR** pushbutton. Restore Side 0 of plant to service. TTY printout should indicate low voltage alarm. Depress **OFF-0** pushbutton.	Install oscillator circuit pack. Depress **NOR** pushbutton. Restore Side 0 of plant to service. TTY printout should indicate low voltage alarm has cleared. Remove Side 0 of plant from service. Depress **OFF-0** pushbutton. Repeat for each additional monitor in side of plant.

[1] At **MP** frame on **RINGING & TONE** plant, use 723B circuit pack puller to remove oscillator circuit pack as given in TABLE A for low voltage monitor being checked

[2] On **RINGING & TONE** panel, depress **NOR** pushbutton

[3] At TTY, type message RST:RT 0;UCL!

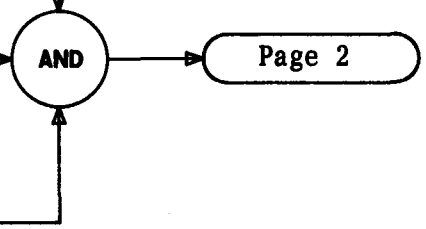


TABLE A

LOW VOLTAGE MONITOR BEING CHECKED	OSCILLATOR TO BE REMOVED	OSCILLATOR LOCATION	CIRCUIT PACK CODE
TTLV0	350-0	0-7-3	A980 or A1151
ARLV0	440-0	0-7-5	A981 or A1152
BTLV0	620-0	0-9-5	A983 or A1154
MTLV0	440-0	0-7-5	A981 or A1152
HTLV0	480-0	0-9-3	A982 or A1153

TEST LOW VOLTAGE MONITORS – SIDE 0

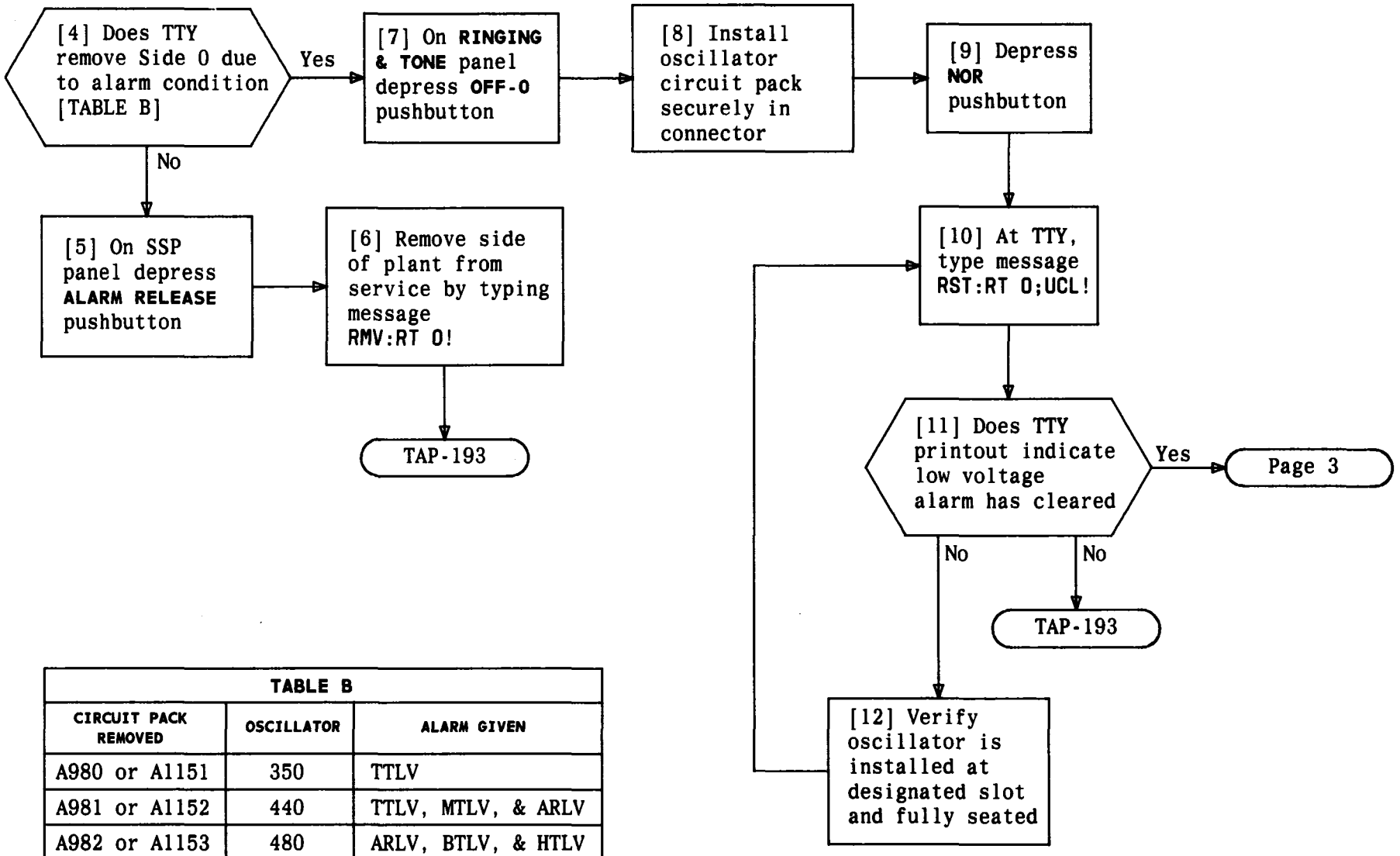


TABLE B		
CIRCUIT PACK REMOVED	OSCILLATOR	ALARM GIVEN
A980 or A1151	350	TTLV
A981 or A1152	440	TTLV, MTLV, & ARLV
A982 or A1153	480	ARLV, BTLV, & HTLV
A983 or A1154	620	BTLV

TEST LOW VOLTAGE MONITORS – SIDE 0

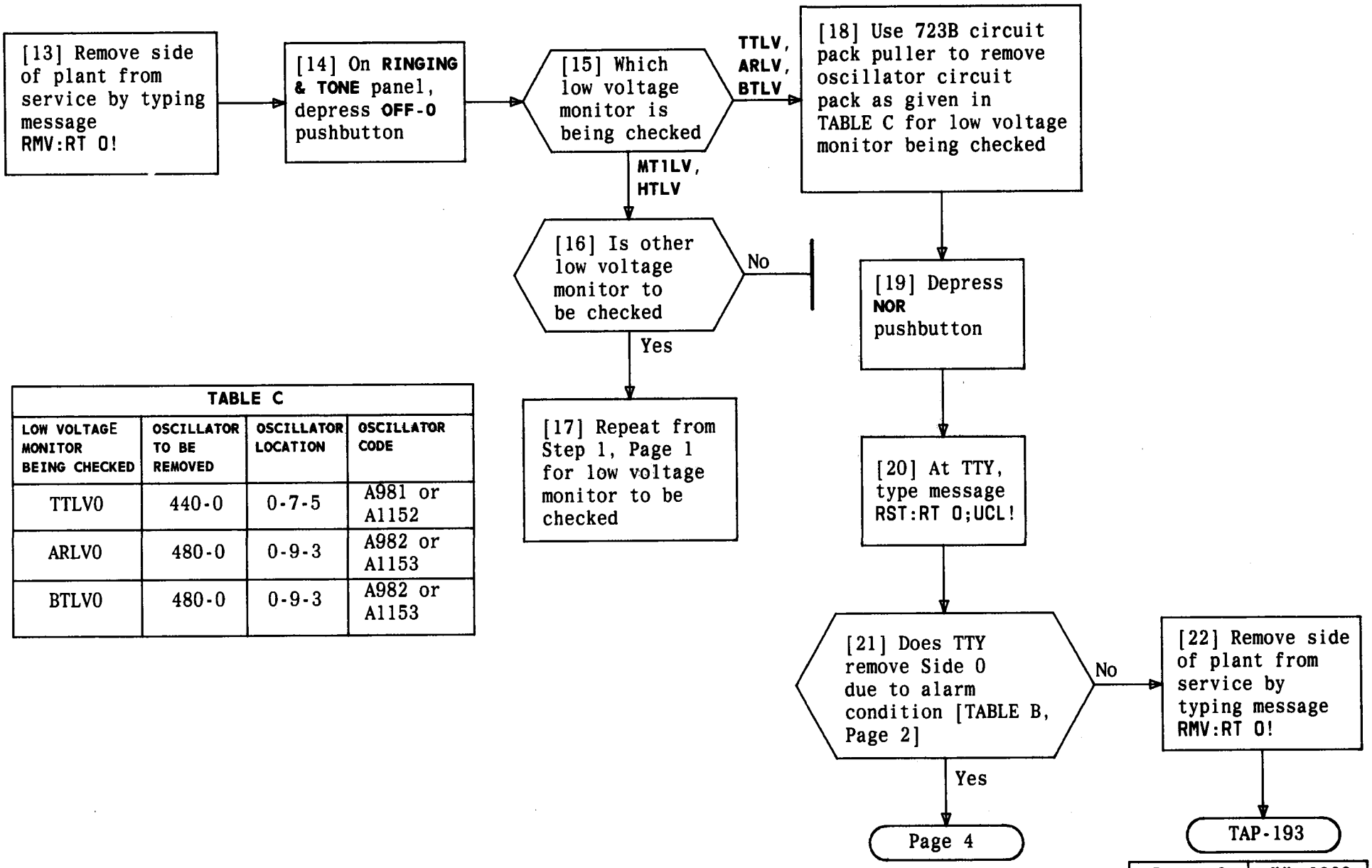
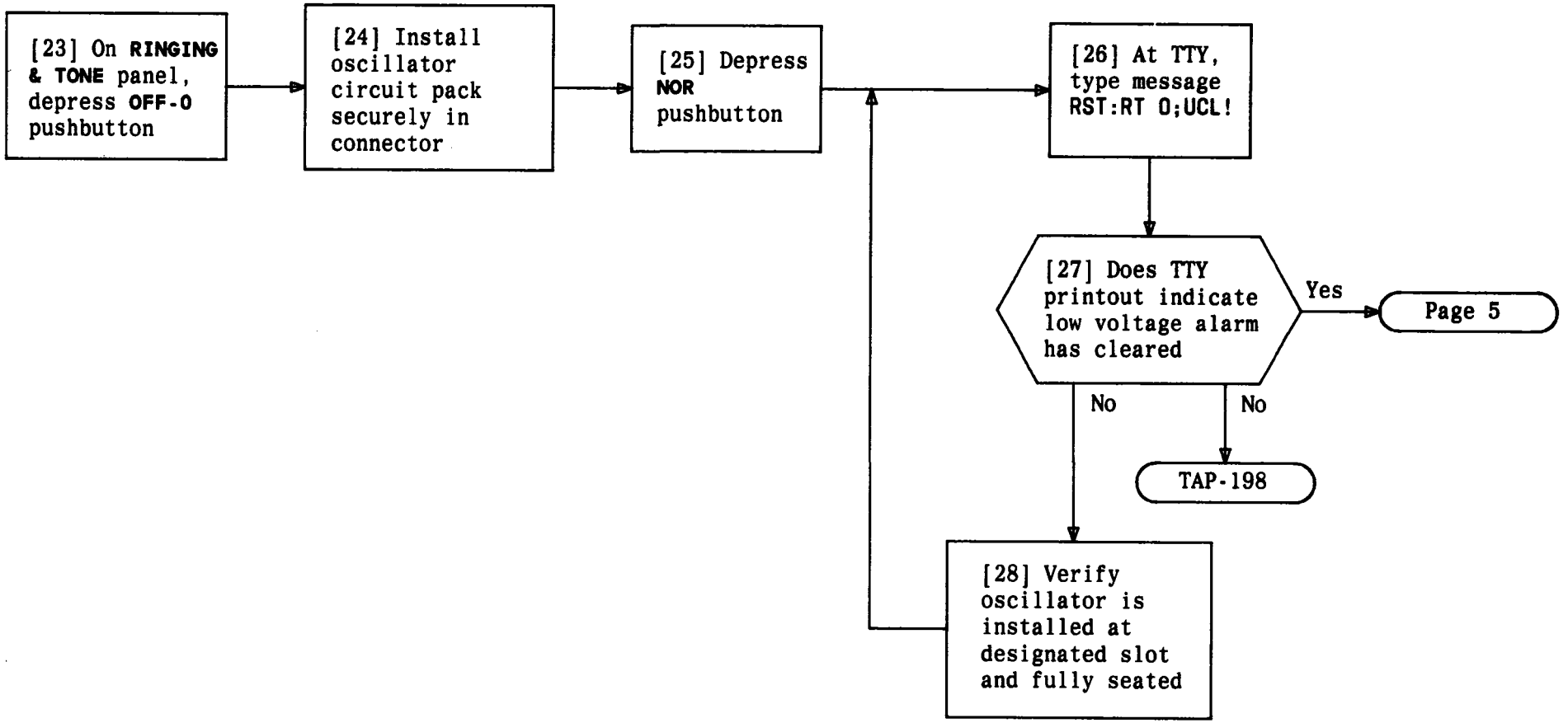


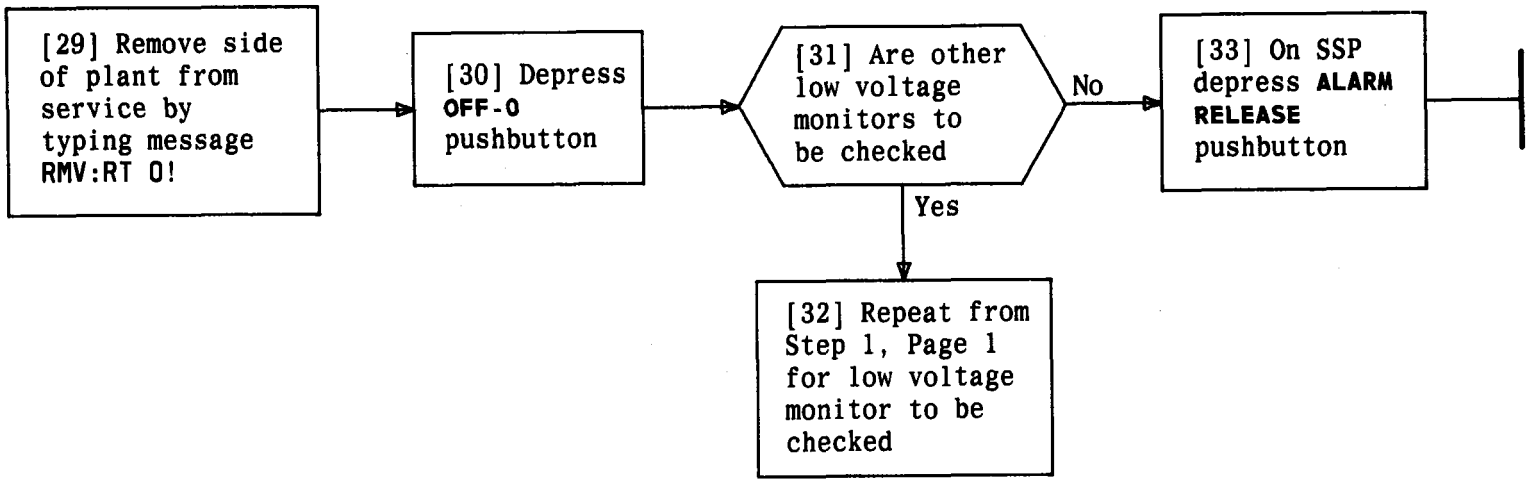
TABLE C

LOW VOLTAGE MONITOR BEING CHECKED	OSCILLATOR TO BE REMOVED	OSCILLATOR LOCATION	OSCILLATOR CODE
TTLV0	440-0	0-7-5	A981 or A1152
ARLV0	480-0	0-9-3	A982 or A1153
BTLV0	480-0	0-9-3	A982 or A1153

TEST LOW VOLTAGE MONITORS – SIDE 0



TEST LOW VOLTAGE MONITORS – SIDE 0



TEST LOW VOLTAGE MONITORS – SIDE 0

SUMMARY	
See DANGER 1, DANGER 2, and WARNING 1. Depress **NOR** pushbutton. Measure ac outputs as given in TABLE A. Voltage requirements should be met as given in TABLE A.	Connect frequency counter at **INVERTER TB2** terminals **8** and **9**. Frequency should be 19.95 to 20.05 Hz. Depress **OFF-0** pushbutton.

[1] See WARNING 1. Condition DMM to measure approximately 100 Vac

[2] See DANGER 1, DANGER 2, and FIG. 1. At **MP** frame on rear of **RINGING & TONE** plant for inverter being checked, locate **TB2** terminal board and connect DMM per TABLE A

[3] On **RINGING & TONE** panel, depress **NOR** pushbutton

AND

PWR OFF lamp goes out

Page 2

TABLE A

INVERTER OUTPUT	DMM CONNECTION AT TERMINALS ON INVERTER TB2 TERMINAL BOARD	OUTPUT VOLTAGE REQUIREMENT
86(A)	8 and 9	84.5 to 88.0
86(B)	4 and 5	
97(A)	8 and 10	94.5 to 101.0
97(B)	4 and 6	
105(A)	8 and 11	103.0 to 110.0
105(B)	4 and 7	
105(C)	1 and 3	

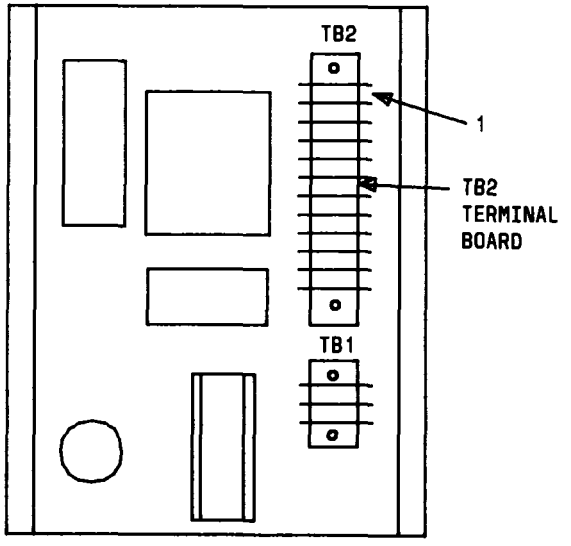


FIG. 1

WARNING 1

Erroneous reading and damage to equipment may result if DMM is not isolated from ground

DANGERS

1. ***Voltage potentials of up to 400 volts to ground are present at rear of plant***
2. ***Isolation of DMM from ground creates potential hazard. Avoid bodily contact between test meter and other components, conductors, or ground***

CHECK 20-HZ INVERTER – SIDE 0

[4] Are output voltage requirements met in TABLE A for inverter 86-, 97-, and 105-volt outputs

Yes

No

TAP-194

[5] On **RINGING & TONE** panel, depress **OFF-0** pushbutton

[6] Disconnect DMM

[7] Set frequency counter controls per FIG. 2

[8] At inverter **TB2**, connect frequency counter across terminals **8** (common) and **9**

[9] Depress **NOR** pushbutton

AND

Page 3

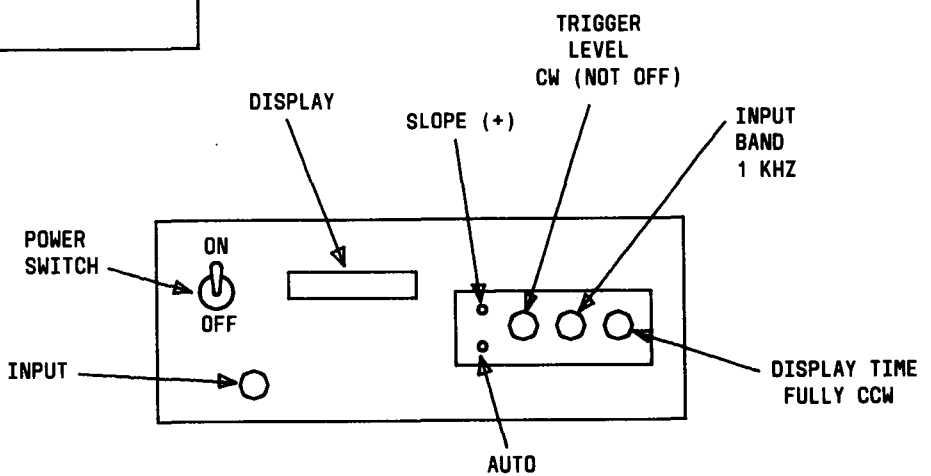
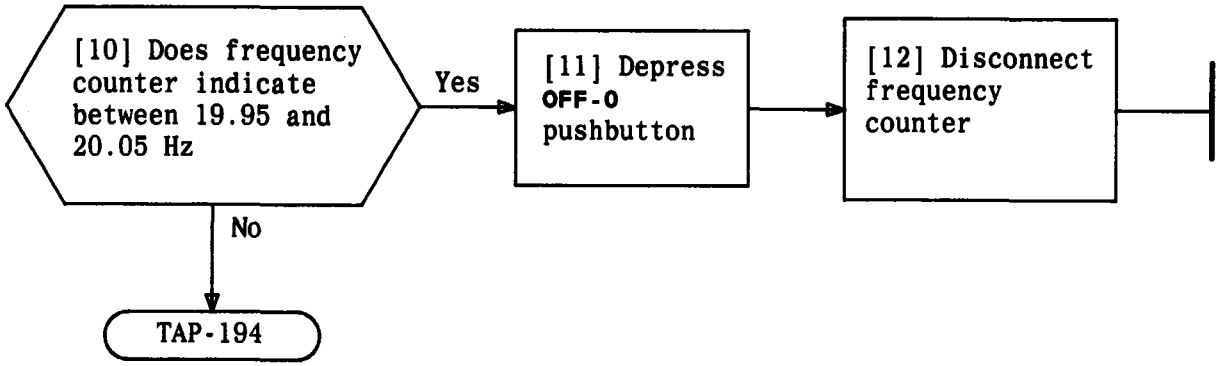


FIG. 2

CHECK 20-HZ INVERTER – SIDE 0



CHECK 20-HZ INVERTER – SIDE 0

SUMMARY

See DANGER 1. Connect 720A voltage pickup tool at **F24** spare fuse position. Depress **NOR** pushbutton. Restore Side 0 of plant to service. Touch tip of 411C test pick to test point on fuse cap of **F1**. **OFF-0** lamp should light, TTY printout should indicate **RT** fuse alarm. Remove test pick from fuse cap. **OFF-0** lamp should go out. Depress **OFF-0** pushbutton, then depress **NOR** pushbutton. Restore Side 0 of plant to service. TTY should indicate that fuse alarm has cleared. Test remainder of fuses [TABLES A and B] by observing that **OFF-0** lamp lights and then goes out when test connection is made at fuse cap and then is released. Depress **OFF-0** pushbutton.

[1] See DANGER 1 and FIG. 1. At distribution fuse panel, using fuse alarm test cord, install 720A tool at **F24** position

[2] On **RINGING & TONE** panel, depress **NOR** pushbutton

[3] At TTY type message RST:RT 0;UCL!

[4] See FIG. 2. At **F1** fuse, touch tip of 411C test pick to test point on fuse cap

AND

Page 2

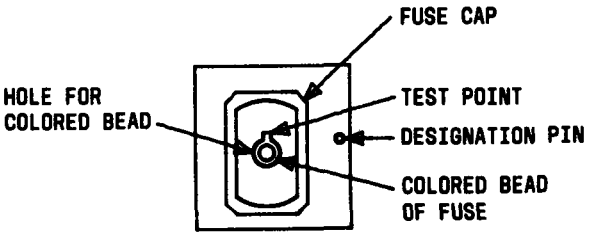


FIG. 2 – Alarm Fuse Cap – Typical

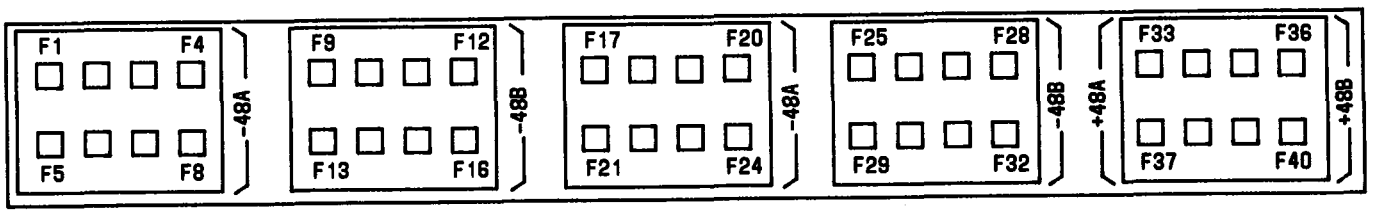
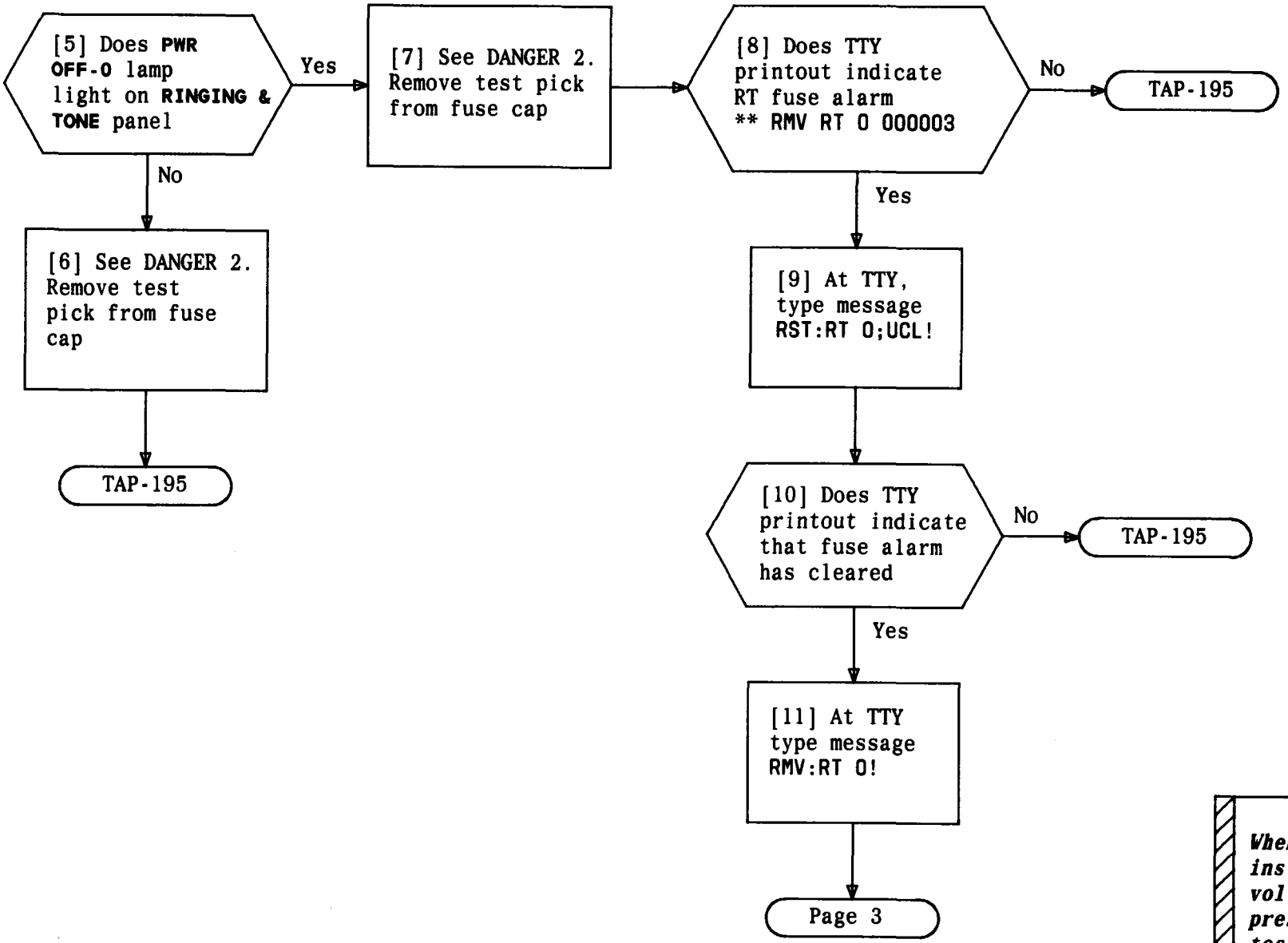


FIG. 1 – 48-Volt Distribution Fuse Panel

DANGER 1
When 720A tool is installed, 48-volt potential is present on tip of test pick

TEST 48-VOLT BATTERY DISTRIBUTION FUSE ALARMS – SIDE 0



DANGER 2
When 720A tool is installed, 48-volt potential is present on tip of test pick

TEST 48-VOLT BATTERY DISTRIBUTION FUSE ALARMS — SIDE 0

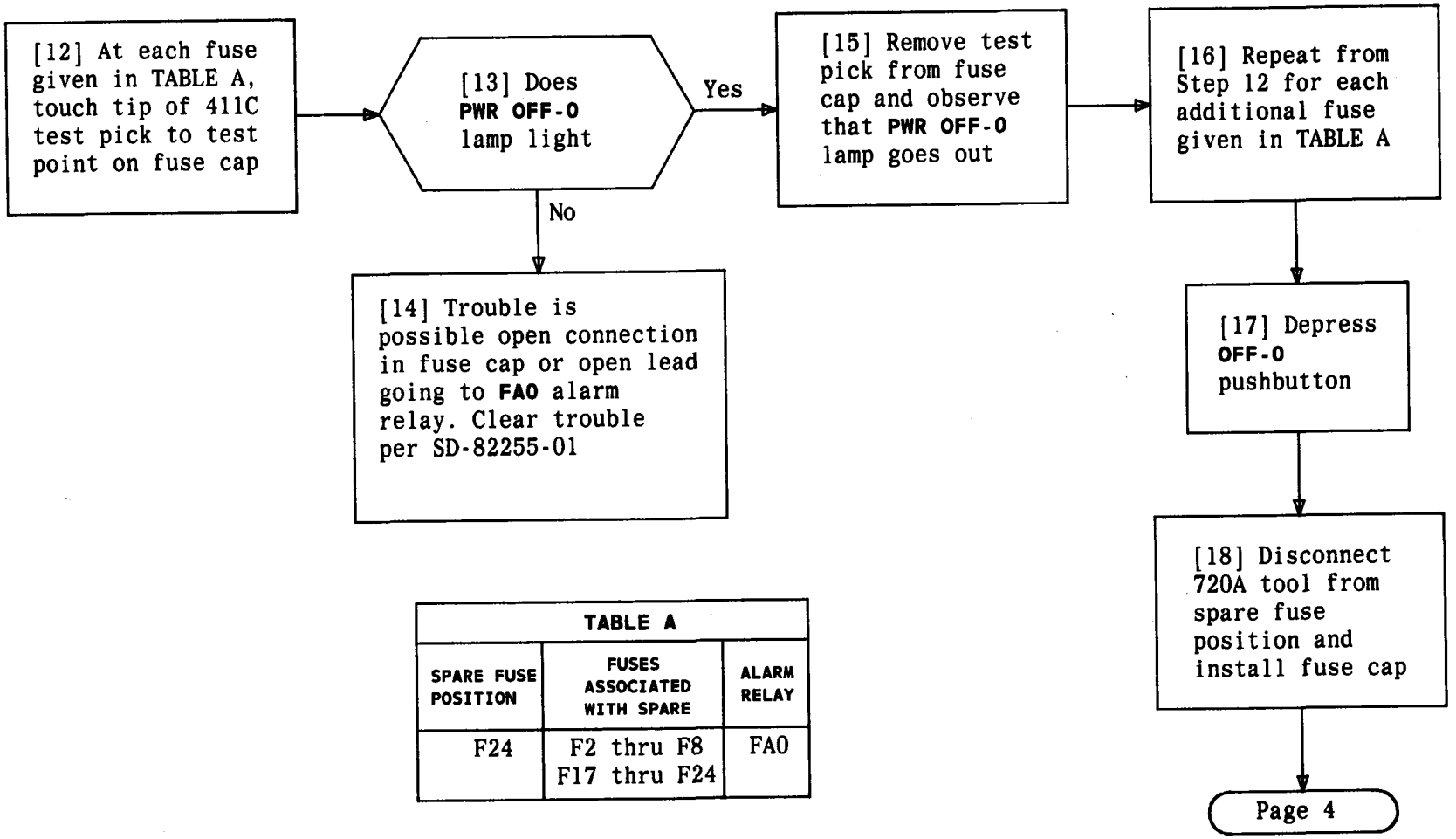


TABLE A

SPARE FUSE POSITION	FUSES ASSOCIATED WITH SPARE	ALARM RELAY
F24	F2 thru F8 F17 thru F24	FA0

TEST 48-VOLT BATTERY DISTRIBUTION FUSE ALARMS – SIDE 0

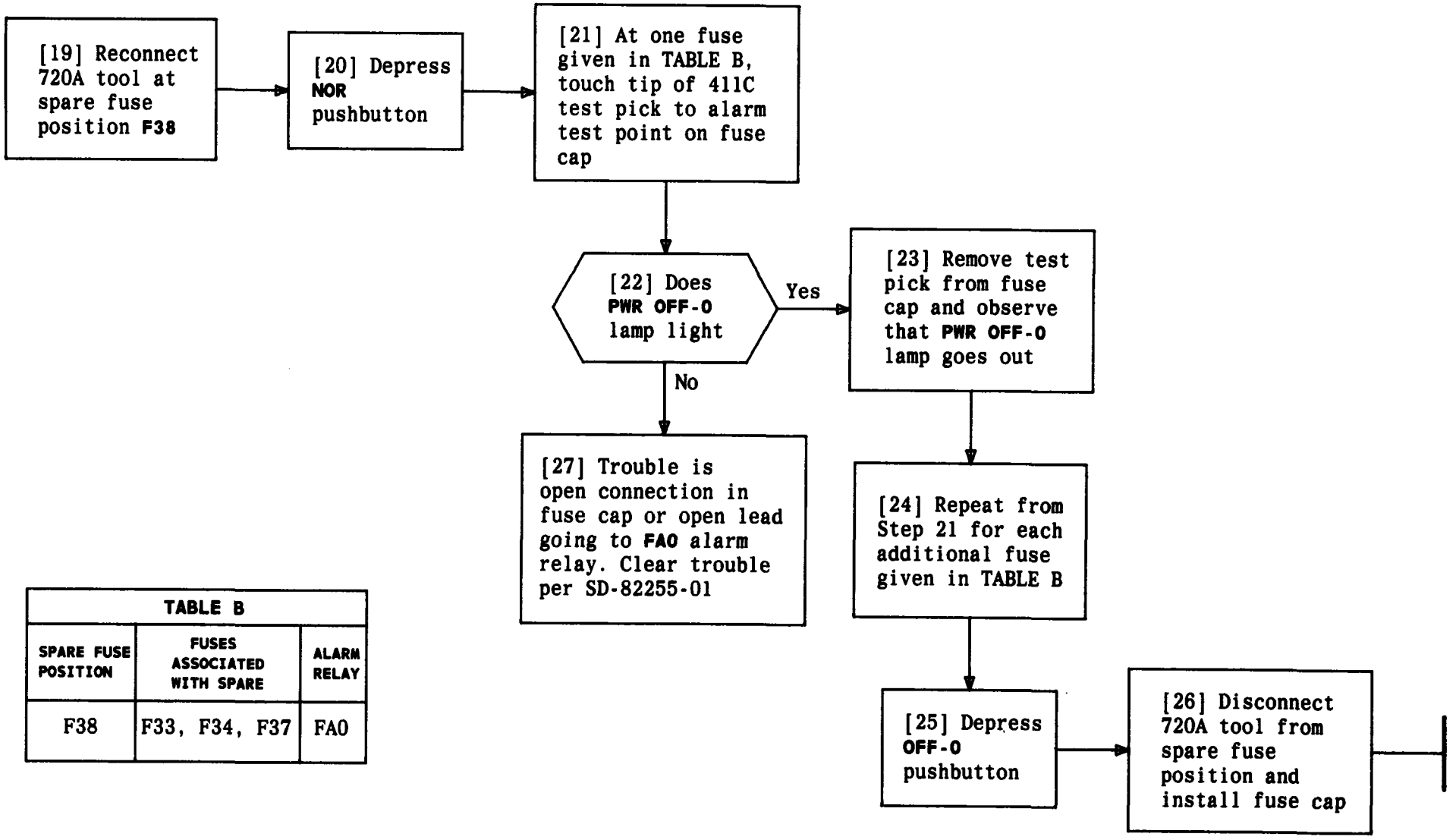
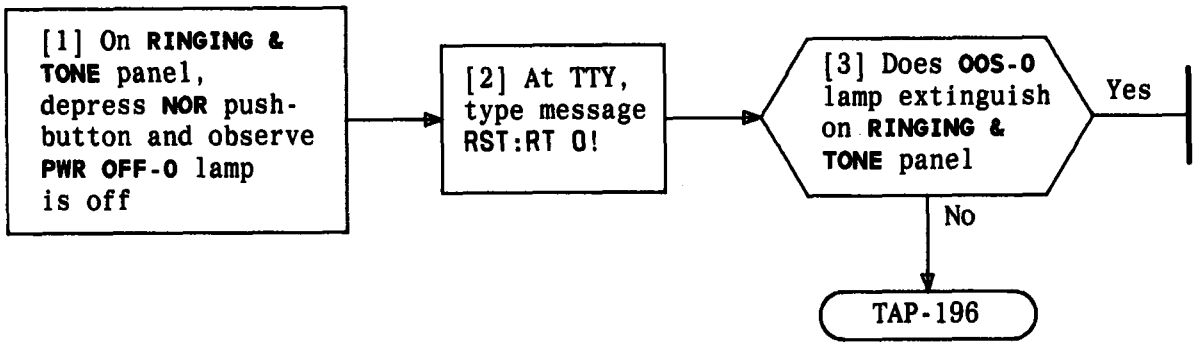


