RECTIFIERS
KS-20493, L21 AND L22
48 VOLTS, 100 AMPERES
ITT-NORTH ELECTRIC COMPANY
TROUBLE LOCATING

CONTENTS PAGE

KS-20493 RECTIFIER

LIST NO.	INPUT	OUTPUT
L21	208 - 240V	—48V
L22	480V	—48V

The rated current output is 0 to 100 amperes.

Note: From 48.00 Vdc to 57.20 Vdc the rated output current is 100 amperes. Beyond 57.20 Vdc, up to 61.40 Vdc, the rated output current is 80 amperes.

Danger 1: Voltages inside the rectifier case are over 150 volts to ground. Do not allow a test pick to touch two metal parts at the same time as destructive and dangerous short circuits may occur. Disconnect the alternating current supply before working on the rectifier except when necessary to make tests.

Danger 2: Inductors and transformers of these rectifiers have class H insulation, and the temperatures of the inner windings may be approximately 170° C (338° F). The outside temperatures will be proportionately high. Heat sinks and studs of semiconductor power devices may be approximately 90° C (194° F). Contact with these components must be avoided to prevent burns.

1. GENERAL

1.01 This rectifier provides regulated dc power from a single-phase ac power source to charge and float a 23- or 24-cell battery at full load, or to charge a 25- or 27-cell battery at 80 percent of rated full load. This rectifier is primarily intended for use in the 110A, 111A, 151A, 303A, 301C, and 302A power plants. This rectifier is of the ferroresonant type. This type rectifier can provide a relatively constant dc output voltage, and may be used wherever the voltage, current capacities, and regulation characteristics meet the requirement with which they will be associated.

1.02 When this section is reissued, the reason for reissue will be listed in this paragraph. This issue does not affect the Equipment Test List.

1.03 The rectifier is arranged for single phase, 60 ±3 Hz, ac input and is suitable for use with battery power plants where 3-phase service is not available. The rectifier is adaptable for the following variations:

1.04 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.

1.05 This rectifier utilizes a triac and voltage and current regulator circuits to electronically control the output voltage. The rectifier power components are protected by the external charge fuse or external charge circuit breaker and by the current limit features.

1.06 This issue of the section is based on drawing SD-82401-01, Issue 2B. If this section is to be used with equipment or apparatus that is associated with an earlier or later issue of the drawing, reference should be made to the SDs and CDs to determine the extent of the changes and the manner in which the section may be affected.

1.07 For more detailed information on the operation of the KS-20493 rectifier manufactured by ITT-North Electric Company, see Section 169-745-302.

1.08 Electrolytic capacitors should be maintained in accordance with Section 032-110-701.

1.09 Semiconductor devices and printed circuit assemblies should be maintained in accordance with Section 032-173-301.

2. LIST OF TOOLS AND TEST APPARATUS

CODE OR SPEC NO.	DESCRIPTION
TOOLS	
—	3-inch C Screwdriver
TEST APPARATUS	
KS-20538	Volt-Ohm-Milliammeter (or equivalent)
KS-20599, L4	Digital Multimeter (or equivalent)
—	CP4 Extender Board 100-ohms, 10-watt resistor Thermometer, Fisher Scientific Company No. 14-985

3. OPERATION

3.01 ***Normal operation of the KS-20493*** rectifier manufactured by ITT-North Electric Company shall be in accordance with Section 169-745-302. In the event of a trouble condition, the rectifier should be removed from service in accordance with Section 169-745-302.

3.02 ***Restoring the Rectifier to Service After a Trouble Condition:*** Before placing the rectifier back into service after a trouble condition, perform the routine checks as covered in Part 4 of Section 169-745-302 to insure proper operation.

4. TROUBLESHOOTING PROCEDURES

4.01 In the event of trouble, the rectifier should be examined for faulty connections, broken, burned, or shorted wires. Inspect the wiring harness and leads from all components for possible breaks and shorts. Also check that all solder joints are making good electrical contact. If the problem appears to be in circuitry, the recommended method of repair is to replace the plug-in circuit boards. The following is a list of circuit boards and the functions they control.

