

KS-20489 RECTIFIERS
48 VOLTS, 400 AMPERES
OPERATING METHODS

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1. GENERAL

1.01 The KS-20489 rectifiers provide an isolated, filtered, and regulated dc voltage for automatically floating and charging battery plants. The KS-20489 L11 and L12 rectifiers are used for floating and charging 23-cell battery plants, with manual switching for additionally charging either 2- or 4-end-cells. The KS-20489 L21 and L22 rectifiers are used for floating and charging 24-cell battery plants without end-cells. The KS-20489 rectifiers are initially intended for use in the 300-type power plants but may be used wherever their characteristics and design apply. The rectifiers operate on a 3-phase, 3-wire, 57- to 63-Hz alternating current. The L11 and L21 rectifiers operate on an ac input voltage of 186 to 253 volts (depending upon tap settings) and the L12 and L22 rectifiers operate on an ac input voltage of 430 to 506 volts (depending upon tap settings). The output of these rectifiers is rated at 48 volts, 400 amperes.

1.02 This section is reissued to expand paragraph 1.03, Warning 1; expand and correct paragraph 1.04; correct information in paragraph 3.04(4), Note 2, paragraphs 4.01 through 4.15; expand paragraph 5.02, Caution 1, and change the warning admonishments throughout the section. This issue does affect the Equipment Test List.

1.03 The T1 main transformer and the T2 pulse circuit transformer of the KS-20489 rectifier are equipped with winding taps to permit phase shifting when two or more rectifiers are operated in parallel. The phase shifting is used to reduce the ac input line distortion to the rectifier.

Note: The rectifiers are shipped with the T1 main transformer and the T2 pulse circuit transformer connected for +22 1/2 degree phase shift operation unless otherwise specified on the purchase order.

Danger: *The voltages in this unit exceed 150 volts to ground. Avoid all contact with terminals. 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 ac input power to the rectifier before working on the unit except when necessary to make tests.*

Warning 1: *Before removing or installing circuit packs in the rectifier, operate the POWER ON/OFF (S1) switch to the POWER OFF position and remove the relay and alarm (F8) fuse and then operate the DC OUTPUT (S3) switch to the OFF position. Re-install F8 when all circuit packs are in place.*

Warning 2: *Verify that the POWER ON/OFF (S1) switch is in the POWER OFF position before operating the DC OUTPUT (S3) switch from one position to another.*

Note: If the DC OUTPUT (S3) switch is operated from one position to another while

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the POWER ON/OFF (S1) switch is in the POWER ON position, the rectifier will shut down and lock out. To restart the rectifier after a shutdown occurs, operate the POWER ON/OFF (S1) switch to the POWER OFF position to release the relays and operate the switch back to the POWER ON position to restart the rectifier.

1.04 The instructions given in this practice are based on circuit schematic drawing SD-81995-01, Issue 6. For a detailed description of operation, see the corresponding circuit description. If this section is to be used with equipment or apparatus that is associated with an earlier or later issue of the schematic drawing, reference should be made to SDs and CDs to determine the extent of the changes and the manner in which the section may be affected.

Danger: The following points of the rectifier will always have battery voltage on them if the rectifier is connected to the battery and plant control circuit.

- (a) **BAT and EC (L11 and L12 rectifiers only) bus bars**
- (b) **Terminal B of the RELAY AND ALARM (F8) fuse holder**
- (c) **Terminal B of the -SENSE (F10) fuse holder**
- (d) **Terminal C of the RECT FAIL lamp assembly**
- (e) **The RB and HVG remote sense leads on the PLANT CONTROL DISCONNECT (J10) jack**
- (f) **Terminal 13 of the VOLTAGE REGULATOR (CP5) circuit pack connector (J5)**
- (g) **Terminal 6 of the RELAY AND ALARM (CP7) circuit pack connector (J7)**
- (h) **HIGH VOLTAGE MONITOR ADJUST (R24) potentiometer**
- (i) **DC OUTPUT (S3) switch.**

Note: If the PLANT CONTROL DISCONNECT (J10) jack is removed from the PLANT CONTROL DISCONNECT (P10) plug, the battery voltage will be removed from the points in (e) through (h).

Warning: The output filter capacitors in the rectifiers must be charged to the approximate battery or battery plus end-cell voltage before operating the DC OUTPUT (S3) switch to the BAT (all rectifiers) or EC (L11 and L12 rectifiers only) position. To charge the filter capacitors, follow the procedures in 3.06.

1.05 Routine checks should be made during a period when they will cause the least service reaction.

1.06 Refer to Fig. 1 for a front view of the KS-20489 L22 rectifier with the doors open.

1.07 The abbreviations cw and ccw used herein refer to clockwise and counterclockwise, respectively.

1.08 For more detailed information on operation and maintenance of individual equipment or apparatus, refer to the appropriate Bell System Practices.

2. LIST OF TOOLS AND TEST APPARATUS

CODE OR SPEC NO.	DESCRIPTION
TOOLS	
—	3-Inch C Screwdriver
—	10-Ohm, 50-Watt Minimum Resistor
—	6-Ampere, 125-Volt DC Rated Fuse
—	15-Ampere, 125-Volt DC Rated Switch
TEST APPARATUS	
KS-8039	DC Volt-Milliammeter
KS-14510	Volt-Ohm-Milliammeter

