

## PBX TIE TRUNK TESTS AND ADJUSTMENT

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**1. GENERAL**

**1.01** This section describes the station tests of transmission and signaling performance to be used on initial installation and maintenance of 4-wire tie trunk voice lines that use the following equipment:

- Tie trunk circuit SD-65718 or SD-66799
- DX signaling
- 4-wire facilities using 24V4 repeaters or 4-wire terminating set and pad control circuit SD-65789-01 (A&M).

**1.02** The test procedures in this section are designed to prevent the circuit irregularities caused by improper installation, thus improving

customer service. In general, most of the test procedures contained in this section are described in more detail in the sections listed in Part 7.

**1.03** The designated control office has the general responsibility of having the trunk meet service requirements before placing it in service. This responsibility includes verifying the completion of tests and adjustments made at other locations as well as those made at the control office. Overall tests (PBX to PBX) are preferred, and they are required when the circuit is not provided with testboard (serving test center [STC]) access. The control office should control the tests and record the test results. Sectional tests, PBX to STC tests, and inter-STC tests are permissible when difficulties in coordinating overall tests at both PBXs are expected. In this case, the only overall testing consists of operational tests between the operators at each PBX.

**1.04** The tests covered in this practice are:

- Verification of equipment types and options
- 1000-Hz loss tests
- Frequency response
- Noise tests
- DX balance
- Balance tests
- Pulsing tests
- Overall operational tests.

**1.05** The circuit layout record (CLR) should contain the following information:

- (a) The codes of apparatus to be plugged into the various sockets.
- (b) The loss of the 89-type resistor to be plugged into each 849-type network, 1C, 1D, 1G, 1M, or 1N terminating set.
- (c) Prescription-designed screw setting of plug-in units that are provided with screw-type switches. (Prescription design is the preselection of plug-in units and their settings by the circuit layout forces.) A complete prescription design specifies amplifier gain settings, including switch positions, capacitor settings, etc.

- (d) The required 1000-Hz gain of each amplifier as measured with its equalizer adjusted as specified. The gain between the IN and OUT jacks of the amplifier may include the effect of the associated loaded-cable equalizer (Fig. 1).
- (e) Wiring options and associated strapping.
- (f) Transmission levels.
- (g) Singing point/echo return loss (ERL).
- (h) Control office designation.
- (i) The expected measured loss (EML) as measured at the A jack located in the tie trunk circuit.
- (j) Tandem or nontandem trunk operation.
- (k) Level of circuit conditioning (voiceband or C-type).

**1.06** Each equipment item should be checked to insure that it agrees with the CLR. Discrepancies between the installed equipment and information shown on the CLR should be brought to the attention of the responsible engineering group.

**1.07** *Each 24V4 plug-in unit includes one or more rugged pins at the plug end. These pins serve as guides for proper aiming and seating of the plug-in units. Take extreme caution not to bend the connection pins when pushing a unit into its socket. Place the unit in its assigned position on the shelf and push it in gently until the plug touches the socket. Still pushing gently, shift the plug slightly from side to side until the guide pin or pins engage their sockets. Then, slowly but firmly, push the unit fully into the socket. When inserting amplifiers, do not push on the gain-control disk. No unit will fit into a socket designed for a unit of another type or into its own socket when wrong side up.*

**1.08** *When closing screw contacts, avoid shearing off the screwheads. Finger-grip of the screwdriver is recommended instead of fist-grip. When opening screw contacts, make two full turns of the screwdriver. Adjusting screws are not "captive." If a screw is damaged,*

*it may be completely removed and replaced with a good one.*

## **2. EQUIPMENT IDENTIFICATION AND ADJUSTMENT**

**2.01** The identification and general installation procedures of tie trunk circuits SD-65718 and SD-66799 are provided in Section 534-364-XXX. Before transmission tests are made, the trunk circuit options should be verified with the CLR. Tables A through D may be used to verify that the trunk circuit signaling and transmission options have been installed and are wired properly. The tables list the options and their strapping, which appear on terminal strip A (TSA), (TSB), (TSC).

**2.02** The trunk may consist of more than one transmission facility. Each segment should be aligned separately to meet its own requirements. When an overall measurement indicates the need for corrective action, the segments should be checked individually and corrected. After changing any facility segment, overall measurements and operational tests *must* be made on each circuit to insure proper alignment of the circuit.

### **A. 24V4 Repeater**

**2.03** Table E provides the mounting arrangements and circuit drawings for 24V4-type repeaters. The 24V4B repeater is designed for installation in PBX systems to terminate 4-wire service at the customer's premises and to provide access to the wiring between the terminating set and amplifiers at a terminal board (TB1) on the back of the mounting shelf. Figure 1 illustrates the relationship of the test jacks to the equalizer.

**2.04** The 24V4-type repeater mounting shelves include a test jack field and provide space for the following V4 plug-in units:

- 359-type equalizer
- 227-type amplifiers or 849-type networks
- 1-type terminating set.

**2.05** Adjacent to every screw-type switch on the plug-in units is a designation consisting of letters or numerals or both. Some of these designations express the resistance or capacitance control of the switches; others indicate the function of the switch in the circuit.

TABLE A  
J58824BC, LIST 22 SERVICE OPTIONS FOR SD-65718-01

DESCRIPTION	OPTION	STRAP	
		TS(B)	TS(C)
2-Wire transmission with DX signaling, without E-type repeaters, and with cable loops of less than 38 miles	WH	1-4 2-3 28-29 30-32	
	WM		1-3
2-Wire transmission with DX signaling, without E-type repeaters, and with cable loops of 38 miles or more	WD		2-3 9-10
	WH	1-4 2-3 28-29 30-32	
	WM		1-3
2-Wire transmission with DX signaling, with E-type repeaters, and with cable loops of 15 miles maximum	WH	1-4 2-3 28-29 30-32	
	WM		1-3
2-Wire transmission with E&M lead signaling	WM		1-3
	WJ	2-27 3-4 29-31	4-9
	UC		3-11
4-Wire transmission with DX signaling, with or without V4 repeater, and with cable loops of less than 15 miles	WH	1-4 2-3 28-29 30-32	
	UC		3-11
4-Wire transmission with DX signaling, with or without V4 repeater, and with cable loops of 15 to 60 miles	WH	1-4 2-3 28-29 30-32	
	VS		1-10 2-3
	UC		3-11
4-Wire transmission with DX signaling, with or without V4 repeaters, and with cable loops of 60 to 75 miles	WH	1-4 2-3 28-29 30-32	
	WD		2-3 9-10
	UC		3-11

TABLE A (Cont)  
J58824BC, LIST 22 SERVICE OPTIONS FOR SD-65718-01

DESCRIPTION	OPTION	STRAP	
		TS(B)	TS(C)
4-Wire transmission with E&M lead signaling	WM		1-3
	WJ	2-27 3-4 29-31	4-9
	UC		3-11
Pulse repeating requirements not used*	WS		12-15
Improved 2-wire trunk transmission required	VK	(See Fig. 29)	
Improved 2-wire trunk transmission not required	VJ	17-20 21-22 23-24 25-26	

\* When pulse repeating requirements are used (eg, for tandem dialing), strap TS(B) 31-41-51, or 31-41 and 12-51, or 31-41-51-12, as required, to meet both current flow and percent break limits at 12 pps.

TABLE B  
J58824CF-1 SERVICE OPTIONS FOR SD-65718-02

DESCRIPTION	OPTION	STRAP	
		TS(A)	TS(B)
2-Wire transmission with DX signaling, without E-type repeaters, and with cable loops of less than 38 miles	K	24-34	
	U		11-15 25-35
	W		17-54
	ZM		26-56 36-46
2-Wire transmission with DX signaling, without E-type repeaters, and with cable loops of 38 miles or more	K	24-34	
	T		37-47
	U		11-15 25-35
	W		17-54
	ZM		26-56 36-46
2-Wire transmission with DX signaling, with E-type repeaters, and with cable loops of 15 miles maximum	K	24-34	
	U		11-15 25-35
	W		17-54
	ZM		26-56 36-46
2-Wire transmission with E and M Lead signaling	K	24-34	
	V		11-25 35-45 47-48
	W		17-54
	ZK		44-54
	ZL		26-36
4-Wire transmission with DX signaling, with or without V4 repeaters, and with cable loops of less than 15 miles	U		11-15 25-35
	ZK		44-54
4-Wire transmission with DX signaling, with or without V4 repeaters, and with cable loops of 15 to 60 miles	S		17-37 27-54
	U		11-15 25-35
	ZK		44-54
4-Wire transmission with DX signaling, with or without V4 repeaters, and with cable loops of 60 to 75 miles	T		37-47 27-54
	U		11-15 25-35
	ZK		44-54

TABLE B (Cont)  
J58824CF-1 SERVICE OPTIONS FOR SD-65718-02

DESCRIPTION	OPTION	STRAP	
		TS(A)	TS(B)
4-Wire transmission with DX signaling, with V4 repeaters, with 2-wire extension, and with cable loops of less than 15 miles	U		11-15 25-35
	B		16-46
	ZK		44-54
4-Wire transmission with DX signaling, with V4 repeaters, with 2-wire extension, and with cable loops of 15 to 60 miles	S		17-37 27-54
	U		11-15 25-35
	B		16-46 55-56
	ZK		44-54
4-Wire transmission with DX signaling, with V4 repeaters, with 2-wire extension, and with cable loops of 60 to 75 miles	T		37-47 27-54
	U		11-15 25-35
	B		16-46 55-56
	ZK		44-54
4-Wire transmission with E and M lead signaling	V		11-25 35-45 47-48
	W		17-54
	ZK		44-54
Pulse repeating requirements are not used*	Y		12-31

\* When pulse repeating requirements are used (eg, for tandem dialing), strap TS(B) 31-41-51, or 31-41 and 12-51, or 31-41-51-12, as required, to meet both current flow and percent break limits at 12 pps.