CP1—DC Auxiliary Power Supplies, AC Monitor and Simulated Output Current

CP2—Voltage and Current Regulation and Current Limit

CP3—Alarm Circuits

CP4—Extender board for convenience in trouble locating and adjusting

CP5—Printed circuit module containing the connectors on which CP1, CP2, and CP3 mount and contains the interconnecting wiring between circuit packs

Danger 1: Do not apply AC power to the rectifier except when checking voltages, currents, or waveforms. To completely isolate the rectifier from

the AC line, the AC switch at the bus plug-in unit or power service must be operated to OFF.

Danger 2: Use care when working with wrenches and test leads to prevent shorting the DC circuit. Always disconnect the rectifier from battery and the AC service before performing repairs.

Warning 1: Plus side of battery is grounded. When using an oscilloscope or any other test equipment powered from the AC line which has one probe connected to the chassis, that probe must always be connected to ground potential when troubleshooting the rectifier.

Warning 2: Under no circumstances should fuses or circuit breakers of higher rating than those specified be used.

4.02 Locating troubles in the main frame should not be attempted until all printed circuit boards (CP1 through CP3) have been found to be good.

4.03 When trouble is traced to a circuit pack, replace it with a new or properly repaired circuit pack. Do not attempt to repair defective circuit packs unless personnel are equipped and trained to repair circuit packs. Handle the defective circuit pack in accordance with local instructions.

4.04 To determine proper operation of printed circuit boards (circuit packs CP1 through CP3), refer to Table A. Table A provides a set of normal operating voltages at critical portions of the circuit. Test jacks of different colors are provided on the accessible edges of the boards.

Note: All measurements are to be made using the KS-20599, L4, digital multimeter or equivalent. The positive (+) terminal of the meter is connected to the test jack specified in Table A, and the negative (-) terminal is connected to the green test jack on CP1.

4.05 To determine proper operation of transformers T1 and T2, refer to Table B. Table B provides a set of normal operating voltages at the secondary terminals of these transformers when the ac input voltage is nominal (208, 240, or 480 volts).

Note: Low- or high-line voltage would alter the readings shown in column 3 proportionally.

Column 1 shows the transformer terminal numbers as referenced on SD-82401-01, and column 2 indicates the recommended terminals at which to take the reading. For example, to find the voltage appearing between terminals 7 and 8A of T1, place the test picks between E2 and E3 on the transformer termination board. Voltage readings on the T2 secondary should be taken directly at the transformer terminals.

4.06 ***Placing the Rectifier in the Test Mode:*** The rectifier should be tested and adjusted in the TEST mode, disconnected from the office load. To place the rectifier in the TEST mode, use the following procedure:

(1) Turn the rectifier off by operating the POWER ON-POWER OFF (S1) switch to OFF.

(2) Remove the external charge and charge alarm fuses or operate the external charge circuit breaker to OFF.

(3) Disconnect the PLANT CONTROL DISCONNECT (J1) connector from the rectifier.

(4) Connect a jumper between the BAT output terminal and the CBS lead (terminal 15 of the PLANT CONTROL DISCONNECT, P1 connector).

(5) The rectifier is now in the TEST mode and may be turned on without disturbing the office load.

4.07 The following danger and warnings should be observed while operating or performing maintenance on the rectifier.

Danger: Voltages inside the rectifiers are over 150 volts to ground. Avoid all contact with terminals.

Warning 1: Do not remove any printed circuit assembly while the

TABLE A		
VOLTAGE MEASUREMENT AT TEST JACKS ON CIRCUIT PACK		VOLTAGE READING (VDC)
METER (+) LEAD CONNECTION	METER (–) LEAD CONNECTION	
CP1 CIRCUIT PACK		
Red (TP6)	Green (TP4)	–22.8
Brown (TP2)		– 8.0
Black (TP1		–12.8
Yellow (TP3)		+10.8
Orange (TP5)		+ 5.0
Blue (TP7)		–10.0
Slate (TP8)		– 6.2
CP2 CIRCUIT PACK		
Black (TP1)	Green (TP4) on CP1	–52.8
Red (TP3)		– 3.7
Brown (TP2)		– 0.1
Orange (TP4)		+ 0.1
CP3 CIRCUIT PACK		
Red (TP1)	Green (TP4) on CP1	–22.8

rectifier is in operation. Remove power from the circuit before removing and replacing printed circuit assemblies (circuit packs).