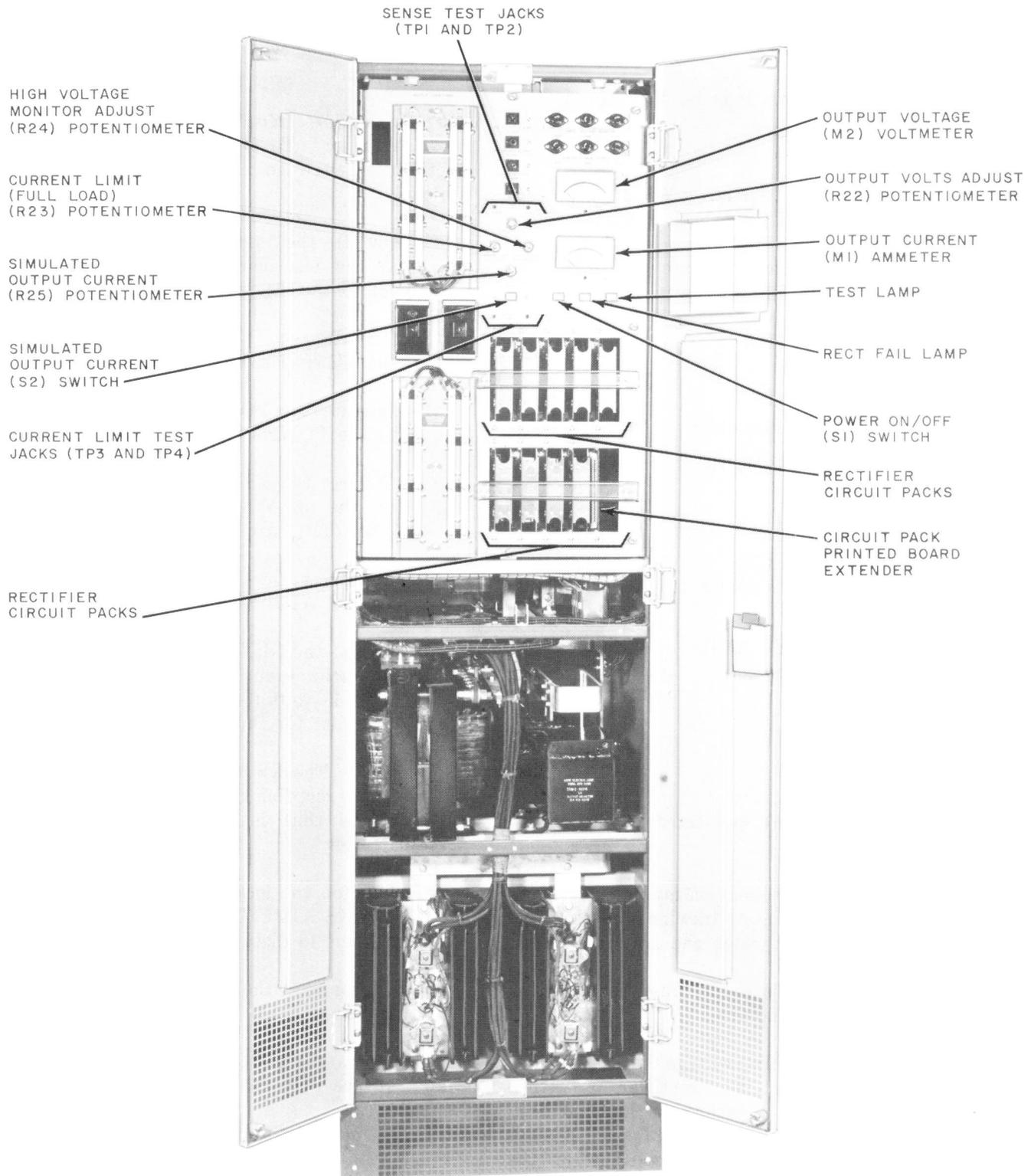


Fig. 1—KS-20489 L22 Rectifier—Front Doors Open

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TEST APPARATUS

— Weston Model 904 AC Voltmeter
(8 Ranges 750/300/150/75/30/-
15/7.5/3)

Note: Equivalents may be substituted.

3. OPERATION

3.01 Preparing to Start: When preparing to start the rectifier, check the following.

- (1) The following controls are positioned as indicated.

CONTROL	POSITION
POWER ON/OFF (S1) switch	POWER OFF
SIMULATED OUTPUT CURRENT (S2) Switch	OFF
DC OUTPUT (S3) Switch	OFF
Associated switch and fuse unit in bus duct or in power service cabinet	OFF
SIMULATED OUTPUT CURRENT (R25) potentiometer	fully ccw

- (2) The batteries are connected to the output of the rectifier.
- (3) All external connections are made in accordance with the schematic drawing covering the associated circuit of which the unit is a part.
- (4) All associated fuses are installed in their respective fuse holders.
- (5) The nominal ac input voltage that is connected to the input of the rectifier is within allowable tolerances (measured with the Weston Model 904 ac voltmeter connected for the 300-volt scale for the L11 and L21 rectifiers or the 750-volt scale for the L12 and L22 rectifiers).
- (6) Verify that all circuit packs are properly installed in the rectifier.

Note: If any circuit pack is not properly installed in the rectifier, the interlock path in the rectifier will be open and the unit will not start.

3.02 Starting (Rectifier Used in a Power Plant): To start the rectifier when the rectifier is used in a power plant, proceed as follows.

- (1) Operate the associated switch and fuse unit in the bus duct or in the power service cabinet to the ON position.
- (2) Operate the DC OUTPUT (S3) switch to the TEST position.
- (3) Operate the POWER ON/OFF (S1) switch to the POWER ON position.
- (4) Connect the KS-8039 volt-milliammeter, set on the 75 VOLTS scale, to the rectifier +SENSE (TP1) and -SENSE (TP2) test jacks.
- (5) Loosen the locking device on the OUTPUT VOLTS ADJUST (R22) potentiometer.
- (6) Adjust the OUTPUT VOLTS ADJUST (R22) potentiometer until the KS-8039 meter indicates 49 volts for the L11 and L12 rectifiers or 50.2 volts for the L21 and L22 rectifiers.
Note: The KS-8039 meter that is connected to the rectifier may not indicate the same voltage that is actually available to the batteries.
- (7) Tighten the locking device on the OUTPUT VOLTS ADJUST (R22) potentiometer, being careful not to disturb the setting.
- (8) Disconnect the KS-8039 meter from the rectifier.
- (9) Operate the POWER ON/OFF (S1) switch to the POWER OFF position.
- (10) Operate the associated switch and fuse unit in the bus duct or in the power service cabinet to the OFF position.
- (11) Operate the DC OUTPUT (S3) switch to the OFF position.

- (12) Perform the capacitor charging procedure given in 3.06.
- (13) After performing the capacitor charging procedure in 3.06, restore the rectifier to normal plant operation in accordance with the associated power plant Bell System Practice.
- (14) Observe the indication on 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 voltages for different types of batteries, refer to Section 157-601-301.

- (15) Verify that the rectifier is supplying the required output voltage to the batteries (as specified in the associated power plant Bell System Practice).

Note: If the rectifier is not producing the required output voltage to the batteries, continue with (16).

- (16) Loosen the locking device on the OUTPUT VOLTS ADJUST (R22) potentiometer.
- (17) Adjust the OUTPUT VOLTS ADJUST (R22) potentiometer until the rectifier is supplying the required output voltage to the batteries (as specified in the associated power plant Bell System Practice).
- (18) Tighten the locking device on the OUTPUT VOLTS ADJUST (R22) potentiometer, being careful not to disturb the setting.

3.03 Starting (Rectifier Not Used In A Power Plant): To start the rectifier when the rectifier is not used in a power plant, proceed as follows.

- (1) Operate the associated switch and fuse unit in the bus duct or in the power service cabinet to the ON position.
- (2) Operate the DC OUTPUT (S3) switch to the TEST position.

- (3) Operate the POWER ON/OFF (S1) switch to the POWER ON position.
- (4) Connect the KS-8039 volt-milliammeter, set on the 75 VOLTS scale, to the rectifier +SENSE (TP1) and -SENSE (TP2) test jacks.
- (5) Loosen the locking device on the OUTPUT VOLTS ADJUST (R22) potentiometer.
- (6) Adjust the OUTPUT VOLTS ADJUST (R22) potentiometer until the KS-8039 meter indicates 49.9 volts for the L11 and L12 rectifiers or 52.1 volts for the L21 and L22 rectifiers.

Note: The KS-8039 meter that is connected to the rectifier may not indicate the same voltage that is actually available to the batteries. The nominal float voltage for the batteries is usually 2.17 volts per cell. For additional information on the required voltages for different types of batteries, refer to Section 157-601-301.

- (7) Tighten the locking device on the OUTPUT VOLTS ADJUST (R22) potentiometer, being careful not to disturb the setting.
- (8) Disconnect the KS-8039 meter from the rectifier.
- (9) Operate the POWER ON/OFF (S1) switch to the POWER OFF position.
- (10) Operate the associated switch and fuse unit in the bus duct or in the power service cabinet to the OFF position.
- (11) Operate the DC OUTPUT (S3) switch to the OFF position.
- (12) Perform the capacitor charging procedure given in 3.06.

