RECTIFIERS
KS-19210 L23 AND L24
+24 VOLTS, 400 AMPERES
OPERATING METHODS

1. GENERAL

1.01 The KS-19210 L23 and L24 rectifiers provide a regulated, positive 24-volt dc output for automatically floating and charging a 12-cell central office battery. The rectifiers are primarily intended for use in the 326A and 326B power plants.

1.02 This issue does affect the Equipment Test List.

1.03 The KS-19210 L23 and L24 rectifiers are rated at 24 volts, 400 amperes dc. These rectifiers will provide a maximum of 28.6 volts at full load. The input requirement is 3-phase, 3-wire, 60-Hz ±2 percent ac. The nominal ac input voltage is 208/240 volts for L23 or 480 volts for L24. The rectifier operates within the absolute input limits of 189 to 253 volts ac for L23 and 432 to 504 volts ac for L24.

> ***Warning: The voltages inside the rectifier cabinet 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 or dangerous short circuits may occur.***

1.04 The KS-19210 L23 and L24 rectifiers are designed for continuous automatic operation with the output connected to the battery and load. The rectifiers will operate under manual control [AUTO-MAN (S2) key in MAN position] to bypass certain automatic features. In the automatic mode of operation, the rectifier transmits signals to the plant and responds to signals from the plant.

1.05 The rectifiers can operate with the output disconnected from the battery and load (S1 switch in OFF position) for test purposes. In the test mode of operation, various current-dependent controls can be checked with the load simulator circuit without actually loading the rectifier.

1.06 This issue of the section is based on the following drawing: SD-81627-02, 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 that is associated with an earlier or later issue of the schematic 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 detailed information on operation and maintenance of the 326A or 326B power plants, refer to Section 167-624-301.

2. LIST OF TOOL AND TEST APPARATUS

CODE OR SPEC NO.	DESCRIPTION
TOOLS	
—	3-Inch C Screwdriver
—	Resistor (1800-ohm, 2-watt)
—	Resistor (10-ohm, 50-watt)
—	Fuse (6-ampere, 125-volt dc)
—	Switch (15-ampere, 125-volt dc)
TEST APPARATUS	
*KS-8039	DC Volt-Milliammeter
*KS-14510	Volt-Ohm-Milliammeter

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

3. OPERATION

3.01 ***Preparing to Start:*** When preparing to put the rectifier in service, check the following. (Refer to Fig. 1.)

(a) The controls are positioned as follows:

OFF-NOR (S4) Switch to OFF

DC OUTPUT (S1) Switch to OFF

AUTO-MAN (S2) Key to AUTO

NOR-TST (S5) Key to TST

CC TST (ON-OFF) (S3) Switch to OFF

CC TST (R36) Potentiometer to fully counterclockwise (ccw)

MAN ADJ (R17) Potentiometer to fully ccw

CONT (CB1) Circuit Breaker to OFF

Associated AC Switch and Fuse Unit in bus duct or power service cabinet to OFF

Note: Do not disturb the setting of any other control at this time.

(b) The T1 input transformer taps have been selected to match the ac input voltage.

(c) All associated fuses are installed in their respective fuse holders.

Later model KS-19210 L23 and L24 rectifiers are not equipped with the VM1 OUTPUT voltmeter. When not equipped with the VM1 voltmeter, test jacks J11 and J12 are provided on the meter panel to measure the rectifier output voltage.

3.02 ***Charging Output Filter Capacitors:*** This procedure charges the output filter capacitors, preventing arcing when closing the DC OUTPUT (S1) switch to the BAT position from the OFF position.

(1) Verify that the rectifier controls are positioned as listed in 3.01.

(2) Remove the CAP ALM (F6), 1 1/3-ampere fuse, and then the CAP (F4), 30-ampere fuse. (Refer to Fig. 2.)

Note: This isolates the output filter capacitor blank to permit operation of the DC OUTPUT (S1) switch.

(3) Operate the DC OUTPUT (S1) switch to the BAT position.

Caution: The output filter capacitors are not charged and must be charged prior to installing the CAP (F4) fuse in its fuse holder. The filter capacitors are charged by connecting a jumper across the F4 fuse holder as given in (4).