TABLE C

## J58824CG-1 SERVICE OPTIONS FOR SWITCHBOARD APPLIQUE 552A, 552D, 556A, 605A

DESCRIPTION		OPTION	STRAP TS(A) TERM.
Number of busy lamps in trunk groups	1	R	34-44
	2	N	14-24
		R	34-44
	3	Q	24-34
	4	Q	24-34
		R	34-44
	5	N	14-24
		Q	24-34
		R	34-44
	6	M	14-15
	7	M	14-15
		N	14-24
	8	M	14-15
		N	14-24
		R	34-44
	9	M	14-15
		Q	24-34
	10	M	14-15
		N	14-24
		Q	24-34
Automatic flashing recall required		Z1	11-21 31-41 12-32 22-42 13-23
Automatic flashing recall not required		ZJ	21-31 32-42
When incoming calls are to be routed directly to switchboard attendant		X	33-43

TABLE D

## J58824CH-1 SERVICE OPTIONS FOR SWITCHBOARD APPLIQUE 606B, 607A, 608A, 608D

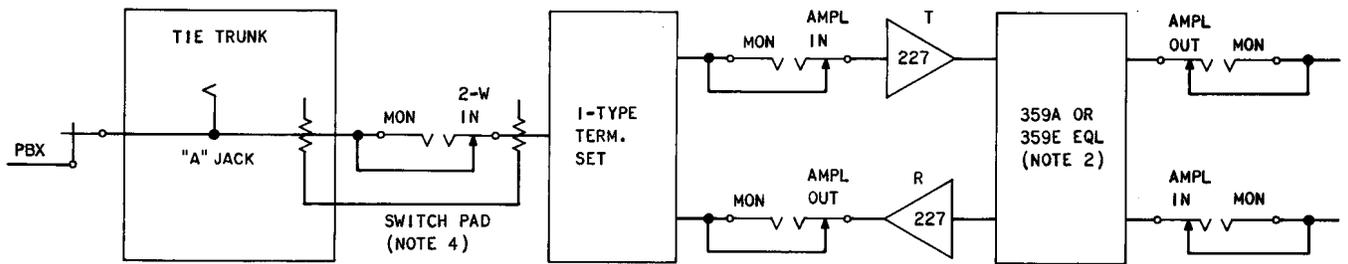
DESCRIPTION	OPTION	STRAP	
		TS(A) TERM.	TS(B) TERM.
608A or 608D termination	J	12-22 13-23 14-24 15-35 25-27 16-26 26-45 43-44	
Required to convert TOUCH-TONE® pulses to dial pulses (608A or 608D switchboard)	ZH		15-16
Not required to convert TOUCH-TONE pulses to dial pulses (608A or 608D switchboard)	ZG		34-44 15-25 16-35
Incoming calls are to be routed directly to the switchboard attendant	X		26-36
To provide automatic cut-through to tie trunk on outgoing calls when switchboard is arranged for manual operation	D	18-37	
When applique unit is not used with TOUCH-TONE access circuit			43-48 33-38 28-28 13-18

TABLE E

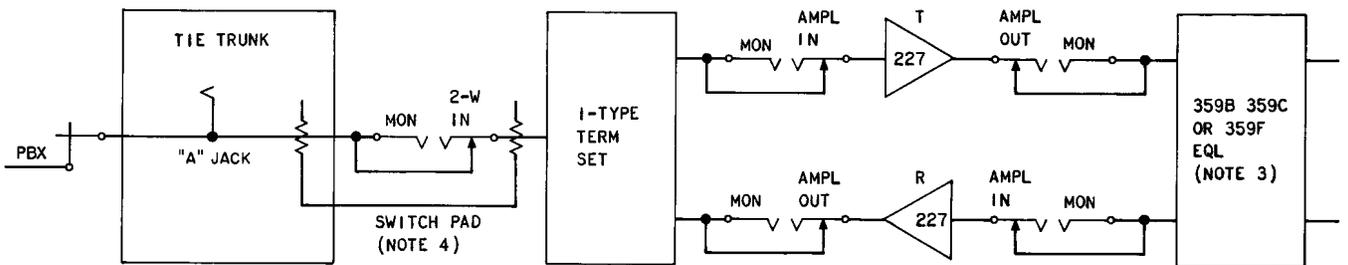
## V4 REPEATER MOUNTINGS

DESCRIPTION	MOUNTING ARRANGEMENT (SIZE)	SPECIFICATION	CIRCUIT DRAWING
24V4A Repeater	1-3/4" by 23"	J98615AJ	SD-97047-01
24V4A Repeater	1-3/4" by 23"	H831-078	T-700574
24V4B Repeater	Apparatus Box	J98615BA	SD-99739-01
24V4B Repeater	Apparatus Box	H831-044	T-700429
24V4C Repeater	1-3/4" by 23"	J98615BJ	SD-97047-01
24V4D Repeater	1-3/4" by 23"	J98615BL	SD-97047-01

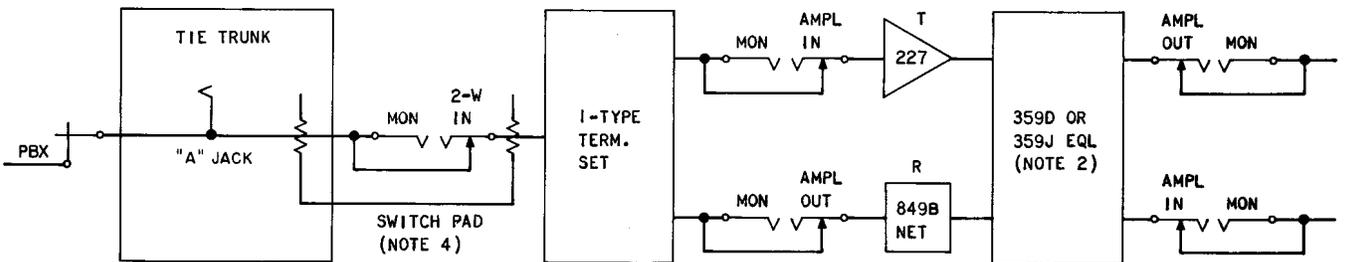
359A OR E EQUALIZER WITH 227 AMPLIFIER



359B OR C OR F EQUALIZER WITH 227 AMPLIFIER (NOTE 1)



359D OR J EQUALIZER WITH 849B NETWORK (RECEIVING)



NOTES:

1. IF AN 849-TYPE NETWORK (849C) WERE USED, THE LOCATION AND IMPEDANCE OF THE TEST JACKS WOULD BE THE SAME.
2. THE 359A, D, E AND J EQUALIZERS INSERT NO LOSS IN THE T DIRECTION.
3. THE 359B AND F EQUALIZERS INSERT LOSS IN BOTH THE T AND R DIRECTIONS: THE 359C INSERTS NO LOSS.
4. THE 2-W IN AND MON JACKS APPEAR IN THE MIDDLE OF THE 2DB PAD WHEN THE PAD IS IN. THE PORTION TOWARD THE TERM SET CAN BE REMOVED BY PUTTING THE S1 SCREW DOWN WHEN MAKING A MEASUREMENT.

Fig. 1—Test Jack Locations

**359-Type Equalizer**

**2.06** The 359-type equalizer (Table F) provides equalization for various 4-wire facilities. Improper equalization reduces margin against singing, sometimes to the point at which singing occurs. For a nonloaded facility, the equalizers consist of nonadjustable transformers in both pairs of both ends of the repeater section. For a loaded facility an adjustable equalizer is used at the low level end of each pair.

**2.07** The equalizer screw settings should be as shown on the CLR. Section 332-116-201 provides prescription settings and instructions for decoding the screw switch positions if they are shown on the CLR. Equalizer touch-up adjustments are provided in Fig. 2.

**227-Type Amplifiers**

**2.08** The 227-type A, B, E or F amplifiers should be provided for the gain of tie trunk voice lines. The 227C or 227D amplifiers should be provided if the line has alternate data capabilities.

**2.09** The 227-type amplifier must be of the type specified on the CLR. The gain control potentiometer and screw-type switches should be adjusted to provide the gain indicated on the CLR. Table G lists the screw-type switch positions for each gain range in dB. The marks and figures outside the gain control potentiometer are intended only as rough guides. The following steps must be followed for the final touch-up and gain at the amplifiers.

