KS-20039, L11, L12, L23, AND L24, RECTIFIERS
24 VOLTS, 800 AMPERES
OPERATING METHODS

1. GENERAL

1.01 The KS-20039, L11, L12, L23, and L24, rectifiers provide an isolated, filtered, constant dc voltage from an ac power source for use in floating and charging 24-volt central office batteries. The L11 and L12 rectifiers are capable of charging and floating a main battery of 11 cells or up to 14 cells with the manual end-cell switching capability. The L23 and L24 rectifiers are capable of charging and floating a main battery of 11 or 12 cells. The rectifiers which are rated at 24 volts 800 amperes, require a 3-phase, 3-wire, 58 to 63 Hz ac input power source. The L11 and L23 require between 189 to 253 volts while the L12 and L24 require between 420 and 504 volts. Table A summarizes the characteristics of the different list number rectifiers.

1.02 This section is reissued to add information on the L23 and L24 rectifiers and to revise Parts 3, 4, and 5. This reissue does affect the Equipment Test List. Since this is a general revision, arrows normally used to indicate changes have been omitted.

1.03 The DC OUTPUT (S3) switch is a 4-position switch with positions of BAT, OFF, TST, and EC. With the switch in the BAT position, the output of the rectifier is connected to the F bus bar and auxiliary contacts provide ground relay circuit. With the switch in the TST position (the TST lamps light), the output of the rectifier is disconnected from the battery, the reference sensing leads are connected to the output of the rectifier, and the simulated current circuit is activated, allowing the rectifier to be tested without being connected to the battery. In the EC position, the output of the rectifier is connected to the EC bus bar and the reference sensing leads are connected to the battery. In the EC mode of operation, the END CELL (red) lamp is illuminated. With the switch in the OFF position, the rectifier is disconnected from the battery. If the switch is placed in an intermediate position, the rectifier is shut down.

1.04 The AC TAP (S2) switch is a 2-position switch with positions of BAT and EC. With the switch in the BAT position, T1 transformer taps are selected for charging the main battery. With the switch in the EC position, the taps are selected for charging the main battery and the end cells.

1.05 The KS-20039, L11 and L12, rectifiers will continuously float or charge 11-, 12-, 13-, or 14-cell batteries, depending on the position of the AC TAP (S2) switch and the DC OUTPUT (S3) switch. Ground signals are provided to the plant when the rectifier is connected to charge emergency cells (EM lead), the rectifer shuts down for self protection, or the DC OUTPUT (S3) switch is not in the BAT or EC position (RFA lead). A closed path is provided between the CA and CB leads if the rectifier output is above approximately 10 percent of rated current output. The rectifier will limit its output current to an adjustable value between full load and half load in response to a ground signal on the PL lead. The rectifier is shut down and locked out in response to a ground signal from the plant on the HV lead. The rectifier will shut down without lockout in response to a ground signal from the plant on the TR lead.

TABLE A

KS-20039 RECTIFIERS

LIST NO.	FEATURES
11	208/240-Volt ac input with negative output and end cell charging capability. Intended to charge and float an 11- or 12-cell battery plant.
12	480-Volt ac input with negative output and end cell charging capability. Intended to charge and float an 11- or 12-cell battery plant.
23	208/240-Volt ac input with positive output and no end cell charging capability. Intended to charge and float a 12-cell battery plant.
24	480-Volt ac input with positive output and no end cell charging capability. Intended to charge and float a 12-cell battery plant.

1.06 When two or more rectifiers are operated in parallel, effective multiphase operation is achieved by phase shifting, so that the ac line currents in the rectifier have different displacements with respect to the line voltage. Each phase of the T2 transformer is equipped with a main winding and a phase-shift winding. Taps on the phase-shift winding provide for several shift angles as shown on the circuit notes of the circuit schematic drawing.

1.07 The instructions are based on circuit schematic drawing SD-81895-01, Issue 4B. For a detailed description of the operation, see the corresponding circuit description. If this section is to be used with equipment or apparatus reflecting later or earlier issue(s) of drawings, reference should be made to the SDs and CDs to determine the extent of the change and the manner in which the section may be affected.

1.08 The following danger and warnings should be observed when operating the rectifier, performing routine checks, or performing maintenance on the rectifier.

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

Warning 1: Do not remove any plug-in circuit pack while the rectifier is in operation.