3.04 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) Operate the POWER ON/OFF (S1) switch to the POWER OFF position.

Requirement: The POWER OFF (white) lamp lights and the POWER ON (blue) lamp extinguishes.

- (3) Operate the associated switch and fuse unit in the bus duct or in the power service cabinet to the OFF position.
- (4) Operate the DC OUTPUT (S3) switch to the OFF position.

Note 1: When the rectifier is shut down, the output filter capacitors should fully discharge through discharge resistors in approximately 1 minute.

Note 2: To completely disconnect the rectifier from the ac input power and the batteries, disconnect the rectifier from the plant control circuit by disconnecting the PLANT CONTROL DISCONNECT (J10) jack from the (P10) plug on the rectifier and manually disconnect the batteries from the rectifier by disconnecting the battery bus bars at the rectifier.

Danger: Use all necessary precautions when disconnecting battery bus bars to prevent short circuits which could result in fires, equipment damage, or personal injury.

Note 3: If the rectifier is to be left out of service for an extended period of time, remove all associated fuses from their respective fuse holders and refer to Section 032-110-701 for information on maintaining electrolytic capacitors when they are not in service.

3.05 Automatic and Manual Operation:

Initially, the rectifier must be started manually. During normal operation the rectifier remains energized and connected to the load. The rectifier can be stopped manually or by signals from the associated power plant. The rectifier can also be restarted manually or by signals from the associated power plant.

3.06 Charging Filter Capacitors: To charge the output filter capacitors (C1 through C16) in the rectifier, verify that the procedures in 3.01 have been followed and continue as follows.

Note: If the resistor, fuse, and switch combination has been permanently wired into

the rectifier, follow only the procedures in (3) and (4) and (6) through (8).

- (1) Connect a 10-ohm, 50-watt minimum resistor; a 6-ampere, 125-volt dc rated fuse; and a 15-ampere, 125-volt dc rated switch (operated to the OFF position) in series.

- (2) Connect the resistor, fuse, and switch combination between the -TEST lug and the charge and discharge side of the BAT (all rectifiers) or EC (L11 and L12 rectifiers only) bus bar.

Warning: When connecting the resistor, fuse, and switch combination to the rectifier, always connect the combination to the charge and discharge side of the BAT (all rectifiers) or EC (L11 and L12 rectifiers only) bus bar last to prevent shorts from occurring. When disconnecting the resistor, fuse, and switch combination from the rectifier, always disconnect both ends of the combination from the rectifier at the same time to prevent shorts from occurring.

- (3) Operate the switch of the resistor, fuse, and switch combination to the ON position.
- (4) When the OUTPUT VOLTAGE (M2) voltmeter indicates the approximate battery or battery plus end-cell voltage, operate the DC OUTPUT (S3) switch to the desired BAT (all rectifiers) or EC (L11 and L12 rectifiers only) position.

Note 1: The voltage indicated on the OUTPUT VOLTAGE (M2) voltmeter before the DC OUTPUT (S3) switch is operated to the desired BAT (all rectifiers) or EC (L11 and L12 rectifiers only) position will be slightly lower than the nominal battery or battery plus end-cell voltage.

Note 2: The END CELL (red) lamp lights when the DC OUTPUT (S3) switch is in the EC position.

- (5) Disconnect the resistor, fuse, and switch combination from the rectifier [observe caution in (2)].

- (6) Operate the switch of the resistor, fuse, and switch combination to the OFF position.
- (7) Operate the associated switch and fuse unit in the bus duct or in the power service cabinet to the ON position.
- (8) Operate the POWER/ON (S1) switch to the POWER ON position.

Requirement: The POWER ON (blue) lamp lights and the POWER OFF (white) lamp extinguishes.

3.07 The release of the RF relay in the rectifier will shut down the rectifier and cause lockout. If lockout occurs, correct the condition that causes lockout and operate the POWER ON/OFF (S1) switch to the POWER OFF position to reset the relays and back to the POWER ON position to restart the rectifier.

4. ROUTINE CHECKS

4.01 It is necessary to perform some of the routine checks with the rectifier operating in the test mode. To put the rectifier in the test mode of operation, follow the procedures in (1) through (4). When the routine checks have been completed, restore the rectifier to the normal mode of operation by following the procedures in (5) through (9).

Placing Rectifier In Test Mode of Operation

- (1) If the rectifier is used in a power plant, remove the rectifier from plant operation in accordance with the associated power plant Bell System Practice.
 - (2) Operate the POWER ON/OFF (S1) switch to the POWER OFF position.
- Requirement:** The POWER OFF (white) lamp lights and the POWER ON (blue) lamp extinguishes.
- (3) Operate the DC OUTPUT (S3) switch to the TEST position.

Requirement: The TEST (white) lamp and SIMULATED OUTPUT CURRENT OFF (white) lamp light.

- (4) Disconnect the PLANT CONTROL DISCONNECT (J10) jack from the (P10) plug.

Note: Failure to disconnect (J10) will result in a rectifier failure alarm signal to the plant that will initiate a rectifier shutdown and lockout.

- (5) Operate the POWER ON/OFF (S1) switch to the POWER ON position.

Requirement: The rectifier starts, the POWER ON (blue) lamp lights, the SIMULATED OUTPUT CURRENT OFF (white) lamp remains lighted, and the POWER OFF (white) lamp extinguishes.

Restoring Rectifier To Normal Mode of Operation

- (6) Operate the POWER ON/OFF (S1) switch to the POWER OFF position.

Requirement: The POWER OFF (white) lamp lights and the POWER ON (blue) lamp extinguishes.

- (7) Operate the associated switch and fuse unit in the bus duct or in the power service cabinet to the OFF position.
- (8) Operate the DC OUTPUT (S3) switch to the OFF position.

Requirement: The TEST (white) lamp and SIMULATED OUTPUT CURRENT (white) lamp extinguish.

- (9) Reconnect the rectifier PLANT CONTROL DISCONNECT (J10) jack to (P10) plug.
- (10) Perform all steps of the capacitor charging procedure in 3.06.
- (11) If the rectifier is used in a power plant, restore the rectifier to normal plant operation in accordance with the associated power plant Bell System Practice.

4.02 Keep the ventilating passages of the rectifier unobstructed to ensure adequate cooling during operation.

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4.03 Inspect the AC INPUT CONTACTOR (ST3) in the rectifier for the condition of contacts and clean if necessary. The relays that are mounted on circuit packs are not adjustable and should be replaced in the event of a malfunction or poor condition of contacts.

4.04 The DC OUTPUT (S3) switch should be cleaned and lubricated in accordance with Section 030-745-701. Before cleaning and lubricating the switch, the rectifier must be disconnected from the ac input power and it is preferred that the rectifier be completely disconnected from the batteries. To perform maintenance on the DC OUTPUT (S3) switch with the rectifier completely disconnected from the batteries, follow the instructions in (1) and (2). If a decision is made not to disconnect the rectifier from the batteries, follow only the instructions in (1). After performing maintenance on the switch, restore the rectifier to normal operation by following the instructions in either (3) or (4).