STEP	PROCEDURE
1	Assemble the testing equipment shown in Fig. 3 and ensure that the oscillator is set for minimum output before it is turned on. If impedances other than 600 ohms are provided as options in the oscillators and detectors, be sure that both devices are set for 600 ohms.
2	Be sure that amplifiers and equalizers, where required, are <b>fully inserted</b> and that all adjusting screws are set as specified in the CLR information. In some setups, the amplifier outputs are connected to the test jacks via wiring in the equalizer units. In these cases, even when a dummy equalizer (359C, 359E) is specified, it must be fully inserted in the proper socket for all connections between jacks and amplifiers to be completed. In the <b>basic V4 repeater</b> , however, all jacks are connected directly to amplifier sockets.
3	Note the gain specified on the CLR. Call it "G." Now connect the oscillator directly to the detector as shown by the dotted line in Fig. 3 and adjust its output to $-G$ dBm ( $G$ dB <b>below</b> 0 dBm).
4	Disconnect the oscillator from the detector and connect both units to the amplifier as shown by the solid lines in Fig. 3. Adjust the gain-control potentiometer so that it gives a detector reading of $0$ dBm $\pm 0.1$ dB. If the potentiometer cannot be adjusted so that it gives $0$ dBm without adjustment of the gain-control screws, check all screw settings. If no error is found, try another amplifier (and, in turn, another equalizer when one is specified). <b>Example:</b> Assume that a measured gain of $8.0$ dB is specified for the R AMPL on the CLR. In accordance with the lineup procedure, the test oscillator is set to send $-8.0$ dBm output as measured directly into the detector. Then the oscillator is connected to the IN jack of the R AMPL, whereas the detector is connected to the OUT jack of the R AMPL. The gain-control potentiometer of the amplifier is rotated to such a position that the detector reads $0$ dBm.
5	Verify that the 227-type amplifier screw switches are <b>not</b> set as follows: All screws <b>up</b> All screws <b>down</b> Screw labeled 21-36 <b>down without</b> screw labeled 10-24 <b>down</b> .

TABLE F  
359-TYPE EQUALIZERS

EQUALIZER	4-WIRE FACILITY	EQUALIZATION		1-KHz LOSS BETWEEN NOMINAL IMPEDANCES †	TRANSFORMER IMPEDANCE RATIO		IMPEDANCE FACING FACILITIES (OHMS)	ADJUSTABLE ‡	SIMPLEX PATH RESISTANCE PER TRANSFORMER (OHMS) §
		TRMT	RCV		EQPT	LINE			
359A *	Loaded Cable — H88 With Gain (Amplifier) Required	No	Yes	6.2 to 9.2	—	—	1200	Yes A, B	No Tap
359B	Long Lengths of Nonloaded Cable	Yes	Yes	0.5	600	150	150	No	1.3
359C Dummy	600-Ohm Equipment (No Equalization)	No	No	0	—	—	600	No	No Tap
359D	Loaded Cable — H88 With 849B Network Required	No	Yes	0 to 3.0	—	—	1200	Yes A, B	No Tap
359E Dummy	Short Lengths of Loaded Cable — H88 With Amplifier (No Equalization)	No	No	0	—	—	1200	No	No Tap
359F	Short Lengths of Nonloaded Cable	Yes	Yes	0.5	600	600	600	No	6.75
359G	Loaded Cable, Carrier Channels, or Data Applications	No	Yes	8.5 to 20.0	—	—	600	Yes C	No Tap
359H	Loaded Cable, Carrier Channels, or Data Applications	No	Yes	0.9 to 1.2	—	—	600	Yes D	No Tap
359J Dummy	Short Lengths of Loaded Cable — H88 With 849B Network Required (No Gain or Equalization)	No	No	0	—	—	1200	No	No Tap

TABLE F (Cont)  
359-TYPE EQUALIZERS

EQUALIZER	4-WIRE FACILITY	EQUALIZATION		1-KHz LOSS BETWEEN NOMINAL IMPEDANCES †	TRANSFORMER IMPEDANCE RATIO		IMPEDANCE FACING FACILITIES (OHMS)	ADJUSTABLE ‡	SIMPLEX PATH RESISTANCE PER TRANSFORMER (OHMS) §
		TRMT	RCV		EQPT	LINE			
359K*	Loaded Cable — H44 With Gain (Amplifier) Required	No	Yes	6.2 to 7.8	—	—	600	Yes B	No Tap
359L	Loaded Cable — H44 With 849G Network	No	Yes	0 to 1.6	—	—	600	Yes B	No Tap
359M	Long Lengths of Nonloaded Cable Critical Voiceband Data Systems	Yes	Yes	0.3	600	150	150	No	0.5
359N	Short Lengths of Nonloaded Cable Critical Voiceband Data Systems	Yes	Yes	0.3	600	600	600	No	1.5
359P*	Unigauge	No	Yes	6.2 to 24.5	—	—	1200	Yes A, B	No Tap

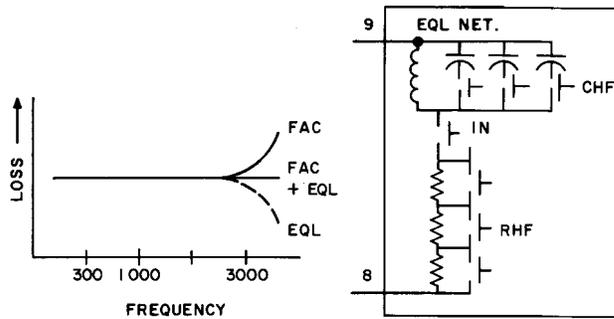
\* Includes a 6.2-dB pad.

† This is the loss used in computation of levels. See Section 852-307-101 for 359-type equalizer screw settings.

‡ The letter shown in this column applies to the applicable equalization adjustments shown in Fig. 2.

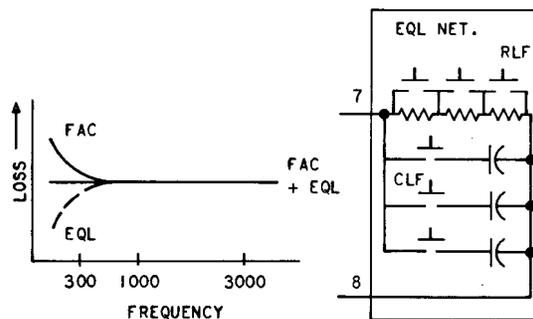
§ For calculations of signaling ranges, add 15% to the tabulated average values. This compensates for manufacturing variations and temperature.

(A) HIGH-FREQUENCY COMPENSATION (HFC)



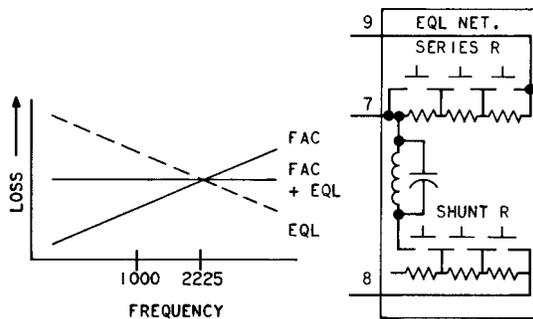
TURN IN SCREW DOWN FOR HFC. COMPENSATE FOR HIGH-FREQUENCY FACILITY ROLLOFF BY INCREASING CHF (SCREW DOWN) AND REDUCING RHF (SCREW DOWN). CHF IS VARIABLE ONLY ON THE 359P EQUALIZER GAIN ADJUSTMENT MUST BE MADE WHEN EQUALIZATION IS COMPLETE.

(B) LOW-FREQUENCY COMPENSATION (LFC)



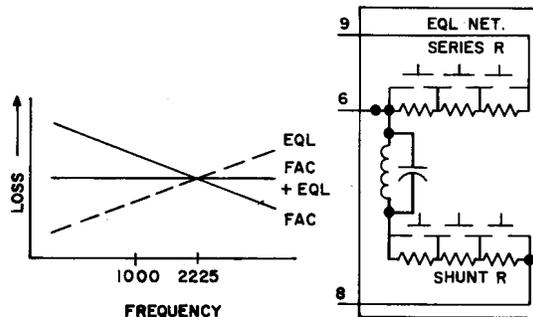
COMPENSATE FOR LOW-FREQUENCY FACILITY ROLLOFF BY INCREASING CLF (SCREW DOWN) AND REDUCING RLF (SCREW-DOWN). NO GAIN ADJUSTMENT IS NECESSARY.

(C) + SLOPE COMPENSATION



COMPENSATE FOR POSITIVE FACILITY SLOPE BY INCREASING SERIES R (SCREW UP) AND DECREASING SHUNT R (SCREW DOWN). GAIN ADJUSTMENT MUST BE MADE WHEN EQUALIZATION IS COMPLETE.

(D) - SLOPE COMPENSATION

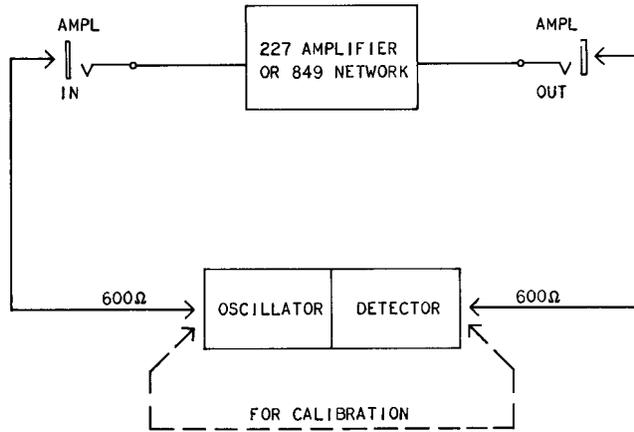


COMPENSATE FOR NEGATIVE FACILITY SLOPE BY INCREASING SERIES R (SCREW UP) AND DECREASING SHUNT R (SCREW DOWN). GAIN ADJUSTMENT MUST BE MADE WHEN EQUALIZATION IS COMPLETE.

