

BELL SYSTEM PRACTICES
Outside Plant Construction
and Maintenance

SECTION G63.231.1
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AT&T Co Standard

ELECTROLYSIS TESTING

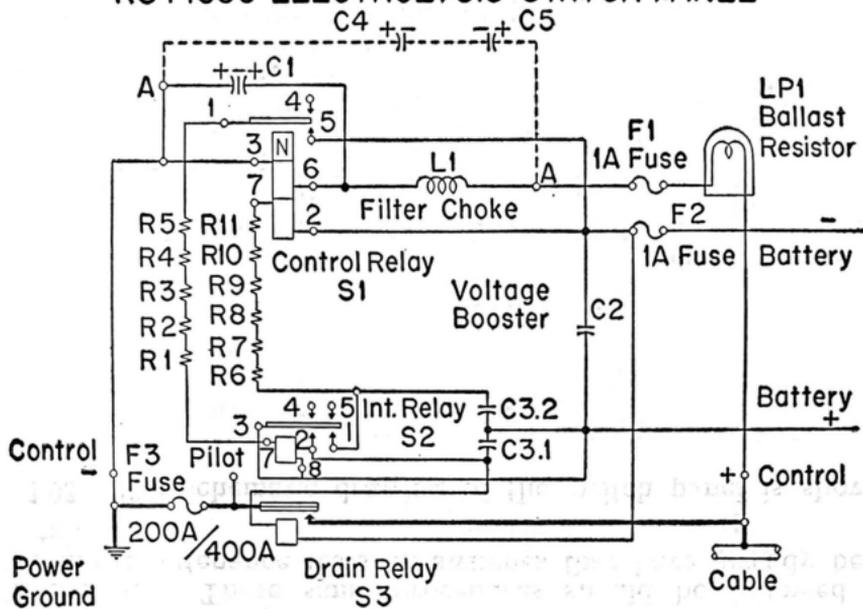
KS-14385 ELECTROLYSIS SWITCH

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1. GENERAL

- 1.01 This section covers the testing and maintenance of the KS-14385 Electrolysis Switch.
- 1.02 Many of the adjustments given in this section must, of necessity, be made at the time the switch is installed in the field. These same procedures should be followed in making maintenance tests on switches that have already been installed.
- 1.03 The schematic drawing of the switch panel is shown.

SCHEMATIC CIRCUIT- KS I4386 ELECTROLYSIS SWITCH PANEL



| Desig | Apparatus | Desig | Apparatus |
|-------|--------------------------------|--|-----------|
| C1 | 30,30 μ F Capacitor | R1 | 270 |
| C2 | 20,20,20,20, μ F Capacitor | R2 | 360 |
| C3.1 | 0.5, 0.5 μ F Capacitor | R3 | 470 |
| C3.2 | | R4 | 1000 |
| F1&F2 | 1 Amp Fuse | R5 | 1800 |
| F3 | 200 or 400 Amp Fuse | R6 | 330 |
| LP1 | 60 W 115V Mazda Lamp | R7 | 3300 |
| S1 | 280BW | R8 | 3900 |
| S2 | 276B | R9 | 4700 |
| S3 | Cutler Hammer | R10 | 5600 |
| L1 | 307 W Ret Coil | R11 | 6800 |
| C4 | KS I4329 Capacitor | Note A. Capacitor Circuit from A to A installed only when AC Potential on Control Circuit exceeds 1 Volt. | |
| C5 | | | |

Note

A. Capacitor Circuit from A to A installed only when AC Potential on Control Circuit exceeds 1 Volt.

2. SWITCH ADJUSTMENTS

Operating Power—Central Office Battery

2.01 The resistance of the cable pairs over which the central office battery is transmitted should be such that the voltage at the switch with all relays operated is not less than 10 nor more than 28 volts. After the switch has operated, the minimum current required to hold the 200-ampere switch, which has an internal resistance of 67 ohms, is 0.150 ampere. The hold current for the 400-ampere switch, which has an internal resistance of 61 ohms, is 0.165 ampere. To reliably operate the 200-ampere switch requires a minimum of 0.260 ampere and for the 400-ampere switch a minimum of 0.286 ampere. To obtain the additional current to operate the switch, over that required to hold it closed after operating, a voltage booster consisting of a multi-section capacitor is connected across the battery supply at the switch. This capacitor is charged by the central office battery and discharges into the switch relays as needed to supply the additional current required during the short period of operation.

