ANALYSIS AND CORRECTION OF PULSING FAILURES USING PULSING TEST SET SD-31481-01 (J34717A) STEP-BY-STEP AND COMMUNITY DIAL OFFICES

1. GENERAL

1.01 This section describes a general procedure for the analysis and correction of pulsing failures encountered in making pulsing tests of selectors, connectors and test distributors with test set SD-31481-01 (J34717A).

1.02 This section is reissued to revise the rotary and vertical armature spring tension adjustments and to include additional procedures for the correction of pulsing failures.

1.03 The procedure covered herein attempts to point out the most likely causes of the various trouble conditions and the method of their correction but should not be construed as in any way altering standard requirements for the individual pieces of apparatus affected nor as excluding from consideration any mechanical or electrical adjustments not specifically mentioned.

1.04 The information in this section is based on the assumption that the magnet pulsing test will have been made on any switch on which a failure was encountered under the leak test condition on the over-all pulsing test.

1.05 Troubles should be cleared in the sequence in which they are mentioned under 3. METHOD, i.e., magnet pulsing failures first, other leak pulsing failures second, and loop pulsing failures last, regardless of the order in which these failures are disclosed by the routine tests.

1.06 A complete over-all pulsing test should be made in accordance with the appropriate section on any switch on which trouble has been cleared, before restoring it to service.

1.07 The last page of this section consists of a summary of the detailed information included under 3. METHOD.

1.08 Wherever the B, C, and E relays are mentioned in this section it is intended to mean the relays which perform functions corresponding to those of the B, C, and E position relays in the regular local connector.

2. APPARATUS

2.01 All of the apparatus listed in the section covering pulsing tests of the type of switch involved.

2.02 Pulsing Test Set J34717A (SD-31481-01) ←

2.03 No. 35 Type Test Set and associated cords.

2.04 Relay Timing Test Set J94713A (SD-90418-01), if available.

2.05 Tools and Gauges required for testing and adjusting 197- and 198-type switches and 204-type selectors.

2.06 Tools and Gauges required for testing and adjusting the relays in the switch circuits.

3. METHOD

(A) Failures Indicated on the Magnet Pulsing Test - Motor Mechanism Trouble - Overstepping and Understepping

3.01 If the switch oversteps or understeps on ↰ the magnet pulsing test it may be due to incomplete operation of the magnet armature during the pulse closure period. Reduction of the armature spring tension or cleaning of the armature backstop may correct this trouble. Do not reduce the tension more than the amount required to meet the test. Reduction of this tension to such values may result in a "floating" armature (not resting against the backstop) if the pawl spring tension is excessive, in which case replace the pawl spring. It has been found that the best operation is generally obtained on switches operating on self interruptions (line finders, level hunting connectors, etc) when the rotary and vertical armature spring tensions are between 300 and 450 grams. On all other switches the best operation is generally obtained when the rotary and vertical armature spring tensions are between 100 and 300 grams. Do not increase the tensions of these springs more than necessary to insure proper rotary and vertical operation. Measure this tension at the end of the spring with the magnet armature in the unoperated position. ↵

3.02 If adjustment of the armature spring tension does not correct the overstepping or understepping condition, check the other adjustable mechanical parts which may affect the vertical or rotary action.

(a) For the vertical action include a check of the release link requirements, a check of the double dog spring requirements, a check of the vertical magnet position and the vertical dog requirements. For best results the vertical magnet position should be such that, with the magnet electrically operated and the shaft raised by hand so that the vertical pawl rests against the overthrow stop, the gap between the top of the vertical dog and the under surface of the vertical tooth is just enough to be perceptible rather than being near the maximum value specified for this requirement. In other words, with the magnet electrically operated, it should be possible to raise the shaft only enough for the movement to be perceptible. Also, the vertical alignment of the vertical dog should be such that the drop in the shaft, when the armature is released, is negligible rather than near the maximum value specified for this requirement; that is, with the magnet electrically operated, the vertical dog should just be able to re-enter after it is manually pulled free from the vertical ratchet and then released.

(b) For the rotary action include a check of the rotary magnet position, rotary pawl front stop position, rotary pawl guide position, rotary armature play and rotary dog requirements.

3.03 If overstepping or understepping still occurs, check the armature assembly and replace it if necessary. For the vertical action include a check for vertical pawl play, vertical armature play and excessive vertical armature travel. For the rotary action include a check for rotary pawl play. In either case it may be that the trouble is due to a bowed armature or to an armature not having a flat face.

3.04 If the switch still fails to meet the vertical pulsing test, loosen the upper and lower bearing mounting screws using the 3" cabinet screwdriver and shift the shaft as far to the rear of the switch as the holes in the shaft bearing permit. Tighten the bearing mounting screws securely and recheck requirements involved.

3.05 If unable to adjust the motor mechanism to eliminate vertical or rotary failures, it may be that the difficulty can be overcome by substituting one of the later type magnet heel pieces, (approximately 1" by 1-1/2"), for the existing heel piece if it is the narrower type (approximately 1/2" by 1-1/2").

