PULSE REPEATING RELAYS
PULSING REQUIREMENTS A1 THROUGH J1
USING 2B-1 SIGNALING TEST SET SD-56134-02 (J64730)
AND ASSOCIATED PULSE REPEATING ADAPTER CIRCUIT

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1. GENERAL

1.01 This section covers the method of checking the pulse repeating requirements (percent break maximum and minimum values) for a pulse repeating relay using the 2B-1 signaling test set. The method of checking the pulse repeating requirements using the SD-31481-01 (J34717A) pulsing test set and SD-31667-01 (J34720A) pulse repeating test set can be found in Section 040-012-711 and for the 4A signaling test set in Section 040-012-713.

1.02 This section is reissued for the following reasons:

(a) To add pulsing requirement A6.

(b) To make major revisions in the format of the section for clarification purposes.

1.03 The 2B-1 signaling test set specified herein is a modified 2B signaling test set. The modification consists of the addition of capacitor C18 per SD-56134-02 which conditions the 2B set for use with the pulse repeating adapter per SD-56134-02, Fig. 1. The pulsing circuit of the 2B-1 set provides a source of controlled pulses or supervisory signals suitable for application toward the line or drop on E or M signaling leads. Conversion to loop pulsing is one of the functions provided by the pulse repeating adapter. The circuit also provides a means of measuring the percent break of received pulses or of observing received supervisory signals. The pulse repeating adapter converts the battery and ground pulses of the 2B-1 set to a form suitable for testing local and toll pulse repeating relays in CX, SX, and DX circuits.

1.04 The circuit requirements table of the circuit under test will provide a pulse repeating requirement (e.g. A1, B1, etc) and a minimum and maximum output percent break value (e.g. 48 to 78% BK). Using this provided information, refer to the specified pulsing requirement in this section. The information for the specified pulsing requirement will provide the following:

(a) Definition of the pulse repeating requirement.

(b) 2B-1 signaling test set control settings.

(c) Test set connections to relay under test.

(d) Special conditioning instructions to assure the accurate testing of the relay under test.

1.05 The pulsing circuit of the 2B-1 test set will provide a source of controlled pulses suitable for application toward the relay under test. The 2B-1 test set also provides circuitry to measure the received pulses from either the relay under test or the A1 relay in the test set and display the results on PPS and PERCENT BREAK meters. Supervisory signals are observed by lamps located on the 2B-1 test set.

1.06 Some of the pulse repeating requirements in this section will specify LOOP and LEAK conditions to be set up on the 2B-1 test set and applied to the relay under test. These conditions are applied one at a time to the relay under test. For example, set the specified LOOP condition on the 2B-1 test set LOOP RES keys, and test to determine if the output percent break of the relay under test is below the specified maximum level. Remove the loop condition value, and set the specified LEAK condition on the 2B-1 test set LEAK switch and test to determine if the output percent break of the relay under test is within the specified minimum level. The definitions for these conditions are as follows.

(a) ***Loop Condition:*** When input loop conditioning of a given resistance (0, 800, 1200 ohms, etc) is performed on the 2B-1 test set, the test set will be conditioned to outpulse at 12 pulses per second (PPS) with a 68.5 percent break and at the specified resistance value.

(b) ***Leak Zero Condition:*** This conditioning of the 2B-1 test set will provide outpulsing at 12 PPS with a 60.5 percent break and at a zero resistance value.

(c) ***Leak A Condition:*** This conditioning of the 2B-1 test set will provide outpulsing at 12 PPS with a 60.5 percent break. The resistance and capacitance values will be 10,200 ohms in parallel with the series combination of 5050 ohms and 2.15 microfarads across the K1 pulsing relay contacts.

(d) ***Leak B Condition:*** This conditioning of of the 2B-1 test set will provide outpulsing at 12 PPS with a 60.5 percent break. The resistance and capacitance values will be 10,200 ohms across the K1 pulsing relay contacts.

(e) ***Leak C Condition:*** This conditioning of the 2B-1 test set will provide outpulsing at 12 PPS with a 60.5 percent break. The resistance and capacitance values will be 10,200 ohms in parallel with the series combination of 600 ohms and 2.15 microfarads across the K1 pulsing relay contacts.

(f) ***Leak D Condition:*** This conditioning of the 2B-1 test set will provide outpulsing at 12 PPS with a 60.5 percent break. The resistance and capacitance values will be 20,300 ohms in parallel with the series combination of 600 ohms in series with 2.15 microfarads across the K1 pulsing relay contacts.

(g) ***Leak D1 Condition:*** This conditioning of the 2B-1 test set will provide outpulsing at 12 PPS with a 60.5 percent break. The resistance and capacitance values will be 600 ohms in series with 2.15 microfarads across the K1 pulsing relay contacts.◀

1.06 ***Lettered Steps:*** A letter a, b, c, etc, added to a step number in Part 4 or 5 of this section indicates an action which may or may not be required, depending on local conditions. The condition under which a lettered step or a series of lettered steps should be made is given in the ACTION column, and all steps governed by the same condition are designated by the same letter within a test. Where a condition does not apply, all steps designated by that letter should be omitted.

2. ▶DEFINITIONS OF PULSE REPEATING REQUIREMENTS

A. A1 Requirement

2.01 A1 requirement is specified primarily for 221- and similar-type pulse repeating relays used in outgoing repeaters and 2-party message rate trunks.

B. A2 Requirement

2.02 A2 requirement is specified primarily for 280-, 239-, and similar-type pulse repeating relays used in outgoing repeaters.

C. A3 Requirement

2.03 A3 requirement is specified primarily for 221- and similar-type pulse repeating relays used in certain other types of outgoing repeaters.

D. A4 Requirement

2.04 A4 requirement is specified primarily for H-type pulse repeating relays used in coin box trunk circuits.

E. A5 Requirement

2.05 A5 requirement is specified primarily for 221-type pulsing relays used in message ticketer trunk circuits for stepping a 204-type selector.

F. A6 Requirement

2.06 A6 requirement is specified primarily for 221-type pulsing relays used in the SXS originating register circuit (SD-32351-01).

G. B1 through B6 Requirements

2.07 B1 through B6 requirements are specified primarily for toll transmission selectors or toll incoming trunks. These requirements are fundamentally the same. The requirements differ by variations specified in resistances inserted for pulsing tests and in whether or not the incoming trunk circuit is connected during the test.

H. C1 Requirement

2.08 C1 requirement is specified for SXS loop signaling type pulse correcting repeaters having 221- or similar-type pulse timing relays.

I. C2 Requirement

2.09 C2 requirement is specified for loop signaling type pulse correcting repeaters having 280-, 239-, or similar-type pulse timing relays.

J. C3 Requirement

2.10 C3 requirement is specified for incoming composite signaling type pulse correcting repeaters having 221- or similar-type pulse timing relays.

K. C4 Requirement

2.11 C4 requirement is specified for incoming composite signaling type pulse correcting repeaters having 280-, 239-, or similar-type pulse timing relays.

L. D1 Requirement

2.12 D1 requirement is specified primarily for composite signaling type pulse correcting repeaters outgoing from panel tandem and having 280-, 239-, or similar-type pulse timing relays.

M. E1 and E2 Requirements

2.13 E1 and E2 requirements are specified primarily for outgoing composite signaling type pulse correcting repeaters having 221-, 239-, 280-, or similar-type pulse timing relays. The requirements E1 and E2 are fundamentally the same, the difference being in the maximum external pulsing loop over which the pulse timing relays and in the leak conditions under which the pulse timing relays are tested.

N. F1 through F6 Requirements

2.14 F1 through F6 requirements are specified primarily for 2-speed pulse correcting repeaters and trunk circuits having U- or similar-type pulse timing relays. The specific use of the requirement is as follows:

(a) ***F1 requirement*** is specified for outgoing composite signaling circuits.

(b) ***F2 requirement*** is specified for incoming composite signaling circuits.

(c) ***F3 requirement*** is specified for battery and ground signaling outgoing circuits.

(d) ***F4 requirement*** is specified for battery and ground signaling type circuits.

(e) ***F5 requirement*** is specified for loop signaling type circuits having a minimum insulation resistance of 15,000 ohms.