Fig. 2—Equalizer Adjustment

**TABLE G**  
**227-TYPE AMPLIFIER SWITCH SETTINGS**

GAIN RANGE IN DB	SCREW-TYPE SWITCH POSITIONS		
	21 - 36	0 - 13	10 - 24
21 - 36	Closed	Open	Closed
10 - 24	Open	Open	Closed
0 - 13	Open	Closed	Open



**Fig. 3—Gain Test Arrangement**

**849-Type Networks**

**2.10** The 849-type networks are used to provide impedance matching in place of the 227-type amplifiers where gain is not required. Recessed in the front of the network is a 6-pin socket for receiving the 89-type plug-in resistor. The value of the 89-type resistor should be specified on the CLR.

**89-Type Resistors**

**2.11** The 89-type resistor is a plug-in resistor unit designed to insert a specified loss in the transmission path of the 849-type network, 1-type terminating set, or a 1C pad socket. Table H provides a list of the 89-type plug-in resistor units.

**TABLE H**  
**89-TYPE PLUG-IN RESISTOR UNITS**

DB	TYPE	DB	TYPE	DB	TYPE
INF	89B	8.25	89AP	16.75	89DB
0.	89A	8.5	89AR	17.0	89BR
0.25	89CH	8.75	89AS	17.25	89DC
0.5	89C	9.0	89AT	17.5	89BS
0.75	89D	9.25	89AU	17.75	89DD
1.0	89E	9.5	89AW	18.0	89BT
1.25	89F	9.75	89AY	18.25	89DE
1.5	89G	10.0	89BA	18.5	89BU
1.75	89H	10.25	89CJ	18.75	89DF
2.0	89J	10.5	89BB	19.0	89BW
2.25	89K	10.75	89CK	19.25	89DG
2.5	89L	11.0	89BC	19.5	89BY
2.75	89M	11.25	89CL	19.75	89DH
3.0	89N	11.5	89BD	20.0	89CA
3.25	89P	11.75	89CM	20.25	89FT
3.5	89R	12.0	89BE	20.5	89CB
3.75	89S	12.25	89CN	20.75	89FU
4.0	89T	12.5	89BF	21.0	89CC
4.25	89U	12.75	89CP	21.25	29DJ
4.5	89W	13.0	89BG	21.5	89CD
4.75	89Y	13.25	89CR	21.75	89FW
5.0	89AA	13.5	89BH	22.0	89CE
5.25	89AB	13.75	89CS	22.25	89FY
5.5	89AC	14.0	89BJ	22.5	89GA
5.75	89AD	14.25	89CT	22.75	89GB
6.0	89AE	14.5	89BK	23.0	89DK
6.25	89AF	14.75	89CU	24.0	89GD
6.5	89AG	15.0	89BL	25.0	89CF
6.75	89AH	15.25	89CW	26.0	89GC
7.0	89AJ	15.5	89BM	27.0	89GE
7.25	89AK	15.75	89CY	28.0	89FP
7.5	89AL	16.0	89BN	29.0	89FR
7.75	89AM	16.25	89DA	30.0	89CG
8.0	89AN	16.5	89BP	35.0	89FS

**SECTION 311-300-500**

**1-Type Terminating Set**

**2.12** The 1-type terminating sets (Table I) provide a means of interconnecting a 4-wire circuit to a 2-wire circuit while providing proper impedance matching; the terminating set should be of the same impedance as the PBX. The recommended PBX impedance (except for No. 101 ESS and CENTREX-CO) is 600 ohms.

**2.13** The terminating set impedance (which is marked on the front panel of each set) and

the PBX impedance must be as specified on the CLR. Some of the 1-type terminating sets (such as the 1M or 1N) are equipped with pad sockets (see listing in Table I). Generally, when the CLR specifies the use of terminating sets equipped with pad sockets, it should also specify the use of pads (89-type resistors) with loss of at least 5 dB. The use of these pads is helpful in ensuring that the impedance on the 4-wire transmit and receive sides of the hybrid is maintained at 600 ohms; the use of pads may be required to meet the PBX balance requirements specified in Section 311-350-500.

**TABLE I**  
**1-TYPE TERMINATING SETS**

TERM. SET	NOMINAL 2-WIRE IMPEDANCE (OHMS)† ‡	1-KHZ 2W-TO-4W POWER LOSS BETWEEN NOMINAL IMPEDANCES			NOMINAL MIDPOINT CAPACITANCE (μF)	EQUIPPED WITH SIMPLEX INDUCTOR § ¶	EQUIPPED WITH PAD SOCKETS
		HYBRID ALONE	HYBRID WITH AMPL SCREWS DOWN	HYBRID WITH NO AMPL SCREWS DOWN			
1A	900	3.8	4.1	4.2	1	Yes	No
1B	600	3.7	4.4	4.5	1	Yes	No
1C*	900	4.2	—	—	1	No	Yes
1D*	600	4.5	—	—	1	No	Yes
1F*	900	4.2	—	—	1	Yes	Yes
1G*	900	4.2	—	—	1 or 4	No	Yes
1K	900	3.8	4.1	4.2	1	Yes	No
1L	600	3.7	4.4	4.5	1	Yes	No
1M*	900	4.2	—	—	1	Yes	Yes
1N*	600	4.5	—	—	1	Yes	Yes

\* This unit is equipped with a hybrid circuit with a fixed impedance improving shunt. It does not have AMPL screws.

† Nominal 4-wire impedance is 600 ohms for all terminating sets.

‡ Cabling on the 2-wire side of the terminating sets should not exceed 65 ohms of series resistance in 900-ohm circuits or 45 ohms of series resistance in 600-ohm circuits.

§ All terminating sets equipped with inductors permit for optional shorting of the inductors (except the 1F).

¶ The simplex inductors are wired in series with the A and B leads on terminating sets 1F, 1K, 1L, 1M, and 1N. They are wired in series with the SX (A1) and SX (B1) leads on terminating sets 1A and 1B.

**2.14** The terminating set screw settings must be set according to the following general guidelines.

COMP NET	<b>Down</b>
S1	<b>Up</b> with PBX tie trunk circuits with pad control. <b>Down</b> with PBX tie trunk circuits without pad control.
NBOC	<b>Up</b> unless additional capacitance is required with the compromise network for terminal balance as specified on the CLR.
TR AMPL	<b>Down</b> when amplifier is used in TR AMPL socket. <b>Up</b> when 849-type network is used in TR AMPL socket.
REC AMPL	<b>Down</b> when amplifier is used in REC AMPL socket. <b>Up</b> when 849-type network is used in REC AMPL socket.
TR NO AMPL	<b>Down</b> when 849-type network is used in TR AMPL socket. <b>Up</b> when amplifier is used in TR AMPL socket.
REC NO AMPL	<b>Down</b> when 849-type network is used in REC AMPL socket. <b>Up</b> when amplifier is used in REC AMPL socket.
SX SHORT INDR	<b>Down</b>
SX NORM SX REV	Either screw should be down. Both screws should <b>never</b> be down.

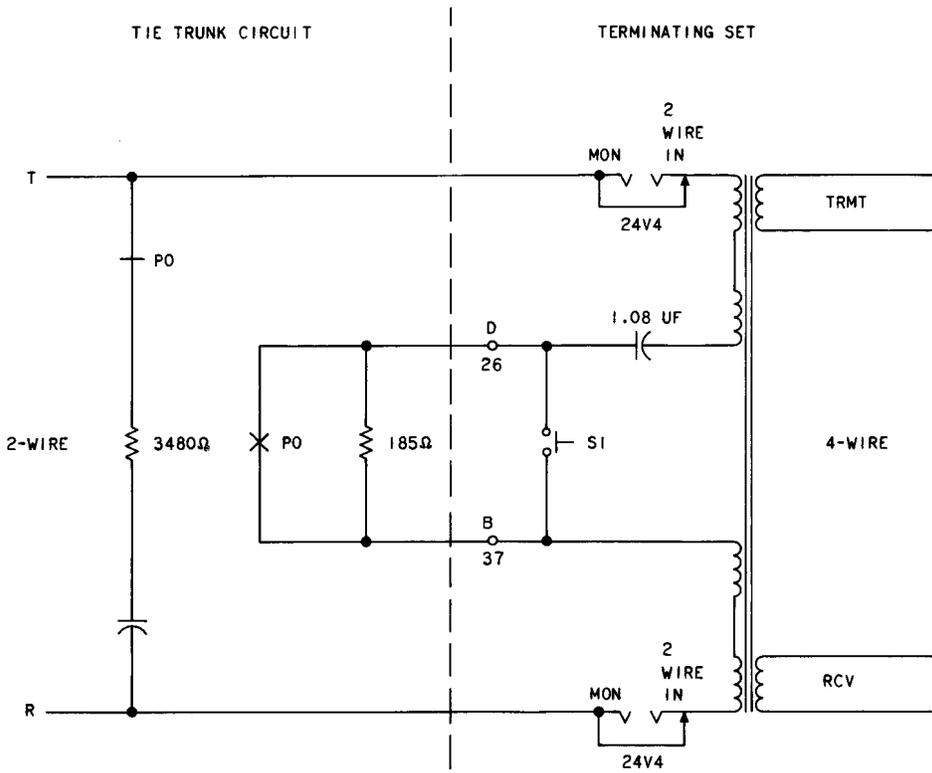
**Switching Pad**

**2.15** A 2-dB switch pad (Fig. 4) may be specified on the CLR and provided in the tie trunk circuit to improve the balance of the wide range of station loop impedances against the network of the 4-wire terminating set. The pads should be switched out on through connections to other trunks

and should be left in on terminating connections to station lines. The pads should not be switched out when the loss of the connected circuit facility is less than 2.0 dB or when balance objectives are not met.

