

**PULSE REPEATING RELAYS**  
**PULSING REQUIREMENTS TA1 THROUGH TF2**  
**USING 4A SIGNALING TEST SET SD-1C244-01 (J94743)**

**1. GENERAL**

**1.01** This section covers the conditions and methods for applying pulsing requirements TA1 through TF2 to pulse repeating relays. The adjusting procedures to be followed where the relays fail to meet the pulse repeating requirements under the conditions described are also included. The relays are associated with circuits in the following groups:

- (a) Intertoll dialing outgoing or 2-way trunks.
- (b) Intertoll keypulsing outgoing or 2-way trunks.
- (c) Intertoll transmission selectors.
- (d) Master office trunks associated with intertoll dialing.
- (e) CX or SX signaling circuits associated with intertoll dialing or keypulsing trunks at the intertoll dialing office end, or associated with pulse link circuits included in intertoll dialing for through-pulsing facilities.
- (f) Toll switching or outgoing trunks associated with intertoll dialing.
- (g) Pulse corrector circuits associated with intertoll dialing trunk circuits.

**1.02** The tests are based upon the use of the 4A signaling test set (SD-1C244-01), J94743A.

**4A Signaling Test Set Features**

**1.03** The 4A signaling test set provides a source of controlled pulses suitable for application toward the line or drop side of a circuit on E or M signaling leads or on a loop. It also provides a source of controlled pulses suitable for testing pulse repeating relays and CX, SX, and DX circuits at the equipment location.

**1.04** Requirements TA, TB, etc, each refer to a particular testing and patching arrangement whereby the 4A test set is connected to the operating winding and to the pulsing contacts of the relay under test. The numerical digit associated with each requirement, TA1, TA2, etc, refers in each case to the percent break of the pulses applied to the relay. Digit one represents 64 percent break; digit two, 59 percent break; digit three, 58 percent break; digit six, 29 percent break; and digit eight, 40 percent break.

**1.05 *Pulse Period and Pulse Width Input to Relay Under Test:*** Pulses applied to the relay under test are delivered by contacts of the K1 relay of the 4A main unit through the LOOP interface unit. Typical patching arrangements between the interface unit and the circuit under test are shown in Section 100-267-101. The pulsing rate and the percent break for the various requirements TA1 through TF2 are shown in Table A in milliseconds PULSE PERIOD and milliseconds PULSE WIDTH respectively. Pulsing period for all requirements except TA6 and TA8 is 83 milliseconds (12 PPS). TA6 and TA8 requirements are 166 milliseconds (6 PPS) and 125 milliseconds (8 PPS), respectively.

**1.06** Six locking-type keys designated LOOP RES are included in the LOOP interface unit. These keys are used to insert a resistance requirement in series with the pulsing input to the relay under test. The keys are designated 100, 200, 400, 800, 1600, and 3200 and may be operated singly or in additive combination to insert the desired resistance value.

**1.07 *Percent Break Output of Relay Under Test:*** The percent break output of a relay under test is delivered via the LOOP unit S/R or R jack to the main unit for measurement and display.

**2. REQUIREMENTS**

**2.01** Table A defines the pulse period and pulse width break of the pulses which shall be applied to the relays under test for each of the requirements TA1 through TF2. The table also lists the relay access jack of the circuit under test and the corresponding jack in the 4A which, when patched together, provide the necessary circuit arrangements for applying the pulses.

**2.02** When pulses are applied to the pulse repeating relay under conditions described in requirements TA1, TA2, etc, the percent break output of the relay should meet the requirements specified in the circuit requirements table on the circuit drawing where provided. Where the requirements are not shown on the circuit drawing, the limits given in Table B of this section should be used.

**2.03** Two general types of circuits are installed in the plant. One type has an adjustable biasing resistance for use with pulse repeating relays and the circuit drawing specifies that this resistance shall be adjusted to obtain the required percent break output. The other type, in general

the earlier of the two, does not have this adjustable biasing resistance. If the circuit drawing shows the adjustable biasing resistance and it has been provided in the office, the limits shown on the drawing should be used. If the drawing shows this adjustable biasing resistance and it is not provided in the office, the limits specified in Table B should be used. If the circuit drawing does not show the adjustable biasing resistance, but percent break output requirements are specified, the requirements on the drawing should be used. If the percent break output requirements are not specified on the circuit drawing, the limits specified in Table B should be used.

