151C (J86917) BATTERY POWER PLANT
−48 VOLTS, 600 AMPERES
OPERATING METHODS

CONTENTS PAGE

CONTENTS PAGE

CONTENTS PAGE

Figures

CONTENTS PAGE

Tables

CONTENTS PAGE

CONTENTS PAGE

1. GENERAL

INTRODUCTION

1.01 This section covers the operating methods of the 151C (J86917A) battery power plant. Included in this section are the following:

- General description and characteristics of the 151C battery power plant
- Physical description and characteristics of the 151C battery power plant
- Functional description and characteristics of the 151C battery power plant
- Acceptance procedures for the 151C battery power plant
- General operating procedures for the 151C battery power plant
- Routine checks to be made on the 151C battery power plant
- Troubleshooting procedures for the 151C battery power plant.

1.02 This issue affects the Equipment Test List.

1.03 This issue of the section is based on the following schematic drawings (SDs).

- SD-81999-02, Issue 1: Power Systems, Rectifier Circuits, Ferroresonant Type, −48 Volts,

100 Amperes, Automatic Regulation, KS-20493 (Lorain Products)

- SD-82398-01, Issue 3AR: Power Systems, Rectifier, 208/240, 220/240, or 480 Volts, 60 Hz Input, 48 Volts, 100 Amperes Output, J87437A

- SD-82401-02, Issue 4D: Power Systems, Rectifier Circuit, Ferroresonant Type, −48 Volts, 100 Amperes, Automatic Regulation, KS-20493 (ITT-North Electric)

- SD-82447-01, Issue 2B: Power Systems, Charge and Discharge Circuit, 48 Volts, 600 Amperes, 100-Type Plants, 151C Power Plant

- SD-82454-01, Issue 2A: Power Systems, 48V Control Circuit for the Charge and Discharge Circuits, 133A, 133B, 151B, 151C, 153A, 155A Power Plants, J85516B.

- SD-82587-01, Issue 1: Power Systems, 24 Volts and 48 Volts Common Control Circuit for Power Plants, J85516C.

If this section is to be used with equipment or apparatus reflecting an earlier or later issue of the schematic drawings SD(s), reference should be made to the SD(s) and the corresponding circuit description CD(s) to determine the extent of the changes and the manner in which the section may be affected.

Danger: Hazardous voltages may be encountered in the 151C power plant. Avoid all contact with terminals to prevent injuries from occurring. Do not allow a test pick to touch two metal parts at the same time as dangerous or destructive short circuits may occur.

Note: This section is based on the new version of the KS-20493 rectifier SD-81999-02 (Lorain Products Corporation) or SD-82401-02 (ITT-North).

1.04 The 151C (J86917) power plant is a negative 48-volt, positive ground, 100- through 600-ampere plant which provides float and recharge capability. The operation of the plant is fully automatic. Normally all rectifiers are operated from commercial power to supply the office load and float the battery. During commercial power failures, the battery provides power for the load. After a commercial power failure has occurred and power is restored, the rectifiers will automatically restart, recharge the battery, and then will resume normal float regulation. Alarms are given whenever any plant fuse or circuit breaker operates, a rectifier fails, or the plant output voltage goes out of prescribed limits. Also, the plant is designed to turn off any rectifier for which the output voltage is too high and attempts to restart any rectifier which fails.

CHARACTERISTICS

A. 151C Power Plant Rectifier Characteristics

1.05 The type of rectifier used in the 151C power plant is one of the following:

- J87437A, 3-phase, negative 48 volt, 100 ampere rectifier

- KS-20493, single-phase, negative 48 volt, 100 ampere rectifier, (manufactured either by Lorain Products Corporation or by ITT-North Electric Company).

The rectifier used will depend on the type of power available. The J87437A rectifier is used if 3-phase power is available, and the KS-20493 rectifier is used if single phase power is available.

1.06 The J87437A rectifier and the KS-20493 rectifiers should not be mixed in a plant; otherwise, a number of problems, such as the following, may arise:

(a) When single-phase rectifiers are used on 3-phase emergency power (engine alternators, for example), the loading effect of the rectifiers must be balanced.

(b) Three-phase rectifiers cannot be used with single-phase power.

(c) Maintenance is more involved when the plant contains both single and 3-phase rectifiers because the single-phase and 3-phase rectifiers require circuit packs and spare parts which are not interchangeable.

(d) Schematic drawings, circuit descriptions, and replacement parts must be maintained for each type rectifier.

1.07 ***J87437 Rectifier:*** The J87437A rectifier is a 48-volt, 100-ampere output, controlled

ferroresonant regulated rectifier. The J87437A, List 1, rectifier operates from a 208/240 volt, 3-phase, 60 ±3 Hz input. The J87437A, List 2, rectifier operates from a 480-volt, 3-phase, 60 ±3 Hz input. The List 3 is used with either List 1 or List 2 to provide an output circuit breaker (CB1) to protect the rectifier and to isolate it from the plant.

1.08 ***KS-20493 Rectifier:*** The KS-20493 rectifier is a negative 48-volt, 100-ampere output, controlled ferroresonant regulated rectifier. The KS-20493, L21, rectifier operates from a 208/240-volt, single-phase, 60 ±3 Hz input. The KS-20493, L22, rectifier operates from a 480-volt, single-phase, 60 ±3 Hz input. The L105 option provides an output circuit breaker to protect the rectifier and to isolate it from the plant. The KS-20493 is available from either Lorain Products Corporation of Lorain, Ohio, or from ITT-North Electric Company of Galion, Ohio.

B. 151C Power Plant Characteristics

1.09 The 151C power plant is a negative 48-volt, 100- through 600-ampere plant. The minimum 100-ampere capacity plant would consist of the following:

- One J86917A originating bay equipped with one rectifier, (J87437A or KS-20493), one J85516B or J85516C plant control unit circuit, and the necessary discharge circuit breaker panels
- One J86917B supplementary bay equipped with one additional rectifier (J87437A or KS-20493).

Note: One additional rectifier is necessary to provide power if the other rectifier fails.

1.10 For power plant capacities greater than 100 amperes, additional rectifiers and supplementary bays can be provided. A 200 ampere, 151C power plant, is shown in Fig. 1. The third rectifier provides protection in case one of the other rectifiers fail. A full capacity plant consists of one J86917A originating bay and four J86917B supplementary bays. The J86917A originating bay is equipped with either the J85516B or the J85516C plant control unit, one rectifier, and the necessary discharge circuit breaker panels. Three of the J86917B supplementary bays are equipped with two rectifiers. The fourth J86917B supplementary bay is equipped with only one rectifier for a total of eight rectifiers.

Note: Eight rectifiers are used in the full capacity plant but the plant capacity is that of six rectifiers (600 ampere) because the seventh and eighth rectifiers provide protection of service should up to two rectifiers fail.

1.11 Battery equipment is furnished in accordance with J87124A or J87124B to meet the desired battery string configuration.

1.12 ***Abbreviations and Acronyms:*** Refer to Table A for a list of abbreviations and acronyms with applicable terms used in this section.

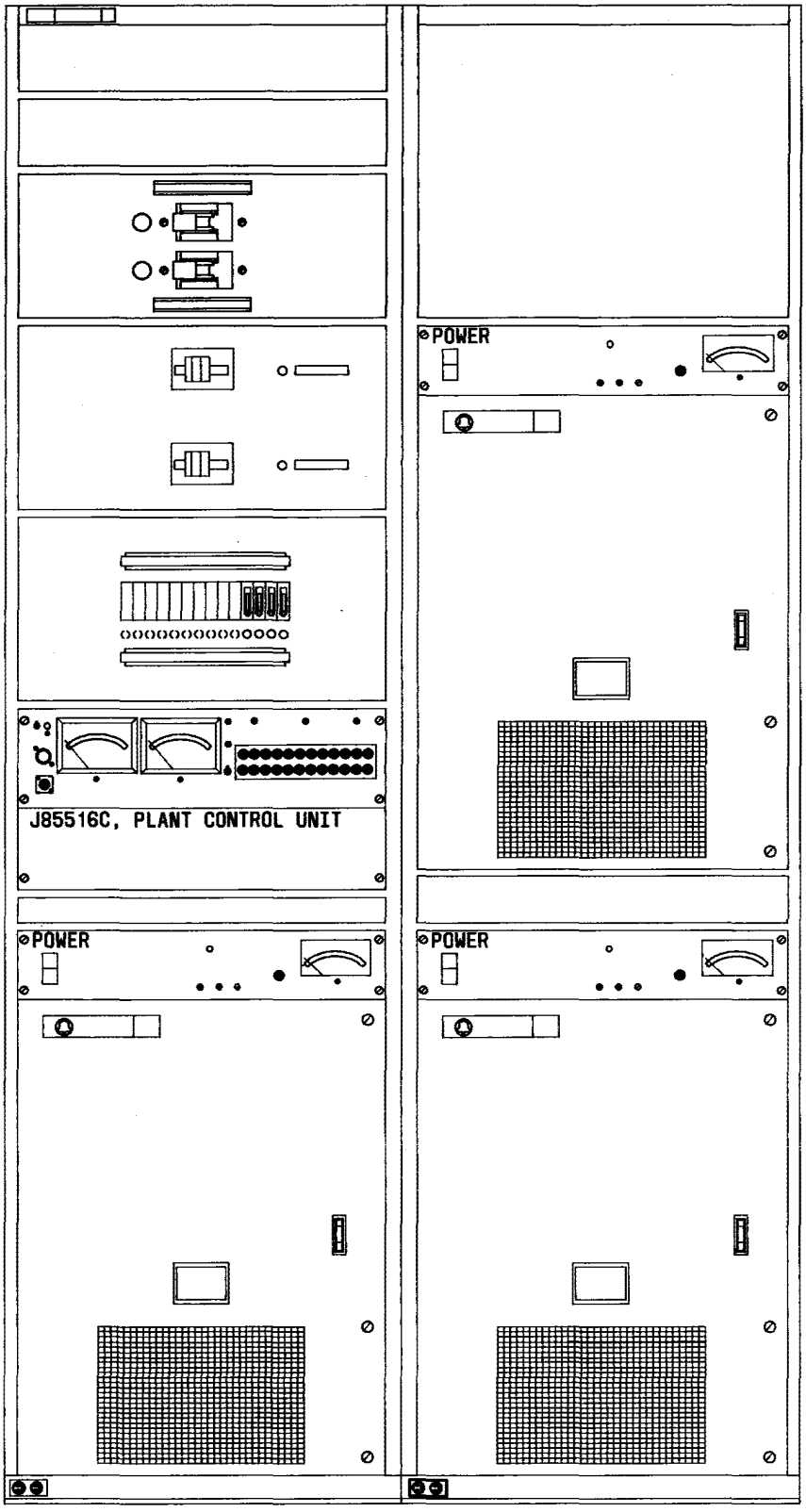

Fig. 1—151C Power Plant (J86917)

TABLE A

ABBREVIATIONS AND ACRONYMS

ABBREVIATION	TERM
BAT	Battery
CCW	Counterclockwise
CHG	Charge
CP	Circuit Pack
CW	Clockwise
DISCHG	Discharge
DMM	Digital Multimeter
FAJ	Fuse Alarm Major
FAN	Fuse Alarm Minor
GRD	Ground
HLV	High-Low Voltage
HV	High Voltage
Hz	Hertz
LED	Light Emitting Diode
LV	Low Voltage
RECT	Rectifier
REG	Regulation
RFA	Rectifer Failure Alarm
RSR	Restart Rectifier

2. PHYSICAL DESCRIPTION

INTRODUCTION

2.01 The initial bay and the supplementary bay are each a single bay framework. The plant contains the following equipment:

(a) Plant Control Unit (J85516B or J85516C)

(b) Rectifier (one of the following types):

- J87437A, L1 and L3, or L2 and L3
- KS-20493, L21 and L105 or L22 equipped with L105 Circuit Breaker—Lorain Products SD-81999-02
- KS-20493, L21 and L105 or L22 equipped with L105 Circuit Breaker — ITT North Electric SD-82401-02

(c) Discharge Circuit Breaker Panels.

DESCRIPTION

A. Plant Control Unit (J85516B or J85516C)

2.02 The J85516( ) plant control unit mounts in the J86917A originating bay between the rectifier and the circuit breaker panels (Fig. 1). On the front panel of the control unit are the plant ammeter, the plant voltmeter, the alarm indicator LEDs, and a control fuse panel using 70-type fuses (Fig. 2 or 3). Table B gives a complete list of controls and indicators on the J85516( ) plant control unit. Located inside the control unit are the plant voltage monitor and plant alarm circuits mounted on a printed wiring board (WC1 or WC2 circuit pack). This board plugs into a printed wiring motherboard which provides connections for rectifier controls and plant alarms. For a functional description of the J85516B plant control unit, as used in the 151C power plant, see paragraph 3.02.

B. Rectifier (J87437A, L1 and L3, or L2 and L3)

2.03 The J87437A, 100-ampere rectifier mounts in a standard 25-inch wide equipment bay (Fig. 1). The J87437A rectifier is designed to be serviced and maintained exclusively from the front.

2.04 The rectifier control panel holds the ON-OFF and test switches, the output voltage adjust potentiometer, the internal sense lead fuses (+V and −V), and the output ammeter (Fig. 4). The panel is removable for access when service is required. See Table C for a complete list of controls, indicators, and fuses on the J87437A rectifier.

2.05 The front door of the J87437A rectifier swings open to allow access to components inside (Fig. 5). The rectifier contains three ferroresonant transformers; one for each ac input phase. A large heat sink holding the rectifying diodes is mounted over the transformers. The regulation, control, and alarm circuits are contained on two printed wiring boards (CP SP1 and CP SP2) which plug into connectors inside the rectifier. Other rectifier components include triac heat sink assemblies, ac capacitors, iron-core inductors, dc output capacitors, and bus bars.

2.06 The J87437A, L1, rectifier operates from a 208/240-volt, 3-phase, 60 ±3 Hz input, and the J87437A, L2, rectifier operates from a 480-volt, 3-phase, 60 ±3 Hz input. Both rectifiers provide a nega-

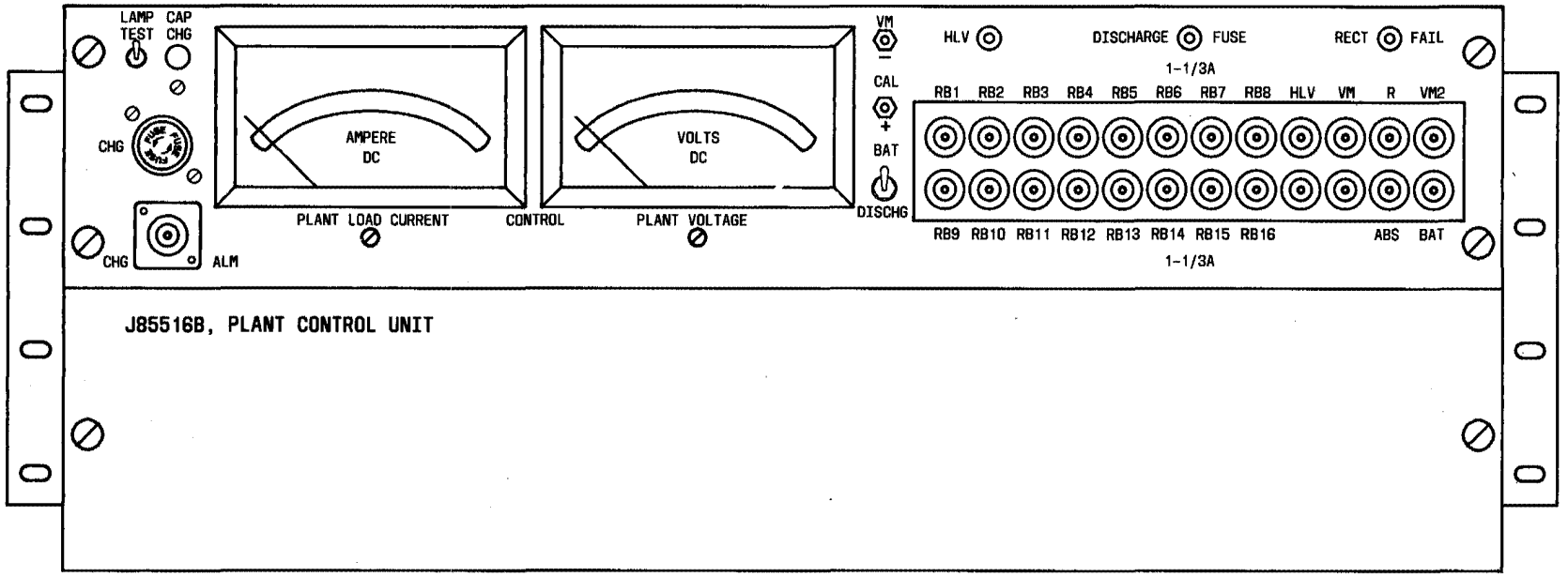

Fig. 2—J85516B, Plant Control Unit

TABLE B

J85516( ) POWER PLANT CONTROL UNIT
CONTROLS, INDICATORS, AND FUSES

NAME	EQUIP. LOCATION	CONTROL, INDICATOR, OR FUSE	TYPE	FUNCTION
Plant Control Unit (J85516)	48V PWR FRM	HLV	LED (red)	Lights when a low or high voltage condition exists on the battery bus.
		DISCHARGE FUSE	LED (red)	Lights when the CHG, VM2, or BAT fuse blows, a load fuse blows, or a load circuit breaker trips.
		RECT FAIL	LED (red)	Lights when the HLV or VM fuse blows, an RB fuse blows, a rectifier output circuit breaker trips, a rectifier shuts down, or an ac power phase is lost.
		PLANT VOLTAGE	Meter	Indicates discharge bus voltage or battery bus voltage.
		PLANT LOAD CURRENT	Meter	Indicates plant load current.
		VM CAL	Test Jacks	Used to calibrate plant voltmeter.
		BAT-DISCHG	Switch	Selects sense points for plant voltmeter.
		CAP CHG	Lamp (White)	Lights to indicate load capacitors are charging.
		LAMP TEST	Switch	Used to test CAP CHG lamp.
		CHG	Fuse	Protects load capacitor charge circuit.
		CHG ALM	Fuse	Provides alarm when CHG fuse blows.
		R	Fuse	Protects high-low voltage monitor, RFA relay, and alarm LEDs.
		HLV	Fuse	Protects high-low voltage monitor.
		VM	Fuse	Protects plant voltmeter.
		VM2	Fuse	Protects plant voltmeter.
		RB	Fuse	Protects rectifier regulator circuits.
		BAT	Fuse	Protects rectifier control circuit.
		ABS	Fuse	Protects battery supply leads in ESS office alarm circuits other than No. 3 ESS applications.