**2.16** The 2-dB pad absence or presence should be determined by the following method.

STEP	PROCEDURE
1	Apply a test tone in the AMP IN jack of the receive amplifier on the 24V4 repeater and measure the level at the 2-WIRE IN jack. The level will be approximately 1 dB lower with the S1 screw up if a 2-dB pad is in the circuit; the level will be the same with S1 <i>up</i> or <i>down</i> if no 2-dB pad is in the circuit.
2	Return S1 screw to the proper position, ie, <i>up</i> with switch pad, <i>down</i> without switch pad.



**WARNING:**  
 WHEN MEASURING AT THE 2-WIRE IN TERMINATING SET JACK, THE PO RELAY MUST BE OPERATED, OR S1 ON THE TYPE I TERMINATING SET MUST BE SCREWED DOWN, OR THE 24V4B TERMINALS 26 AND 37 MUST BE STRAPPED TOGETHER.

**Fig. 4—2-dB Switch Pad Arrangement**

**B. 4-Wire Terminating Set and Pad Control Circuit (SD-65789-01) (A&M)**

- 2.17 Trunks using the 4-wire terminating and pad control circuit (SD-65789-01) should be verified with the CLR or local assignment records for proper pad value, strap, and coil options.
- 2.18 Table J lists coil options for each facility that may be assigned to each trunk using the 4-wire terminating set and pad control circuit (SD-65789-01). The coil and facility assignments should be checked for proper impedance match. Improper impedance matches could impair balance and/or 1000-Hz loss and frequency response objectives.
- 2.19 The methods for strapping the network buildout (NBO) capacitor to equalize office cabling capacitance and meet balance objectives are contained in Section 311-350-500.
- 2.20 Local engineering forces should provide the strapping information to build out the cable pair capacitance for circuits equipped with impedance compensation (Fig. 5 and Fig. 6 of SD-65789-01).
- 2.21 The appropriate equipment verification and PBX transmission adjustment information must be entered on the test record. A sample copy of a test form is shown in Fig. 5 and 6.

**3. TRANSMISSION TESTS**

**3.01** Overall circuit transmission tests should be made *with the assistance of the controlling testboard* at the time of installation or maintenance testing. The transmission tests for basic nonconditioned circuits should include 1000-Hz loss, frequency response, distortion, and C-message weighted noise tests. Transmission performance suitable for data operation may require circuit conditioning tests and certain other additional data transmission tests; transmission performance is covered in Section 314-410-500. The frequency response limits vary depending upon whether or not the trunk is arranged for tandem or nontandem operation. On some CLR's the classification code "VB" is used to designate nontandem trunks, and the code "VBS( )" is used to designate tandem trunks. The number in parentheses designates the maximum number of PBX tie trunks that can be connected in tandem for satisfactory voice operation. The classification codes C1, C2, C4, and C5 may be used to designate special conditioning requirements. The limits and tests for C-type conditioned circuits may be found in 314-410-500.

**3.02** Voice-only circuits are tested at a test level of 0 dBm0 (0 dBm at a 0 TLP). This test level is commonly referred to as "voice level." Data conditioned circuits are tested at a test level of -13 dBm0 (-13 dBm at a 0 TLP). This test level is commonly referred to as "data level."

**TABLE J  
COIL CONSTANTS - 120-TYPE REPEATING COILS**

Nonloaded Facilities Between the Toll Office and PBX	26 GA up to 1500 ft	120H 120HS
	24 GA up to 2000 ft	
	22 GA up to 3000 ft	
Loaded Facilities Between the Toll Office and PBX	10 GA up to 6000 ft	120K 120KS
	26 GA from 1501 to 4000 ft	
	24 GA from 2001 to 7000 ft	
Impedance of Loaded Facility at 1000 Hz	22 GA over 3000 ft	120H 120HS
	19 GA over 6000 ft	
	26 GA over 4000 ft	
Up to 750 ft	24 GA over 7000 ft	120K 120KS
	750 to 1200 ft	
	Over 1200 ft	
		120L 120LS

CIRCUIT TEST RECORD—PBX TIE TRUNKS

E-6436  
SECTION 311-300-500

CIRCUIT NO. \_\_\_\_\_ CO NO. \_\_\_\_\_ TEST DATE \_\_\_\_\_  
CONTROL OFFICE \_\_\_\_\_ PBX LOCATION A \_\_\_\_\_ Z \_\_\_\_\_

EQUIPMENT VERIFICATION:

VERIFIED CORRECT WITH CLR

REFERRED TO CIRCUIT DESIGN

PBX A \_\_\_\_\_  
TB A \_\_\_\_\_  
TB Z \_\_\_\_\_  
PBX Z \_\_\_\_\_

PBX A: 227 AMPL TYPE TRMT \_\_\_\_\_ RCV \_\_\_\_\_ (INDICATE A,B,C,D,E,F) SWITCH PAD YES \_\_\_\_\_ NO \_\_\_\_\_  
TERM. SET IMPEDANCE 600 \_\_\_\_\_ 900 \_\_\_\_\_ TIE TRUNK TYPE SD- \_\_\_\_\_

USE U (UP) OR D (DOWN) BELOW:

TRMT AMPL 0-13 \_\_\_\_\_ 10-24 \_\_\_\_\_ 21-36 \_\_\_\_\_ ; RCV AMPL 0-13 \_\_\_\_\_ 10-24 \_\_\_\_\_ 21-36 \_\_\_\_\_

TERM. SET: COMP NET. \_\_\_\_\_ S1 \_\_\_\_\_ SX SHORT INDR \_\_\_\_\_ TRMT AMPL \_\_\_\_\_ RCV AMPL \_\_\_\_\_

PBX Z: 227 AMPL TYPE TRMT \_\_\_\_\_ RCV \_\_\_\_\_ (INDICATE A,B,C,D,E,F) SWITCH PAD YES \_\_\_\_\_ NO \_\_\_\_\_  
TERM. SET IMPEDANCE 600 \_\_\_\_\_ 900 \_\_\_\_\_ TIE TRUNK TYPE SD- \_\_\_\_\_

USE U (UP) OR D (DOWN) BELOW:

TRMT AMPL 0-13 \_\_\_\_\_ 10-24 \_\_\_\_\_ 21-36 \_\_\_\_\_ ; RCV AMPL 0-13 \_\_\_\_\_ 11-24 \_\_\_\_\_ 21-36 \_\_\_\_\_

TERM. SET: COMP NET. \_\_\_\_\_ S1 \_\_\_\_\_ SX SHORT INDR \_\_\_\_\_ TRMT AMPL \_\_\_\_\_ RCV AMPL \_\_\_\_\_

FOLD

	DX RESISTANCE MEASURED	STRAPPED	DX CAPACITANCE DX MILEAGE	CAPACITY
PBX A—CO A _____	OHMS	_____ OHMS	_____	_____
PBX Z—CO Z _____	OHMS	_____ OHMS	_____	_____
TESTER PBX A _____	CO A _____	CO Z _____	PBX Z _____	

PULSING TESTS:

A. OUTGOING (A RELAY)	PBX A	PBX Z	LIMIT
SEND 12 PPS AT 60.5%	RCV _____%	RCV _____%	58-62%
INCOMING (PULSE CORRECTING RELAY)			
SEND 12 PPS AT 60.5%	RCV _____%	RCV _____%	54-66%
SEND 6 PPS AT 60.5%	RCV _____%	RCV _____%	54-66%
B. END SECTION*	PBX—TB	TB—PBX A	
SEND 12 PPS AT 58%	RCV _____%	RCV _____%	54-66%
C. OVERALL †	PBX A—PBX Z	PBX Z—PBX A	
SEND 12 PPS AT 58%	RCV _____%	RCV _____%	54-66%

\* This test not required when overall measurements are made.

† This test not required when sectional measurements are made.