Warning 2: Operation of the rectifier while a trouble exists may cause additional failures of some components. It is essential, while testing, to be alert to the need of quickly shutting down the rectifier until the trouble is localized and corrected.

4.08 ***Trouble Charts and Tests:*** Trouble Charts I through V refer to operated fuses, Trouble Charts VI through X refer to shutdown or rectifier failures in which no fuses are operated, and Trouble Charts XI through XVII refer to an incorrect output. (See Fig. 1.)

4.09 ***Test Point Symbols:*** The test point symbols are stamped on circuit packs.

Note 1: Whenever a test procedure requires testing a circuit pack and components or test points are not accessible, the circuit pack board extender should be used.

Note 2: When checking the possible cause of a trouble, a (+) or (-) symbol after the component or test point indicates the polarity of the terminal. This should always be considered when connecting any test apparatus.

5. COMPONENT CHECKING PROCEDURES

5.01 The test procedures in 5.02 through 5.08 are given as an aid in determining defective components ***not mounted*** on a circuit card. In general, the components most likely to become defective with use are semiconductor devices and capacitors. These tests should be made with the rectifier disconnected from ac input power and battery potential.

TABLE B		
TRANSFORMER TERMINAL	METER CONNECTION	READING (VOLTS RMS)
T1 TRANSFORMER		
7 to 8A	E2 to E3 Bus Bars	42.0
8B to 9A	E1 to E3 Bus Bars	42.0
9B to L2-1	E1 Bus Bar to Term 1 of L2 Inductor	175.0
9B to 11	E1 Bus Bar to E12, E14, or E16	178.0
12 to 13	TB2-3 to TB2-4	40.0
14 to 15	TB2-1 to TB2-2	42.0 (Assuming CB1 is operated and includes R8 resistance)
T2 TRANSFORMER		
6 to 7	Terminal 23 to 10 on CP1 card. (Use CP4 card extender on the CP1 card.	20.3
8 to 7	Terminal 20 to 10 on CP1 card. (Use CP4 card extender on the CP1 card.	20.3

Warning 1: When using an ohmmeter for checking semiconductors, use midrange ohm scale (scales below RX10,000 and above RX10). The high scale ohmmeter voltage may damage the semiconductor device. A scale too low can force excessive current through some semiconductors. Refer to Section 032-173-301.

Warning 2: Before soldering or unsoldering leads of semiconductors, refer to Section 032-173-301. Always use a heat sink when soldering leads on semiconductor devices.

Warning 3: Before checking circuits which contain electrolytic capacitors, reference should be made to Section 032-110-501.

5.02 *Capacitors:*

Warning: Prior to testing a capacitor, it should be completely discharged to ground.

When checking capacitors, determine if the capacitor can be checked safely in the circuit without disconnecting one lead from the capacitor. If either ac or dc voltage sources cannot be isolated from the capacitor under test, disconnect one lead from the capacitor terminal. Initially, the capacitor should be discharged by temporarily connecting a 100-ohm, 10-watt resistor across the capacitor terminals. When checking electrolytic capacitors, proper polarity of the test meter to the capacitor

terminals must be ordered. When using the KS-20538 meter, the black lead of the test meter must be connected to the (+) positive terminals of the capacitor and the red lead of the test meter is connected to the (-) negative capacitor terminal. When testing paper or mica capacitors, polarity of meter leads is not significant. To check a capacitor, proceed as follows:

(1) Set the KS-20538 meter on OHMS X 10,000 scale. (The ohmmeter battery voltage on the OHMS X 10,000 scale is 30 volts dc.)

(2) Connect the meter leads across the capacitor terminals (observing proper polarity for electrolytic capacitors).

Requirement: The ohmmeter indicates low resistance initially and then indicates an increase in resistance as the capacitor charges. Normal resistance readings are as follows:

(a) Paper or mica capacitor of less than 1 microfarad should read 100 megohms or more.

(b) Paper capacitors of more than 1 microfarad should read less than 100 megohms.

(c) Electrolytic capacitors should read greater than 100,000 ohms.

Note: For replacement and maintenance of aluminum type electrolytic capacitors, refer to Section 032-110-701.

5.03 ***Diodes:*** To check a diode, proceed as follows:

(1) Set the KS-20538 meter on the OHMS X 1000 scale. (The OHMS X 1000 scale provides minimum current drain—0.075 milliamperes.)