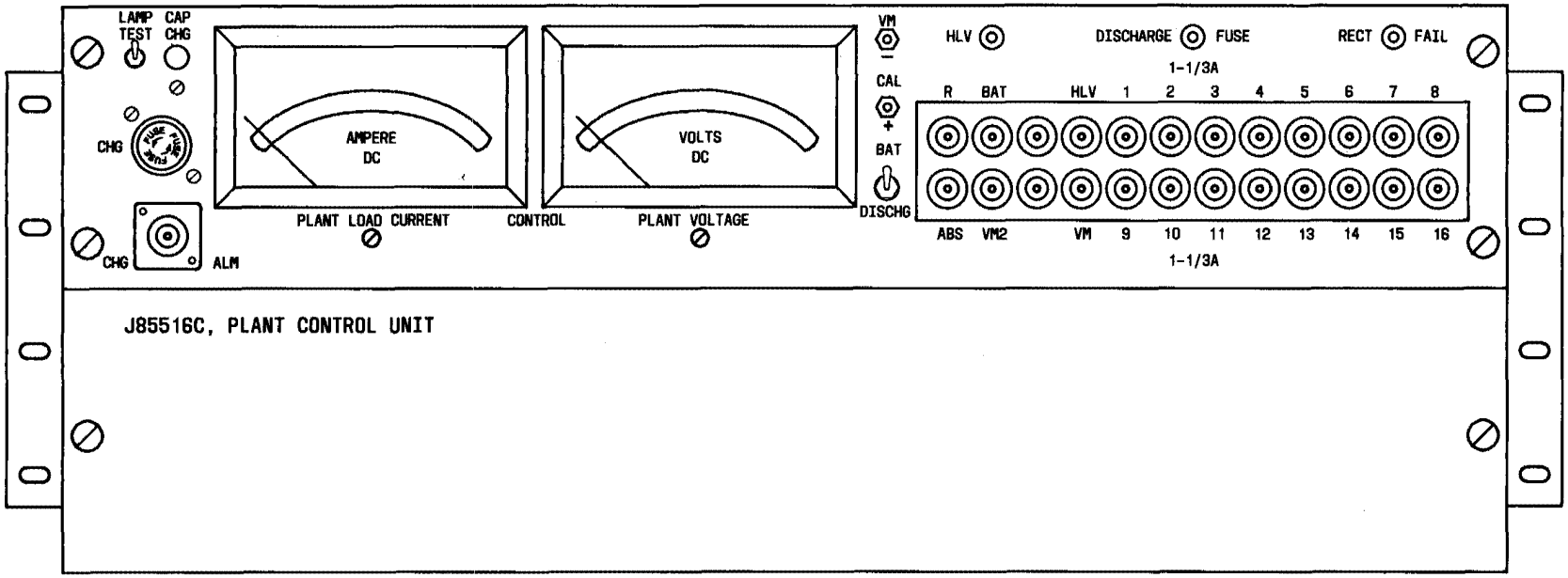

Fig. 3—J85516C Plant Control Unit

TABLE C

J87437A RECTIFIER
CONTROLS, INDICATORS, AND FUSES

NAME	EQUIP. LOCATION	CONTROL, INDICATOR, OR FUSE	TYPE	FUNCTION
Rectifer (J87437A, L1 and L3 or L2 and L3)	48V PWR FRM	OUTPUT CURRENT	Meter	Indicates rectifier output load current or simulated load current.
		ON-OFF	Switch	Manual power switch used to turn on and turn off rectifier.
		DC OUTPUT	Circuit Breaker	Connects rectifier output to the plant charge bus.
		RECT FAIL	LED (Red)	Indicates rectifier is shut down.
		NL/FL	Switch	Used to test rectifier for regulation.
		OUTPUT VOLTS ADJ	Potentiometer	Used to adjust rectifier output voltage.
		REG + and REG -	Test jacks	Used to measure rectifier output voltage.
		RELAY AND ALARM (+V and -V)	Fuses	Protect internal voltage sense leads.

tive 48-volt dc at 100 amperes output. The functional units of the rectifier are as follows:

- Power Circuit
- Voltage Regulation and Control Circuits.

2.07 The rectifier power circuit converts the ac input to a regulated 48-volt output. The basic power unit is a triac controlled, ferroresonant transformer circuit. In this circuit, the magnetic saturation of each ferroresonant transformer is controlled by a triac to regulate the output voltage. Rectifying diodes convert the ac from the transformer to dc which is filtered by an inductor and capacitor bank. Three separate transformer circuits, one for each phase, are connected in parallel to supply the output.

2.08 An output current meter gives a direct indication of the output current. A voltage for sensing purposes is taken across the meter's shunt resistor.

2.09 The regulator and control circuit of the J87437A rectifier consists of the following printed wiring circuit packs:

- Alarm and Power Circuit—CP1
- Voltage Regulation and Current Limit Circuits—CP2.

2.10 The alarm and power circuits, CP1 circuit pack, furnish power to the regulator circuits and provide high-voltage shutdown, remote shutdown and restart, and fuse alarms. The CP1 circuit pack also monitors the presence of the ac input phases and provides a simulated no load/full load test feature.

2.11 The voltage regulation and current limit circuits, CP2 circuit pack, maintain the output

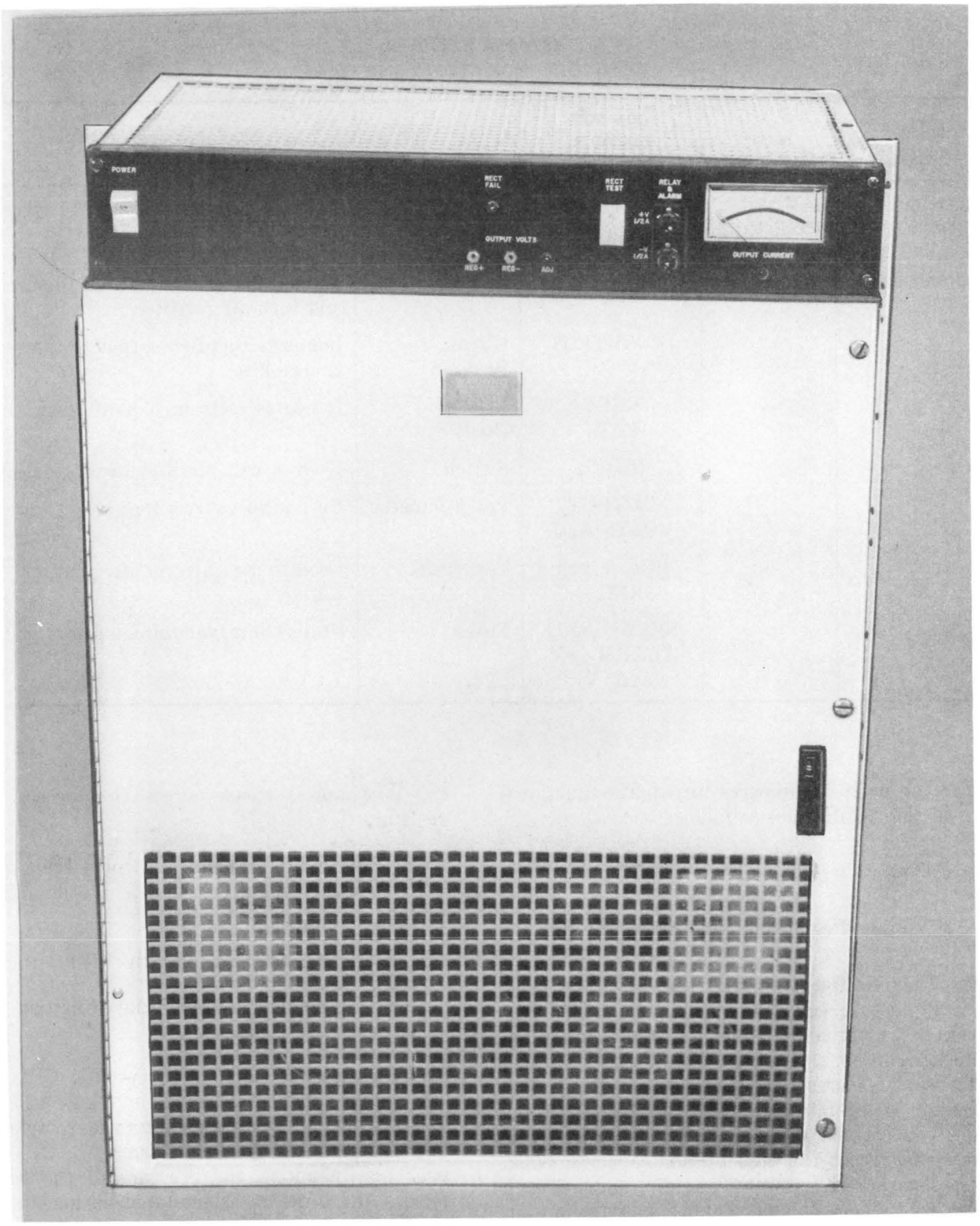

Fig. 4—J87437A, L1 and L3, or L2 and L3, Rectifier

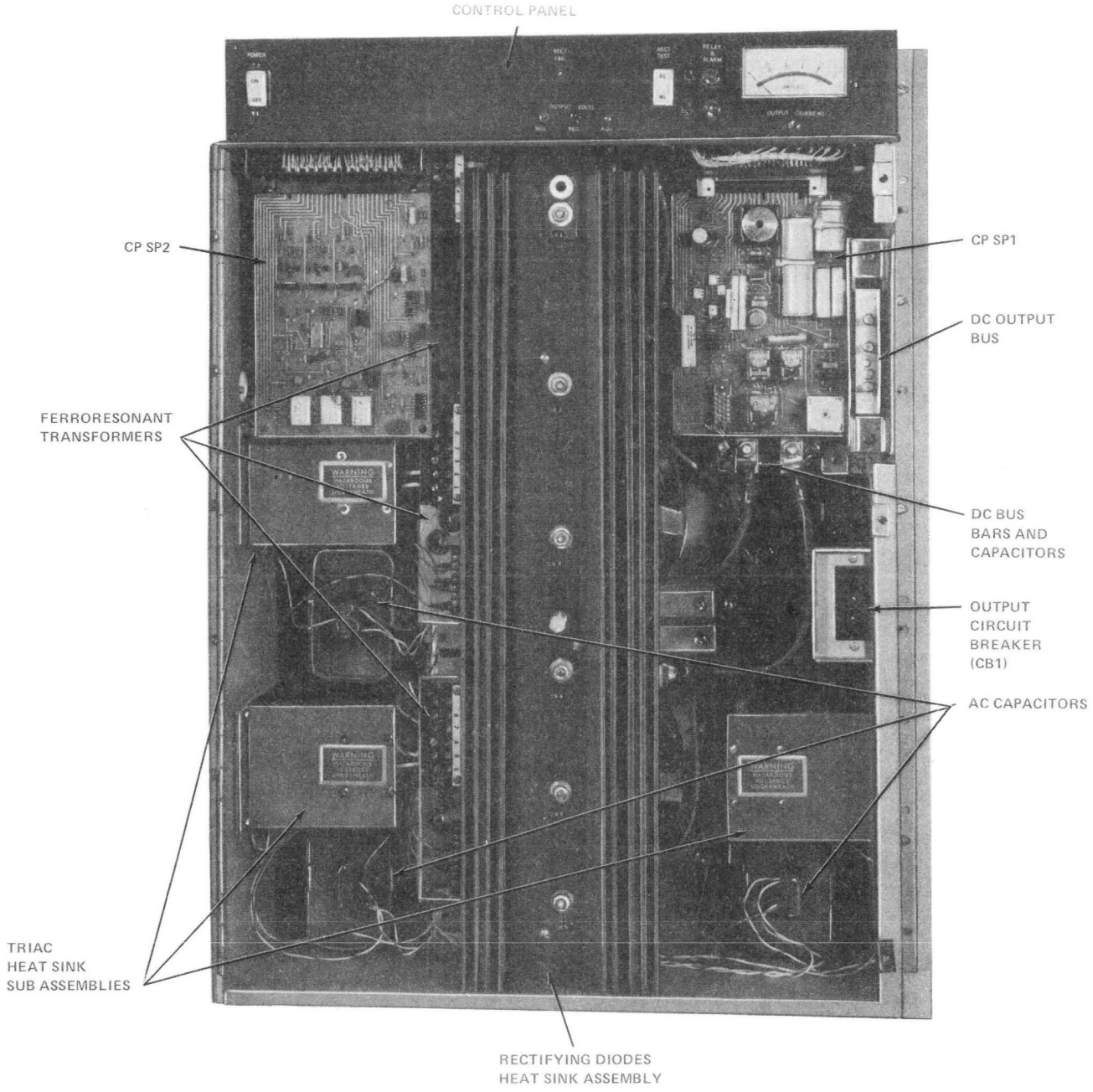

Fig. 5—J87437A, L1 and L3, or L2 and L3, Rectifier—Front Panel Open

voltage at the desired level, sense the value of the output current, and provide current limiting and current walk-in.

C. Rectifier KS-20493, L21 and L22 (Lorain Products and ITT-North Electric)

2.12 The KS-20493 rectifier is designed for single-phases, 60 ±3 Hz ac input and is suitable for use in battery power plants where 3-phase service is not available. The output voltage regulation for combined line and load variation is ±1 percent steady state when the rectifier is operating in an ambient termperature range of 10 to 50°C.

2.13 The KS-20493 rectifier is available from two manufacturers; Lorain Products Corporation (Fig. 6 and 7), and ITT-North Electric Company (Fig. 8 and 9). There are significant differences in the internal design of each rectifier, but the equipment features and the output ratings are the same. The instructions in this section are based on SD-81999-02 (Lorain Product Corporation) or SD-82401-02 (ITT-North). The KS-20493, L105, circuit breaker kit (Option S) is also required when used in the 151C power plant.

2.14 The KS-20493 rectifier utilizes a triac and regulation circuit to electronically control a ferroresonant transformer for control of the output voltage and current. The output voltage is protected by the dc output circuit breaker (Option S) and by the current limit feature.

2.15 This rectifier is designed to mount on a 23-inch relay rack framework or in a cabinet with similar mounting arrangements and can be serviced and maintained from the front only. All electrical connections can be made with the front cover removed. The meter, controls, and fuses are mounted on a hinged panel for access, maintenance, or replacement. For a list of controls, indicators, and fuses on the KS-20493 rectifier, see (Table D, Lorain Products Corporation) or (Table E, ITT-North).

D. Discharge Circuit Breaker Panel

2.16 The discharge circuit breaker panels provide isolation and overload protection for the power plant and connected load. The circuit breaker panels are mounted in the J86917A initial originating bay. Three seperate codes of circuit breakers are used in the 151C plant.

- KS-21124 (see Fig. 10)
- KS-22010 (see Fig. 11)
- KS-22012 (see Fig. 12).

These circuit breakers are dc, single-pole, toggle switch, magnetic-type provided with an alarm switch. When the breakers are tripped by an overcurrent, the toggle switch moves to a midposition between the ON and the OFF position. With the breaker in the tripped position, a normally open alarm switch is closed. To reset the breaker, set the breaker to the OFF position, then to the ON position. To precharge the load, the KS-22010 and the KS-22012 circuit breakers are equipped with an internal charge switch. (See Fig. 11 and 12.) To precharge the load protected by the KS-21124 circuit breaker, an auxiliary KS-21225, List 8, charge switch is mounted adjacent to the circuit breaker (Fig. 10).

> ***Note 1:*** Normally no maintenance is required on the 151C power plant dc distribution circuit breakers.
>
> ***Note 2:*** The KS-22010 circuit breaker shall have growth from right to left in consecutive order when mounted in ED-82835-30, G2, panel.

3. FUNCTIONAL DESCRIPTION

A. Introduction

3.01 The function of the 151C power plant is to supply up to 600 amperes of regulated negative 48-volt dc power. The plant is used to power the office load, float the battery bank, and recharge the battery bank after a commercial power failure has occurred. The functional units of the 151C power plant are as follows:

- Plant Alarm and Control Circuit
- Rectifier
- Discharge Circuit Breaker Panels
- Battery Bank.