Danger: Use all necessary precautions when working on the DC OUTPUT (S3) switch when battery power is connected to the switch or when disconnecting battery bus bars to prevent short circuits which could result in fires, equipment damage, or personal injury.

- (1) Follow the procedures in 3.04(1) through (4).
- (2) Follow the procedures in *Note 2* of 3.04.
- (3) If the rectifier is used in a power plant, restore the rectifier to normal operation by following the procedures in 3.01 and 3.02(11) through (14).
- (4) If the rectifier is not used in a power plant, restore the rectifier to normal operation by following the procedures in 3.01 and 3.02(12).

4.05 Check the accuracy of the rectifier OUTPUT VOLTAGE (M2) voltmeter in accordance with Section 100-510-701.

4.06 Output Voltage Check (Rectifier Used In a Power Plant): To check the rectifier output voltage when the rectifier is used in a power plant, proceed as follows.

- (1) Observe the indication on 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 voltages for different types of batteries, refer to Section 157-601-301.

- (2) Verify that the rectifier is supplying the required output voltage to the batteries (as specified in the associated power plant Bell System Practice).

Note: If the rectifier is not supplying the required output voltage to the batteries, continue with (3).

- (3) Loosen the locking device on the OUTPUT VOLTS ADJUST (R22) potentiometer.
- (4) Adjust the OUTPUT VOLTS ADJUST (R22) potentiometer until the rectifier is supplying the required output voltage to the batteries (as specified in the associated power plant Bell System Practice).
- (5) Tighten the locking device on the OUTPUT VOLTS ADJUST (R22) potentiometer being careful not to disturb the setting.

4.07 Output Voltage Check (Rectifier Not Used In a Power Plant): To check the rectifier output voltage when the rectifier is not used in a power plant, proceed as follows.

- (1) Put the rectifier in the test mode of operation in accordance with 4.01.
- (2) Connect the KS-8039 volt-milliammeter, set on the 75 VOLTS scale, to the rectifier +SENSE (TP1) and -SENSE (TP2) test jacks.

Requirement: The KS-8039 meter indicates 49.9 \pm 0.2 volts for the L11 and L12 rectifiers or 52.1 \pm 0.2 volts for the L21 and L22 rectifiers.

Note 1: The KS-8039 meter that is connected to the rectifier may not indicate the same voltage that is actually available to the

batteries. The nominal float voltage for the batteries is usually 2.17 volts per cell. For additional information on the required voltages for different types of batteries, refer to Section 157-601-301.

Note 2: If the requirement in (2) is met, proceed to (6). If the requirement is not met, continue with (3).

- (3) Loosen the locking device on the OUTPUT VOLTS ADJUST (R22) potentiometer.
- (4) Adjust the OUTPUT VOLTS ADJUST (R22) potentiometer until the KS-8039 meter indicates 49.9 volts for the L11 and L12 rectifiers or 52.1 volts for the L21 and L22 rectifiers.
- (5) Tighten the locking device on the OUTPUT VOLTS ADJUST (R22) potentiometer, being careful not to disturb the setting.
- (6) Disconnect the KS-8039 meter from the rectifier.
- (7) Operate the POWER ON/OFF (S1) switch to the POWER OFF position.
- (8) Operate the associated switch and fuse unit in the bus duct or in the power service cabinet to the OFF position.
- (9) Operate the DC OUTPUT (S3) switch to the OFF position.
- (10) Perform the capacitor charging procedure given in 3.06.

4.08 Full Load Current Limit Check: To check the rectifier full load current limiting circuit, proceed as follows.

- (1) Put the rectifier in the test mode of operation in accordance with 4.01.
- (2) Verify that the SIMULATED OUTPUT CURRENT (R25) potentiometer is rotated fully ccw.
- (3) Connect the KS-14510 volt-ohm-milliammeter, set on the 3 DC VOLTS scale, to the rectifier +CURRENT LIMIT (TP3) and -CURRENT LIMIT (TP4) test jacks.

Note: Allow the rectifier to operate for at least 15 seconds before operating the SIMULATED OUTPUT CURRENT (S2) switch to the ON position.

- (4) Operate the SIMULATED OUTPUT CURRENT (S2) switch to the ON position.

Requirement: The SIMULATED OUTPUT CURRENT ON (white) lamp lights and the SIMULATED OUTPUT CURRENT OFF (white) lamp extinguishes.

- (5) Rotate the SIMULATED OUTPUT CURRENT (R25) potentiometer cw until the rectifier OUTPUT CURRENT (M1) ammeter indicates 400 amperes.

Requirement: The KS-14510 meter indicates between 0 and 0.5 volt.

Note: The CURRENT LIMIT (FULL LOAD) (R23) potentiometer is factory adjusted to limit the output current at 400 amperes and does not generally require field adjustment. If the requirement in (5) is met, proceed to (12). If the requirement is not met, continue with (6).

- (6) Rotate the SIMULATED OUTPUT CURRENT (R25) potentiometer fully ccw.
- (7) Loosen the locking device on the CURRENT LIMIT (FULL LOAD) (R23) potentiometer and rotate the potentiometer fully cw.
- (8) Rotate the SIMULATED OUTPUT CURRENT (R25) potentiometer cw until the rectifier OUTPUT CURRENT (M1) ammeter indicates 400 amperes.
- (9) Rotate the CURRENT LIMIT (FULL LOAD) (R23) potentiometer ccw until the KS-14510 meter indicates between 0 and 0.5 volt.
- (10) Tighten the locking device on the CURRENT LIMIT (FULL LOAD) (R23) potentiometer, being careful not to disturb the setting.
- (11) Rotate the SIMULATED OUTPUT CURRENT (R25) potentiometer fully ccw and repeat (5).

- (12) Rotate the SIMULATED OUTPUT CURRENT (R25) potentiometer fully ccw.
- (13) Operate the POWER ON/OFF (S1) switch to the POWER OFF position.

Requirement: The rectifier shuts down, the POWER OFF (white) lamp lights, the TEST (white) lamp is lighted, and the POWER ON (blue) lamp extinguishes.

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

Requirement: The TEST (white) lamp and SIMULATED CURRENT ON (white) lamp extinguish.

- (15) Operate the DC OUTPUT (S3) switch to the TEST position.

Requirement: The TEST (white) lamp and SIMULATED OUTPUT CURRENT OFF (white) lamp light.

- (16) Operate the POWER ON/OFF (S1) switch to the POWER ON position.

Requirement: The rectifier starts, the POWER ON (blue) lamp lights, the TEST (white) lamp is lighted, and the POWER OFF (white) lamp extinguishes. The SIMULATED OUTPUT CURRENT OFF (white) lamp remains lighted.

- (17) Disconnect the KS-14510 meter from the rectifier.

- (18) After completing the associated checks (checks requiring test mode operation), restore the rectifier to the normal mode of operation in accordance with 4.01.

4.09 Partial Load Current Limit Check (L11 and L12 Rectifiers Only): To check the partial load current limiting circuits in the L11 and L12 rectifiers, proceed as follows.

