KS-20490 RECTIFIERS
DC OUTPUT (S1) SWITCH
TEST, INSPECTION, CLEANING, AND ADJUSTMENTS

1. GENERAL

1.01 This section provides a maintenance procedure for testing, inspecting, cleaning, and adjusting the DC OUTPUT (S1) switch of the KS-20490 rectifiers, Fig. 1.

1.02 This section does affect the Equipment Test List.

1.03 The DC OUTPUT (S1) switch should be tested and inspected at an interval specified in the Equipment Test List, or more often, if experience indicates the need.

Warning: Voltages inside the rectifier cabinet are over 150 volts to ground. Do not attempt any work operations without carefully following the procedure outlined in this section.

2. LIST OF TOOLS, TEST APPARATUS, AND MATERIALS

CODE OR SPEC NO.	DESCRIPTION
TOOLS	
R-1032	Thermometer
R-6440	Ratchet Wrench, 3/8 inch Drive Sockets, 5/16; 1/2; 9/16 inch
R-1324	Screwdriver, 3/8 inch blade
—	File, 6 inch, flat smooth cut
R-2671	Allen Wrench, 1/4 inch
TEST APPARATUS	
KS-20538	Volt-Ohm-Milliammeter or Digital Multimeter, Weston Model 1240
—	Simpson, Model 388-3L Temperature Meter
MATERIALS	
KS-14666 or KS-2423	Cloth Cleaning
KS-19578-L1	Trichloroethane
—	Cloth, Crocus
—	Rouge, Jewelers
—	Asbestos
—	Petrolatum, Chemically pure.

3. TESTS, INSPECTIONS, LUBRICATION, AND ADJUSTMENT OF DC OUTPUT (S1) SWITCH

3.01 Open all doors on the cabinet to maximum open position. This gives maximum working space plus maximum visibility of the switch.

3.02 ***DC OUTPUT (S1) Switch Electrical Test***

Caution: The DC OUTPUT (S1) switch has battery potential on it. Extreme care must be used when performing inspections or maintenance to avoid a short circuit between the switch and other metal parts of the rectifier cabinet.

Note: The rectifier should be operating at full load for 4 hours or more before voltage measurements are taken.

(1) ***Rectifier Operating in BAT Mode:*** If the DC OUTPUT (S1) switch is in the BAT position, the voltage measurements should be taken as follows.

(a) Measurements will be taken on the back side of the DC OUTPUT (S1) switch.

(b) The negative lead of the voltmeter should be placed inside the letter O stamped on the bus link directly below the lower left contact. This bus is stamped COMMON. Refer to Fig. 2.