NOTES:

Fig. 5—Example of Test Form—Front

CIRCUIT TEST RECORD—PBX TIE TRUNKS

E-64 36  
SECTION 311-300-500

CIRCUIT NO. \_\_\_\_\_

TRUNK OPERATION: TANDEM \_\_\_\_\_ NONTANDEM \_\_\_\_\_ CONDITIONING \_\_\_\_\_

EXPECTED TEST LEVELS:	A TO Z	Z TO A
PBX A TEST ACCESS POINT (A JACK)	<u>0.0</u>	<u>. .</u> (EML)
TB A TEST ACCESS POINT	<u>. .</u>	<u>. .</u>
TB Z TEST ACCESS POINT	<u>. .</u>	<u>. .</u>
PBX Z TEST ACCESS POINT (A JACK)	<u>. .</u> (EML)	<u>0.0</u>

1000-HZ LOSS DEVIATION AND FREQUENCY RESPONSE:

	A TO Z			Z TO A		
MEASURED AT	400 HZ	1000 HZ	2800 HZ	400 HZ	1000 HZ	2800 HZ
PBX A	<u>. .</u>					
TB A*	<u>. .</u>					
TB Z*	<u>. .</u>					
PBX Z	<u>. .</u>					

	1000-HZ LOSS DEVIATION		LOSS WITH RESPECT TO 1000 HZ			
	A TO Z	Z TO A	A TO Z		Z TO A	
			400 HZ	2800 HZ	400 HZ	2800 HZ
PBX A*	<u>. .</u>	<u>. .</u>	<u>. .</u>	<u>. .</u>	<u>. .</u>	<u>. .</u>
TB A*	<u>. .</u>	<u>. .</u>	<u>. .</u>	<u>. .</u>	<u>. .</u>	<u>. .</u>
TB Z*	<u>. .</u>	<u>. .</u>	<u>. .</u>	<u>. .</u>	<u>. .</u>	<u>. .</u>
PBX Z*	<u>. .</u>	<u>. .</u>	<u>. .</u>	<u>. .</u>	<u>. .</u>	<u>. .</u>
OVERALL	<u>. .</u>	<u>. .</u>	<u>. .</u>	<u>. .</u>	<u>. .</u>	<u>. .</u>

MESSAGE CIRCUIT NOISE:

	PBX A—TB A*	TB A—TB Z*	TB Z—PBX Z*	OVERALL
MILEAGE	<u>_____</u>	<u>_____</u>	<u>_____</u>	<u>_____</u>
LIMIT	<u>_____</u>	<u>_____</u>	<u>_____</u>	<u>_____</u>

	METER READING (DBRNC)	A TO Z	NOISE CORRECTED TO 0 TLP (DBRNC0)	METER READING (DBRNC)	Z TO A	NOISE CORRECTED TO 0 TLP (DBRNC0)
PBX A	<u>_____</u>	<u>_____</u>	<u>_____</u>	<u>_____</u>	<u>_____</u>	<u>_____</u>
TB A	<u>_____</u>	<u>_____</u>	<u>_____</u>	<u>_____</u>	<u>_____</u>	<u>_____</u>
TB Z	<u>_____</u>	<u>_____</u>	<u>_____</u>	<u>_____</u>	<u>_____</u>	<u>_____</u>
PBX Z	<u>_____</u>	<u>_____</u>	<u>_____</u>	<u>_____</u>	<u>_____</u>	<u>_____</u>

BALANCE TESTS COMPLETED (SECTION 311-350-100, 311-350-500) PBX A \_\_\_\_\_ PBX Z \_\_\_\_\_  
OVERALL TALK AND DIAL TEST COMPLETED PBX A TO Z \_\_\_\_\_ PBX Z TO A \_\_\_\_\_

\*Enter measurements in these blanks only when sectional (not overall) measurements are made.

Fig. 6—Example of Test Form—Back

**SECTION 311-300-500**

**3.03** Figure 7 illustrates two typical tie trunk configurations with 24V4 repeaters. One configuration is shown using all cable facilities, and the other is shown using a mixture of cable and carrier facilities.

**3.04** Figure 1 illustrates the test access point (A jack) at the PBX. Figure 8 illustrates recommended testboard test access points. The transmission test points provide a fixed impedance and TLP. The signaling test access points permit convenient access; cable access points permit ac testing of cable facilities and limited testing of DX signaling. Accurate transmission level measurements cannot be made from the cable access point.

**3.05** Tie trunk circuits SD-65718-01, -02, and SD-66799 have four or five test jacks. *The A jack is for transmission measurements and is located on the PBX side of the 2-dB switch pad.* A combination of the A, B, and C jacks is used in checking the outgoing and incoming signaling capabilities of the tie trunk. The D jack is used to current flow the R relay. The E jack on the SD-65718-02 is used to place incoming calls from the trunk into the PBX.

**Note 1:** A dummy plug placed in the C jack will make the circuit test busy.

**Note 2:** Use of the A jack requires that the test instrument have a dc holding path. Instruments without a dc holding path (such as the WE 3A and 3B noise measuring sets [NMS]) must use an external holding arrangement.

**Note 3:** For testing one-way or 2-way outgoing trunks from the PBX, a connection may be established to a test line at the distant PBX by inserting a hand telephone test set into the A jack and dialing the desired test line number. A dummy plug placed in the C jack makes the circuit busy, and then a transmission measuring set (TMS) with a dc holding path can be inserted in place of the hand telephone test set in the A jack.

**3.06** The following procedures include the recommended test access points, test procedures, and requirements. The test sets used for making the test should have both 600- and 900-ohm outputs and should have a dc holding circuit. Table K lists transmission test equipment suitable for test measurements.

**TABLE K  
TEST EQUIPMENT**

TEST	EQUIPMENT
1000-Hz Loss and Frequency Response	Northeast Electronics TTS 4B-NH, 4B-NH-N, 15B, or 35B
Noise	TTI 1103A or 1103B Digital Transmission Test Set
	WE 21A Transmission Measuring Set*
	Northeast Electronics TTS 4B-NH-N
	TTI 1105 Level/Noise Digital Test Set
	WE 3A*, 3B*, or 3C Noise Measuring Set

\* Requires external holding circuit for use at PBX.

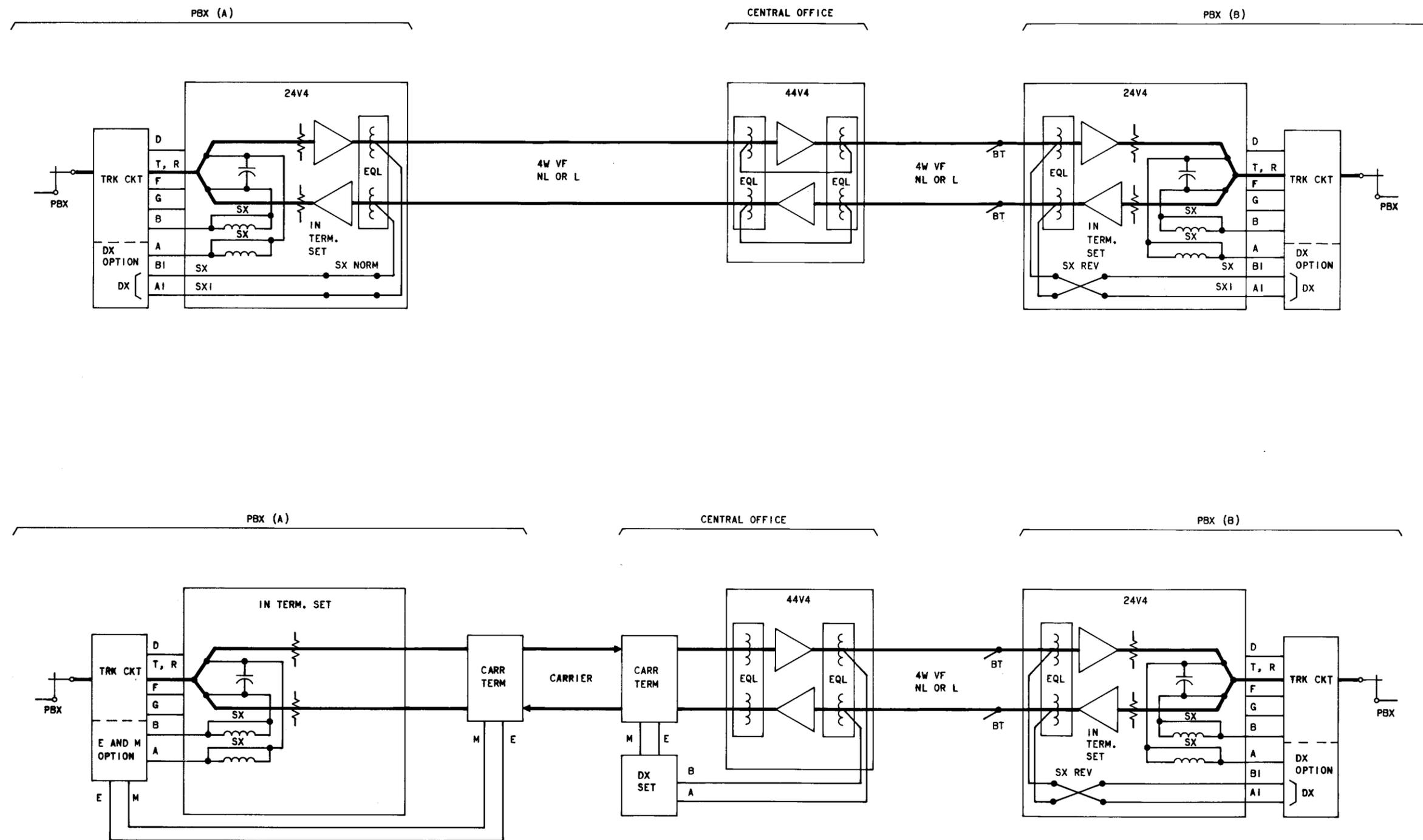
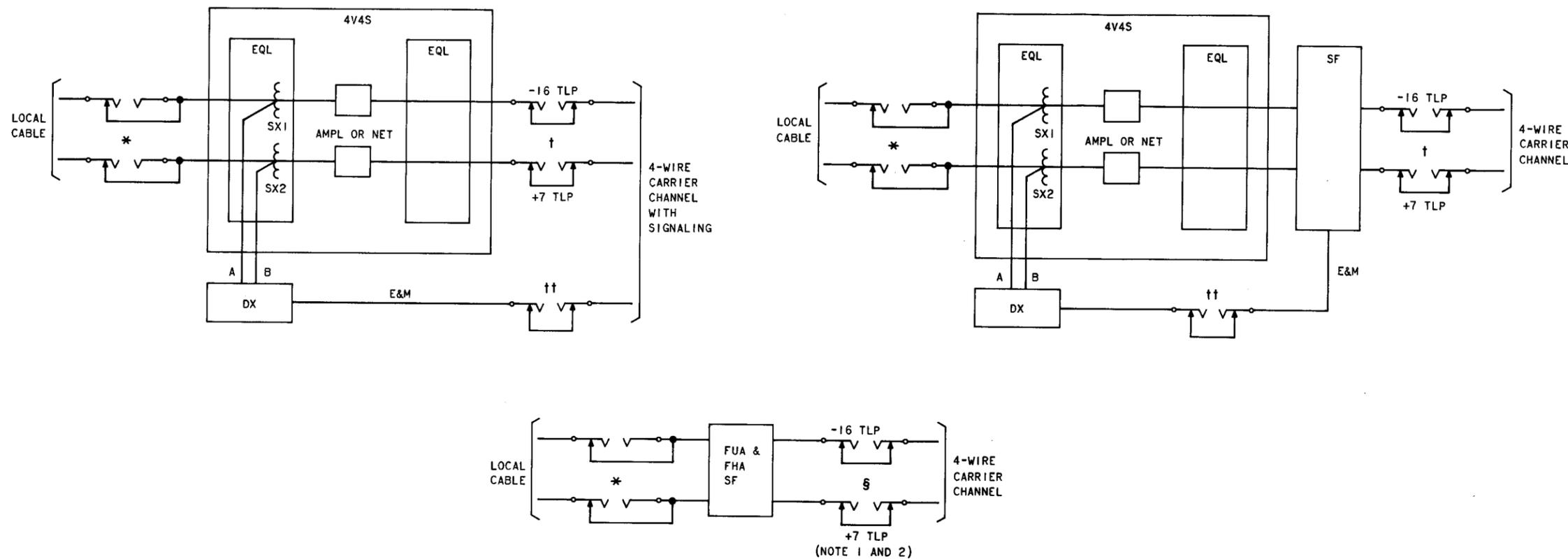