(2) Connect the meter leads across the diode leads. Then reverse the meter connections across the diode.

Requirement: The meter indicates high resistance in one direction and low resistance in the opposite direction.

Note 1: Low resistance or high resistance in both directions indicates a possibly defective diode. If the check indicates a defective diode, disconnect one lead from the diode and repeat the resistance check.

Note 2: For additional information on the diode test, refer to Section 032-173-301.

5.04 ***Transistors:*** To check a transistor, proceed as follows:

(1) Set the KS-20538 meter on the OHM X 10 scale (digital meter on 1000 OHMS).

(2) Connect the meter leads as follows:

(a) Connect meter between emitter and collector leads of the transistor. Then reverse the meter connections to the emitter and collector.

Requirement: The meter indicates high resistance in both directions.

Note: Low or zero resistance in either direction indicates a defective transistor. If the check indicates a defective transistor, disconnect the emitter or collector lead and repeat the resistance check.

(b) Connect the meter between the emitter and base leads of the transistor. Then reverse the meter connections to the emitter and base.

Requirement: The meter indicates low resistance in one direction and high resistance in the opposite direction.

Note: Zero resistance indicates a shorted junction, infinite (∞) resistance indicates an open junction. If a short or open is indicated, disconnect the emitter lead and repeat the resistance check.

(c) Connect the meter between the collector and base leads of the transistor. Then reverse the meter connections to the collector and base.

Requirement: The meter indicates low resistance in one direction and high resistance in the opposite direction.

Note: Zero resistance indicates a shorted junction, infinite (∞) resistance indicates an

open junction. If a short or open is indicated, disconnect the collector lead and repeat the resistance check.

5.05 ***Transformers:*** If a trouble condition still exists after checking the possibility of defective circuit cards, semiconductor devices, and capacitors, check for a possible defective transformer as follows:

(1) Set the KS-20538 meter on OHMS X 1000 scale.

(2) Connect the meter leads across each winding of the transformers.

Requirement: The meter indicates continuity—low resistance.

Note: High or infinite (∞) resistance indicates a defective winding.

(3) Connect the meter leads between the case and one winding terminal of the transformer.

Requirement: The meter indicates an open—infinite (∞) resistance.

5.06 ***Thyristors (Triacs)*** Malfunctioning thyristors or their associated circuitry may exhibit the following symptoms.

Danger: Make all temperature tests with a thermometer.

- Thyristor reactor(s) very hot, possibly to the point of giving off smoke.
- Thyristor heat sink cold after a period of loading.

The following method may be used to check for possibly defective thyristors:

(1) Remove all sources of power from the rectifier.

(2) Disconnect both gate leads as well as the anode lead from the thyristor.

(3) Using the KS-20538 volt-ohm-milliammeter, set to the ohms function, measure the resistance from cathode to anode in both directions.

Requirement: The measured reistance is in excess of one megohm in both directions.

(4) If a shorted thyristor is found, check the associated main inductor before replacing.