B. Plant Control Unit and Alarm Circuit (J85516B or J85516C)

3.02 The plant control and alarm circuit monitors the plant output bus and each individual rectifier, and is able to shut down and restart rectifiers

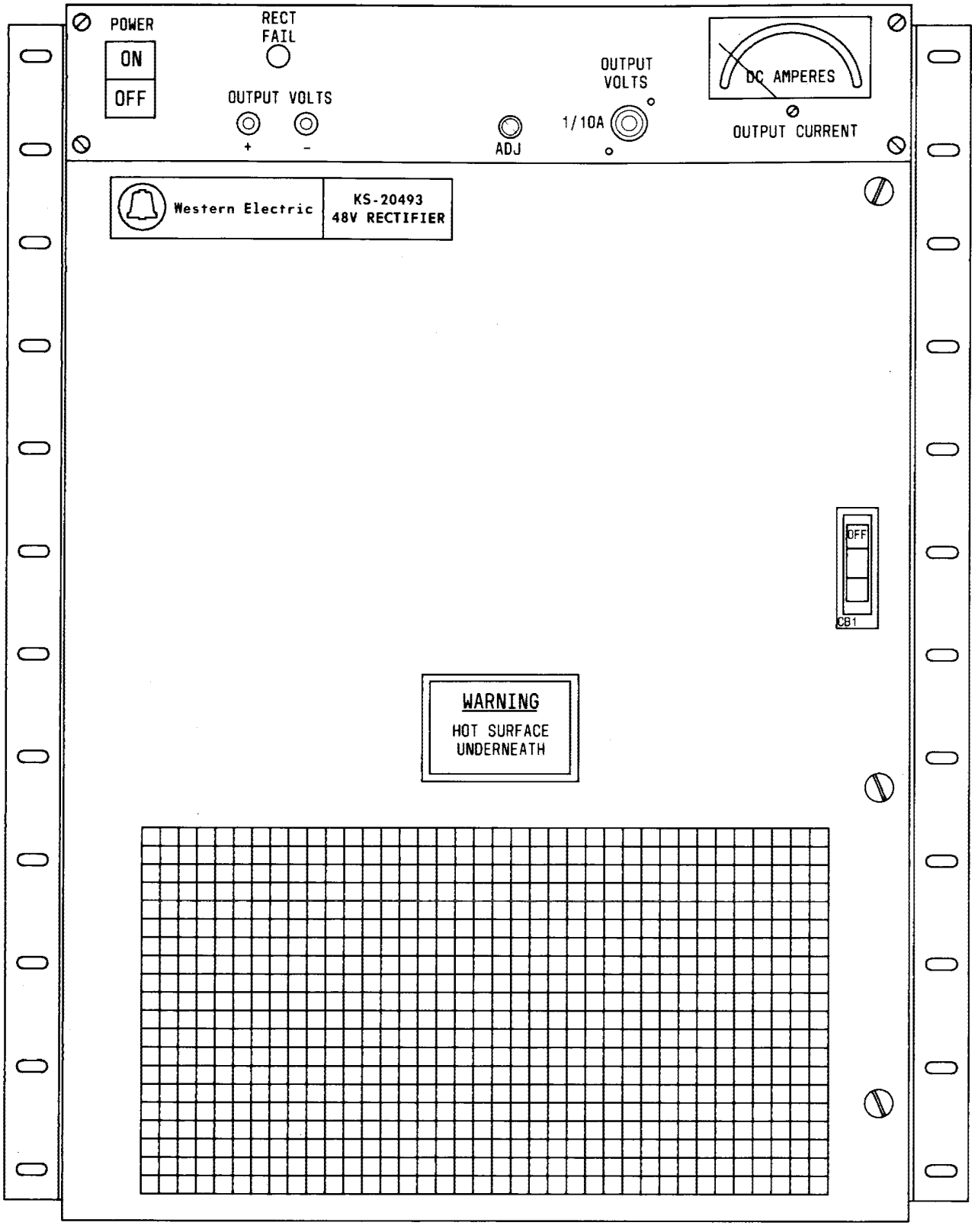

Fig. 6—KS-20493 Rectifier—Front View (Lorain Products Corporation)

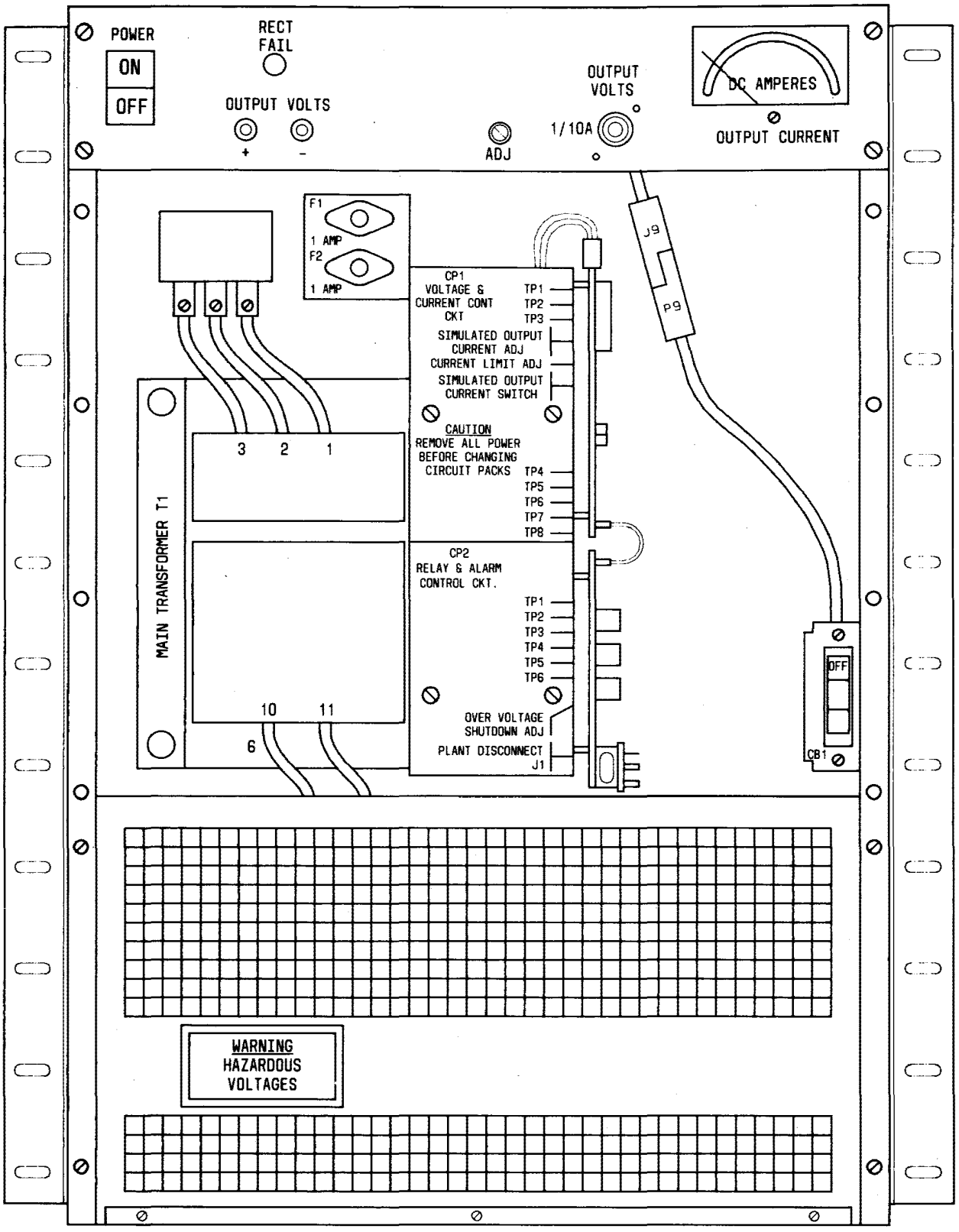

Fig. 7—KS-20493 Rectifier—Front Panel Removed (Lorain Products Corporation)

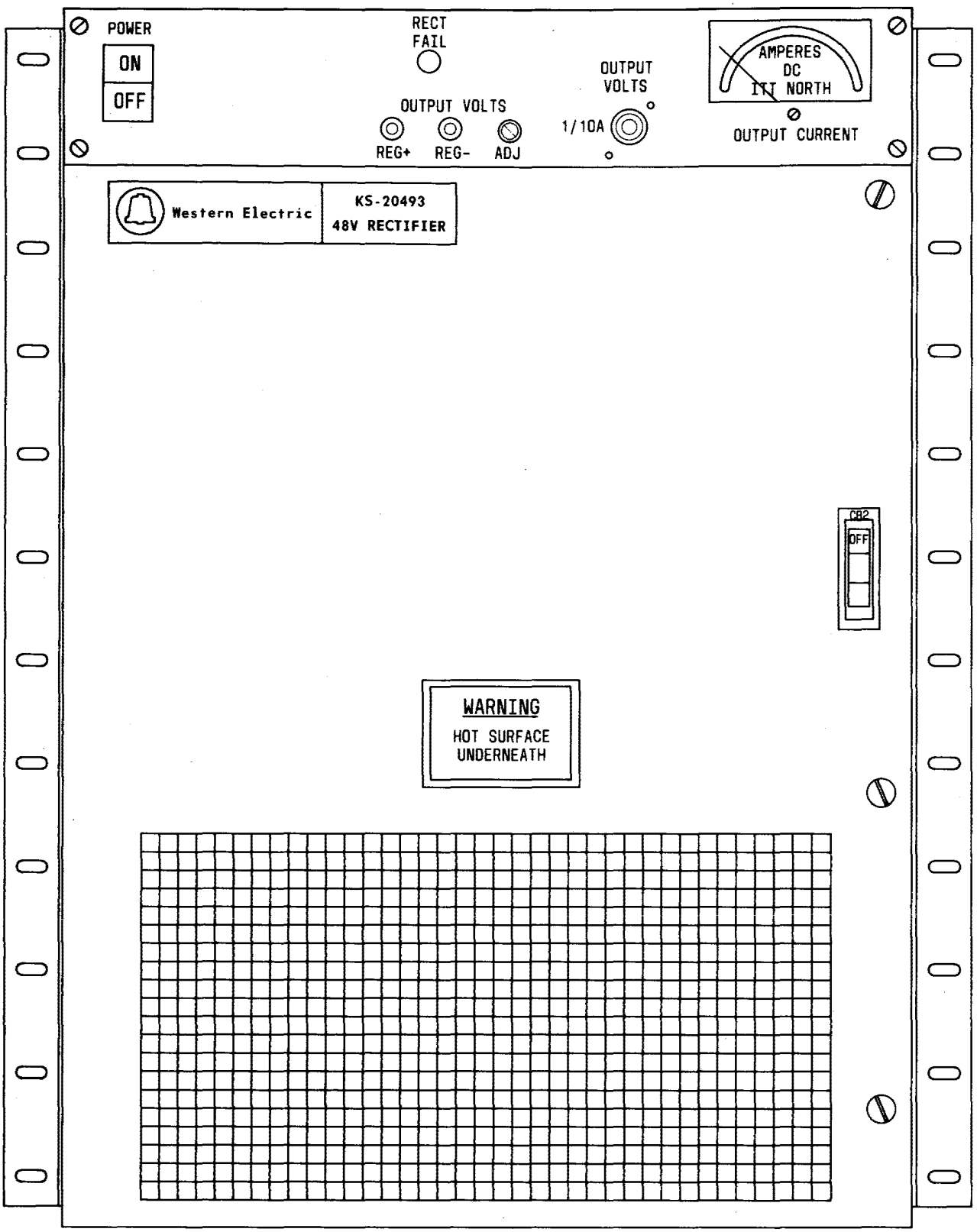

Fig. 8—KS-20493 Rectifier—Front View (ITT-North Electric Company)

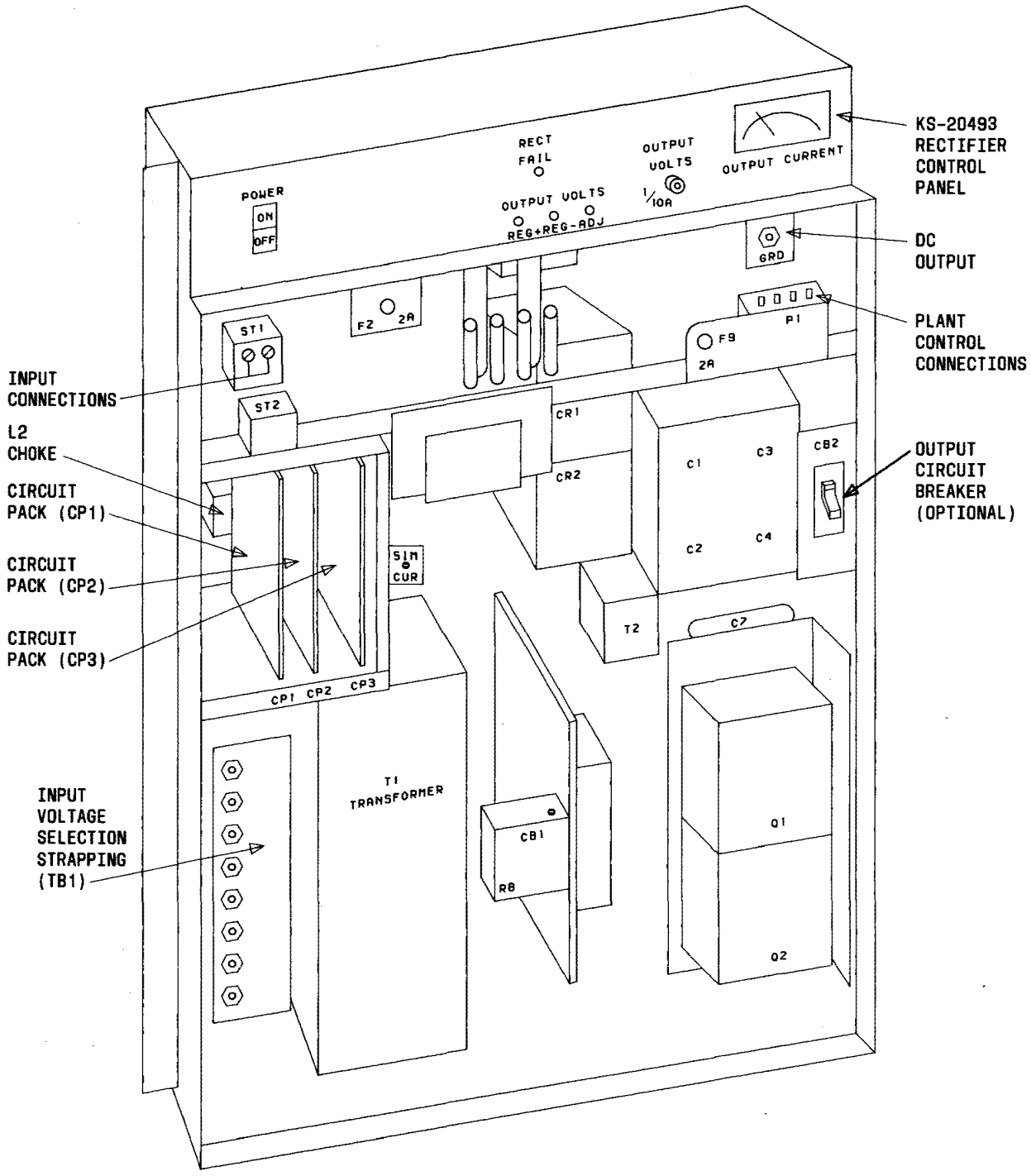

Fig. 9—KS-20493 Rectifier—Front Panel Removed (ITT-North Electric Company)

TABLE D

KS-20493 RECTIFIER, L21, L22 (LORAIN PRODUCTS CORPORATION) CONTROLS, INDICATORS, AND FUSES

NAME	EQUIP. LOCATION	CONTROL INDICATOR	TYPE	FUNCTION
Rectifier KS-20493, L21, L22 (Lorain)	−48V PWR FRM	OUTPUT CURRENT	Meter	Indicates rectifier output load current or simulated load current.
		DC POWER SUPPLY	Fuses	Protect dc supply transformer.
		ON-OFF (S1)	Switch	Manual power switch used to turn on and turn off rectifier.
		RECT FAIL	LED (Red)	Indicates rectifier is shut down.
		OUTPUT VOLTS ADJUST	Potentiometer	Used to adjust rectifier output voltage.
		REG+ and REG−	Test Jacks	Used to measure rectifier output voltage.
		SIMULATED OUTPUT CURRENT (S2)	Switch	Connects simulated current circuit to ammeter and regulator circuits.
		CURRENT LIMIT ADJUST	Rheostat	Used to adjust rectifier current limit.
		CURRENT LIMIT	Test Jacks	Used to measure rectifier current limit.