TABLE B

SPARE FUSE POSITION	FUSES ASSOCIATED WITH SPARE	ALARM RELAY
F38	F33, F34, F37	FA0

TEST 48-VOLT BATTERY DISTRIBUTION FUSE ALARMS – SIDE 0



TURN UP AND RESTORE TO SERVICE RT SIDE 0

CHECK AND ADJUST 400A TONE GENERATOR

SUMMARY

See CAUTION 1 and WARNING 1. At **400A T GEN** connect **3A NOISE MEASURING SET** across terminals **17** and **26** on **TB1** terminal board. Meter should indicate 10 ±1 dBrn. Repeat across terminals **26** and **27**

TABLE A	
EQUIPMENT REQUIRED	RECOMMENDED TYPE
Noise measuring set	J94003A 3A noise measuring set*
Test leads (2)	–
Test plugs (2)	241A plug *
* Or equivalent	

[1] Obtain test equipment in TABLE A

On **3A NOISE MEASURING SET**:

[2] Connect two test leads with 241A plugs at **IN** jacks

[3] Rotate **FUNCTION** switch to **900 NM**

[4] Set **DAMP-NORM** switch to **NORM**

[5] Rotate **DBRN** switch to **85**

[6] Plug in **497A NETWORK** to **3KC FLAT WTG** position

[7] Connect **GRD** terminal to ground

AND → Set conditioned

At **MP** frame on **400A T GEN**:

[8] Remove front cover

[9] See CAUTION 1 and WARNING 1. At right of **400A T GEN**, connect **3A NOISE MEASURING SET** at terminals **17** and **26**

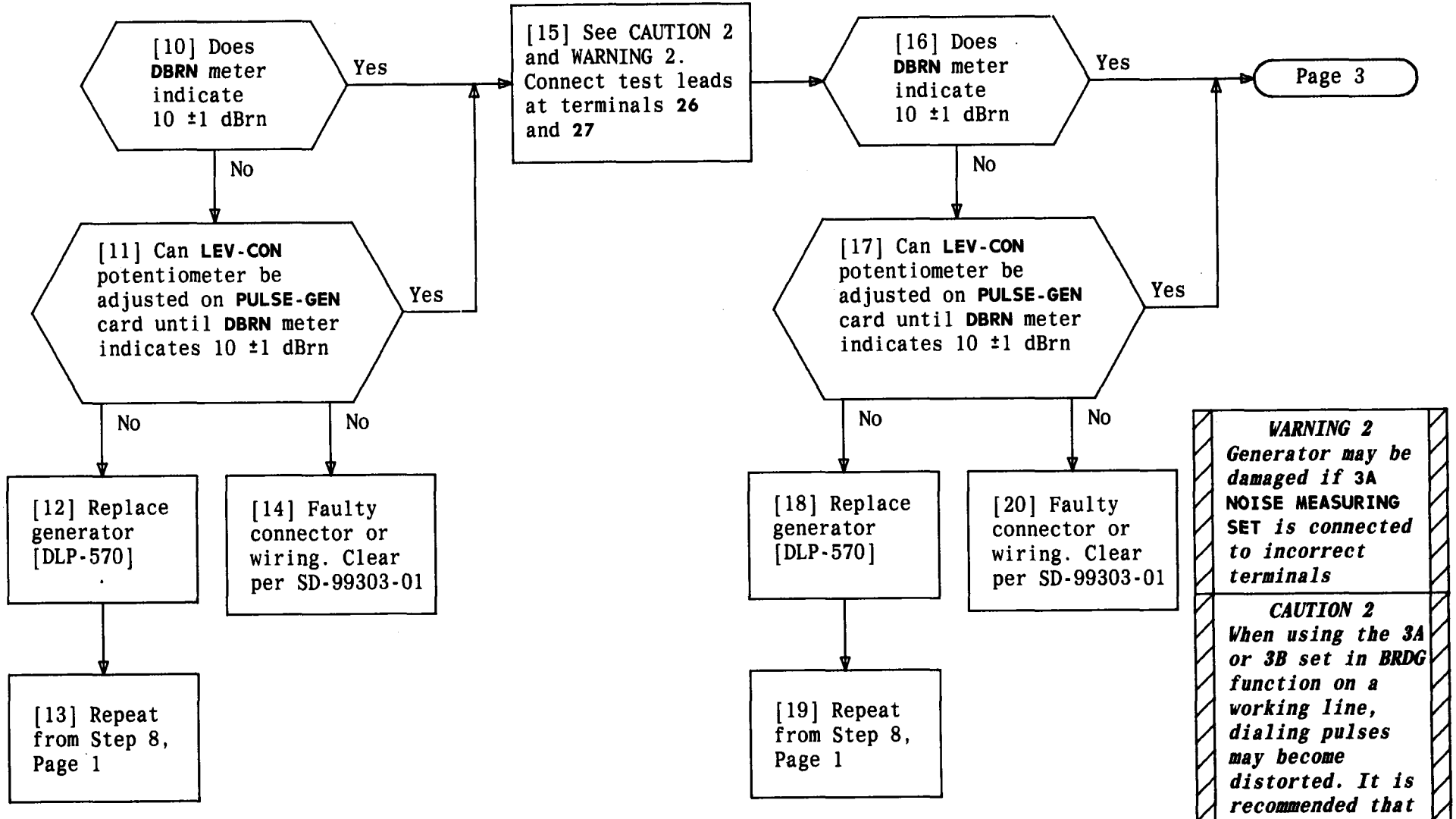
AND → Set connected → Page 2

WARNING 1

Generator may be damaged if 3A NOISE MEASURING SET is connected to incorrect terminal

CAUTION 1

When using the 3A or 3B set in BRDG function on a working line, dialing pulses may become distorted. It is recommended that the set be connected to the line no longer than necessary



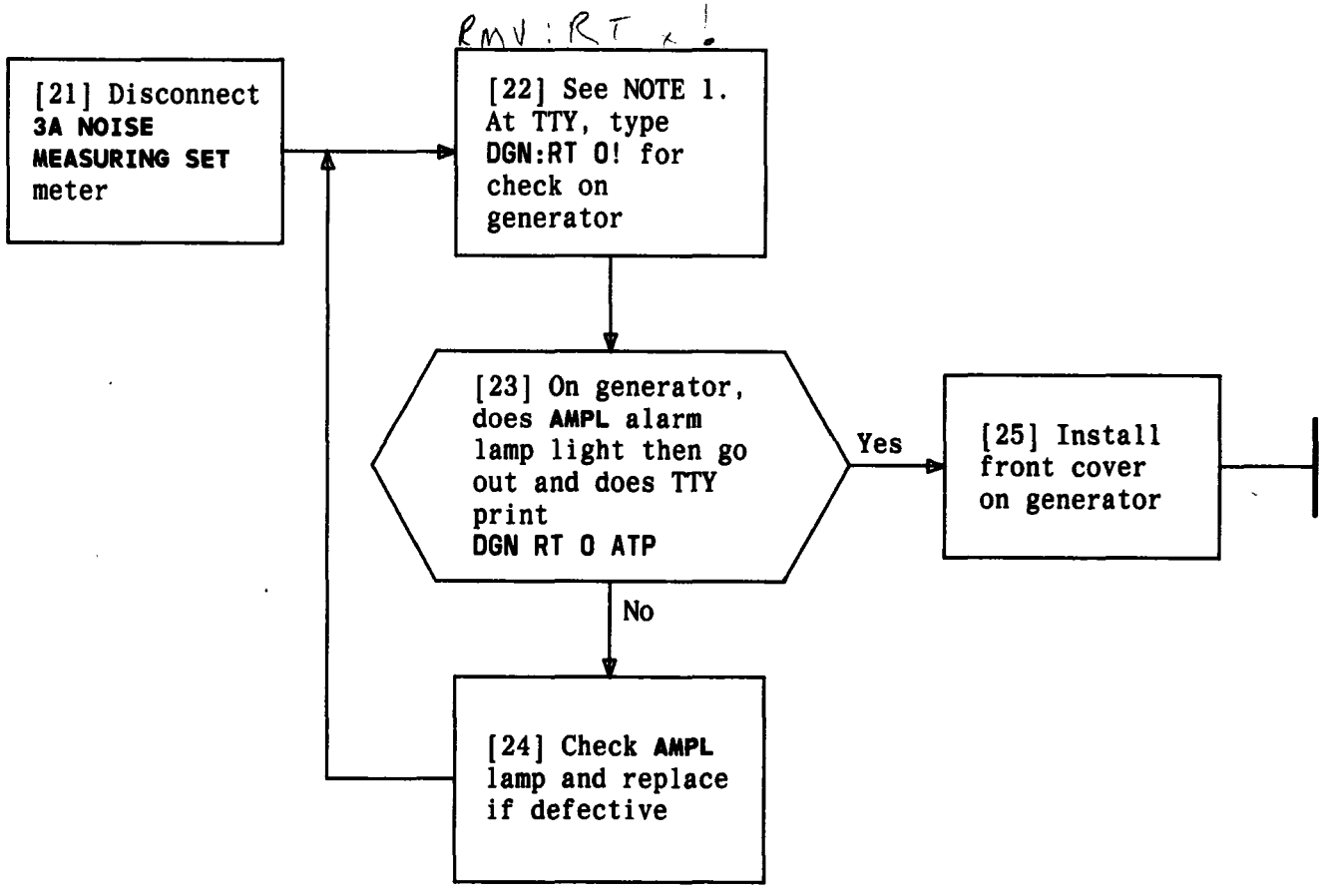
WARNING 2

Generator may be damaged if 3A NOISE MEASURING SET is connected to incorrect terminals

CAUTION 2

When using the 3A or 3B set in BRDG function on a working line, dialing pulses may become distorted. It is recommended that the set be connected to the line no longer than necessary

CHECK AND ADJUST 400A TONE GENERATOR



NOTE 1
Diagnostics for either side 0 or side 1 will initiate diagnostics on 400A tone generator

CHECK AND ADJUST 400A TONE GENERATOR

SUMMARY

See DANGER 1. Connect test cord at ringing distribution fuse load terminal. Touch tip of test pick to alarm test point on fuse cap. Fuse alarms are given. Remove test pick. Alarms turn off.

[1] Get test equipment in TABLE A

[2] See FIG. 1. Connect 411C tool at one end of W1AY cord and at other end of cord, connect connecting clip

AND

Test cord prepared

[3] At **MP** frame on back of **RINGING & TONE plant**: See DANGER 1 and FIG. 2. On ringing distribution fuse panel, connect clip at load terminal of one distribution fuse as given in TABLE B

Page 2

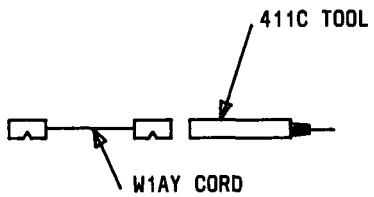


FIG. 1

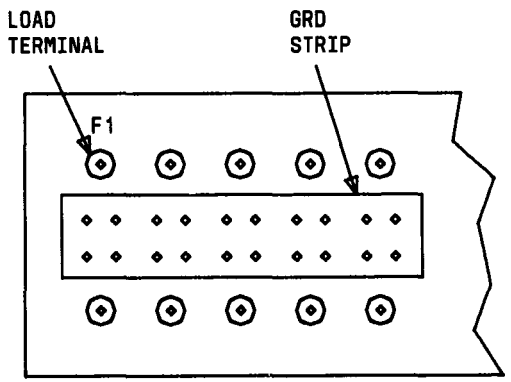


FIG. 2

TABLE A

EQUIPMENT REQUIRED	RECOMMENDED TYPE
Test cord	W1AY cord*
Test pick	411C tool*
Connecting clip	Insulated alligator clips

*or equivalent

TABLE B

RINGING OUTPUTS	FUSE NUMBERS ASSOCIATED WITH RINGING OUTPUT*	FUSE PANEL LOCATION
+AC-DC	F1-F8	0-17-0
–SUP 105	F1-F12	0-16-0
GEN1	F1-F8	0-18-0
105V±	F1-F8	
–AC-DC	F1-F24	0-17-0
105±EML	F1-F16	0-16-0
SUP-97	F1-F10	
SUP+97	F1-F10	
+SUP 105	F1-F16	0-17-0
+TRP	F1-F8	0-18-0
–TRP	F1-F24	

* Fuses are assigned locally

DANGER 1

When 411C tool is connected, up to 300 volts peak-to-peak is present on tip of test pick

Issue 2 | JUL 1980

233-144-100 | DLP

PAGE 1 of 2 | 561

TEST RINGING DISTRIBUTION FUSE ALARMS

[4] See FIG. 3. At front of one fuse associated with ringing output in TABLE B, touch tip of 411C test pick to exposed test point on fuse cap

[5] See NOTE 1. Does system control initiate fuse alarm and TTY trouble report

Yes

No

[6] Trouble in defective FA2 alarm relay or open alarm lead. Clear trouble per SD-82255-01

[7] Remove test pick from fuse cap and observe that TTY printout indicates trouble clear

[8] Repeat from Step 4 for each additional fuse associated with ringing output in TABLE B

[9] Disconnect clip from distribution fuse load terminal

[10] Repeat from Step 3, Page 1 for each additional ringing output as given in TABLE B

AND

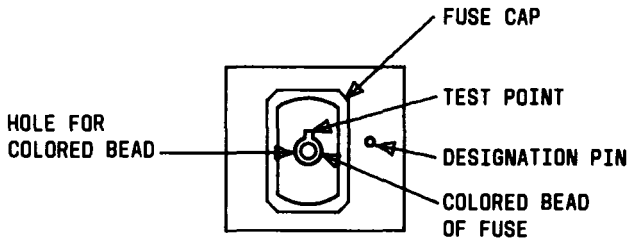


FIG. 3 – Alarm Fuse Cap – Typical

NOTE 1
For exact TTY messages, refer to IM/OM 3H300

TEST RINGING DISTRIBUTION FUSE ALARMS

[1] Obtain test equipment in TABLE A

At **MP** frame:

[2] See NOTE 1. On **RINGING & TONE** panel, depress **OFF-0** (or **OFF-1**) key

PWR OFF lamp lights

AND → Power removed

[3] See FIG. 1. Using 723B circuit pack puller, remove oscillator circuit pack being adjusted

[4] Connect oscillator circuit pack to 158A adapter, then install adapter in circuit pack connector

AND → Oscillator extended → Page 2

TABLE A	
EQUIPMENT REQUIRED	**RECOMMENDED TYPE**
Digital multimeter (DMM)	Hickok Model 3310 (ITE-5356)*†
Circuit pack puller	723B tool†
Circuit pack extender	158A adapter†
Jewelers screwdriver	R1005 tool†
(2) Connecting clips	EZ Hook†
* DMM must be true RMS and isolated from ground † or equivalent	

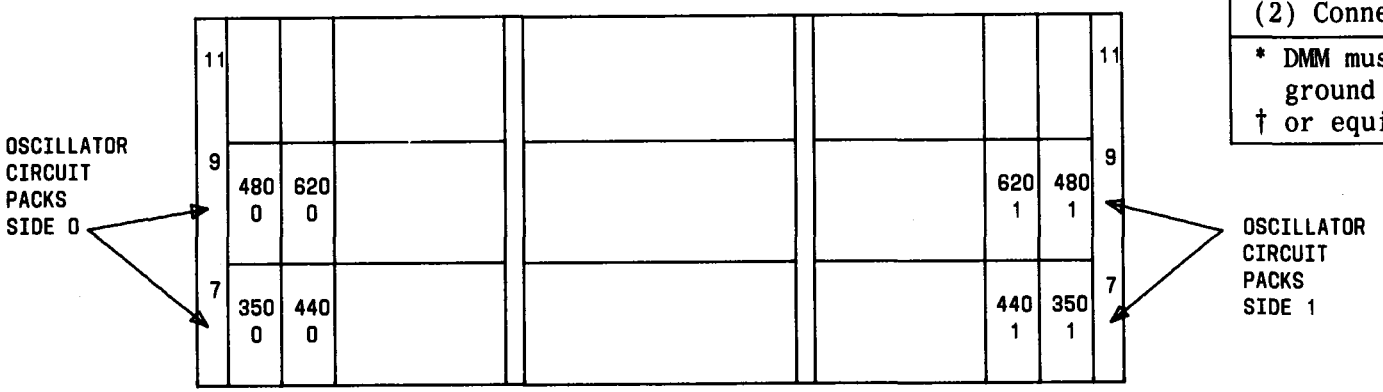


FIG. 1

NOTE 1
Information enclosed in parentheses refers to Side 0 or Side 1

ADJUST OSCILLATOR VOLTAGE LEVEL

[5] See WARNING 1. Isolate DMM from ground [DLP-720] and condition to measure approximately 10V rms

[6] See DANGER 1, DANGER 2, CAUTION 1, WARNING 2, and FIG. 2. At rear of plant, connect DMM across oscillator circuit pack connector terminals 12 and 14 (GRD)

AND

DMM connected

[7] On **RINGING & TONE** panel, depress **NOR** pushbutton

PWR OFF lamp extinguishes

AND

Page 3

[8] On oscillator circuit pack, adjust potentiometer in TABLE B until DMM indicates 2.60 volts

TABLE B		
OSCILLATOR CIRCUIT PACK	CIRCUIT PACK LOCATION	VOLTAGE ADJUST POTENTIOMETER
350-0	0-7-3	R10 for A980 R3 for A1151
350-1	0-7-48	
440-0	0-7-5	R10 for A981 R3 for A1152
440-1	0-7-46	
480-0	0-9-3	R10 for A982 R3 for A1153
480-1	0-9-48	
620-0	0-9-5	R10 for A983 R3 for A1154
620-1	0-9-46	

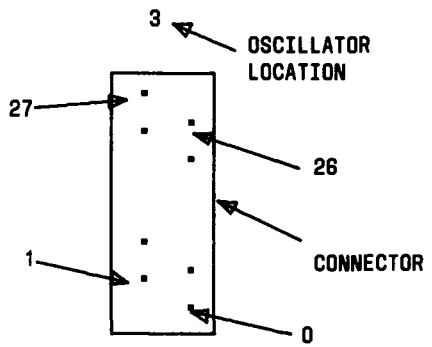


FIG. 2 – Oscillator Connector – Rear View

WARNINGS

1. *Erroneous reading and damage to equipment may result if DMM is not isolated from ground*
2. *DMM(–) lead must be connected to terminal 14 on oscillator connector*

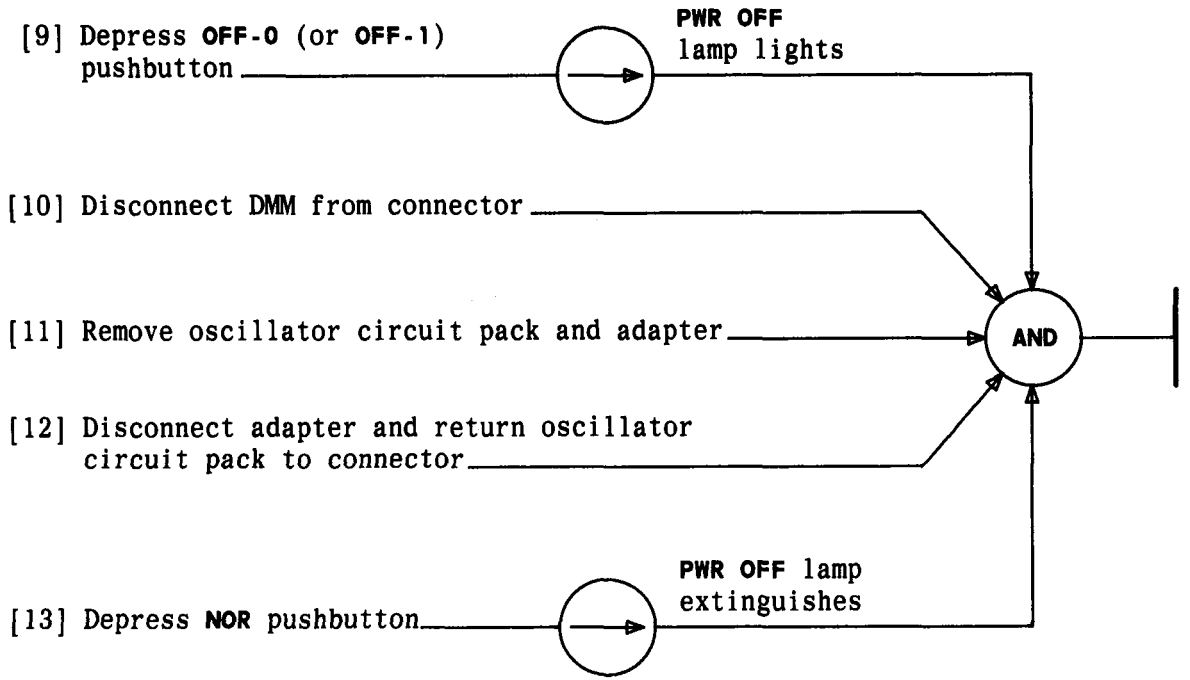
CAUTION 1

Tone voltages to be measured are complex ac waveforms. A True RMS indicating voltmeter is required to accurately adjust voltage levels. Peak and average ac voltmeters produce inaccurate readings.

DANGERS

1. *Voltage potentials of up to 400 volts to ground are present at rear of plant*
2. *Isolation of DMM from ground creates potential hazard. Avoid bodily contact between test meter and other components, conductors, or ground*

ADJUST OSCILLATOR VOLTAGE LEVEL



ADJUST OSCILLATOR VOLTAGE LEVEL

[1] At **MP** frame on **RINGING & TONE** plant, which tone amplifier is being adjusted

TT, AR, BT

[2] For tone amplifier being adjusted, use 723B tool to remove oscillator circuit pack

MT, HT

[3] See WARNING 1. Isolate DMM from ground [DLP-720] and condition to measure approximately 10V rms

[4] See DANGER 1, DANGER 2, and FIG. 1. At rear of plant, use connecting clips to connect DMM across **A1111** (side 0 or 1) connector terminals per TABLE A

Page 2

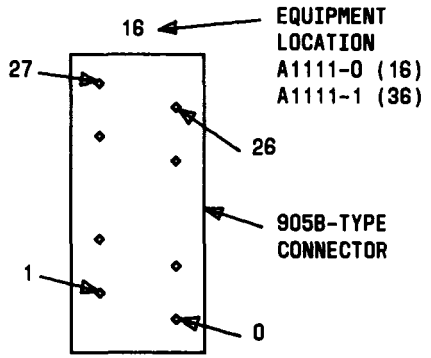


FIG. 1 – A1111 Connector – Rear View

WARNING 1

Erroneous reading and damage to equipment may result if DMM is not isolated from ground

DANGERS

1. ***Voltage potentials of up to 400 volts to ground are present at rear of plant***
2. ***Isolation of DMM from ground creates potential hazard. Avoid bodily contact between test meter and other components, conductors, or ground***

ADJUST TONE AMPLIFIER TO TEST VOLTAGE LEVEL

[5] On **RINGING & TONE** panel, depress **NOR** pushbutton

[6] On amplifier circuit pack, adjust potentiometer given in TABLE A until DMM indicates 3.49 volts rms

[7] Disconnect DMM from **A1111** connector

TABLE A

TONE AMPLIFIER BEING ADJUSTED	OSCILLATOR CIRCUIT PACK TO BE REMOVED		CONNECTION OF DMM ACROSS TERMINALS OF CPA1111 TRAN CONNECTOR	VOLTAGE ADJUST POTENTIOMETER
	FREQUENCY	CODE		
TT	350	A980 or A1151	13 and 26	ADJ-2 (R4)
AR	440	A981 or A1152	1 and 12	ADJ-1 (R3)
BT	480	A982 or A1153	17 and 21	ADJ-2 (R4)
MT	*		15 and 20	ADJ-2 (R4)
HT	*		4 and 9	ADJ-1 (R3)

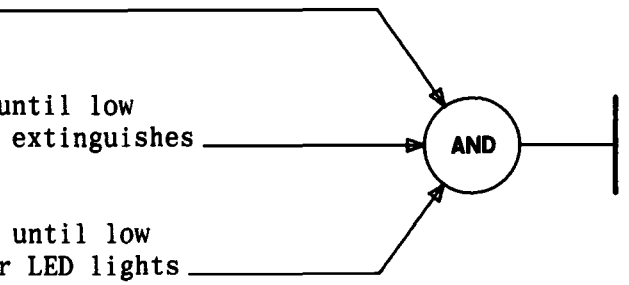
* No oscillator circuit pack is removed

ADJUST TONE AMPLIFIER TO TEST VOLTAGE LEVEL

[1] On A751A or B circuit pack, rotate **LV ADJ** potentiometer fully ccw and observe low voltage relay is released or LED lights [FIG. 1]

[2] Very slowly rotate **LV ADJ** cw until low voltage relay operates or LED extinguishes

[3] Very slowly rotate **LV ADJ** ccw until low voltage relay just releases or LED lights



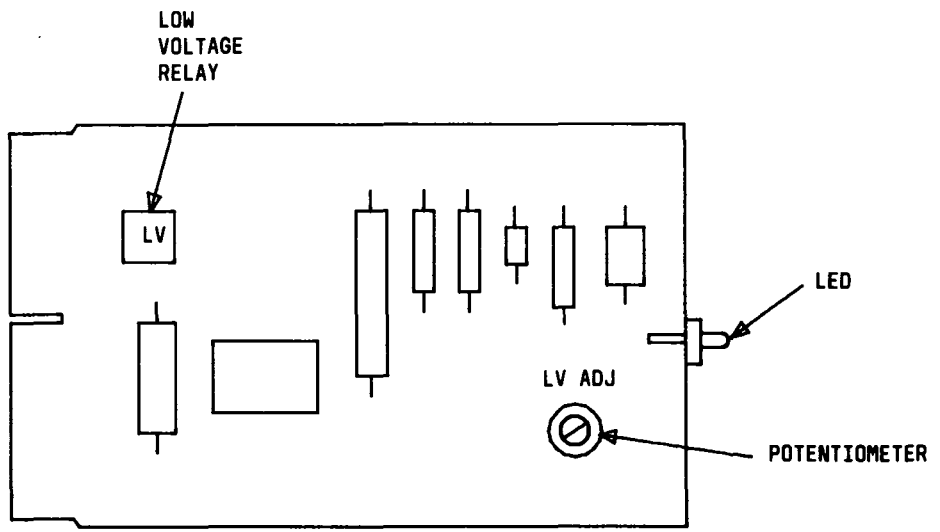


FIG. 1

ADJUST LOW VOLTAGE MONITOR

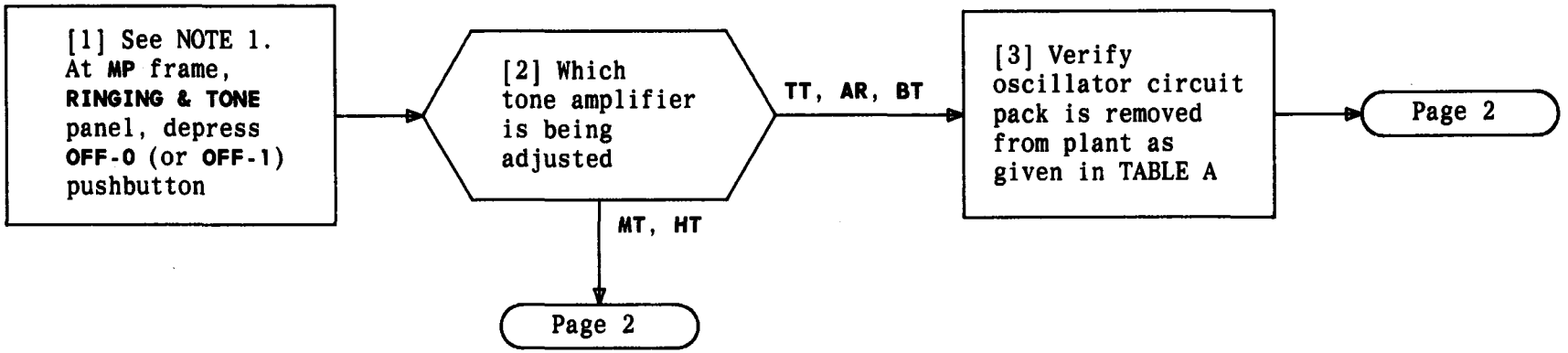


TABLE A

TONE AMPLIFIER	OSCILLATOR CIRCUIT PACK THAT IS REMOVED		CONNECTION OF DMM ACROSS TERMINALS OF CPA1111 TRAN CONNECTOR	POTENTIOMETER TO BE ADJUSTED	VOLTAGE LEVEL-VOLTS RMS †
	FREQUENCY	CODE			
TT	350	A980 or A1151	14 and 25	ADJ-2 (R4)	0.850
AR	440	A981 or A1152	2 and 10	ADJ-1 (R3)	0.255
BT	480	A982 or A1153	18 and 22	ADJ-2 (R4)	0.1414
MT	*		16 and 24	ADJ-2 (R4)	0.480
HT	*		5 and 7	ADJ-1 (R3)	0.290

* No oscillator circuit pack is removed

† True RMS meter must be used

NOTE 1
Information enclosed in parentheses refers to Side 0 or to Side 1

ADJUST TONE AMPLIFIER TO NORMAL VOLTAGE LEVEL

[4] See WARNING 1 and CAUTION 1. Isolate DMM from ground [DLP-720] and condition to measure approximately 10V rms

[5] See DANGER 1, DANGER 2, and FIG. 1. At rear of plant use connecting clips to connect DMM across **A1111** (Side 0 or 1) connector terminals per TABLE A

[6] On **RINGING & TONE** panel, depress **NOR** pushbutton

[7] On 305 amplifier circuit pack, adjust potentiometer given in TABLE A until DMM indicates voltage level in TABLE A

[8] Depress **OFF-0** (or **OFF-1**) pushbutton

AND

Page 3

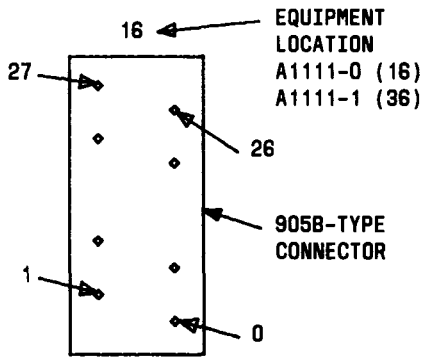


FIG. 1 – A1111 Connector – Rear View

WARNING 1

Erroneous reading and damage to equipment may result if DMM is not isolated from ground

CAUTION 1

Tone voltages to be measured are complex ac waveforms. A True RMS indicating voltmeter is required to accurately adjust voltage levels. Peak and average ac voltmeters produce inaccurate readings.