Note: The jumper used in this procedure is a series connection of a resistor (10-ohm, 50-watt), 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.

(4) ***Caution: To prevent shorting the jumper with other parts of the rectifier, always make the battery (+) connection last.***

Connect the jumper (jumper switch in ***off*** position) from the common positive (+) connection of capacitors C5-C15 to terminal 2 of the L8 inductor. (Refer to Fig. 2.)

(5) Operate the jumper switch to the ***on*** position.

(6) Wait approximately 1 minute to ensure that the filter capacitors are charged and then install the CAP F4, 30-ampere fuse in its fuse holder.

(7) Operate the jumper switch to the off (open) position.

(8) Disconnect the capacitor charging jumper from the rectifier.

(9) Install the CAP ALM (F6) fuse in its fuse holder.

3.03 ***Starting:*** To start the rectifier, proceed as follows.

(a) ***Automatic Operation***

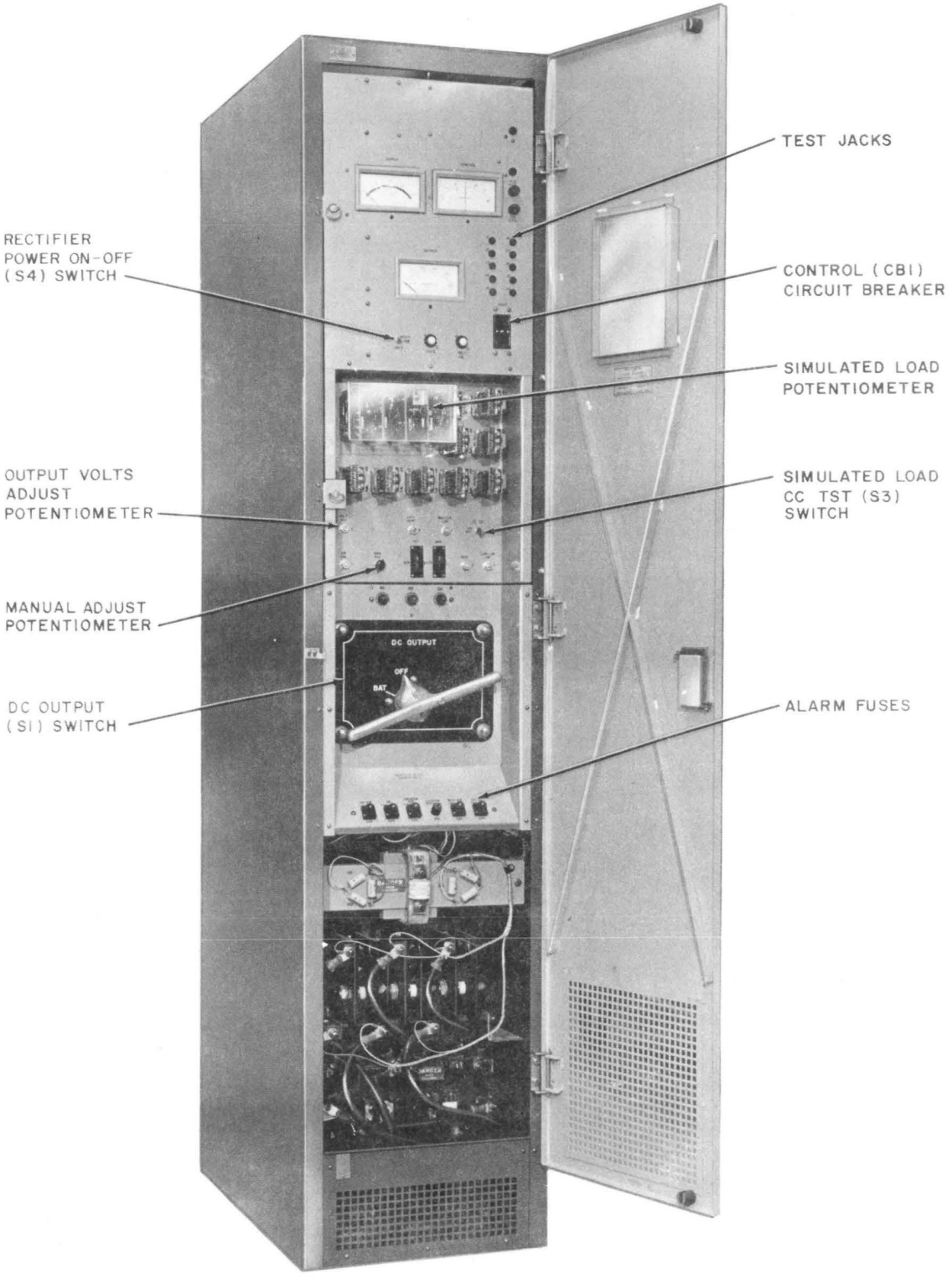

Fig. 1—KS-19210 L23 Rectifier—Front View—Door Open

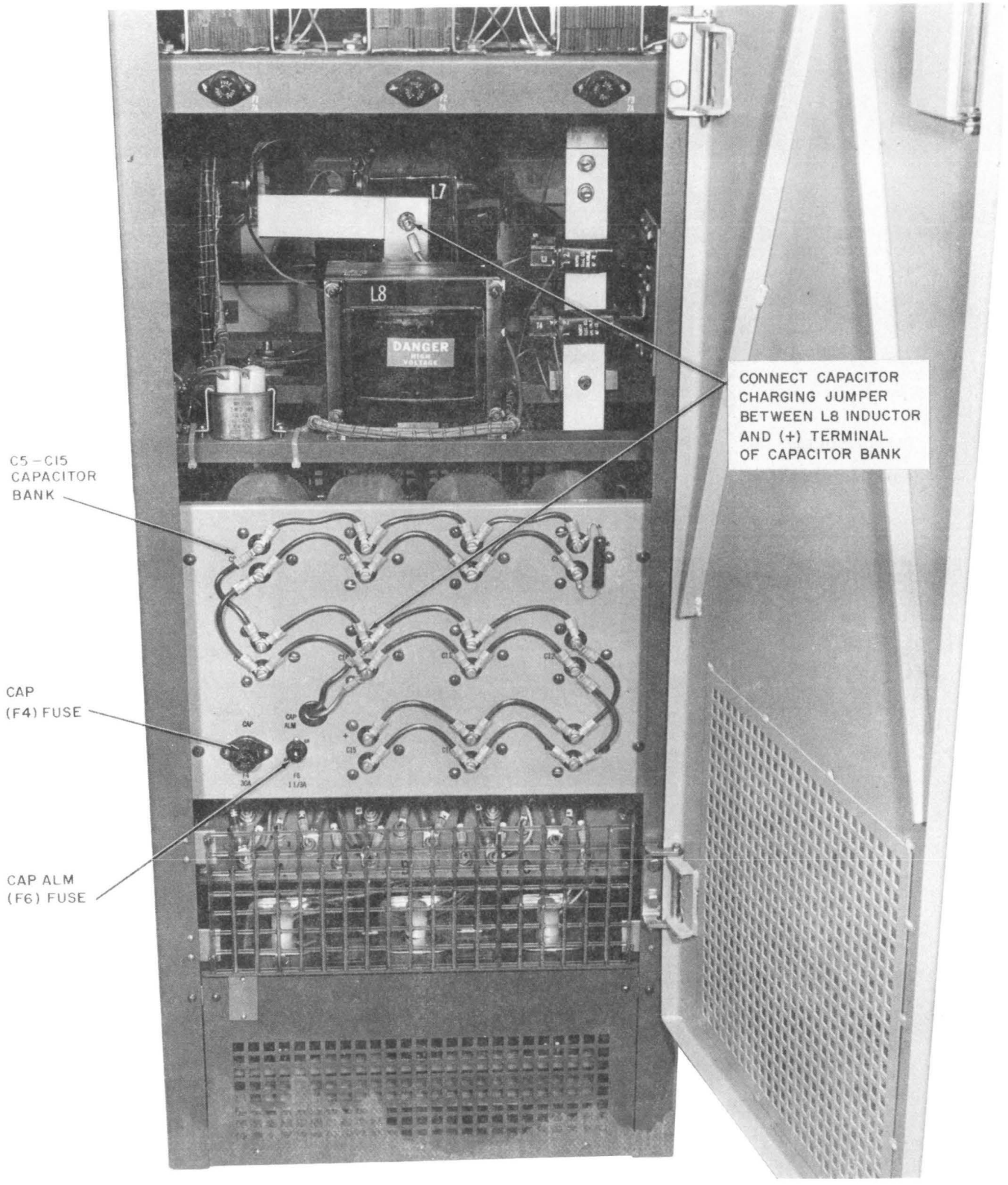

Fig. 2—KS-19210 L23 Rectifier—Partial Rear View—Door Open

(1) Verify that the rectifier controls are positioned as listed in 3.01.

(2) Operate the associated ac switch and fuse unit located in the bus duct or power service cabinet to the ON position.

(3) Connect the KS-8039 volt-milliammeter (or digital meter), set on the 30 VOLTS DC scale, across the terminals of the VM1 OUTPUT voltmeter (or the J11 and J12 test jacks).

(4) Operate the CONT (CB1) circuit breaker to the ON position.

