

**KS-21113, L1 AND L2, RECTIFIERS**  
**ITT—NORTH ELECTRIC COMPANY**  
**140 VOLTS, 200 AMPERES**  
**OPERATING METHODS**

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**1. GENERAL**

**1.01** The KS-21113, L1 and L2, rectifiers provide a regulated dc output voltage for automatically floating and charging a 70-cell, lead acid battery plant. These rectifiers are primarily intended for use in the 415A power plants but may be used wherever their characteristics and design apply. The rectifiers are designed to operate on 3-phase, 3-wire, 57 to 63 Hz ac input. When connecting the rectifiers to ac power service, positive phase rotation must be observed. The KS-21113, L1 and

L2, are positive output rectifiers and provide an adjustable output voltage of 150 to 154 volts dc, 200 amperes, or 150 to 163 volts dc, 20 amperes.

**1.02** This section is reissued to make numerous corrections, additions and deletions. Since this reissue is a general revision, no revision arrows have been used to denote significant changes. This issue affects the Equipment Test List.

***Danger 1: 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.***

***Danger 2: This rectifier includes automatically controlled equipment. Extreme care must be exercised to prevent automatic starting of those parts of the rectifier on which maintenance work is to be done. Before starting work, prevent automatic starting of equipment by removing fuses, blocking relays, opening switches, etc, as necessary. When maintenance work has been completed, make sure that the circuit has been restored to normal.***

**1.03** This rectifier is designed to be serviced and maintained from the front of the unit only. All electrical connections can be made and maintenance performed with the front covers removed (see Fig. 1). The current meter, controls, fuses, and

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printed circuit cards are mounted on a hinged control panel for access for maintenance, testing, and replacement of parts (Fig. 2).

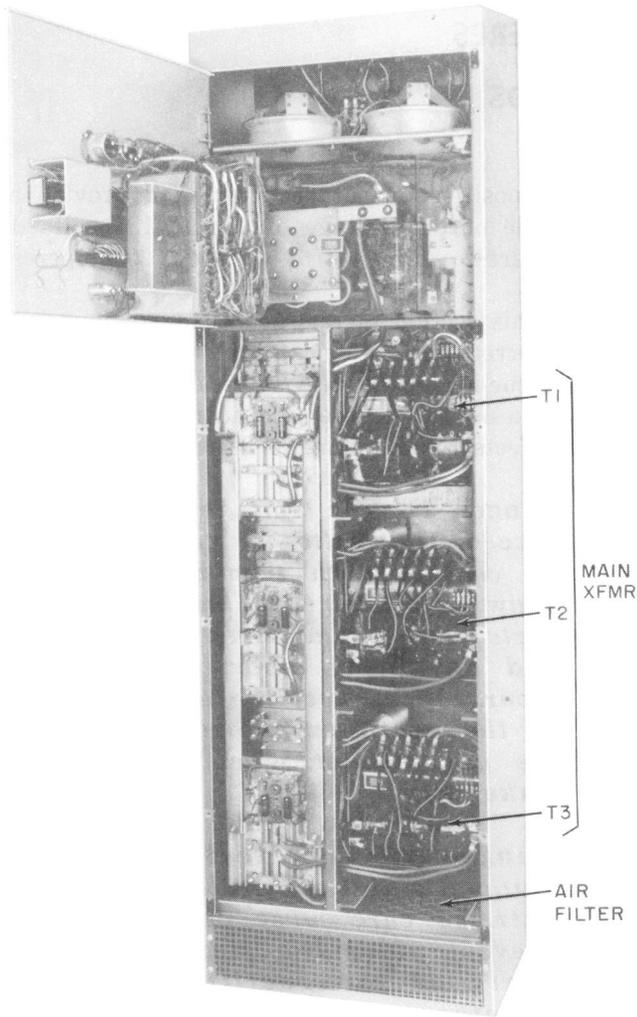


Fig. 1—KS-21113 Rectifier—Front Covers Removed

1.04 The instructions in this practice are based on circuit schematic drawing SD-82238-01, Issue 3B, for the KS-21113 rectifier. For a detailed description of operation, see the corresponding circuit description. If this section is to be used with equipment reflecting later issue(s) of the drawing, reference should be made to the SD and CD to determine the extent of the change(s) and the manner in which the section may be affected.