DANGERS

1. ***Voltage potentials of up to 400 volts to ground are present at rear of plant***
2. ***Isolation of DMM from ground creates potential hazard. Avoid bodily contact between test meter and other components, conductors, or ground***

ADJUST TONE AMPLIFIER TO NORMAL VOLTAGE LEVEL

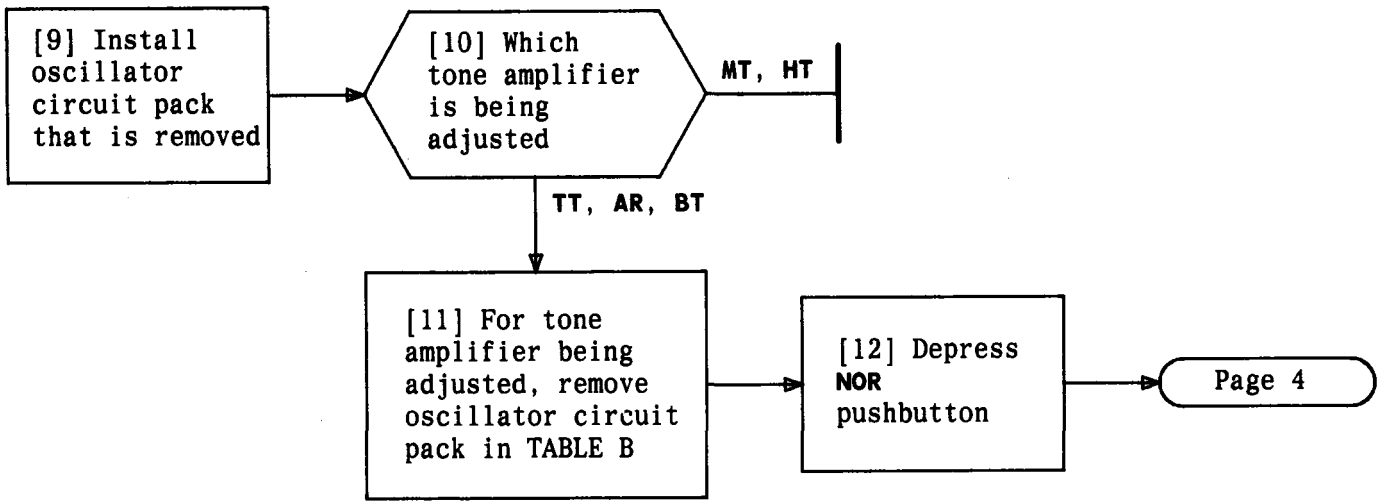


TABLE B

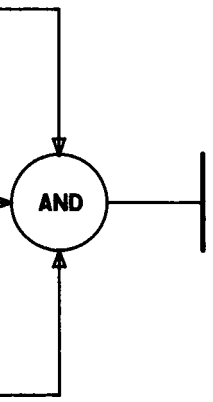
TONE AMPLIFIER	OSCILLATOR CIRCUIT PACK TO BE REMOVED		POTENTIOMETER TO BE ADJUSTED	VOLTAGE LEVEL-VOLTS RMS
	FREQUENCY	CODE		
TT	440	A981 or A1152	ADJ-1(R3)	0.850
AR	480	A982 or A1153	ADJ-2(R4)	0.255
BT	620	A983 or A1154	ADJ-1(R3)	0.1414

ADJUST TONE AMPLIFIER TO NORMAL VOLTAGE LEVEL

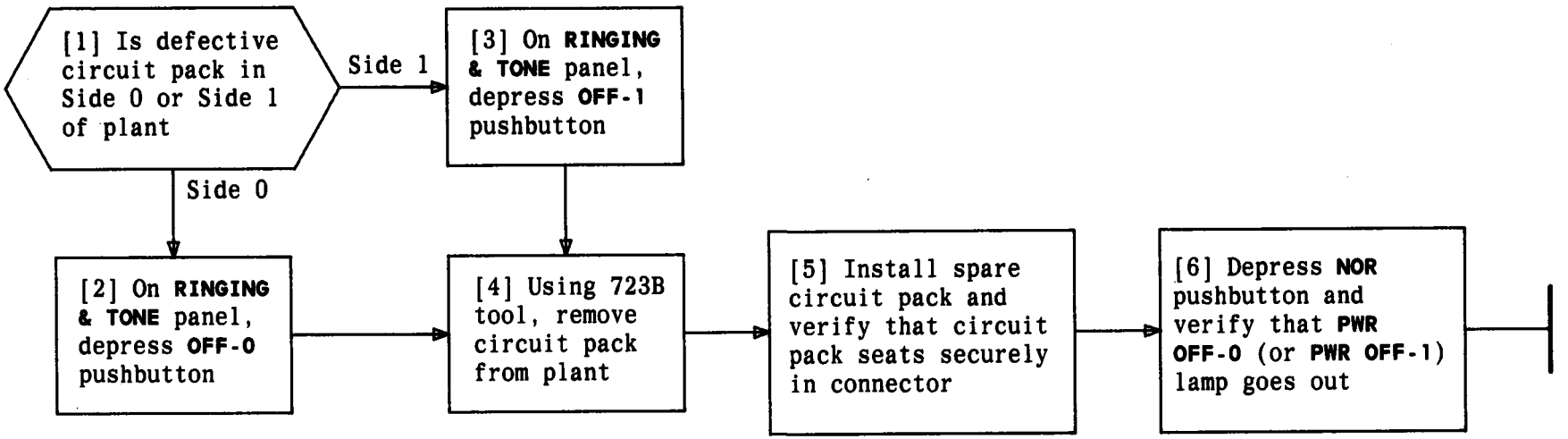
[13] On **305** amplifier circuit pack, adjust potentiometer given in TABLE B until DMM indicates voltage in TABLE B

[14] Depress **OFF-0** (or **OFF-1**) pushbutton

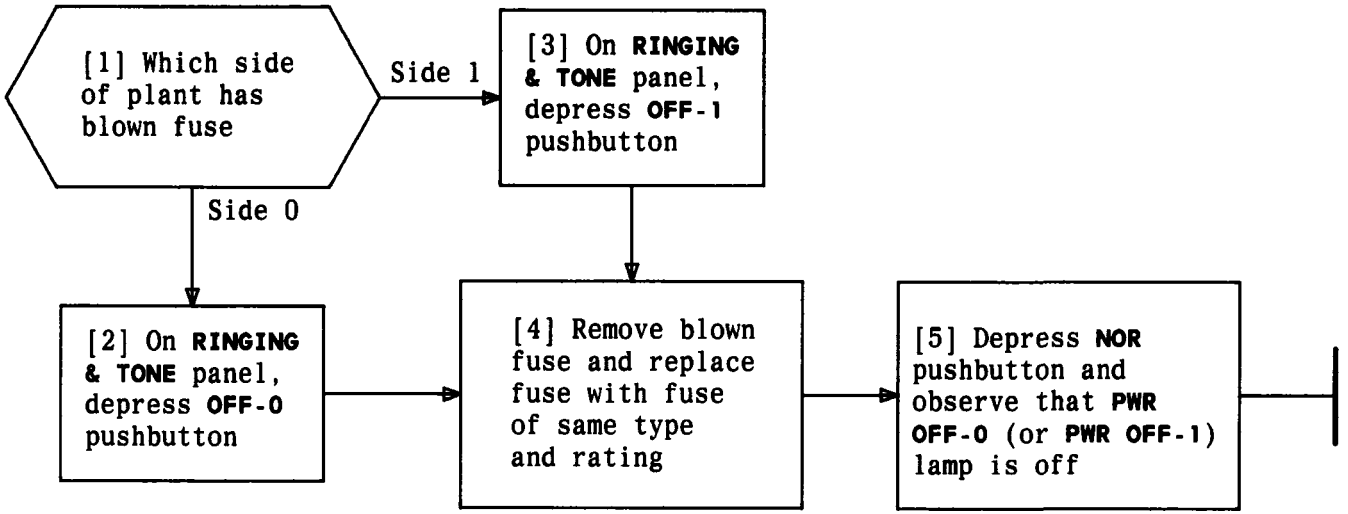
[15] Install oscillator circuit pack



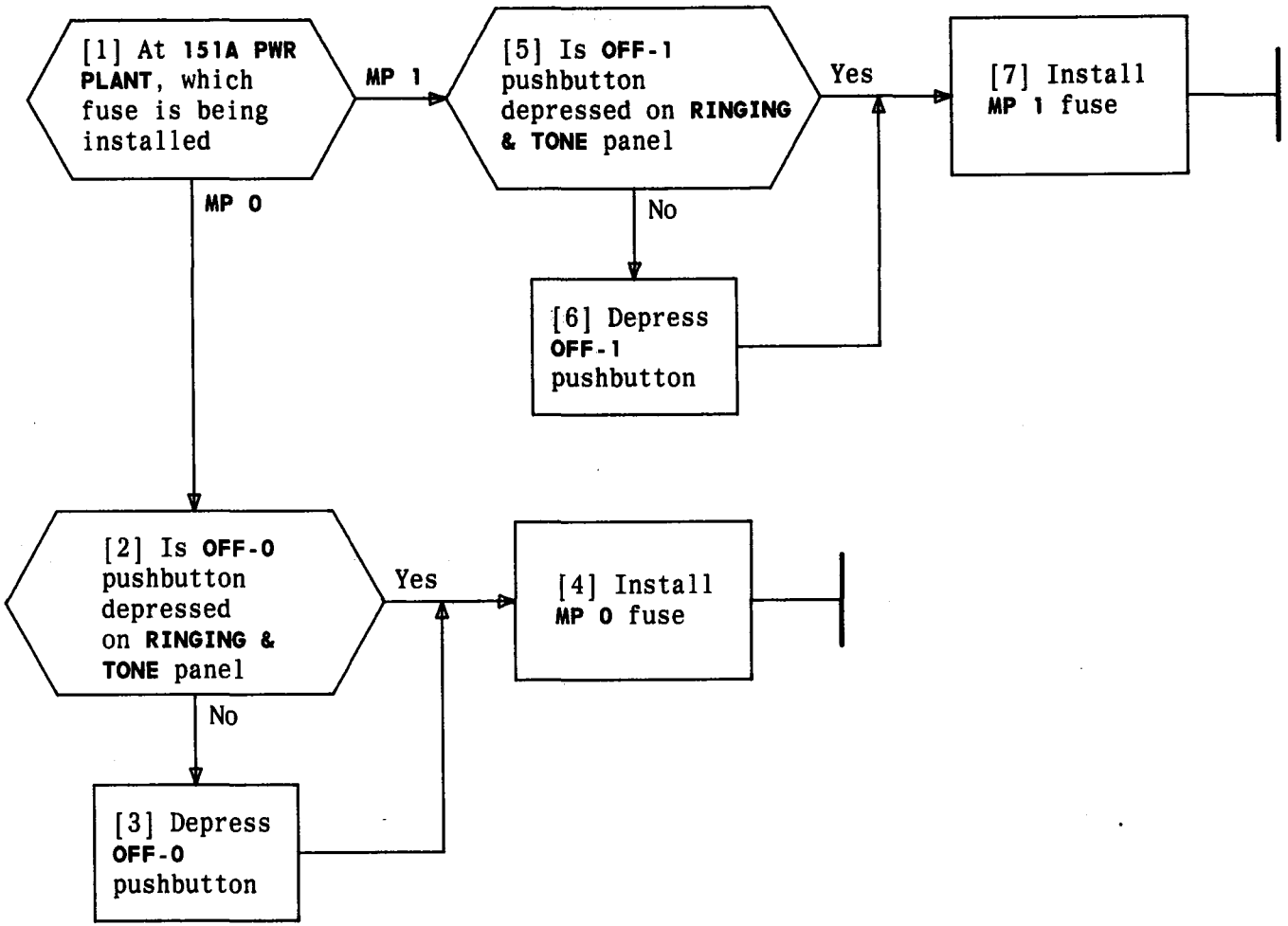
ADJUST TONE AMPLIFIER TO NORMAL VOLTAGE LEVEL



REPLACE CIRCUIT PACK

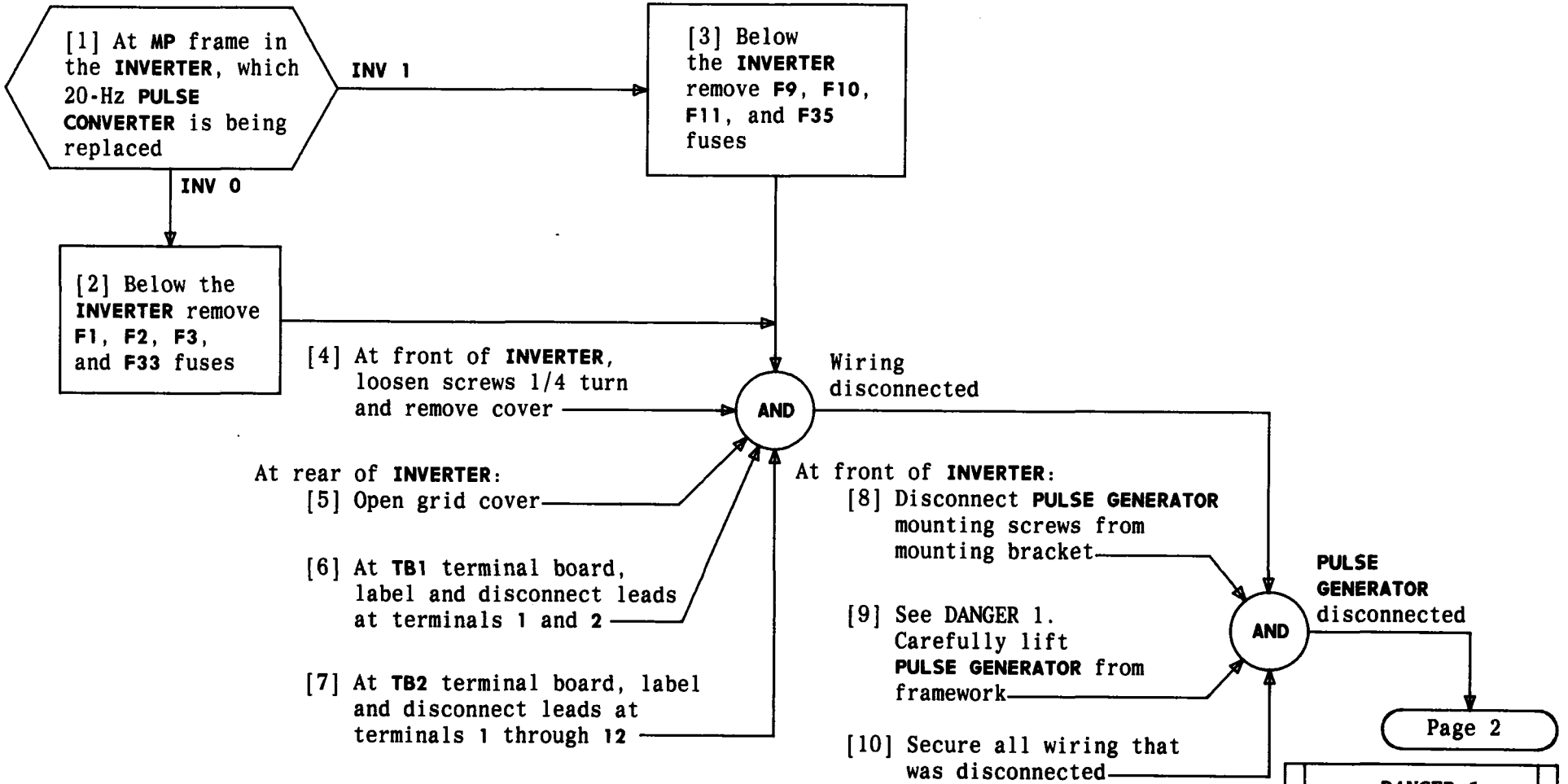


REPLACE BLOWN FUSE



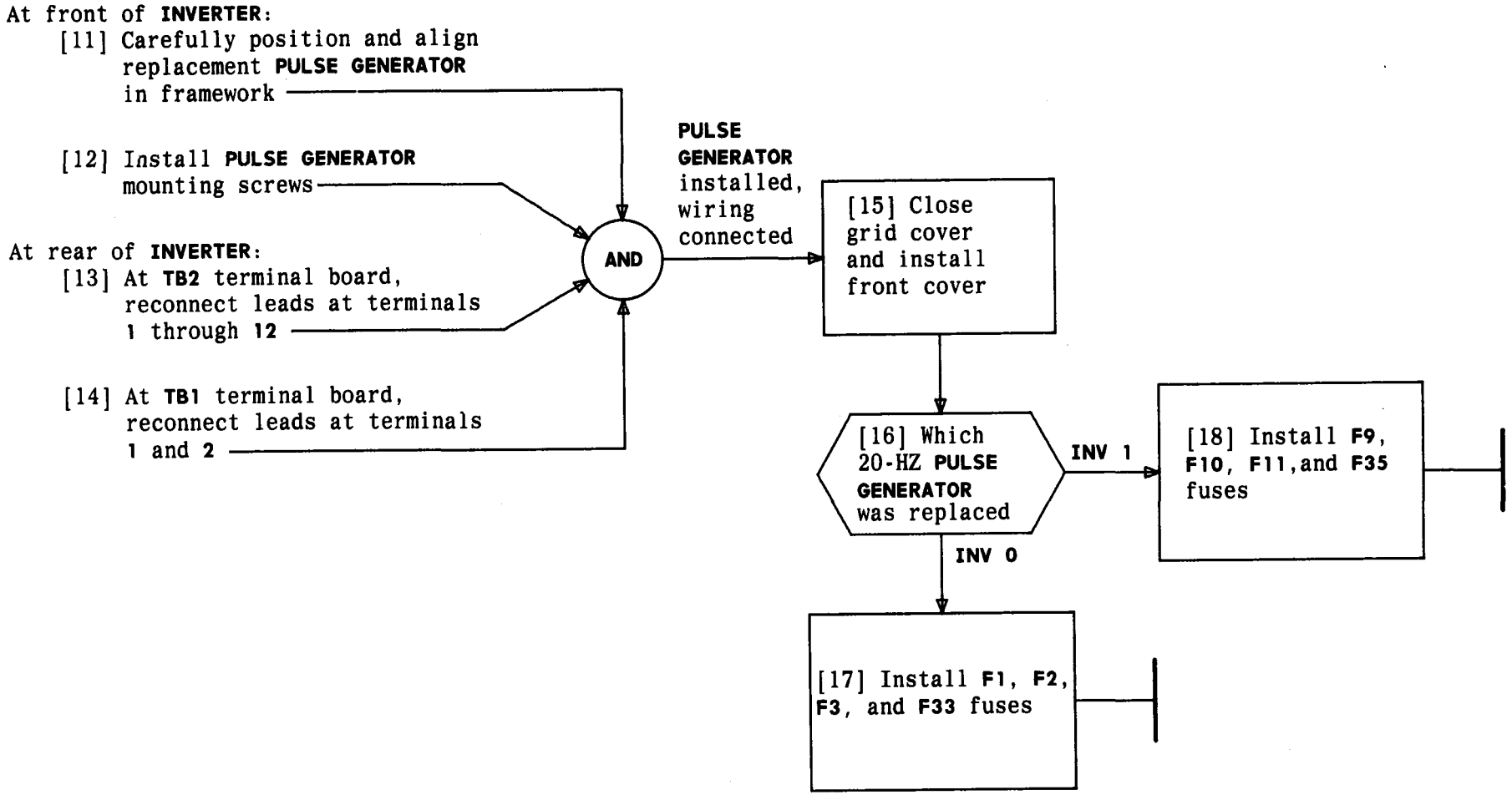
INSTALL MP 0 OR MP 1 FUSE

Issue 2	JUL 1980	
233-144-100		DLP
PAGE 1 of 1		568



DANGER 1
Provide equipment with sufficient capability to handle heavy **PULSE GENERATOR** ***without dropping it***

REPLACE 20-HZ PULSE GENERATOR



REPLACE 20-HZ PULSE GENERATOR

[1] At **MP** frame below **INVERTER**, remove **F26** and **F18** fuses

[2] On rear of **400A T GEN** terminal board **TB1**, label and disconnect leads at terminals **17**, **26**, **27**, **36**, **41**, **44**, **47**, and **48**

AND

Wiring disconnected

At rear of **400A T GEN** [FIG. 1]:

[3] Remove 4 mounting bolts and insulated bushings that bolt generator to mounting bracket

AND

Generator removed

[4] Carefully remove generator from front of framework

[5] Secure all wiring that was disconnected

[6] Carefully position and align replacement generator in mounting bracket

[7] Install generator mounting bolts and insulated bushings

AND

[8] At **TB1** terminal board, reconnect leads at terminals **17**, **26**, **27**, **36**, **41**, **44**, **47**, and **48**

[9] Install **F26** and **F18** fuses

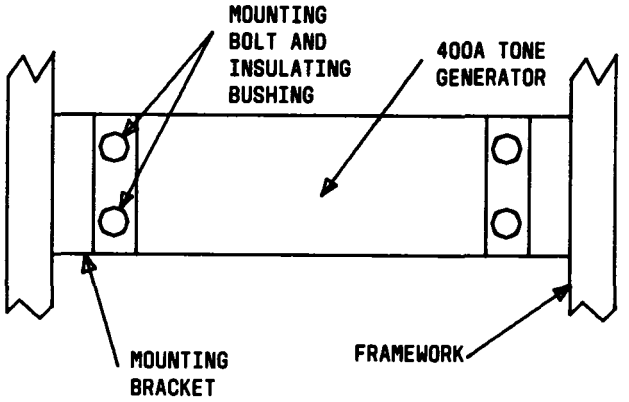


FIG. 1 – 400A Tone Generator – Rear View

REPLACE 400A TONE GENERATOR

[1] See DANGERS 1 and 2. Discharge static electricity from body by touching a ground away from battery area before performing each operation

→

[2] See FIG. 1. Hold flashlight close to each cell jar at 45° angle and inspect vertical positive plate column from top to bottom for diamond like reflecting particles or gray coloration

→

[3] Does diamond like reflecting particles or gray coloration appear

No →

Yes ↓

Page 2

DANGERS

1. ***Battery gas is extremely explosive when sufficiently concentrated. Avoid creating static sparks and use of open flames***
2. ***Protective equipment such as rubber gloves, rubber aprons and splash-proof goggles should be worn when performing maintenance on batteries. Rings, wrist watches, metal bracelets, necklaces, belt buckles, etc, should be removed***

INSPECT INDIVIDUAL CELLS FOR CRYSTALS

[4] Do crystals appear on all cells of a string or only on one or a few

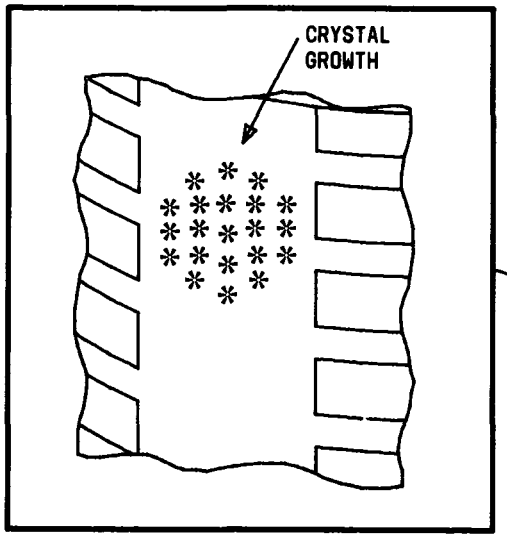
One or a few → Page 3

All

[5] See NOTE 1. Battery float voltage low. Adjust battery bus voltage [DLP-504]

NOTE 1

Battery discharge resulting from a power failure or other reason will normally produce bad sulphate crystals. Crystals will gradually disappear from top to bottom of plate when cells are fully recharged to float



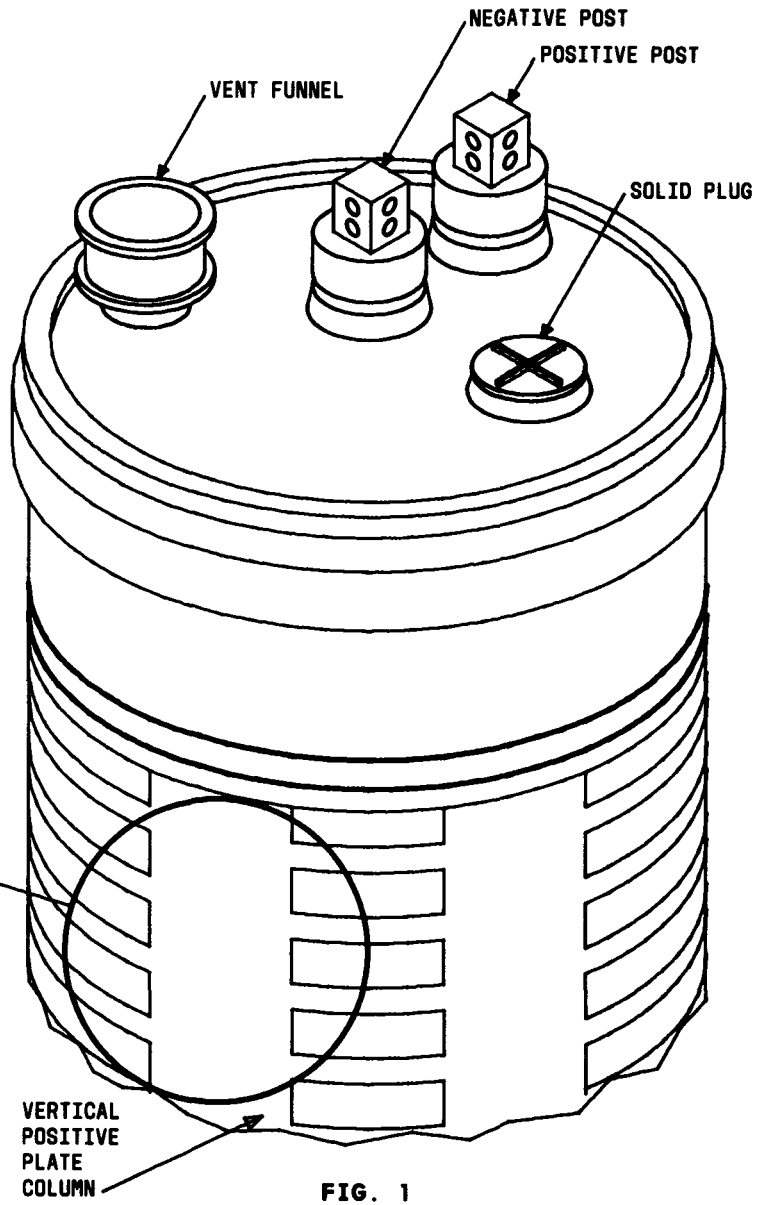
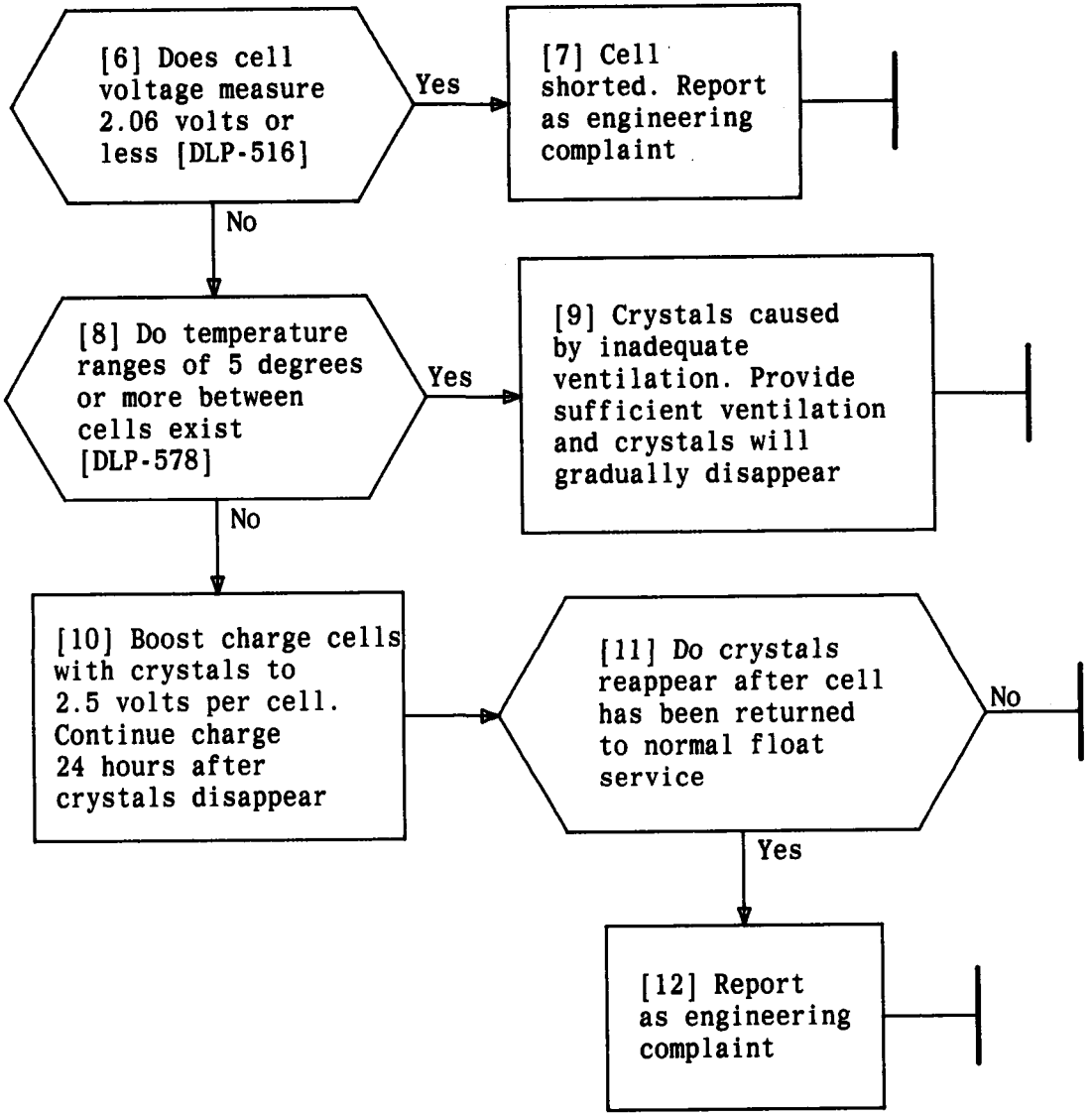


FIG. 1

INSPECT INDIVIDUAL CELLS FOR CRYSTALS



INSPECT INDIVIDUAL CELLS FOR CRYSTALS

[1] Condition KS-20599, L4, or equivalent DMM to measure approximately 10 Vdc

[2] See DANGERS 1 and 2, WARNING 1, and FIG. 1. Connect DMM to positive and negative posts of one cell

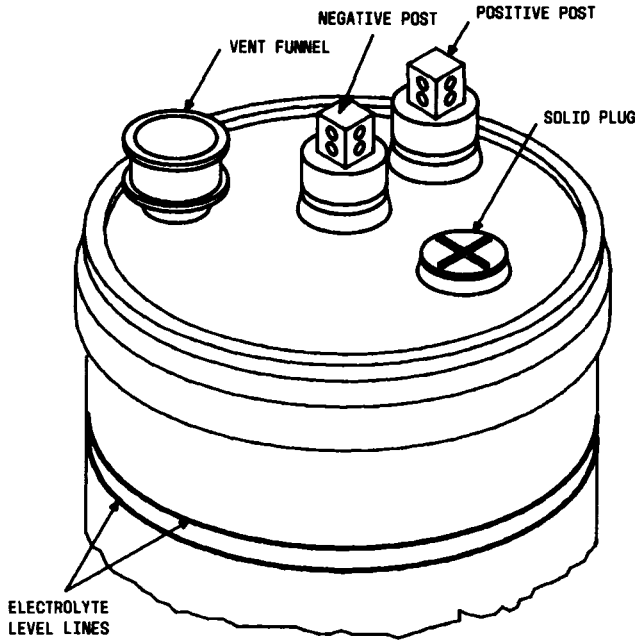
[3] Does DMM indicate 2.13 to 2.22 volts