Fig. 7—Typical Tie Trunk Configurations



- NOTES:
1. REQUIRES WECO 4A SIGNALING TEST SET, OR EQUIVALENT, TO PERFORM DIRECT SF TONE MEASUREMENTS.
  2. EITHER JACK ACCESS OR SMAS 3 ACCESS MAY BE PROVIDED AT THE TESTBOARD.
- \* CABLE TEST ACCESS POINT  
 † TRANSMISSION TEST ACCESS POINT  
 †† SIGNALING TEST ACCESS POINT  
 § TRANSMISSION AND SIGNALING TEST ACCESS POINT

Fig. 8—Recommended Testboard Test Access Points

**STEP****PROCEDURE****A. 1000-Hz Loss and Frequency Response Measurements at PBX**

- 1 Calibrate the TMS at the proper impedance (600Ω or 900Ω). The impedance is marked on the 1-type terminating set.
  - 2 Place a dummy plug in the tie trunk C jack to make the circuit test busy.
  - 3 Verify that the HOLD switch on the TMS is on HOLD.
  - 4 Patch the oscillator portion of the TMS to the tie trunk A jack (Fig. 1). The test level should be 0-dBm transmit.
- Note:** The A jack is located on the PBX side of the 2-dB switch pad.
- 5 If the B2 relay on the SD-65718 is not operated, block it so that it is operated. This removes the idle line termination, thereby preventing a double termination and a 3-dB measurement error.
  - 6 The distant location should make a 1000-Hz measurement at this time.
  - 7 Have the distant location send a 1000-Hz tone at the proper test level.
  - 8 Patch the level meter portion of the TMS to the A jack.
  - 9 The actual measured level should not vary from the expected test level by more than the limits of Table L. Both sectional and overall 1000-Hz loss deviation limits are given in Table L.

**TABLE L**  
**1000-HZ LOSS DEVIATIONS**

LINK	LIMITS		
	CIRCUIT ORDER	MAINTENANCE	IMMEDIATE ACTION
PBX A to PBX Z	1.0	1.5 (2.0)*	4.0
PBX A to TB A	0.5	1.0 (1.5)*	4.0
PBX Z to TB Z	0.5	1.0 (1.5)*	4.0
TB A to TB Z	0.5	1.0	4.0

\* The number in parentheses is for circuits with unregulated aerial cable.

**Note:** The table covers the allowed deviation of actual measured level from the expected measured level in dB.

- 10 Repeat Steps 4 through 8 at test frequencies of 400 and 2800 Hz.

- | STEP | PROCEDURE  |
|------|--|
| 11   | If adjustable 359-type equalizers are provided, touch up the equalizers at this time as shown in Fig. 2 to get the best possible frequency response at 400 Hz and 2800 Hz. Adjustable equalizers are usually provided only in the PBX-to-testboard portions of the circuit. Following the equalizer adjustment, the 1000-Hz loss should be measured again and, if necessary, readjusted. |
| 12   | The frequency response limits are given in Table M. Meeting the sectional frequency response limits is not necessary as long as the overall limits can be met.   |

**TABLE M**  
**FREQUENCY RESPONSE LIMITS**  
**LOSS AT 400 AND 2800 HZ WITH RESPECT TO 1000-HZ LOSS**

TRUNK TYPE	TEST FREQUENCY (HZ)	PBX A TO TB A PBX B TO TB B	TB A TO TB B	PBX A TO PBX B (OVERALL)
Nontandem	400	-1 to +4	-1 to +3.5	-2 to +8
Nontandem	2800	-1 to +5	-1 to +4	-2 to +10
Tandem	400	-0.6 to +1.5	-0.5 to +1.5	-1 to +3
Tandem	2800	-0.6 to +2.3	-0.5 to +2.2	-1 to +4.5

*Note 1:* A plus sign indicates more loss, and a minus sign indicates less loss.

*Note 2:* The overall limits must always be met. The sectional limits (PBX to TB or TB to TB) need not be met as long as the overall limits are met.

*Example:* Assume that end-to-end measurements are made (A jack to A jack) on a circuit with an expected measured loss of 4.9 dB. The measured levels and necessary calculations used to determine the loss with respect to the 1000-Hz loss are as follows:

TEST FREQUENCY (HZ)	MEASURED RECEIVED LEVEL	LOSS AT TEST FREQUENCY	LOSS WITH RESPECT TO 1000 HZ
400	-4.5	4.5	$4.5 - (5.3) = -0.8$
1000	-5.3	5.3	
2800	-8.1	8.1	$8.1 - (5.3) = 2.8$

The 1000-Hz loss deviation in this example is  $5.3 - (4.9) = 0.4$  dB. Note that the actual measured loss at 1000 Hz rather than the expected measured loss is used in determining the frequency response.

- |    |   |
|----|---|
| 13 | Record the expected test levels and measured levels at 400, 1000, and 2800 Hz on the test form shown in Fig. 6. |
|----|---|

STEP	PROCEDURE
<b>B. 1000-Hz Loss and Frequency Response Measurements at Testboard</b>	
1	Select the appropriate transmission test access points as discussed in 3.04.
2	Calibrate the TMS at the proper impedance (generally 600 ohms).
3	If a type of signaling other than single-frequency (SF) (2600 Hz) is used at the test access points, initiate an off-hook signal in the direction to be measured.
4	Connect the oscillator portion of the TMS to transmit 1000-Hz tone at a power corresponding to the transmission level point (TLP) at the transmitting test access point. (The transmitting TLPs at the recommended test access points shown in Fig. 8 are +7 when transmitting to the local PBX and -16 when transmitting to the distant testboard or PBX).
5	The distant location should make a 1000-Hz measurement at this time.
6	Have the distant location send a 1000-Hz tone at the proper test level.
7	Connect the level meter portion of the TMS to the appropriate receiving transmission test access point. (The receiving TLPs at the recommended test access points shown in Fig. 8 are -16 when receiving from the local PBX and +7 when receiving from the distant testboard or PBX.)
8	The actual measured level should not vary from the expected measured level by more than the limits given in Table L.
9	Repeat Steps 4 through 7 at test frequencies of 400 and 2800 Hz.
10	If adjustable 359-type equalizers are provided, touch up the equalizers at this time as shown in Fig. 2 to get the best possible frequency response at 400 Hz and 2800 Hz. Adjustable equalizers are normally provided only in the PBX-to-testboard portions of the circuit. Following the equalizer adjustment, the 1000-Hz loss should be measured again and, if necessary, readjusted.
11	The frequency response limits are given in Table M. Meeting the sectional frequency response limits is not necessary as long as the overall limits can be met. Record the expected test levels and measured levels at 400, 1000, and 2800 Hz on the test form shown in Fig. 6.