(5) Operate the OFF-NOR (S4) switch to the NOR position.

Note: The nominal float voltage for the battery in a standard plant is usually 2.17 volts per cell. For additional information on the required float voltage, refer to Section 157-601-301.

(6) Adjust, as required, the VOLT ADJ (R26) potentiometer until the test meter indicates the float voltage (typical 26.04 volts dc) as specified in the power plant Bell System Practice.

Note: The rectifier output voltage, set when the rectifier is in the test mode, may increase as much as 1 volt when the rectifier is connected to the battery (S1 switch to BAT). If the voltage increase (due to the plant sense control circuit) is enough to cause high voltage shutdown of the rectifier during starting, the VOLT ADJ (R26) potentiometer should be adjusted slightly ccw just before starting. After the rectifier is started, the output voltage should be readjusted upward to the float value as specified in the power plant Bell System Practice.

(7) Operate the OFF-NOR (S4) switch to the OFF position.

(8) Operate the CONT (CB1) circuit breaker to the OFF position.

(9) Charge the output filter capacitors and operate the DC OUTPUT (S1) switch to the BAT position in accordance with 3.02.

(10) Operate the associated ac switch and fuse unit located in the bus duct or power service cabinet to the ON position.

(11) Operate the CONT (CB1) circuit breaker to the ON position.

(12) Verify that the AUTO-MAN (S2) key is in the AUTO position.

(13) Operate the NOR-TST (S5) key to the NOR position.

