

KS-19216 130-VOLT RECTIFIER

S6 SWITCH

TESTS, INSPECTIONS, CLEANING, AND ADJUSTMENTS

1. GENERAL

1.01 This section provides a maintenance procedure for testing, inspecting, cleaning, and adjusting the S6 (DC OUTPUT) switch of the KS-19216 rectifier.

Warning: *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.*

1.02 This issue does affect the Equipment Test List.

1.03 The S6 switch should be tested and inspected at an interval specified in the Equipment Test List for the Bell System Practice concerned or more often if experience indicates the need.

2. LIST OF TOOLS, TEST APPARATUS, AND MATERIALS

CODE OR
SPEC NO.

DESCRIPTION

TOOLS

R-1032	Thermometer
R-8950	Syringe, Rubber
KS-14220, List 14	7/16-Inch Socket Wrench
—	Ratchet Wrench, 3/8-Inch Drive
—	Torque Wrench (0-150 ft. lb. capacity)

CODE OR
SPEC NO.

DESCRIPTION

—	Adapter To Fit Torque Wrench Gauge
KS-6909	

TEST APPARATUS

KS-20538	Volt-Ohm-Milliammeter
—	OR
—	Digital Multimeter, Weston Model 1240

MATERIALS

KS-14666	Cloth, Cleaning
or KS-2423	
KS-19578 L1	Trichloroethane Compound
KS-16736 L1	Cloth, Crocus Rouge Jewelers
—	Asbestos
—	Petrolatum
KS-19589 L2	Lubricant
—	20Ω (50 watt) resistor
—	10 amp (250 volt) fuse
—	20 amp (250 volt) switch

3. TESTS AND INSPECTIONS OF S6 SWITCH

3.01 Switch Inspection:

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

Caution: *The S6 switch has battery potential on it which exceeds 100 volts dc. Disconnect the charge leads from the F (BAT) and EC output terminals before work is performed on the switch.*

(b) Visually inspect the electrical contact surfaces of the switch for evidence of discoloration indicating excessive heat. If the contacts are purple, bluish-gray, or black, clean and lubricate only those switch contacts in accordance with the cleaning procedure in 3.05. Test the switch, fuse, and bus bar arrangements in accordance with the procedures for electrical and thermal tests if the contacts remain purple, bluish-gray, or black after being thoroughly cleaned. If the contacts are judged to be in good condition, proceed to (c).

(c) Remove the rectifier from service in accordance with the following:

- (1) Remove the rectifier from plant operation in accordance with the associated power plant Bell System Practice.
- (2) Operate the OFF-NOR (S1) switch to the OFF position.
- (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 (S6) switch to the OFF position.

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

(d) To charge the output filter capacitors, continue as follows.

- (1) Verify that the OFF-NOR (S1) and the DC OUTPUT (S6) switches are in the OFF position.
- (2) Remove the fuseholder which contains the F12 and F13 (CAP. ALM FUSE) fuses.
- (3) Operate the DC OUTPUT (S6) switch to the desired position (BAT, GR1, or GR1 & GR2).

(4) Connect a 20-ohm, 50-watt minimum resistor; a 10-ampere, 250-volt dc rated fuse, and a 20-ampere, 250-volt dc rated switch (operated to the off position) in series.

(5) **Caution:** *When connecting or disconnecting the resistor, fuse, and switch combination to or from the rectifier, always connect or disconnect both ends of the combination at the same time to avoid dangerous or destructive short circuits.*

Connect the resistor, fuse, and switch combination across the (1) battery and (2) load terminals on the back of the F12 fuseblock.

(6) Operate the switch of the resistor, fuse, and switch combination to the on position.

(7) After approximately 5 seconds, observe that the VM 1 voltmeter indicates approximate battery voltage. Then, replace the fuse holder which contains F12 and F13 fuses.

(8) Operate the switch of the resistor, fuse, and switch combination to the off position. Remove the combination from the rectifier circuit.