TABLE E

KS-20493 RECTIFIER, L21, L22 (ITT—NORTH ELECTRIC)
CONTROLS, INDICATORS, AND FUSES

NAME	EQUIP. LOCATION	CONTROL INDICATOR	TYPE	FUNCTION
Rectifier KS-20493, L21, L22 (ITT-North)	—48V PWR FRM	OUTPUT CURRENT	Meter	Indicates rectifier ouput load current or simulated load current.
		24-VOLT BIAS SUPPLY	Fuses	Protect 24-volt bias supply transformer.
		POWER ON/ POWER OFF	Lamp/ Switch	Manual power switch to turn on and turn off rectifier.
		OUTPUT CAPACITOR	Fuse	Protects main dc capacitor bank.
		RECT FAIL	Lamp (Red)	Indicates rectifier is turned off or shut down.
		LOCAL SNS	Lamp (White)	Indicates rectifier regulation leads are opened.
		SIMULATED OUTPUT CURRENT	Pushbutton	Used to connect rectifier simulated load circuit.
		OUTPUT VOLTS ADJUST	Rheostat	Used to adjust rectifier output voltage.
		OUTPUT VOLTS	Test Jacks	Used to measure rectifier output voltage.
		OUTPUT VOLTS	Fuse	Protects against faults to ground at TP2 OUTPUT VOLTS test jack.
		CURRENT LIMIT	Test Jacks	Used to measure rectifier current limit.

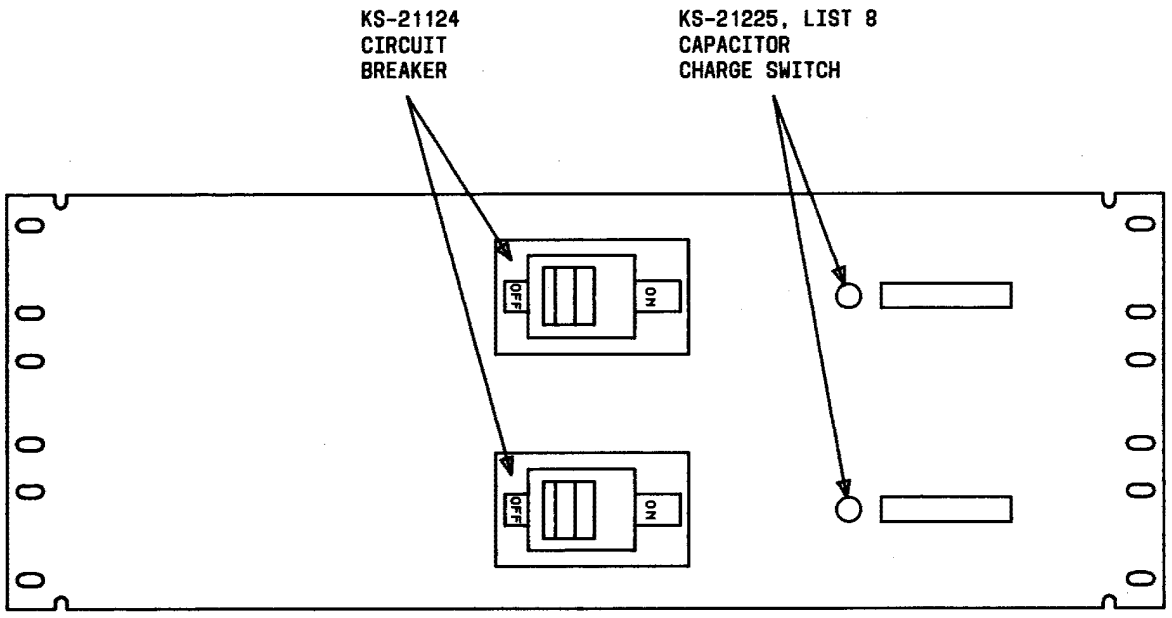

Fig. 10—KS-21124 Circuit Breakers Equipped With KS-21225, L8, Charge Switches Mounted on ED-82835-30, G4, Panel

during certain failure conditions. The functional units of the plant control and alarm circuit are as follows:

- High-Low Voltage Monitors
- Alarm Relays
- Alarm LEDs
- Rectifier Restart Circuit
- REG Sense Circuit
- Discharge Circuit
- Capacitor Charge Circuit
- Meter Circuit.

3.03 The plant high-low voltage monitor circuit monitors the voltage level of the battery bus at the REG bus. The high-low voltage monitor consists of the following:

- High-Voltage Shutdown HV
- Low-Voltage Alarm LV1
- Very Low-Voltage Alarm LV2.

High-low voltage alarm conditions and indications are summarized in Table F.

> ***Note:*** If control unit fuse HLV is open, all high-low voltage alarms are given and a shutdown signal is sent to the rectifiers.

3.04 The high-voltage shutdown HV lights the HLV LED and provides major alarm contact closures and a shutdown signal to the faulty rectifier(s). The HV signals and major alarms are given when the REG bus voltage increases to 53.00 volts.

3.05 The low-voltage alarm LV1 provides minor alarm contact closures and lights the HLV LED when the REG bus voltage drops to 51.25 volts dc.

3.06 The very low-voltage alarm LV2 provides major alarm contact closures and lights the HLV LED when the REG bus voltage drops to 48.25 volts dc.

3.07 The plant alarm relays provide alarm contact closures which light a plant alarm LED and

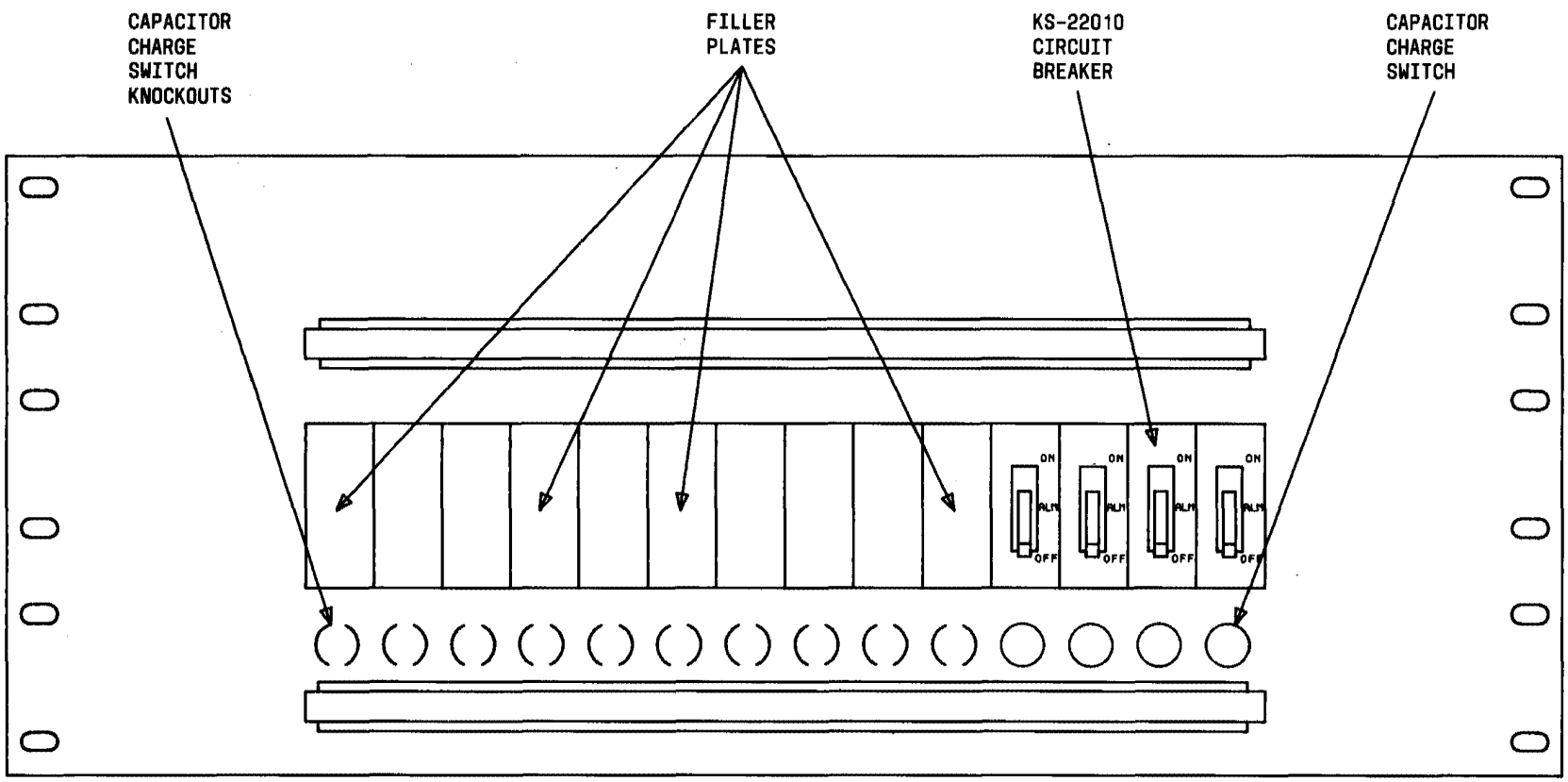

Fig. 11—KS-22010 Circuit Breakers Mounted on ED-82835-30, G2, Panel

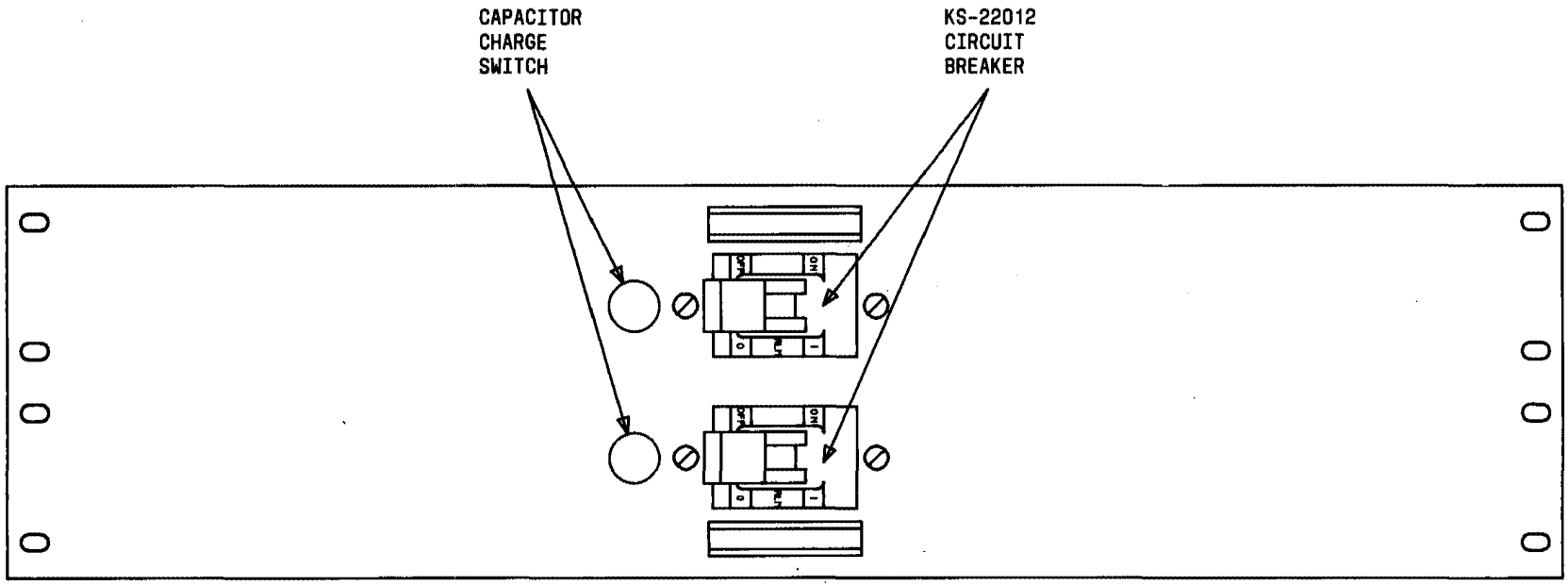

Fig. 12—KS-22012 Circuit Breaker Mounted on ED-82835-30, G3, Panel

TABLE F

HIGH-LOW VOLTAGE ALARMS

VOLTAGE ALARM	PLANT VOLTAGE	PLANT ALARM LED LIGHTED	PLANT ALARM GIVEN
High Voltage	53.00 ±0.50 volts or above	HLV, RECT FAIL (when rectifiers are shut down)	Major
Low Voltage	51.25 ±0.50 volts	HLV	Minor
Very Low Voltage	48.25 ±0.50 volts or below	HLV	Major

initiate local and remote alarms. The plant alarm relays are identified as follows:

- ***FAN Relay***—Provides minor alarm contact closures and lights the RECT FAIL LED when the HLV or VM fuse blows, or an RB fuse blows.

- ***FAJ Relay***—Provides major alarm contact closures and lights the DISCHARGE FUSE LED when the CHG, VM2, or BAT/fuse blows, a load fuse blows, or a load circuit breaker trips.

Note: The FAJ relay provides major alarm contact closures but does not light the DISCHARGE FUSE LED when the R fuse blows.

- ***RFA Relay***—Provides minor alarm contact closures and lights the RECT FAIL LED when a rectifier fails and shuts down, a power phase is lost, or a rectifier output circuit breaker trips.

Table G gives a summary of plant fuse alarm indications.

3.08 The plant alarm LEDs light to identify an alarm condition in the plant. The plant alarm LEDs are identified as follows:

- ***HLV***—Provides a visual indication of a high or low voltage condition.

Note: The HLV LED will also light due to a blown HLV fuse on the plant control unit.

- ***DISCHARGE FUSE***—Provides a visual indication of a major fuse alarm.

- ***RECT FAIL***—Provides a visual indication of a failed rectifier or a minor fuse alarm.

Note: When the R fuse on the plant control unit is blown, none of the plant alarm LEDs will be able to light.

3.09 The rectifier restart circuit attempts to restart plant rectifiers that have failed and shut down. A rectifier failure activates the RFA relay which in turn operates relay RSR in the control unit after a delay of about 2 seconds. The RSR relay, when operated, provides a contact closure to all the rectifiers in the plant. This closure will cause any rectifier which has shut down to make one attempt to restart. If a rectifier shutdown was caused by a transient condition, the failed rectifier(s) will restart and resume normal operation. However, if the trouble which caused the shutdown is continuous, the rectifier will attempt to restart, then lock out. A delay circuit holds the restart contacts closed for approximately 5 minutes after the RFA relay releases. If the rectifier fails again within 5 minutes of the previous RFA signal, the rectifier will not be able to attempt a restart.

Note: The restart circuit is also activated by the loss of a power phase or a tripped rectifier output circuit breaker.

3.10 Voltage signals from the battery are supplied to the REG bus. The REG circuit supplies voltage signals from the REG bus to the individual recti-

TABLE G

FUSE ALARMS

FUSE OR CIRCUIT BREAKER	FUSE ALARM RELAY OPERATED	PLANT ALARM LED LIGHTED	OFFICE ALARM SIGNALS GIVEN
Control unit fuses RB1-RB16 (as required) HLV, VM	FAN	RECT FAIL	Minor
Control unit fuses CHG, R, VM2, BAT	FAJ	DISCHARGE FUSE (except R fuse)	Major
Rectifier fuses RELAY and ALARM +V and -V	FAN	RECT FAIL	Minor
Rectifier circuit breaker CB1	FAN	RECT FAIL	Minor
Discharge fuses and circuit breakers	FAJ	DISCHARGE FUSE	Major

fier regulator circuits, the plant voltage monitor circuits, and the plant meter circuit. Regulation fuses RB( ) supply REG bus sense voltage to the individual rectifier regulator circuits. The high-low voltage monitor senses the REG bus voltage through the HLV fuse. The PLANT VOLTAGE meter senses the REG bus voltage through the VM fuse.

3.11 The plant discharge circuit provides voltage signals and operating current from the discharge bus to the capacitor charge circuit, the high-low voltage monitor, the RFA relay, the alarm LEDs, the meter circuit, and the control circuits of the rectifiers. The capacitor charge circuit is supplied through the CHG fuse. The RFA relay and the alarm LEDs are supplied through the R fuse. The meter circuit senses the discharge bus voltage through the VM2 fuse. The rectifier control circuits are supplied through the BAT fuse.

3.12 The capacitor charge circuit is used to precharge capacitors in the load circuit before the circuit breakers for the loads are operated to ON. The CAP CHG lamp lights to provide a visual indication that charging is taking place. The LAMP TEST switch is used to test the capacitor charge circuit by lighting the CAP CHG lamp if the circuit is functioning properly.

3.13 The meter circuit provides indications of plant voltage and load current. The PLANT VOLTAGE meter reads the voltage selected by the BAT-DISCHARG switch, either the battery bus voltage (measured at the REG bus) or the discharge bus voltage. Test jacks VM CAL (+) and (−) are provided for connecting a test meter to read plant voltage and to calibrate the PLANT VOLTAGE meter. The PLANT LOAD CURRENT meter indicates load current supplied by the plant.

C. Rectifiers

3.14 The rectifiers rectify the incoming ac power to a constant negative 48-volt output. Each 151C power plant can use one of three different rectifiers. The J87437A, L1 and L3, rectifier operates from a 208/240-volt, 3-phase, 60 ±3 Hz input, and the J87437A, L2 and L3, rectifier operates from a 480-volt, 3-phase, 60 ±3 Hz input. The KS-20493, L21, rectifier operates from a 208/240-volt, ac single-phase, 60 ±3 Hz input. The KS-20493, L22, rectifier operates from a 480-volt, ac single-phase, 60 ±3 Hz input.