- (1) Put the rectifier in the test mode of operation in accordance with 4.01 except leave the POWER ON/OFF (S1) switch in the POWER OFF position.

Warning: Before removing or installing circuit packs in the rectifier, remove the relay and alarm (F8) fuse and then operate the DC OUTPUT (S3) switch to the OFF position. Re-install (F8) fuse when all circuit packs are in place.

- (2) Remove the CURRENT LIMIT AND SIMULATED OUTPUT CURRENT CIRCUIT (CP6) circuit pack from the rectifier.

- (3) Install the associated printed board extender and the CURRENT LIMIT AND SIMULATED OUTPUT CURRENT CIRCUIT (CP6) circuit pack in the rectifier.

- (4) Operate the partial load (PL) relay by connecting a jumper from TP7 to TP21 (ground) on the printed board extender.

- (5) Verify that the SIMULATED OUTPUT CURRENT (R25) potentiometer is rotated fully ccw.

- (6) Operate the POWER ON/OFF (S1) switch to the POWER ON position.

Requirement: The POWER ON (blue) lamp lights and the POWER OFF (white) lamp extinguishes.

- (7) Connect the KS-14510 volt-ohm-milliammeter, set on the 3 DC VOLTS scale, to the rectifier +CURRENT LIMIT (TP3) and -CURRENT LIMIT (TP4) test jacks.

- (8) Allow the rectifier to operate for at least 15 seconds then operate the SIMULATED OUTPUT CURRENT (S2) switch to the ON position.

Requirement: The SIMULATED OUTPUT CURRENT ON (white) lamp lights and the SIMULATED OUTPUT CURRENT OFF (white) lamp extinguishes.

- (9) Rotate the SIMULATED OUTPUT CURRENT (R25) potentiometer cw until the rectifier OUTPUT CURRENT (M1) ammeter indicates the current value specified in the associated power plant Bell System Practice. If a plant requirement is not given, rotate the potentiometer

cw until the rectifier OUTPUT CURRENT (M1) ammeter indicates 200 amperes.

Requirement: The KS-14510 meter indicates between 0 and 0.5 volt.

Note: The CURRENT LIMIT (PARTIAL LOAD) (R34) potentiometer is factory adjusted to limit the output current at 200 amperes and does not generally require field adjustment. If the requirement in (9) is met, proceed to (16). If the requirement is not met, continue with (10).

- (10) Rotate the SIMULATED OUTPUT CURRENT (R25) potentiometer fully ccw.
- (11) Loosen the locking device on the CURRENT LIMIT (PARTIAL LOAD) (R34) potentiometer and rotate the potentiometer fully cw.
- (12) Rotate the SIMULATED OUTPUT CURRENT (R25) potentiometer cw until the rectifier OUTPUT CURRENT (M1) ammeter indicates the current value specified in the associated power plant Bell System Practice. If a plant requirement is not given, rotate the potentiometer cw until the rectifier OUTPUT CURRENT (M1) ammeter indicates 200 amperes.
- (13) Rotate the CURRENT LIMIT (PARTIAL LOAD) (R34) potentiometer ccw until the KS-14510 meter indicates between 0 and 0.5 volt.
- (14) Tighten the locking device on the CURRENT LIMIT (PARTIAL LOAD) (R34) potentiometer, being careful not to disturb the setting.
- (15) Rotate the SIMULATED OUTPUT CURRENT (R25) potentiometer fully ccw and repeat (9).
- (16) Rotate the SIMULATED OUTPUT CURRENT (R25) potentiometer fully ccw.
- (17) Operate the POWER ON/OFF (S1) switch to the POWER OFF position.

Requirement: The rectifier shuts down, the POWER OFF (white) lamp lights, the TEST (white) lamp is lighted, and the POWER ON (blue) lamp extinguishes.

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

Requirement: The TEST (white) lamp extinguishes.

- (19) Operate the SIMULATED OUTPUT CURRENT (S2) switch to the OFF position.

Requirement: The SIMULATED OUTPUT CURRENT OFF (white) lamp lights and the SIMULATED OUTPUT CURRENT ON (white) lamp extinguishes.

- (20) Disconnect the KS-14510 meter from the rectifier.

- (21) Remove the jumper that is connected from TP7 to TP21 (ground) on the printed board extender.

- (22) Remove the CURRENT LIMIT AND SIMULATED OUTPUT CURRENT CIRCUIT (CP6) circuit pack and the associated printed board extender from the rectifier.

- (23) Install the CURRENT LIMIT AND SIMULATED OUTPUT CURRENT CIRCUIT (CP6) circuit pack in the rectifier.

- (24) Operate the DC OUTPUT (S3) switch to the TEST position.

Requirement: The TEST (white) lamp lights.

- (25) Operate the POWER ON/OFF (S1) switch to the POWER ON position.

Requirement: The rectifier starts, the POWER ON (blue) lamp lights, the TEST (white) lamp is lighted, and the POWER OFF (white) lamp extinguishes.

- (26) After completing the associated checks (checks requiring test mode of operation), restore the rectifier to the normal mode of operation in accordance with 4.01.

4.10 Fuse Alarm Checks: To check the fuse alarm circuits, proceed as follows.

- (1) Put the rectifier in the test mode of operation in accordance with 4.01 except leave the

POWER ON/OFF (S1) switch in the POWER OFF position.

(2) Remove one of the following fuses from its respective fuse holder and replace the removed fuse with an operated fuse of the same type.

- (a) DC OUTPUT ALARM (F7) fuse
- (b) RELAY AND ALARM (F8) fuse
- (c) OUTPUT VOLTAGE (F9) fuse
- (d) -SENSE (F10) fuse
- (e) OUTPUT CAPACITORS (bank A) (F12) alarm fuse
- (f) OUTPUT CAPACITORS (bank B) (F14) alarm fuse

(3) Operate the POWER ON/OFF (S1) switch to the POWER ON position.

Requirement: The rectifier does not start. The POWER ON (blue) lamp lights, the RECT FAIL (white) lamp lights, and the POWER OFF (white) lamp extinguishes.

◆**Note 1:** If the PLANT CONTROL DISCONNECT (J10) jack is not disconnected from the (P10) plug, placing an operated fuse in (2) and (c) through (f) activates an alarm with POWER ON/OFF (S1) switch operated to the POWER ON position. If the PLANT CONTROL DISCONNECT (J10) jack is not disconnected from the (P10) plug, placing an operated fuse in (b) activates an alarm regardless of the position of the POWER ON/OFF (S1) switch.

Note 2: ◆ The rectifier is in the shutdown and lockout mode.

- (4) Remove the operated fuse that was installed in the rectifier.
- (5) Install the original fuse in its respective fuse holder in place of the operated fuse.
- (6) Operate the POWER ON/OFF (S1) switch to the POWER OFF position.

Requirement: The POWER OFF (white) lamp lights, the RECT FAIL (white) lamp extinguishes, and the POWER ON (blue) lamp extinguishes.

(7) Operate the POWER ON/OFF (S1) switch to the POWER ON position.

Requirement: The rectifier starts, the POWER ON (blue) lamp lights, and the POWER OFF (white) lamp extinguishes.

(8) Operate the POWER ON/OFF (S1) switch to the POWER OFF position.