Warning 2: The POWER ON-POWER OFF switch must be operated (depressed and released) to shut down the rectifier before the DC OUTPUT (S3) switch or the AC TAP (S2) switch is operated from one position to another.

Warning 3: Do not operate the DC OUTPUT (S3) switch to the BAT or EC position without first charging the output filter capacitors.

1.09 The abbreviations cw and ccw refer to clockwise and counterclockwise, respectively.

1.10 Routine checks should be made during a period when they will not interfere with service.

2. LIST OF TEST APPARATUS AND TOOLS

CODE OR SPEC NO.	DESCRIPTION
TEST APPARATUS	
KS-20599,L4	Digital Multimeter
KS-8039	DC Volt-Milliammeter or equivalent*
TOOLS	
—	Extender Board—Lorain Part Number 4233-302
—	10-Ohm 50-Watt Minimum Resistor

*A digital type meter is a suitable substitute for this meter.

TOOLS

—	6-Ampere 125-Volt DC Rated Fuse
—	15 Ampere 125-Volt DC Rated SPST Switch
—	60-Watt 120-Volt Incandescent Lamp
—	Lamp Socket (1)
—	Clip Leads (2)

3. OPERATION

3.01 The rectifier is enclosed in a cabinet structure having complete front and rear access. The only apparatus visible from the exterior is the OUTPUT CURRENT (M1) ammeter, the POWER ON-POWER OFF (S1) switch with the associated POWER ON blue lamp and the POWER OFF white lamp, the END CELL red lamp (L11 and L12 only) the TEST white lamp and the RECT FAIL white lamp. All of the adjustable controls are accessible only after opening the front doors.

3.02 ***Preparing to Charge Output Filter Capacitors:*** When preparing to charge the output filter capacitors, verify that the rectifier controls are positioned as follows:

(a) PWR ON-PWR OFF (S1) switch to PWR OFF

(b) DC OUTPUT (S3) switch to OFF

(c) RELAY POWER (CB1) circuit breaker to OFF

(d) AUX AC CKTS (CB2) circuit breaker to OFF

(e) Associated ac switch and fuse unit in bus duct or power service cabinet to OFF

(f) OUTPUT CAPACITOR F1 and F2 fuses and associated alarm fuses are installed.

3.03 ***Charging Output Filter Capacitors—New Type Knife DC OUTPUT (S3) Switch:*** This procedure charges the output filter capacitors, preventing arcing when closing the DC OUTPUT (S3) switch to the BAT or EC position from the OFF or TST position.

(1) Verify that the rectifier controls are positioned in accordance with paragraph 3.02.

(2) Lift and hold the locking lever on the DC OUTPUT (S3) switch.

Requirement: The red CAPACITOR CHARGING lamp lights.

Note: The CAPACITOR CHARGING lamp extinguishes when the output filter capacitors are charged to battery potential.

(3) When the lamp extinguishes, operate the DC OUTPUT (S3) switch to the BAT or EC position.

(4) Release the locking lever.

Note: If the rectifier is turned on when the DC OUTPUT (S3) switch is in the TST position, the red CAPACITOR CHARGING lamp is illuminated continuously.

Warning: Each time the DC OUTPUT (S3) switch is operated to the OFF or TST position, the output filter capacitors must be charged in accordance with paragraph 3.03 prior to operating the switch to either the BAT or EC position.

3.04 ***Charging Output Filter Capacitors—Rotary Type DC Output (S3) Switch:*** This procedure charges the output filter capacitors, preventing arcing when closing the DC OUTPUT (S3) switch to the BAT or EC position from the OFF or TST position.

(1) Verify that the rectifier controls are positioned in accordance with paragraph 3.02 except for subparagraph 3.02(f).

(2) Remove the OUTPUT CAPACITOR F1-F1 alarm and F2-F2 alarm fuses from the rectifier.

Note: This isolates the DC OUTPUT (S3) switch from the output filter capacitor bank and permits operation of the switch to the BAT or EC position. However, the output

filter capacitors must be charged prior to installing the OUTPUT CAPACITOR F1 and F2 fuses if the DC OUTPUT (S3) switch is in the BAT or EC position.

(3) Operate the DC OUTPUT (S3) switch to the desired BAT or EC position.