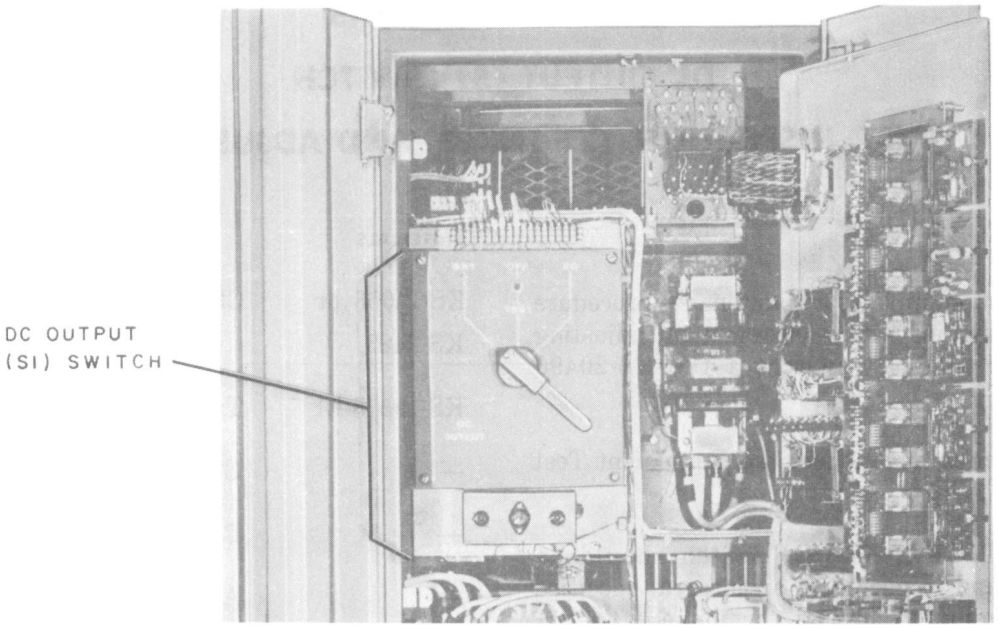


Fig. 1—DC OUTPUT (S1) Switch—Front View

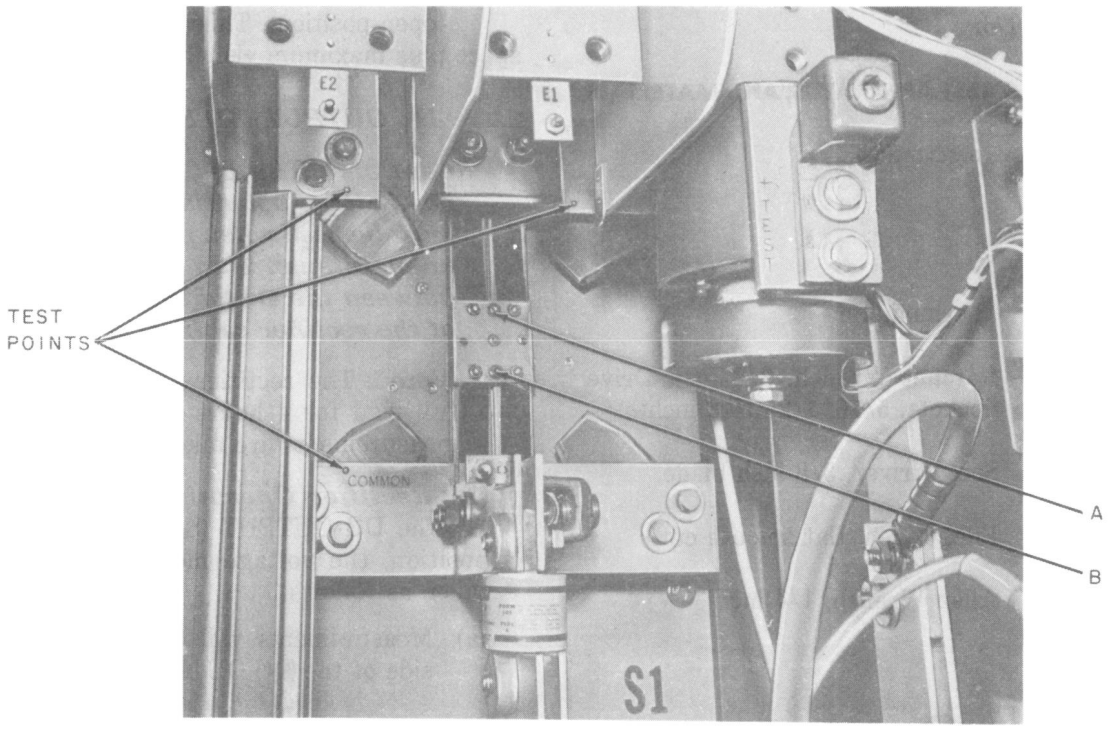


Fig. 2—DC OUTPUT (S1) Switch—Rear View

(c) The positive lead of the voltmeter should be placed inside the letter O stamped above the upper right switch contact [BAT Terminal assembly of DC OUTPUT (S1) switch]. The normal voltage drop at the test points should be 15 millivolts.

Note: If the rectifier is delivering less than full load, reduce the voltage drop value by the same percentage that the observed load is less than the rated load. For example, if the load is 200 amperes instead of 400 amperes the maximum allowable voltage drop should be reduced to 7.5 millivolts.

(d) Disconnect the voltmeter.

(2) ***Rectifier Operating in EC Mode:*** If the DC OUTPUT (S1) switch is in the EC position the voltage measurements should be taken as follows.

(a) Measurements will be taken from the back side of the DC OUTPUT (S1) switch insulating panel.

(b) The negative lead of the voltmeter should be placed inside the letter O stamped on the bus link directly below the lower left contact. Ths bus is stamped COMMON. Refer to Fig. 2.

(c) The positive lead of the voltmeter should be placed inside the letter O stamped above the upper left switch contact [EC terminal assembly of DC OUTPUT (S1) switch]. The normal voltage drop at the test points is 15 millivolts.