(f) ***F6 requirement*** is specified for loop signaling type circuits with a minimum insulation resistance of 30,000 ohms.

O. G1 and G2 Requirements

2.15 G1 and G2 requirements are specified primarily for outgoing composite signaling repeaters having 221- or similar-type pulse repeating relays where no pulse corrector is used.

P. H1 Requirement

2.16 H1 requirement is specified for use in composite type B or simplex signaling trunk circuits having 221-type pulsing relay used in crossbar tandem offices for trunk and repeater circuits to step-by-step offices.

Q. H2 Requirement

2.17 H2 requirement is specified for loop or battery and ground pulsing repeaters having 221-type pulse repeating relays used in crossbar tandem offices for trunk and repeater circuits to step-by-step offices.

R. J1 Requirement

2.18 J1 requirement is specified primarily for 280- or 239-type pulse-repeating relays used in 2-way trunk circuits for use at intermediate offices to connect loop signaling trunks to composite signaling circuits.◀

3. APPARATUS

3.01 2B-1 signaling test set and pulse repeating adapter (SD-56134-02) with KS-19653 L1 power supply.

3.02 ▶35-type test set SD-96003-01 (J94714A) or SD-95410-01 (J97414B) used for compensating trunk conductor resistance. (See Section 100-101-101.)◀

3.03 One each 2P1D and 2P3B patching cords, length as required (for patching 2B-1 test set to pulse repeating adapter).

3.04 One or two of the following cords (for patching the 2B-1 pulse repeating adapter to the relay circuit under test):

3P6F, 5P3A, 6P4B, 3P7A, 6P3A, 3P15A

4. PREPARATION

STEP	ACTION	VERIFICATION
1	At 2B-1 signaling test set— Set all keys to normal. ***Note:*** The OG-BG key is normal in the OG position.	
2	Using TST BAT cords, connect signaling test set to TST BAT supply jacks. ***Note 1:*** Only one pair of A and B jacks shall be connected to a given battery supply filter circuit. ***Note 2:*** When signaling test set is bay mounted, power will be cabled to test set and cords will not be required.	
3a	If using portable ac power supply KS-19653 L1— At signaling test set— Connect TST BAT cords to BAT jacks provided on power supply.	
4a	At KS-19653 L1 power supply— Adjust 48-volt ADJ potentiometer until 48-volt supply voltage equals 48-volt office battery voltage. ***Note:*** The KS-14510 L1 meter may be used to measure the necessary voltages.	
5	On signaling test set— Operate SCALE SEL switch to PPS.	
6	Operate CONT PLS key to DIAL PLS. ***Note:*** Allow a few minutes for test set warmup.	Pointers of the PULSES PER SECOND and PERCENT BREAK meters indicate 0 on their ***black*** scales.

STEP	ACTION	VERIFICATION
7b	If verification for Step 6 is not met— Set pointers to 0 by means of turning the pointer adjustment screw on the face of each meter.	

5. METHOD

A. A1 Through A6 Pulse Repeating Requirements

5.01 The pulse repeating relays, using requirements A1 through A6, shall meet the percent break limits specified on the circuit requirements table when checked under the following test procedures. Requirement A4 shall be met with the cover on the relay.

STEP	ACTION	VERIFICATION
8	Make busy circuit to be tested per local instructions.	
9c	If using A1, A2, A3, or A4 requirement and relay under test outpulses over outside trunk conductors to a distant office— Connect test setup as shown in Fig. 1.	
10c	Prepare 35-type test set to be used as a milliammeter per Section 100-101-101.	
11c	At pulse repeating adapter— Set CF key to R.	Indication on 35-type test set milliammeter. (Note for future use.)
12c	Set CF key to A1.	
13c	Adjust RCV LOOP potentiometer clockwise. ***Note:*** Steps 9c through 13c adjusts the RCV LOOP in series with the A1 relay in the pulse repeating adapter so that the current reading in the RCV LOOP relay is the same as the current reading in the trunk loop to the relay in the distant office.	Same indication on 35-type test set milliammeter as in Step 11c.
14c	Disconnect test setup.	
15c	At distant office— Disconnect trunk conductors.	
16c	At associated selector in distant office— Disconnect pulsing relay.	
17d	If using A1, A2, A3, or A4 requirement— Connect input and output connections between 2B-1 test set and circuit under test as specified	

STEP	ACTION	VERIFICATION
	by the circuit requirements table and as shown in Fig. 2.	
18e	If using A5 or A6 requirement— Connect input and output connections between 2B-1 test set and circuit under test as specified by the circuit requirements table and as shown in Fig. 3.	
19	At signaling test set— Adjust the ADJ PPS control until PULSES PER SECOND meter indicates 12.	
20	Set TWDL key to OFF HK.	
21	Set MEAS % BK key to LINE.	
22	At pulse repeating adapter— Set FUNCTION switch to P/C.	
23	At signaling test set— Adjust CAL % BK control until PERCENT BREAK meter indicates a 0 on red scale.	
24f	If using A1, A2, A3, A4, or A6 requirement— At pulse repeating adapter— Set FUNCTION switch to LP2.	At signaling test set— PERCENT BREAK meter indicates 0 on red scale. If indication is other than 0, excessive cord conductor loss is present between the adapter and the circuit under test.
25g	If using A5 requirement— At pulse repeating adapter— Set FUNCTION switch to LP1.	At signaling test set— PERCENT BREAK meter indicates 0 on red scale. If indication is other than 0, excessive cord conductor loss is present between the adapter and the circuit under test.
26	Set FUNCTION switch to P/C.	
27	At signaling test set— Set TWDL key to normal position.	
28	Set PLS key to LINE.	
29	Slowly adjust ADJ % BK control until the PERCENT BREAK meter indicates 68.5 on the red scale.	
30f	If using A1, A2, A3, A4, or A6 requirement— At pulse repeating adapter— Set FUNCTION switch to LP2.	