Requirement: The POWER OFF (white) lamp lights and the POWER ON (blue) lamp extinguishes.

(9) Repeat the procedures in (3) through (8) for each of the remaining fuses in (2).

(10) After completing the associated checks (checks requiring test mode of operation), restore the rectifier to the normal mode of operation in accordance with 4.01.

4.11 Transfer Shutdown (TR) Check ◆(302B Plant Only): ◆ To check the operation of the plant controlled transfer shutdown (TR) circuit, proceed as follows.

- (1) ◆Put the rectifier in the test mode of operation in accordance with 4.01 except leave the POWER ON/OFF (S1) switch in the POWER OFF position.◆
- (2) Remove the RELAY AND ALARM (CP7) circuit pack from the rectifier. ◆Refer to Paragraph 1.03, Caution 2.◆
- (3) Install the associated printed board extender and the RELAY AND ALARM (CP7) circuit pack to the rectifier.
- (4) Operate the POWER ON/OFF (S1) switch to the POWER ON position.

Requirement: The rectifier starts, the POWER ON (blue) lamp lights, the TEST (white) lamp is lighted, ◆the SIMULATED OUTPUT CURRENT OFF (white) lamp remains lighted,◆ and the POWER OFF (white) lamp extinguishes.

(5) Allow the rectifier to operate for at least 15 seconds and then carefully connect a jumper between TP22 (TR) and TP3 (GRD 3) on the associated printed board extender.

Requirement: The rectifier shuts down and the POWER ON (blue), the POWER OFF (white), the SIMULATED OUTPUT CURRENT OFF (white), and the TEST (white) lamps are lighted.

(6) Carefully disconnect the jumper from TR22 (TR) and TP3 (GRD 3) of the associated printed board extender.

Requirement: The rectifier starts, the POWER ON (blue) lamp is lighted, the TEST (white) lamp is lighted, the SIMULATED OUTPUT CURRENT OFF (white) lamp remains lighted, and the POWER OFF (white) lamp extinguishes.

(7) Operate the POWER ON/OFF (S1) switch to the POWER OFF position.

Requirement: The rectifier shuts down, the POWER OFF (white) lamp lights, and the POWER OFF (blue) lamp extinguishes.

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

Requirement: The TEST lamp and SIMULATED OUTPUT CURRENT OFF (white) lamp extinguishes.

(9) Remove the RELAY AND ALARM (CP7) circuit pack and the associated printed board extender from the rectifier. Refer to Paragraph 1.03, Caution 2.

(10) Install the RELAY AND ALARM (CP7) circuit pack in the rectifier.

(11) After completing the associated checks (checks requiring test mode of operation), restore the rectifier to the normal mode of operation in accordance with 4.01.

4.12 Plant Controlled (HV) Shutdown and Lockout Check: To check the operation of the plant controlled (HV) shutdown and lockout circuit, proceed as follows.

(1) Put the rectifier in the test mode of operation in accordance with 4.01 except leave the POWER ON/OFF (S1) switch in the POWER OFF position.

(2) Remove the CURRENT LIMIT AND SIMULATED OUTPUT CURRENT (CP6) circuit pack from the rectifier. Refer to Paragraph 1.03, Caution 2.

(3) Install the associated printed board extender and the CURRENT LIMIT AND SIMULATED OUTPUT CURRENT (CP6) circuit pack in the rectifier.

(4) Connect the KS-14510 volt-ohm-milliammeter, set on the X100 scale, between TP18 and TP22 on the printed board extender.

Requirement: The KS-14510 meter indicates an open circuit.

Note: The open circuit indication means that the low output (LO) relay is not operated. On the L11 and L12 rectifiers, the open circuit indication also means that the CA-CB loop to the plant control circuit (terminals 18 and 22 of CP6 circuit pack) is an open circuit.

(5) Verify that the SIMULATED OUTPUT CURRENT (R25) potentiometer is rotated fully ccw.

(6) Operate the POWER ON/OFF (S1) switch to the POWER ON position.

Requirement: The rectifier starts, the POWER ON (blue) lamp lights, the TEST lamp is lighted, and the POWER OFF (white) lamp extinguishes.

(7) Allow the rectifier to operate for at least 15 seconds and then operate the SIMULATED OUTPUT CURRENT (S2) switch to the ON position.

Requirement: The SIMULATED OUTPUT CURRENT ON (white) lamp lights and the SIMULATED OUTPUT CURRENT OFF (white) lamp extinguishes. The OUTPUT CURRENT (M1) ammeter indicates less than 200 amperes. The KS-14510 volt-ohm-milliammeter indicates zero, or short circuit.

Note: The short circuit indication means that the low output (LO) relay has operated. On the L11 and L12 rectifiers, the open circuit indication also means that the CA-CB loop to the plant control circuit (terminals 18 and 22 of CP6 circuit pack) is a closed circuit.

- (8) Carefully connect a jumper between TP24 (HV) and TP21 (ground) on the associated printed board extender.

Requirement: The rectifier will shut down and lock out. The POWER ON (blue), the POWER OFF (white), the RECT FAIL (white), and the SIMULATED OUTPUT CURRENT ON (white) lamps are lighted.

- (9) Carefully remove the jumper from the TP24 (HV) and TP21 (ground) on the associated printed board extender.
- (10) Disconnect the KS-14510 meter from the associated printed board extender.
- (11) Operate the POWER ON/OFF (S1) switch to the POWER OFF position.
- (12) Operate the DC OUTPUT (S3) switch to the OFF position.
- (13) Remove the CURRENT LIMIT AND SIMULATED OUTPUT CURRENT (CP6) circuit pack and the associated printed board extender from the rectifier. ♦Refer to paragraph 1.03, Caution 2.♦
- (14) Install the CURRENT LIMIT AND SIMULATED OUTPUT CURRENT (CP6) circuit pack in the rectifier.
- (15) After completing the associated checks (checks requiring test mode of operation), restore the rectifier to the normal mode of operation in accordance with 4.01.

4.13 AC Input Voltage Monitor Check:

To check the ac input voltage monitor circuit, proceed as follows.

♦**Danger:** These fuses have an ac potential present at the fuseholder whenever ac input power is applied to the rectifier. Exercise care when removing or inserting a fuse.

- (1) Put the rectifier in the test mode of operation in accordance with 4.01.
- (2) Rotate the SIMULATED OUTPUT CURRENT (R25) potentiometer to its fully ccw position.

Note: Allow the rectifier to operate for at least 15 seconds before operating the SIMULATED OUTPUT CURRENT (S2) switch to the ON position.

- (3) Operate the SIMULATED OUTPUT CURRENT (S2) switch to the ON position.

Requirement: The SIMULATED OUTPUT CURRENT ON lamp lights, the OFF lamp is extinguished, and the OUTPUT CURRENT (M1) ammeter indicates less than 200 amperes.♦

- (4) Remove one of the AC INPUT VOLTAGE MONITOR fuses (F1, F2, or F3) from its respective fuse holder.

Requirement: The rectifier shuts down. The POWER ON (blue) and POWER OFF (white) lamps are lighted.

Note: When the rectifier shuts down, the indicator on the OUTPUT CURRENT (M1) ammeter swings to zero.