(e) With the ac input set to zero and the S6 switch (DC OUTPUT) set to OFF, remove the F12 fuse and the F13 (CAP. ALM FUSE) fuse from their fuseblock. Operate the S6 switch from the OFF to the BAT position five or six times. Operate the S6 switch from the OFF position to the GR1 and GR1 & GR2 position five or six times. These actions clean the blade and clip assembly surfaces.

(f) Charge the output filter capacitors as in (d) and operate the S6 switch to the position for normal operation.

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

(h) Return the rectifier to normal operation in accordance with the appropriate power plant Bell System Practice.

3.02 S6 Switch Electrical Tests:

Caution 1: *The millivoltmeter should be isolated from ground. Do not use a meter with a 3-wire cord without first disconnecting the ground wire. Use a 3-wire to 2-wire adapter.*

Caution 2: *The S6 switch has battery potential on it which exceeds 100 volts dc.*

(a) **Switch in BAT Position:** Remove the plastic guards (if equipped) from the top and sides of the switch. After the rectifier has been delivering full load for 4 hours or more with the S6 switch in the BAT position, the maximum allowable voltage drop (as measured with the KS-20538 volt-ohm-milliammeter) between the contact stud on the S6 switch and the stationary clip representing BAT position on the base shall be 12 millivolts dc (with ambient temperature stabilized).

(b) **Switch in GR1 or GR1 & GR2 Position:** After the rectifier has been delivering full load for 4 hours or more with the S6 switch in the GR1 or GR1 & GR2 position, the maximum allowable voltage drop (as measured with the KS-20538 volt-ohm milliammeter) between the contact stud on the S6 switch and the stationary clip representing the EC position on the base shall be 12 millivolts dc (with ambient temperature stabilized).

3.03 S6 Switch Temperature Rise Tests:

(a) Using a suitable insulating material, hold and secure the R-1032 thermometer (or equivalent) against the following points: (1) stationary clips on the base representing BAT when the switch is in the BAT position, GR1 or GR1 & GR2 when the switch is in the GR1 or GR1 & GR2 position; (2) switch arm blade when in full contact with BAT, GR1 or GR1 & GR2 stationary clips on the base; and (3) the rotor blade contact stud on the hinge post. Cover the exposed part of the bulb with asbestos and hold the thermometer against each of the check points. 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.

(b) The temperature rise (temperature obtained from check point minus the ambient temperature in the area of the rectifier cabinet) of each check point shall not exceed 30°C for the copper, unplated surfaces, or 55°C, for the silver-plated surfaces.

Example: With an ambient room temperature of 25°C, the temperature of the silver-plated switch shall not exceed 80°C, that is, 25°C + 55°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: Do not convert the two Centigrade readings separately to Fahrenheit and add the separate Fahrenheit readings since this gives an incorrect value.

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 even if the checks in 3.02 and 3.03 are within limits.

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 without removing the switch from the rectifier. 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 S6 switch must be disassembled, cleaned, and adjusted in accordance with 3.07, 3.08, and 3.09. 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 switch must be replaced and the defective unit handled in accordance with local instructions.

3.05 Cleaning and Lubrication of S6 Contacts (Fixed and Rotary):

- (a) Remove the rectifier from service in accordance with the appropriate power plant Bell System Practices.

Caution: *Make sure the OFF-NOR (S1) switch is in the OFF position. Operate the associated switch and fuse unit in the bus duct or in the power service cabinet to the OFF position.*

- (b) Operate the S6 (DC OUTPUT) switch to the OFF position.

Caution 1: *The S6 switch has battery potential on it which exceeds 100 volts dc. Disconnect the charge leads from the F (BAT) and EC output terminals before work is performed on the switch.*

Caution 2: *The switch clip representing the BAT GR1, or GR1 & GR2 position has battery potential on it. It is preferred to clean the switch with no battery potential on it. This can be accomplished by removing the charge leads. If it is impracticable to remove the battery power, exercise extreme caution when cleaning the switch. Surround live parts with canvas or other insulating material.*

- (c) Clean the **copper** switch contact surfaces as follows:

(1) The mating surfaces of the contacts should be shiny-bright for cool operation. If the rotating member is plain copper (not annealed), both it and the fixed mating contact should be degreased and cleaned of all tarnish. The copper members become oxidized through lack of use or because of corrosive atmosphere. The copper members should be cleaned with KS-19589 L2 lubricant to improve current carrying-capacity since copper oxide is an insulator.