(14) In accordance with the power plant Bell System Practice, operate the OFF-NOR (S4) switch to the NOR position.

(15) Observe the associated power plant output voltmeter for the desired float voltage as specified in the power plant Bell System Practice.

Note: The associated power plant output voltmeter indicates the actual voltage that is available to the battery. The plant voltmeter and the test meter connected at the rectifier VM1 OUTPUT voltmeter (or J11 and J12 test jacks) may not indicate the same voltage due to loop voltage drop of the charge leads.

(16) If the rectifier is not supplying the required output to the battery, follow the procedure in the power plant Bell System Practice and adjust the VOLT ADJ (R26) potentiometer until the rectifier is supplying the required output to the battery.

(17) Disconnect the test meter from the rectifier.

(b) ***Manual Operation:*** With the rectifier adjusted in accordance with (a), the rectifier is placed in the manual mode of operation as follows.

Caution: An operator must be on duty continuously when the rectifier is operating in the manual mode. Manual operation is intended for trouble-locating procedures or to maintain the rectifier in service if trouble exists in the control circuit. During manual operation, the MAN ADJ (R17) potentiometer must be operated clockwise (cw) or ccw to maintain the required output

voltage. The MAN ADJ (R17) potentiometer should be fully ccw before operating the AUTO-MAN (S2) key from one position to another.

(1) Place the rectifier in the manual mode of operation in accordance with the power plant Bell System Practice.