Note: If the rectifier is delivering less than full load, reduce the voltage drop value by the same percentage that the observed load is less than the rated load. For example, if the load is 200 amperes instead of 400 amperes the maximum allowable voltage drop should be reduced to 7.5 millivolts.

(d) Disconnect the voltmeter.

3.03 ***DC OUTPUT (S1) Switch Temperature Rise Tests***

Note 1: The following measurements should be taken on the back side of the DC OUTPUT (S1) switch.

Note 2: The rectifier doors should be closed for half an hour before taking the following measurements. The measurements should be taken as quickly as possible upon opening the rectifier doors. The temperature of the switch contacts will decrease when the doors are opened. If the measurements cannot be taken within two minutes, close the doors for half an hour and then repeat the following procedure.

Note 3: If the measurement taken with the R-1032 thermometer approaches the maximum limit of 45°C, a more accurate measurement may be taken with the Simpson Model 388-3L temperature meter. Connect the probe of the Simpson 388-3L to the test points listed in 3.03 (1) and close the rectifier doors for half an hour before taking measurements.

(1) Hold the R-1032 thermometer against the following points:

(a) The upper left fixed contact, if the switch is in the EC position.

(b) The upper right fixed contact, if the switch is in the BAT position.

(c) Both contact end portions of the rotary center pole regardless of the position of the switch.

(2) Cover the exposed part of the bulb with asbestos and hold the thermometer securely against each check point. Make sure none of the asbestos comes between the thermometer bulb and the surface to be checked. If this should happen, the asbestos would act as a thermal insulator and improper readings would be obtained.

(3) The temperature rise (temperature obtained from check point minus the ambient temperature in the area of the rectifier cabinet) of each check point when measured in a room in which the temperature of the ambient air is 20°C to 50°C, shall not exceed 45°C.

Example: With an ambient room temperature of 25°C, the temperature of the test point will not exceed 70°C, that is 25°C + 45°C. This temperature (80°C) is equivalent to a temperature reading of 176°F allowable under these conditions [using °F = 9/5 (°C) + 32°].

Note 1: Do not convert the two Centigrade readings separately to Fahrenheit and add the separate Fahrenheit readings since this gives incorrect results.

Note 2: The rectifier is not designed to operate in a room with an ambient temperature exceeding 50°C.

3.04 ***Requirements and Corrective Actions (if needed)***

Requirement 1: If all measurements in 3.02 and 3.03 are within limits, no further action is necessary. However, the contacts should be cleaned annually in accordance with 3.05.

Requirement 2: If any of the measurements in 3.02 and 3.03 exceed the specified limits clean and lubricate only the switch contacts in accordance with 3.05. Then repeat the tests in 3.02 and 3.03.

Requirement 3: If after performing Requirement 2, the voltage drop and temperature rise measurements are not within limits, the DC OUTPUT (S1) switch must be disassembled, cleaned and adjusted in accordance with 3.05 and 3.07. Then repeat 3.02 and 3.03.

Requirement 4: If after performing Requirement 3 the voltage drop and temperature rise measurements are not within limits, the defective Rotor assembly and/or defective terminals must be replaced and the defective components handled in accordance with local instructions. It should not be necessary to change the switch unless a major failure has occurred.

3.05 ***Cleaning and Lubrication of DC OUTPUT (S1) Switch Contacts***

(1) Remove the rectifier from service in accordance with Section 169-742-301.

(2) Operate the POWER ON/OFF (S2) switch to the POWER OFF position. The POWER OFF (white) lamp lights and the POWER ON lamp (blue) extinguishes.

(3) Operate the DC OUTPUT (S1) switch to the OFF position. The RECT FAIL (white) lamp lights and the RFA or RFA-RTN alarm is activated. The rectifier is shut down and locked out.

(4) Operate the associated AC switch and fuse unit in the bus duct or in the power service cabinet to the OFF position.

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

(5) Operate the RELAY AND ALARM POWER (CB2) circuit breaker to OFF.

(6) Disconnect the CP-P900 PLANT CONTROL DISCONNECT from its connector. The RFA or RFA-RTN alarm is deactivated.

Caution: The DC OUTPUT (S1) switch has battery potential on it. Unless the battery potential is removed, extreme care must be used when performing inspections or maintenance to avoid a short circuit between the switch and other metal parts of the rectifier cabinet. The switch should be insulated from surrounding parts using canvas, plastic sheeting, or other appropriate insulating material before cleaning. Use insulated tools and equipment.