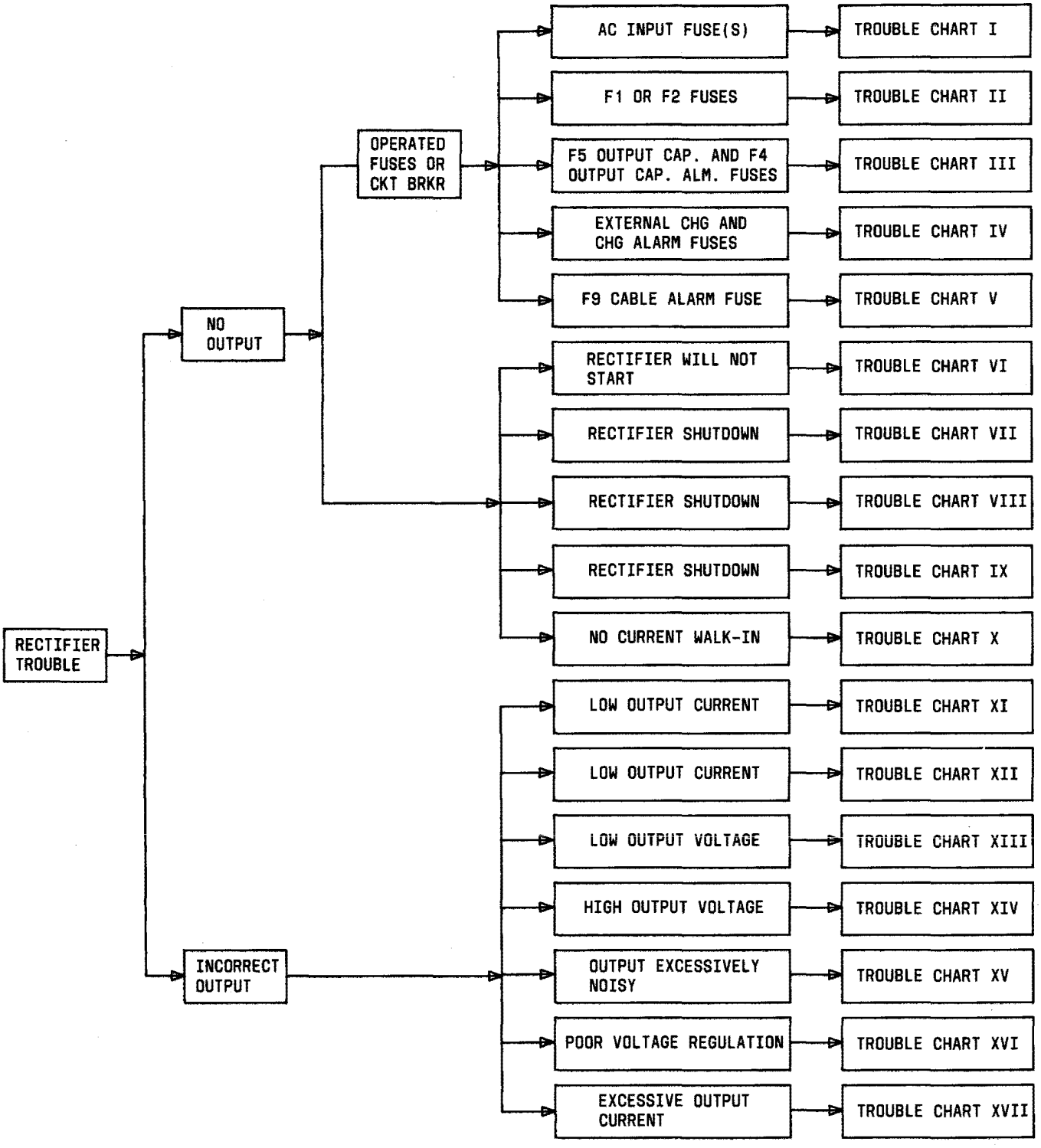

Fig. 1—TROUBLE CHART

TROUBLE CHART I

OPERATED AC INPUT FUSES

LAMP INDICATION	METER INDICATION	PLANT SIGNALS
RECT FAIL	OUTPUT CURRENT — 0	SENDS CLOSURE RFA AND RFA-RTN OR RFA (GROUND) SIGNAL TO PLANT
PROBABLE CAUSE	**TEST PROCEDURE**	**CORRECTIVE ACTION**
Shorted power diode CR1 or CR2	Completely remove power from the rectifier and check per 5.03	Replace as necessary

TROUBLE CHART II

OPERATED F1 OR F2 FUSE

LAMP INDICATION	METER INDICATION	PLANT SIGNALS
RECT FAIL	OUTPUT CURRENT — 0	SENDS RFA (GROUND) ON LOOP CLOSURES RFA AND RFA-RTN TO PLANT
PROBABLE CAUSE	**TEST PROCEDURE**	**CORRECTIVE ACTION**
Defective transformer T2	Completely remove power from rectifier and check T2 per 5.05	Replace as necessary

TROUBLE CHART III

OPERATED F5 OUTPUT CAPACITOR AND F4 OUTPUT CAPACITOR ALARM FUSES

LAMP INDICATION	METER INDICATION	PLANT SIGNALS
POWER ON RECT FAIL	OUTPUT CURRENT — 0	SENDS RECTIFIER FAILURE SIGNALS TO PLANT (SEE CHARTS I AND II)

PROBABLE CAUSE	TEST PROCEDURE	CORRECTIVE ACTION
Defective output filter capacitors C1 through C5	Completely remove power from the rectifier and check per 5.02	Replace capacitors as necessary
Defective diode CR1 an CR2 in power secondary	Completely remove power from the rectifier and check per 5.03	Replace diodes as necessary