The maximum resistance of cable pairs to obtain the proper voltage at the switch is calculated as follows:

For 48-volt battery and a 200-ampere switch—

$$\frac{47.5 \text{ Volts}^*}{0.15 \text{ Amp.}} - 67 \text{ ohms} = 250 \text{ ohms}$$

* Minimum voltage of central office battery.

2.02 The minimum hold voltage is that battery potential which will be impressed on the switch terminals when relays S1, S2 and S3 are energized by a central office battery discharged to its minimum voltage (23.5 or 47.5 volts). The switch may be adjusted so that it will operate satisfactorily if this is not less than 10 volts. The resistors R1, R2, R3, R4 and R5 may be shunted to compensate the first operate circuit if the minimum hold voltage falls to a value in the lower part of the range 10 to 28 volts. One or more of the resistors may be shunted to produce suitable compensation as is indicated in Table I. If the hold voltage exceeds 28 volts, special ballast resistance should be added to the battery circuit in the central office.

TABLE I

| Holding Voltage | Resistors Shunted (marked X) | | | | |
|--------------------|------------------------------|----|------|----|----|
| | R1 | R2 | R3 | R4 | R5 |
| 10 | X | X | X | X | X |
| 11 | X | | X | X | X |
| 12 | X | | | X | X |
| 13 | | X | X | | X |
| 14 | | | X | | X |
| 15 | | X | X | X | |
| 16 | | | X | X | |
| 17 | X | X | X | | |
| 18 | X | | X | | |
| 19 | X | | | | |
| 20 to 28 | | | none | | |

Adjustment of Voltage Booster

2.03 The voltage booster C2 should be of proper value to obtain the best performance of the electrolysis switch when it is operated by battery power transmitted over long loops. Proper adjustment can be determined by observing switch performance with a single 20 mf capacitor section connected at C2. Then an additional 20 mf section should be connected in parallel with the first section and the switch performance again observed. Additional sections should be added until proper performance is obtained. Do not add more sections than are necessary for proper performance, as a condition may be found wherein the relays will start to close but fail to hold up because C2 has not had time to recharge to adequate voltage. If this performance is observed, one or more 20 mf sections of C2 should be disconnected until the best switch performance is obtained.

Operating Power—Power Panel

2.04 If an electrolysis switch is installed at a location beyond the practicable range of central office power, a-c power from a local connection is used. Power output terminals on the power panel are connected to the "battery +" and "battery —" terminals on the switch panel and the rectified current is smoothed by the capacitor C2. The connecting wires pass behind the panels so they will not interfere with work done at the front of the switch.

2.05 The current which may safely be drawn continuously from the rectifier is 0.25 ampere. The d-c potential applied to the switch panel should be in the range from 20 to 28 volts when the switch is unoperated and not less than 10

volts when the switch is operated. If it is found that voltages of these values are not produced when a single section of capacitor C2 is connected across the "battery + and —" terminals on the switch panel, additional sections should be connected in parallel with the first section until the necessary voltages are produced.

Adjustment of Switch to Operate at a Particular Control Voltage

2.06 The switch **operate voltage** is the potential difference between the two control terminals (read with a high resistance voltmeter) just before the contacts of the S3 relay close. Most switch installations provide satisfactory cable protection with a voltage of +0.25 volt. Assuming a voltage of 0.25 the following procedure should be used in adjusting a switch in the field.