(7) Using a clean KS-14666 cloth soaked with KS-19578 L1 trichloroethane, wipe all contact surfaces, fixed and rotary. Using a clean dry cloth, wipe all surfaces dry. Continue cleaning until all surfaces are clean.

(8) If black (sulfated) tarnish is present, remove with crocus cloth or jeweler's rouge. Wipe all surfaces clean and dry.

(9) Apply a thin coating of chemically pure petrolatum to both fixed and rotary switch contacts.

(10) Charge output filter capacitors in accordance with 3.06 (1) through (5) for the EC position.

(11) Restore the rectifier to service in accordance with 3.06 (3) through (8).

3.06 ***Capacitor Charging Procedure:*** In order to prevent damage to the switch contacts when the DC OUTPUT (S1) switch is operated from the OFF position to the BAT or EC positions, the output capacitor banks. [A] and [B] are charged as follows.

(1) Depress POWER ON/OFF (S2) switch to OFF position. POWER ON (blue) lamp extinguishes. POWER OFF (white) lamp lights.

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

(3) Operate the OFF-TEST (S4) switch to the TEST position. The TEST (white) lamp lights.

(4) 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 open position) in series.

(5) ***Caution: When connecting the resistor, fuse, and switch combination to the rectifier, always connect the combination to terminal E3 first to prevent dangerous shorts from occurring.***

Connect the resistor, fuse, and switch combination between terminal E3 and E1 for the BAT position or between terminals E3 and E2 for the EC position.

(6) Operate the switch of the combination circuit to the closed position. Observe that the voltage indication on the OUTPUT VOLTS (M2) voltmeter begins to increase.

Caution: Verify that the POWER OFF (S2) switch is in the POWER OFF position and that the associated AC switch and fuse unit in the bus duct or power service cabinet is in the OFF position, before operating the DC OUTPUT (S1) switch from one position to the other.

(7) When the OUTPUT VOLTAGE (M2) voltmeter indicates the approximate battery voltage or battery plus end-cell voltage, operate the DC OUTPUT (S1) switch to the desired BAT or EC position.

Note: The END CELL (red) lamp lights when the DC OUTPUT (S1) switch is in the EC position.

(8) ***Caution: When disconnecting the combination circuit from the rectifier always disconnect both ends of the circuit at the same time to prevent shorts from occurring.***

Disconnect the resistor, fuse, and switch combination from the rectifier.

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

(10) Restore the rectifier to service in accordance with Section 169-742-301.

3.07 ***Disassembly of the DC OUTPUT (S1) Switch:***

Note: In general, disassembly of this switch is not recommended. However, should disassembly become necessary to meet the requirements in 3.04, proceed as follows.

(1) In order to do a more complete cleaning job of both the fixed and rotary poles, the DC OUTPUT (S1) switch may be disassembled as follows.

(a) Remove the rectifier from service in accordance with 3.05, (1) through (6).

(b) Rotate the center pole until it is in a horizontal position. Remove the two screws A and B shown in Fig. 2. The entire center pole assembly may now be withdrawn. This allows easier access to the fixed contacts. The inner surfaces of the center pole can now be cleaned in accordance with 3.05, (7) through (9).

(c) The center pole is equipped with sacrificial poles so that when the first contact is made at closure, the current inrush to the capacitor bank will not damage the main contacting areas of the switch. Opening and closing the switch will cause these sacrificial poles to erode. If any prominant projections exist, remove them with a file. Any erosion on the fixed contact surfaces can also be smoothed with a file. Reassemble the center pole assembly by reversing the procedure.

(d) In the event of major damage to the fixed contacts they may be dismantled completely from the panel assembly. The EC and BAT contacts can be dismantled by removing the two hex head cap screws (at 45° angle) in each contact. To remove the COMMON contacts, remove the four bottom cap screws (two each at 45° angle) and the COMMON link bus that holds one side of the output fuse and negative test lug. When the COMMON bus is out of the way, the two common contact assemblies may be picked off from their mounting block. Reassemble by reversing the procedure.

(e) If for any reason, the center arm shaft does not turn freely, it may be removed to apply grease to the shaft. This is accomplished by first driving out pin A in Fig. 3 and removing the insulated shaft extension and the Truarc retaining ring. When the shaft is out of the bearing, clean both parts with trichloroethane and apply a thin film of petrolatum. Reassemble the center arm shaft by reversing the procedure, taking special note of the following adjustments.