TROUBLE CHART IV

OPERATED EXTERNAL CHG AND CHG ALARM FUSES

LAMP INDICATION	METER INDICATION	PLANT SIGNALS
POWER ON RECT FAIL	OUTPUT CURRENT — 0	SENDS RFA SIGNALS TO PLANT

PROBABLE CAUSE	TEST PROCEDURES	CORRECTIVE ACTION
Defective CR1 or CR2 diode in power secondary	Completely remove power from rectifier and check per 5.03	Replace diodes as necessary

TROUBLE CHART V

OPERATED F9 CABLE ALARM FUSE

LAMP INDICATION	METER INDICATION	PLANT SIGNALS
POWER ON RECT FAIL	OUTPUT CURRENT — 0	SENDS RFA SIGNAL TO PLANT

PROBABLE CAUSE	TEST PROCEDURE	CORRECTIVE ACTION
Possible faulty CR123 on CP1 or defective components on CP1, CP2, or CP3 circuit Packs	Turn off rectifier Replace F9 fuse. Check per 5.03. If good, substitute new or repaired CP1, CP2, or CP3 circuit packs in sequence, one at a time	Replace as necessary

TROUBLE CHART VI

RECTIFIER WILL NOT START

LAMP INDICATION	METER INDICATION	PLANT SIGNALS
RECT FAIL	OUTPUT CURRENT — 0	SENDS RFA SIGNAL TO PLANT

PROBABLE CAUSE	TEST PROCEDURE	CORRECTIVE ACTION
A. Failure of the ac service	Measure voltage at the primary of T2 transformer	If other than a temporary situation, notify the power company
B. Faulty AC INPUT CONTACTOR (ST2) coil	Remove fuses or trip the circuit breaker in the switch and fuse unit in bus duct or in the power srvice cabinet. Check continuity of contactor coil and condition of main power contacts	Repair or replace as necessary
C. Faulty ST1 relay	Remove ac service as in B above. Check coil of ST1 for continuity and condition of contacts 4 and 7	Replace as required
D. Faulty ac input monitor circuit on CP1	Substitute a new or repaired CP1 circuit pack	Replace CP1 circuit pack as required

TROUBLE CHART VII

RECTIFIER SHUTDOWN

LAMP INDICATION	METER INDICATION	PLANT SIGNALS
RECT FAIL	OUTPUT CURRENT — 0	SENDS RFA SIGNAL TO PLANT
PROBABLE CAUSE	**TEST PROCEDURE**	**CORRECTIVE ACTION**
Low input line voltage	Measure the input line voltage	If other than a temporary situation, notify the power company

TROUBLE CHART VIII

RECTIFIER SHUTDOWN

LAMP INDICATION	METER INDICATION	PLANT SIGNALS
POWER ON POWER OFF	OUTPUT CURRENT — 0	
PROBABLE CAUSE	**TEST PROCEDURE**	**CORRECTIVE ACTION**
False signal from plant over lead TR	Check wiring of lead TR to plant for false ground	Repair or replace as necessary

TROUBLE CHART IX

RECTIFIER SHUTDOWN

LAMP INDICATION	METER INDICATION	PLANT SIGNALS
POWER ON RECT FAIL	OUTPUT CURRENT — 0	SENDS RFA SIGNAL TO PLANT
PROBABLE CAUSE	**TEST PROCEDURE**	**CORRECTIVE ACTION**
Interlock released. Circuit pack cards CP1 through CP3 not fully inserted into sockets		Turn off rectifier and reinsert cards in sockets

TROUBLE CHART X

NO CURRENT WALK-IN DURING TURN ON

LAMP INDICATION	METER INDICATION	PLANT SIGNALS
POWER ON	OUTPUT CURRENT — 0	
PROBABLE CAUSE	**TEST PROCEDURE**	**CORRECTIVE ACTION**
Defective CP2 circuit pack	Substitute a new or repaired CP2 circuit pack	Repair or replace CP2 as necessary