(2) Operate the NOR-TST (S5) key to the TST position.

(3) Operate the AUTO-MAN (S2) key to the MAN position.

(4) Rotate the MAN ADJ (R17) potentiometer cw until the plant float voltage requirement is met.

3.04 ***Removing From Service:*** To remove the rectifier from plant service, proceed as follows.

(1) Refer to the power plant Bell System Practice and operate the OFF-NOR (S4) switch to the OFF position.

(2) If the rectifier is to remain out of service, operate the CONT (CB1) circuit breaker to the OFF position and operate the DC OUTPUT (S1) switch to the OFF position.

Caution: If the rectifier is to remain out of service for an extended period of time, 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.

3.05 ***Restoring To Service:*** To restore the rectifier to plant service, refer to 3.03 and the power plant Bell System Practice.

4. ROUTINE CHECKS

4.01 The following routine checks should be made in accordance with the Equipment Test List, or after the rectifier has been out of service for an extended period of time and is to be returned to service, or if maintenance is performed which may affect the settings of the rectifier controls.

4.02 ***Ventilating Passages:*** Keep the ventilating passages of the rectifier unobstructed to ensure adequate cooling during operation. The interior of the rectifier should be cleaned periodically while the rectifier is shut down. Remove dust from all accessible components inside the rectifier cabinet with a long handle, blade-type brush. Using a suitable vacuum cleaner, vacuum the floor area inside the rectifier cabinet to remove all dust and dirt. The period between cleaning should be determined by local conditions.

4.03 ***Contactor and Relays:*** As often as local experience demands, the AC contactor and relays should be inspected for adjustment and condition of contacts, making sure they are in accordance with the circuit requirement table and the appropriate Bell System Practice.

4.04 ***DC OUTPUT (S1) Switch:*** Inspect, test, clean, and lubricate the S1 switch in accordance with the procedures outlined in Section 169-704-701.

4.05 ***Output Voltage Adjustment***

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

(2) Operate the OFF-NOR (S4) switch to the OFF position.

(3) Operate the DC OUTPUT (S1) switch to the OFF position.

Note: The AUTO-MAN (S2) key should be in the AUTO position and the MAN ADJ (R17) potentiometer should be fully ccw.

(4) Connect the KS-8039 volt-milliammeter (or digital meter), set on 30 VOLTS DC scale, across the terminals of the VM1 OUTPUT voltmeter (or the J11 and J12 test jacks).

(5) Operate the NOR-TST (S5) key to the TST position.

(6) Operate the OFF-NOR (S4) switch to the NOR position.

(7) Adjust as required the VOLT ADJ (R26) potentiometer until the test meter indicates the required float voltage. This voltage is equal to 2.17 volts per cell (26.04 volts dc) or the float value specified in the power plant Bell System Practice.

(8) If the rectifier is equipped with the VM1 OUTPUT voltmeter, adjust the zero adjust on the VM1 voltmeter as required until its indication agrees with the indication on the test meter.

(9) Operate the simulated current CC TST (ON-OFF) (S3) switch to ON and if necessary hold operated.

(10) Rotate the simulated current CC TST (R36) potentiometer cw until the AM1 ammeter indicates 400 amperes.

Requirement: The test meter should still indicate the voltage value set in (7). [A minor readjustment of the VOLT ADJ (R26) potentiometer is permissible.]

(11) Release the CC TST (S3) switch and rotate the CC TST (R36) potentiometer fully ccw.

(12) Operate the OFF-NOR (S4) switch to the OFF position.

(13) Disconnect the test meter from the rectifier.

(14) To start the rectifier, perform 3.03(a)(9) through (17).

4.06 ***Maximum Current Limit Check***

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

(2) Operate the OFF-NOR (S4) switch to the OFF position.

(3) Operate the DC OUTPUT (S1) switch to the OFF position.

Note: The AUTO-MAN (S2) key should be in the AUTO position and the MAN ADJ (R17) potentiometer should be fully ccw. The VOLT ADJ (R26) potentiometer should be set for float voltage.