- The spaces marked H and K on Fig. 4A should be 1/8 inch (nominal) plus 1/64 inch, minus 1/32 inch. In other words the spaces marked H and K may be 3/32 inch to 9/64 inch apart.
- If this distance is greater than 9/64 inch, the steel leaf springs have relaxed and should be replaced.
- The pole pairs should be parallel as illustrated in Fig. 4B.

(f) After reassemblying the DC OUTPUT (S1) switch, restore the rectifier to normal service in accordance with Section 169-742-301.

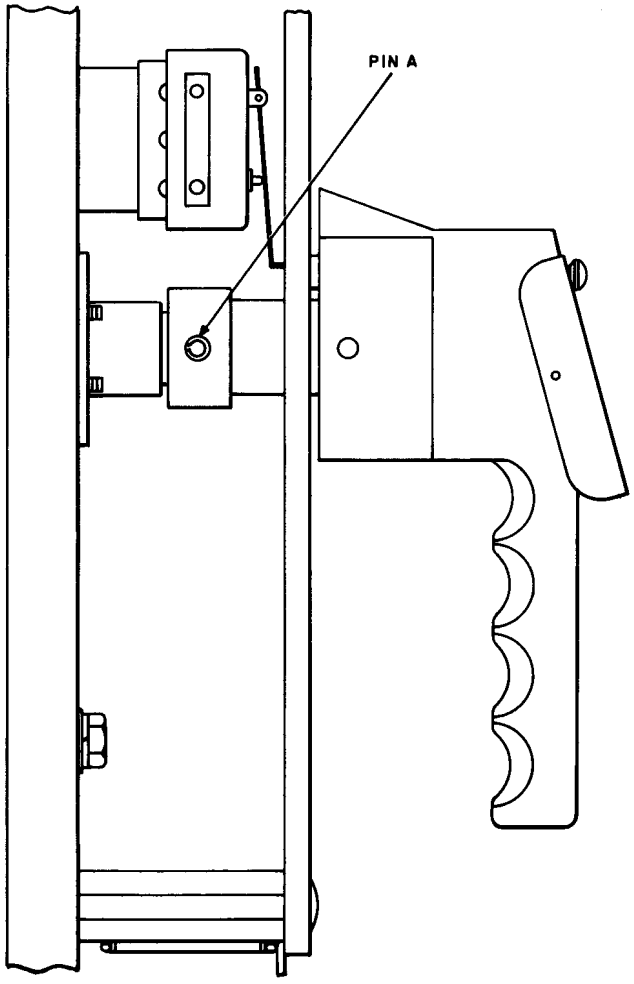
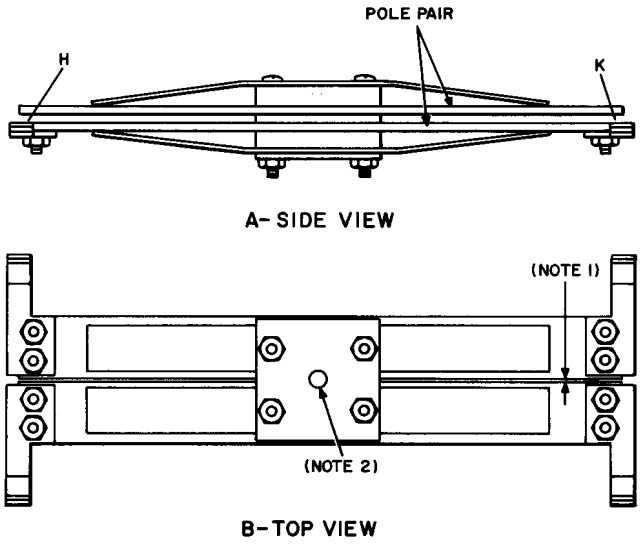


Fig. 3—DC OUTPUT (S1) Switch—Partial Side View



NOTE:
1. POLE PAIRS SHOULD BE PARALLEL.
2. A 1/4 INCH DIAMETER PIN SHOULD PASS FREELY TROUGH THIS HOLE AFTER THE ASSEMBLY HAS BEEN TIGHTENED.

Fig. 4—DC OUTPUT (S1) Switch—Rotary Contact