TROUBLE CHART XI

LOW OUTPUT CURRENT

LAMP INDICATION	METER INDICATION	PLANT SIGNALS
POWER ON LOCAL SNS	OUTPUT CURRENT — LOW	CLOSURE ON CA-CB LEADS
PROBABLE CAUSE	**TEST PROCEDURE**	**CORRECTIVE ACTION**
A. Operated sense lead fuses in plant	Check fuses	Replace fuses as necessary
B. Open sense lead	Check wiring	Correct cause of open sense lead

TROUBLE CHART XII

LOW OUTPUT CURRENT

LAMP INDICATION	METER INDICATION	PLANT SIGNALS
POWER ON	OUTPUT CURRENT — LOW	
PROBABLE CAUSE	**TEST PROCEDURE**	**CORRECTIVE ACTION**
A. Operated ferresonant capacitor fuses F6, F7, and/or F8	Check capacitors C7 through C11 per 5.02	Replace capacitors and fuses as necessary
B. Defective circuit pack CP2	Substitute a new or repaired circui pack	Replace circuit pack as necessary
C. Improper adjustment of output voltage (R5)		Readjust OUTPUT VOLTS ADJUST in accordance with 169-745-302

TROUBLE CHART XIII

LOW OUTPUT VOLTAGE

LAMP INDICATION	METER INDICATION	PLANT SIGNALS
POWER ON	OUTPUT CURRENT — LOW TO NORMAL	
PROBABLE CAUSE	**TEST PROCEDURE**	**CORRECTIVE ACTION**
A. Defective circuit pack CP1	Substitute a new or repaired circuit pack	Replace circuit pack as necessary
B. Defective circuit circuit pack CP2	Substitute a new or repaired circuit pack	Replace circuit pack as necessary
C. Incorrect setting of OUTPUT VOLTS ADJUST (R5) rheostat		Readjust in accordance with Section 169-745-302
D. Defective Q1 triac	Check Q1 for short circuit condition	Replace Q1 as necessary

TROUBLE CHART XIV

HIGH OUTPUT VOLTAGE

LAMP INDICATION	METER INDICATION	PLANT SIGNALS
POWER ON	OUTPUT CURRENT — NORMAL TO HIGH	
PROBABLE CAUSE	**TEST PROCEDURE**	**CORRECTIVE ACTION**
A. Improper setting of OUTPUT VOLTS ADJUST (R5) rheostat		Readjust R5 in accordance with Section 169-745-302
B. Defective circuit pack CP2	Substitute a new or repaired CP2 circuit pack	Replace CP2 as necessary
C. Defective triac Q1	Check Q1 for open condition	Replace Q1 as necessary

TROUBLE CHART XV

OUTPUT EXCESSIVELY NOISY (RIPPLE GREATER THAN 275 MV AT BATTERY)

LAMP INDICATION	METER INDICATION	PLANT SIGNALS
POWER ON	OUTPUT CURRENT — NORMAL	
PROBABLE CAUSE	**TEST PROCEDURE**	**CORRECTIVE ACTION**
A. Defective filter capacitor (C1-C5)	Check capacitors per 5.02	Replace any defective filter capacitor
B. Defective L1 filter choke	Check choke per 5.05	Replace choke as necessary

TROUBLE CHART XVI

POOR VOLTAGE REGULATION AT BATTERY

LAMP INDICATION	METER INDICATION	PLANT SIGNALS
POWER ON	OUTPUT CURRENT — NORMAL	
PROBABLE CAUSE	**TEST PROCEDURE**	**CORRECTIVE ACTION**
Improper current limit adjustment		Readjust current limit rheostat (R222) as required

TROUBLE CHART XVII

EXCESSIVE OUTPUT CURRENT

LAMP INDICATION	METER INDICATION	PLANT SIGNALS
POWER ON	OUTPUT CURRENT — HIGH	
PROBABLE CAUSE	**TEST PROCEDURE**	**CORRECTIVE ACTION**
A. Improper adjustment of CURRENT LIMIT (R222) control		Readjust CURRENT LIMIT (R222) control
B. Defective circuit pack CP2	Substitute a new or repaired circuit pack CP2	Replace CP2 circuit pack as required
C. Defective meter or circuits associated with meter.	Use card extender on CP1 card. Check for 5 volts direct current across C103 with rectifier loaded to 100 amperes.	If 5 volts are not present, replace CP1; if 5 volts are present, check R103 and R4A. If correct voltages, replace meter.