Note: The jumper used in this procedure is a series connection of a 60-watt 120-volt incandescent lamp in a socket, a fuse (6-ampere 125-volt), and an ON-OFF switch (15-ampere 125-volt). Suitable clip leads are utilized to connect the jumper in the rectifier circuit.

Warning: To prevent inadvertent short of the jumper with other parts of the rectifier, always make the connection to the L5 inductor last.

(4) Connect the jumper (JUMPER switch to OFF position) between the output capacitor bus bar associated with OUTPUT CAPACITOR F1 fuse and the L5 inductor as given in Table B.

(5) Operate the ON-OFF switch of the capacitor charging jumper to the ON position.

(6) After the lamp goes out, install the fuse holder which contains the OUTPUT CAPACITOR (F1) fuse.

(7) Operate the jumper ON-OFF switch to OFF and disconnect the jumper from the rectifier.

(8) Repeat (4) through (7) for the OUTPUT CAPACITOR F2 fuse.

Warning: Each time the DC OUTPUT (S3) switch is operated to the OFF or TST position, the output filter capacitors must be charged in accordance with paragraph 3.04 prior to operating the switch to either the BAT or EC position.

3.05 ***Preparing to Start:*** To prepare the rectifier for service, proceed as follows:

(a) The controls are positioned as follows:

POSITION	CONTROL
POWER OFF (Illuminated)	POWER ON-POWER OFF (S1) Switch
OFF	DC OUTPUT (S3) Switch
BAT	AC TAP (S2) Switch (L11 or L12)
ON	RELAY POWER (CB1) Circuit Breaker
ON	AUX AC CKTS (CB2) Circuit Breaker

TABLE B

KS-20039, L11 AND L12 (OPTION ZH)

	OUTPUT CAPACITOR FUSE	CONNECT CAPACITOR CHARGING JUMPER BETWEEN		
KS-20039 RECTIFIER WITH ROTARY DC OUTPUT SWITCH	F1	(-) Buse Bar of C13-C19 Capacitor Bank. (Left Front of Rectifier)	And	Terminal 2 of OUTPUT INDUCTOR L5
	F2	(-) Bus Bar of C20-C26 Capacitor Bank. (Right Front of Rectifier)	And	Terminal 2 of OUTPUT INDUCTOR L5

Fully ccw	SIMULATED OUTPUT CURRENT Potentiometer

Note: Do not change the setting of any other controls.

(b) For rectifiers connected in parallel, the proper phase shift windings on the main transformer (T2A, T2B, and T2C) are selected and connected correctly. (See Note 104 on SD-81895-01.)

(c) The six plug-in circuit packs are installed in their proper slot.

(d) All internal and remote fuses of the proper type and rating are installed.

3.06 ***Starting:*** To start the rectifiers, proceed as follows:

(1) Charge the output filter capacitors in accordance with paragraph 3.03 or 3.04.

(2) Operate the DC OUTPUT (S3) switch to the TST position.

Note: Assure that the AC TAP (S2) switch on the L11 or L12 rectifier is in the BAT position.

(3) Operate the switch on the AC power service cabinet or switch and fuse unit in the bus duct to the CLOSED position.

(4) Depress the POWER ON-POWER OFF (S1) switch.

Requirement: The POWER OFF white lamp that is lighted will extinguish, and the POWER ON blue lamp will light.

(5) Connect the KS-8039 volt-milliammeter, set on the 75 VOLTS scale, to the rectifier + SENSE (positive lead) and - SENSE (negative lead) test jacks.

Note: On recent production units, the SENSE test jacks are not provided. On these units, monitoring should be done with the external voltmeter (KS-8039) connected to the + and - OUTPUT VOLTS jacks.

(6) Adjust the OUTPUT VOLTS ADJUST (R221) potentiometer until the KS-8039 meter indicates 23.4 volts (11-cell battery plant) or 25.5 volts (12-cell battery plant).

Note: The KS-8039 meter that is connected to the rectifier may not indicate the same voltage that is actually available to the batteries. Therefore, it is necessary to set the voltage at a value lower than float voltage to prevent a possible high-voltage shutdown.

(7) Disconnect the KS-8039 meter from the rectifier.

(8) Depress the POWER ON-POWER OFF (S1) switch to the POWER OFF position.

Requirement: The POWER OFF lamp lights.

(9) Operate the DC OUTPUT (S3) switch to the OFF position.

(10) Perform capacitor charging procedure given in paragraph 3.03 or 3.04.