Yes

[4] Repeat Steps 2 and 3 for each additional cell

No

TAP-134



WARNING 1

Never disconnect leads from meter without first disconnecting them from battery

DANGERS

1. ***Protective equipment such as rubber gloves, rubber aprons, and splash-proof goggles should be worn when performing maintenance on batteries. Rings, wrist watches, metal bracelets, necklaces, belt buckles, etc, should be removed***
2. ***Extremely high current potential present in this circuit***

Issue 2	JUL 1980
233-144-100	DLP
PAGE 1 of 1	576

MEASURE INDIVIDUAL CELL VOLTAGE

[1] See DANGER 1. Is there any corrosion on terminals and/or connectors

Yes

No

[2] Are connections tight

Yes

No

[3] Tighten connections using two insulated wrenches

[4] Obtain materials and tools in Table A

[5] See CAUTION 1 and FIG. 1. Install temporary wiring and switch

[6] Close switch

[7] Use two insulated wrenches to remove intercell connector

AND

Page 2

TABLE A	
EQUIPMENT REQUIRED	RECOMMENDED TYPE
NO-OX-ID A	R-3266 L1
4/0 sandpaper	-
Table soda	-
Wiper paper	Scott #58 or #59
Insulated wrenches	-
Switch and wire	-
Typewriter brush	R2969

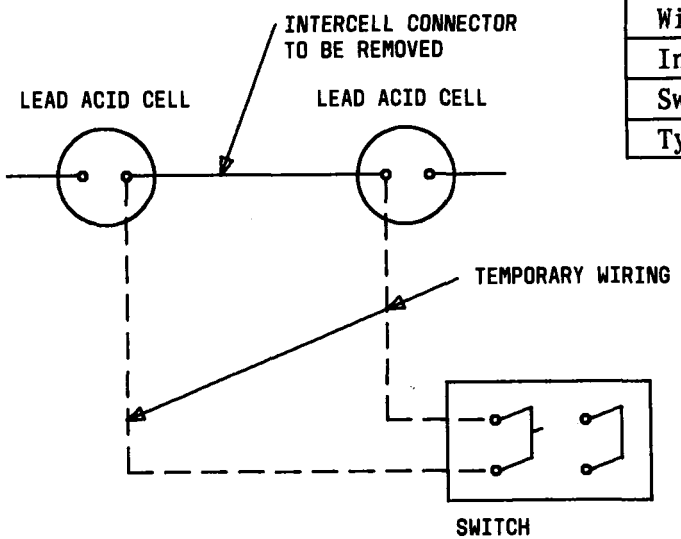
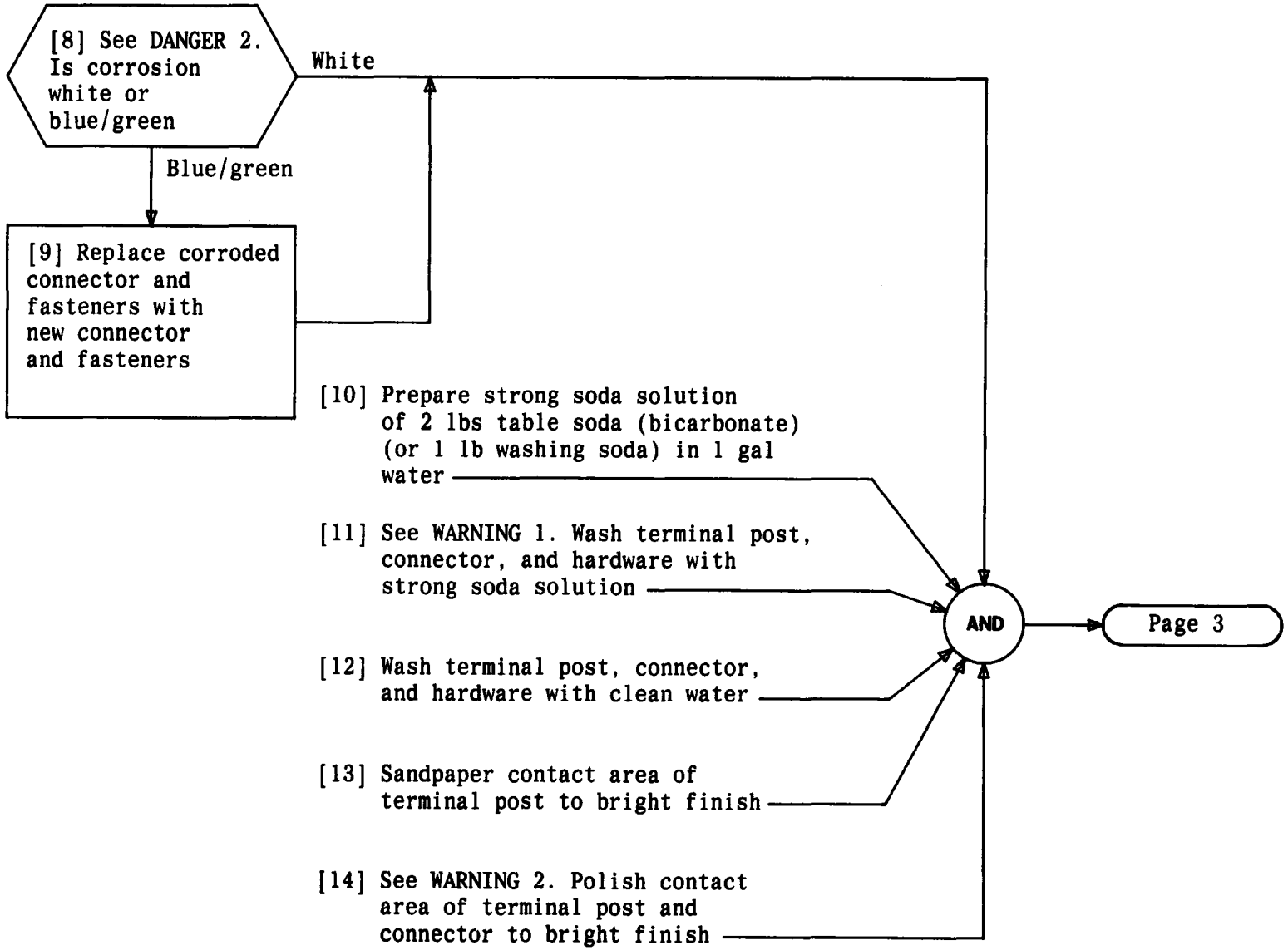


FIG. 1

CAUTION 1
Wiring must be of sufficient size to carry the load under power failure conditions

DANGER 1
Extremely high current potential present in this circuit

MAINTAIN BATTERY TERMINALS AND CONNECTORS



WARNINGS

1. ***Do not allow neutralizing solutions to enter cell***
2. ***Sandpaper, stiff wire brushes, or other abrasive tools should not be used on intercell connectors or fastening hardware as this will remove the protective lead coating***

DANGER 2

Extremely high current potential present in this circuit

MAINTAIN BATTERY TERMINALS AND CONNECTORS

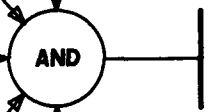
[15] See DANGER 3. Coat contact areas with NO-OX-ID A

[16] Using insulated wrenches, connect intercell connector to terminal post

[17] Open switch and remove temporary wiring

[18] Coat terminal areas of cell with NO-OX-ID A

[19] Wipe off any excess NO-OX-ID A compound



DANGER 3
Extremely high current potential present in this circuit

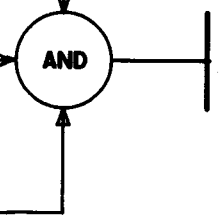
Issue 2	JUL 1980
233-144-100	DLP
PAGE 3 of 3	577

MAINTAIN BATTERY TERMINALS AND CONNECTORS

[1] See DANGER 1, WARNING 1 and NOTE 1.
Insert thermometer through vent tunnel in one cell on battery tier

[2] Completely submerge thermometer bulb in electrolyte for at least 2 minutes

[3] Record thermometer reading (reference temperature) for the battery tier on form provided



NOTE 1
Only one temperature measurement per battery tier is necessary.

WARNING 1
Do not use mercury filled thermometers to take cell temperature

DANGER 1
Extremely high current potential present in this circuit

CHECK ELECTROLYTE TEMPERATURE

[1] See DANGER 1. For each cell, is electrolyte level between marks on jar

Yes

No

[2] See WARNINGS 1, 2, 3, and FIG. 1. Add water approved for storage battery use (TABLE A) to bring electrolyte up to required level

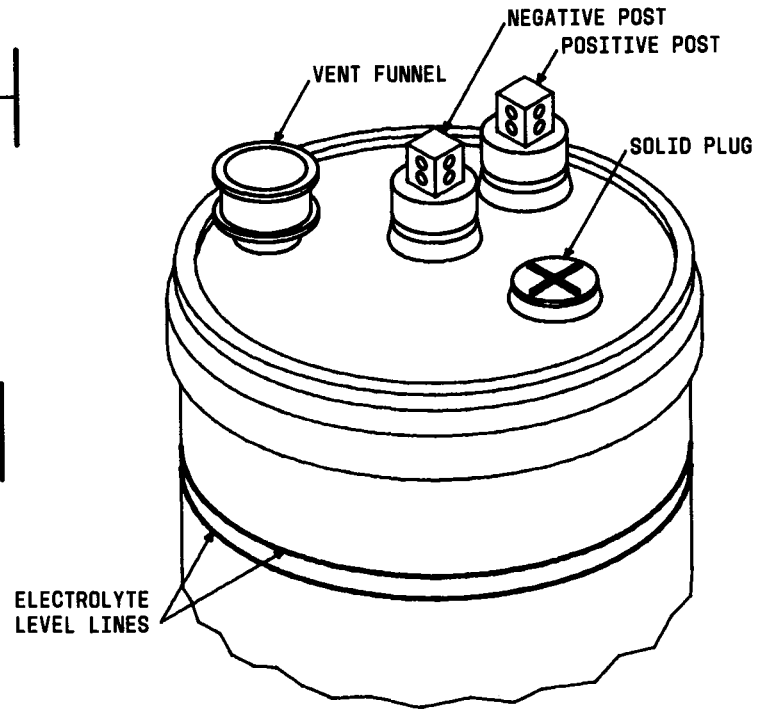


FIG. 1

TABLE A

MAXIMUM ALLOWABLE IMPURITIES IN BATTERY WATER

TYPE OF IMPURITY	PPM OR MG/LITER (BY WEIGHT)	PERCENT
Total solids	500	0.0500
Fixed solids	350	0.0350
Organic & volatile matter	50	0.0050
Chloride	25	0.0025
Iron	4	0.0004
Nitrates & nitrites	15	0.0015
Ammonia	5	0.0005
Manganese	0.007	0.0000007

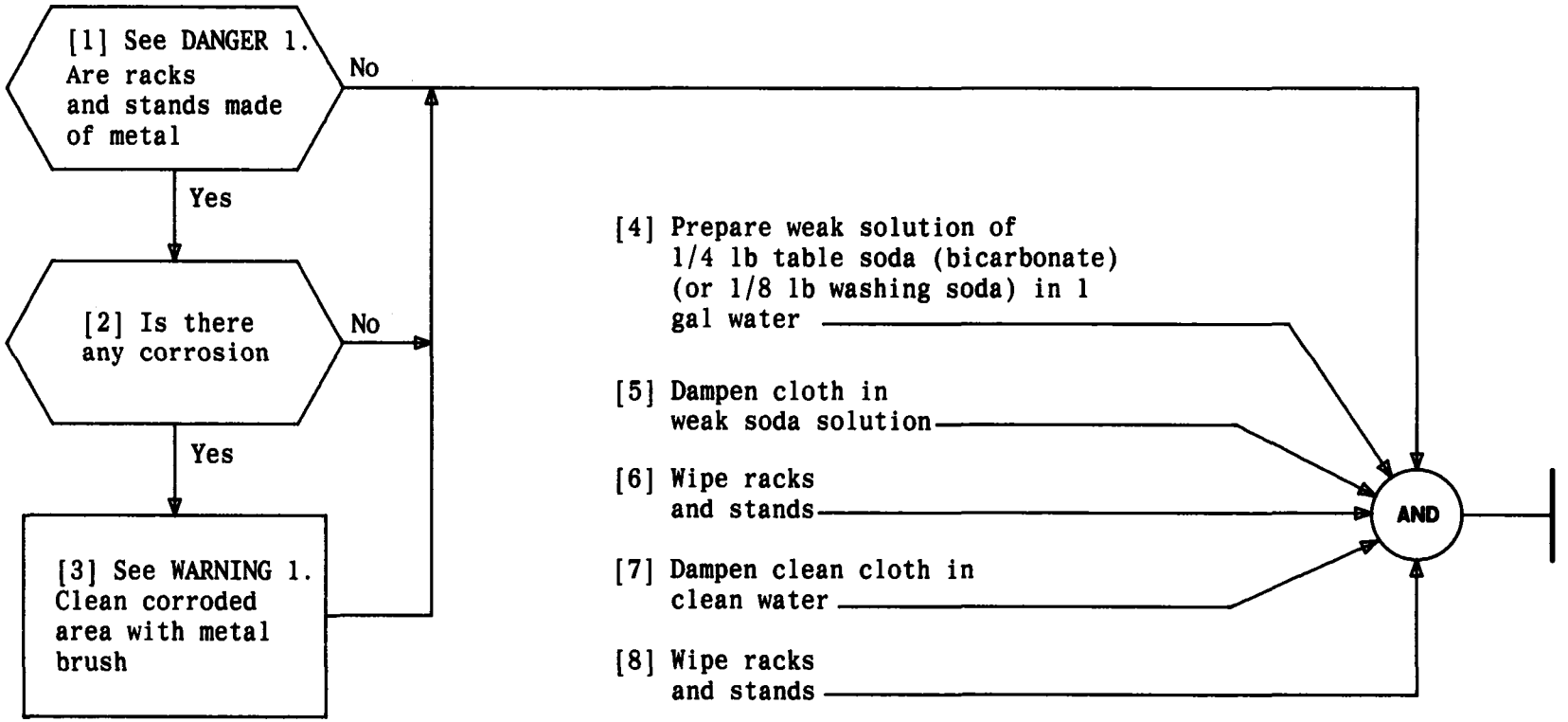
WARNINGS

1. ***Acid or electrolyte shall not be added to any cell as a substitute for adequate charging. Do not contaminate the electrolyte of KS-20472 cells by using electrolyte from lead-calcium or lead-antimony.***
2. ***Plastic funnels will not contaminate but must be rinsed with clean water before using to fill different type cells. Do not use funnels of lead-calcium composition. Only clean plastic funnels shall be used.***
3. ***Under no circumstances shall electrolyte be disposed of in a manner that may result in environmental pollution or damage to equipment. The electrolyte should be neutralized where the possibility of damage may occur.***

DANGER 1

Extremely high current potential present in this circuit

MAINTAIN ELECTROLYTE LEVEL



CLEAN RACKS AND STANDS

WARNING 1
At no time shall wire brush be brought in close proximity to cell terminals and intercell connectors

DANGER 1
Extremely high current potential present in this circuit

Issue 2	JUL 1980
233-144-100	DLP
PAGE 1 of 1	580

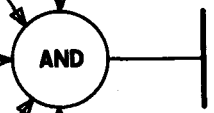
[1] See DANGER 1.
Prepare weak soda solution of 1/4 lb table soda (bicarbonate) (or 1/8 lb washing soda) in 1 gal water

[2] See WARNING 1. Dampen cloth in weak soda solution

[3] Wipe jars

[4] Dampen clean cloth in clean water

[5] Wipe jars



CLEAN BATTERY JARS

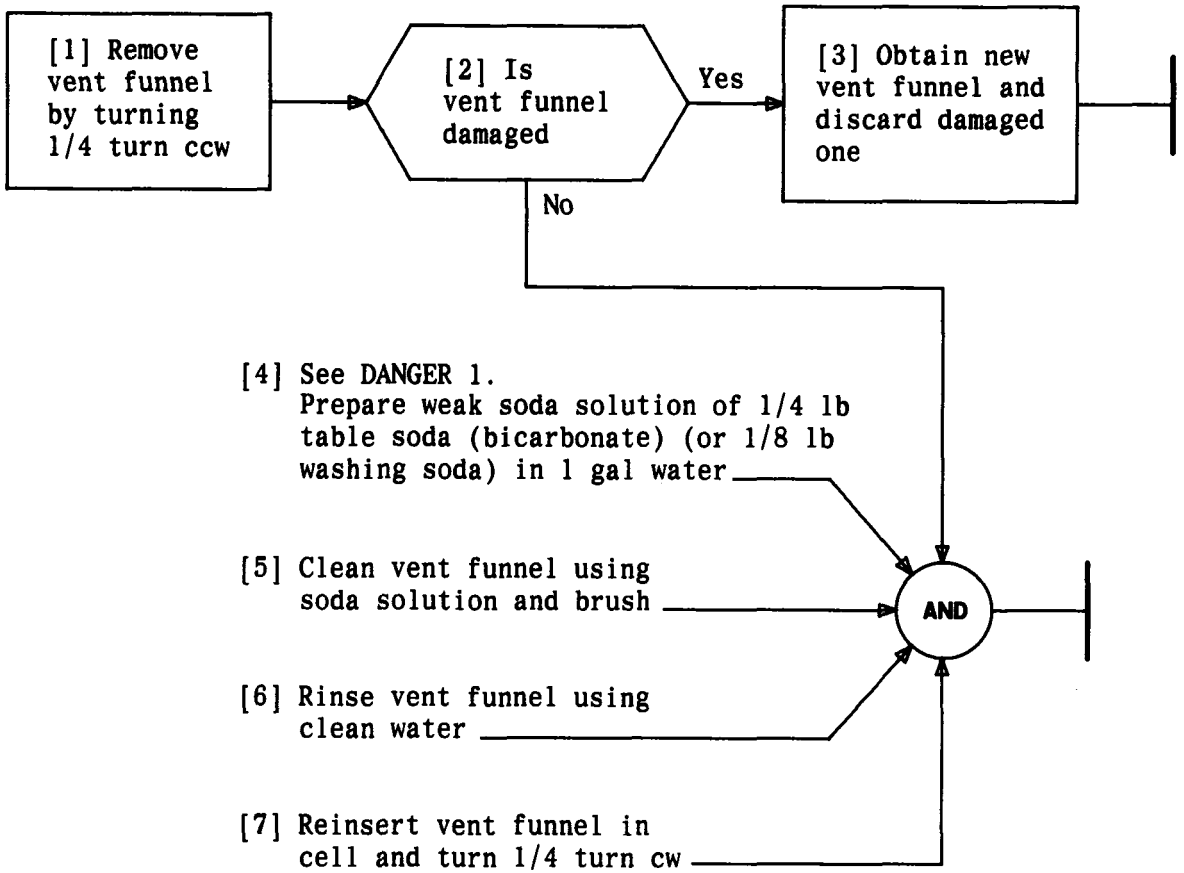
WARNING 1

Do not allow neutralizing solutions to enter cell

DANGER 1

Extremely high current potential present in this circuit

Issue 2	JUL 1980
233-144-100	DLP 581
PAGE 1 of 1	



INSPECT AND CLEAN ANTIEXPLOSION DEVICE

DANGER 1	
Extremely high current potential present in this circuit	
Issue 2	JUL 1980
233-144-100	DLP
PAGE 1 of 1	582

SUMMARY

See FIG. 1. In test mode, panel voltmeter indicates 110 to 125 Vac and **INVERTER RUN** lamp lights. **INVERTER** restores to normal within 30 to 50 seconds.

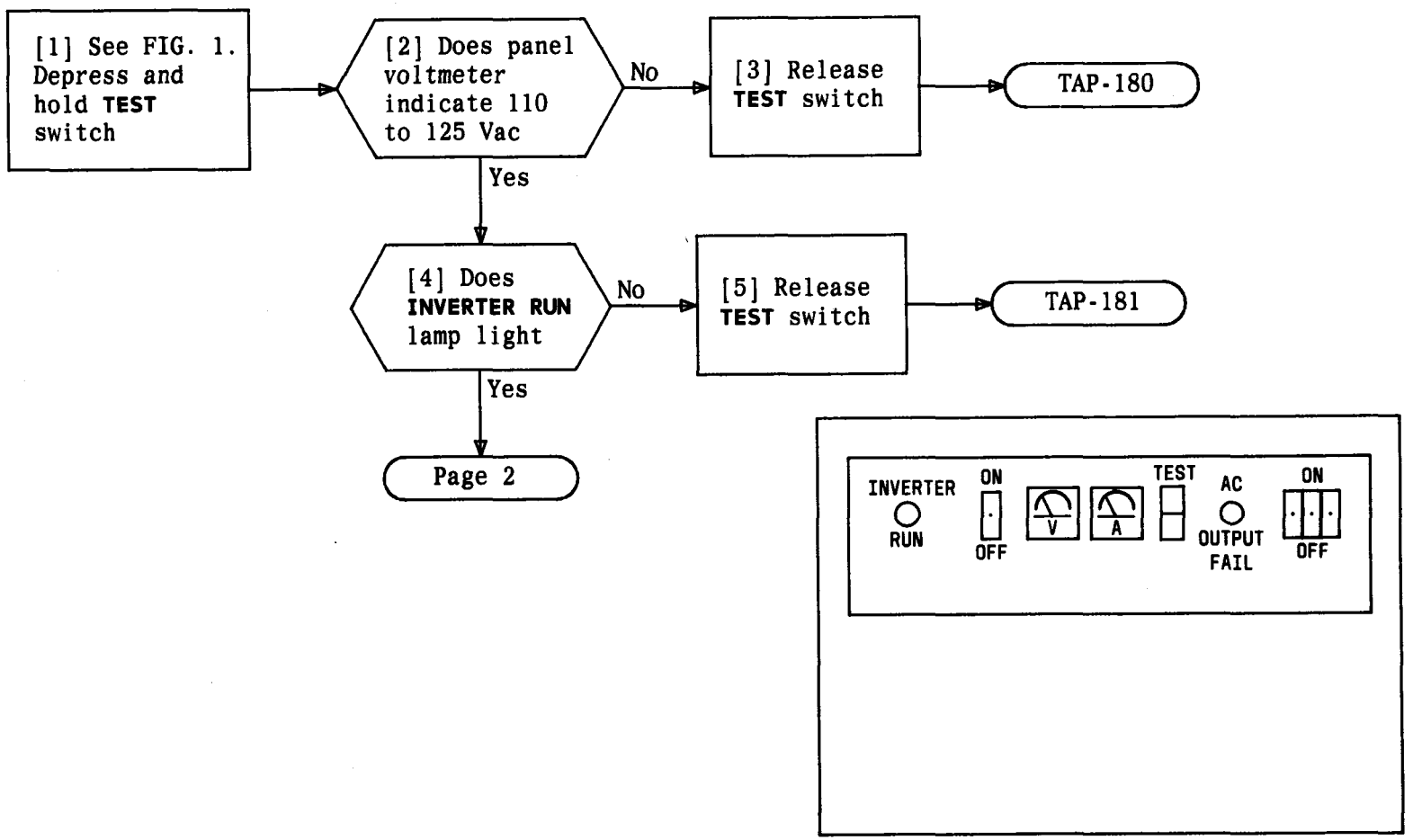


FIG. 1

CHECK INVERTER TRANSFER AND ALARM CIRCUITS

Issue 2	JUL 1980
233-144-100	DLP
PAGE 1 of 2	610

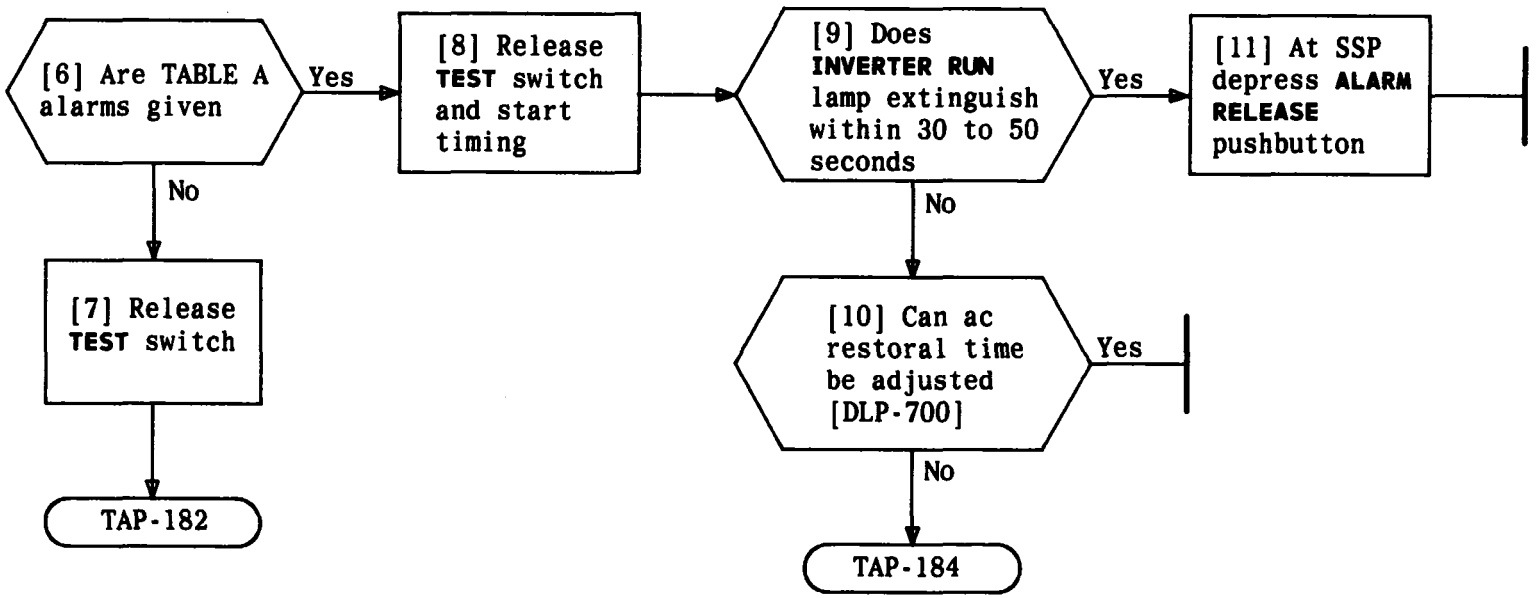


TABLE A
POWER ALARMS

LOCATION	INDICATION
1. SSP	Major (red) Major power (red)
2. TTY	** REPT MISCA 25 12 OFN
3. BUILDING	Major audible
4. INVERTER	Inverter run (amber)

CHECK INVERTER TRANSFER AND ALARM CIRCUITS

SUMMARY

Operate AC input circuit breaker to **ON**. Install fuses **P** and **ACL**. Install fuse supplying power to **INVERTER**. Set **ON-OFF** switch, **CB1**, and **CB2** to **ON**. Plug **ANNOUNCEMENT** machine and TTY into output of **INVERTER**

[1] At commercial AC input power panel, set **INVERTER** circuit breaker to **ON** or install fuse

[2] At **TST** frame below **INVERTER**, install fuses **P** and **ACL**

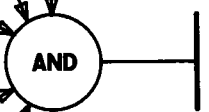
[3] At **151A PWR PLANT**, on −48V discharge distribution panel, install **30A FRN TST INV** fuse supplying power to **INVERTER**

At **TST** frame on front panel of **INVERTER**:

[4] Set **ON-OFF** switch to **ON**

[5] Set **CB1** and **CB2** to **ON**

[6] Plug **ANNOUNCEMENT** machine and TTY into **INVERTER** output



RESTORE KS-20816 L2 INVERTER TO SERVICE

SUMMARY

See DANGER 1. Measure input DC voltage on **TB1** terminals **1** and **2**. Reading should be -42 to -56 Vdc

[1] Condition DMM to measure approximately 100 Vdc

[2] See DANGER 1. At **TST** frame **INVERTER**, connect DMM across direct current input **TB1** terminals **1** and **2** [FIG. 1]

AND

[3] Does DMM read between -42 and -56 Vdc

Yes

52.04

[4] Disconnect DMM

No

TAP-183

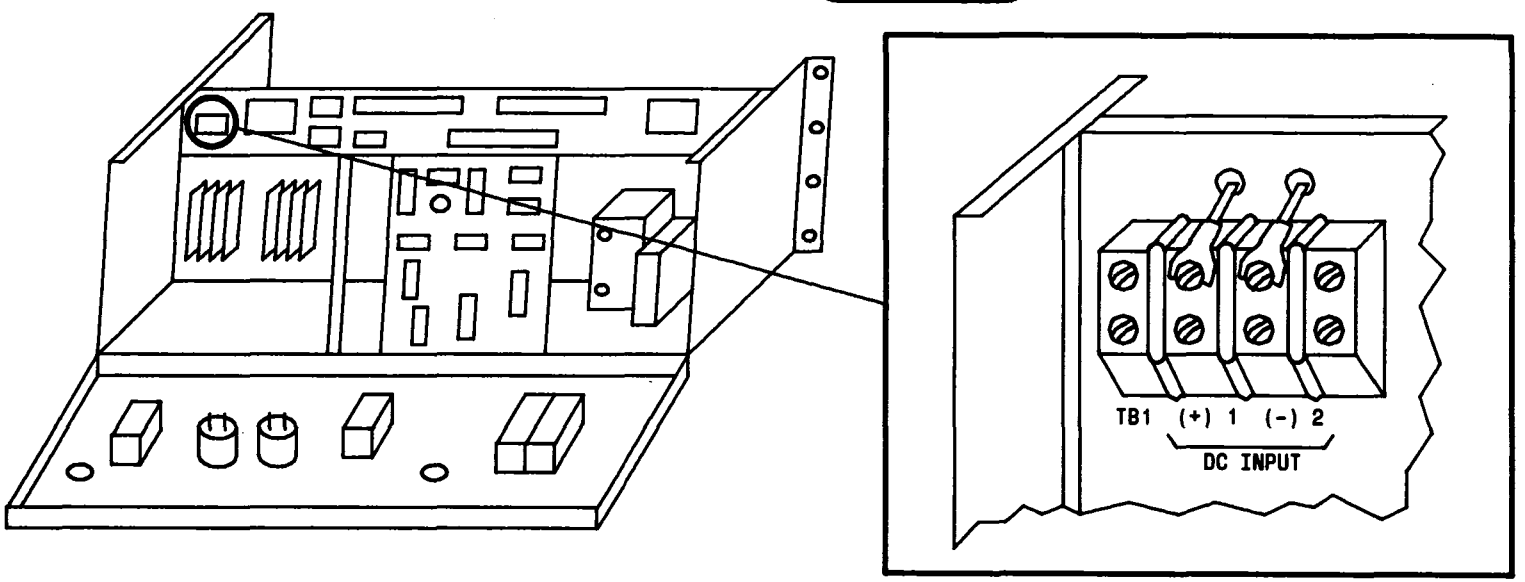


FIG. 1

DANGER 1
Voltages in this circuit are over 150 volts to ground

Issue 2	JUL 1980
233-144-100	DLP
PAGE 1 of 1	612

CHECK DC INPUT VOLTAGE

SUMMARY

See DANGER 1. Measure output voltage of operating **INVERTER** on **TB 2** terminals **1** and **2**. Indication should be 110 to 125 Vac

[1] Condition DMM to measure approximately 125 Vac

At **TST** frame **INVERTER**:

[2] See DANGER 1 and FIG. 1. Connect DMM across AC output **TB2** terminals **1** and **2**

[3] Depress and hold **TEST** switch

AND

[4] Does DMM indicate between 110 and 125 Vac

No

[5] Release **TEST** switch

[6] At SSP depress **ALARM RELEASE** pushbutton

TAP-180

Yes

[7] Release **TEST** switch

[8] Disconnect DMM

[9] At SSP depress **ALARM RELEASE** pushbutton

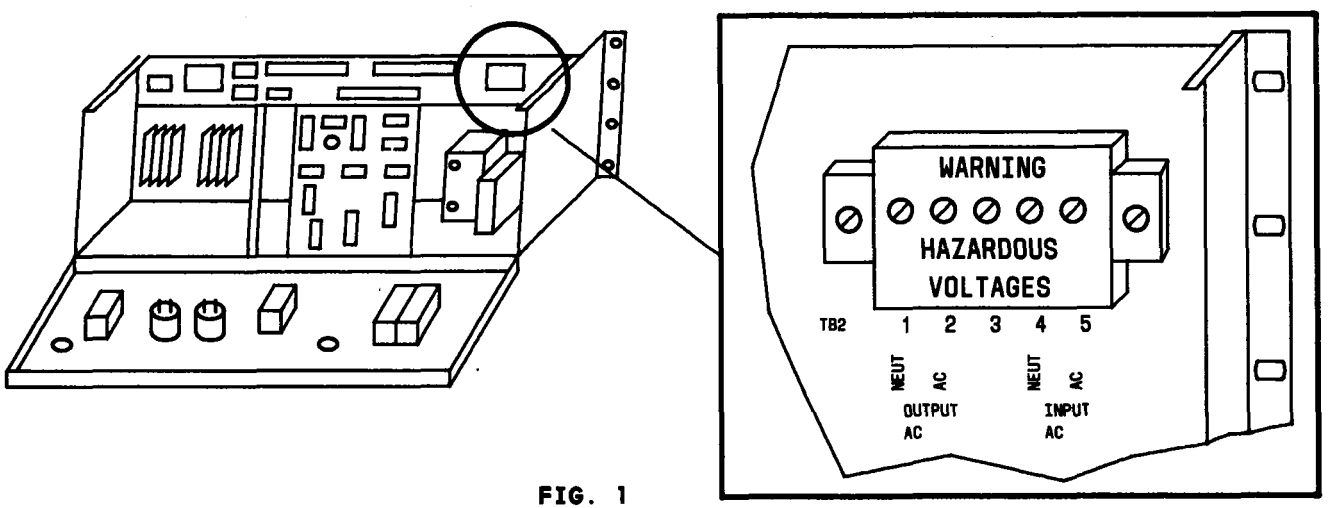


FIG. 1

DANGER 1
Voltages in this circuit are over 150 volts to ground

Issue 2	JUL 1980
233-144-100	DLP
PAGE 1 of 1	613

CHECK AC OUTPUT VOLTAGE

CALIBRATE PANEL VOLTMETER

SUMMARY

See DANGER 1. Adjust panel meter for exact voltage indication

At **TST** frame **INVERTER**:

[1] See DANGER 1 and FIG. 1. Connect DMM leads across panel voltmeter terminals

AND

Page 2

[2] Depress and hold **TEST** switch

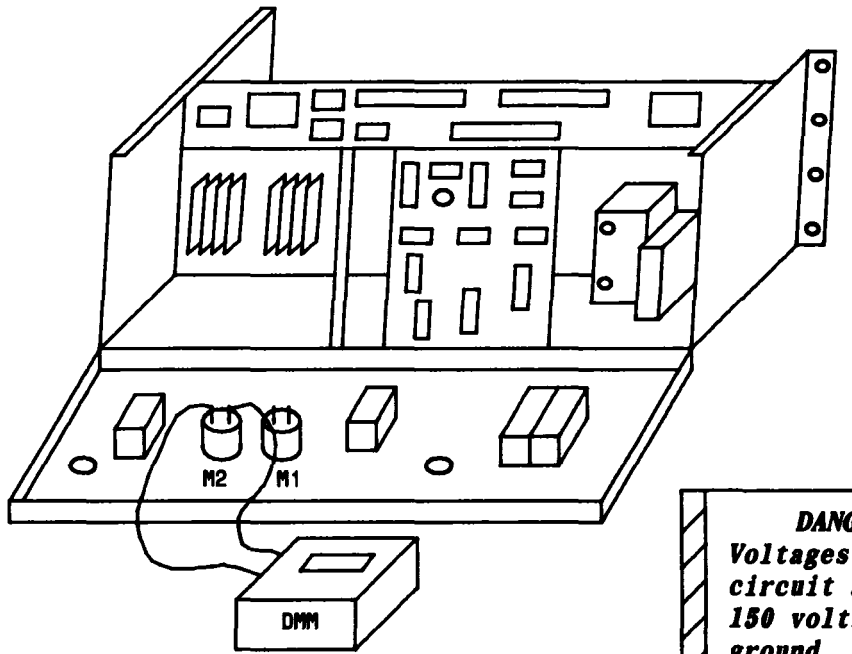
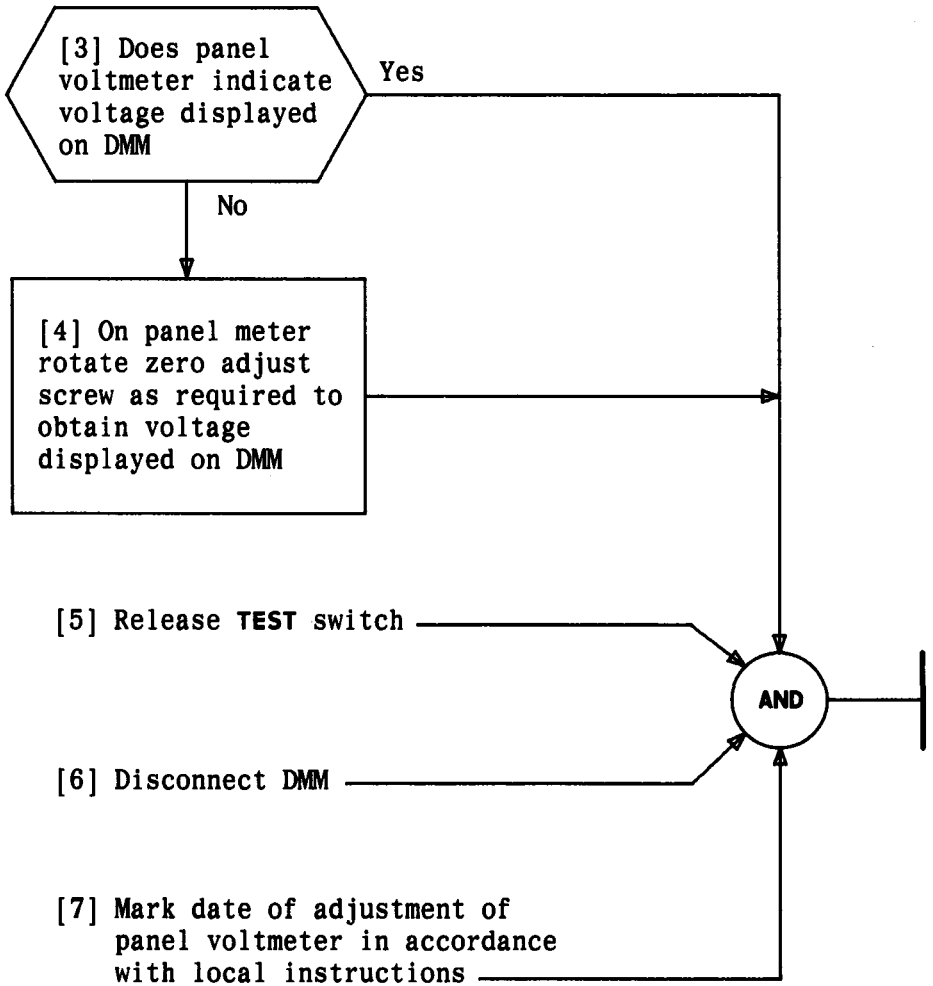


FIG. 1

DANGER 1
Voltages in this circuit are over 150 volts to ground



CALIBRATE PANEL VOLTMETER

SUMMARY
See DANGER 1. Measure the output frequency at **TB2** terminals **1** and **2** of operating **INVERTER**. Frequency should be between 59.7 and 60.3 Hz. Adjust **R23** on **A1** for 60 Hz.

[1] Set frequency counter controls to measure 60 Hz

At **TST** frame **INVERTER**:

[2] See DANGER 1. Connect frequency counter across **TB2** terminals **1** and **2**

[3] Depress and hold **TEST** switch

AND

Page 2

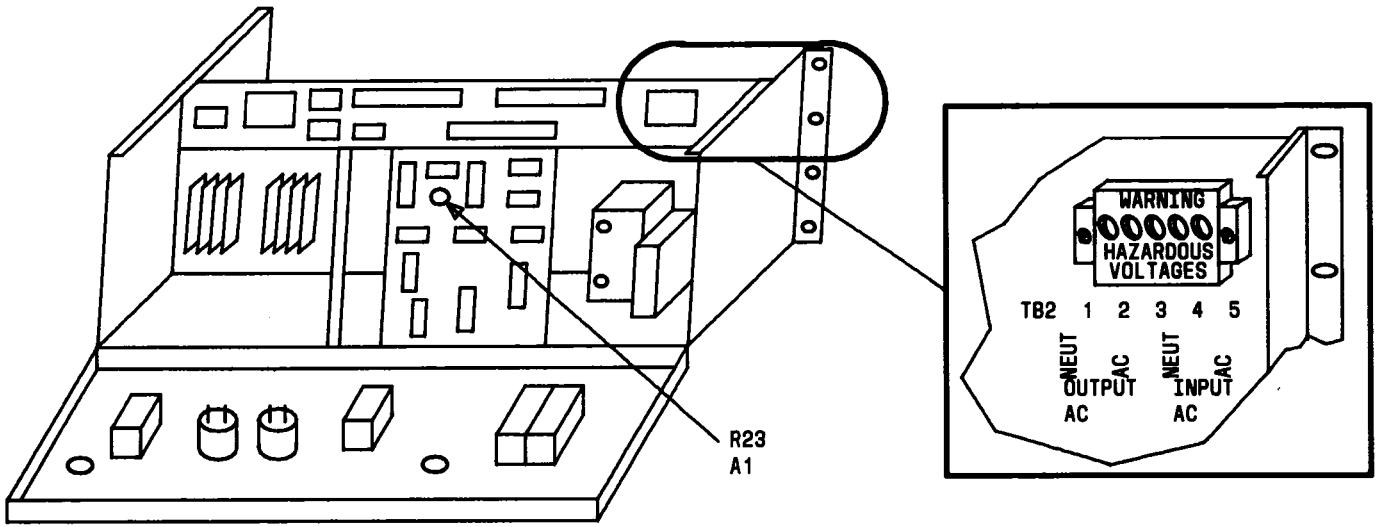
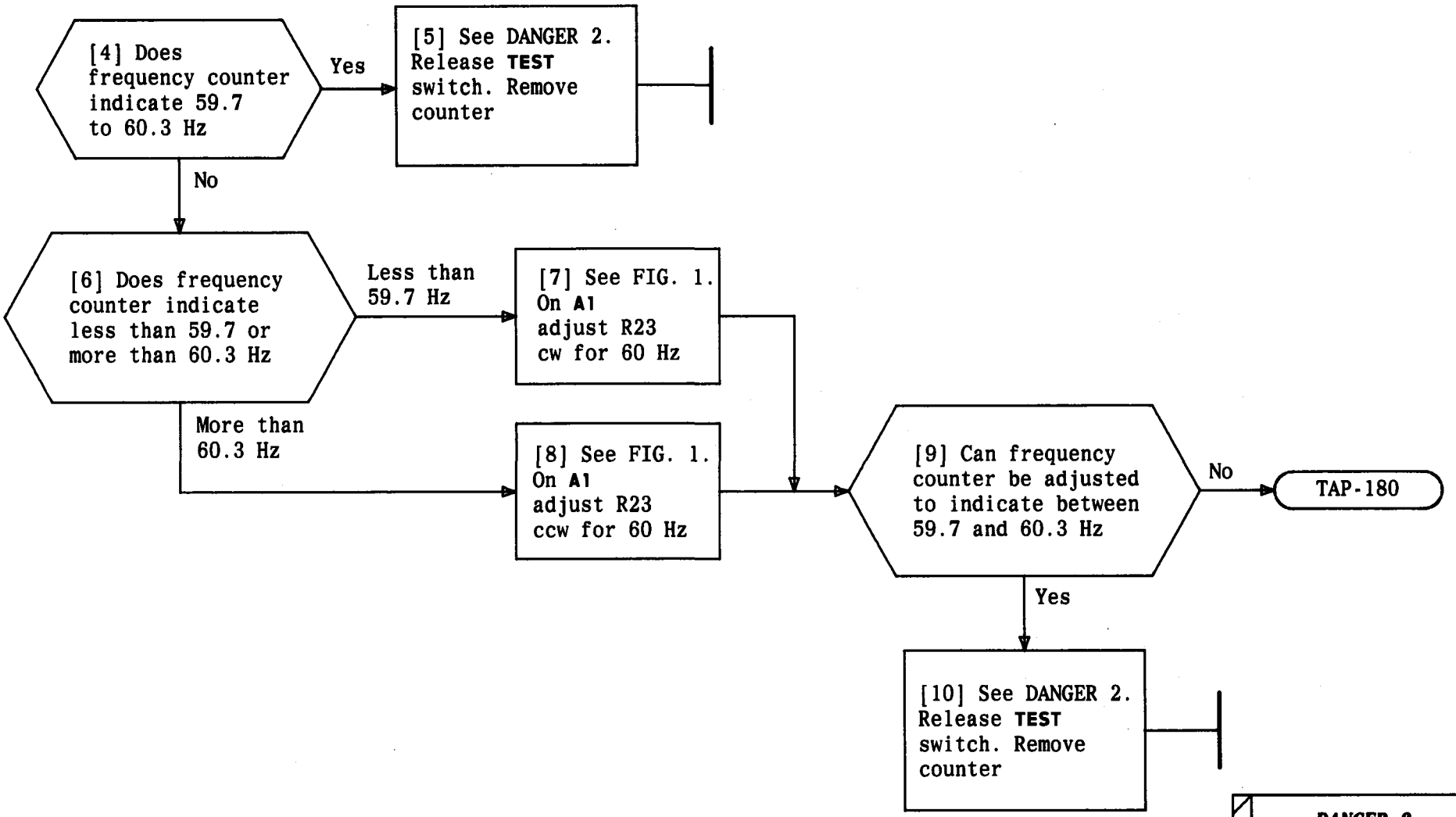


FIG. 1

DANGER 1
Voltages in this circuit are over 150 volts to ground

CHECK AC OUTPUT FREQUENCY



CHECK AC OUTPUT FREQUENCY

DANGER 2
Voltages in this circuit are over 150 volts to ground

SUMMARY

See DANGER 1. Check input voltages at **TB2** terminals **4** and **5**. Indication should be 110 to 125 Vac

[1] Condition VOM to measure approximately 125 Vac

[2] See DANGER 1. Connect VOM to AC input **TB2** terminals **4** and **5** [FIG. 1]

AND

[3] Does VOM indicate between 110 and 125 Vac

Yes

[4] Disconnect VOM

No

[5] Trouble is in input circuit breaker or wiring per (SD-3H908-01). Refer trouble to installation group

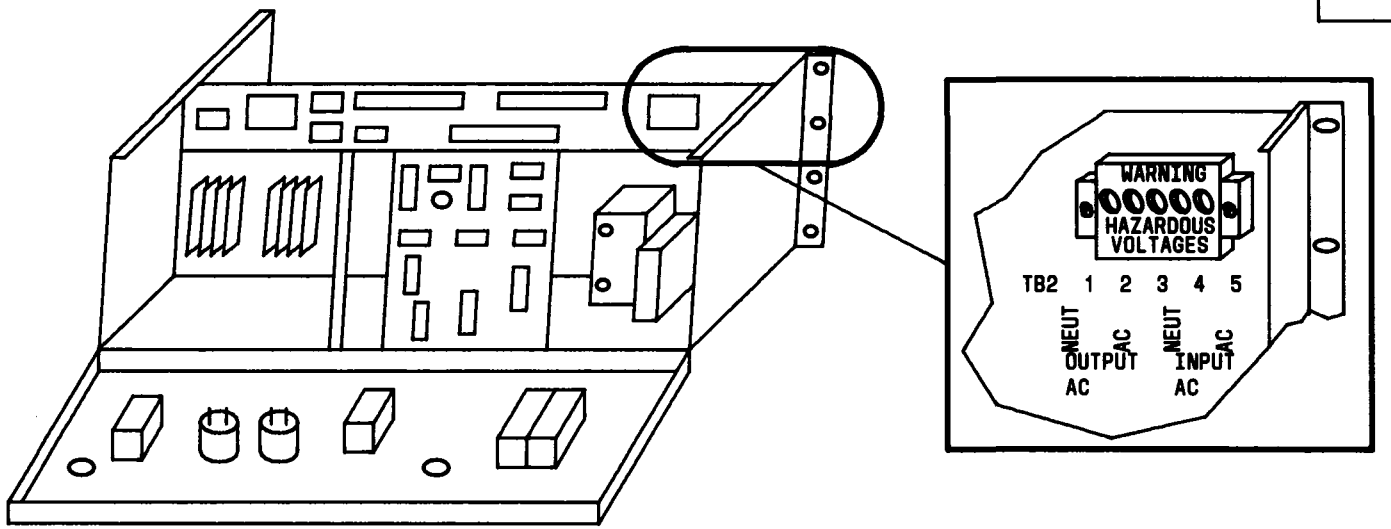


FIG. 1

DANGER 1
Voltages in this circuit are over 150 volts to ground

Issue 2	JUL 1980
233-144-100	DLP
PAGE 1 of 1	616

CHECK INVERTER AC INPUT VOLTAGE

SUMMARY

Plug **ANNOUNCEMENT** machine and TTY into utility outlet. Remove fuses **P** and **ACL**. Set **ON-OFF** switch, **CB1**, and **CB2** to **OFF**. Remove fuse supplying power to **INVERTER**. Set **INVERTER** input circuit breaker to **OFF**

At **TST** frame:

[1] At back of **INVERTER**, plug TTY into utility outlet

[2] If equipped with **7A ANNOUNCEMENT** machine, plug into utility outlet

[3] Below **INVERTER**, remove fuses **P** and **ACL**

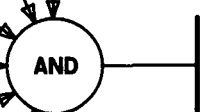
On front panel of **INVERTER**:

[4] Set **ON-OFF** switch to **OFF**

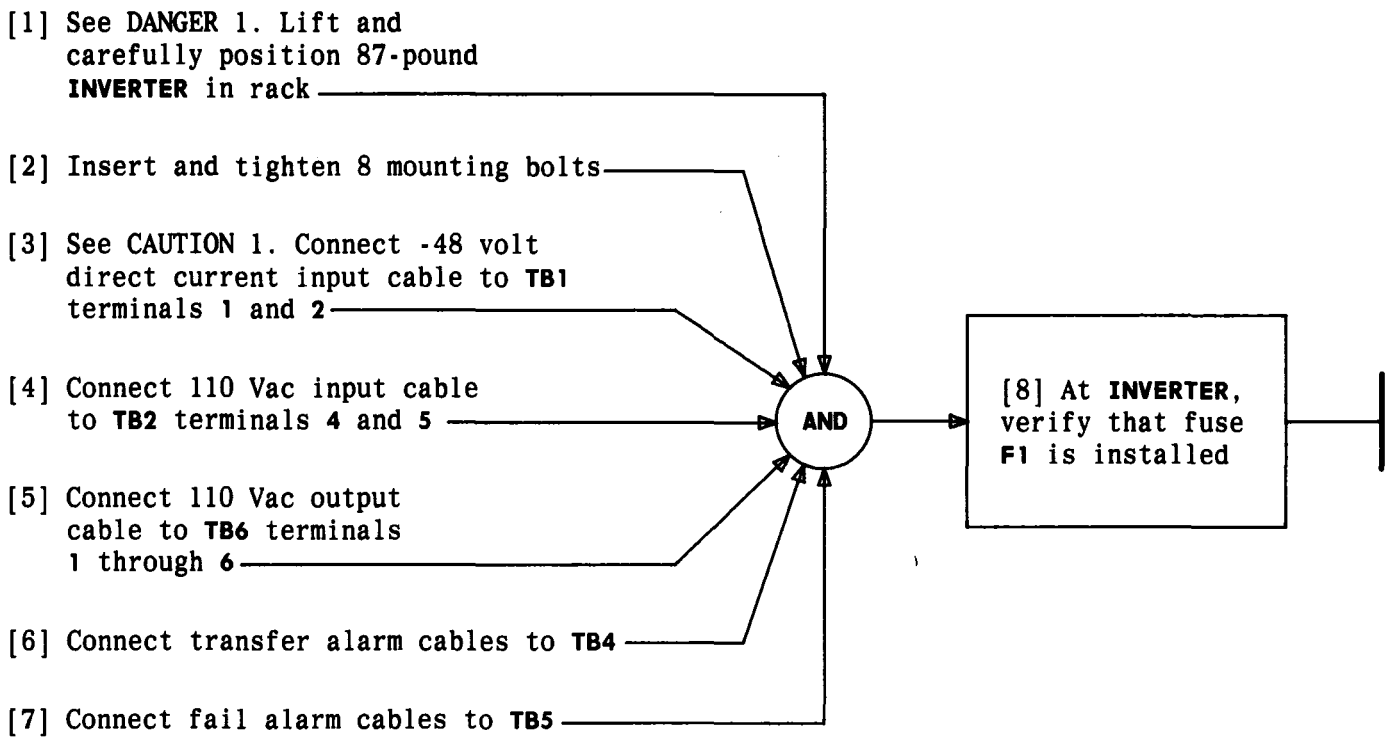
[5] Set **CB1** and **CB2** to **OFF**

[6] At **151A PWR PLANT**, on −48V discharge distribution panel, remove **30A FRN TST INV** fuse supplying power to **INVERTER**

[7] At commercial AC input power panel, set **INVERTER** circuit breaker to **OFF** or remove fuse



REMOVE FROM SERVICE AND TURN DOWN KS-20816 L2 INVERTER



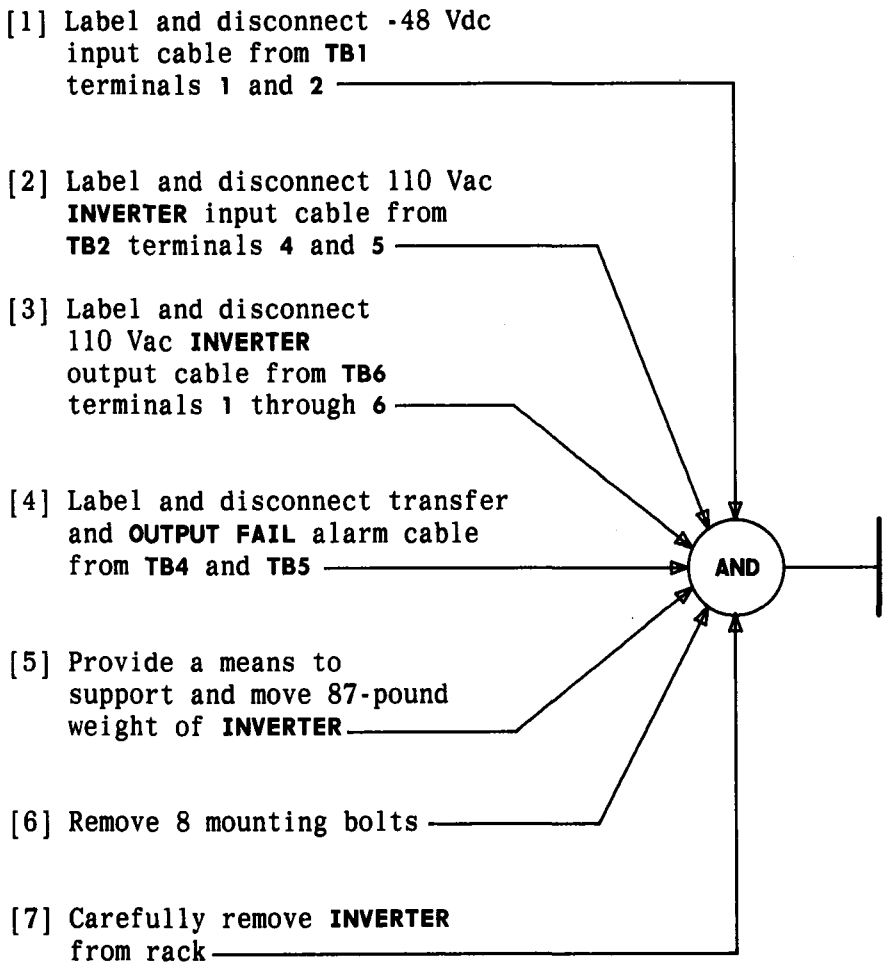
INSTALL INVERTER IN RACK

CAUTION 1

***Proper polarity should be observed when connecting dc input. Improper polarity will cause serious damage to* INVERTER**

DANGER 1

***Provide equipment with sufficient capability to handle heavy* INVERTER**



REMOVE INVERTER FROM RACK

Issue 2	JUL 1980
233-144-100	DLP
PAGE 1 of 1	620

SUMMARY
Check the output of the 24-volt DC converter at the output voltage test jacks. Adjust the output voltage potentiometer if necessary.

[1] Condition DMM to measure approximately 100 Vdc

[2] See FIG. 1. Connect meter leads to (+)**V OUT** and (–)**V OUT**.

AND

[3] Does meter indicate +24.7 volts

Yes

[4] Remove meter leads

No

[5] Can output be adjusted to +24.7 volts by **V ADJ**

Yes

[6] Remove meter leads

No

TAP-230

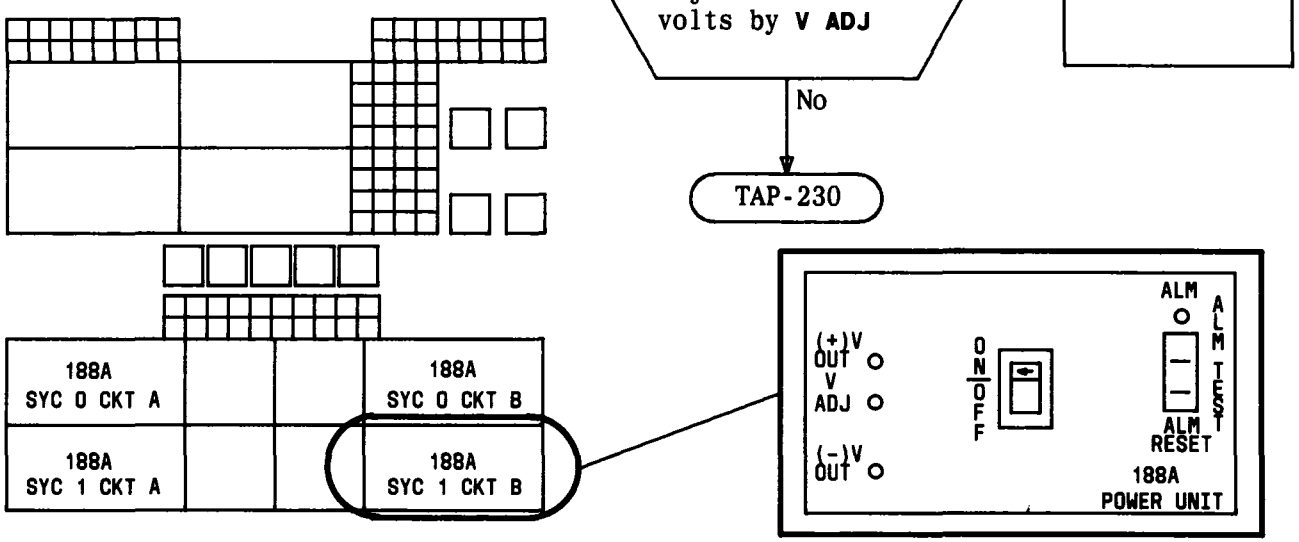


FIG. 1 – Top of Miscellaneous Power Frame

CHECK/ADJUST 188A POWER UNIT (+24 VOLT CONVERTER) DC OUTPUT VOLTAGE

Issue 2	JUL 1980
233-144-100	DLP
PAGE 1 of 1	687

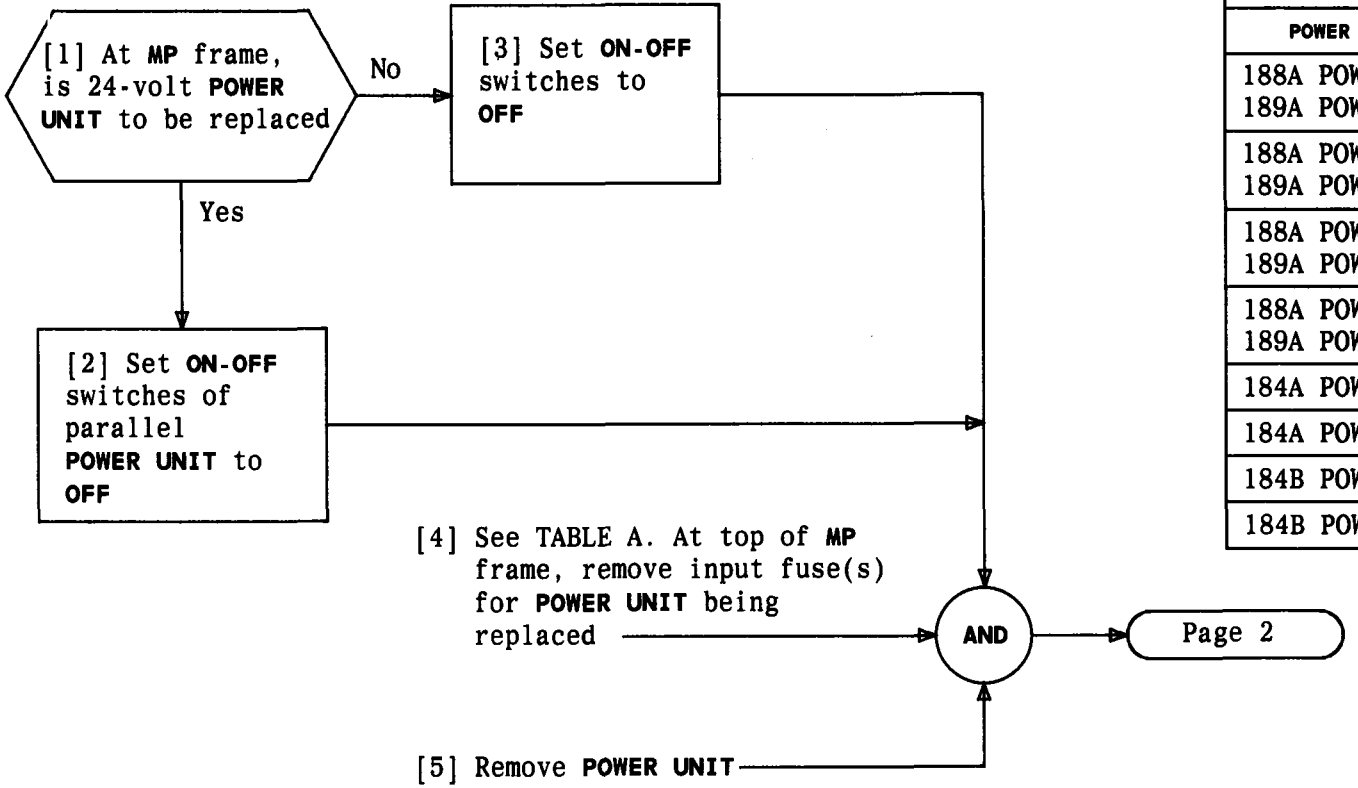
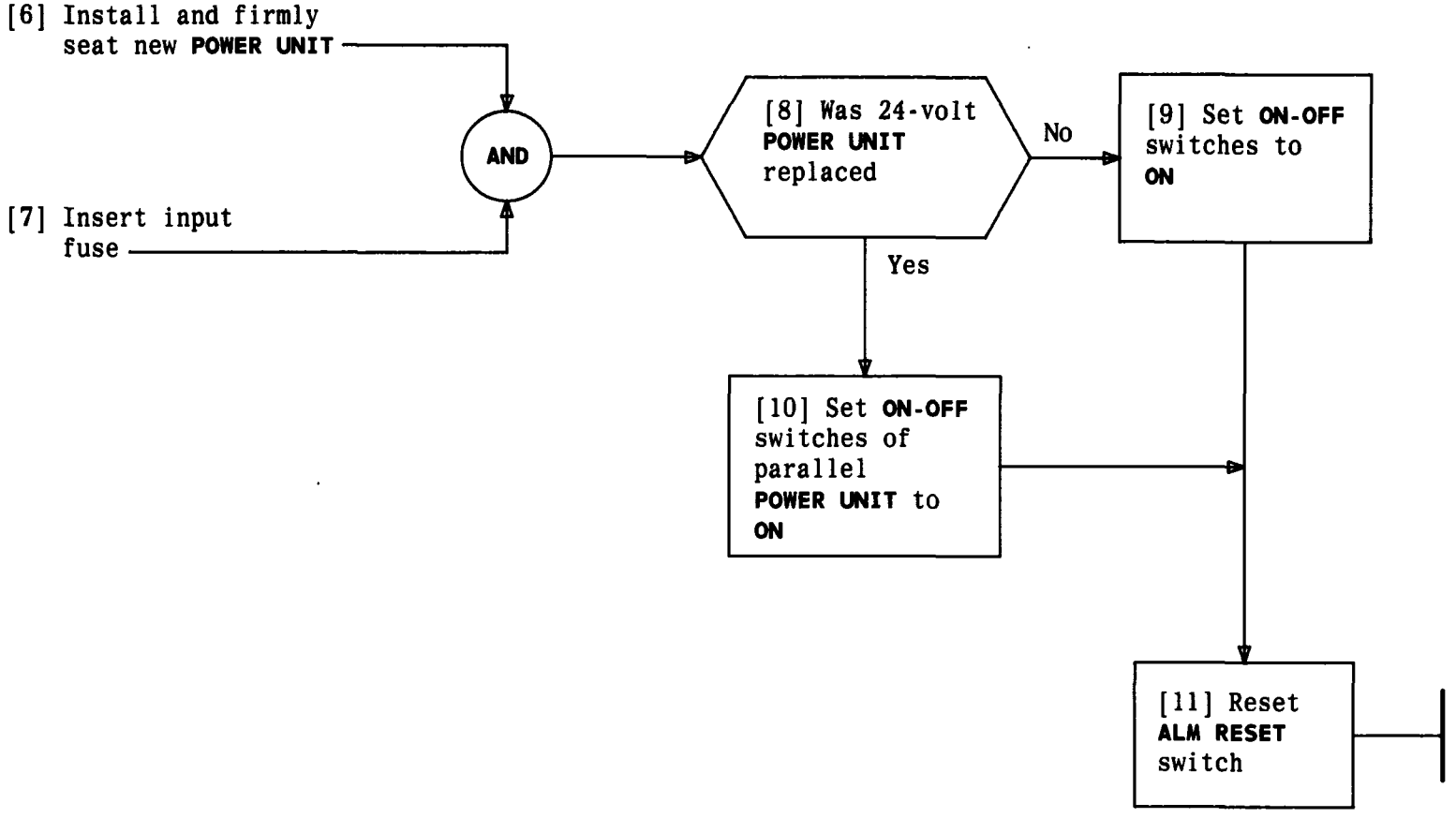


TABLE A

INPUT FUSES

POWER UNIT	CONVERTER	FUSE
188A POWER UNIT 189A POWER UNIT	+24 CONVA(0)	1ABS0 1CV0
188A POWER UNIT 189A POWER UNIT	+24 CONVB(0)	2ABS0 2CV0
188A POWER UNIT 189A POWER UNIT	+24 CONVA(1)	1ABS1 1CV1
188A POWER UNIT 189A POWER UNIT	+24 CONVB(1)	2ABS1 2CV1
184A POWER UNIT	+48CONV(0)	D0
184A POWER UNIT	+48CONV(1)	D1
184B POWER UNIT	±130CONV(0)	C0
184B POWER UNIT	±130CONV(1)	C1

REPLACE 184A, 184B, 188A, OR 189A POWER UNIT



REPLACE 184A, 184B, 188A, OR 189A POWER UNIT

CHECK 188A POWER UNIT (+24 VOLT CONVERTER) POWER ALARM

SUMMARY

See CAUTION 1. Test the power alarm by increasing output voltage to 27.5 volts and decreasing output voltage to 23.5 volts to set power alarms of TABLE A.