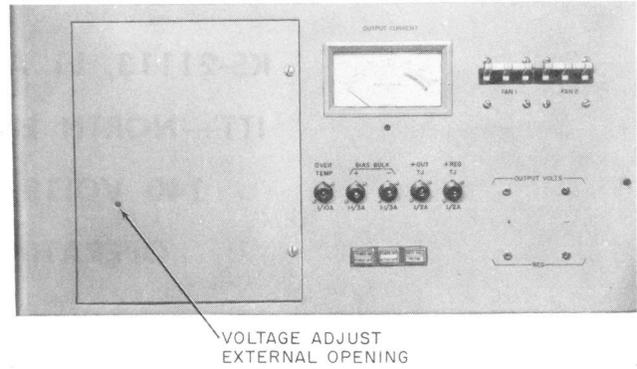


Fig. 2—KS-21113 Rectifier Control Panel

## 2. LIST OF TOOLS AND TEST EQUIPMENT

CODE OR SPEC NO.	DESCRIPTION
<b>TOOLS</b>	
—	Trimpot Screwdriver
KS-21113, L208	Extender Board
<b>TEST APPARATUS</b>	
KS-20599, L4	Digital Multimeter (4-1/2 digits minimum)
KS-21113	10-Ampere Dummy Load

## 3. OPERATION

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

- (1) The POWER ON/POWER OFF switch is in the POWER OFF position.
- (2) The associated ALM and EXTERNAL CHARGE fuses are removed from the KS-21114 bay.
- (3) The associated ac circuit breaker in the KS-21115 bay is turned off.

**Note:** Remove and set aside the lower half of the front cover. Open the hinged control panel to gain access to terminals E23 and E24.

(4) Remove the plant connector P8 (Fig. 3) from its cabinet mounted jack J8. Check for continuity between terminals 12 and 13 of jack J8. If continuity does not exist, press the POWER ON/POWER OFF switch on the rectifier and recheck for continuity. Continuity indicates that the POWER ON/POWER OFF switch is in the POWER OFF position. It should be left in the POWER OFF position.

(5) The required panel fuses are the proper value and are in their holders securely.

(6) Operate the fan circuit breakers, FAN 1 and FAN 2, to the ON position. The rectifier will not operate if these circuit breakers are in the open position.

(7) Rotate the OUTPUT VOLTS ADJUST potentiometer R302 two turns counterclockwise (ccw). This potentiometer is located on circuit card CP3.

(8) Verify that all circuit packs (Fig. 4) are inserted firmly in their respective holders.

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

**Warning 1:** Any time the rectifier is turned on, it must already be connected directly to the load box or the battery via the EXTERNAL CHARGE fuse to avoid rectifier damage.

**Warning 2:** If the rectifier is in the OFF position, and the EXTERNAL CHARGE fuse is not in place, do not insert the EXTERNAL CHARGE fuse into its fuse holder. This will cause arcing and danger to the fuse holder.

**Warning 3:** No output fusing is provided by the rectifier; under no circumstances should the rectifier be operated on battery without a KS-21114 dc distribution and control bay or other approved means of fusing.