(11) After performing the capacitor charging procedure in paragraph 3.03 or 3.04, restore the rectifier to normal plant operation in accordance with the associated power plant Bell System Practice.

(12) Observe the indication of the associated power plant output voltmeter.

Note: The associated power plant output voltmeter indicates the actual voltage that is available to the batteries. The nominal float voltage for the batteries in a standard plant is usually 2.17 volts per cell. For additional information on the required float voltages for different types of batteries, refer to Section 157-601-701.

(13) Verify that the rectifier is supplying the required output to the batteries (as specified in the associated power plant Bell System Practice). When the rectifier is operated in parallel with other rectifiers, it is important that the associated power plant Bell System Practice be followed.

Note: If the rectifier is not producing the required output voltage to the batteries, continue with (14).

(14) Adjust the OUTPUT VOLTS ADJUST (R221) potentiometer until the rectifier is supplying the required output voltage to the batteries (as specified in the associated power plant Bell System Practice).

3.07 ***Stopping:*** To stop the rectifier, proceed as follows:

(1) Remove the rectifier from plant operation in accordance with the associated power plant Bell System Practice.

(2) Depress the POWER OFF-POWER ON (S1) switch to the POWER OFF position.

Requirement: The POWER OFF white lamp lights and the POWER ON blue lamp is extinguished.

(3) If the rectifier is to remain out of service for an undetermined interval of time, disconnect the rectifier from the battery by operating the DC OUTPUT (S3) switch to the OFF position and disconnect the ac input.

Warning: Connect the electrolytic capacitors of the output filter to a source of direct current of suitable voltage and polarity in accordance with Section 032-110-701.

EMERGENCY CELL CHARGING

3.08 ***Charging by Load the EM GR1 or the EM GR1 and GR2 Emergency Cells (L11 and L12 Rectifiers Only):***

(1) Depress the POWER ON-POWER OFF (S1) switch to the POWER OFF position. The POWER OFF lamp lights and the POWER ON lamp is extinguished.

Warning: Before operating the DC OUTPUT (S3) switch to the BAT or EC position, charge the output filter capacitors in accordance with paragraph 3.03 or 3.04.

(2) Operate the AC TAP (S2) and the DC OUTPUT (S3) switches to the EC positions. The END CELL red lamp lights (L11 and L12 only).

(3) Operate the EM CELL CHG knife switch on the battery control board to either GR1 or GR1 and GR2 position, depending upon which group of cells is to be charged.

(4) Depress the POWER ON-POWER OFF (S1) switch to the POWER ON position.

Requirement: The POWER ON lamp lights; the END CELL lamp remains lighted; and the POWER OFF lamp is extinguished (L11 and L12 only).

Note: The previous procedure is merely intended to describe the operation of controls in the rectifier. The charging rate through the emergency cells will vary with the load. The procedure for recharging after power failure is described in the section of the associated power plant.

4. ROUTINE CHECKS

4.01 It is suggested that the following routine checks should be made annually or more often if experience indicates that it is required. The rectifier may be tested with its output disconnected from the battery by operating the DC OUTPUT (S3) switch to the TST position.

4.02 All relays and other components are coded as shown in the circuit schematic drawing SD-81810-01. Some relays are not adjustable and should be replaced in the event of a malfunction. The capsulated MB type relay cannot be visually inspected, but all other relays should be inspected periodically for contact adjustment and contact erosion.

4.03 Clean, test, and adjust the AC TAP (S2) and DC OUTPUT (S3) switches in accordance with Section 169-730-701.

4.04 ***Voltage Regulation and Current Limit Adjustments:*** The rectifier may be adjusted with its output disconnected from the battery. The following procedure is to be used for all subsequent voltage regulation and current limit adjustments.

(1) Depress the POWER ON-POWER OFF (S1) switch.

Requirement: The POWER OFF lamp lights and the POWER ON lamp extinguishes.

(2) Open the rear cabinet doors and operate the DC OUTPUT (S3) switch to the TST position.

Requirement: The TEST lamp lights.

Note 1: Assure that the AC TAP (S2) switch (L11 and L12 only) is in the BAT position.

Note 2: When the DC OUTPUT (S3) switch is in the TST position, the sensing circuit is transferred from the RB and RG leads to the rectifier output.