TABLE A
POWER ALARMS

LOCATION	INDICATION
1. SSP	**MINOR** (amber) **MINOR POWER** (amber)
2. TTY	Message
3. Building	Minor audible

[1] At MP miscellaneous power frame, condition DMM to measure approximately 100 Vdc

[2] See CAUTION 1. Connect DMM to (+)**V OUT** and (–)**V OUT**. See FIG. 1

[3] Observe and note output voltage reading (24.7 volts)

[4] With jewelers screwdriver slowly rotate **V ADJ** cw until **ALM** led lights or until meter indicates maximum 27.5 volts ≥6.95

AND

[5] Does **ALM** led light between 26.5 and 27.3 volts and are the alarms of TABLE A set

Yes → Page 2

No → [6] Check wiring per SD-3H905-01

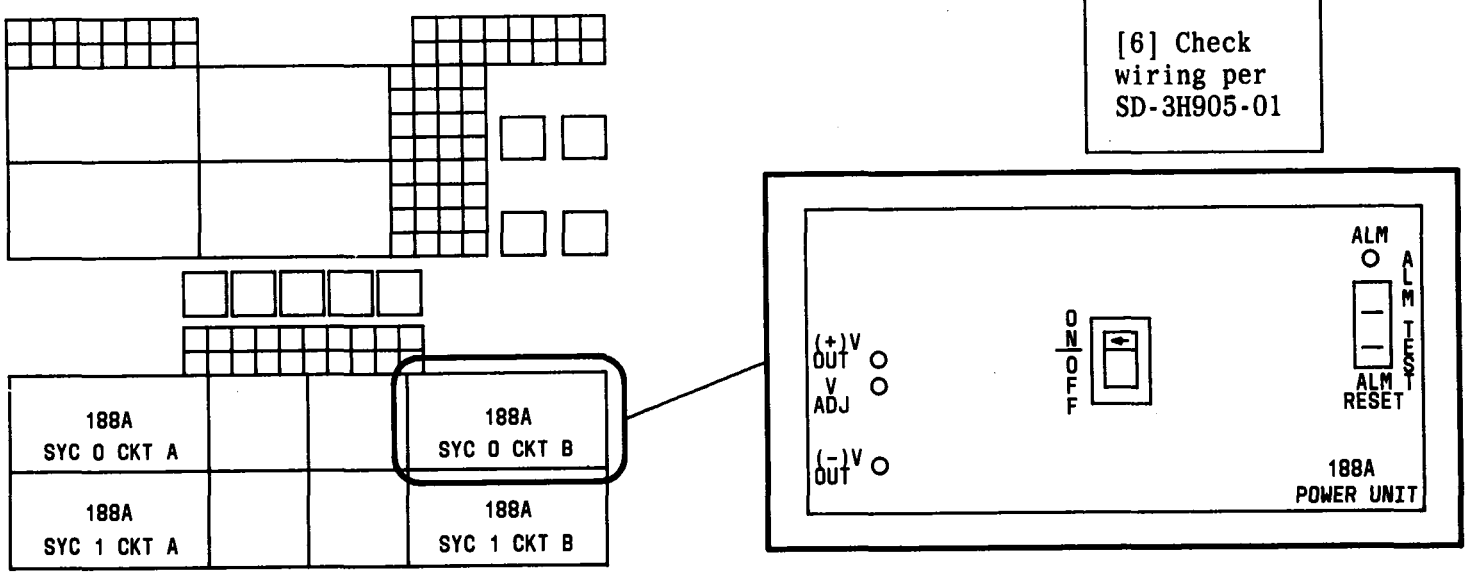
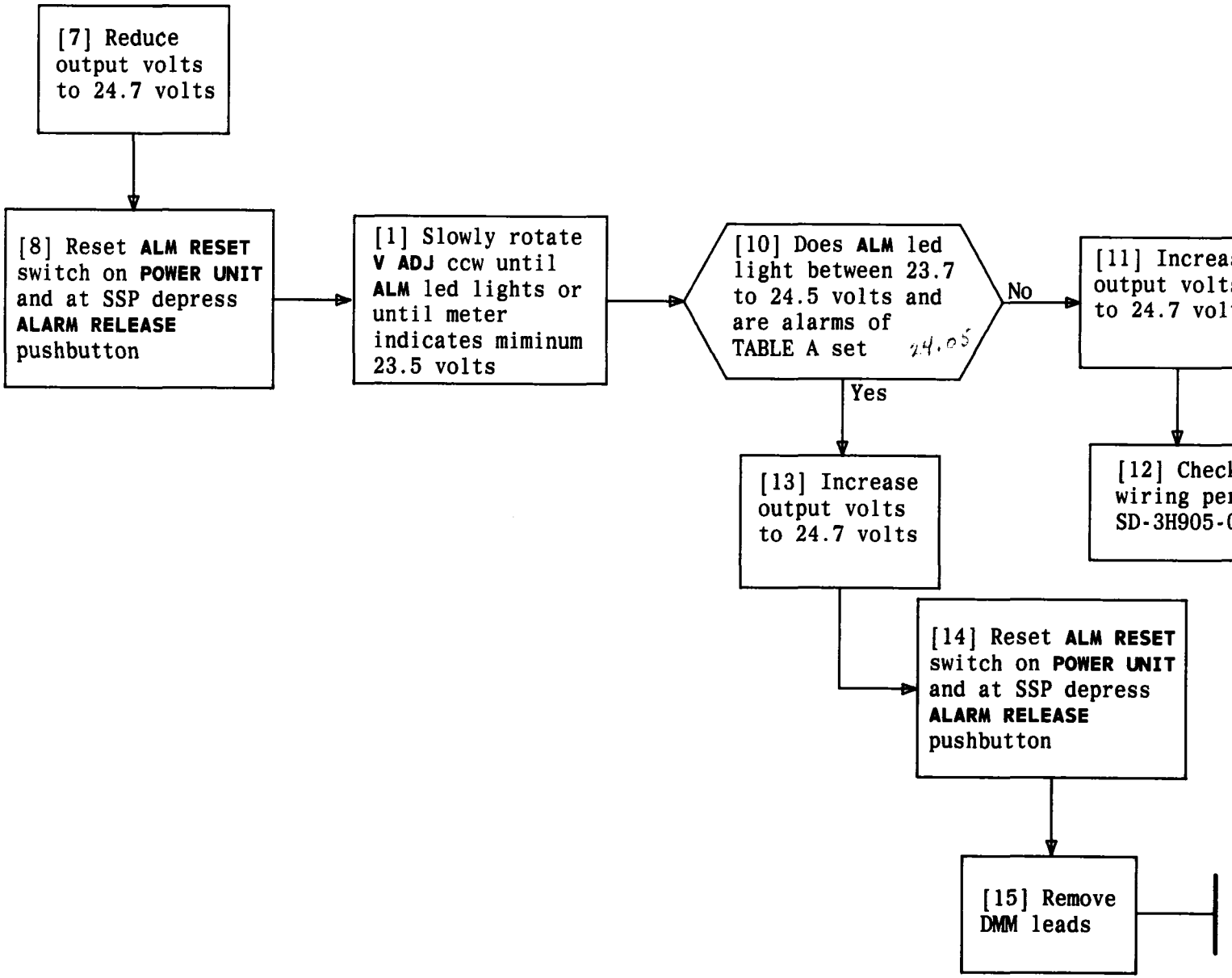


FIG. 1 – Top of Miscellaneous Power Frame

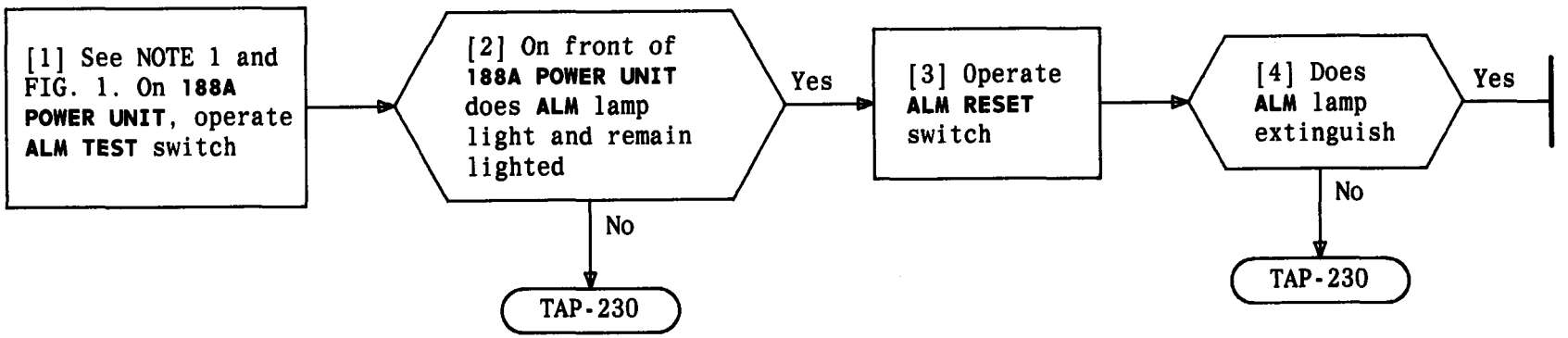
CAUTION 1
Test converter power alarms only when normal service will not be affected.



CHECK 188A POWER UNIT (+24 VOLT CONVERTER) POWER ALARM

SUMMARY

See NOTE 1 and FIG. 1. Operate **ALM TEST** switch. **ALM** lamp on front panel lights and remains lighted until **ALM RESET** switch is operated.



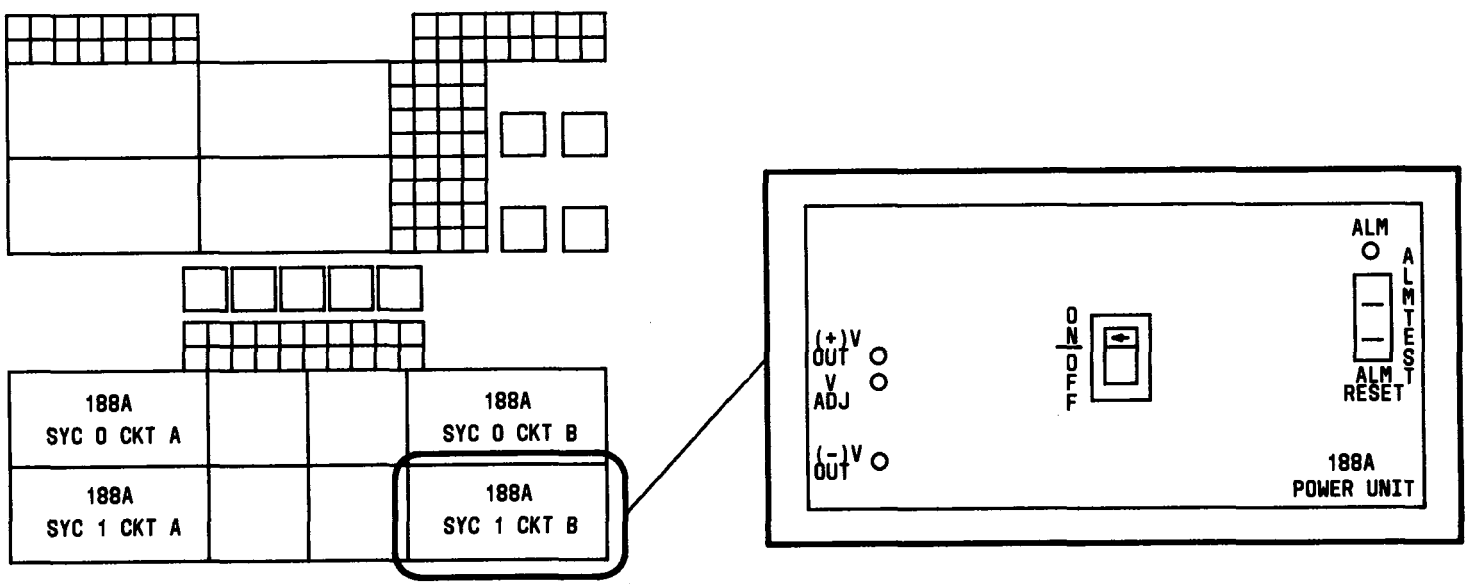


FIG. 1 – Top of Miscellaneous Power Frame

NOTE 1

This test does not operate TTY printout or remote alarms

Issue 2	JUL 1980
233-144-100	DLP
PAGE 1 of 1	693

CHECK 188A POWER UNIT (+24 VOLT CONVERTER) NO POWER ALARM

[1] Condition DMM to measure approximately 50 Vdc

[2] See DANGER 1, FIG. 1, and NOTE 1. On connector **J5** at back of **184A POWER UNIT**, connect DMM to terminal **A**(-) and **F**(+)

AND

[3] Does DMM indicate between +51.0 and +52.0 volts

Yes

No

TAP-230

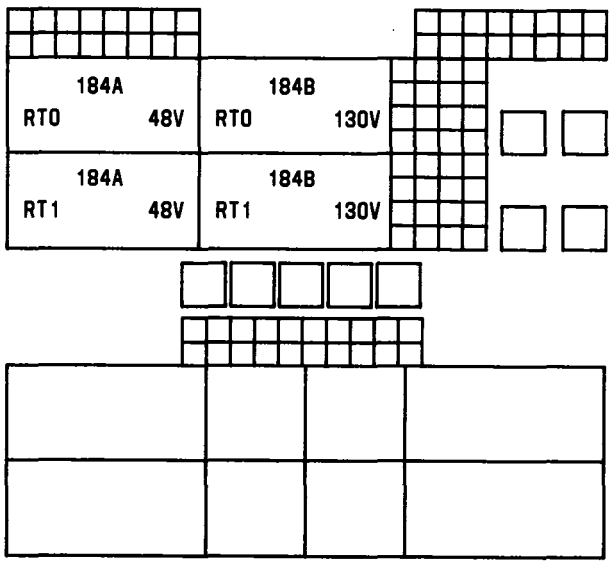


FIG. 1

NOTE 1
Back of connector is lettered in fine print next to connecting pins

DANGER 1

Voltages in this circuit are over 50 volts to ground

Issue 2	JUL 1980
233-144-100	DLP
PAGE 1 of 1	695

CHECK 184A POWER UNIT (+48V CONVERTER) OUTPUT

SUMMARY

Using fuse alarm test cord, check input and distribution fuse alarm circuitry of **184A POWER UNIT**.

TABLE A INPUT FUSES	
CIRCUIT	DESIGNATION
0	D0
1	D1

[1] See FIG. 1. Install 720A voltage pickup tool at suitable spare –48 position

[2] See FIG. 2 and CAUTION 1. At fuse in TABLE A, for circuit out of service touch tip of 411C test pick to exposed test point on fuse cap

AND

[3] Are TABLE B alarms given

Yes → Page 3

No → [4] Clear defective wiring and/or +48 FA alarm relay per SD-3H905-01

TABLE B FUSE ALARMS	
LOCATION	INDICATION
1. SSP	**FUSE** (red) **MAJOR** (red)
2. TTY	Message
3. Building	Audible, Major

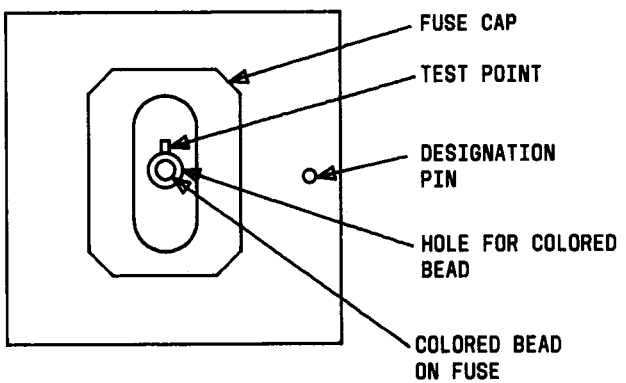


FIG. 2 – Alarm Fuse Cap – Typical

CAUTION 1
Test fuses in circuit out of service only

CHECK 184A POWER UNIT (+48 VOLT CONVERTER) FUSE ALARM

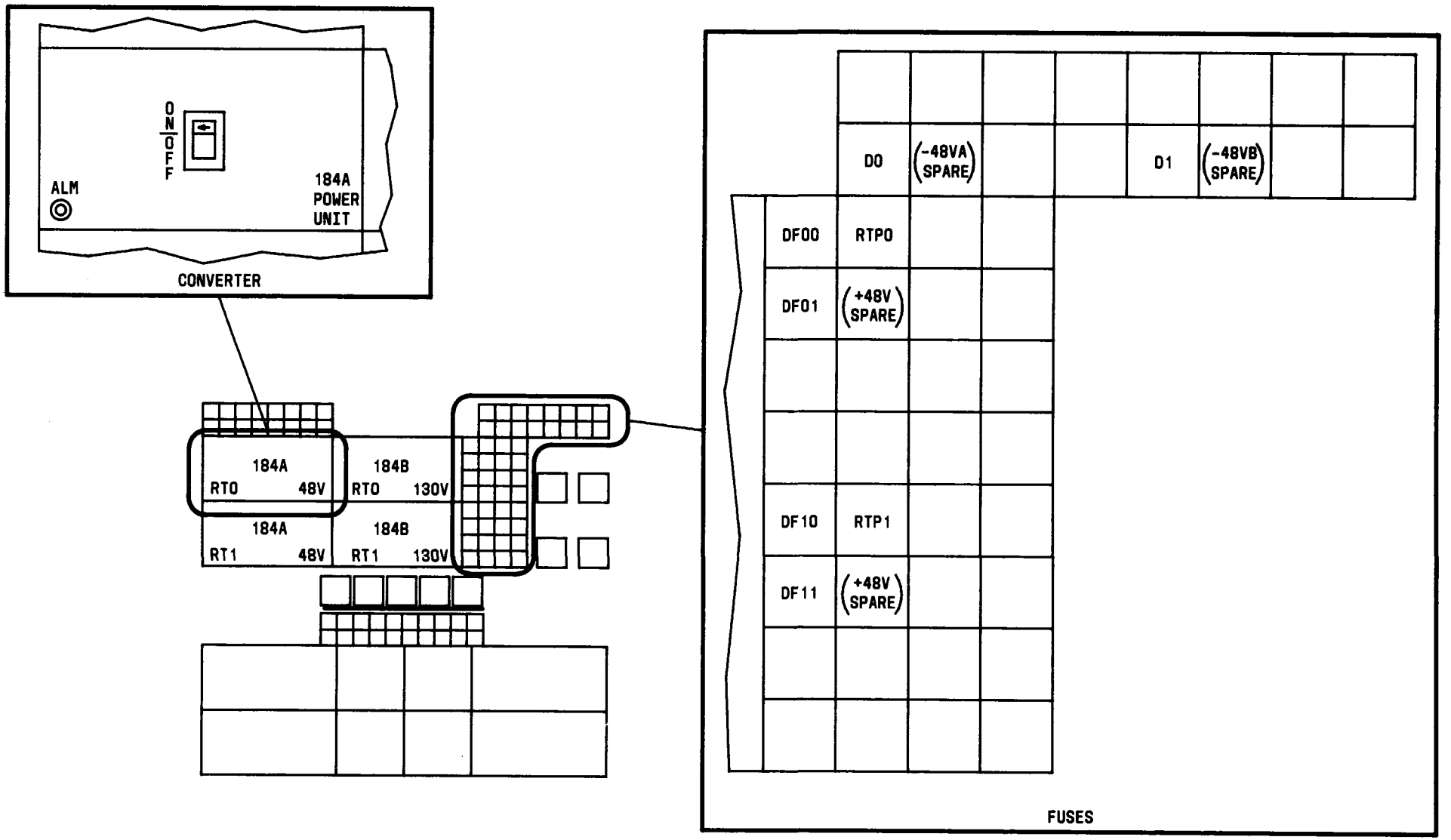


FIG. 1 – Top of Miscellaneous Power Frame

CHECK 184A POWER UNIT (+48 VOLT CONVERTER) FUSE ALARM

[5] Remove test pick from fuse cap

[6] At SSP depress **ALARM RELEASE** pushbutton

[7] See FIG. 1. Move 720A voltage pickup tool to suitable spare +48V position

[8] See FIG. 2. At one fuse in TABLE C for circuit out of service, touch tip of 411C test pick to exposed test point on fuse cap

AND

[9] Are TABLE B alarms given

Yes

No

[10] Clear defective wiring and/or +48 FA alarm relay per SD-3H905-01

TABLE C DISTRIBUTION FUSES	
CIRCUIT	DESIGNATION
0	DF00 DF01 RTP0
1	DF10 DF11 RTP1

[11] Remove test pick from fuse cap

[12] At SSP depress **ALARM RELEASE** pushbutton

AND

[13] Repeat Steps 8 through 12 for each additional fuse in TABLE C for side out of service

[14] Disconnect 720A tool from spare fuse position and install fuse cap

CHECK 184A POWER UNIT (+48 VOLT CONVERTER) FUSE ALARM

[1] Condition DMM to measure approximately 130 Vdc

[2] See DANGER 1 and FIG. 1. On connector **J6** at back of **184B POWER UNIT**, connect DMM to terminal **D**(+) and **H**(−)

AND

[3] Does DMM indicate between +128.0 and +132.0 volts

Yes

No

TAP-230

[4] See NOTE 1. Move DMM leads to terminal **A**(−) and **H**(+)

[5] Does DMM indicate between −128.0 and −132.0 volts

Yes

No

TAP-230

[6] Disconnect DMM

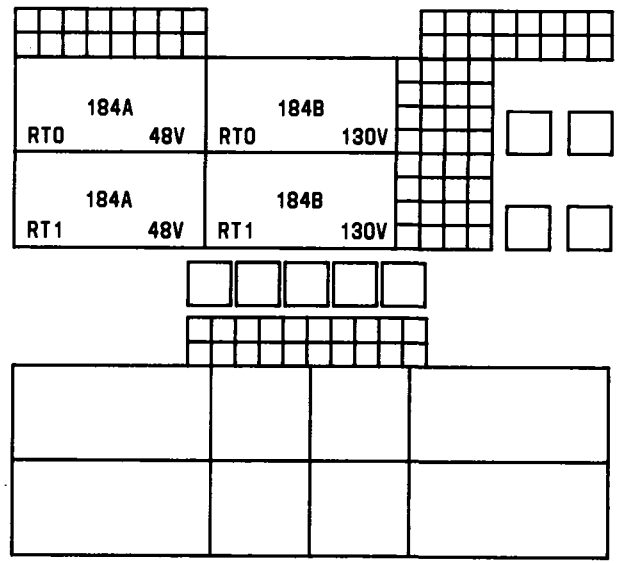


FIG. 1

NOTE 1
Terminal H is a common return

DANGER 1

Voltages in this circuit are over 130 volts to ground

Issue 2	JUL 1980
233-144-100	DLP
PAGE 1 of 1	698

CHECK 184B POWER UNIT (±130V CONVERTER) OUTPUT

SUMMARY
Using fuse alarm test cord, check input and distribution fuse alarm circuitry of **184B POWER UNIT**.

[1] See FIG. 1. Install 720A voltage pickup tool at suitable spare –48 position

[2] See FIG. 2. At one fuse in TABLE A, touch tip of 411C test pick to exposed test point on fuse cap

AND

[3] Are TABLE B alarms given

Yes → Page 3

No → [4] Clear defective wiring and/or FA alarm relay per SD-3H905-01

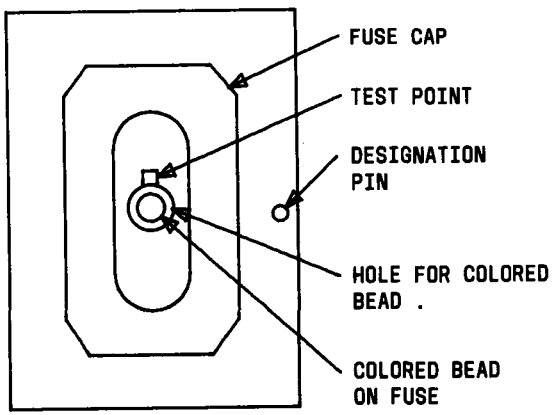


FIG. 2 – Alarm Fuse Cap – Typical

TABLE A
INPUT FUSES

CIRCUIT	DESIGNATION
0	C0
1	C1

TABLE B
FUSE ALARMS

LOCATION	INDICATION
1. SSP	**FUSE** (red) **MINOR** (amber)
2. TTY	Message
3. Building	Audible, Minor

CHECK 184B POWER UNIT (±130 VOLT CONVERTER) FUSE ALARM

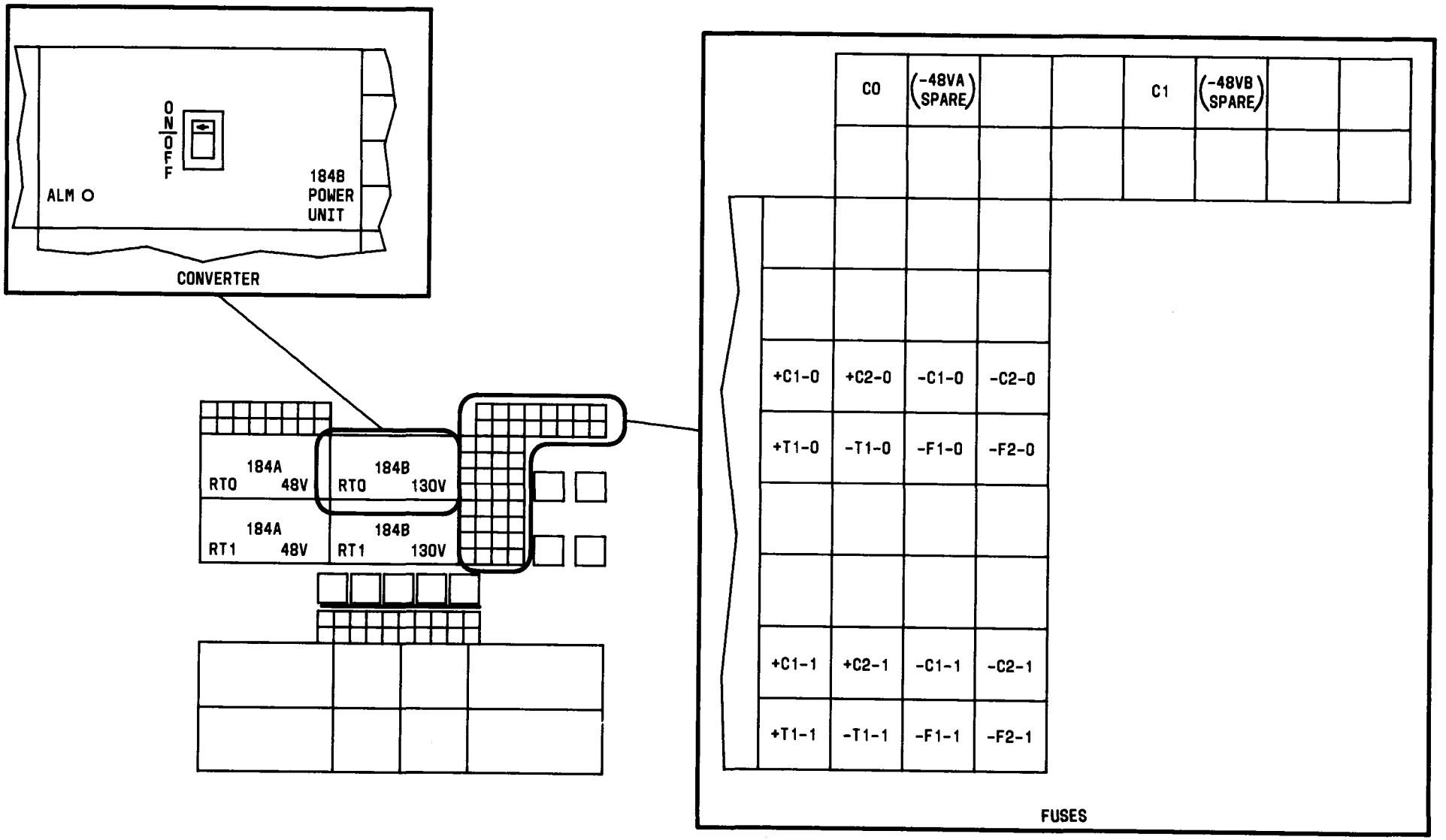


FIG. 1 – Top of Miscellaneous Power Frame

CHECK 184B POWER UNIT (±130 VOLT CONVERTER) FUSE ALARM

[5] Remove test pick from fuse cap and observe alarms retire

[6] At SSP depress **ALARM RELEASE** pushbutton

[7] Move 720A voltage pickup tool to suitable spare −48V position. See FIG. 1

[8] See FIG. 2. At one fuse in TABLE C, touch tip of 411C test pick to exposed test point on fuse cap

AND

[9] Are TABLE B alarms given

Yes

No

[10] Clear defective wiring and/or FA alarm relay per SD-3H905-01

TABLE C DISTRIBUTION FUSES	
CIRCUIT	DESIGNATION
0	+C1-0 +C2-0 +T1-0
1	+C1-1 +C2-1 +T1-1

[11] Remove test pick from fuse cap and observe alarms retire

[12] At SSP depress **ALARM RELEASE** pushbutton

AND

Page 4

[13] Repeat Steps 8 through 12 for each additional fuse in TABLE C

[14] Disconnect 720A tool from spare fuse position and install fuse cap

CHECK 184B POWER UNIT (±130 VOLT CONVERTER) FUSE ALARM

[15] Connect 720A voltage pickup tool to suitable spare -48V position. See FIG. 1

[16] See FIG. 2. At one fuse in TABLE D, touch tip of 411C test pick to exposed test point on fuse cap

AND

[17] Are TABLE B alarms given

Yes

No

[18] Clear defective wiring and/or FA alarm relay per SD-3H905-01

TABLE D DISTRIBUTION FUSES	
CIRCUIT	DESTINATION
0	-C1-0 -C2-0 -T1-0 -F1-0 -F2-0
1	-C1-1 -C2-1 -T1-1 -F1-1 -F2-1

[19] Remove test pick from fuse cap and observe alarms retire

[20] At SSP depress **ALARM RELEASE** pushbutton

[21] Repeat Steps 16 through 20 for each additional fuse in TABLE D

[22] Disconnect 720A tool from spare fuse position and install fuse cap

AND

CHECK 184B POWER UNIT (±130 VOLT CONVERTER) FUSE ALARM

SUMMARY

See DANGER 1. Adjust **R3** on **A2** for time delay of 30 to 50 seconds.