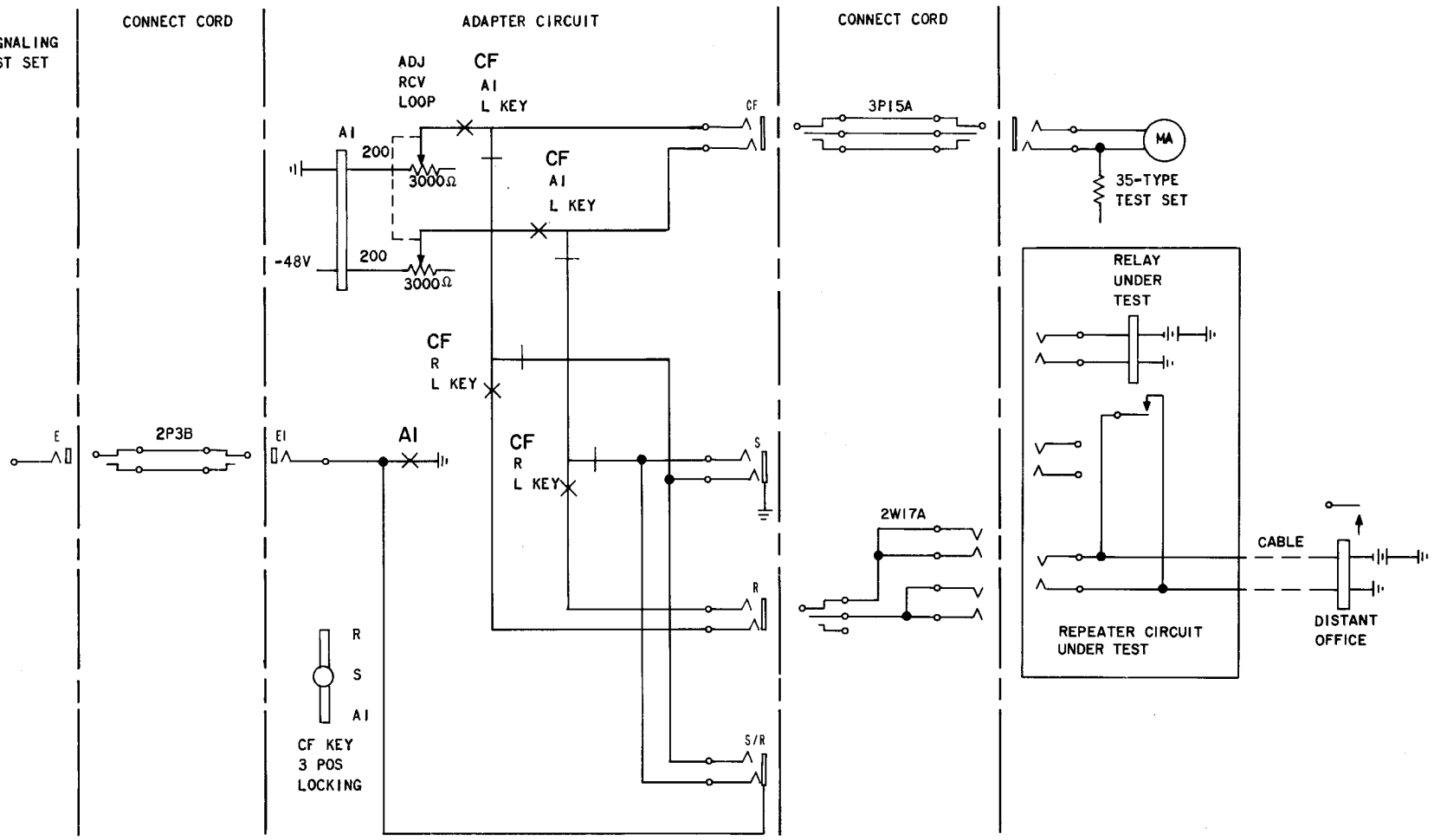

Fig. 1—Method of Compensating for Trunk Conductor Resistance to Distant Office

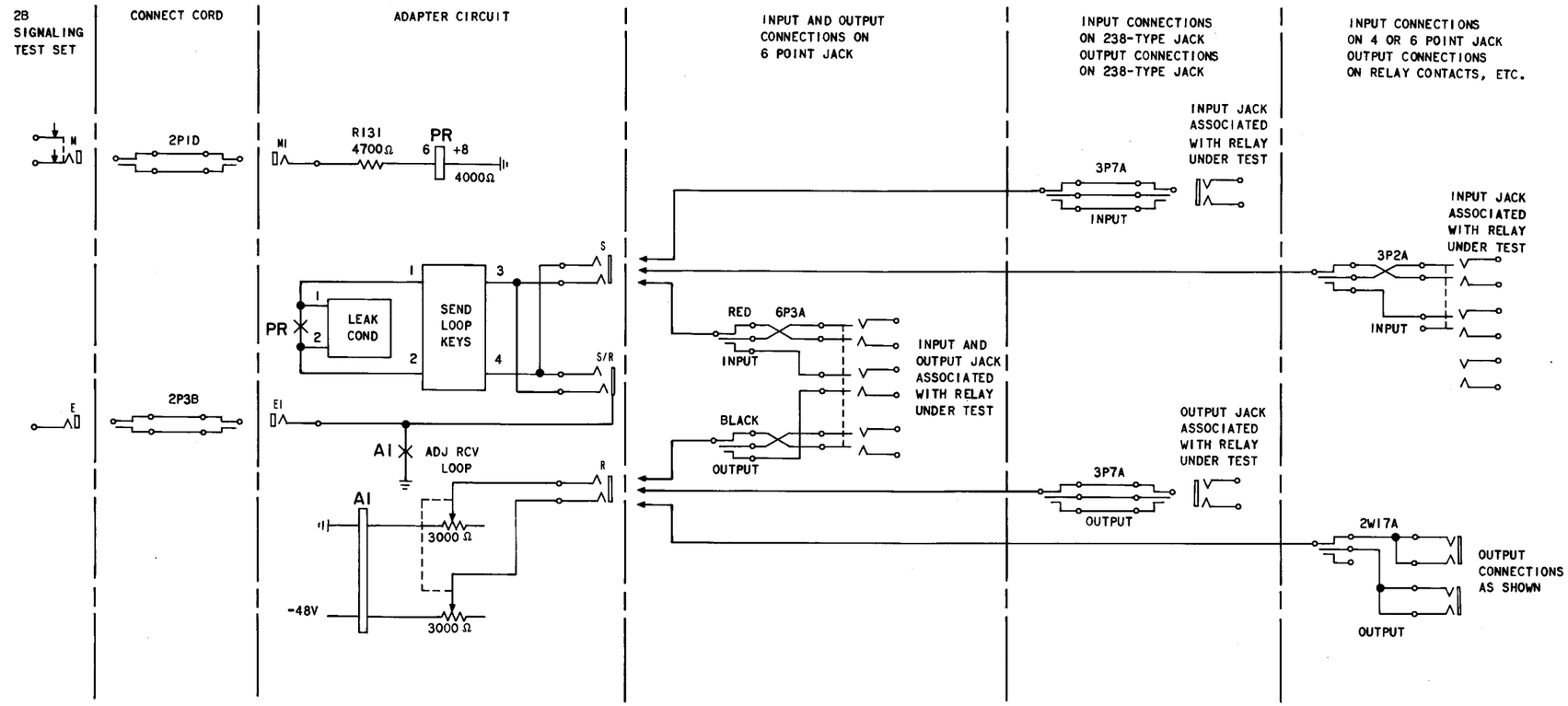

Fig. 2—Typical Test Circuit—Pulse Repeating Adapter Function Switch Set to LP2 Position

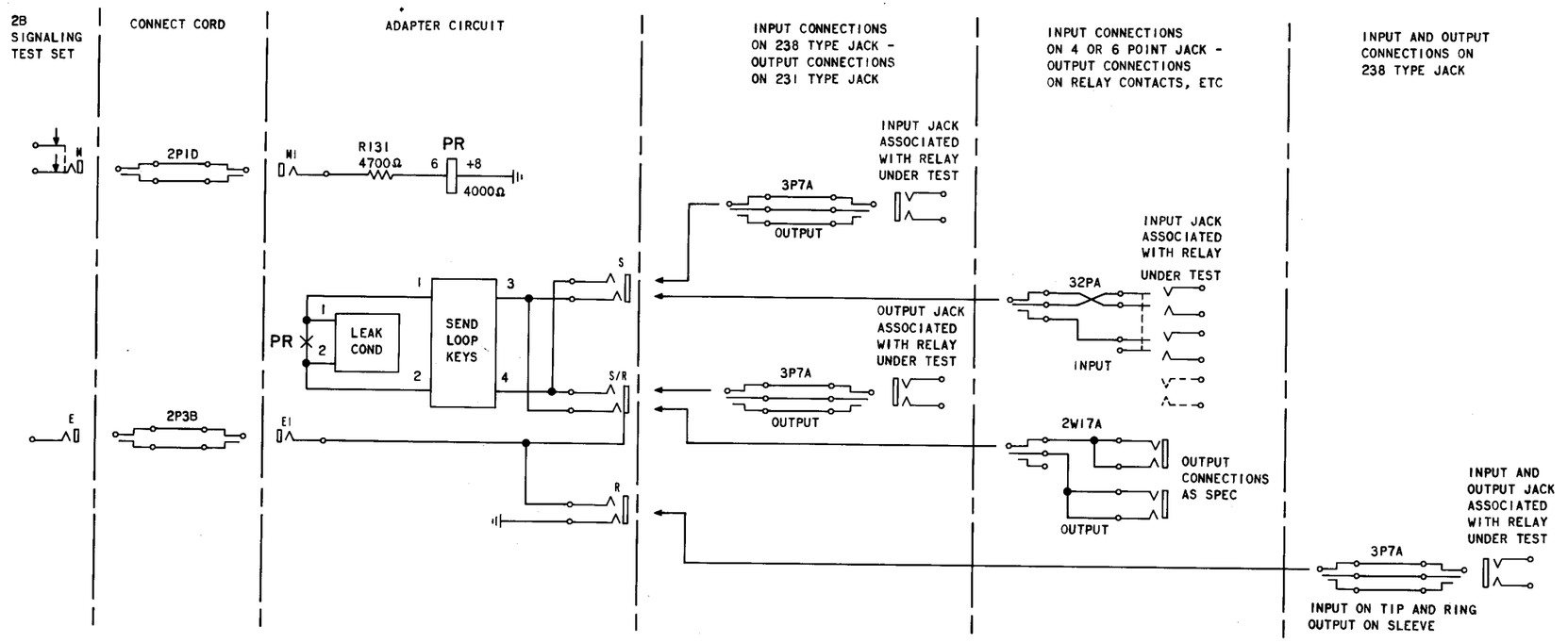

Fig. 3—Typical Test Circuit—Pulse Repeating Adapter Function Switch to LP1 Position