(2) Check the contacts for discoloration. If they are discolored (blue to black), check to make sure that all the connecting nuts are securely tightened. Check and, if necessary, tighten all lock nuts to make sure that the fixed contacts are tight against the base plate.

(3) Wipe all accessible contact surfaces clean with a clean KS-14666 cleaning cloth moistened with KS-19578 L1 trichloroethane. It may be necessary to place a cloth under the switch to keep dirt off the parts under the switch. Apply KS-16736 L1 compound liberally to all accessible contact surfaces with a scrubbing motion.

Caution: *If battery potential was not removed from the S6 switch, the output filter capacitors must be charged as in 3.01 (d) before operating the switch to the closed position.*

(4) Clean the contacts by operating the switch as in 3.01(e).

(5) Apply the KS-16736 compound to all accessible contact surfaces to replace the compound removed by the operation of the switch.

(6) After a half-hour interval, remove all of the cleaning compound from the switch using a clean KS-14666 cloth. Then using a cloth moistened with KS-19578 L1 trichloroethane, wipe clean all accessible contact surfaces.

(7) Apply a light coat of chemically pure petrolatum on the contact surfaces of the switch.

(8) A light-weight oil should be used sparingly on the other noncurrent carrying moving parts of the switch.

(9) Clean the current-carrying threaded studs, washers, and nuts which project from the rear of the S6 switch, using first the KS-16736 L1 compound and then the KS-19578 L1 trichloroethane.

(10) If the charge leads were disconnected from the output terminals, reconnect them. Charge the output filter capacitors as in 3.01(d) and then restore the rectifier to normal operation.

- (d) Clean the **silver-plated** switch contact surfaces as follows:

(1) Operate the S6 switch to the OFF position.

- (2) Using a clean KS-14666 cloth soaked with KS-19578 L1 trichloroethane, wipe all contact surfaces clean. Using a clean cloth, wipe all surfaces dry. Continue cleaning until all surfaces are clean.
- (3) If black (sulfated) tarnish is present, remove with crocus cloth or jeweler's rouge. Wipe all surfaces clean and dry.
- (4) Using a clean cloth, apply petrolatum to the inner surfaces of the contact clips.
- (5) Clean the contact clips by operating the switch as in 3.01 (e).

Caution: *If battery potential was not removed from the S6 switch, the output capacitors must be charged as in 3.01(d) before operating the S6 switch. It is preferred that the procedure in 3.01(e) be followed.*

- (6) Operate the S6 switch to the BAT position. Wipe the excess petrolatum from the BAT clips.
- (7) Then operate the switch to the GR1 and GR1 & GR2 positions. Wipe off the excess petrolatum from the GR1 and GR1 & GR2 clips.
- (8) Operate the S6 switch to OFF and back to GR1 and GR1 & GR2 six times to clean the hinge joint. Do the same between the BAT position and OFF [making sure procedure is followed as in 3.01(e)].
- (9) If the charge leads were disconnected from the output terminals, reconnect them.
- (10) Charge the output filter capacitors as in 3.01(d) and then restore the rectifier to normal operation in accordance with the appropriate Bell System Practice.

3.06 **Cleaning the Rotating Arm—Center Connection:**

- (a) Clean the joint using KS-19578 L1 trichloroethane. With the switch (S6) **disconnected from battery potential and ac input set to zero** rotate the joint back and forth through its complete excursion while applying

the cleaner. It may be necessary to place a cloth under the switch to keep dirt off the parts under the switch.