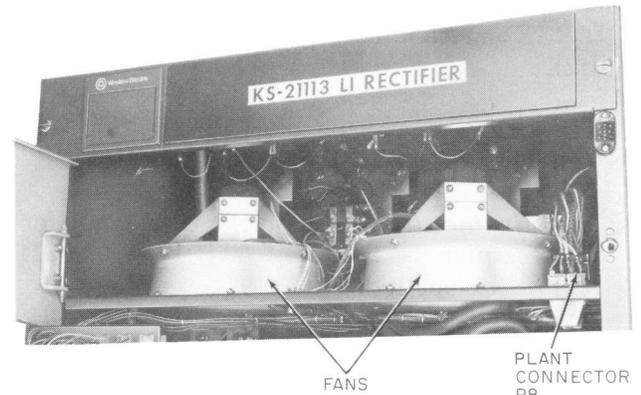


Fig. 3—KS-21113 Rectifier—Cover Removed

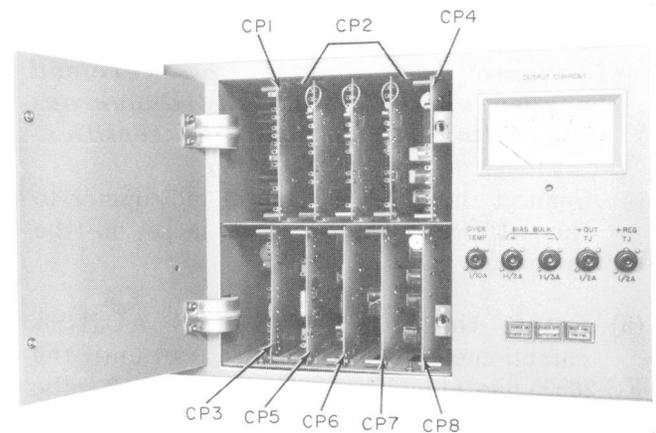


Fig. 4—KS-21113 Rectifier—Control Panel With Circuit Packs in Place

**Warning 4:** Whenever the plant connector is disconnected from its associated cabinet-mounted jack, it must not be placed on or in the adjacent fan housing. This is to avoid damage to the fan and connector.

(1) Connect the KS-21113 dummy load, supplied with the plant, to terminals E23 and E24 of the rectifier. It is not necessary to observe

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polarity. Replace the associated EXTERNAL CHARGE and ALM fuses removed in subparagraph 3.01(2).

- (2) Operate the associated ac distribution bay circuit breaker to the ON position.

**Requirement:** The POWER OFF lamp for the rectifier is lighted. The POWER ON lamp does not light.

- (3) Depress the POWER ON/POWER OFF switch in the POWER ON position to start the rectifier.

**Requirement:** The rectifier starts, the POWER OFF lamp is extinguished, and the POWER ON lamp is lighted.

**Danger: The following steps are performed with the rectifier operating. Extreme care should be exercised because of the potentially dangerous high voltage throughout the rectifier.**

- (4) Connect the KS-20599 digital multimeter to the OUTPUT VOLTS test jacks on the control panel.
- (5) Rotate the OUTPUT VOLTS ADJUST potentiometer R302 clockwise (cw) until the KS-20599 digital multimeter indicates 152.0 volts.
- (6) Disconnect the KS-20599 digital multimeter.
- (7) Install the EXTERNAL CHARGE fuse and ALM fuse (in that order) in the KS-21114 dc distribution and control bay that is associated with the rectifier being placed in service.

**Danger: The following steps are performed with battery voltage present on the rectifier bus bars.**

- (8) Shut the rectifier down by depressing the POWER ON/POWER OFF switch to the POWER OFF position.

**Requirement:** The rectifier shuts down, the POWER ON lamp is extinguished, and the POWER OFF lamp is lighted. The cooling fans are stopped.

- (9) Disconnect the 10-ampere dummy load from terminal E23 and E24 of the rectifier.

- (10) Reconnect the plant connector P8 to cabinet mounted J8. Close and secure the rectifier control panel. Remount, and secure in place, the lower half of the rectifier front cover.

- (11) Restart the rectifier by depressing the POWER ON/POWER OFF switch to the POWER ON position.

**Requirement:** The rectifier starts, the POWER OFF lamp is extinguished, and the POWER ON lamp is lighted. The cooling fans are operating.

**3.03 Shutdown:** To shut the rectifier down, proceed as follows.

- (1) Depress the POWER ON/POWER OFF switch to the POWER OFF position.

**Requirement:** The rectifier shuts down, the POWER ON lamp is extinguished, and the POWER OFF lamp is lighted.

- (2) Remove the associated ALM and EXTERNAL CHARGE fuses from the KS-21114 power distribution bay until the rectifier is placed in service again.
- (3) Operate the associated ac circuit breaker in the KS-21115 distribution bay to the OFF position.
- (4) Operate circuit breakers FAN 1 and FAN 2 on the rectifier control panel to the OFF position.