**3. APPARATUS**

**3.01** 4A test set (J94743A) equipped with LOOP interface unit (J94743AB) (Section 100-267-101)

**3.02** One or two of the following cords (for patching the 4A test set to the relay circuit under test):

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

TABLE A

REQUIREMENTS	JACK PROVIDING ACCESS TO RELAY UNDER TEST	CORES JACK IN 4A TEST SET	PULSE PERIOD (MS) INPUT TO RELAY UNDER TEST	PULSE WIDTH (MS) INPUT TO RELAY UNDER TEST
TA1	C	S/R	83	53
TA2	C	S/R	83	49
TA6	C	S/R	166	48
TA8	C	S/R	125	50
TB2	T A	S R	83	49
TC1	T	S R	83	53
TD2	T	S R	83	49
TE3	TST PLS	S R	83	48
TF2	TEST*	S R	83	49

\*6-Point jack not designated.

TABLE B

CIRCUIT	REQUIREMENTS	FIG. NO. WIRING OR STRAP	DUMMY PLUG-IN JACK	OUTPUT PERCENT BREAK LIMITS	SEE NOTE
SD-55060-01	TD2	-	C	57-61	
SD-55086-01	TD2	A	B	57-61	
SD-55087-01	TD2	-	B	55-59	
SD-55088-01	TD2	A	A	55-59	
SD-55109-01		See circuit requirements table			
SD-55130-01	TE3	-	MB	58-62*	
SD-55130-01	TE3	-	MB	60-64	
SD-55275-01		See circuit requirements table			
SD-55301-01		See circuit requirements table			
SD-55379-01		See circuit requirements table			
SD-55415-01	TE3	4	MB	60-64	2
SD-55415-01	TE3	-	MB	58-62*	
SD-55530-01		See circuit requirements table			
SD-64469-01		See circuit requirements table			
SD-64471-01	TD2	T	B	60-64	
SD-64471-01	TD2	S	B	56-61	
SD-64471-01	TD2	R & S	B	58-62	
SD-64471-01	TD2	No Strap		56-61	
SD-64472-01		See circuit requirements table			
SD-64473-01		See circuit requirements table			
SD-64474-01		See circuit requirements table			
SD-64475-01	TA1	-	-	56-61	
SD-64482-01		See circuit requirements table			
SD-64484-01	TA1	-	-	56-61*	
SD-64484-01	TA1	-	-	57-59	
SD-64485-01		See circuit requirements table			
SD-64487-01		See circuit requirements table			
SD-64531-01		See circuit requirements table			
SD-64538-01		See circuit requirements table			
SD-64574-01	TD2	A or H	C	55-59	
SD-64584-01	TD2	A or B	C	55-59	
SD-64606-01	TD2	A or B	C	55-59	
SD-64630-01	TD2	T or R	C	57-61	
SD-64644-01	TD2	T or R	C	57-61	
SD-64645-01	TD2	T or R	C	55-59	
SD-64645-02	TD2	T or R	C	57-61	
SD-64646-01	TD2	-	C	55-59	
SD-64649-01	TD2	T or R	C	57-61	
SD-64662-01	TA1	-	-	56-61	

3.03 258C (dummy) plugs as required.

#### 4. TEST SET PREPARATION

4.01 Circuits providing jacks for access to the relays to be tested are connected to the 4A

test set by patching these jacks to the LOOP unit of the 4A test set. Section 100-267-101 provides functional sketches and possible hook-up arrangements for each setting of the FUNCTION switch on the LOOP interface unit of the 4A signaling test set.

TABLE B (Cont)

CIRCUIT	REQUIREMENTS	FIG. NO. WIRING OR STRAP	DUMMY PLUG-IN JACK	OUTPUT PERCENT BREAK LIMITS	SEE NOTE
ES-64663-01	TA1	-	-	56-61	
ES-64666-01	TD2	-	B	61-65	
ES-64678-01	TA1	-	-	56-61	
ES-64679-01	TD2	-	B	61-65	
SD-64680-01	See circuit requirements table				
SD-64680-01	TA1	-	-	56-61	
SD-64682-01	TE3	-	MB	60-64	4
SD-64824-01	See circuit requirements table				
SD-64832-01	TD2	Fig. D or E	-	-	
SD-64832-01	TD2	Strap E	B	56-61	
SD-64832-01	TD2	Strap F	B	58-62	
SD-64832-01	TD2	Strap G	B	60-64	
SD-64832-01	TD2	Strap H	B	56-61	
ES-64856-01	TD2	-	B	58-62	
SD-64899-02	TD2	-	B	56-61	
SD-95028-01	TE3	-	MB	62-72	
SD-95028-02	TE3	-	MB	62-72	
SD-95028-03	TE3	-	MB	62-72	
SD-95029-01	TE3	-	MB	62-72	
SD-95029-02	TE3	-	MB	62-72	
SD-95048-01	TE3	-	MB	55-68	
SD-95048-01	TE3	-	MB	62-72*	
SD-95051-01	TE3	-	MB	55-68*	2,3
SD-95051-01	TE3	-	MB	62-72	
SD-95053-01	TE3	-	MB	55-68	1
SD-95060-01	See circuit requirements table				
SD-95067-01	TE3	-	PLS	57-59	
SD-95095-01	See circuit requirements table				
SD-95311-01	See circuit requirements table				

\*239-Type relays.