(3) Observe the OUTPUT VOLTAGE (M2) voltmeter and OUTPUT CURRENT (M1) ammeter for a reading of zero.

Note: The M2 voltmeter is not furnished on more recent production units. On these, monitoring should be done with an external voltmeter (KS-8039) connected to the + and - OUTPUT VOLTS jacks.

(4) Using the KS-8039 dc volt-milliammeter, connect the negative lead to the - SENSE jack and the positive lead to the + SENSE jack.

Note 1: The KS-8039 dc volt-milliammeter is more accurate than the rectifier voltmeter (when furnished) and should be used for all adjustments.

Note 2: A comparison of both meters should be made as a check of the rectifier voltmeter accuracy.

(5) Verify that the SIMULATED OUTPUT CURRENT (R26) potentiometer is rotated fully ccw.

(6) Depress the POWER ON-POWER OFF (S1) switch.

Requirement: The POWER ON lamp lights and the POWER OFF lamp extinguishes.

Warning: When using the SIMULATED OUTPUT CURRENT (R26) potentiometer, make sure that it is rotated fully ccw after each adjustment.

Note 1: The following adjustments are made with the output voltage adjusted at 23.4 volts (11-cell battery plants) or 25.5 volts (12-cell battery plants) while the rectifier is in the TEST mode of operation.

Note 2: When the rectifier is used in a power plant, the output voltage should be adjusted in accordance with paragraph 3.06.

4.05 ***Output Voltage Adjustments:***

(1) Perform procedures in subparagraphs 4.04(1) through (6)

(2) Slowly rotate the SIMULATED OUTPUT CURRENT (R26) potentiometer cw until the OUTPUT CURRENT (M1) ammeter indicates 400 amperes.

Note: If voltage is unstable in the following procedure, check for possible anti-hunt adjustment (see paragraph 4.17).

4.06 ***High-Voltage Monitor Adjustments (L23 and L24 Only):*** The high-voltage monitor is set at the factory to shut down and lock out the rectifier when the main battery voltages across the HVB and HVG leads exceeds 27.2 ±0.1 volts. This is the setting when the rectifier is used as a 12-cell charger. When used as an 11-cell charger, readjust the setting for 25 ±0.1 volts. To reset or readjust, proceed as follows:

(1) Turn the rectifier off and disconnect the P1-J1 PLANT CONTROL DISCONNECT.

(2) Remove the CP6 circuit pack, insert it into the extender board, and insert the combination into the CP6 connector on the frame.

(3) Operate the DC OUTPUT switch to the TEST position.

(4) Connect a jumper between terminal 4 on CP6 and the wiring side of the - OUTPUT VOLTS jack. Connect a jumper between terminal 2 on CP6 and the wiring side of the + OUTPUT

VOLTS jack. Also connect a jumper between terminals 11 and 13 on CP6.

(5) Connect a dc voltmeter (KS-8039 or KS-20599, L4) across the + and - OUTPUT VOLTS jacks.

(6) Rotate the SIMULATED OUTPUT CURRENT potentiometer fully ccw.

(7) Turn the rectifier on and adjust the OUTPUT VOLTS ADJUST potentiometer for a reading of 25.0 ±0.1 volts (11-cells) or 27.2 ±0.1 volts (12-cells) on the external voltmeter.

(8) Rotate the HIGH VOLTAGE potentiometer fully cw.

(9) Rotate the SIMULATED OUTPUT CURRENT potentiometer cw until the OUTPUT CURRENT ammeter indicates approximately 80 amperes.

(10) Rotate the HIGH VOLTAGE potentiometer slowly ccw until HV1 relay operates.

Requirement: The rectifier locks out within 1 second.

(11) Turn the rectifier off and disconnect the jumpers, extender, and voltmeter. Reconnect the P1-J1 PLANT CONTROL DISCONNECT and reinsert CP6.

4.07 ***High-Voltage Monitor Test (L23 and L24 Only):*** To test the operation of the high-voltage monitor, perform Steps (1) through (7) of paragraph 4.06.

(1) Rotate the SIMULATED OUTPUT CURRENT (R26) potentiometer slowly cw.

Requirement 1: At approximately 80 amperes, the HV1 relay operates.

Requirement 2: The rectifier shuts down within 1 second.

(2) Depress the POWER ON-POWER OFF SWITCH to POWER OFF.