STEP	ACTION	VERIFICATION
31f	Set SEND LOOP keys 800 and 400 to IN. ***Note:*** Verify LEAK switches are set to OUT.	At signaling test set— Red scale of the PERCENT BREAK meter indicates the output percent break is below the maximum limit specified on circuit requirements table for relay under test. ***Note:*** If relay under test fails to meet specified limits, refer to Part 6 for adjusting procedures.
32g	If using A5 requirement— At pulse repeating adapter— Set FUNCTION switch to LP1.	
33g	Set SEND LOOP keys 800, 400, and 200 to IN. ***Note:*** Verify LEAK control is set to OUT.	At signaling test set— Red scale of the PERCENT BREAK meter indicates that the output percent break is above the minimum limit specified on the circuit requirements table for relay under test. ***Note:*** If relay under test fails to meet specified limits, refer to Part 6 for adjusting procedures.
34	Set all SEND LOOP keys to OUT.	
35	Set FUNCTION switch to P/C.	
36	At signaling test set— Slowly adjust ADJ % BK control until the PERCENT BREAK meter indicates 60.5 on the red scale.	
37f	If using A1, A2, A3, A4, or A6 requirement— At pulse repeating adapter— Set FUNCTION switch to LP2.	
38	If using A5 requirement— At pulse repeating adapter— Set FUNCTION switch to LP1.	
39	Set LEAK selector switch to A.	If using A1, A2, A3, A4, or A6 requirement— At signaling test set— Red scale of the PERCENT BREAK meter indicates that the output percent break of relay under test is above the minimum limit specified on the circuit requirements table. If using A5 requirement— At signaling test set— Red scale of the PERCENT BREAK meter indicates that the output percent break is

STEP	ACTION	VERIFICATION
		below the maximum limit specified on circuit requirements table for relay under test. ***Note:*** If relay under test fails to meet the specified limits, refer to Part 6 for adjusting procedures.
40h	If no further tests are to be made— Remove all test equipment and restore all circuits to normal.	

B. B1 through B6 Pulse Repeating Requirements

5.02 The pulse repeating relay shall meet the percent break limits specified on the circuit requirements table when checked under the following test procedures.

STEP	ACTION	VERIFICATION
8	Make busy circuit to be tested per local instructions.	
9	Connect input and output connections between 2B-1 test set and circuit under test as specified by the circuit requirements table and as shown in Fig. 2.	
10c	If the circuit under test is an incoming trunk circuit and repeats pulses from a manual or toll office— At associated selector— Disconnect pulsing relay.	
11d	If using B1, B2, or B3 requirement— Leave incoming trunk conductors connected to the circuit.	
12e	If using B4, B5, or B6 requirement— Disconnect incoming trunk conductors.	
13	At signaling test set— Adjust the ADJ PPS control until PULSES PER SECOND meter indicates 12.	
14	Set TWDL key to OFF HK.	
15	At pulse repeating adapter— Set FUNCTION switch to P/C.	
16	Set MEAS % BK key to LINE.	

STEP	ACTION	VERIFICATION
17	At signaling test set— Adjust CAL % BK control until PERCENT BREAK meter indicates a 0 on red scale.	
18	At pulse repeating adapter— Set FUNCTION switch to LP2.	At signaling test set— PERCENT BREAK meter indicates 0 on red scale. If indication is other than 0, excessive cord conductor loss is present between the adapter and the circuit under test.
19	Set FUNCTION switch to P/C.	
20	At signaling test set— Set TWDL key to normal position.	
21	Set PLS key to LINE.	
22	Slowly adjust ADJ % BK control until the PERCENT BREAK meter indicates 68.5 on the red scale.	
23	At pulse repeating adapter— Set FUNCTION switch to LP2.	
24f	If using B2 or B5 requirement and circuit requirements table specifies 0 to 600 ohm loop— Set SEND LOOP keys 400 and 200 to IN.	
25g	If using B2 or B5 requirement and circuit requirements table specifies 0-1200 ohm loop— Set SEND LOOP keys 800 and 400 to IN.	
26h	If using B1 or B4 requirement— Set SEND LOOP keys 800 and 100 to IN.	
27i	If using B3 or B6 requirement— Set SEND LOOP keys 1600 and 400 to IN.	
28	Set LEAK switch to D1.	At signaling test set— Red scale of the PERCENT BREAK meter indicates that the output percent break is below maximum limit specified on circuit requirements table for relay under test. ***Note:*** If relay under test fails to meet specified limits, refer to Part 6 for adjusting procedures.
29	Set SEND LOOP keys to OUT.	

STEP	ACTION	VERIFICATION
30	Set FUNCTION switch to P/C.	
31	At signaling test set— Slowly adjust ADJ % BK control until the PERCENT BREAK meter indicates 60.5 on the red scale.	
32	At pulse repeating adapter— Set FUNCTION switch to LP2.	
33	Set LEAK selector switch to C.	At signaling test set— Red scale of the PERCENT BREAK meter indicates that the output percent break is above minimum limits specified on circuit requirements table for relay under test. ***Note:*** If relay under test fails to meet the specified limits, refer to Part 6 for adjusting procedures.
34j	If no further tests are to be made— Remove all test equipment and restore all circuits to normal.	

C. C1 through C4 Pulse Repeating Requirements

5.03 The pulse repeating relay shall meet the percent break limits specified on the circuit requirements table when checked under the following test procedures.

STEP	ACTION	VERIFICATION
8	Make busy circuit to be tested per local instructions.	
9	Connect input and output connections from 2B-1 test set to circuit under test as specified by the circuit requirements table and as shown in Fig. 2.	
10c	If the circuit under test is an incoming repeater— At associated selector— Disconnect pulsing relay.	
11d	If circuit under test is an outgoing repeater— At circuit under test— Disconnect trunk conductors.	
12	At signaling test set— Adjust the ADJ PPS control until PULSES PER SECOND meter indicates 12.	

STEP	ACTION	VERIFICATION
13	Set TWDL key to OFF HK.	
14	At pulse repeating adapter— Set FUNCTION switch to P/C.	
15	Set MEAS % BK key to LINE.	
16	At signaling test set— Adjust CAL % BK control until PERCENT BREAK meter indicates a 0 on red scale.	
17	At pulse repeating adapter— Set FUNCTION switch to LP2.	At signaling test set— PERCENT BREAK meter indicates 0 on red scale. If indication is other than 0, excessive cord conductor loss is present between the adapter and the circuit under test.
18	Set FUNCTION switch to P/C.	
19	At signaling test set— Set TWDL key to normal position.	
20	Set PLS key to LINE.	
21	Slowly adjust ADJ % BK control until PERCENT BREAK meter indicates 60.5 on the red scale.	
22	At pulse repeating adapter— Set FUNCTION switch to LP2.	
23e	If using C1 or C2 requirement— Set SEND LOOP key 1600 to IN. ***Note:*** Verify LEAK control is set to OUT.	At signaling test set— Red scale of the PERCENT BREAK meter indicates that the output percent break is within the specified limits of the circuit requirements table for relay under test. ***Note:*** If relay under test fails to meet specified limits, refer to Part 6 for adjusting procedures.
24f	If using C3 or C4 requirement— Verify SEND LOOP keys and LEAK control are set to OUT.	At signaling test set— Red scale of the PERCENT BREAK meter indicates that the output percent break is within the specified limits of the circuit requirements table for relay under test. ***Note:*** If relay under test fails to meet specified limits, refer to Part 6 for adjusting procedures.