- (1) Clean and tighten fuse mountings and make sure ballast lamp is firmly in socket.
- (2) Remove fuses F2 and F3 from their mountings.
- (3) Remove the control wire from the + control terminal.
- (4) Connect the KS-14416 Test Set terminals to the two control terminals. The key of the test set should be in the neutral position. Connect the terminals of an 81A test set to left-hand clip of F2 mounting and left-hand terminal of resistor R5, with switch operated to "C". When contacts of 280 BW relay close, the 81A buzzer will operate.
- (5) Back off bias spring of 280 BW relay in counterclockwise direction so that it exerts no pressure on the relay armature.
- (6) Loosen pole piece clamping screws and screw the pole pieces to the extremes of their travel leaving maximum gaps between them and the armature.
- (7) Adjust the contact positions by turning the contact screws, using a No. 340 tool so that the total travel of the armature at the contacts is .004 inch maximum, .003 inch minimum as measured with a No. 74D gauge. The armature should stand approximately midway between the contact points after this adjustment.
- (8) Reduce the magnetic air gaps gradually and equally on each side of the armature by rotating the pole pieces using the No. 340 tool until the armature, when moved by hand, will stick with slight and approximately equal force to each contact. This force may be measured with a No. 70F gauge and should be about 1.5 grams on each side.

(9) Tension the biasing spring against the armature so that it is normally held against the right-hand contact. Adjust the biasing spring tension so that the relay will operate within limits as follows:

(a) Apply a potential of 2.5 volts to the test circuit poled in the direction which tends to hold the armature against the right-hand contact.

(b) Reduce the applied potential to .25 volt and reverse the direction of current flow by operating the reversing switch. The tension of the biasing spring should be sufficient to just permit the armature to move to the left-hand contact.

(c) If the armature movement is not as described, the biasing spring tension should be readjusted and steps (a) and (b) repeated until proper armature movement is obtained.

(d) With the armature held against the left-hand contact by the application of .25 volt the potential should be gradually reduced and its value read when the armature moves from the left-hand to the right-hand contact.

(e) The voltage read in step (d) should be within the range 0.06 to 0.12. If it is not, the magnetic gaps referred to in step (8) should be readjusted very slightly and steps 9a, 9b, 9c and 9d repeated until it does.

(10) Retighten the pole piece clamping screws and check test the relay as follows: Saturate control relay by applying 2.5 volts to test circuit in the direction which holds the armature against the right-hand contact; then decrease voltage to 0.25 and reverse by operating reversing switch. Armature should move from right to left and then restore to the right-hand contact when the test voltage is decreased to a value within the range 0.06 to 0.12 volt.

Adjustment of Switch to Release at a Particular Control Voltage

2.07 The switch release adjustment is made by limiting the value of current passing through the 45-ohm holding winding of the S1 relay. This current is between 1 and 3 milliamperes and is controlled by resistors R6, R7, R8, R9, R10 and R11. These resistors are normally connected in series and adjustments are made by shunting out as many resistors as may be required. Energization of the holding winding of the S1 relay neutralizes the effect of the biasing spring during the period that the switch is operated. The current necessary for proper operation will be different with different tensions of the biasing spring. No adjustment of the current should be made

until the switch is placed in service and the power supply voltage has been adjusted as outlined in Paragraphs 2.01 to 2.05. When the switch is to be adjusted for release at a particular voltage it should first be check tested. If the switch does not operate satisfactorily it should be readjusted as outlined in Paragraph 2.06.

2.08 The switch is adjusted to release at a desired control circuit voltage by shunting one or more of the resistances R6, R7, R8, R9, R10 and R11. The procedure outlined below should be followed.