(3) Rotate the SIMULATED OUTPUT CURRENT (R26) potentiometer fully ccw.

(4) Disconnect the jumper from CP6 circuit pack.

(5) Remove the extender board from CP6 and reinsert CP6 into correct position.

(6) Reconnect the P1-J1 PLANT CONTROL DISCONNECT and reinsert CP6.

(7) Depress the POWER ON-POWER OFF switch to POWER ON.

Requirement: The test dc volt-milliammeter should still indicate 23.4 volts. (A minor readjustment of the OUTPUT VOLTS ADJUST (R221) potentiometer is permissible to retain the 23.4 volts or 25.5 volts)

(8) Disconnect the KS-8039 dc volt-milliammeter.

(9) Depress the POWER ON-POWER OFF switch to POWER OFF.

Requirement: The POWER OFF lamp lights and the POWER ON lamp extinguishes.

(10) Charge the output filter capacitors in accordance with paragraph 3.03 or 3.04 including operation of the DC OUTPUT (S3) switch to the BAT position.

(11) If no other adjustments are to be made, place the rectifier in service as outlined in paragraph 3.06.

4.08 ***Current Limit Full Load Adjustments:***

(1) Perform procedures in subparagraphs 4.04(1) through (6).

(2) Slowly rotate the SIMULATED OUTPUT CURRENT (R26) potentiometer cw until the OUTPUT CURRENT (M1) ammeter indicates 800 amperes.

Requirement: The test dc volt-milliammeter should still indicate the required float voltage (23.4 or 25.5 volts).

(3) If the test dc volt-milliammeter indication drops ***before*** the OUTPUT CURRENT (M1) ammeter reaches 800 amperes, proceed as follows. Otherwise, proceed to (4).

(a) Rotate the CURRENT LIMIT FULL LOAD (R223) potentiometer fully cw.

(b) Slowly rotate the SIMULATED OUTPUT CURRENT (R26) potentiometer cw until the OUTPUT CURRENT (M1) ammeter indicates 810 amperes.

(c) Slowly rotate the CURRENT LIMIT FULL LOAD (R223) potentiometer ccw until the test dc volt-milliammeter drops 1 volt.

(4) If the test dc volt-milliammeter does not drop until ***after*** the OUTPUT CURRENT (M1) ammeter exceeds 810 amperes, proceed as follows:

(a) Adjust the SIMULATED OUTPUT CURRENT (R26) potentiometer until the OUTPUT CURRENT (M1) ammeter indicates 810 amperes.

(b) Slowly rotate the CURRENT LIMIT FULL LOAD (R223) potentiometer ccw until the test dc volt-milliammeter indication drops 1 volt.

(5) Rotate the SIMULATED OUTPUT CURRENT potentiometer (R26) fully ccw.

(6) Disconnect the KS-8039 dc volt-milliammeter.

(7) Depress the POWER ON-POWER OFF (S1) switch to POWER OFF.

Requirement: The POWER OFF lamp lights and the POWER ON lamp extinguishes.

(8) Charge the output filter capacitors in accordance with paragraph 3.03 or 3.04 including operation of the DC OUTPUT (S3) switch to the BAT position.

(9) If no other adjustments are to be made, place the rectifier in service as outlined in paragraph 3.06.

4.09 ***Current Limit Partial Load Adjustments (L11 and L12 only):***

Note: This adjustment is set at the factory. The CURRENT LIMIT PARTIAL LOAD (R222) potentiometer is changed only when the rectifier is required to give up some of its load. If, for example, rejection of 300 amperes is required, the current-limit point is 500 amperes. The arbitrary current-limit of 500 amperes has been selected herein for reference purposes only.

(1) Perform procedures in subparagrphs 4.04(1) through (6).

(2) Place a temporary frame ground, using a suitable cord, to the PL lead designated terminal 30 of circuit pack CP4 (relay and alarm circuit). This ground operates the PL relay, which in turn short-circuits the CURRENT LIMIT FULL LOAD (R223) potentiometer and removes the short circuit from the CURRENT LIMIT PARTIAL LOAD (R222) potentiometer.

(3) Slowly rotate the SIMULATED OUTPUT CURRENT (R26) potentiometer cw until the OUTPUT CURRENT (M1) ammeter indicates 500 amperes.

Requirement: The test dc volt-milliammeter should still indicate 23.4 volts.