(4) Connect the KS-8039 volt-milliammeter (or digital meter), set on 30-VOLTS DC scale, across the terminals of the VM1 OUTPUT voltmeter (or the J11 and J12 test jacks).

(5) Operate the NOR-TST (S5) key to the TST position.

(6) Operate the OFF-NOR (S4) switch to the NOR position.

Requirement: The test meter should indicate float voltage (typical 26.04 volts dc).

(7) Operate the simulated current CC TST (ON-OFF) (S3) switch to ON and if necessary hold operated.

(8) Rotate the simulated current CC TST (R36) potentiometer cw until the voltage indicated on the test meter dips to 25.75 $\pm$0.25 volts dc.

Requirement: The AM1 ammeter indicates 420 $\pm$10 amperes. The control current AM2 ammeter (if equipped) deflects negatively.

Note: If the requirement is met in (8), proceed to (13). If the requirement is not met, continue with (9).

(9) Rotate the MAX CUR LIM (R39) potentiometer slightly cw.

(10) Adjust the CC TST (R36) potentiometer until the AM1 ammeter indicates 420 amperes.

(11) Rotate the MAX CUR LIM (R39) potentiometer slowly ccw until the voltage indication on the test meter dips to 25.75 $\pm$0.25 volts dc.

Requirement: The AM1 ammeter indicates 420 $\pm$10 amperes and the AM2 ammeter (if equipped) deflects negatively.

(12) Rotate the CC TST (R36) potentiometer fully ccw and then repeat (8) to check the setting.

Note: If necessary, perform (9) through (11) until the output voltage dips at the 420-ampere level.

(13) Release the CC TST (S3) switch and rotate the CC TST (R36) potentiometer fully ccw.

(14) Operate the OFF-NOR (S4) switch to the OFF position.

(15) Disconnect the test meter from the rectifier.

(16) To start the rectifier, perform 3.03.

4.07 ***Minimum Load Signal Check***

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

(2) Operate the OFF-NOR (S4) switch to the OFF position.

(3) Operate the DC OUTPUT (S1) switch to the OFF position.

Note: The AUTO-MAN (S2) key should be in the AUTO position and the MAN ADJ (R17) potentiometer should be fully ccw.

(4) Operate the NOR-TST (S5) key to the TST position.

(5) Operate the OFF-NOR (S4) switch to the NOR position.

(6) Operate the simulated current CC TST (ON-OFF) (S3) switch to ON and if necessary hold operated.

(7) Rotate the simulated current CC TST (R36) potentiometer cw until the K13 relay releases and then slowly ccw until the K13 relay operates.

Requirement: The AM1 ammeter indicates 40 $\pm$5 amperes.

Note: If the requirement is met in (7), proceed to (11). If the requirement is not met, continue with (8).

(8) Adjust the CC TST (R36) potentiometer until the AM1 ammeter indicates 40 amperes.

(9) If the K13 relay is operated, rotate the MIN LD SIG (R56) potentiometer cw until the K13 relay releases and then ccw until the relay operates. If the K13 relay is released, rotate the MIN LD SIG (R56) potentiometer ccw until the K13 relay operates.

(10) Rotate the CC TST (R36) fully ccw and repeat (7) to check the setting.

(11) Release the CC TST (S3) switch and rotate the CC TST (R36) potentiometer fully ccw.

(12) Operate the OFF-NOR (S4) switch to the OFF position.

(13) To start the rectifier, perform 3.03.

4.08 ***High Voltage Monitor Check***

Note: The high voltage monitor circuit limits the output of the rectifier if the battery voltage exceeds 27.2 volts dc. If the high voltage condition persists for more than one second, the high voltage monitor will shut down and lock out the rectifier when the rectifier is supplying 40 amperes or more load current.

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

(2) Operate the OFF-NOR (S4) switch to the OFF position.

(3) Operate the DC OUTPUT (S1) switch to the OFF position.

(4) Operate the NOR-TST (S5) key to the TST position.

With the NOR-TST (S5) key in the TST position, the high voltage monitor senses voltage at the output terminals of rectifiers with serial numbers 149 and higher. Early model KS-19210 L23 and L24 rectifiers (serial numbers 124 through 148) sense voltage at the battery.