**Notes**

1. Check SD circuit requirements table, charts, or circuit notes for further information to make proper break limit tests.
2. The pulse repeating relay should be checked in accordance with adjustment A or B, as covered in the section for the particular relay involved (206, 239, 280 etc).
3. Strap ring and sleeve of TST jack of SD-95051-01, if "K" option is not provided.
4. Supplementary check with test panel for 209-type relays may be necessary where circuit conditions are severe.

## 5. METHOD

STEP	ACTION	VERIFICATION
1	Remove circuit to be tested from service per local instructions.	
2	Connect 4A test set to 110 volts ac.	
3	Equip 4A test set with LOOP interface unit.	
4	Connect the pulsing contacts of the relay under test to the proper jack on the LOOP unit. Refer to the appropriate connection figure in Section 100-267-101.	
5	Connect the winding of the relay under test to the proper jack on the LOOP unit.	
6	Set FUNCTION switch on main unit to % BK.	
7	Set MS RANGE switch to 99.9.	
8	Set RECEIVE switch to LP.	
9	Set SEND switch to LP.	
10	Set PULSE MODE switch to CONT.	
11	Operate GEN SUPV key to OFF HK.	
12	Set PULSE PERIOD switch to value indicated in Table A.	
13	Set PULSE WIDTH switch to value indicated in Table A.	
14	Operate LOOP RES keys as required per circuit requirements table of circuit under test.  <i>Note:</i> Unless otherwise specified on the circuit requirement table, the LEAK switch and the LOOP RES keys are always set to OUT.	
15	Set LEAK switch as required per circuit requirements table of circuit under test.	
16	Set FUNCTION switch on LOOP unit to position corresponding to requirements test being performed. See Table A.	
17	Operate TALK key to PULSE.	

STEP	ACTION	VERIFICATION
18	Operate OPERATE-CLEAR key.	
	<i>Note:</i> The OPERATE-CLEAR and START-STOP keys are operated when the lamps behind the keys are lighted and released when the lamps are extinguished.	
19	Operate START-STOP key.	4A display indicates percent break output of pulsing relay contacts under test. Refer to Part 6—ADJUSTING PROCEDURES.
20	Release OPERATE-CLEAR key.	
21	Release START-STOP key.	
22a	If no further tests are to be made— Remove all test equipment and restore all circuits to normal.	
<b>6. ADJUSTING PROCEDURES</b>		
6.01	If the pulse repeating requirements are not met, check the relay under test as covered in the circuit requirements table for the particular type of relay involved and readjust the relay as required.	(b) A higher percent break will result when the contact travel is adjusted toward the maximum specified value or when the pole pieces are adjusted with the magnetic bias to the right.
6.02	If the percent break is still not within the specified limits, change the strapping of the adjustable biasing resistance, if provided, to meet requirements (see 6.03).	<b>6.05</b> For 239-type relays which are equipped with solid armatures, the best pulsing performance is usually obtained when the contact travel is adjusted at a point approximately midway between the maximum and minimum limits.
6.03	When an 8E resistance lamp is used in a voltage compensation arrangement, the percent break output of the relay may in many cases be improved by substituting a 12E resistance lamp for the 8E resistance lamp.	<b>6.06</b> In the case of 221-type and similar relays:  (a) A lower percent break will result when the residual airgap and spring tension are adjusted toward the minimum values.  (b) A higher percent break will result when the residual airgap and spring tension are adjusted toward the maximum values.
	<i>Note:</i> In the case of SD-64484-01, the substitution of a 12E lamp for an 8E lamp must be accompanied by a wiring change in the circuit as covered in the circuit notes of the circuit.	
6.04	In the case of 239- or 280-type relays:	<b>6.07</b> Any change in the adjustment of 209-type relays must be followed by a recheck with the test panel or circuit for the particular relay involved.
	(a) A lower percent break will result when the contact travel is adjusted toward the minimum specified value or when the pole pieces are adjusted with the magnetic bias to the left.	<b>6.08</b> If all the requirements cannot be met, replace the relay under test with a new one and repeat the test.
		<b>6.09</b> After readjustments, test the circuit with its associated circuits for proper operation.