- (1) Disconnect the control wire from the + control terminal.
- (2) Connect the electrolysis switch test set and a sensitive voltmeter to the + and - control terminals. Connect 81A test set terminals to the + cable terminal and to the pilot terminal.
- (3) Remove fuse F3 from mounting.
- (4) Apply voltage to the control switch to operate relay S1. Relays S2 and S3 will operate in turn.
- (5) Decrease the applied voltage to the control circuit and read the value at which relays S1, S2 and S3 release.
- (6) Apply a temporary shunt to one or more of the resistances R6 to R11 and repeat the above operation until the switch is caused to open the drain relay contacts at a desired value.

2.09 Place the switch in service and observe the operation. If necessary readjust the hold current by means of resistors R6 to R11 until satisfactory performance is obtained.

2.10 When the drainage current increases and decreases in smooth sequence, the switch will reliably close and open the drainage bond at the desired values. If the drainage current fluctuates very rapidly, indicative of rapid variation of cable to drainage point voltage, often with change from positive to negative, the switch may tend to cycle, i.e., oscillate between the open and closed positions with probable injury to the relay contacts. In order to minimize unwanted repetitious switch operation on exposures of this nature, the switch release may be set to a lower positive value or even to a negative value and still provide acceptable cable protection.

Placing Switch in Operation

2.11 To place switch in operation place a 1-ampere fuse in F1 mounting after first making sure that fuses F2 and F3 are in their respective mountings.

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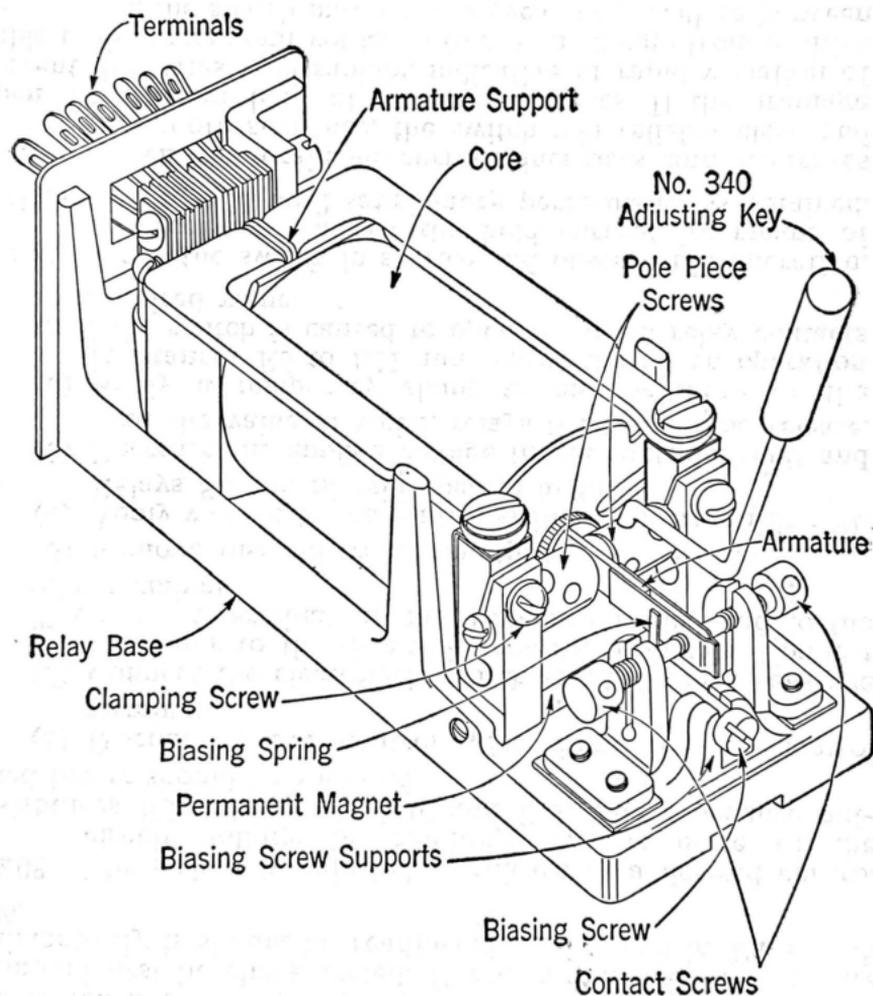
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Removing Switch from Operation

2.12 A switch should be taken out of operation only when the drainage current is zero or very small in value to prevent damaging contacts of relay S3. Removal of fuse F1 will render the switch inoperative.