D. Discharge Circuit Breaker Panels

3.15 The discharge circuit breaker panels function to provide isolation and overload protection for the power plant (see paragraph 2.16).

E. Battery Bank (J87124A, B)

3.16 A 24-cell battery bank comprised of lead-acid cells connected between the charge battery bus and the discharge bus. Normally the 151C power plant rectifiers supply current to the charge battery bus to float the batteries and power the office load through the discharge bus. When a commercial power failure occurs, the batteries supply current to the discharge bus to power the loads. After ac input power is restored, the rectifiers recharge the batteries through the battery charge bus.

4. APPARATUS

4.01 ***List of Tools and Test Equipment:*** The following Tools and Test Equipment are listed below:

TOOLS	DESCRIPTION
141	Cord Tip
411C	Test Pick
720A	Voltage Pickup Tool
W1AY	Test Cord
—	3-Inch C Screwdriver
—	5-Inch E Screwdriver
TEST EQUIPMENT	
KS-20599, L4	Digital Multimeter (DMM) (or equivalent)

5. ACCEPTANCE TESTS

INTRODUCTION

5.01 In order to determine that the 151C power plant is operating properly when first installed, the following acceptance tests should be performed. These tests should be performed in the order they are listed. If a trouble is discovered during testing, correct the problem; then, return to the beginning of the test procedure where the trouble was found and start the test over.

TEST PROCEDURES

A. Test Plant Rectifiers

5.02 The procedures for testing the rectifiers in the plant are given in the following Bell System Practices which describes the operating methods of the rectifier:

RECTIFIER	SECTION
J87437A	169-652-306
KS-20493 (Lorain Products)	169-745-301
KS-20493 (ITT-North)	169-745-302

5.03 The following tests should be performed on each rectifier in the plant:

(1) Check output voltage adjustment.

(2) Check voltage regulation (J87437A only).

(3) Check current limit (KS-20493 only).

(4) Check high voltage shutdown (KS-20493 only).

(5) Check TR shutdown (KS-20493 only).

(6) Check automatic restart (KS-20493 only).

B. Check and Adjust Battery Bus Voltage and Rectifier Output Current

5.04 To balance the output currents of the rectifiers and set the battery bus voltage, proceed as follows:

(1) Set the KS-20599, L4, digital multimeter (DMM) to measure approximately 100 volts dc. Connect the DMM across the VM CAL (+) and (−) test jacks on the plant control unit. (See Fig. 2 or 3).

(2) Set the voltmeter selector switch on the plant control unit to BAT (Fig. 2 or 3).

Requirement: The OUTPUT CURRENT ammeter on each rectifier indicates some load current (see Note 1) and the DMM indicates the required charge bus voltage (see Note 2).

Note 1: The rectifiers are not required to share load current equally.

Note 2: Use 52.08 volts dc as the correct charge voltage (2.17 volts per cell for 24-cell battery).

Note 3: If the voltage and current requirements are met, go to (6). If the requirements are not met, continue with (3).

(3) On rectifiers with no current indication, rotate the OUTPUT VOLTS ADJ potentiometer slowly cw, using the 3-inch C screwdriver, until the rectifier ammeter indicates some load current (Fig. 4, 5, 6, 7, 8, or 9).

Requirement: The DMM indicates the correct charge voltage [see (2) Note 2].

Note: If the voltage and current requirements are met, go to (6). If the requirements are not met, continue with (4)(a) or (b).

(4) To adjust plant voltage, proceed as follows:

(a) ***Bus Voltage High:*** If the actual battery bus voltage is higher than the required voltage, rotate the OUTPUT VOLTS ADJ potentiometer, using the 3-inch C screwdriver, slightly ccw on rectifiers with the highest current indication.

(b) ***Bus Voltage Low:*** If the actual battery bus voltage is lower than the required voltage, rotate the OUTPUT VOLTS ADJ potentiometer, using the 3-inch C screwdriver, slightly cw on rectifiers with the lowest current indication.

(5) Repeat the procedure from (3) until the battery bus voltage is set.

(6) Set the plant voltmeter selector switch to DISCHG (Fig. 2 or 3).

Requirement: The DMM indicates approximately the same value as the battery bus voltage.

(7) Set the voltmeter selector switch to BAT and disconnect the DMM from the VM CAL test jacks.

C. Calibrate Plant Voltmeter

5.05 To calibrate the plant voltmeter on the J85516B or J85516C plant control unit, proceed as follows:

(1) Set the DMM to measure approximately 100 volts dc. Connect the DMM across the VM CAL (+) and (−) test jacks. (See Fig. 2 or 3).

Requirement: The PLANT VOLTAGE meter (Fig. 2 or 3) indicates within 0.25 volt of the DMM voltage indication.

Note: If the requirement is not met, use the 3-inch C screwdriver to adjust the calibration screw on the PLANT VOLTAGE meter until the indication on the PLANT VOLTAGE meter equals the indication on the DMM.

(2) Disconnect the DMM from the VM CAL test jacks.

D. Check Plant Fuse Alarms

5.06 To check the plant fuse alarms for proper operation, proceed as follows:

Note: The later design of fuse caps for 70-type fuses contains an aperture or slot adjacent to the hole for the colored bead, providing access to the alarm test point (Fig. 13). The new P-344900 fuse cap assembly is for use on nonmodular fuse blocks (18A, 19A, and 21A) and the P-11F667 fuse cap assembly is for use on modular fuse blocks (22- through 27-type). This style cap should be used when testing fuse alarm.

Danger: Due to shock hazard, possible fuse and/or equipment damage, the former procedure of testing fuse alarms by inserting a 411C tool or a 266C tool (wire burnisher) held in a 265C tool (contact burnisher holder) beside the colored bead on older fuse caps without the slot or aperture, should be discontinued.

(1) Prepare the alarm test cord by connecting one end of the W1AY testing cord to the 141 cord tip and 720A voltage pickup tool. On the opposite end of the W1AY testing cord, connect the 411C test tool. (See Fig. 14).

(2) Verify that the 720A tool is equipped with a good 70G 1/2-ampere fuse.

(3) At the J85516B or J85516C plant control unit fuse panel, install the 720A voltage pickup tool

at a suitable spare 70-type fuse position (Fig. 2 or 3).

Danger: The battery voltage is present on the tip of the test cord when 720A voltage pickup tool is in fuse position.

(4) At the RB1 fuse, touch the tip of the 411C test pick to the exposed test point on the fuse cap (Fig. 13).

Requirement: The RECT FAIL LED lights (Fig. 2 or 3) and a minor alarm is given.

Note: If the alarm requirements are not met, remove the test pick from the fuse cap and refer to Table J. If the requirements are met, continue with (5).

(5) Remove the test pick from the fuse cap.

Requirement: The RECT FAIL LED turns off and the alarm ceases.

(6) Repeat (4) for each additional RB fuse, the HLV fuse, and the VM fuse.

(7) At the BAT fuse, touch the tip of the 411C test pick to the exposed test point on the fuse cap.

Requirement: The DISCHARGE FUSE LED lights (Fig. 2 or 3) and a major alarm is given.

Note: If the alarm requirements are not met, remove the test pick from the fuse cap and refer to Table J. If the requirements are met, continue with (8).

(8) Remove the test pick from the fuse cap.

Requirement: The DISCHARGE FUSE LED turns off and the alarm ceases.

(9) Repeat (7) for the R fuse, the VM2 fuse, and the CHG ALM fuse (located at the left side of the plant control unit).

(10) Remove the 720A voltage pickup tool from the fuse panel and install spare removed in (3).

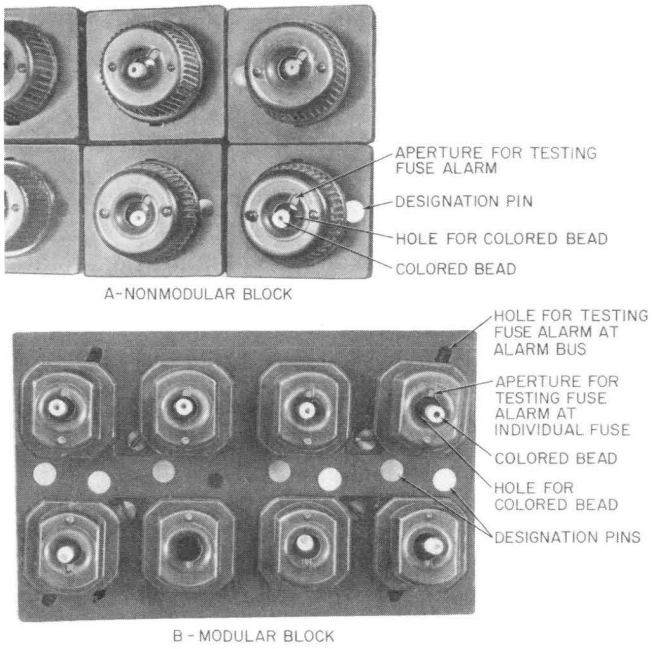

Fig. 13—Typical 70-Type Fuse Cap

E. Check Plant Control Unit Low-Voltage (LV1 and LV2) Monitors

Note: The battery voltage must be at float value when performing this check.

5.07 To check the low-voltage (LV1 and LV2) monitors, proceed as follows:

(1) Remove the lower front panel on the J85516B or J85516C plant control unit by loosening the screws on each end of the panel with the 5-inch E screwdriver and lifting the panel off (Fig. 2 and 15 or 3 and 16).

Note: The test switch is a momentary contact switch.

(2) On the WC1 or WC2 circuit pack (Fig. 15 or 16), operate the TST or LV2 TST switch to the test position.

Requirement: The HLV LED on the J85516B or J85516C plant control unit lights and a major alarm is given.

Note: If the alarm requirement is not met, refer to Table X.

(3) Release the test switch.

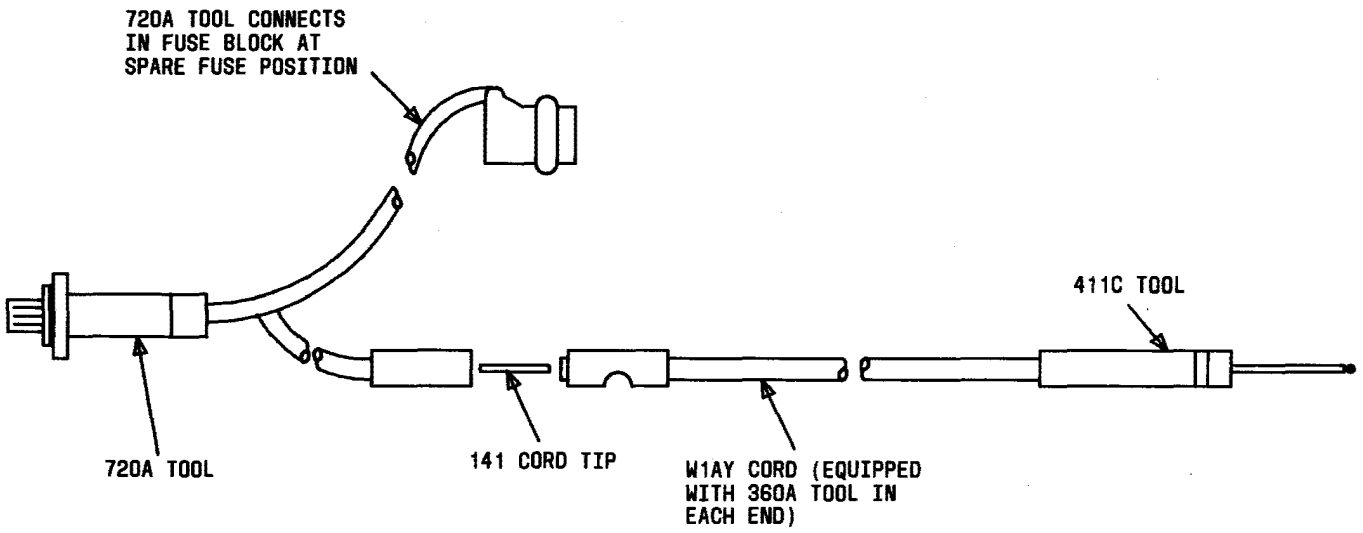

Fig. 14—Fuse Alarm Test Cord

Requirement: The HLV LED goes out and the major alarm stops.

Note: If the requirement is not met, refer to Table X.

(4) Operate the TST or LV1 TST switch to the test position.

Requirement: The HLV LED lights and a minor alarm is given.

Note: If the alarm requirement is not met, refer to Table X.

(5) Release the test switch.

Requirement: The HLV LED goes out and the minor alarm stops.

Note: If the requirement is not met, refer to Table X.

(6) Replace the lower front panel of the plant control unit.

F. Check Plant High-Voltage (HV) Monitor (J85516C Control Panel Only)

Note: The battery voltage must be at float value when performing this check.

5.08 To check the high-voltage (HV) monitor, proceed as follows:

(1) Remove the lower front panel on the plant control unit by removing the screws on each end of the panel and lifting the panel off (Fig. 3 and 16).

Note: The HV TST switch is a momentary contact switch.

(2) On the WC2 circuit pack (Fig. 16), operate the HV TST switch to the test position.

Requirement: The HLV LED on the plant control unit lights and a major alarm is given.

Note: If the alarm requirement is not met, refer to TABLE X.

(3) Release the HV TST switch.

Requirement: The HLV LED goes off and the major alarm ceases.

(4) Replace the lower front panel of the plant control unit.

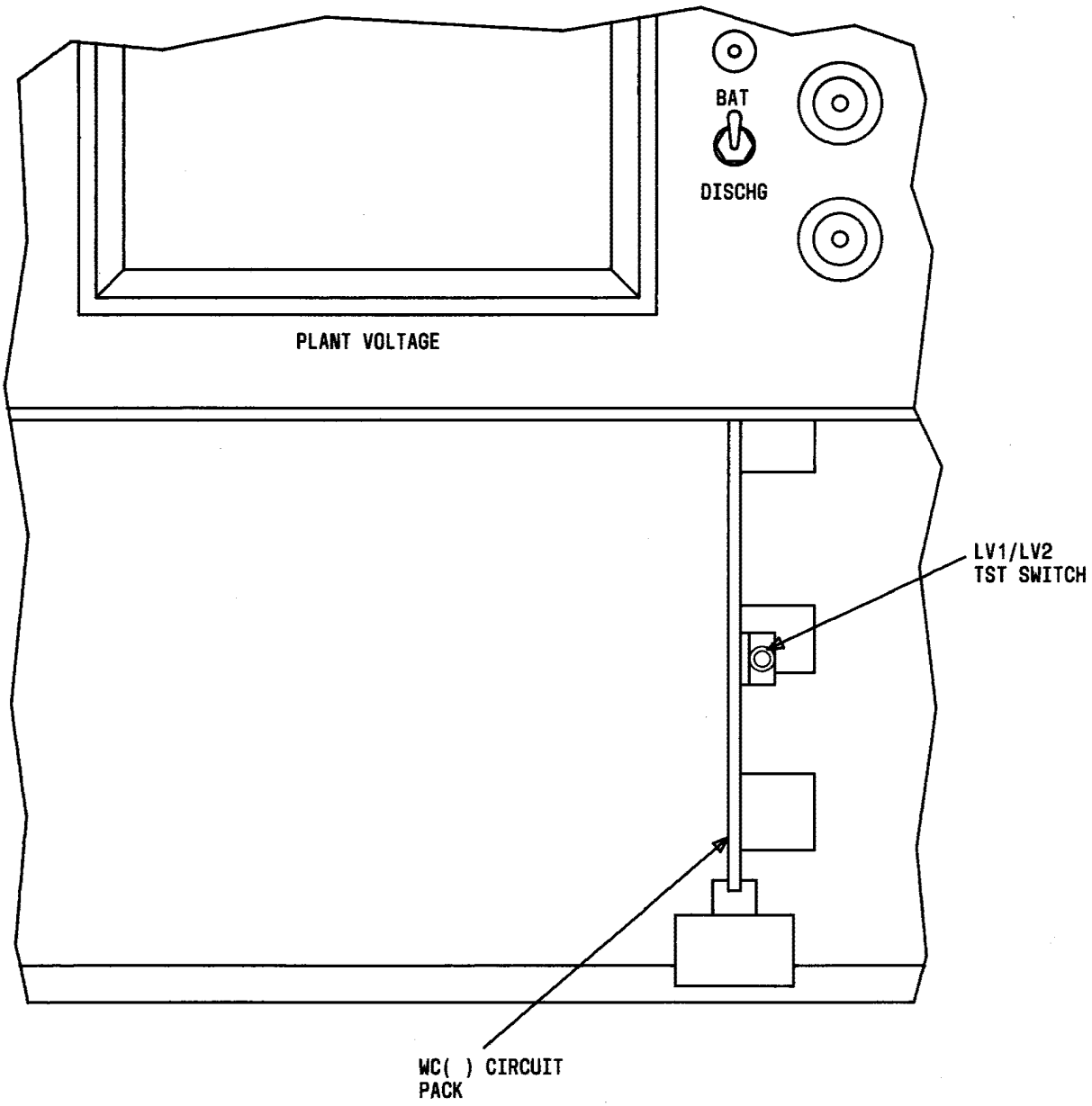

Fig. 15—J85516B Plant Control Unit (Partial View—Lower Front Panel Removed)
WC( ) Circuit Pack