## 4. ROUTINE CHECKS AND MAINTENANCE

**4.01** Routine checks are intended to detect defects particularly in infrequently operating parts of the equipment, insofar as possible, to guard against circuit failures which interfere with service. The rectifier should be removed from service before performing maintenance checks and/or cleaning filters.

**4.02** Periodically check the output voltage on the associated power PLANT VOLTAGE meter when the unit is operating on voltage control. If the voltage is not correct, readjust the rectifier voltage as outlined in paragraph 4.05.

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

**4.04** Relays that are mounted on circuit boards can be checked by using the KS-21113, List 208, extender board furnished with the rectifier and must be replaced in case of malfunction. Periodically check all relays for condition of contacts to insure that they are in accordance with the applicable circuit requirements table and Bell System Practices.

***Danger 1: Always exercise extreme care when working on or near rectifier bus bars. Battery voltage will be present unless plant disconnect plug P8 is disconnected and the associated ALM and EXTERNAL CHARGE fuses in the KS-21114 distribution bay are removed.***

***Danger 2: AC input power is present on one side of contactor ST3.***

**4.05 Output Voltage Adjustment**, when necessary, is made as follows.

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

**Requirement:** The rectifier shuts down, the POWER ON lamp is extinguished, and the POWER OFF lamp is lighted.

- (2) Remove the associated ALM and EXTERNAL CHARGE fuses from the KS-21114 dc distribution bay.

- (3) Operate the associated ac circuit breaker in the KS-21115 bay to the OFF position.

**Requirement:** The POWER OFF lamp is extinguished.

- (4) Disconnect the plant disconnect plug P8 from its cabinet-mounted mating jack J8.

- (5) Connect the leads from the dummy load, supplied with the rectifier, to terminals E23 and E24 of the unit. It is not necessary to observe polarity.

- (6) Operate the associated ac circuit breaker in the KS-21115 bay to the ON position.

**Requirement:** The POWER OFF lamp is lighted.

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

**Requirement:** The rectifier starts, the POWER ON lamp is lighted, and the POWER OFF lamp is extinguished.

- (8) Connect the KS-20599 digital multimeter, set on the 1000-volt dc scale, to the OUTPUT VOLTS test jacks on the control panel and measure the output voltage of the rectifier.

**Requirement:** The voltage indicated on the KS-20599 digital multimeter is 152.0 volts

- (9) Adjust the OUTPUT VOLTS ADJUST potentiometer R302 as required until the KS-20599 digital multimeter indicates 152.0 volts.

- (10) Disconnect the KS-20599 meter.

**4.06 Current Limit Adjustment:** The current limiting of the rectifier is adjusted by rotating the CURRENT LIMIT ADJUST potentiometer, R318, to the desired set point while performing the output voltage adjustment in paragraph 4.05. Use the OUTPUT CURRENT meter on the rectifier control panel to monitor current limit setting.

**Requirement:** The OUTPUT CURRENT meter indicates the desired current reading.

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**Note:** The rectifier current limit is factory set at 200 amperes and should never need adjustment unless a lower current limit is desired.

### 5. TROUBLES

**5.01** The purpose of this Part is to present to the user some of the more common types of failures that may be experienced during operation of this rectifier, and to provide possible causes in an effort to aid in the restoration of normal charging functions in a minimum amount of time. All control circuitry is located on removable printed circuit cards to facilitate in localizing trouble and replacing the defective components or circuitry with a properly operating card.

**5.02** In the event of a rectifier failure with no evidence of component failure or damage, the following visual checks should be made.

(a) Examine wiring on the printed card sockets for shorts, broken wires, etc.

(b) After replacing cards, be sure all cards are securely in their sockets. The removal of any one card opens the interlock circuit and shuts the charger down.

(c) Check that all fuses are in their sockets and are not operated. All alarm fuses shut the charger down upon failure.

(d) Overheating will cause F8 fuse to operate, shutting the rectifier down. Check for visual obstruction of air flow (dirty filters) causing rectifier to overheat. Replace fuse after a cooling down period and restart rectifier.