STEP	ACTION	VERIFICATION
25g	If no further tests are to be made— Remove all test equipment and restore all circuits to normal.	

D. D1 Pulse Repeating Requirement

5.04 The pulse repeating relay shall meet the percent break limits specified on the circuit requirements table when checked under the following test procedures.

STEP	ACTION	VERIFICATION
8	Make busy the circuit to be tested per local instructions.	
9	Connect input and output connections between 2B-1 test set and circuit under test as specified by the circuit requirements table and as shown in Fig. 3.	
10	At signaling test set— Adjust the ADJ PPS control until PULSES PER SECOND meter indicates 12.	
11	Set TWDL key to OFF HK.	
12	At pulse repeating adapter— Set FUNCTION switch to P/C.	
13	Set MEAS % BK key to LINE.	
14	At signaling test set— Adjust CAL % BK control until PERCENT BREAK meter indicates a 0 on red scale.	
15	At pulse repeating adapter— Set FUNCTION switch to LP1.	At signaling test set— PERCENT BREAK meter indicates 0 on red scale. If indication is other than 0, excessive cord conductor loss is present between the adapter and the circuit under test.
16	Set FUNCTION switch to P/C.	
17	At signaling test set— Set TWDL key to normal position.	
18	Set PLS key to LINE.	
19	Slowly adjust ADJ % BK control until PERCENT BREAK meter indicates 60.5 on the red scale.	

STEP	ACTION	VERIFICATION
20	At pulse repeating adapter— Set FUNCTION switch to LP1. ***Note:*** Verify SEND LOOP keys are set to OUT and LEAK control is set to OUT.	At signaling test set— Red scale of the PERCENT BREAK meter indicates that the output percent break is within the specified limits of the circuit requirements table for the relay under test. ***Note:*** If relay under test fails to meet specified limits, refer to Part 6 for adjusting procedures.
21c	If no further tests are to be made— Remove all test equipment and restore all circuits to normal.	

E. E1 and E2 Pulse Repeating Requirements

5.05 The pulse repeating relay shall meet the percent break limits specified on the circuit requirements table when checked under the following test procedures.

STEP	ACTION	VERIFICATION
8	Make busy the circuit to be tested per local instructions.	
9	Connect input and output connections between 2B-1 test set and circuit under test as specified by the circuit requirements table and as shown in Fig. 3.	
10	At circuit under test— Disconnect incoming signaling lead to composite signaling relay under test.	
11	At signaling test set— Adjust the ADJ PPS control until PULSES PER SECOND meter indicates 12.	
12	Set TWDL key to OFF HK.	
13	Set MEAS % BK key to LINE.	
14	At pulse repeating adapter— Set FUNCTION switch to P/C.	
15	At signaling test set— Adjust CAL % BK control until PERCENT BREAK meter indicates a 0 on red scale.	
16	At pulse repeating adapter— Set FUNCTION switch to LP1.	At signaling test set— PERCENT BREAK meter indicates 0 on red scale. If indication is other than 0, excessive cord

STEP	ACTION	VERIFICATION
		conductor loss is present between the adapter and the circuit under test.
17	Set FUNCTION switch to P/C.	
18	At signaling test set— Set TWDL key to normal position.	
19	Set PLS key to LINE.	
20	Slowly adjust ADJ % BK control until PERCENT BREAK meter indicates 60.5 on the red scale.	
21	At pulse repeating adapter— Set FUNCTION switch to LP1. ***Note:*** Verify SEND LOOP keys are set to OUT.	
22c	If using E1 requirement— Set LEAK switch to A.	At signaling test set— Red scale of the PERCENT BREAK meter indicates that the output percent break is within the specified limits of the circuit requirements table for the relay under test. ***Note:*** If relay under test fails to meet specified limits, refer to Part 6 for adjusting procedures.
23d	If using E2 requirement— Set LEAK switch to C.	At signaling test set— Red scale of the PERCENT BREAK meter indicates that the output percent break is within the specified limits of the circuit requirements table for the relay under test. ***Note:*** If relay under test fails to meet specified limits, refer to Part 6 for adjusting procedures.
24e	If no further tests are to be made— Remove all test equipment and restore all circuits to normal.	

F. F1 through F6 Pulse Repeating Requirements

5.06 The pulse repeating relays shall meet the percent break limits as specified on the circuit requirements table when checked under the following test procedures.

STEP	ACTION	VERIFICATION
8	Make busy the circuit to be tested per local instructions.	
9	Connect input and output connections between 2B-1 test set and circuit under test as specified by the circuit requirements table and as shown in Fig. 3.	
10c	If using F1 requirement— At circuit under test— Disconnect signaling lead to composite signaling relay.	
11d	If using F2, F3, or F4 requirement— At associated circuit— Disconnect associated pulsing relay. ***Note:*** In the case of repeaters per SD-31929-01, disconnect battery and ground from the associated incoming selector by inserting an open plug into the P jack.	
12e	If using F5 or F6 requirement— At circuit under test— Disconnect conductors to succeeding circuit.	
13e	Disconnect incoming trunk conductors.	
14f	If using F1, F3, F4, F5, or F6 requirement— At pulse repeating adapter— Set SEND LOOP keys to equivalent of minimum working limit of pulse receiving relay in circuit under test. ***Note:*** The minimum working limit of the pulse receiving relay can be found in the schematic drawing for the circuit under test.	
15	At signaling test set— Adjust the ADJ PPS control until PULSES PER SECOND meter indicates 6.	
16	Set TWDL key to OFF HK.	
17	Set MEAS % BK key to LINE.	
18	At pulse repeating adapter— Set FUNCTION switch to P/C.	
19	At signaling test set— Adjust CAL % BK control until PERCENT BREAK meter indicates a 0 on red scale.	

STEP	ACTION	VERIFICATION
20	At pulse repeating adapter— Set FUNCTION switch to LP1.	At signaling test set— PERCENT BREAK meter indicates 0 on red scale. If indication is other than 0, excessive cord conductor loss is present between the adapter and the circuit under test.
21	Set FUNCTION switch to P/C.	
22	At signaling test set— Set TWDL key to normal position.	
23	Set PLS key to LINE.	
24	Slowly adjust ADJ % BK control until the PERCENT BREAK meter indicates 30.25 on the red scale.	
25f	If using F1, F3, F4, F5, or F6 requirement— At pulse repeating adapter— Set FUNCTION switch to LP1. ***Note:*** Verify LEAK switches are set to OUT.	At signaling test set— Red scale of the PERCENT BREAK meter indicates that the output percent break meets the specified requirement for low speed shown in the circuit requirements table of circuit under test. ***Note:*** If relay under test fails to meet the specified requirement, refer to Part 6 for low speed adjusting procedures.
26g	If using F2 requirement— At pulse repeating adapter— Set FUNCTION switch to LP1. ***Note:*** Verify SEND LOOP keys and LEAK switches are set to OUT.	At signaling test set— Red scale of the PERCENT BREAK meter indicates that the output percent break meets the specified requirement for low speed shown in the circuit requirements table of circuit under test. ***Note:*** If relay under test fails to meet the specified requirement, refer to Part 6 for low speed adjusting procedures.
27	At signaling test set— Adjust the ADJ PPS control until PULSES PER SECOND meter indicates 12.	
28	At pulse repeating adapter— Set FUNCTION switch to P/C.	
29	Slowly adjust ADJ % BK control until the PERCENT BREAK meter indicates 60.5 on the red scale.	

STEP	ACTION	VERIFICATION
30	At pulse repeating adapter— Set FUNCTION switch to LP1.	
31i	If using F1, F3, F4, or F5 requirement— Set LEAK switch to A.	At signaling test set— Red scale of the PERCENT BREAK meter indicates that the output percent break meets the specified requirement for high speed shown in the circuit requirements table of circuit under test. ***Note:*** If relay under test fails to meet the specified requirement, refer to Part 6 for high speed adjusting procedures.
32g	If using F2 requirement— Set all SEND LOOP keys and LEAK switches to OUT.	At signaling test set— Red scale of the PERCENT BREAK meter indicates that the output percent break meets the specified requirement for high speed shown in the circuit requirements table of circuit under test. ***Note:*** If relay under test fails to meet the specified requirement, refer to Part 6 for high speed adjusting procedures.
33j	If using F6 requirement— Set LEAK switch to D.	At signaling test set— Red scale of the PERCENT BREAK meter indicates that the output percent break meets the specified requirement for high speed shown in the circuit requirements table of circuit under test. ***Note:*** If relay under test fails to meet the specified requirement, refer to Part 6 for high speed adjusting procedures.
34k	If no further tests are to be made— Remove all test equipment and restore all circuits to normal.	