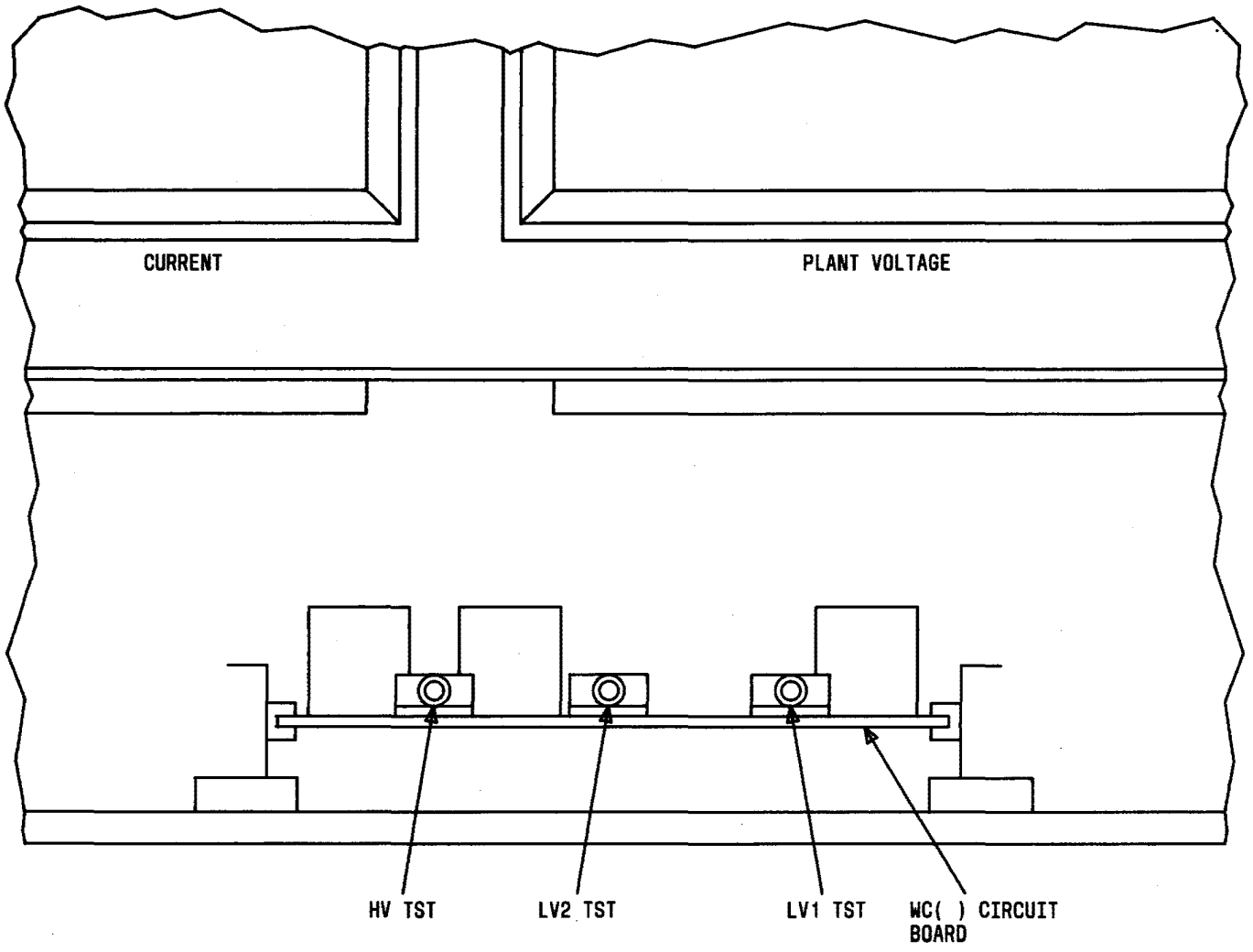

Fig. 16—J85516C Plant Control Unit—(Partial View—Lower Front Panel Removed) WC( ) Circuit Pack

6. OPERATION

INTRODUCTION

6.01 The 151C power plant is completely automatic maintaining the battery at float voltage and should require no day-to-day routine adjustments. Normally, the plant is energized and connected to the office loads. However, should the plant need to be shut down or started up, refer to the following procedure which is applicable.

OPERATING PROCEDURES

A. Preparing to Start the 151C Plant (Equipped With J87437A Rectifiers)

6.02 When preparing to start the plant, proceed as follows:

(1) Verify that all discharge circuit breakers are set to OFF (Fig. 10, 11, and 12).

(2) At the J85516B or J85516C plant control unit (Fig. 2 or 3), verify that all fuses in the plant are of the proper size and type and are installed in their respective fuse holders.

(3) Verify that all rectifier ON-OFF switches and DC OUTPUT circuit breakers are set to OFF and the plant connectors are plugged into P1 of all the rectifiers (Fig. 4 and 5).

(4) Operate ac service circuit breaker to ON, or install ac service fuses.

B. Starting the 151C Plant (Equipped With J87437A Rectifiers)

6.03 To start the plant, proceed as follows:

(1) Verify that the plant is ready to start in accordance with paragraph 6.02.

(2) Operate the ON-OFF switch of the first rectifier to be powered up to ON (Fig. 4 and 5).

Note: The rectifier may shut down immediately after the ON-OFF switch is operated to ON due to the filter capacitors charging. If this happens, operate the ON-OFF switch to OFF, then back to ON to restart the rectifier.

(3) Operate the DC OUTPUT circuit breaker of the first rectifier to be powered up to ON (Fig. 4 and 5).

(4) Repeat from Step (1) for each additional rectifier to be turned up in the plant.

Note: The LAMP TEST switch is a momentary contact switch.

Warning: Momentarily hold the LAMP TEST switch in the ON position for only a few seconds. Holding the switch in the ON position for longer than a few seconds will cause the CAP CHG lamp to burn out.

(5) Momentarily operate the LAMP TEST switch on the plant control unit (Fig. 2 or 3) to the ON position, then release the switch back to the OFF position.

Requirement: The CAP CHG lamp on the control unit (Fig. 2 or 3) is lighted when the LAMP TEST switch is in the ON position.

Note: If the requirement is not met, replace the CAP CHG lamp.

Warning: Do not hold a load charge pushbutton depressed for longer than 2 seconds if the CAP CHG lamp does not begin to dim.

(6) Depress and hold the load charge pushbutton on the first discharge circuit breaker to be switched on.

Requirement: The CAP CHG lamp on the control unit glows brightly initially and then dims out.

Note: If the requirement is not met, release the load charge pushbutton and check for troubles in the associated load circuit. If the CAP CHG lamp did not light, check for an open circuit or an open fuse in the input of the load. If the CAP CHG lamp lighted but did not dim, check for a short circuit across the input of the load.

(7) Release the load charge pushbutton and immediately operate the circuit breaker to ON.

(8) Repeat from Step (6) for each additional discharge circuit breaker to be turned on.

(9) Adjust the battery bus voltage and balance the rectifier output currents by following the procedure given in paragraph 5.04.

C. Stopping the 151C Plant (Equipped With J87437A Rectifiers)

6.04 To stop the power plant, proceed as follows:

(1) Operate the ON-OFF switch of the first rectifier to be shut down to OFF (Fig. 4 and 5).

(2) Operate the DC OUTPUT circuit breaker of the first rectifier to be shut down to OFF (Fig. 4 and 5).

(3) Repeat (1) and (2) for each additional rectifier in the plant.

(4) At the J85516B or J85516C plant control unit, remove all fuses from the fuse panel (Fig. 2 or 3).

(5) Set all discharge circuit breakers to OFF.

D. Preparing to Start the 151C Plant (Equipped With KS-20493 Rectifiers)

6.05 When preparing to start the plant, proceed as follows:

(1) Verify that all plant discharge circuit breakers are set to OFF (Fig. 10, 11, and 12).

(2) At the J85516B or J85516C plant control unit (Fig. 2 or 3), verify that all fuses in the plant are of the proper size and type and are installed in their respective fuse holders.

(3) On each KS-20493 rectifier, verify that the POWER ON/OFF (S1) switch is in the OFF position (Fig. 6, 7, 8, or 9).

(4) Verify that the plant control cable is connected to the rectifier.

(5) On each rectifier, verify that the rectifier output circuit breaker is set to ON.

(6) Operate ac service breakers to ON, or install ac service fuses.

E. Starting the 151C Plant (Equipped With KS-20493 Rectifiers)

6.06 To start the plant, proceed as follows:

(1) Verify that the plant is ready to start in accordance with paragraph 6.05.

(2) Operate the POWER ON/OFF (S1) switch of the first KS-20493 rectifier to be powered up to the ON position (Fig. 6, 7, 8, or 9).

(3) Connect the KS-20599, L4, digital multimeter, set to the 100 volts dc scale, to the REG (+) and REG (−) test jacks.

(4) Loosen the locking device and slowly rotate the OUTPUT VOLTS ADJ potentiometer to read 52.08 volts. Tighten the locking device being careful not to disturb setting.

(5) Repeat from Step (1) for each additional rectifier to be turned up in the plant.

Note: The LAMP TEST switch is a momentary contact switch.

Warning: Momentarily hold the LAMP TEST switch in the ON position for only a few seconds. Holding the switch in the ON position for longer than a few seconds will cause the CAP CHG lamp to burn out.

(6) Momentarily operate the LAMP TEST switch on the plant control unit (Fig. 2 or 3) to the ON position, then release the switch back to the OFF position.

Requirement: The CAP CHG lamp on the control unit (Fig. 2 or 3) is lighted when the LAMP TEST switch is in the ON position.

Note: If the requirement is not met, replace the CAP CHG lamp.

Warning: Do not hold a load charge pushbutton depressed for longer than 2 seconds if the CAP CHG lamp does not begin to dim.

(7) Depress and hold the load charge pushbutton on the first discharge circuit breaker to be switched on.

Requirement: The CAP CHG lamp on the control unit glows brightly initially and then dims out.

Note: If the requirement is not met, release the load charge pushbutton and check for trou-

bles in the associated load circuit. If the CAP CHG lamp did not light, check for an open circuit or an open fuse in the input of the load. If the CAP CHG lamp lighted but did not dim, check for a short circuit across the input of the load.

(8) Release the load charge pushbutton and immediately operate the circuit breaker to ON.

(9) Repeat from Step (7) for each additional discharge circuit breaker to be turned on.

(10) Adjust the battery bus voltage and balance the rectifier output currents by following the procedure given in paragraph 5.04.

F. Stopping the 151C Plant (Equipped With KS-20493 Rectifiers)

6.07 To stop the power plant, proceed as follows:

(1) Operate the POWER ON-OFF switch of the first KS-20493 rectifier to be shut down to OFF (Fig. 6, 7, 8, or 9).

(2) Operate the DC OUTPUT circuit breaker of the first rectifier to be shut down to OFF.

(3) Repeat (1) and (2) for each additional rectifier in the plant.

(4) At the J85516B or J85516C plant control unit, remove all fuses from the fuse panel (Fig. 2 or 3).

(5) Operate all discharge circuit breakers to OFF.

7. ROUTINE CHECKS

INTRODUCTION

7.01 Routine checks are intended to determine whether or not the plant equipment, and infrequently operated parts in particular, are in proper operating condition. Routine checks also will help, insofar as possible, to guard against circuit failures which interfere with service. Checks and adjustments other than those required by trouble conditions should be performed when there is a minimum interference to service.

Note: No maintenance is required on the dc distribution circuit breakers.

CHECKS

7.02 The following checks should be performed periodically at specified time intervals:

(a) Clean ventilating passages.

(b) Check output voltage adjustment and voltage regulation of the rectifiers per paragraph 5.02 and 5.03.

(c) Check battery bus voltage and rectifier output current per paragraph 5.04.

(d) Calibrate plant voltmeter per paragraph 5.05.

(e) Check plant fuse alarms per paragraph 5.06.

(f) Check plant low voltage monitors per paragraph 5.07.

(g) Check plant high voltage monitor per paragraph 5.08 (J85516C control panel only).

(h) Perform battery inspection and maintenance routines in accordance with the appropriate battery maintenance information.

8. TROUBLES

INTRODUCTION

8.01 This part gives procedures for locating and correcting the most common types of troubles that the plant may experience. The possible causes of a trouble and the actions to take for correcting the problem are listed in a trouble chart for each individual trouble condition. The trouble clearing procedures following the trouble clearing tables are detailed repair procedures used in servicing the plant.

8.02 To assist in locating the correct trouble chart, when an alarm has been given, the trouble flowcharts of Fig. 17 and 18 are provided. In general, equipment should be visually inspected for faulty connections, shorts, broken wires, and burned components. It is suggested that the probable causes of troubles listed in the trouble charts be checked in the order given. If the trouble cannot be located and corrected with the assistance of the trouble charts, then refer to the proper schematic diagrams and circuit descriptions for further information (see paragraph

1.03). After a repair has been made, the equipment repaired should be verified to be operating properly by following the appropriate test procedure in Part 5.

8.03 When a trouble is traced to a circuit pack, replace the circuit pack with the proper new or repaired circuit pack. Do not attempt to repair defective circuit packs unless personnel are equipped and trained to repair circuit packs. When it is necessary to replace a circuit pack, refer to Section 032-173-301, which covers Testing, Replacing, Handling, Storing, and Shipping Circuit Packs and Semiconductor Devices. Return defective circuit packs to an authorized repair facility in accordance with local instructions.

8.04 The following Tables H through AB cover troubles in the plant control unit, the plant rectifiers, and the charge discharge circuit.