**5.03** The trouble flow chart in Fig. 5 contains information on the more common failures and possible causes.

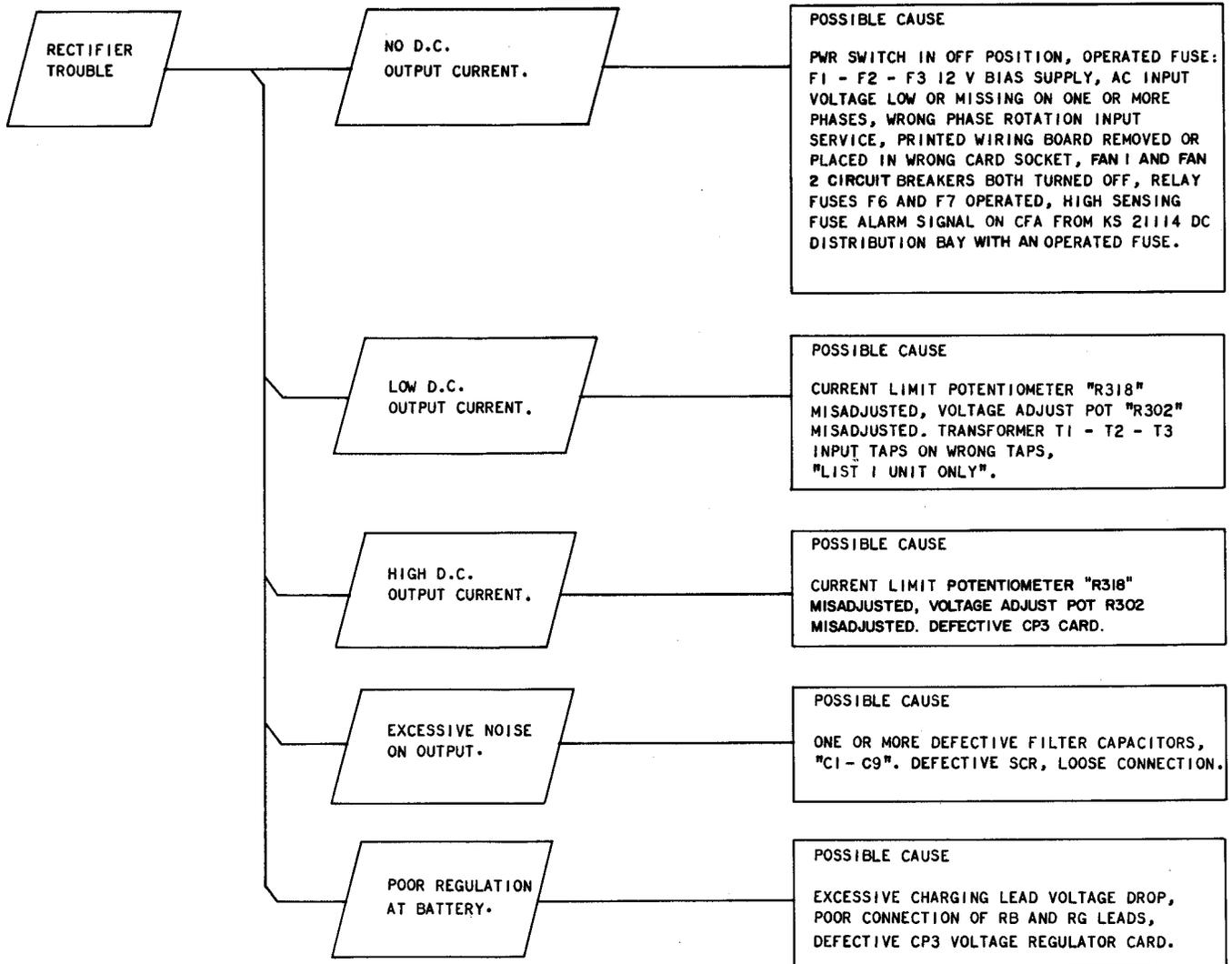


Fig. 5—Trouble Flow Chart