(5) If the rectifier has serial number 124 through 148, proceed as follows.

(a) Disconnect the plant HVB (+) and HVG (−) sense leads from terminals 11 and 12 of TS1 terminal strip.

(b) Using suitable clip leads, connect terminal 12 of TS1 terminal strip to the GRD(−) bus bar, and terminal 11 of TS1 to the CHG (F5) fuse [output (+) terminal].

(6) Connect the KS-8039 volt-milliammeter (or digital meter), set on 30 VOLTS DC scale, across the terminals of the VM1 OUTPUT voltmeter (or the J11 or J12 test jacks).

(7) Connect an 1800-ohm resistor across the J1 and J8 test jacks.

Note: The addition of the 1800-ohm resistor permits adjustment of the rectifier output voltage to 28.0 volts for test purposes.

(8) Rotate the VOLT ADJ (R26) potentiometer fully ccw.

(9) Operate the OFF-NOR (S4) switch to the NOR position.

(10) Operate the simulated current CC TST (ON-OFF) (S3) switch to ON and if necessary hold operated.

(11) Rotate the simulated current CC TST (R36) potentiometer cw until the AM1 ammeter indicates 100 amperes.

(12) Observe the test meter and slowly adjust the VOLT ADJ (R26) potentiometer cw until the rectifier shuts down.

Requirement: The test meter indicates an output voltage of 27.2 $\pm$0.1 volts dc at shutdown.

Note: If the requirement is met in (12), proceed to (25). If the rectifier shuts down at less than or greater than 27.2 $\pm$0.1 volts dc, continue with (13).

(13) Release the CC TST (S3) switch.

(14) Rotate the VOLT ADJ (R26) potentiometer fully ccw.

(15) Rotate the HIGH VOLTS ADJ (R161) potentiometer fully cw.

(16) Operate the OFF-NOR (S4) switch to OFF and then to the NOR position.

(17) Operate the CC TST (S3) switch to ON and if necessary hold operated.

Requirement: The AM1 ammeter indicates 100 amperes. [Adjust the CC TST (R36) potentiometer as required.]

(18) Rotate the VOLT ADJ (R26) potentiometer cw until the test meter indicates an output voltage of 27.2 volts dc.

(19) Slowly rotate the HIGH VOLTS ADJ (R161) potentiometer ccw until the rectifier shuts down.

(20) Release the CC TST (S3) switch.

(21) Rotate the VOLT ADJ (R26) potentiometer fully ccw.

(22) Operate the OFF-NOR (S4) switch to OFF and then to the NOR position.

(23) Operate the CC TST (S3) switch to ON and if necessary hold operated.

Requirement: The AM1 ammeter indicates 100 amperes. [Adjust the CC TST (R36) potentiometer as required.]

(24) Repeat (12) to check the high voltage setting.

Requirement: The rectifier shuts down at 27.2 $\pm$0.1 volts dc.

Note: If the requirement is met in (24), continue with (25). If the requirement is not met, readjust the high voltage setting as given in (13) through (19).

Selective Shutdown Check

(25) Release the CC TST (S3) switch and rotate the CC TST (R36) potentiometer fully ccw.

(26) Rotate the VOLT ADJ (R26) potentiometer fully ccw.

(27) Operate the OFF-NOR (S4) switch to OFF and then to the NOR position.

(28) Rotate the VOLT ADJ (R26) potentiometer fully cw.

Requirement: The rectifier should ***not*** shut down.

Note: If the requirement is met in (28), continue with (29). If the rectifier shuts down, check for proper operation of the K13 relay as given in 4.07. If the K13 relay operates properly, repeat (25) through (28) to check for selective shutdown. If the rectifier shuts down, replace the high voltage monitor circuit pack.

(29) Rotate the VOLT ADJ (R26) potentiometer fully ccw.

(30) Operate the OFF-NOR (S4) switch to the OFF position.

(31) Readjust the rectifier output voltage as given in 4.05.

4.09 ***Fuse Failure Alarm Check***

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

(2) Operate the OFF-NOR (S4) switch to the OFF position.