[1] See DANGER 1. Loosen fastener screws on upper front of cover. Pull cover forward and down

[2] Depress and hold **TEST** switch

AND

Page 2

[3] Release **TEST** switch and start timing

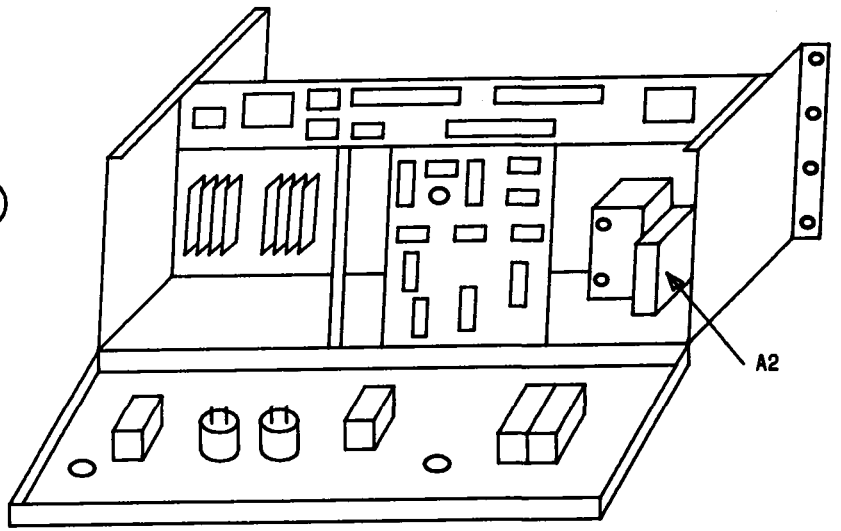
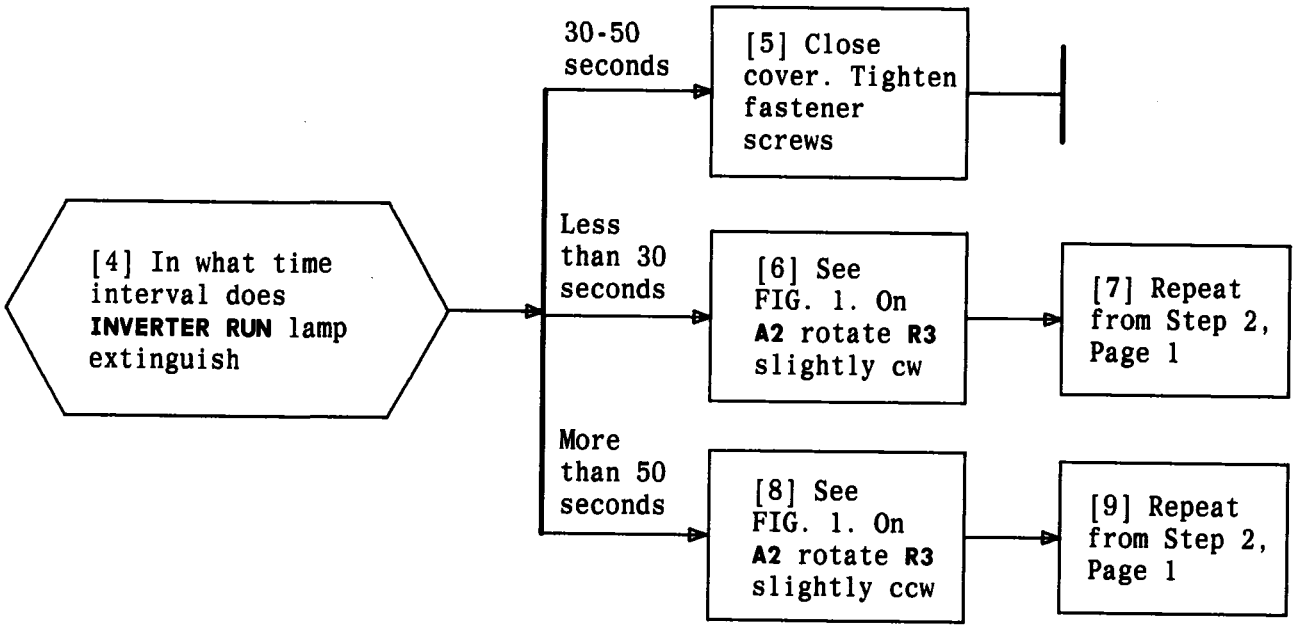


FIG. 1

DANGER 1
Voltages in this circuit are over 150 volts to ground

Issue 2	JUL 1980
233-144-100	DLP
PAGE 1 of 2	700

ADJUST INVERTER AC RESTORAL TIME



ADJUST INVERTER AC RESTORAL TIME

POWER DOWN INDIVIDUAL J87437A 48V RECTIFIER

SUMMARY

See WARNING 1 and FIG. 1. Depress **POWER ON-OFF** switch to **OFF** to turn off rectifier. Remove **RB** fuse and set circuit breaker on **EXTERNAL CHARGE CIRCUIT BREAKER/RECT** panel to **OFF**. Set **CB1** to **OFF** and depress **ALARM RELEASE** pushbutton.

[1] See FIG. 1. At **151A PWR PLANT** on 48V rectifier meter panel, depress **POWER ON-OFF** switch to **OFF**

[2] See WARNING 1. On **CONTROL UNIT** remove **RB** fuse associated with rectifier

[3] On **EXTERNAL CHARGE CIRCUIT BREAKER/RECT** panel, set circuit breaker associated with rectifier to **OFF**

AND

[4] On rectifier, set **CB1** to **OFF**

Major audible alarm sounds. **RECT FAIL** lamp lights

[5] At SSP panel depress **ALARM RELEASE** pushbutton

Major alarm is silenced. **RECT FAIL** lamp goes out

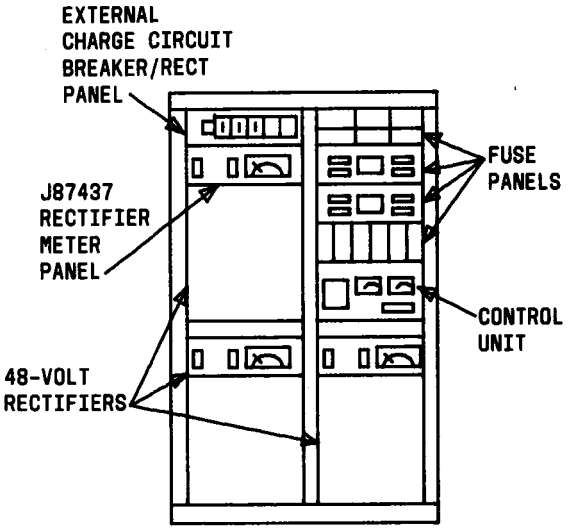


FIG. 1

WARNING 1

Rectifier circuit could be damaged when rectifier is turned on if* RB *fuse is installed and* EXTERNAL CHARGE *circuit breaker is set to* OFF. ***When RB ***fuse is removed, rectifier may be turned on to operate in test mode***

CHECK J87437A 48V RECTIFIER OUTPUT VOLTAGE

SUMMARY

See NOTE 1. DMM connected across **OUTPUT VOLTS** test jacks indicates desired output level. Rotate **OUTPUT VOLTS ADJ** rheostat until DMM indicates desired output level.

[1] Condition DMM to measure approximately 100 Vdc

[2] See FIG. 1. At **48V RECTIFIER**, connect DMM across **OUTPUT VOLTS REG+** and **REG–** test jacks

[3] Depress **POWER ON-OFF** switch to **ON**

AND

[4] See NOTE 1. Does DMM indicate required charge bus voltage

Yes

No

[5] Can output **VOLTS ADJ** rheostat be adjusted to required charge bus voltage

Yes

No

TAP-237

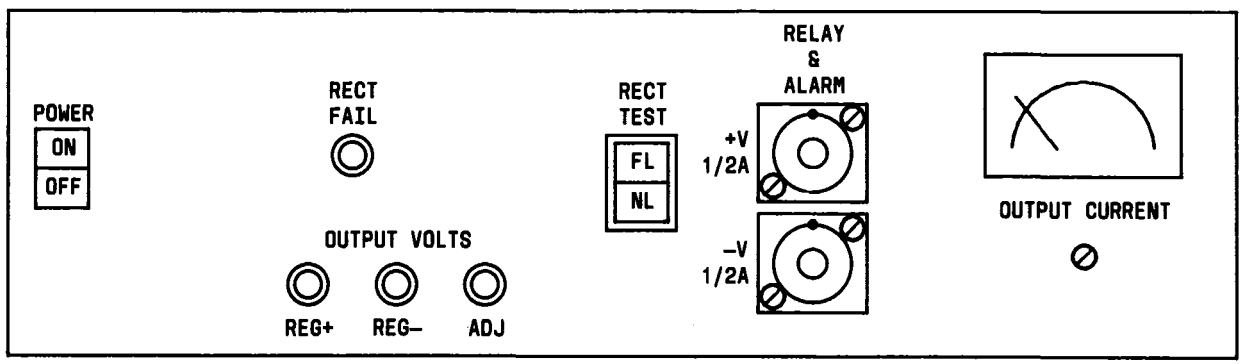


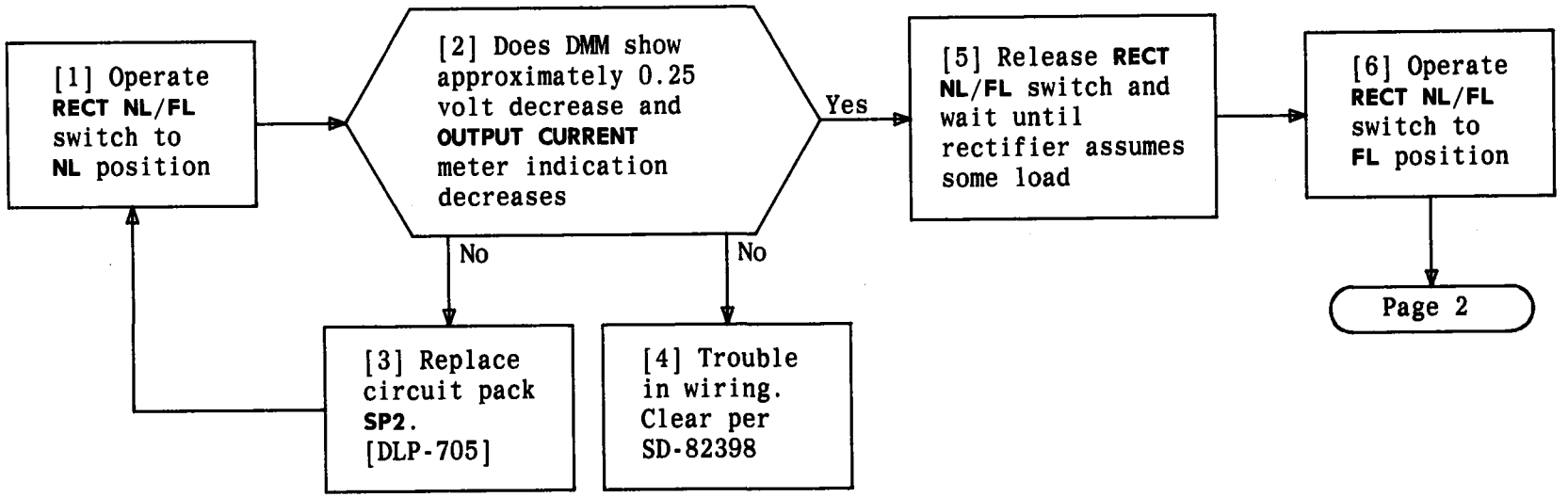
FIG. 1

NOTE 1

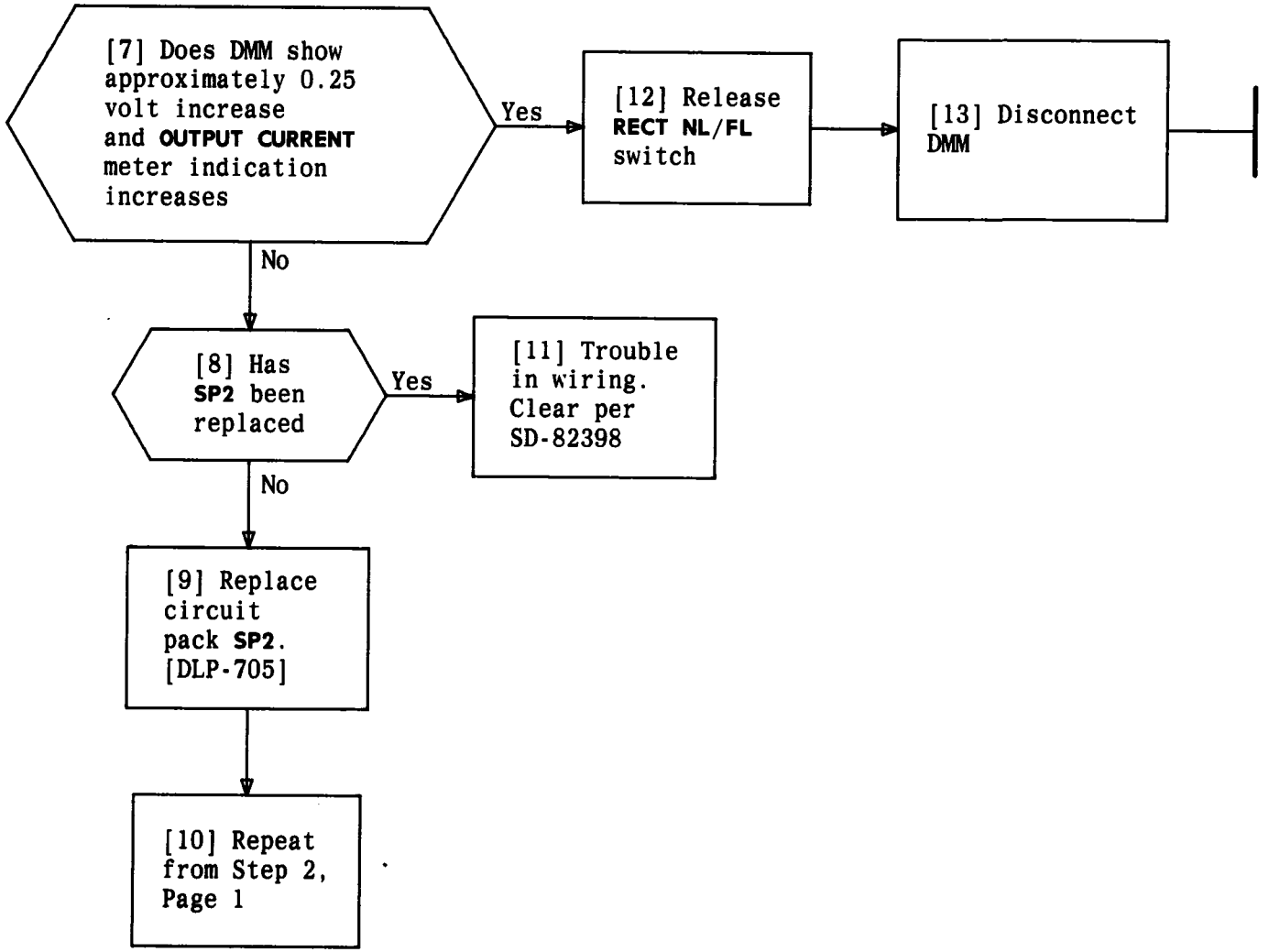
Charge voltage is determined by local requirements. Refer to office records for exact setting. In absence of local requirements, charge voltage is at a level that produces 52.08 Vdc measured at battery bus

SUMMARY

Operate **RECT NL/FL** switch to **NL**. Voltage decreases 0.25 volt and current decreases. Operate **RECT NL/FL** switch to **FL**. Voltage increases 0.25 volt and current increases.



CHECK ADJUSTMENT OF J87437A 48V RECTIFIER CURRENT LIMIT AND REGULATOR CIRCUIT



CHECK ADJUSTMENT OF J87437A 48V RECTIFIER CURRENT LIMIT AND REGULATOR CIRCUIT

SUMMARY

See WARNING 1. Turn off rectifier. Install **RB** fuse. Charge rectifier output filter capacitors and set circuit breaker to **ON**. Turn on rectifier. Set **CB1** to **ON**

At **151A PWR PLANT**:

[1] On **48V RECTIFIER**, depress **POWER ON-OFF** switch to turn off rectifier

[2] At **CONTROL UNIT**, install **RB** fuse associated with rectifier

LOCAL SNS lamp goes out

[3] See WARNING 1. Charge rectifier output filter capacitors and set external circit breaker to **ON** [DLP-517]

AND

[4] Depress **POWER ON-OFF** switch to turn on rectifier

TTY message REPT PWR B 16 a 000000 NORM is given

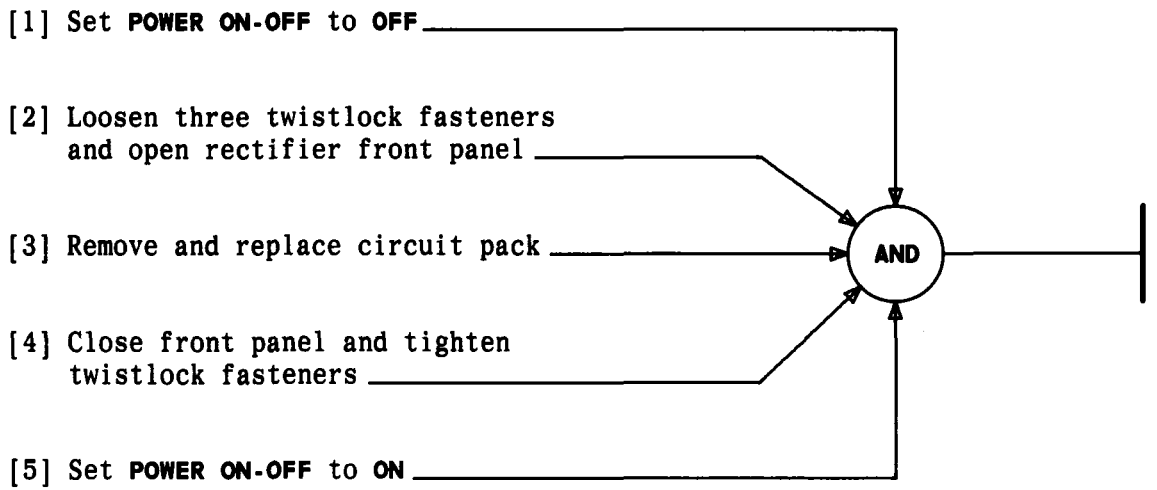
[5] After 10 seconds, set rectifier **CB1** to **ON**

WARNING 1

Do not turn circuit breaker to ON before charging the capacitors as damage to the circuit breaker may occur

Issue 2	JUL 1980
233-144-100	DLP
PAGE 1 of 1	704

POWER UP INDIVIDUAL J87437A 48V RECTIFIER



REPLACE CIRCUIT PACK IN J87437A 48V RECTIFIER

SUMMARY

See WARNING 1, FIG. 1 and FIG. 2. Depress **POWER ON-POWER OFF** pushbutton to turn off rectifier. Remove **RB** fuse and set circuit breaker on **EXTERNAL CHARGE CIRCUIT BREAKER/RECT** panel to **OFF**. See **DANGER 1**. Remove front panel on **48V RECTIFIER** and disconnect the plant control disconnect **J1**. Connect jumper between **DC OUTPUT** terminal and pin 15 of **P1**.

[1] See FIG. 1. At **151A PWR PLANT** on **48V RECTIFIER** meter panel, depress **POWER ON-POWER OFF** pushbutton

[2] See WARNING 1. On **CONTROL UNIT**, remove **RB** fuse associated with rectifier

LOCAL SNS lamp lights

[3] On **EXTERNAL CHARGE CIRCUIT BREAKER/ RECT** panel, set circuit breaker associated with rectifier to **OFF**

[4] See DANGER 1. Remove front panel on **48V RECTIFIER**

AND

LOCAL SNS and **PWR OFF** lamps go out

[5] Disconnect the plant control disconnect J1 from the rectifier

[6] See FIG. 2. Connect a W1AP jumper cord between **DC OUTPUT** output **BAT** terminal and pin 15 of **P1**

WARNING 1

Rectifier circuit could be damaged when rectifier is turned on if* RB *fuse is installed and* EXTERNAL CHARGE *circuit breaker is set to* OFF. *When* RB *fuse is removed, rectifier may be turned on to operate in test mode

DANGER 1

Extremely high current potentials present. Do not allow a test pick to touch two metal parts at the same time as dangerous and destructive short circuits may occur

PLACE ITT-NORTH KS-20493 48V RECTIFIER IN TEST MODE

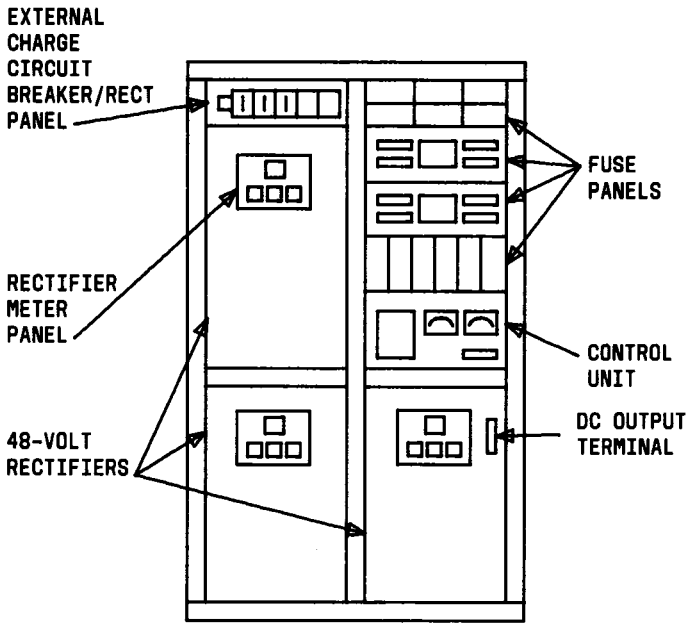


FIG. 1

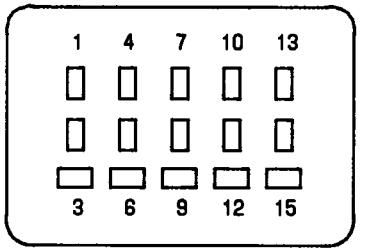


FIG. 2 – P1 Pin Location

PLACE ITT-NORTH KS-20493 48V RECTIFIER IN TEST MODE

SUMMARY

See NOTE 1. DMM connected across **OUTPUT VOLTS** test jacks indicates desired output level. Rotate **OUTPUT VOLTS ADJUST** rheostat until DMM indicates desired output level

[1] Condition DMM to measure approximately 100 Vdc

[2] At **151A PWR PLANT** on **48V RECTIFIER** [FIG. 1], Connect DMM across **OUTPUT VOLTS** (+) and (–) test jacks

[3] Depress **POWER ON–POWER OFF** pushbutton to turn on rectifier

POWER ON and **LOCAL SNS** lamps light

AND

DMM connected across output

[4] See NOTE 1. Does DMM indicate required charge bus voltage

Yes

No

Page 2

[5] Verify locking device is secure on **OUTPUT VOLTS ADJUST** rheostat

[6] Disconnect DMM

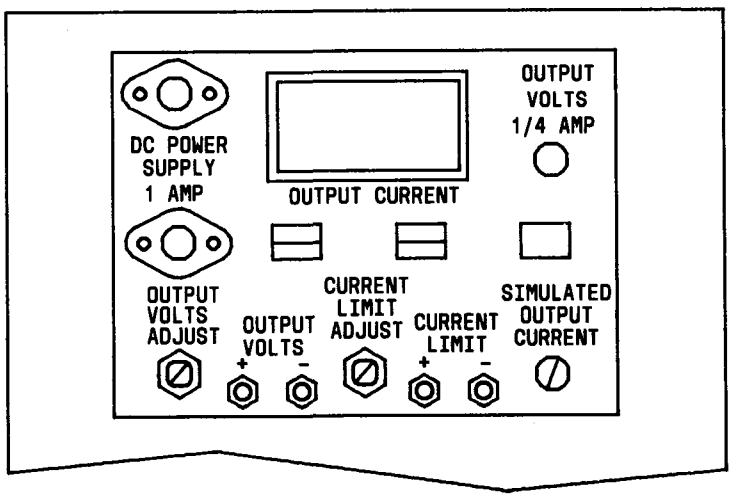
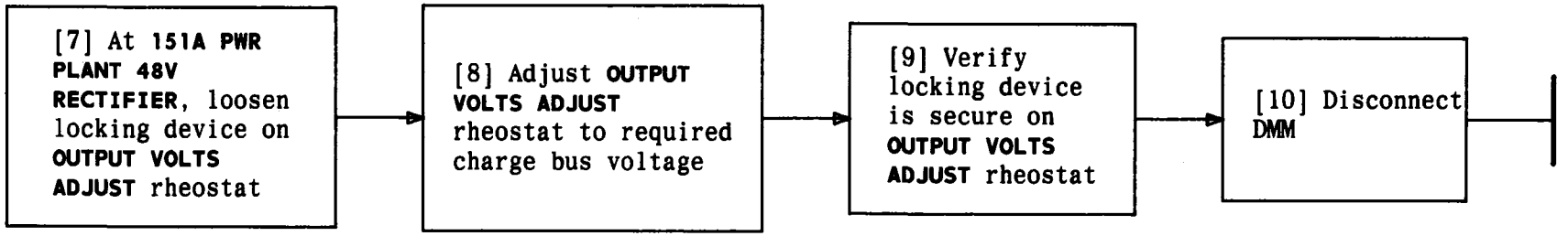


FIG. 1

NOTE 1

Charge voltage is determined by local requirements. Refer to office records for exact setting. In absence of local requirements, charge voltage is at a level that produces 52.08 Vdc measured at battery bus

CHECK ITT-NORTH KS-20493 48V RECTIFIER OUTPUT VOLTAGE



CHECK ITT-NORTH KS-20493 48V RECTIFIER OUTPUT VOLTAGE

[1] Condition DMM to measure approximately 100 Vdc

[2] At **151A PLANT** on **48V RECTIFIER**, connect DMM at **CURRENT LIMIT** (+) and (-) test jacks

[3] Verify **SIMULATED OUTPUT CURRENT** rheostat is rotated fully ccw

[4] Depress and hold **SIMULATED OUTPUT CURRENT** pushbutton

SIMULATED OUTPUT CURRENT lamp lights

AND

Page 2

[5] See FIG. 1. Using jewelers screwdriver, rotate **SIMULATED OUTPUT CURRENT** rheostat slowly cw until DMM indication increased to greater than 0 volt

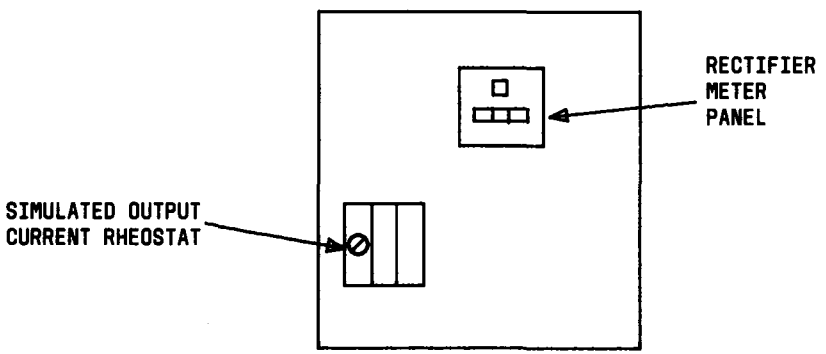
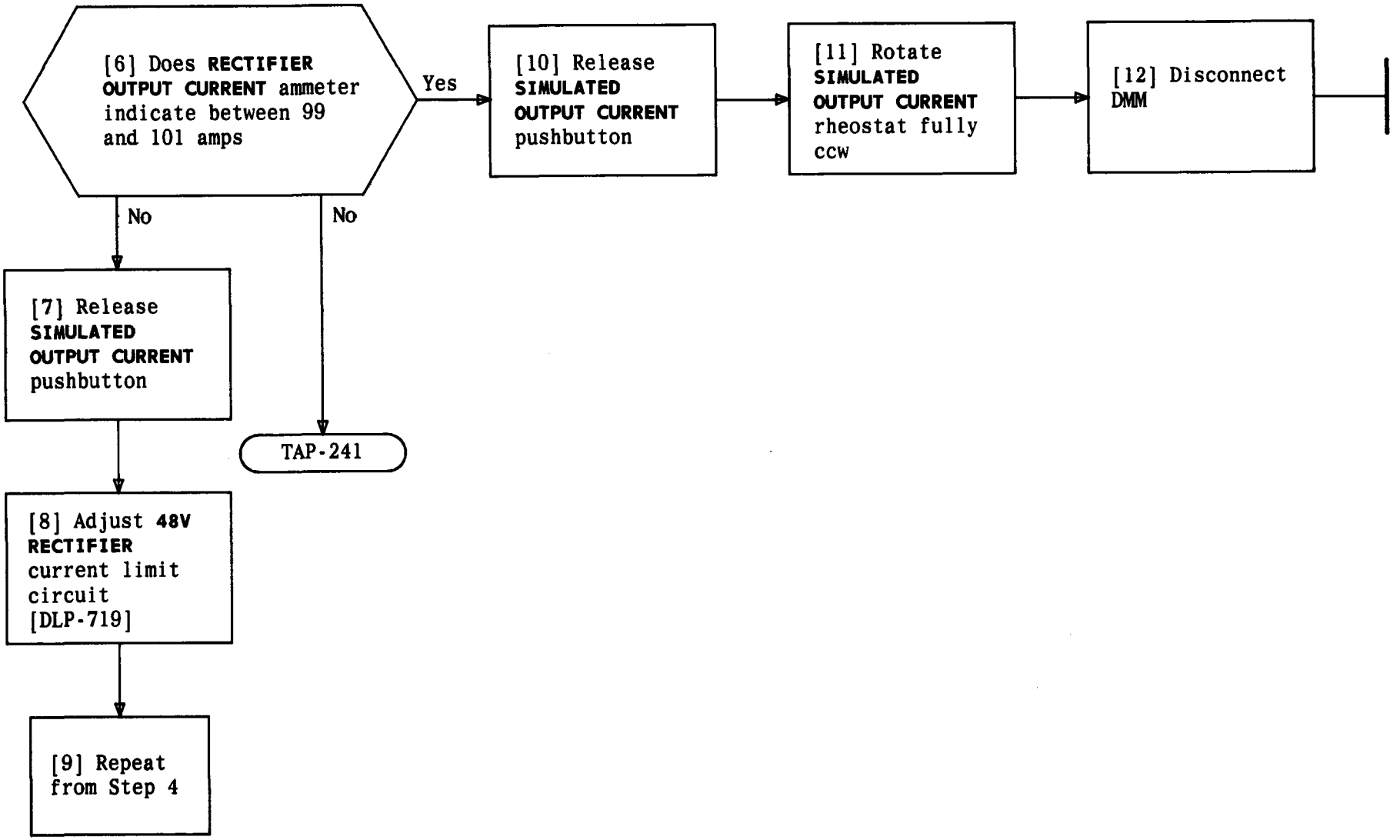
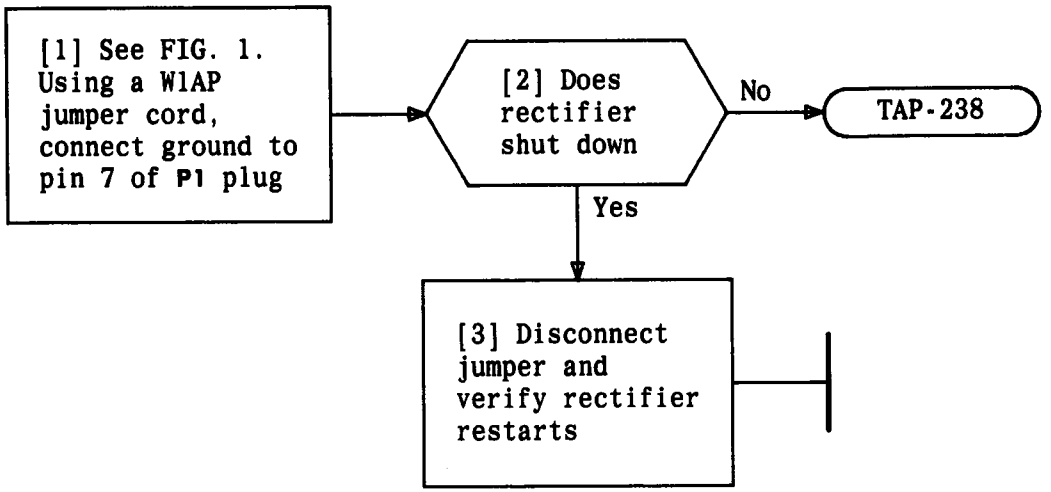


FIG. 1

CHECK ITT-NORTH KS-20493 48V RECTIFIER CURRENT LIMITING ADJUSTMENT



CHECK ITT-NORTH KS-20493 48V RECTIFIER CURRENT LIMITING ADJUSTMENT



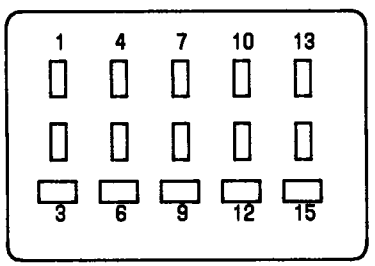


FIG. 1 – P1 Pin Location

CHECK ITT-NORTH KS-20493 48V RECTIFIER TR SHUTDOWN

SUMMARY

Connect ground to pin 6 of **P1** plug. Depress and hold **SIMULATED OUTPUT CURRENT** switch. Rotate the **SIMULATED OUTPUT CURRENT** rheostat cw. Release the **SIMULATED OUTPUT CURRENT** switch. Disconnect the jumper. Depress the **POWER ON-POWER OFF** switch twice. Rotate **SIMULATED OUTPUT CURRENT** rheostat fully ccw.

[1] See FIG. 1. Using a W1AP jumper cord, connect ground to pin 6 of **P1** plug

[2] Depress and hold the **SIMULATED OUTPUT CURRENT** switch

[3] Rotate the **SIMULATED OUTPUT CURRENT** rheostat cw

Rectifer shuts down

No

TAP-239

[4] Release the **SIMULATED OUTPUT CURRENT** switch

AND

[5] Disconnect the jumper

[6] Depress the **POWER ON-POWER OFF** switch twice

Rectifier restarts

[7] Rotate the **SIMULATED OUTPUT CURRENT** rheostat fully ccw

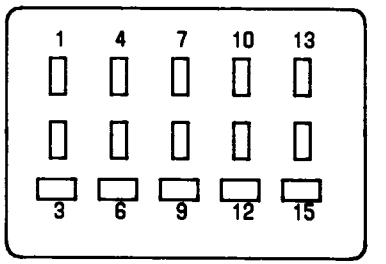


FIG. 1 – P1 Pin Location

CHECK ITT-NORTH KS-20493 48V RECTIFIER HV SHUTDOWN

Issue 2	JUL 1980
233-144-100	DLP
PAGE 1 of 1	715

SUMMARY

See WARNING 1. Depress and hold **SIMULATED OUTPUT CURRENT** switch. Rotate **SIMULATED OUTPUT CURRENT** rheostat until **OUTPUT CURRENT** meter indicates 10 amperes. Release **SIMULATED OUTPUT CURRENT** switch. Connect ground to pin 6 of **P1**. Depress and hold **SIMULATED OUTPUT CURRENT** switch. Release switch. Connect pin 4 and pin 5 of **P1**. Depress **SIMULATED OUTPUT CURRENT** switch. Temporarily remove jumper from pin 4 of **P1**; then replace. Remove jumpers from pin 6 to ground and pins 4 and 5.