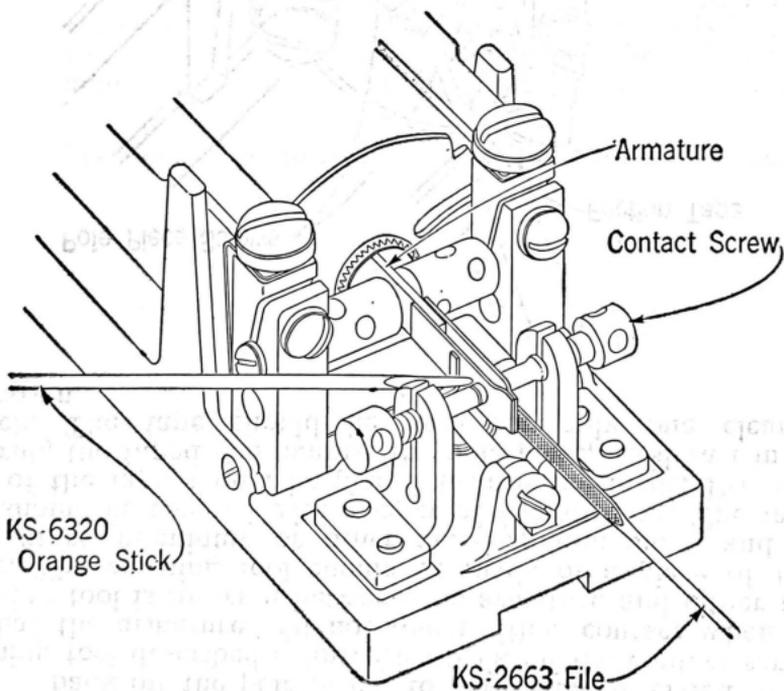
3. MAINTENANCE OF 280 BW RELAY

3.01 The 280 BW relay with parts identified is shown in the following sketch.



3.02 Cleaning Non-Pitted Contacts: Burnish the contacts with a No. 265B Tool (Contact Burnisher). The blade of the burnisher should be kept free of dirt by wiping it with a clean dry cloth. In burnishing the contacts place the blade of the 265B tool between the contacts, press the armature against the blade and at the same time move the blade back and forth across the contacts about three or four times. When unable to clean the contacts by burnishing, dip the flat end of a clean toothpick into mineral spirits to a depth of about 1/2 inch and deposit the liquid on the contacts. Then rub the flat end of the toothpick between the contacts. The liquid should soften any deposit on the contacts and rubbing should remove it. When the contacts are thoroughly dry, burnish them with the 265B tool.

3.03 Cleaning Pitted Contacts: With a 340 Adjusting Key, back off the contact screws equally so that a KS-2663 File will just enter between the armature and the contact. Hold the armature against the file with a KS-6320 Orange Stick and with the file held in a horizontal position, file the contacts, as shown below. File until the contacts are free of pits and build-ups, as determined by visual inspection. After filing the contacts they should be burnished with the 265B tool.



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3.04 **Cleaning Pole Pieces:** Using a 340 Adjusting Key, back off the pole pieces to permit the insertion of the cleaning tool described below. Also back off the contact screws so that the armature will not touch either contact when the cleaning tool is inserted between the armature and either pole piece. The cleaning tool should be made of a piece of thin, stiff, brass, aluminum or other non-magnetic metal and the end should be covered with a layer of friction tape. The tacky side of the tape should be placed toward the blade. Press, do not rub, the taped end against the pole piece, as shown in the sketch. The tape should be used for only one cleaning operation.