- (5) Install the removed fuse in its respective fuse holder.

Requirement: The rectifier restarts. The POWER ON (blue) lamp is lighted and the POWER OFF (white) lamp is extinguished.

- (6) Repeat the procedures in (4) and (5) for each of the remaining fuses in (4).

4.14 High Voltage Monitor Check: To check the rectifier high voltage monitor circuit, proceed as follows.

- (1) ♦Put the rectifier in the test mode of operation in accordance with 4.01 except leave the POWER ON/OFF (S1) switch in the POWER OFF position.♦
- (2) Remove the HIGH VOLTAGE MONITOR (CP8) circuit pack from the rectifier. ♦Refer to Paragraph 1.03, Caution 2.♦

(3) Install the associated printed board extender and the HIGH VOLTAGE MONITOR (CP8) circuit pack in the rectifier.

(4) Connect a jumper between TP19 and TP28 (ground) board extender.

(5) Connect a jumper from terminal 3 on the HIGH VOLTAGE MONITOR ADJUST (R24) potentiometer to the rectifier -TEST lug.

(6) Connect the KS-14510 volt-ohm-milliammeter, set on the 12 DC VOLTS scale, between TP6 (positive) and TP7 (negative) on the HIGH VOLTAGE MONITOR (CP8) circuit pack.

Note: The KS-14510 meter may indicate a slightly negative voltage.

(7) Connect the KS-8039 volt-milliammeter, set on 75 VOLTS scale, to the rectifier +SENSE (TP1) and -SENSE (TP2) test jacks.

(8) Verify that the SIMULATED OUTPUT CURRENT (R25) potentiometer is rotated fully ccw.

Requirement: The TEST (white) lamp lights.

(9) Operate the POWER ON/OFF (S1) switch to the POWER ON position.

Requirement: The POWER ON (blue) lamp lights and the POWER OFF (white) lamp extinguishes.

(10) Allow the rectifier to operate for at least 15 seconds and then operate the SIMULATED OUTPUT CURRENT (S2) switch to the ON position.

Requirement: The SIMULATED OUTPUT CURRENT ON (white) lamp lights, the SIMULATED OUTPUT CURRENT OFF (white) lamp extinguishes and the OUTPUT CURRENT (M1) ammeter indicates less than 200 amperes.

(11) Loosen the locking device on the OUTPUT VOLTS ADJUST (R22) potentiometer and very slowly rotate the potentiometer cw until the indicators on the OUTPUT CURRENT (M1) ammeter and OUTPUT VOLTAGE (M2) voltmeter

swing toward zero indicating that the rectifier is shut down.

Requirement: The KS-8039 meter indicates between 51.3 and 51.9 volts for the L11 and L12 rectifiers and between 53.5 and 54.1 volts for the L21 and L22 rectifiers when the rectifier shutdown occurs. After a time delay of 0.5 to 1 second (following rectifier shutdown), the KS-14510 meter indicates approximately 9.6 volts, indicating that the high voltage (HV) relay has operated.

Note 1: The POWER ON (blue) lamp is lighted and the POWER OFF (white) and RECT FAIL (white) lamps will be lighted if the rectifier has shut down.

Note 2: The HIGH VOLTAGE MONITOR ADJUST (R24) potentiometer is factory adjusted and does not generally require field adjustment. If the requirement in (11) is met, rotate the OUTPUT VOLTS ADJUST (R22) and SIMULATED OUTPUT CURRENT (R25) potentiometers fully ccw and proceed to (19). If the requirement is not met (rectifier not shut down), rotate the OUTPUT VOLTS ADJUST (R22) and SIMULATED OUTPUT CURRENT (R25) potentiometers fully ccw and proceed to (14). If the requirement is not met (rectifier shuts down), rotate the OUTPUT VOLTS ADJUST (R22) and SIMULATED OUTPUT CURRENT (R25) potentiometer fully ccw and continue with (12).

(12) Operate the POWER ON/OFF (S1) switch to the POWER OFF position and then back to the POWER ON position.

(13) Loosen the locking device on the HIGH VOLTAGE MONITOR ADJUST (R24) potentiometer and rotate the potentiometer fully cw.

(14) Rotate the OUTPUT VOLTS ADJUST (R22) potentiometer cw until the KS-8039 meter indicates 51.6 volts for the L11 and L12 rectifiers and 53.8 volts for the L21 and L22 rectifiers.

(15) Very slowly rotate the HIGH VOLTAGE MONITOR ADJUST (R24) potentiometer ccw until the indicators on the OUTPUT CURRENT (M1) ammeter and on the OUTPUT VOLTAGE (M2) voltmeter and KS-8039 meter

swing toward zero indicating that the rectifier has shut down.

Requirement: After a time delay of 0.5 to 1 second (following rectifier shutdown), the KS-14510 meter indicates approximately 9.6 volts, indicating that the high voltage (HV) relay has operated.

Note: The POWER ON (blue), POWER OFF (white), and RECT FAIL (white) lamps should be lighted.

- (16) Rotate the OUTPUT VOLTS ADJUST (R22) potentiometer fully ccw.
- (17) Operate the POWER ON/OFF (S1) switch to the POWER OFF position and then back to the POWER ON position.
- (18) Tighten the locking device on the HIGH VOLTAGE MONITOR ADJUST (R24) potentiometer and repeat (11).
- (19) Operate the POWER ON/OFF (S1) switch to the POWER OFF position.

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

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

Requirement: The TEST (white) lamp extinguishes.

- (21) Disconnect the KS-14510 meter from the rectifier.
- (22) Remove the jumper that is connected from terminal 3 on the HIGH VOLTAGE MONITOR ADJUST (R24) potentiometer to the rectifier -TEST lug.
- (23) Remove the jumper that is connected from TP19 to TP28 (ground) on the associated printed board extender.
- (24) Remove the HIGH VOLTAGE MONITOR (CP8) circuit pack and the associated printed board extender from the rectifier. ♦Refer to Paragraph 1.03, Caution 2.♦

- (25) Install the HIGH VOLTAGE MONITOR (CP8) circuit pack in the rectifier.

- (26) Operate the DC OUTPUT (S3) switch to the TEST position.

Requirement: The TEST (white) lamp lights and SIMULATED OUTPUT CURRENT OFF (white) lamp lights.♦

- (27) Operate the POWER ON/OFF (S1) switch to the POWER ON position.

Requirement: The POWER ON (white) lamp lights, the TEST (white) lamp is lighted, and the POWER OFF (white) lamp extinguishes.

- (28) Allow the rectifier to operate for at least 15 seconds and then operate the SIMULATED OUTPUT CURRENT (S2) switch to the ON position.

Requirement: The SIMULATED OUTPUT CURRENT ON (white) lamp lights and the SIMULATED OUTPUT CURRENT OFF (white) lamp extinguishes.

- (29) Rotate the OUTPUT VOLTS ADJUST (R22) potentiometer cw until the KS-8039 meter indicates the voltage requirement specified in the associated power plant Bell System Practice. If a plant requirement is not given, rotate the potentiometer cw until the KS-8039 meter indicates 49.9 volts for the L11 and L12 rectifiers or 52.1 volts for the L21 and L22 rectifiers.