G. G1 and G2 Pulse Repeating Requirements

5.07 The pulse repeating relays shall meet the percent break limits as specified on the circuit requirements table when checked under the following test procedures.

STEP	ACTION	VERIFICATION
8	Make busy the circuit to be tested per local instructions.	
9	Connect input and output connections between 2B-1 test set and circuit under test as specified	

STEP	ACTION	VERIFICATION
	by the circuit requirements table and as shown in Fig. 3.	
10	At circuit under test— Disconnect signaling lead to composite signaling relay.	
11	At signaling test set— Adjust the ADJ PPS control until PULSES PER SECOND meter indicates 12.	
12	Set TWDL key to OFF HK.	
13	At pulse repeating adapter— Set FUNCTION switch to P/C.	
14	Set MEAS % BK key to LINE.	
15	At signaling test set— Adjust CAL % BK control until PERCENT BREAK meter indicates a 0 on red scale.	
16	At pulse repeating adapter— Set FUNCTION switch to LP1.	At signaling test set— PERCENT BREAK meter indicates 0 on red scale. If indication is other than 0, excessive cord conductor loss is present between the adapter and the circuit under test.
17	Set FUNCTION switch to P/C.	
18	At signaling test set— Set TWDL key to normal position.	
19	Set PLS key to LINE.	
20	Slowly adjust ADJ % BK control until the PERCENT BREAK meter indicates 68.5 on the red scale.	
21	At pulse repeating adapter— Set FUNCTION switch to LP1.	
22c	If using G1 requirement— At pulse repeating adapter— Set SEND LOOP keys 800 and 400 to IN. ***Note:*** Verify LEAK switches are set to OUT.	At signaling test set— Red scale of the PERCENT BREAK meter indicates that the output percent break is above the minimum limit specified on the circuit requirements table for relay under test. ***Note:*** If relay under test fails to meet the specified requirement, refer to Part 6 for adjusting procedures.

STEP	ACTION	VERIFICATION
23d	If using G2 requirement— At pulse repeating adapter Set SEND LOOP keys 1600 to 400 to IN. ***Note:*** Verify LEAK switches are set to OUT.	At signaling test set— Red scale of the PERCENT BREAK meter indicates that the output percent break is above the minimum limit specified on the circuit requirements table for relay under test. ***Note:*** If relay under test fails to meet the specified requirement, refer to Part 6 for adjusting procedures.
24	At pulse repeating adapter— Set FUNCTION switch to P/C.	
25	At signaling test set— Slowly adjust ADJ % BK control until the PERCENT BREAK meter indicates 60.5 on the red scale.	
26	At pulse repeating adapter— Set FUNCTION switch to LP1.	
27	Set LEAK switch to A.	
28c	If using G1 requirement— Set SEND LOOP keys 800 and 400 to OUT.	At signaling test set— Red scale of the PERCENT BREAK meter indicates that the output percent break is below the maximum limit specified on the circuit requirements table for relay under test. ***Note:*** If relay under test fails to meet the specified requirement, refer to Part 6 for adjusting procedures.
29d	If using G2 requirement— Set SEND LOOP keys 1600 to OUT and 800 to IN.	At signaling test set— Red scale of the PERCENT BREAK meter indicates that the output percent break is below the maximum limit specified on the circuit requirements table for relay under test. ***Note:*** If relay under test fails to meet the specified requirement, refer to Part 6 for adjusting procedures.
30e	If no further tests are to be made— Remove all test equipment and restore all circuits to normal.	

H. H1 and H2 Pulse Repeating Requirements

5.08 The pulse repeating relays shall meet the percent break limits as specified on the circuit requirements table when checked under the following test procedures.

STEP	ACTION	VERIFICATION
8	Make busy circuit to be tested per local instructions.	
9c	If using H2 requirement— Connect test set as shown in Fig. 1.	
10c	Prepare 35-type test set to be used as a milliammeter per Section 100-101-101.	
11c	At pulse repeating adapter— Set CF key to R.	Indication on 35-type test set milliammeter. (Note for future use.)
12c	Set CF key to A1.	
13c	Adjust RCV LOOP potentiometer clockwise. ***Note:*** Steps 9c through 13c adjust the RCV LOOP in series with the A1 relay in the pulse repeating adapter so that the current reading in the RCV LOOP is the same as the current reading in the trunk loop to the relay in the distant office.	Same indication on 35-type test set milliammeter as in Step 11c.
14c	Connect input and output connections between 2B-1 test set and circuit under test as specified by the circuit requirements table and as shown in Fig. 2.	
15d	If conductor loop is 2000 ohms or less and using H2 requirement— At distant office— Disconnect associated selector pulsing relay.	
16e	If conductor loop is over 2000 ohms and using H2 requirement— At crossbar tandem office— Disconnect associated selector pulsing relay.	
17f	If using H1 requirement— Connect input and output connections between 4A test set and circuit under test as specified by the circuit requirements table and as shown in Fig. 3.	
18	At signaling test set— Adjust the ADJ PPS control until PULSES PER SECOND meter indicates 12.	
19	Set TWDL key to OFF HK.	
20	At pulse repeating adapter— Set FUNCTION switch to P/C.	

STEP	ACTION	VERIFICATION
21	Set MEAS % BK key to LINE.	
22	At signaling test set— Adjust CAL % BK control until PERCENT BREAK meter indicates 0 on red scale.	
23e	If using H2 requirement— At pulse repeating adapter— Set FUNCTION switch to LP2.	At signaling test set— PERCENT BREAK meter indicates 0 on red scale. If indication is other than 0, excessive cord conductor loss is present between the adapter and the circuit under test.
24f	If using H1 requirement— At pulse repeating adapter— Set FUNCTION switch to LP1.	At signaling test set— PERCENT BREAK meter indicates 0 on red scale. If indication is other than 0, excessive cord conductor loss is present between the adapter and the circuit under test.
25	Set FUNCTION switch to P/C.	
26	At signaling test set— Set TWDL key to normal position.	
27	Set PLS key to LINE.	
28	Slowly adjust ADJ % BK control until the PERCENT BREAK meter indicates 68.5 on the red scale.	
29	At pulse repeating adapter— Set SEND LOOP keys 1600 and 100 to IN. ***Note:*** Verify LEAK control is set to OUT.	
29c	If using H2 requirement— At pulse repeating adapter— Set FUNCTION switch to LP2.	At signaling test set— Red scale of the PERCENT BREAK meter indicates the output percent break is below maximum limit specified on circuit requirements table for relay under test. ***Note:*** If relay under test fails to meet specified limits, refer to Part 6 for adjusting procedures.
30f	If using H1 requirement— At pulse repeating adapter— Set FUNCTION switch to LP1.	At signaling test set— Red scale of the PERCENT BREAK meter indicates the output percent break is below the maximum limit specified on circuit requirements table for relay under test.

STEP	ACTION	VERIFICATION
		Note: If relay under test fails to meet the specified limits, refer to Part 6 for adjusting procedures.
31	At pulse repeating adapter— Set FUNCTION switch to P/C.	
32	At signaling test set— Slowly adjust ADJ % BK control until the PERCENT BREAK meter indicates 60.5 on the red scale.	
33	At pulse repeating adapter— Set SEND LOOP switches 1600 and 100 to OUT.	
34	Set LEAK switch to D.	
35c	If using H2 requirement— Set FUNCTION switch to LP2.	At signaling test set— Red scale of the PERCENT BREAK meter indicates that the percent break is above the minimum limit specified on the circuit requirements table for relay under test. *Note:* If relay under test fails to meet the specified limits, refer to Part 6 for adjusting procedures.
36f	If using H1 requirement— Set FUNCTION switch to LP1.	At signaling test set— Red scale of the PERCENT BREAK meter indicates that the percent break is above the minimum limit specified on the circuit requirements table. *Note:* If relay under test fails to meet the specified limits, refer to Part 6 for adjusting procedures.
37g	If no further tests are to be made— Remove all test equipment and restore all circuits to normal.	