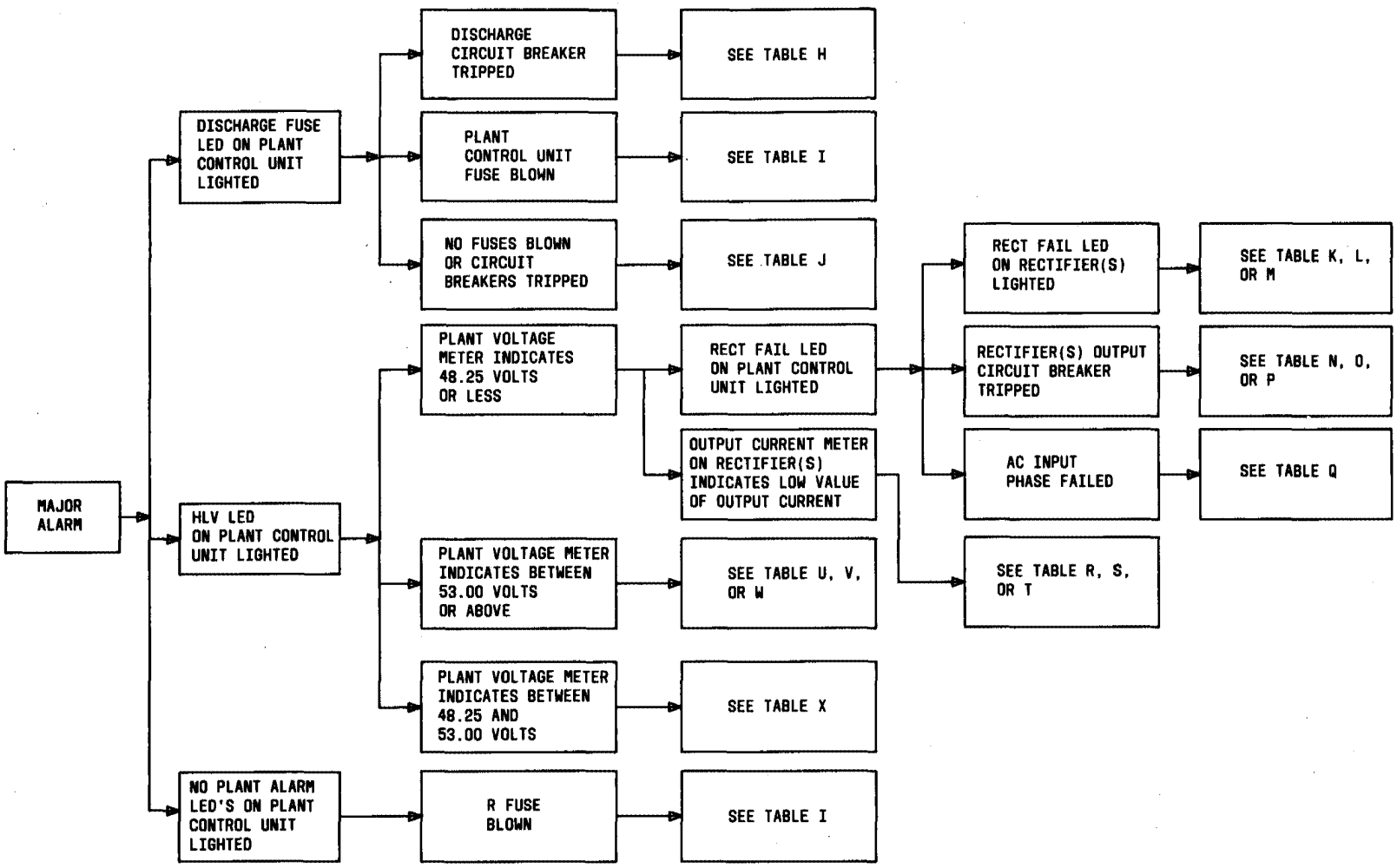

Fig. 17—151C Power Plant Trouble Flowchart—Major Alarm

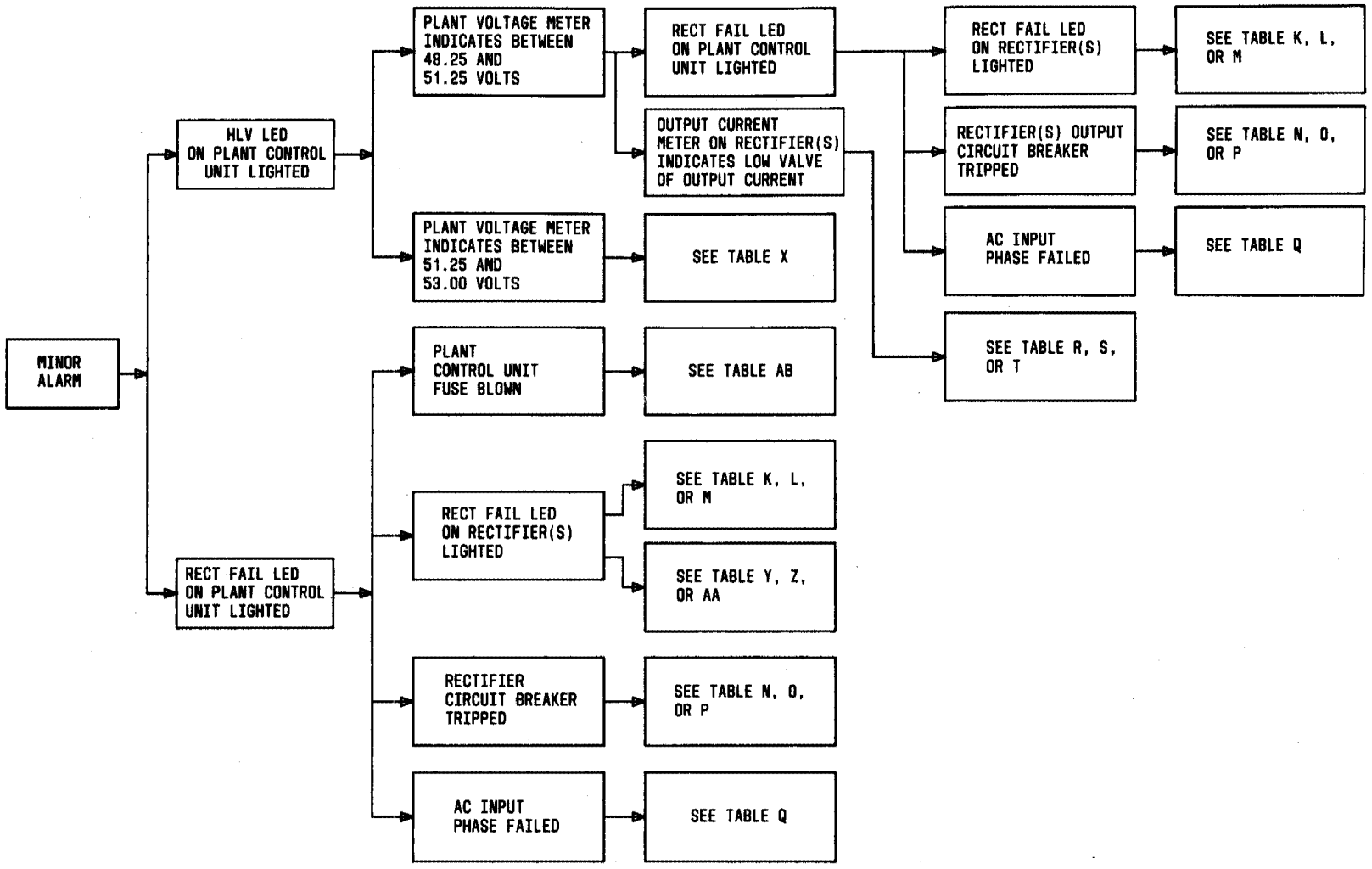

Fig. 18—151C Power Plant Trouble Flowchart—Minor Alarm

TABLE H

DISCHARGE CIRCUIT BREAKER TRIPPED

SYMPTOM	INITIAL ACTION	PROBABLE CAUSE	CORRECTIVE ACTION
DISCHARGE FUSE LED lighted	Reset tripped circuit breaker. If the circuit breaker trips again, examine the probable cause	The load circuit associated with the tripped circuit breaker is drawing an excessive amount of current, or a short circuit is present across the input of the load	Check the load circuit for short circuits or other defects. Reset the tripped circuit breaker.

TABLE I

J85516( ) PLANT CONTROL UNIT FUSE BLOWN (MAJOR ALARM)

SYMPTON	INITIAL ACTION	PROBABLE CAUSE	CORRECTIVE ACTION
A. DISCHARGE FUSE LED lighted	Replace blown fuse. If fuse blows again, proceed with the corrective action for the fuse that is blown	(1) CHG fuse blown, CHG ALM fuse blown (when capacitor charge pushbutton on circuit breaker is depressed to charge load capacitors)	Check load circuit for a short circuit at the input. Replace both CHG fuse and CHG ALM fuse.
		(2) VM2 fuse blown	Check for short to ground on the PLANT VOLTAGE meter leads.
		(3) BAT fuse blown (J87437A rectifier only)	Shut down plant per paragraph 6.04, unplug all rectifier plant connctors, and replace BAT fuse. Reconnect plant connectors one at a time until the BAT fuse blows. Replace CP SP1, per paragraph 8.07, of rectifier which caused fuse to blow. Replace BAT fuse and restart plant per paragraphs 6.02 and 6.03.
		(4) BAT fuse blown (KS-20493 rectifier Lorain Products Corporation only)	Shut down plant per paragraph 6.07, unplug all rectifier plant connectors, and replace BAT fuse. Reconnect plant connectors one at a time until the BAT fuse blows. Using Section 169-745-311, locate and clear trouble. Replace BAT fuse and restart plant per paragraphs 6.05 and 6.06.

TABLE I (Contd)

J85516( ) PLANT CONTROL UNIT FUSE BLOWN (MAJOR ALARM)

SYMPTON	INITIAL ACTION	PROBABLE CAUSE	CORRECTIVE ACTION
A. DISCHARGE FUSE LED lighted (Contd)	Replace blown fuse. If fuse blows again, proceed with the corrective action for the fuse that is blown (Contd)	(5) BAT fuse-blown (KS-20493 rectifier ITT-North Electric Company only)	Shut down plant per paragraph 6.07, unplug all rectifier plant connectors, and replace BAT fuse. Reconnect plant connectors one at a time until the BAT fuse blows. Using Section 169-745-312, locate and clear trouble. Replace BAT fuse and restart plant per paragraphs 6.05 and 6.06.
		(6) R fuse blown	Check LEDs, resistors R3, R4, and R5. Remove control unit, WC1 or WC2 circuit pack and replace R fuse. If fuse does not blow with WC1 or WC2 circuit pack removed, the board is defective. Replace WC1 or WC2 circuit pack.
		(7) ABS fuse blown	Check for short in battery supply leads in ESS alarm circuit.
B. RECT FAIL LED lighted	Remove WC1 or WC2 circuit pack. Replace control fuse. If fuse does not blow with board removed, board is defective	WC1 or WC2 circuit pack defective.	Replace control unit WC1 or WC2 circuit pack per paragraph 8.05 (J85516B) or paragraph 8.06 (J85516C).

TABLE J

PLANT ALARMS DO NOT OPERATE PROPERLY

SYMPTON	INITIAL ACTION	PROBABLE CAUSE	CORRECTIVE ACTION
DISCHARGE FUSE LED lighted, no trouble present	Test plant alarms by following the procedures given in paragraphs 5.06, 5.07, and 5.08. If plant alarm requirements given in the procedures are not met, proceed with the corrective action	(1) Defective plant alarm circuit	Replace control unit WC1 or WC2 circuit pack per paragraph 8.05 (J85516B) or paragraph 8.06 (J85516C).
		(2) Open wiring to LEDS	Check continuity to LEDs.
		(3) LEDs burned out	Replace LEDS.

TABLE K

J87437A RECTIFIER WILL NOT RESTART

SYMPTON	INITIAL ACTION	PROBABLE CAUSE	CORRECTIVE ACTION
RECT FAIL LED on rectifier is lighted and stays lighted (J87437A rectifier only)	Operate the ON-OFF switch to OFF, then operate it to ON to restart rectifier. If rectifier does not start, examine probable causes	(1) Relay RFA (K2) in rectifier operated:	
		(a) RELAY & ALARM fuse +V or –V blown	Replace CP SP1 and/or CP SP2 per paragraph 8.07 to correct trouble. Replace blown fuse.
		(b) Internal high voltage shutdown voltage shutdown circuit in rectifier defective	Replace CP SP2 per paragraph 8.07.
		(c) Defective external selective high voltage shutdown circuit in rectifier	Replace CP SP1 and/or CP SP2 per paragraph 8.07.
		(2) Restart circuit in rectifier defective	Replace CP SP1 per paragraph 8.07.
		(3) Restart circuit in J85516( ) plant control unit defective.	Replace WC1 or WC2 circuit pack per paragraph 8.05 (J85516B) or paragraph 8.06 (J85516C).

TABLE L

KS-20493 (LORAIN) RECTIFIER WILL NOT RESTART

SYMPTOM	INITIAL ACTION	PROBABLE CAUSE	CORRECTIVE ACTION
RECT FAIL LED on rectifier is lighted and stays lighted	Operate the ON-OFF switch to OFF, then operate it to ON to restart rectifier. If rectifier does not start, examine probable causes	(1) Relay RFA (K2) in rectifier operated:	
		(a) F1 or F2 fuse blown	Replace CP1 per paragraph 8.08. Replace blown fuse.
		(b) Internal high voltage shutdown circuit in rectifier defective	Replace CP2 per paragraph 8.08.
		(2) Restart circuit in rectifier defective	Replace CP2 per paragraph 8.08.
		(3) Restart circuit in J85516( ) plant control unit defective	Replace WC1 or WC2 circuit pack per paragraph 8.05 (J85516B) or paragraph 8.06 (J85516C).

TABLE M

KS-20493 (ITT-NORTH) RECTIFIER WILL NOT RESTART

SYMPTOM	INITIAL ACTION	PROBABLE CAUSE	CORRECTIVE ACTION
RECT FAIL LED on rectifier is lighted and stays lighted	Operate the ON-OFF switch to OFF, then operate it to ON to restart rectifier. If rectifier does not start, examine probable causes	(1) Relay RFA in rectifier operated:	
		(a) 24V BIAS supply fuses F1 or F2 blown	Replace CP1 per paragraph 8.08. Replace blown fuse.
		(b) OUTPUT VOLTS fuse F3 blown	Clear short at TP2 OUTPUT VOLTS test jack.
		(c) CABLE ALARM fuse F9 blown	Clear short in DC cable assembly.
		(d) Internal high voltage shutdown circuit in rectifier defective	Replace CP3 per paragraph 8.08.
		(e) Defective external selective high voltage shutdown circuit in rectifier	Replace CP3 per paragraph 8.08.
		(2) Restart circuit in rectifier defective	Replace CP3 per paragraph 8.08.
		(3) Restart circuit in J85516( ) plant control unit defective	Replace WC1 or WC2 circuit pack per paragraph 8.05 (J85516B) or paragraph 8.06 (J85516C).

TABLE N

J87437A RECTIFIER OUTPUT CIRCUIT BREAKER (CB1) TRIPPED

SYMPTOM	INITIAL ACTION	PROBABLE CAUSE	CORRECTIVE ACTION
RECT FAIL LED on control unit is lighted; OUTPUT CURRENT meter on rectifier indicates zero output current	Reset circuit breaker. If breaker trips again, examine probable causes	(1) R13 or R14 open (located at each end of OUTPUT CURRENT meter shunt R18)	Replace R13 or R14.
		(2) Defective current limiting circuit	Replace CP SP2 or CP SP2B per paragraph 8.07.

TABLE O

KS-20493 (LORAIN) RECTIFIER OUTPUT CIRCUIT BREAKER (CB1) TRIPPED

SYMPTOM	INITIAL ACTION	PROBABLE CAUSE	CORRECTIVE ACTION
RECT FAIL LED on control unit is lighted; OUTPUT CURRENT meter on rectifier indicates zero output current	Reset circuit breaker. If breaker trips again, examine probable causes	(1) R4.1 or R67 open (located at each end of OUTPUT CURRENT meter shunt R3)	Replace R4.1 or R67.
		(2) Defective current limiting circuit	Replace CP1 per paragraph 8.08.

TABLE P

KS-20493 (ITT-NORTH) RECTIFIER OUTPUT CIRCUIT BREAKER (CB2) TRIPPED

SYMPTOM	INITIAL ACTION	PROBABLE CAUSE	CORRECTIVE ACTION
RECT FAIL LED on control unit is lighted; OUTPUT CURRENT meter on rectifier indicates zero output current	Reset circuit breaker. If breaker trips again, examine probable causes	(1) R103 or R108 open (located at each end of OUTPUT CURRENT meter shunt R4)	Replace R103 or R108.
		(2) Defective current limiting circuit	Replace CP2 per paragraph 8.08.

TABLE Q

AC INPUT PHASE FAILED

SYMPTOM	INITIAL ACTION	PROBABLE CAUSE	CORRECTIVE ACTION
RECT FAIL LED on plant control unit is lighted.		(1) Input fuse in power service cabinet blown	Locate and correct cause of blown fuse. Replace fuse.
		(2) AC power failure	Locate and correct fault in the ac distribution circuit.
		(3) Phase monitor circuit defective	
		(a) J87437A rectifier	Shut down plant per paragraph 6.04. Restart each rectifier per paragraph 6.03 one at a time until the RECT FAIL LED on the control unit lights. Replace CP SP1, per paragraph 8.07, of the rectifier which caused the RECT FAIL LED to light. Restart all remaining rectifiers.
		(b) KS-20493 rectifiers (Lorain and ITT-North)	Shut down plant per paragraph 6.07. Restart each rectifier per paragraph 6.06 one at a time until the RECT FAIL LED on the control unit lights. Replace CP1 per paragraph 8.08, of the rectifier which caused the RECT FAIL LED to light. Restart all remaining rectifiers.

TABLE R

J87437A RECTIFIER OUTPUT VOLTAGE TOO LOW

SYMPTOM	INITIAL ACTION	PROBABLE CAUSE	CORRECTIVE ACTION
OUTPUT CURRENT meter on rectifier(s) indicates low value of output current		(1) ADJ potentiometer out of adjustment	Adjust rectifier output voltage per paragraph 5.02 and 5.03. Adjust plant voltage and balance rectifier currents per paragraph 5.04.
		(2) Defective voltage regulation circuit or defective voltage walk-in circuit	Replace CP SP2 or CP SP2B per paragraph 8.07.
		(3) Triac Q1, Q2, or Q3 defective	Replace defective triac Q1, Q2, or Q3.
		(4) Loose connections on ferroresonant transformer T1, T2, or T3	Tighten loose connections.
		(5) RECT TEST switch held in NL position	Replace RECT TEST switch.

TABLE S

KS-20493 (LORAIN) RECTIFIER OUTPUT VOLTAGE TOO LOW

SYMPTOM	INITIAL ACTION	PROBABLE CAUSE	CORRECTIVE ACTION
OUTPUT CURRENT meter on rectifier(s) indicates low value of output current		(1) ADJ potentiometer out of adjustment.	Adjust rectifier output voltage per paragraph 5.02 and 5.03. Adjust plant voltage and balance rectifier currents per paragraph 5.04.
		(2) Defective voltage regulation circuit or defective voltage walk-in circuit	Replace CP1 per paragraph 8.08.
		(3) Triac Q1, Q2, or Q3 defective	Replace defective triac Q1, Q2, or Q3.
		(4) Loose connections on ferroresonant transformer T1, T2, or T3	Tighten loose connections.

TABLE T

KS-20493 (ITT-NORTH) RECTIFIER OUTPUT VOLTAGE TOO LOW

SYMPTOM	INITIAL ACTION	PROBABLE CAUSE	CORRECTIVE ACTION
OUTPUT CURRENT meter on rectifier(s) indicates low value of output current		(1) ADJ potentiometer out of adjustment.	Adjust rectifier output voltage per paragraph 5.02 and 5.03. Adjust plant voltage and balance rectifier currents per paragraph 5.04.
		(2) Defective voltage regulation circuit or defective voltage walk-in circuit	Replace CP2 per paragraph 8.08.
		(3) Triac Q1, Q2, or Q3 defective	Replace defective triac Q1, Q2, or Q3.
		(4) Loose connections on ferroresonant transformer T1, T2, or T3	Tighten loose connections.
		(5) Defective SRS relay or C107 capacitor on CP1	Replace CP1 per paragraph 8.08.

TABLE U

J87437A RECTIFIER HV SHUTDOWN DOES NOT OPERATE

SYMPTOM	INITIAL ACTION	PROBABLE CAUSE	CORRECTIVE ACTION
The PLANT VOLTAGE meter indicates 53.00 volts or more	Check for shutdown rectifiers	Selective high voltage shutdown circuit on rectifiers not shut down inoperative.	
		(a) Rectifiers not delivering approximately 10 amperes or more	Operation is normal. Circuit is operative only when output current is approximately 5 percent or more of rated maximum output current. Readjust output voltage and current per paragraph 5.04.
		(b) Output current monitoring circuit defective	Replace CP SP2 or CP SP2B per paragraph 8.07.
		(c) High voltage shutdown circuit defective	Replace CP SP1 per paragraph 8.07.