(4) If the test dc volt-milliammeter indication drops ***before*** the OUTPUT CURRENT (M1) ammeter reaches 500 amperes, proceed as follows. Otherwise, proceed to (5).

(a) Rotate the CURRENT LIMIT PARTIAL LOAD (R222) potentiometer fully cw.

(b) Slowly rotate the SIMULATED OUTPUT CURRENT (R26) potentiometer until the OUTPUT CURRENT (M1) ammeter indicates 510 amperes.

(c) Slowly rotate the CURRENT LIMIT PARTIAL LOAD (R222) potentiometer ccw until the test dc volt-milliammeter drops 1 volt.

(5) If the test dc volt-milliammeter does not drop until ***after*** the OUTPUT CURRENT (M1) ammeter exceeds 510 amperes, proceed as follows:

(a) Adjust the SIMULATED OUTPUT CURRENT (R26) potentiometer until the OUTPUT CURRENT (M1) ammeter indicates 510 amperes.

(b) Slowly rotate the CURRENT LIMIT PARTIAL LOAD (R222) potentiometer ccw until the test dc volt-milliammeter drops 1 volt.

(6) Rotate the SIMULATED OUTPUT CURRENT (R26) potentiometer fully ccw.

(7) Remove the temporary frame ground from the PL lead placed in (2).

(8) Disconnect the KS-8039 dc volt-milliammeter.

(9) Depress the POWER ON-POWER OFF (S1) switch to POWER OFF.

Requirement: The POWER OFF lamp lights and the POWER ON lamp extinguishes.

(10) Charge the output filter capacitors in accordance with paragraph 3.03 or 3.04 including operation of the DC OUTPUT (S3) switch to the BAT position.

(11) If no other tests are to be made, place the rectifier in service as outlined in paragraph 3.06.

4.10 ***Rectifier Shutdowns in the Test Mode:*** The rectifier may be tested with its output disconnected from the battery. The following procedure is to be used for all subsequent simulated shutdown tests.

(1) Depress the POWER ON-POWER OFF (S1) switch.

Requirement: The POWER OFF lamp lights and the POWER ON lamp extinguishes.

(2) Open the cabinet doors and operate the DC OUTPUT (S3) switch to TST.

Requirement: The TEST lamp lights and the output capacitors discharge.

(3) Depress the POWER ON-POWER OFF (S1) switch.

Requirement 1: The POWER ON lamp lights.

Requirement 2: The TEST lamp remains lighted.

Requirement 3: The POWER OFF lamp extinguishes.

4.11 ***Shutdown by Blown DC OUTPUT ALM or OUTPUT CAPACITOR (F1 ALM and F2 ALM) Fuses:***

(1) Place rectifier in the test mode as outlined in subparagraphs 4.10(1) through (3).

(2) One at a time, remove the 70-type DC OUTPUT ALM and the F2 ALM fuses, and replace with a blown fuse.

(3) Each operation shuts down the rectifier and lights the RECT FAIL and POWER OFF lamps.

(4) Replace the blown fuse with a good fuse.

Requirement: The rectifier does not restart and the RECT FAIL lamp remains lighted.

(5) The rectifier will restart by twice depressing the POWER ON-POWER OFF (S1) switch.

Requirement: The RECT FAIL and POWER OFF lamps extinguish.

(6) If further tests are to be performed, proceed to paragraph 4.12. If no other tests are to be made, remove rectifier from the test mode and return to service as outlined in paragraph 3.06.

4.12 ***Shutdown by Tripped Circuit Breaker:***

(1) Place rectifier in the test mode as outlined in paragraphs 4.10(1) through (3).

(2) One at a time, operate the RELAY POWER (CB1) and the AUX AC CKTS (CB2) circuit breakers to the OFF or tripped position.

(3) Each operation shuts down the rectifier. When the CB2 circuit breaker trips, the RECT FAIL and POWER OFF lamps light. When the CB1 circuit breaker trips, the RECT FAIL and POWER OFF lamps do not light and the POWER ON lamp is extinguished.

(4) The rectifier will restart by depressing the POWER ON-POWER OFF (S1) switch twice.

Requirement: The RECT FAIL and POWER OFF lamps will extinguish.

(5) If no further tests are to be made, remove rectifier from the test mode and return to service as outlined in paragraph 3.06.