I. J1 Pulse Repeating Requirements

5.09 The pulse repeating relays shall meet the percent break limits as specified on the circuit requirements table when checked under the following test procedures.

STEP	ACTION	VERIFICATION
8	Make busy circuit to be tested per local instructions.	

STEP	ACTION	VERIFICATION
9	Connect input and output connections between 2B-1 test set and circuit under test as specified by the circuit requirements table and as shown in Fig. 3.	
10	At circuit under test— Insert an open plug into C jack to remove signaling battery from front pulsing contact of relay under test.	
11	At signaling test set— Adjust the ADJ PPS control until PULSES PER SECOND meter indicates 12.	
12	Set TWDL key to OFF HK.	
13	At pulse repeating adapter— Set FUNCTION switch to P/C.	
14	Set MEAS % BK key to LINE.	
15	At signaling test set— Adjust CAL % BK control until PERCENT BREAK meter indicates 0 on red scale.	
16	At pulse repeating adapter— Set FUNCTION switch to LP1.	At signaling test set— PERCENT BREAK meter indicates 0 on red scale. If indication is other than 0, excessive cord conductor loss is present between the adapter and the circuit under test.
17	Set FUNCTION switch to P/C.	
18	At signaling test set— Set TWDL key to normal position.	
19	Set PLS key to LINE.	
20	Slowly adjust ADJ % BK control until the PERCENT BREAK meter indicates 68.5 on the red scale.	
21	At pulse repeating adapter— Set FUNCTION switch to LP1. ***Note:*** Verify all SEND LOOP keys are set to OUT, and LEAK switches are set to OUT.	At signaling test set— Red scale of the PERCENT BREAK meter indicates that output percent break is below maximum limit specified on circuit requirements table for relay under test. ***Note:*** If relay under test fails to meet specified limits, refer to Part 6 for adjusting procedures.

STEP	ACTION	VERIFICATION
22	At pulse repeating adapter— Set FUNCTION switch to P/C.	
23	At signaling test set— Slowly adjust ADJ % BK control until the PERCENT BREAK meter indicates 60.5 on the red scale.	
24	At pulse repeating adapter— Set LEAK switch to D1.	
25	Set FUNCTION switch to LP1.	At signaling test set— Red scale of the PERCENT BREAK meter indicates that output percent break is above the minimum limit specified on the circuit requirements table. *Note:* If relay under test fails to meet the specified limits, refer to Part 6 for adjusting procedures.
26c	If no further tests are to be made— Remove all test equipment and restore all circuits to normal.◀	

6. ADJUSTING PROCEDURES FOR PULSE REPEATING RELAYS

A. A1 Through ▶A6◀ REQUIREMENTS

Requirement A1 ▶and A6◀

6.01 If the pulse repeating requirement is not met, check the relay under test as covered in Section 040-236-701 covering 221-type relays and readjust the relay as required. If the percent break is above the maximum specified when making the loop test, decrease the spring tension of the relay under test. If the percent break is below the minimum specified for the leak test, increase the spring tension. The leak adjustment will be facilitated if the percent break is held within one percent of the maximum limit on the loop test.

6.02 If the percent break is still above the maximum limit, some improvement can be gained by decreasing the residual airgap setting of the pulse repeating relay. If the percent break is still below the minimum limit, increase the residual airgap setting of the pulse repeating relay. In certain cases, it may be necessary to decrease or increase the heel gap to decrease or increase the percent break. If this is done, recheck the relay.

6.03 If the requirement cannot be met, replace the relay with a new one and repeat the test.

6.04 After readjustments or replacements, check the relay for current flow requirements and test the ▶overall circuit for proper operation.◀

Requirement A2

6.05 Readjust the relay under test as covered in Section 040-267-701 covering 280-type relays or Section 040-228-701 covering 239-type relays. If the requirement cannot be met, replace the relay with a new one and repeat the test.

6.06 After readjustments or replacements, check the relay for current flow requirements and test the ▶overall circuit for proper operation.◀

Requirement A3

6.07 If the pulse repeating requirement is not met, check the relay under test as covered

in Section 040-236-701 covering 221-type relays and readjust the relay as required. If the percent break is above the maximum specified when making the loop test, decrease the spring tension of the relay under test as required. If the percent break is below the minimum specified for the leak test, increase the spring tension as required. No effort should be made to hold the percent break within one percent of the maximum limit.

6.08 If the percent break is still above the maximum limit, some improvement can be gained by decreasing the residual ▶airgap◀ of the pulse repeating relay. If the percent break is still below the minimum limit, increase the residual ▶airgap◀ of the pulse repeating relay. In certain cases, it may be necessary to decrease or increase the heel gap to decrease or increase the percent break. If this is done, recheck the relay.

6.09 If the requirement cannot be met, replace the relay with a new one and repeat the test.

6.10 After readjustments or replacements, check the relay for current flow requirements and test the ▶overall circuit for proper operation.◀

Requirement A4

6.11 If the pulse repeating requirement is not met, check the relay under test as covered in Section 040-510-701 covering H-type relays and readjust the relay as required. If the percent break is above the maximum specified when making the loop test, decrease the spring tension of the relay under test as required. If the percent break is below the minimum specified for the leak test, increase the spring tension as required.

6.12 If the requirement cannot be met, replace the relay with a new one and repeat the test.

6.13 After readjustments or replacements, check the relay for current flow requirements and test the ▶overall circuit for proper operation.◀

Requirement A5

6.14 If the pulse repeating requirement is not met, check the relay under test as covered in Section 040-236-701 covering 221-type relays and readjust the relay as required. If the percent break is below the minimum specified when making the loop test, decrease the spring tension of the relay under test as required. If the percent break is above the maximum specified for the leak test, increase the spring tension as required.

6.15 If the percent break is still below the minimum limit, some improvement can be gained by decreasing the residual ▶airgap◀ of the pulse repeating relay. If the maximum percent break requirement still is not met, increase the residual ▶airgap◀ of the pulse repeating relay. In certain cases, it may be necessary to decrease or increase the heel gap to increase or decrease the percent break. If this is done, recheck the relay.

6.16 If the requirement cannot be met, replace the relay with a new one and repeat the test.

6.17 After readjustments or replacements check the relay for current flow requirements and test the ▶overall circuit for proper operation.◀

B. B1 Through B6 Requirements

6.18 If the pulse repeating requirement is not met, check the relay under test as covered in the section covering the particular type of relay involved and readjust the relay as required. If the percent break is above the maximum specified when making the loop test, decrease the spring tension of the relay under test as required. If the percent break is below the minimum specified for the leak test, increase the spring tension as required. In making this adjustment, the leak adjustment will be facilitated if the percent break is held within one percent of the maximum limit on the loop test. If necessary, adjust the residual airgap setting and the spring tension of the B relay toward the minimum until it holds.

6.19 If the percent break is still above the maximum limit, some improvement can be gained by decreasing the residual of the pulse repeating relay. If the percent break is still below the minimum limit, increase the residual of the pulse repeating relay. In certain cases, it may be necessary to decrease or increase the heel gap to decrease or increase the percent break. If this is done, recheck the relay.

6.20 If the requirement cannot be met, replace the relay with a new one and repeat the test.

6.21 After readjustments or replacements, check the relay for current flow requirements and test the ▶overall circuit for proper operation.◀

C. C1 Through C4 Requirements

Requirements C1 and C3

6.22 If the pulse repeating requirement is not met, check the relay under test as covered in Section 040-236-701 covering 221-type relays and readjust the relay as required. If the percent break is above the maximum specified, increase the spring tension of the relay (usually designated H) under test or if the percent break is below the minimum specified, decrease the spring tension. If the required percent break cannot be obtained by adjusting the relay under test within its requirements, check that the auxiliary relay (usually designated K) meets its requirements. Increase the spring tension of the auxiliary relay to increase the percent break and decrease the spring tension to decrease the percent break.