TABLE V

KS-20493 (LORAIN PRODUCTS CORPORATION) RECTIFIER HV SHUTDOWN DOES NOT OPERATE

SYMPTOM	INITIAL ACTION	PROBABLE CAUSE	CORRECTIVE ACTION
The PLANT VOLTAGE meter indicates 53.00 volts or more	Check for shutdown rectifiers	Selective high voltage shutdown circuit on rectifiers not shut down inoperative.	
		(a) Rectifiers not delivering approximately 5 amperes or more	Operation is normal. Circuit is operative only when output current is approximately 5 percent or more of rated maximum output current. Readjust output voltage and current per paragraph 5.04.
		(b) High voltage shutdown circuit defective	Replace CP2 per paragraph 8.08.

TABLE W

KS-20493 (ITT-NORTH) RECTIFIER HV SHUTDOWN DOES NOT OPERATE

SYMPTOM	INITIAL ACTION	PROBABLE CAUSE	CORRECTIVE ACTION
The PLANT VOLTAGE meter indicates 53.00 volts or more	Check for shutdown rectifiers	Selective high voltage shutdown circuit on rectifiers not shut down inoperative.	
		(a) Rectifiers not delivering approximately 5 amperes or more	Operation is normal. Circuit is operative only when output current is approximately 5 percent or more of rated maximum output current. Readjust output voltage and current per paragraph 5.04.
		(b) High voltage shutdown circuit defective	Replace CP3 per paragraph 8.08.
		(c) Output current monitoring circuit defective	Replace CP1 or CP2 per paragraph 8.08.

TABLE X

PLANT VOLTAGE MONITOR DOES NOT OPERATE PROPERLY

SYMPTON	INITIAL ACTION	PROBABLE CAUSE	CORRECTIVE ACTION
A. Low voltage relay (LV1) released at a plant voltage other than 51.25 volts dc	Test the low voltage alarm by following the procedure given in paragraph 5.07. If the requirements given in the procedure are not met, investigate the probable causes	(1) Defective low voltage alarm circuit	Replace J85516B or J85516C power plant control unit WC1 or WC2 circuit pack per paragraph 8.05 (J85516B) or paragraph 8.06 (J85516C).
		(2) HLV fuse blown	Replace blown fuse. If fuse blows again, replace WC1 or WC2 circuit pack per paragraph 8.05 (J85516B) or paragraph 8.06 (J85516C).
B. Very low voltage relay (LV2) released at a plant voltage other than 48.25 volts dc	Test the very low voltage alarm by following the procedure given in paragraph 5.07. If the requirements given in the procedue are not met, investigate the probable causes	(1) Defective very low voltage alarm circuit	Replace WC1 or WC2 circuit pack per paragraph 8.05 (J85516B) or paragraph 8.06 (J85516C).
		(2) HLV fuse blown	Replace blown fuse. If fuse blows again, replace WC1 or WC2 circuit pack per paragraph 8.05 (J85516B) or paragraph 8.06 (J85516C).
C. High voltage relay (HV) released at a plant voltage other than 53.00 volts dc (WC2 circuit pack only)	Test the high voltage alarm by following the procedure given in paragraph 5.08. If the requirements given in the procedure are not met, investigate the probable causes	(1) Defective high voltage alarm circuit	Replace WC2 circuit pack per paragraph 8.06.
		(2) HLV fuse blown	Replace blown fuse. If fuse blows again, replace WC2 circuit pack per paragraph 8.06.

TABLE Y

J87437A RECTIFIER HIGH VOLTAGE SHUTDOWN OCCURRED

SYMPTOM	INITIAL ACTION	PROBABLE CAUSE	CORRECTIVE ACTION
RECT FAIL LED on control unit lighted	If a rectifier was shut down by the HV shutdown circuit, operate the ON-OFF switch to OFF, then operate it to ON to restart rectifier. If rectifier does not start, examine probable causes	(1) Rectifier output voltage too high:	
		(a) ADJ potentiometer out of adjustment	Adjust rectifier output voltage per paragraph 5.02 and 5.03. Adjust plant voltage and balance rectifier currents per paragraph 5.04.
		(b) External voltage sense leads R+ or R– open	Check external voltage sense lead connections in rectifier and control unit. Correct fault.
		(c) Current control circuit defective	Replace CP SP2 or CP SP2B per paragraph 8.07.
		(d) RECT TEST switch held in FL position	Replace RECT TEST switch.
		(2) HV shutdown circuit defective	Replace WC1 or WC2 circuit pack per paragraph 8.05 (J85516B) or paragraph 8.06 (J85516C).
		(3) HLV, RB, or VM fuse blown	Replace blown fuse. If fuse blows again, replace WC1 or WC2 circuit pack per paragraph 8.05 (J85516B) or paragraph 8.06 (J85516C).

TABLE Z

KS-20493 (LORAIN PRODUCTS CORPORATION) RECTIFIER HIGH VOLTAGE SHUTDOWN OCCURRED

SYMPTOM	INITIAL ACTION	PROBABLE CAUSE	CORRECTIVE ACTION
RECT FAIL LED on control unit lighted	If a rectifier was shut down by the HV shutdown circuit, operate the ON-OFF switch to OFF, then operate it to ON to restart rectifier. If rectifier does not start, examine probable causes	(1) Rectifier output voltage too high:	
		(a) ADJ potentiometer out of adjustment	Adjust rectifier output voltage per paragraph 5.02 and 5.03. Adjust plant voltage and balance rectifier currents per paragraph 5.04.
		(b) External voltage sense leads R+ or R– open	Check external voltage sense lead connections in rectifier and control unit. Correct fault.
		(c) Current control circuit defective	Replace CP2 per paragraph 8.08.
		(2) HV shutdown circuit defective	Replace WC1 or WC2 circuit pack per paragraph 8.05 (J85516B) or paragraph 8.06 (J85516C).
		(3) HLV, RB, or VM fuse blown	Replace blown fuse. If fuse blows again, replace WC1 or WC2 circuit pack per paragraph 8.05 (J85516B) or paragraph 8.06 (J85516C).

TABLE AA

KS-20493 (ITT-NORTH) RECTIFIER HIGH VOLTAGE SHUTDOWN OCCURRED

SYMPTOM	INITIAL ACTION	PROBABLE CAUSE	CORRECTIVE ACTION
RECT FAIL LED on control unit lighted	If a rectifier was shut down by the HV shutdown circuit, operate the ON-OFF switch to OFF, then operate it to ON to restart rectifier. If rectifier does not start, examine probable causes	(1) Rectifier output voltage too high:	
		(a) ADJ potentiometer out of adjustment	Adjust rectifier output voltage per paragraph 5.02 and 5.03. Adjust plant voltage and balance rectifier currents per paragraph 5.04.
		(b) External voltage sense leads R+ or R– open	Check external voltage sense lead connections in rectifier and control unit. Correct fault.
		(c) Current control circuit defective	Replace CP1 or CP2 per paragraph 8.08.
		(2) HV shutdown circuit defective	Replace WC1 or WC2 circuit pack per paragraph 8.05 (J85516B) or paragraph 8.06 (J85516C).
		(3) HLV, RB, or VM fuse blown	Replace blown fuse. If fuse blows again, replace WC1 or WC2 circuit pack per paragraph 8.05 (J85516B) or paragraph 8.06 (J85516C).

TABLE AB

J85516( ) PLANT CONTROL UNIT FUSE BLOWN (MINOR ALARM)

SYMPTOM	INITIAL ACTION	PROBABLE CAUSE	CORRECTIVE ACTION
RECT FAIL LED lighted	Replace blown control fuse. If fuse blows again, proceed with the corrective action for the fuse that is blown	(1) HLV fuse	Replace control unit WC1 circuit pack per paragraph 8.05 or WC2 circuit pack per paragraph 8.06.
		(2) VM fuse	Check for short to ground on PLANT VOLTAGE meter leads or defective PLANT VOLTAGE meter.
		(3) RB( ) fuse	Check for short to ground on regulation lead RB( ) from rectifier.

TROUBLE CLEARING PROCEDURES

A. Replace J85516B Power Plant Control Unit Circuit Pack

8.05 To replace the WC1 circuit pack in the J85516B plant control unit, proceed as follows:

(1) Remove the HLV fuse and the R fuse from the plant control unit fuse panel (Fig. 2).

Note: When the HLV fuse or the R fuse is removed, both major and minor alarms are given and a shutdown signal is sent to the rectifiers.

(2) Using the 5-inch E screwdriver, loosen the screw at each side of the lower front panel of the J85516B plant control unit and lift the panel off (Fig. 2).

Danger: High current potential exists on the terminals inside the plant control unit and on the back of the upper front panel. Avoid shorting any terminals together.

(3) Loosen the two screws on each side of the upper front panel with the 5-inch E screwdriver (Fig. 2). Lift the panel off and allow the panel to hang face down supported by its wiring.

(4) Locate the WC1 circuit pack (Fig. 15).

(5) Grasp the WC1 circuit pack by the finger hole at the front edge of the board and pull the circuit pack free of its connector. Turn the card on an angle and remove from unit.

(6) Insert the new WC1 circuit pack into the plant control unit. Make certain the circuit pack connector is aligned with the pins on the motherboard before the connector and pins are pushed together.

(7) Replace the upper front panel onto the plant control unit and secure the panel holding screws.

(8) Replace the lower front panel onto the plant control unit and secure the panel holding screws.

(9) Replace the R fuse and the HLV fuse into the plant control unit fuse panel.

Note: After both the R fuse and the HLV fuse are in place, a restart signal is sent to the rectifiers.

B. Replace J85516C Power Plant Control Unit Circuit Pack

8.06 To replace the WC1 or WC2 circuit pack in the J85516C plant control unit, proceed as follows:

(1) Remove the HLV fuse and the R fuse from the plant control unit fuse panel (Fig. 3).

Note: when the HLV fuse or the R fuse is removed, both major and minor alarms are given and a shutdown signal is sent to the rectifier.

(2) Using the 5-inch E screwdriver, loosen the screw at each side of the lower front panel of the J85516C plant control unit and lift the panel off (Fig. 3).

Danger: High current potential exists inside the plant control unit and on the back of the upper front panel. Avoid shorting any terminals together.

(3) Locate the WC1 or WC2 circuit pack (Fig. 16).

(4) Grasp the WC1 or WC2 circuit pack by the finger hole at the front edge of the board and pull the circuit pack out.

(5) Insert the new WC1 or WC2 circuit pack into the plant control unit. Make certain the circuit pack connector is aligned with the pins on the motherboard before the connector and pins are pushed together.

(6) Replace the lower front panel onto the plant control unit and secure the panel holding screws.

(7) Replace the R fuse and the HLV fuse into the plant control unit fuse panel.

Note: After both the R fuse and the HLV fuse are in place, a restart signal is sent to the rectifiers.

C. Replace CP SP1 or CP SP2 Rectifier Circuit Pack (On J87437A Rectifier Only)

8.07 To replace CP SP1 or CP SP2 circuit pack in a J87437A rectifier, proceed as follows:

(1) At the rectifier, operate the ON-OFF switch to OFF (Fig. 4 or 5).

(2) Operate the output circuit breaker (CB1) to OFF (Fig. 4 or 5).

(3) Remove the rectifier ac input fuse for each phase from the power service cabinet.

Danger: Wait at least 3 minutes after operating the output circuit breaker to OFF before opening the front panel. This will give the filter capacitors time to discharge.

(4) On a 100-ampere rectifier, loosen the three screws on the right side of the front panel using the 5-inch E screwdriver and swing the door open (Fig. 4 and 5).

(5) Unplug the plant connector from CP SP1 or CP SP2 (Fig. 5) by turning the T-handle locking screws at the top and bottom of the connector ccw to release the connector. Alternate between turning the upper screw several turns and turning the lower screw several turns. The connector will then stay parallel to the board as it is being unplugged and will not bind.

(6) Unlock the card holder at each side of the circuit pack by moving each holder away from and slightly behind the circuit pack to free the locking tabs (Fig. 5).

(7) Pull the circuit pack out of its connector (Fig. 5).

(8) Insert the new circuit pack fully into the connector. Snap the locking tab on the card holder at each side of the circuit pack into the notch on the board.

(9) Plug the plant connector back onto CP SP1 or CP SP2. Alternate between turning the upper screw several turns cw and turning the lower screw several turns cw until the screws are tight.

(10) Close the front panel and secure the panel locking screw.

(11) Replace the ac input fuses in the power service cabinet.

(12) At the J85516( ) plant control unit, remove the RB fuse associated with the rectifier being serviced (Fig. 2 or 3).

(13) Set the KS-20599, L4, DMM to measure approximately 100 volts dc. Connect the meter to rectifier test jacks REG+ and REG− (Fig. 4 or 5).

(14) Operate the rectifier ON-OFF switch to ON.

Note: The rectifier may shut down immediately after the ON-OFF switch is operated to ON due to the filter capacitors charging. If this happens, operate the ON-OFF switch to OFF, then back to ON to restart the rectifier.

(15) Using the 3-inch C screwdriver, adjust the rectifier ADJ potentiometer (Fig. 4 or 5) until the DMM indicates the required charge voltage.

Note: Use 52.08 volts dc as the correct voltage.

(16) Replace the RB fuse into the plant control unit fuse panel.

(17) Operate the rectifer output circuit breaker to ON.

(18) Check and adjust the battery bus voltage and the rectifier output current by following the procedure given in paragraph 5.04.

D. Replace CP1, CP2, or CP3 Circuit Pack in KS-20493 (ITT-North or Lorain Products Corporation) Rectifier

8.08 To replace CP1, CP2, or CP3 circuit pack in a KS-20493 rectifier, proceed as follows:

(1) At the rectifier, operate the ON-OFF switch to OFF (Fig. 6, 7, 8, or 9).

(2) Operate the output circuit breaker to OFF.

(3) Remove the ac input fuse from the power service cabinet.

Danger: Wait at least 3 minutes after operating the output circuit breaker to OFF before opening the front panel. This will give the filter capacitors time to discharge.

(4) Loosen the three screws on the right side of the front panel, using the 5-inch E screwdriver, and swing panel open (Fig. 6, 7, 8, or 9).

(5) Unlock the holding tabs and carefully remove the circuit pack from its connector.

(6) Insert the new circuit pack fully into the connector. Secure the locking tabs holding the circuit pack.

(7) Close the front panel and secure the panel locking screws.

(8) Reinstall the ac input fuses in the power service cabinet.

(9) Set the rectifier output circuit breaker to ON.

(10) Set the rectifier ON/OFF switch (S1) to ON.

(11) Connect the KS-20599, L4, digital multimeter, set to 100 volts dc, to the REG(+) and REG(−) test jacks.

(12) Using the 3-inch C screwdriver, adjust the OUTPUT VOLTS ADJ potentiometer until the DMM indicates 52.08 volts dc.

(13) Check and adjust the battery bus voltage and rectifier output current by following the procedure given in paragraph 5.04.

9. REFERENCES

9.01 The following list provides further information concerning the 151C rectifier power plant.

NUMBER	TITLE
169-652-306	Rectifiers, J87437A, List 1, 2, and 3, + or −48 Volts, 100 Amperes, Operating Methods
169-745-301	Rectifiers, KS-20493, L21 and L22, −48 Volts, 100 Amperes, Lorain Products Corporation, Operating Methods
169-745-302	KS-20493, L21 and L22, Rectifiers ITT-North Electric Company, −48 Volts, 100 Amperes, Operating Methods
169-745-311	Rectifiers, KS-20493, L21 and L22, −48 Volts, 100 Amperes, Lorain Products Corporation, Trouble-Locating Information
169-745-312	Rectifiers, KS-20493, L21 and L22, −48 Volts, 100 Amperes, ITT-North Electric Company, Trouble-Locating
802-679-162	151C Power Plant, −48 Volts, 0 Through 600 Amperes, Equipment Design Requirements Power Systems
SD-81999-02	Power Systems, Rectifier Circuits, Ferroresonant Type, −48 Volts, 100 Amperes, Automatic Regulation KS-20493 (Lorain Products)
SD-82398-01	Power Systems, Rectifier, 208/240, 220/240, or 480 Volts, 60 Hz Input, 48 Volts, 100 Amperes Output, J87437A
SD-82401-02	Power Systems, Rectifier Circuit, Ferroresonant Type, −48 Volts, 100 Amperes, Automatic Regulation, KS-20493 (ITT-North Electric)
SD-82447-01	Power Systems, Charge and Discharge Circuit, 48 Volts, 600 Amperes, 100 Type Plants, 151C Power Plant
SD-82454-01	Power Systems, 48V Control Circuit for the Charge and Discharge Circuits, 133A, 133B, 151B, 151C, 153A, 155A, Power Plants, J85516B
SD-82587-01	Power Systems, 24 Volts and 48 Volts Common Control Circuit for Power Plants, J85516C
J87124A	Power Systems Specification for 48 Volt Battery Equipment, 24 Main Cells, 2 Tier, 1 Row Battery Stand, 100-Type Power Plants
J87124B	Power Systems Specification for 48 Volt Battery Equipment, 24 Main Cells, 2 Tier, 2 Row Battery Stand, 100- and 300-Type Power Plants.