- (30) Tighten the locking device on the OUTPUT VOLTS ADJUST (R22) potentiometer, being careful not to disturb the setting.

Note: When the rectifier shuts down, the indicator on the OUTPUT CURRENT (M1) ammeter swings to zero.

- (31) After completing the associated checks (checks requiring test mode of operation), restore the rectifier to the normal mode of operation in accordance with 4.01.

4.15 ♦AUX DC Power Supply Fuse♦ Check:
To check the AUX DC power supply circuit, proceed as follows.

⚠Danger: These fuses have an ac potential present at the fuseholder whenever ac input power is applied to the rectifier. Exercise care when removing or inserting a fuse with the POWER ON/OFF (S1) switch operated to the ON position.

- (1) Put the rectifier in the test mode of operation in accordance with 4.01.
- (2) Rotate the SIMULATED OUTPUT CURRENT (R25) potentiometer fully ccw.

Note: Allow the rectifier to operate for at least 15 seconds before operating the SIMULATED OUTPUT CURRENT (S2) switch to the ON position.

- (3) Operate the SIMULATED OUTPUT CURRENT (S2) switch to the ON position.

Requirement: The SIMULATED OUTPUT CURRENT ON lamp lights, the OFF lamp is extinguished, and the OUTPUT CURRENT (M1) ammeter indicates less than 200 amperes.⚡

- (4) Remove one of the AUX DC POWER SUPPLY fuses (F4, F5, or F6) from its respective fuse holder.

Requirement: The rectifier shuts down and locks out. The POWER ON (blue) lamp is lighted and the RECT FAIL (white) lamp lights.

Note: When the rectifier shuts down, the indicator on the OUTPUT CURRENT (M1) ammeter swings to zero.

- (5) Install the fuse that was removed in (1) in its respective fuse holder.

Requirement: The rectifier does not start.

- (6) Operate the POWER ON/OFF (S1) switch to the POWER OFF position.

Requirement: The POWER OFF (white) lamp lights and the RECT FAIL (white) and POWER ON (blue) lamps extinguish.

- (7) Operate the POWER ON/OFF (S1) switch to the POWER ON position.

Requirement: The rectifier restarts. The POWER ON (blue) lamp lights, and the POWER OFF (white) lamp extinguishes.

- (8) Repeat the procedures in (4) through (8) for each of the remaining fuses in (4).

5. TROUBLES

5.01 When trouble conditions develop in the rectifier, it is necessary to first decide whether to locate the troubles with the rectifier operating or de-energized. Some components in the rectifier may become overheated when the rectifier is operated for more than a few minutes with trouble conditions existing in the equipment. If the trouble is of a nature that causes excessive output from the rectifier, take the initial steps with the rectifier de-energized and energize the rectifier for short periods of time only in order to make electrical measurements. It is essential, when testing, to be alert to the need for quickly shutting the rectifier down at any time until the trouble is localized and cleared.

Warning: In making continuity checks, use the ohmmeter portion of the KS-14510 volt-ohm-milliammeter. Do not use the X10,000 position for testing semiconductors as the higher voltage may damage them.

5.02 When trouble conditions exist in a circuit pack, replace the circuit pack with a unit that is repaired and adjusted in accordance with factory specifications at a location authorized to perform these repairs and adjustments. When it is necessary to replace or test a circuit pack, refer to Section 032-173-301.

Warning 1: Before removing or inserting a circuit pack in the rectifier, first ⚡remove fuse (F8) and then⚡ operate the POWER ON/OFF (S1) switch and then the DC OUTPUT (S3) switch to their OFF positions. ⚡Re-install fuse (F8) when the circuit pack is in place.⚡

Warning 2: Verify that the POWER ON/OFF (S1) switch is in the OFF position before operating the DC OUTPUT (S3) switch from one position to another.

SECTION 169-741-301

5.03 Should any of the following troubles develop, it is suggested that the possible causes be checked in the order given. If the trouble is not found, check for loose or open connections, improperly seated circuit packs, or short circuits due to foreign

matter lying across wiring terminals. This list is not all-inclusive. For a more comprehensive analysis of a possible trouble condition in the rectifier, see Section 169-741-311.

TROUBLE	LAMP INDICATION	POSSIBLE CAUSE
(a) No dc output voltage from the rectifier (rectifier shut down)	POWER ON (blue) POWER OFF (white)	<p>No ac input power to the rectifier.</p> <p>AC INPUT CONTACTOR →(ST3)← defective.</p> <p>Low ac input power to the rectifier.</p> <p>AC INPUT VOLTAGE MONITOR fuse, F1, F2, or F3 blown.</p> <p>AC INPUT VOLTAGE MONITOR CIRCUIT (CP9) circuit pack defective.</p>
(b) No dc output voltage from the rectifier (rectifier shut down and locked out)	POWER ON (blue) POWER OFF (white) RECT FAIL	<p>DC OUTPUT (S3) switch not in the TEST, BAT, or EC (EC in L11 and L12 rectifier only) position.</p> <p>OUTPUT VOLTS ADJUST (R22) potentiometer set for high output voltage causing rectifier to shut down.</p> <p>Any of the circuit packs except CP7 removed from rectifier.</p> <p>Input battery voltage exceeds a maximum limit and rectifier is carrying 10 percent or more of its rated load.</p> <p>OUTPUT CAPACITOR fuse, F12 or F14 blown.</p> <p>AUX DC POWER SUPPLY fuse F4, F5, or F6 blown.</p> <p>DC OUTPUT ALARM fuse F7 blown.</p> <p>OUTPUT VOLTAGE fuse F9 blown.</p>

TROUBLE	LAMP INDICATION	POSSIBLE CAUSE
		-SENSE fuse F10 blown.
		RELAY AND ALARM fuse F8 blown.
		HIGH VOLTAGE MONITOR ADJUST (R24) potentiometer not properly adjusted.
		AUX DC POWER SUPPLY (CP1) circuit pack defective.
		VOLTAGE REGULATOR (CP5) circuit pack defective.
		PULSE (CP2) circuit pack defective.
(c) Low dc output voltage from the rectifier.	POWER ON (blue)	OUTPUT VOLTS ADJUST (R22) potentiometer not properly adjusted.
		Improper main transformer (T1) tap connections.
		VOLTAGE REGULATOR (CP5) circuit pack defective.
(d) High dc output voltage from the rectifier.	POWER ON (blue)	OUTPUT VOLTS ADJUST (R22) potentiometer not properly adjusted.
		Improper main transformer (T1) tap connections.
		VOLTAGE REGULATOR (CP5) circuit pack defective.
(e) Rectifier not limiting full load current properly.	POWER ON (blue)	CURRENT LIMIT (FULL LOAD) (R23) potentiometer not properly adjusted.
		CURRENT LIMIT AND SIMULATED OUTPUT CURRENT (CP6) circuit pack defective.
(f) Rectifier not limiting partial load current properly (L11 and L12 rectifiers only).	POWER ON (blue)	CURRENT LIMIT (PARTIAL LOAD) (R34) potentiometer not properly adjusted.
		CURRENT LIMIT AND SIMULATED OUTPUT CURRENT (CP6) circuit pack defective.