3.06 If still unable to adjust the motor mechanism to eliminate vertical or rotary understepping it may be due to a sluggish release of the vertical or rotary magnet caused by short-circuited turns. Substitution of magnet coils may be necessary to disclose this condition.

(B) Failures Indicated under the Leak Condition on the Over-all Pulsing Test - Vertical Failure, Rotary Failure, Premature Cut-in, Overstepping and Understepping

3.07 If the test failure is of the type indicated by the switch cutting in on one of the lower levels, and the switch motor mechanism has passed the magnet test, it may be that the C relay is failing to meet its test requirements. If this is so, the C relay may have excessive spring tension, excessive front contact follow, excessive residual, or excessive heel gap. Proceed as in Paragraph 3.08 or 3.09 as the case may be.

3.08 Where a relay timing test set is available, readjust the C relay, as necessary, to meet its readjust timing requirements. The timing requirements of the C relay shall be met with the switch cover on. To meet the timing requirements it may be necessary to work toward the minimum values specified for those adjustments which affect the holding time, retaining as much of the residual as possible. Also it may be found that an occasional relay which meets the timing requirements will fail to hold long enough to permit the switch to pass the Leak A over-all pulsing test, and it will be necessary in such cases to still further favor the adjustments which increase the holding time. If it is impossible to make the C relay meet the pulsing tests without exceeding the limits of its readjust timing requirements it may be that the A relay is too slow in releasing, in which case proceed as in Paragraphs 3.11 through 3.14.

3.09 If a timing test set is not available it may be necessary to completely readjust the C relay in accordance with its several mechanical and electrical requirements. In this

case, it may be necessary to work toward the minimum values specified for those adjustments which affect the holding time, retaining as much of the residual as possible. If it is impossible to make the C relay meet the pulsing tests without exceeding its readjust requirements it may be that the A relay is too slow in releasing, in which case proceed as in Paragraphs 3.11 through 3.14.

3.10 If the test failure is of the type indicated by the switch failing to rotate beyond one of the lower numbered terminals during rotary pulsing, and the switch motor mechanism has passed the magnet test, it may be that the E relay is failing to meet its test requirements. If this is so, the probable relay conditions causing the failure and the adjusting procedures to be followed are the same as described in Paragraphs 3.07 through 3.09 for the C relay.

3.11 If the switch still cuts in on one of the lower levels or fails to rotate beyond one of the lower numbered terminals after the C or E relay has been checked in accordance with Paragraphs 3.07 through 3.10, or if it oversteps or understeps during vertical or rotary pulsing, it may be that the A relay is too slow in releasing or that there is chatter on the back contact of the A relay. Slow release may be due to insufficient spring tension, insufficient front contact follow, insufficient residual or insufficient heel gap, or the relay may be sluggish in its performance due to binding of the armature lever, stud or hinge. Chatter may be due to insufficient spring tension or lack of stud gap. In either case, the pulses delivered by the A relay may be too short to permit complete operation of the magnet armature, or to allow the C or E relay to hold during the pulse closure period.

3.12 If necessary, readjust the A relay in accordance with its several mechanical and electrical requirements. In some cases it may be necessary to work toward the maximum value specified for the residual or heel gap.

3.13 If unable to adjust the A relay to meet the test, it may be due to a sluggish release of the relay caused by short-circuited turns. Substitution of the relay coil may be necessary to disclose this condition.

3.14 If the C or E relay still fails to hold on the pulsing tests it may be due to a defective relay coil. Substitution of the C or E relay coil may be necessary to disclose this condition.

(C) Failures Indicated under the Loop Condition on the Over-all Pulsing Test - Failure of B Relay to Hold - Fall-down

3.15 If the test failure is of a type indicating that the B relay is not holding during pulsing, such as fall-down of the switch, it may be that the B relay is failing to meet its test requirements. If this is so, the B relay may have excessive spring tension, excessive front contact follow, excessive residual or excessive heel gap. Proceed as in Paragraph 3.16 or 3.17, as the case may be.

3.16 Where a relay timing test set is available readjust the B relay, as necessary, to meet its readjust timing requirements. In the case of unmodified 222-type relays, to meet the timing requirements it may be necessary to work toward the minimum values specified for those adjustments which affect the holding time, retaining as much of the residual as possible. Also it may be found that an occasional relay which meets the timing requirements will fail to hold on the loop over-all pulsing test, and it will be necessary in such cases to favor still further the adjustments which increase the holding time. If necessary to change the residual, the mechanical requirements of the relay such as armature travel and contact follow shall be rechecked. If the B relay still fails to hold on the over-all pulsing test, proceed as in Paragraphs 3.18 through 3.21.

3.17 If a timing test set is not available it may be necessary to completely readjust the B relay in accordance with its several mechanical and electrical requirements. In this case it may be necessary to work toward the minimum values specified for those adjustments which affect the holding time, retaining as much of the residual as possible. If the B relay still fails to hold on the over-all pulsing test, proceed as in Paragraphs 3.18 through 3.21.