4.13 *Shutdown by Plant High-Voltage Condition:*

(1) Place the rectifier in the test mode as outlined in subparagraphs 4.10(1) through (3).

(2) Disconnect the P1 connector (PLANT CONTROL DISCONNECT) and connect ground to terminal 6 of the male part of the connector.

(3) Slowly rotate the SIMULATED OUTPUT CURRENT (R26) potentiometer cw until the OUTPUT CURRENT (M1) ammeter indicates 80 amperes.

Requirement: The rectifier shuts down and the RECT FAIL and POWER OFF lamps light.

(4) Remove the ground from terminal 6 of the P1 connector and reconnect the connector.

(5) Rotate the SIMULATED OUTPUT CURRENT (R26) potentiometer fully ccw.

(6) The rectifier restarts by depressing the POWER ON-POWER OFF (S1) switch twice.

Requirement: The RECT FAIL and POWER OFF lamps extinguish.

(7) If further tests are to be performed, proceed to paragraph 4.14. If no other tests are to be made, remove the rectifier from the test mode and return to service as outlined in paragraph 3.06.

4.14 *Shutdown by TR Ground Signal From Plant:*

(1) Place rectifier in the test mode as outlined in subparagraphs 4.10(1) through (3).

(2) Using a suitable cord, place a temporary frame ground to the TR lead picked up at terminal 29 on CP4.

Requirement: The rectifier shuts down and the POWER OFF lamp lights.

(3) Remove the temporary ground from terminal 29 on CP4.

Requirement: The rectifier immediately restarts and the POWER OFF lamp extinguishes.

(4) Remove the rectifier from the test mode and return to service as outlined in paragraph 3.06.

4.15 *Shutdown by Circuit Pack Malfunction:*

(1) Depress the POWER ON-POWER OFF (S1) switch.

Requirement: The POWER OFF lamp lights and the POWER ON lamp extinguishes.

(2) Pull out any one of the circuit pack cards (CP2, CP3, or CP4), then depress the POWER ON (S1) switch.

Requirement: The rectifier will not start.

(3) Depress the POWER ON-POWER OFF (S1) switch to achieve a power off condition and replace the circuit pack card.

Requirement: The rectifier restarts after depressing the POWER ON-POWER OFF (S1) switch.

4.16 *Shutdown by Thyristor Failure Detector Circuit:*

(1) Depress the POWER ON—POWER OFF (S1) switch.

Requirement: The POWER OFF lamp lights and the POWER ON lamp extinguishes.

(2) Place the rectifier in the TEST mode as outlined in subparagraphs 4.10(1) through (3).

(3) Connect a test load of at least 150 amperes across the + TEST and - TEST terminations.

(4) Disconnect the coaxial gate lead to any thyristor CR1—CR6 and insulate the "snap-fit" end.

(5) Proper operation is indicated by an immediate shutdown and lockout after turn on of the rectifier.

Note: If rectifier fails to shut down and lock out, carefully turn the R701 potentiometer on CP7 cw until the TF1 relay operates.

(6) Remove the test load connected across the + TEST and - TEST terminations and reconnect the coaxial gate lead that was disconnected in (4).

(7) Remove the rectifier from the test made and return to service as outlined in paragraph 3.06.

4.17 ***ANTI-HUNT 1 Network Adjustment:***

Note: The ANTI-HUNT potentiometers were replaced by factory selected resistors on late production units of L11 and L12 rectifiers. The L21 and L22 rectifiers have always been furnished with factory selected resistors.

(1) The ANTI-HUNT 1 (R209) potentiometer setting should not be changed except as a last resort. Every effort should be made to identify the cause using a process of elimination. Fluctuating ac power or hunting in other rectifiers of the plant can be responsible.

(2) If the output is unstable or noisy and is definitely traced to the rectifier, rotate the ANTI-HUNT 1 (R209) potentiometer ccw only until the hunting or noise stops.

4.18 ***ANTI-HUNT 2 Network Adjustment:*** The ANTI-HUNT 2 (R220) potentiometer is used for testing only. When testing without the battery on a resistive load, screw terminals A and B located on the voltage regulator and current circuit (CP2) circuit pack should be jumped. This provides an adjustable anti-hunt netwrk to improve stability. The jumper must be removed for normal operation.

5. TROUBLES

5.01 Whenever a trouble condition is encountered in the operation of the rectifier, refer to Section 169-735-311, Trouble Locating.