[1] See WARNING 1. Depress and hold **SIMULATED OUTPUT CURRENT** switch

SIMULATED OUTPUT CURRENT lamp lights

[2] Adjust **SIMULATED OUTPUT CURRENT** rheostat until **OUTPUT CURRENT** meter indicates 10 amperes

[3] Release **SIMULATED OUTPUT CURRENT** switch

[4] See FIG. 1. Using a W1AP jumper cord, connect ground to pin 6 of **P1** plug

[5] Depress and hold **SIMULATED OUTPUT CURRENT** switch

Rectifier shuts down and locks out

No

TAP-240

[6] Remove W1AP jumper connected between pin 6 of **P1** plug and ground

[7] Release **SIMULATED OUTPUT CURRENT** switch

AND

Page 2

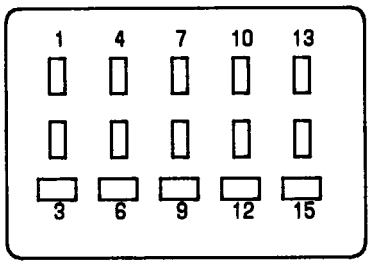
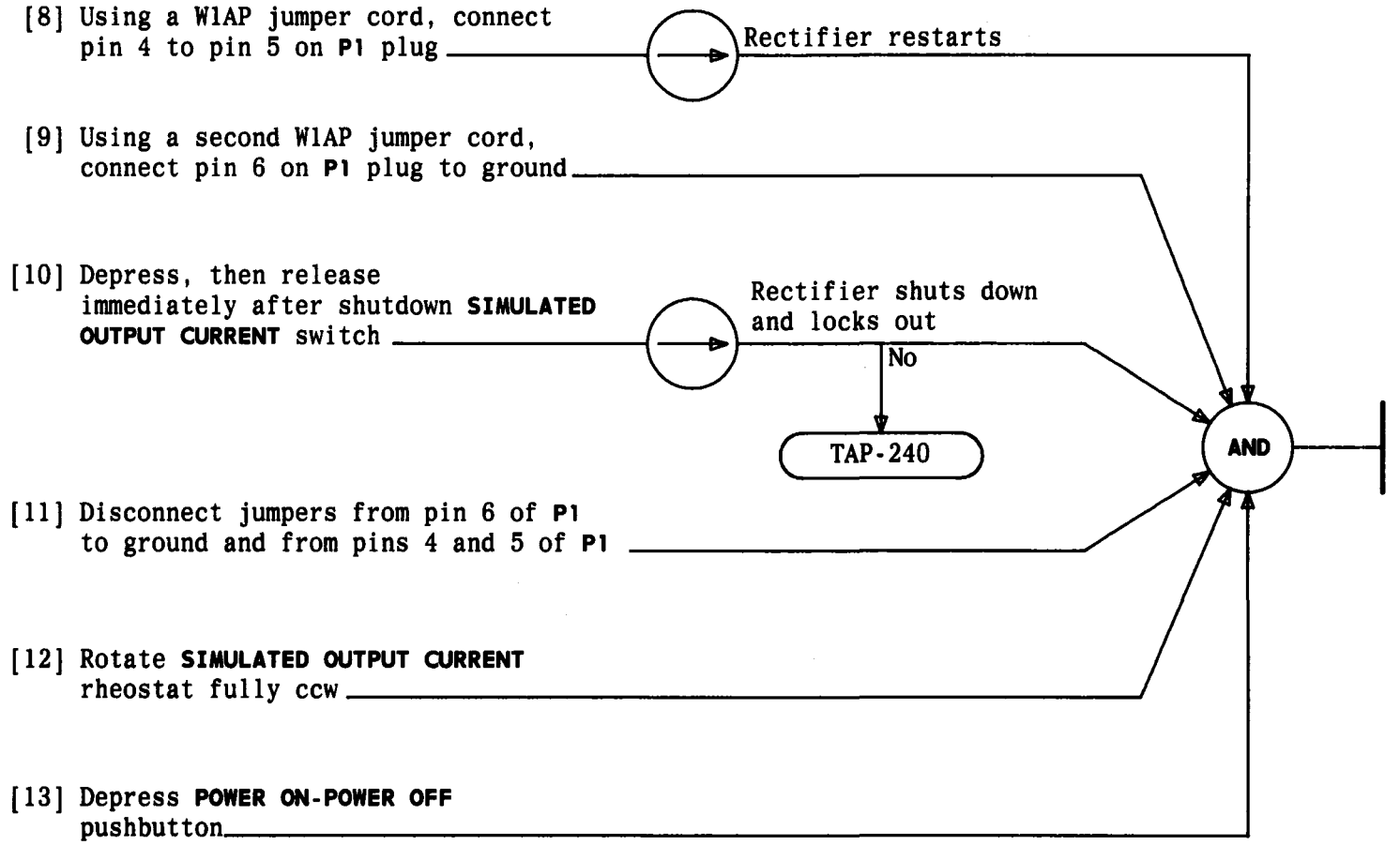


FIG. 1 – P1 Pin Location

WARNING 1

***Make sure the* EXTERNAL CHARGE CIRCUIT BREAKER *is off before depressing the* SIMULATED OUTPUT CURRENT switch

CHECK ITT-NORTH KS-20493 48V RECTIFIER AUTOMATIC RESTART



CHECK ITT-NORTH KS-20493 48V RECTIFIER AUTOMATIC RESTART

SUMMARY

See WARNING 1. Turn off rectifier. Remove jumper. Connect J1. Install **RB** fuse. Charge rectifier output filter capacitors and set circuit breaker to **ON**. Turn on rectifier

At **151A PWR PLANT:**

[1] On **48V RECTIFIER**, depress **POWER ON-POWER OFF** pushbutton to turn off rectifier

[2] Disconnect jumper between **DC OUTPUT** and pin 15 of **P1**, then connect **J1** to **P1**

LOCAL SNS, POWER ON RECT FAIL lamps light

[3] At **CONTROL UNIT**, install **RB** fuse associated with rectifier

LOCAL SNS lamp goes out

[4] Install front panel on rectifier

[5] Charge rectifier output filter capacitors [DLP-517]

AND

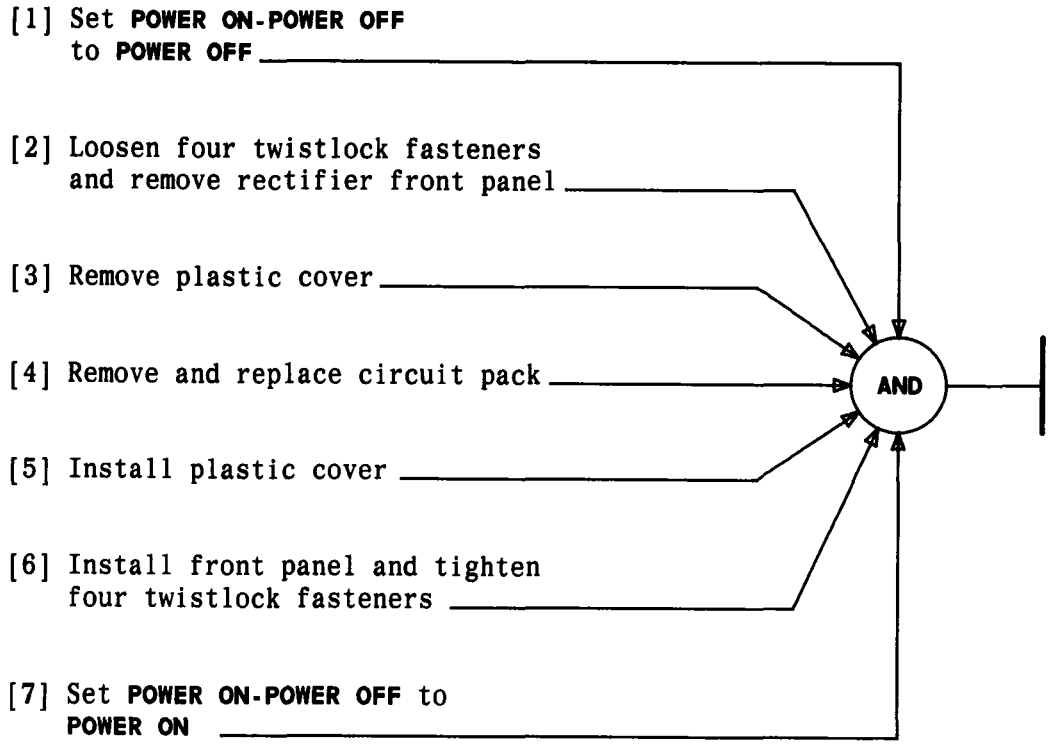
[6] Depress **POWER ON-POWER OFF** pushbutton to turn on rectifier

RECT FAIL lamp goes out
TTY message
REPT PWR B 16 a 000000 NORM
is given

WARNING 1

Do not turn circuit breaker to ON before charging the capacitors as damage to the circuit breaker may occur

POWER UP INDIVIDUAL ITT-NORTH KS-20493 48V RECTIFIER



REPLACE CIRCUIT PACK IN ITT-NORTH KS-20493 48V RECTIFIER

Issue 2	JUL 1980
233-144-100	DLP
PAGE 1 of 1	718

On **48V RECTIFIER**

[1] Rotate **CURRENT LIMIT ADJUST** rheostat fully cw

[2] Rotate **SIMULATED OUTPUT CURRENT** rheostat fully cw

[3] Depress and hold **SIMULATED OUTPUT CURRENT** pushbutton

SIMULATED OUTPUT CURRENT lamp lights

AND

[4] Adjust **SIMULATED OUTPUT CURRENT** rheostat until rectifier **OUTPUT CURRENT** ammeter indicates 100 amperes

[5] Rotate **CURRENT LIMIT ADJUST** rheostat slowly ccw until DMM indicates an increasing voltage (greater than 0 volt)

[6] Release **SIMULATED OUTPUT CURRENT** pushbutton

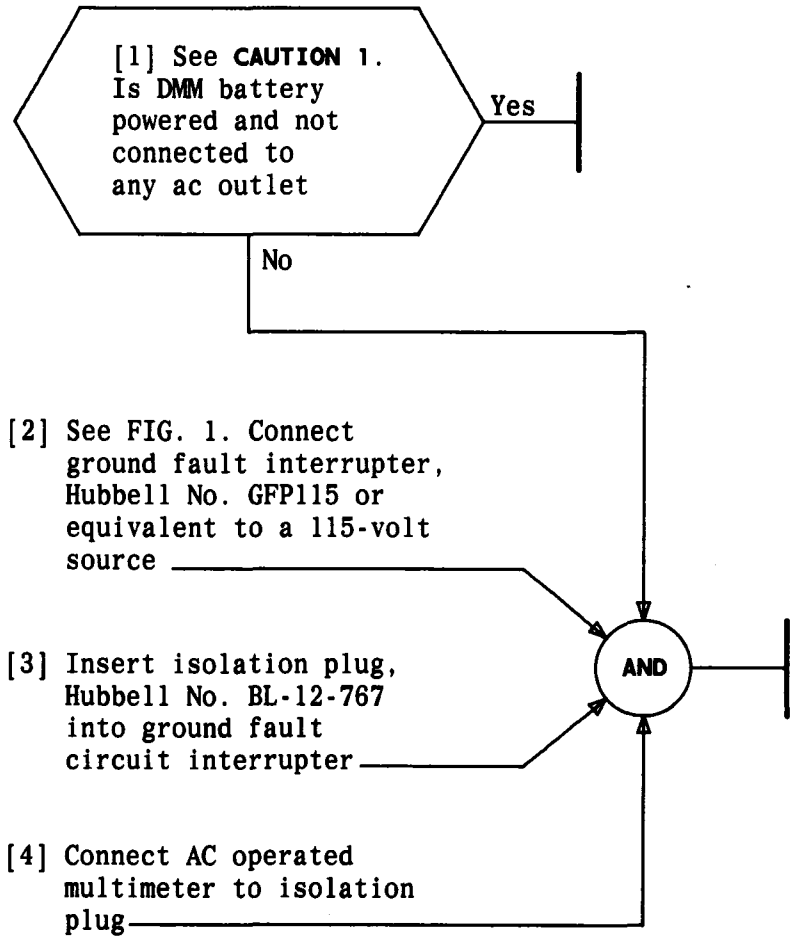
SIMULATED OUTPUT CURRENT lamp goes out

AND

[7] Rotate **SIMULATED OUTPUT CURRENT** rheostat fully ccw

ADJUST ITT-NORTH KS-20493 48V RECTIFIER CURRENT LIMIT CIRCUIT

Issue 2	JUL 1980	
233-144-100		DLP
PAGE 1 of 1		719



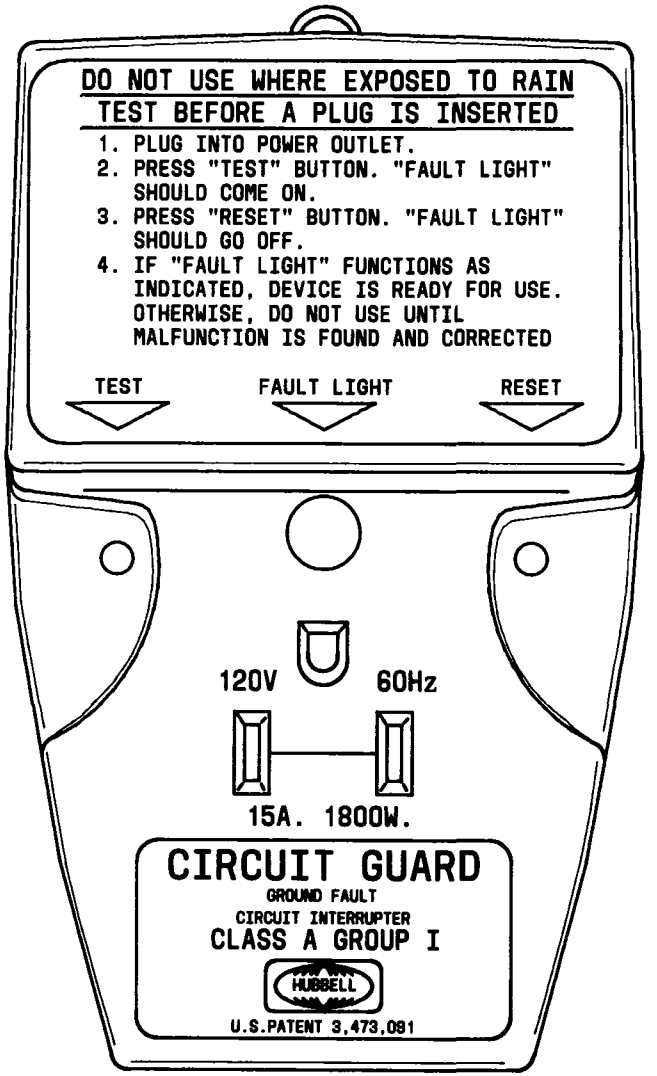


FIG. 1

CAUTION 1

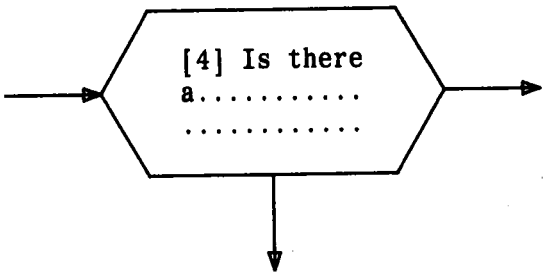
The test meter must be isolated from ground to prevent equipment damage during testing. If meter is battery powered and not connected to ac power, the meter is isolated, and no additional isolation is required. If the meter is ac powered, this procedure must be followed

Issue 2	JUL 1980
233-144-100	DLP
PAGE 1 of 1	720

ISOLATE AC OPERATED MULTIMETER

INDEX

INDEX

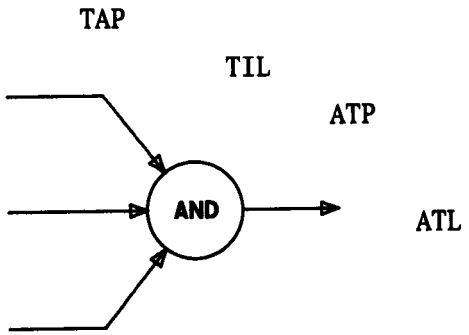


WARNING
Always be safety conscious on and off the job

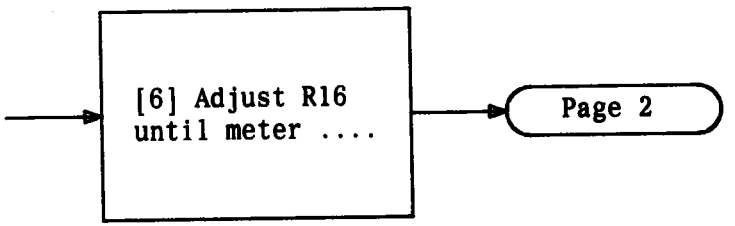
This is a . . . . . .

TASK ORIENTED PRACTICE. . . . . *or* TOP

The next few pages will tell you how to use this document.



[DLP-540]



HOW TO USE THIS "TOP"

This book is called a Task Oriented Practice or a "TOP." It is a type of programmed document – one which gives you step-by-step instructions of how to do a job (or task). A TOP can be a big help in your everyday work, but you must know how to use it correctly. Take a few minutes, say 15 or 20, and study these few pages until you feel you understand how to use a TOP. Taking this time now will very likely save you time and effort later on.

An important thing to remember about TOP is that it contains all the needed instructions to complete a job. If you are doing the job for the first time, you will be directed through each action without having to guess or remember where to find the necessary information. If you are experienced on a particular job, TOP can provide just that information which you may have forgotten.

Almost all of your jobs can be classified into one of four types – ***Routine, Acceptance, Company Order,*** or ***Trouble Clearing***. This is how TOP defines these four work types:

Routine

that work you do as part of a Controlled Maintenance Plan like scheduled cleaning or scheduled tests. Routine work may also include those things you do as a "routine" part of your job like requesting a TTY printout or turning on equipment in the mornings and off in the evenings.

Acceptance

that work you do to verify that equipment is installed properly. Normally this is a test or inspection you perform when Western Electric has completed a new installation or addition. It could also be a test you perform when another group from ***your*** Company has completed an installation or addition of equipment. Acceptance work, however, is always related to testing or checking newly installed equipment.

Company Order

that work you do in response to one of several different "orders" which may be given to you. Some of the orders you may be familiar with are Circuit Orders, Service Orders, Traffic Orders, Recent Change Orders, etc. Normally, company order type work is something done to install, establish, change, or discontinue some service offered by the telephone company.

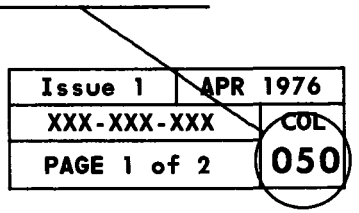
Trouble Clearing

is simply what it says – that work you do to clear and repair troubles in the system. Trouble clearing may be done in answering a customer complaint, responding to some office alarm, an abnormal TTY printout, etc.

Try to fix these four work types firmly in your mind. As you will see, you must classify each job you get in one of these four types before you will be able to look up the instructions in the TOP.

Now glance briefly at the front cover; there are several things which will be useful there. In the upper-right corner is the 9-digit volume number. Near the center is the volume title which tells you something about the contents – such things as the system (or subsystem) name and perhaps the type of jobs included in the volume. Next is a four-line index located in the lower-left corner. This index provides the location of four "lists" which are simply a listing of all the jobs in each of the four job types. If a nine-digit (XXX-XXX-XXX) number appears on

the front cover index, that particular list is located in another volume of the TOP. A three-digit number on the line means that the list is in this volume, and the list can be located by searching the lower-right corner of each page for the ***referenced number***.



These numbers will always be arranged in numerical order; however, all numbers in the sequence will not be used.

Some TOP volumes may cover only a small part of a system, so on the inside of each front cover you will find a documentation plan. This plan will give a bird's-eye view of all the volumes in the TOP and can help you quickly determine the correct volume.

Locate one of the TOP volumes which contains a Company Order List, and note from the front cover that this list is numbered "050." Turn to that number in the TOP.

This Company Order List (COL) is simply a listing of all the Circuit Order jobs, Service Order jobs, etc, that may be done on this system. Once you know the job you have to do, use the lists as an index to find the number of the "procedure" which tells you ***what to do*** to complete that job.

Now pick one of these jobs from the list which references to a COP (Company Order Procedure), and using the referenced number, locate that procedure in the TOP. Look over this procedure and note that it gives all the items which must be done to complete the job.

The items are numbered and must be completed in that order; however, you may see some lettered (A, B, C...) items in the procedure. These letters are assigned to options or other items which may be done differently because of equipment variations, etc. Look over the following example to get a better idea of what is meant by the numbers (1, 2, 3...) and letters (A, B, C...) which may be used in the procedure.

ITEM	SUBTASKS	PROCEDURE NUMBER
1	Do the first thing first	DLP-XXX
2	Do the second item next	DLP-XXX
3	Do the following optional items as required by the Company Order or as is required by the system you are working on	
	A. An optional item	DLP-XXX
	B. Another optional item	-
	C. Another optional item which must be done in the sequence below	
	1. First part of Option "C"	DLP-XXX
	2. Last part of Option "C"	DLP-XXX
4	Do the next part of the job	DLP-XXX
5	Do the last part of the job	DLP-XXX

Remember that this procedure tells you ***what*** to do in order to complete the total job. If you know ***how*** to do an item in the procedure, you should go ahead and complete it. If you need further information on ***how*** to do part of the job, then you should turn to the referenced DLP or Detail Level Procedure. When you complete all the steps in the DLP, then you must turn back to the COP or Company Order Procedure to find the next item to be done.

TOP is designed so that you will have to read only what is necessary to get your job done. At any time when you know how to perform all the steps in an item, it is not necessary to look further for the "how to" information – simply complete the item and go on to the next one. This idea, in TOP, is known as "bypassing."

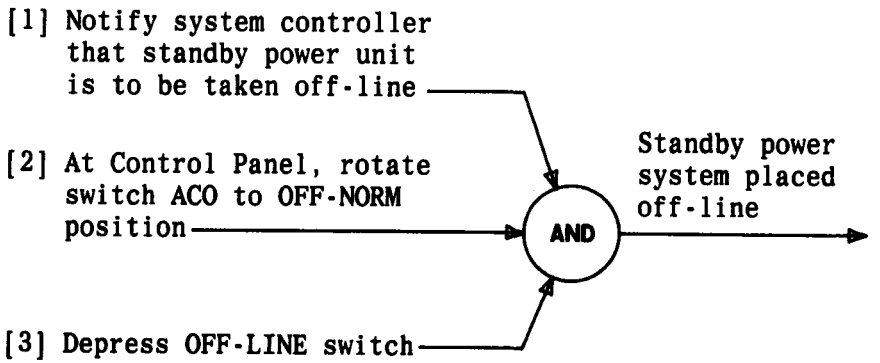
Here are some of the things designed into TOP to help you "bypass" information you may already know:

Summary Statement

A summary statement is used with a DLP (or the flow-charted procedures). It tells you briefly what the procedure does and what type measurement or result can be observed. After reading the summary, you may be able to complete the procedure without reading further. Some shorter DLPs, of course, do not have summary statements.

Result Statement

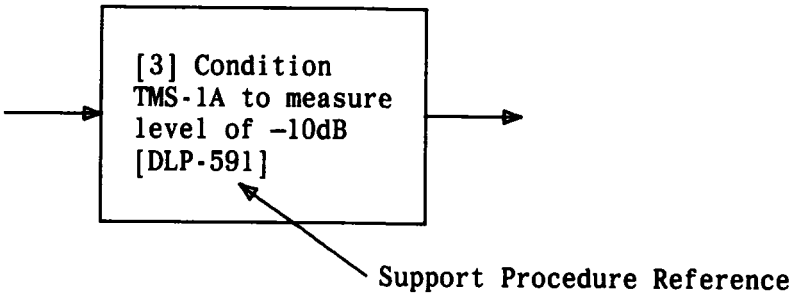
A result statement may be used in a flow-charted procedure along with the "AND" symbol. Here is an example of the "AND" symbol and a ***result statement***:



When using a procedure, read the result statement first. If you know how to place standby power system in off-line status, it would be unnecessary to read steps 1, 2, and 3.

Support Procedures

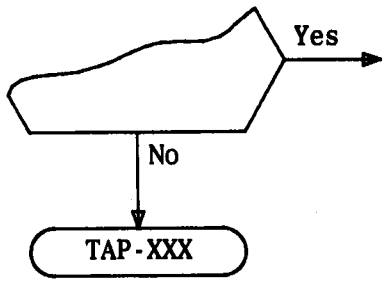
When you see this kind of reference in TOP, it refers to a support procedure.



The support procedure (DLP-591) would provide information about how to operate the TMS-1A. Of course, if you are familiar with the TMS-1A, there is no reason to look up DLP-591.

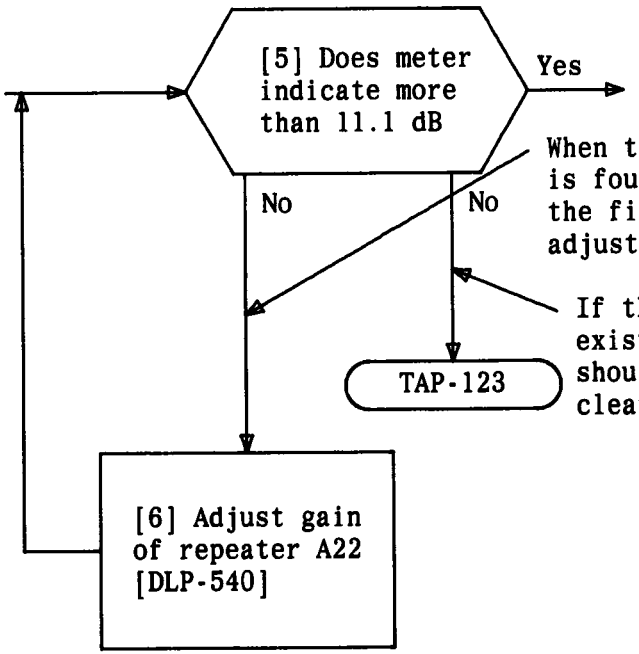
So far, the Company Order type jobs have been the main topic; however, you will find that the Routine and Acceptance categories are used in the same manner. You may come across a couple of new abbreviations in those categories, namely, Acceptance Task Procedure (ATP) and Routine Task Procedure (RTP). These categories are used in the same way that the Company Order Procedure (COP) is used in the Company Order work.

While using TOP, you probably will run across a reference similar to this:



This reference to TAP-XXX indicates that the equipment is not operating correctly and the TAP (Trouble Analysis Procedure) should be used to help you find and repair the trouble.

This idea can be carried further. In some cases, a decision block may have more than one abnormal output. This simply means that you should try more than one solution to the problem. See the example below.

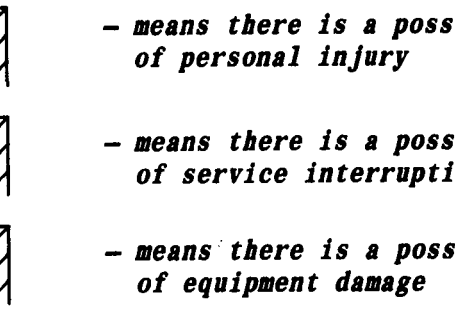


When the meter reading is found to be incorrect, the first action is to adjust the A22 repeater

If the problem still exists, TAP-123 should be used to clear the trouble

Trouble clearing information in TOP is basically used the same way as the other types. When a trouble report or equipment alarm requires you to troubleshoot a system, the Trouble Indicator List (TIL) is the place to start. This (TIL) is a listing of trouble symptoms or alarms with a reference to a Trouble Analysis Procedure (TAP). The TAP is an aid in analyzing and locating the cause of the trouble. The TAP may reference to other information such as a Trouble Analysis Data (TAD) or an Isolation Diagram (ISD) as an aid in the trouble clearing process.

Any job must always be done safely and it is no different with TOP. Here are three items which you should look for in TOP:



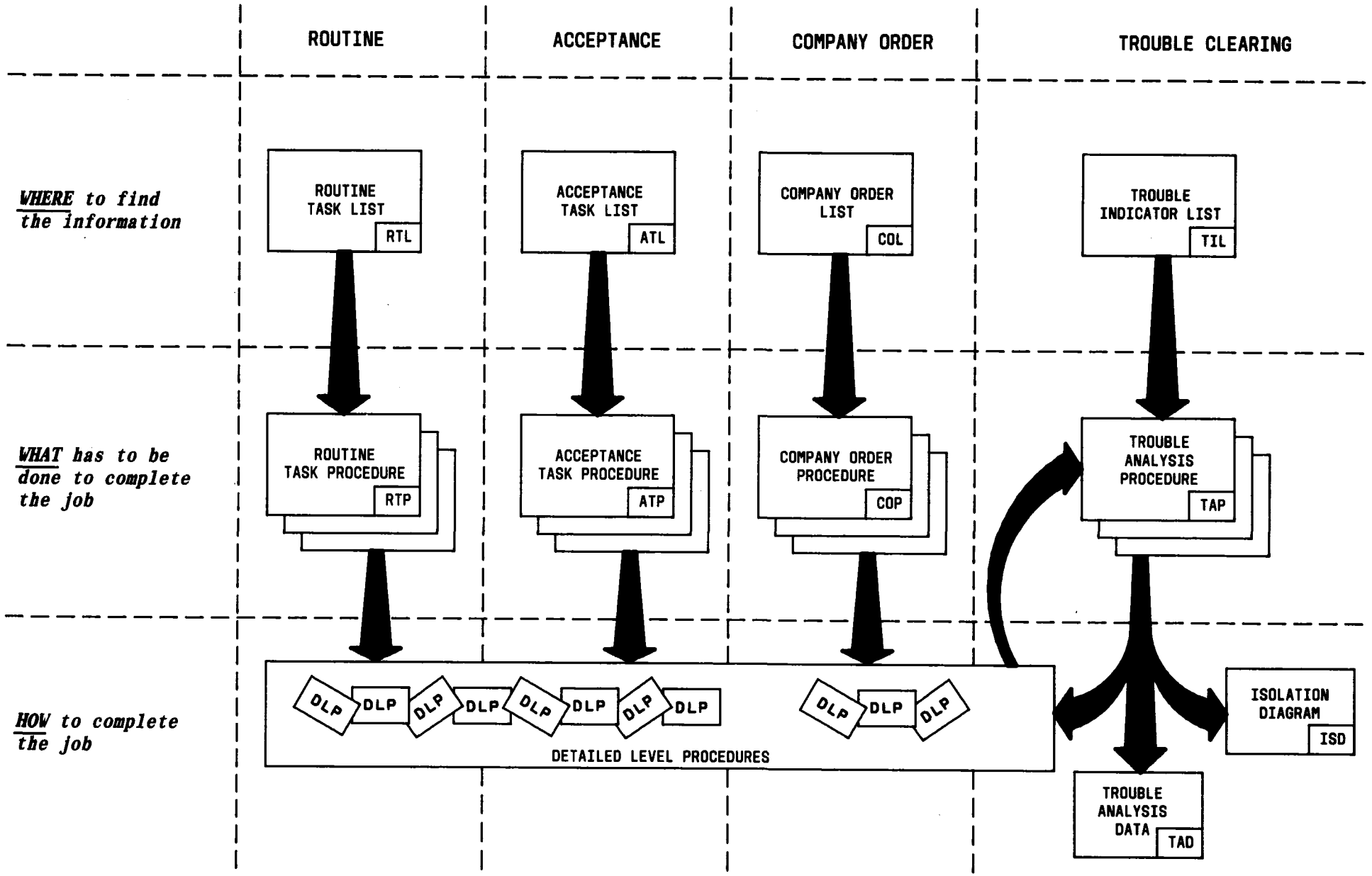
– means there is a possibility of personal injury

– means there is a possibility of service interruption

– means there is a possibility of equipment damage

The last page of this introductory section is a diagram which shows all the elements used to make up a TOP and basically how they are organized to make a complete document. The diagram may, at first, seem to be complex; but remember, TOP is a programmed document and it always tells you where to find the next bit of information required to do the job. The diagram, however, may be useful later if you need to know the words which DLP, TAP, etc, represent or simply a memory jogger about TOP in general.

While using any TOP, if you find errors, or if a procedure is inadequate or missing, your comments are greatly needed. They may be forwarded by using the standard form E3973 which is available through your Company. Thank you for helping us prepare better documentation.


ROUTINE
ACCEPTANCE
COMPANY ORDER
TROUBLE CLEARING
WHERE to find the information
WHAT has to be done to complete the job
HOW to complete the job
ROUTINE TASK LIST
RTL
ACCEPTANCE TASK LIST
ATL
COMPANY ORDER LIST
COL
TROUBLE INDICATOR LIST
TIL
ROUTINE TASK PROCEDURE
RTP
ACCEPTANCE TASK PROCEDURE
ATP
COMPANY ORDER PROCEDURE
COP
TROUBLE ANALYSIS PROCEDURE
TAP
DLP
DETAILED LEVEL PROCEDURES
ISOLATION DIAGRAM
ISD
TROUBLE ANALYSIS DATA
TAD