3.18 If the B relay still fails to hold on the over-all pulsing test after it has been checked in accordance with Paragraphs 3.15 through 3.17, it may be that the A relay has excessive spring tension, excessive armature travel, excessive residual or excessive heel gap, insufficient front contact follow, or it may be sticking on the backstop. Also the A relay may be sluggish in its operation due to binding of the armature lever, stud or hinge, or to short-circuited turns.

3.19 If necessary, readjust the A relay in accordance with its several mechanical and electrical requirements. In some cases it may be necessary to work toward the maximum front contact follow which can be obtained while still meeting the contact separation and other mechanical requirements.

3.20 In the case of a 222-type B relay, if still unable to meet the test or if it would be necessary to practically eliminate the residual in order to meet the test, substitute a B relay armature of the 1:1 ratio type in place of the existing B relay armature.

3.21 Inability to meet the test may be due to a defective coil on the A or B relay. Substitution of both coils may be necessary to disclose this condition unless the A relay coil has already been replaced in meeting the leak condition as in Paragraph 3.12. If necessary to substitute a 222-type B relay coil, replace the entire relay with a 248 type.

(D) Slow Release of C Relay - Vertical Kick

3.22 If the test failure is of a type indicating that the C relay is not releasing quickly enough after the first digit, such as a vertical kick of the shaft or vertical stepping on the second digit, it may be that the relay has insufficient spring tension, insufficient front contact follow, insufficient residual or insufficient heel gap.

3.23 If a relay timing test set is available, check the relay to its timing requirements and readjust as necessary to meet these requirements. In the absence of a timing test set it may be necessary to completely readjust the relay in accordance with its several mechanical and electrical requirements.

(E) Understepping

3.24 If the switch, having met the leak condition, understeps during vertical or rotary pulsing it may be that the A relay is too fast in releasing and that the open period of the pulses which it delivers is too short to permit complete release of the magnet armature. The relay may have excessive spring tension, excessive front contact follow, excessive residual or excessive heel gap. If necessary readjust the A relay in accordance with its several mechanical and electrical requirements.

3.25 The understepping may be due to insufficient tension in the armature spring of the vertical or rotary magnet (see Paragraph 3.01), or to sticky substance on the overthrow stop. It may also be due to short-circuited turns on the vertical or rotary magnet coils. Substitution of magnet coils may be necessary to disclose this latter condition unless the substitution has already been made in meeting the magnet pulsing test as in Paragraph 3.06.

3.26 Understepping may also be caused by a weak pawl spring. Replacement of the pawl spring may be necessary to disclose this condition. Usually it will be indicated as a probable defect by the fact that, after correction of a leak failure involving readjustment of the A relay or of the magnet, the switch fails on the loop requirement although it had previously met the loop test.

SUMMARY SHEET

	Paragraph
(A) Magnet Pulsing Test - Motor Mechanism Trouble - Overstep and Understep	
(1) Check magnet armature spring tension. Clean armature backstop. Replace pawl spring if armature "floats."	3.01
(2) Vertical action. Check release link and double dog spring requirements, vertical magnet position, and vertical dog requirements.	3.02(a)
(3) Rotary action. Check rotary magnet position, rotary pawl frontstop position, rotary pawl guide position, rotary armature play and rotary dog requirements.	3.02(b)
(4) Check armature assembly. Replace if necessary.	3.03
(5) Shift the shaft as far to the rear of switch as possible.	3.04
(6) Substitute wide magnet heel piece for old type.	3.05
(7) Replace magnet coils if necessary.	3.06
(B) Failures on Leak - Over-all Pulsing Test	
(1) Vertical Failure - Premature Cut-in, Overstep and Understep	
(a) Check C relay. Timing test. Slower release.	3.07 through 3.09
(b) Check A relay. Faster release. Replace coil if necessary	3.11 through 3.13
(c) Replace C relay coil if necessary.	3.14
(2) Rotary Failure - Premature Cut-in, Overstep and Understep	
(a) Check E relay. Timing test. Slower release.	3.10
(b) Check A relay. Faster release. Replace coil if necessary.	3.11 through 3.13
(c) Replace E relay coil if necessary.	3.14
(C) Failures on Loop - Over-all Pulsing Test - Failure of a B Relay to Hold - Fall-down	
(1) Check B relay. Timing test. Slower release.	3.15 through 3.17
(2) Check A relay. Greater front contact follow. Slower release.	3.18 & 3.19
(3) Substitute 1:1 ratio armature on 222-type B relay.	3.20
(4) Replace coils of A and 248-type B relays if necessary. Replace 222-type B relay with 248 type if necessary.	3.21
(D) Slow Release of C Relay - Vertical Kick	
(1) Check C relay. Timing test. Faster release.	3.22 & 3.23
(E) Understepping	
(1) Check A relay. Slower release.	3.24
(2) Check magnet armature spring tension. Clean overthrow stop. Replace magnet coils if necessary.	3.25
(3) Replace weak pawl spring.	3.26