(3) Operate the DC OUTPUT (S1) switch to the OFF position.

(4) Operate the NOR-TST (S5) key to the TST position.

CHG ALM (F7) Fuse

(5) Remove the 70-type fuse from the CHG ALM (F7) fuse holder.

(6) Install a blown 70-type fuse in the F7 fuse holder.

(7) Operate the OFF-NOR (S4) switch to the NOR position.

Requirement: The rectifier starts and then shuts down, the OVERLOAD (DS6) lamp lights, and the plant RFA signal is given.

Note: The RFA (rectifier failure alarm) signal is provided through the release of the K22 relay in the rectifier alarm circuit. The RFA signal to the plant is either an ungrounded loop closure between the RFA and RFA RTN leads, or ground on the RFA lead as required by the plant alarm circuit.

(8) Operate the OFF-NOR (S4) switch to the OFF position.

Requirement: The OVERLOAD (DS6) lamp extinguishes and the RFA signal is removed.

(9) Remove the blown 70-type fuse from the F7 fuse holder and install the original 70-type fuse.

CAP ALM (F6) Fuse

(10) Remove the 70-type fuse from the CAP ALM (F6) fuse holder.

(11) Install a blown 70-type fuse in the F6 fuse holder.

(12) Operate the OFF-NOR (S4) switch to the NOR position.

Requirement: The rectifier starts and then shuts down, the RECT FAIL (DS5) lamp lights, and the plant RFA signal is given.

(13) Operate the OFF-NOR (S4) switch to the OFF position.

Requirement: The RECT FAIL (DS5) lamp extinguishes and the RFA signal is removed.

(14) Remove the blown 70-type fuse from the F6 fuse holder and install the original 70-type fuse.

CONTACTOR ALM (F10) Fuse and CONTROL (F12) Fuse

(15) Repeat (10) through (14) for each fuse.

RELAY (F11) Fuse

(16) Remove the 70-type fuse from the RELAY (F11) fuse holder.

Requirement: The RFA signal is given.

(17) Operate the OFF-NOR (S4) switch to the NOR position.

Requirement: The rectifier does not start. The RECT FAIL (DS5) lamp does not light.

(18) Operate the OFF-NOR (S4) switch to the OFF position.

(19) Install the original 70-type fuse in the F11 fuse holder.

Requirement: The RFA signal is removed.

(20) To start the rectifier, perform 3.03.

4.10 *Shutdown Feature-Plant TR Lead*

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

(2) Operate the OFF-NOR (S4) switch to the OFF position.

(3) Operate the DC OUTPUT (S1) switch to the OFF position.

(4) Operate the NOR-TST (S5) key to the TST position.

(5) Operate the OFF-NOR (S4) switch to the NOR position.

(6) Place a temporary frame ground, using a suitable cord to the TR lead picked up at terminal 7 of TS1 terminal strip.

Requirement: The K15 relay operates and the rectifier shuts down (K1 contactor releases). The RECT FAIL (DS5) lamp does not light.

(7) Remove the temporary frame ground from terminal 7 of TS1.

Requirement: The rectifier will start.

(8) Operate the OFF-NOR (S4) switch to the OFF position.

(9) To start the rectifier, perform 3.03.

5. TROUBLES

5.01 When a trouble is encountered in the operation of the rectifier, refer to Section 169-704-311 for trouble-locating procedures.

Caution: Cyclic hunting (fluctuation of the output) should be corrected as soon as possible to prevent damage to the rectifier.

5.02 ***Hunting:*** To stop hunting, slowly rotate the ANTI-HUNT (R21) potentiometer ccw until hunting ceases. If the rectifier still hunts after rotating the ANTI-HUNT (R21) potentiometer fully ccw, proceed as follows.

(1) Rotate the ANTI-HUNT (R21) potentiometer fully cw.

(2) Rotate the GAIN (R21) potentiometer one-eighth turn ccw.

(3) Slowly rotate the ANTI-HUNT (R21) potentiometer ccw until hunting ceases.

(4) If the rectifier still hunts after rotating the ANTI-HUNT (R21) fully ccw, repeat (1) through (3) until hunting ceases.