6.23 If the requirement cannot be met, replace the relay under test with a new one and repeat the test.

6.24 After readjustments or replacements, check the relay for current flow requirements and test the ▶overall circuit for proper operation.◀

Requirements C2 and C4

6.25 If the pulse repeating requirement is not met, check the relay under test as covered in Section 040-267-701 covering 280-type relays or Section 040-228-701 covering 239-type relays and readjust the relay as required. If the percent break still is not within the specified limits, change the strapping of the biasing resistance or change the setting of the potentiometer as required. A change of 100 ohms in the biasing resistance will change the percent break by approximately two percent. An increase in the biasing resistance will increase the percent break, while decreasing the resistance will decrease the percent break. If the required percent cannot be obtained by adjusting the relay (usually designated H) under test within its requirements or by changing the biasing resistance, check that the auxiliary relay (usually designated K) meets its requirements. Increase the spring tension of the auxiliary relay to increase the percent break and decrease the spring tension of that relay to decrease the percent break.

6.26 If the requirement cannot be met, replace the relay under test with a new one and repeat the test.

6.27 After readjustments or replacements, check the relay for current flow requirements and test the ▶overall circuit for proper operation.◀

D. D1 Requirement

6.28 If the pulse repeating requirement is not met, check the relay under test as covered in Section 040-267-701 covering 280-type relays or Section 040-228-701 covering 239-type relays and readjust the relay as required. If the percent break is not within the specified limits, change the strapping of the biasing resistance as required. An increase in the biasing resistance will reduce the percent break; decreasing the resistance will increase the percent break.

6.29 If the requirement cannot be met, ensure that the auxiliary relays (usually the P and CP relays) meet their requirements.

6.30 If these relays are in adjustment, replace the relay under test with a new one and repeat the test.

6.31 After readjustments or replacements, check the relay for current flow requirements and test the ▶overall circuit for proper operation.◀

E. E1 and E2 Requirements

6.32 If the pulse repeating requirement is not met, check the relay under test as covered in this section covering the particular type of relay involved and readjust the relay as required. If the required percent break cannot be obtained by adjusting the pulse timing relay within its requirements, check that the auxiliary relay (usually designated K) is within its current flow requirements and adjust if necessary.

6.33 If the requirement cannot be met, replace the relay under test with a new one and repeat the test.

6.34 After readjustments or replacements, check the relay for current flow requirements and test the ▶overall circuit for proper operation.◀

F. F1 Through F6 Requirements

6.35 If the pulse repeating requirement is not met, check the relay under test as covered in Section 040-518-701 covering U-type relays and readjust the relay as required.

6.36 ***Low Speed Adjustment—To be Applied First:*** If the reading of the percent break meter is above the maximum specified for the 6-pps speed, decrease the spring tension of the relay (usually the H relay) under test and if the percent break reading is below the minimum specified for the 6-pps speed, increase the spring tension. If the required percent break cannot be obtained by adjusting the relay under test within its requirements, check that the auxiliary relays (usually the J or P relays) meet their requirements.

6.37 ***High Speed Adjustment—To be Applied Last:*** If the reading of the percent break meter is above the maximum specified for the 12-pps speed, increase the spring tension of the relay (usually the F relay) under test, and if the percent break reading is below the minimum specified for the 12-pps speed, decrease the spring tension. If the required percent break cannot be obtained by adjusting the relay under test within its requirements, check that the auxiliary relays (usually the E or P relays) meet their requirements.

6.38 If the preceding requirements cannot be met, replace the relay under test with a new one and repeat the test.

6.39 After readjustments or replacements, check the relay for current flow requirements and test the ▶overall circuit for proper operation.◀

Requirements F2 and F3

6.40 If the pulse repeating requirement is not met, check the relay under test as covered in the section covering the particular type of relay involved and readjust the relay as required.

6.41 ***Low Speed Adjustment—To be Applied First:*** If the reading of the percent break meter is above the maximum specified for the 6-pps speed, increase the spring tension of the relay (usually the H or H1 relay) under test and if the percent break is below the minimum specified for the 6-pps speed, decrease the spring tension. If the required percent break cannot be obtained by adjusting the relay under test within its requirements, check that the auxiliary relays (usually J and K or J and P relays) meet their requirements.

6.42 ***High Speed Adjustment—To be Applied Last:*** If the reading of the percent break meter is above the maximum specified for the 12-pps speed, decrease the spring tension of the relay (usually the F relay) under test, and if the percent break is below the minimum value specified for the 12-pps speed, increase the spring tension. If the required percent break cannot be obtained by adjusting the relay under test within its requirements, check that the auxiliary relays (usually E and K or E and P relays) meet their requirements.

6.43 If the preceding requirements cannot be met, replace the relay under test with a new one and repeat the test.

6.44 After readjustments or replacements, check the relay for current flow requirements and test the ▶overall circuit for proper operation.◀

Requirements F4, F5, and F6

6.45 If the pulse repeating requirement is not met, check the relay under test as covered in the section covering the particular type of relay involved and readjust the relay as required.

6.46 ***Low Speed Adjustment—To be Applied First:*** If the reading of the percent break meter is above the maximum specified for the 6-pps speed, increase the spring tension of the relay (usually the TO relay) under test. If the percent break is below the minimum specified for the 6-pps speed, decrease the spring tension.

6.47 ***High Speed Adjustment—To Be Applied Last:*** If the reading of the percent break meter is above the maximum specified for the 12-pps speed, decrease the resistance of the shunt on the winding of the relay (usually the TC relay) under test. If the percent break is below the minimum value specified for the 12-pps speed, increase the resistance of the shunt. If sufficient change cannot be obtained by varying this shunt resistance, change the spring tension of the relay under test. Decrease the tension to decrease the

percent break, and increase the tension to increase the percent break. If the required percent break cannot be obtained by adjusting the relay under test as just described, check that the auxiliary relay (usually the LU relay) meets its requirements.

6.48 If the preceding requirements cannot be met, replace the relay under test with a new one and repeat the test.

6.49 After readjustments or replacements, check the relay for current flow requirements and test the ▶overall circuit for proper operation.◀

G. G1 and G2 Requirements

6.50 If the pulse repeating requirement is not met, check the relay under test as covered in Section 040-236-701 covering 221-type relays and readjust the relay as required.

6.51 If the percent break reading is below the minimum specified when making the loop test, decrease the spring tension of the relay under test as required. If the percent break reading is above the maximum specified for the leak tests, increase the spring tension as required.

6.52 If the requirements cannot be met, replace the relay under test with a new one and repeat the test.

6.53 After readjustments or replacements, check the relay for current flow requirements and test the ▶overall circuit for proper operation.◀

H. H1 and H2 Requirements

6.54 If the pulse repeating requirement is not met, check the relay under test as covered in Section 040-236-701 covering 221-type relays and readjust the relay as required. If the percent break is above the maximum specified in making the loop test, decrease the spring tension of the relay under test as required. If the percent break is below the minimum specified for the leak test, increase the spring tension as required.

6.55 If the percent break is still above the maximum limit, some improvement can be obtained by decreasing the residual of the pulse repeating relay. If the percent break is still below the minimum limit, increase the residual of the pulse repeating relay. In certain cases, it may be necessary to increase or decrease the heel gap to decrease or increase the percent break. If this is done, recheck the relay.

6.56 If the requirement cannot be met, replace the relay with a new one and repeat the test.

6.57 After readjustments or replacements, check the relay for current flow requirements and test the ▶overall circuit for proper operation.◀

I. J1 Requirement

6.58 If the pulse repeating requirement is not met, check the relay under test as covered in Section 040-267-701 covering 280-type relays or Section 040-228-701 covering 239-type relays and readjust the relay as required. If the percent break still is not within the specified limits, change the strapping of the biasing resistance as covered in the circuit notes. An increase in the biasing resistance will decrease the percent break, while decreasing the resistance will increase the percent break.

6.59 If the requirement cannot be met, replace the relay under test with a new one and repeat the test.

6.60 After readjustments or replacements, check the relay for current flow requirements and test the ▶overall circuit for proper operation.◀