- (b) After cleaning, lubricate the joint with KS-19589 L2 lubricant. Rotate the switch again to facilitate oil penetration.
- (c) Reconnect the charge leads to the output terminals and restore the rectifier to normal operation in accordance with the appropriate Bell System Practice.

Note: The switch will operate without trouble for longer periods of time between cleanings if it is operated [with the power off and the procedure in 3.01(e) followed] through its complete excursion six times at intervals of every six months.

3.07 **Disassembly of the S6 Switch:**

Note: In general, disassembly of these switches at operating locations is not recommended. Switches requiring disassembly should be replaced and sent to the factory. However, should disassembly for any model become necessary, proceed as follows.

Battery potential and ac input shall be removed. The stationary contacts are tightened against the plastic panel via studs and nuts. Separate the switch by removing the four nuts, one at each corner, from the screws through the mounting supports. The rotor nut must be removed from the drive shaft. An insulated spacer is used to separate the front plate from the base. Clean the holes through which the drive shaft passes and lubricate with petrolatum. Do not ream or enlarge the hole in the base. This will increase the shaft clearance and allow unneeded axial movement.

3.08 **Working on Disassembled S6 Switches:**

- (a) **Cleaning the Rotary Contact Surfaces:**
The rotary contact surfaces may be cleaned when the decks have been separated. First, loosen the nut that is compressing the spring that applies force to the contacting surfaces. This nut is prevented from turning by a set screw. Remove the nut, washers, and spring. This will allow the contacting surfaces to be separated and cleaned. Clean the contact surfaces using KS-16736 L1 cleaning compound and remove

the compound using KS-19578 L1 trichloroethane and KS-14666 cleaning cloth. When the switch has silver-plated areas, use crocus cloth to clean the areas. If the surfaces are galled or have a burr raised by the seizing action, use a fine flat file to remove the peaks of the burrs so that nothing projects above the average plane. Lubricate the contact surfaces with chemically pure petrolatum.

(b) **Inspecting, Adjusting, and Lubricating the Switch:** Check the condition of the contact clips on the end of the rotary arm. They should be shiny-bright and free of arc burn projections. A requisite of a proper operating switch is alignment and proper fit on the contacts. The blades must be parallel with the surface of the base and the clip should be flat and parallel with the center line of rotor blade leaves and free of pitting or burn marks. If the rotor blades or clip are mistreated and become distorted, the blades should be checked at the point of entry to the clip. The opening at the outer end of the rotor blade should be approximately 1/16-inch less than the thickness of the clip. The rotor blade should engage the clip so that each leaf of the blade deflects approximately 1/32-inch. The blade leaves should be evenly spaced to allow uniform contact pressure on both sides of the clip leaves. If a clip leaf is not parallel with blade alignment, the leaf may be adjusted by tapping it down toward the base surface with a plastic tip hammer, or pulling it

upward from the base surface by placing the point of a screwdriver between the clip leaf end and the base. A practical method of inspection is to attempt to pass a nonmetallic feeler gauge (0.003 inches) between the blade leaf and the clip. The maximum depth reached around the periphery of the blade and clip should be 1/8-inch with the gauge. Adjustment is considered good when both leaves of rotor blade make contact with the clip. Spring washers on the blades provide an even pressure on the clips and take up the wear. The rotary and stationary clips should be lubricated with petrolatum.

3.09 Switch Reassembly: After the switch decks have been cleaned and inspected, reassemble the switch in the reverse order of disassembly. Rotate the final assembly to see that all decks engage their respective contacts at the same time. When the rotary clips of each deck are engaged, they should completely cover their fixed contact. It is allowable if the rotary contact is 1/16-inch ahead or behind the fixed contact. The complete assembly may now be replaced in the rectifier and the harness wires securely reconnected.

3.10 Preventive Maintenance For S6 Switches: To prevent gradual build-up of oxides or other nonconductive materials that may cause switch failure, operate the switch [with the power off and the procedure in 3.01 (e) followed] through its entire range about six times at intervals of every six months.