### C. Message Circuit Noise

**3.07** Message circuit noise measurements are required at both ends of the circuit. Message circuit noise is the background noise on a channel in the absence of a signal.

**3.08** The circuit should be monitored with the noise set receiver while the noise measurement is made. If intelligible crosstalk at the noise measurement level is heard, it is an indication of crosstalk or cross modulation, which should be corrected. For those circuits having noise

**SECTION 311-300-500**

measurements that do not meet requirements, the character of noise should be described in terms such as:

Crosstalk

Tone

Teletype impulses

Data impulses

Hum

Static

Frying

Hissing

Singing

**3.09** Table K lists acceptable noise measuring sets used when the following tests are made.

**TABLE N  
BUSY HOUR NOISE MAINTENANCE LIMITS  
DBRNC MESSAGE WEIGHTING REFERRED  
TO 0 TLP**

LENGTH OF CIRCUIT IN MILES	CIRCUIT ORDER AND MAINTENANCE REQUIREMENTS MET IF NOISE IS AT OR BELOW	OBJECTIONABLE NOISE	
		REQUIRES INVES- TIGATION AND ANALYSIS BETWEEN	REQUIRES IMMEDIATE ACTION IF ABOVE
	(A)	(B)	(C)
0 - 50	31	31 - 44	44
51 - 100	34	34 - 44	44
101 - 400	37	37 - 44	44
401 - 1000	41	41 - 50	50
1001 - 1500	43	43 - 50	50
1501 - 2500	45	45 - 50	50
2501 - 4000	47	47 - 50	50

**Notes:**

1. If the maintenance requirement in column A cannot be met by available maintenance techniques, the engineering of the system or the maintenance methods should be changed. The appropriate engineering group should be notified through the lines of organization.
2. The supervisor should be informed if a trunk requires immediate action. The trunk should be removed from service unless the supervisor at the control office determines that it is needed because of traffic load conditions.
3. The noise requirements apply to the total length of the circuit contributing noise at the point of measurement. These limits can be used as a guide to isolate a trouble to a portion of an overall circuit.
4. Compandored Facilities:
  - a. When a trunk is made up of compandored facilities, a combination of compandored and voice cable facilities, or two or more compandored facilities in tandem, above limits should be 5 dB stricter.
  - b. When a trunk is made up of compandored plus noncompandored carrier facilities, such as N plus L, the requirements as listed in the table must apply.
  - c. T carrier is considered to be a noncompandored facility when this table is used.

STEP	PROCEDURE
<b>Terminating Circuit So That Distant End Can Measure Noise</b>	
<i>At the PBX:</i>	
1	Connect the NMS to the A jack of the trunk circuit.
2	Verify that the HOLD switch on the NMS is on HOLD. This operation is necessary to establish an off-hook condition and to remove SF tone from the circuit.
<i>At the testboard:</i>	
1	Connect the NMS or a 600-ohm termination to the proper test access point (the transmitting test access point as described in 3.06).
2	If a type of signaling other than SF (2600 Hz) is used at the test access point, initiate an off-hook signal in the direction to be measured.
<b>Measuring Noise</b>	
<i>At the PBX:</i>	
1	Connect the NMS to the A jack of the trunk circuit.
2	Verify that the HOLD switch on the NMS is on HOLD.
3	Verify that the B2 relay on the SD-65718 is still blocked operated (Step 5 of Part A in the procedure given in 3.06).
4	Verify that C-message weighting is used on the NMS.
5	Measure the noise by adjusting the DBRN (or RCV LEVEL) switch for a meter indication between +2 and +9. Observe the meter for approximately 10 to 30 seconds and establish the point at which the meter needle appears most of the time. Add the meter indication and the DBRN switch setting for total dBrn.
6	Correct the noise measurement to the 0 TLP by subtracting the TLP at the point of measurement from the noise reading to determine the noise power in dBrnc0. For example, when measuring at a -3 TLP, add 3 dB to the reading.
7	The noise in dBrnc0 should meet the requirements in Table N. Record the test results on the form shown in Fig. 6.
<i>At the Testboard:</i>	
1	Connect the NMS to the receiving test access point as described in 3.06.
2	Verify that C-message weighting is used on the NMS.

STEP	PROCEDURE
3	Measure the noise by adjusting the dBrn (or RCV LEVEL) switch for a meter indication between +2 and +9. Observe the meter for approximately 10 to 30 seconds and establish the point at which the meter needle appears most of the time. Add the meter indication and the DBRN switch setting for total dBrn.
4	Correct the noise measurement to the 0 TLP by subtracting the TLP at the point of measurement from the noise reading to determine the noise power in dBrnc0.  <i>Example 1:</i> When measuring at a -16 TLP, add 16 dB to the reading.  <i>Example 2:</i> When measuring at a +7 TLP, subtract 7 dB from the reading.
5	The noise in dBrnc0 should meet the requirements in Table N. Record the test results on the form shown in Fig. 6.  <i>Note:</i> Upon completion of the 1000-Hz loss test, the frequency response test, and the noise test, the blocking tool should be removed from the B2 relay on the SD-65718. The dummy plug may be left in the C jack until the remaining tests are completed.

#### D. Balance Tests

**3.10** To meet overall transmission objectives, tie trunks are designed to operate as close to 0-dB loss as possible. This loss is called "via net loss" (VNL), and is defined as the lowest loss at which a facility (cable, carrier system, etc) may be operated without objectionable impairment from echo, singing, noise, and crosstalk. This low loss operation requires adequate balance at all points when VNL tie trunks are connected to each other or to other trunks or lines. The balance tests in Sections 311-350-100 and 311-350-500 should be made upon the completion of installation or maintenance lineup of the circuit or as requested by the control office.

#### E. Loop-around Tests

**3.11** Loop-around tests may be made from the trunk circuit A jack for the measurement of loss when the combination loop-around and milliwatt test line (SD-98100-01) or equivalent circuit is available at the distant PBX. The loop-around tests require calling two numbers respectively assigned to a milliwatt generator and test termination and holding the two connections simultaneously.

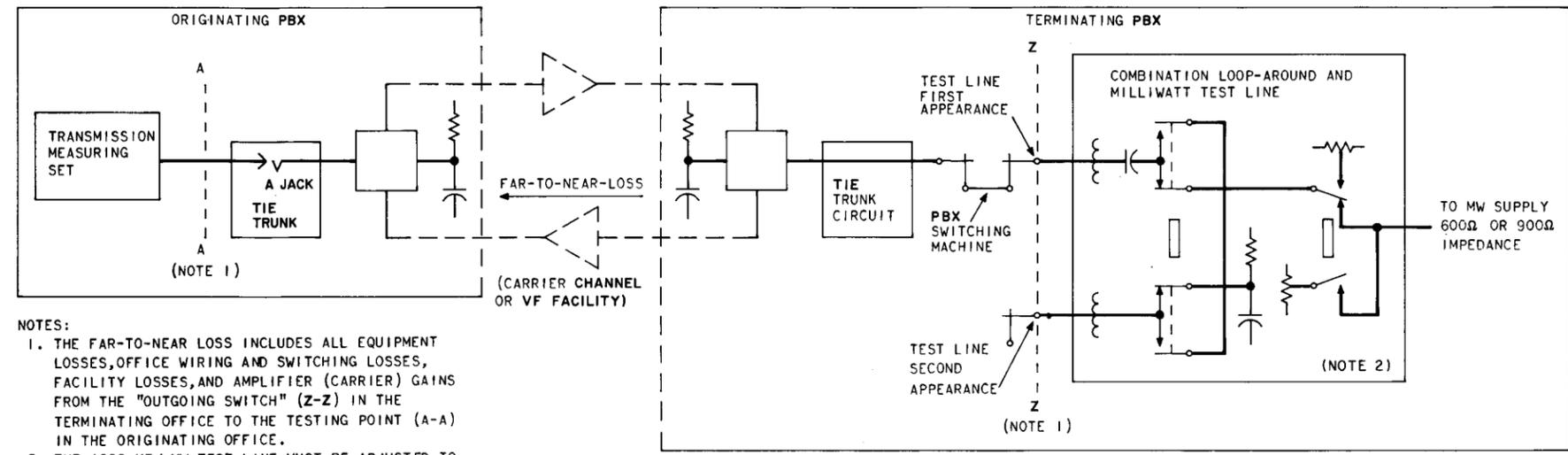
**3.12** The actual measured loss (AML) is first measured in the direction from the terminating

office to the originating office (far-to-near loss). This is done on all of the trunks to be tested by dialing the milliwatt test line on each trunk. A measurement of this type is shown in Fig. 9.

**3.13** After all the trunk far-to-near losses have been measured and recorded, one trunk should be selected as a reference trunk. The reference trunk will be used in measuring the loss of all the other trunks in the direction from the originating office to the terminating office (near-to-far loss). The reference trunk should be stable and its measured far-to-near loss within  $\pm 1.0$  dB of the expected measured loss (EML).

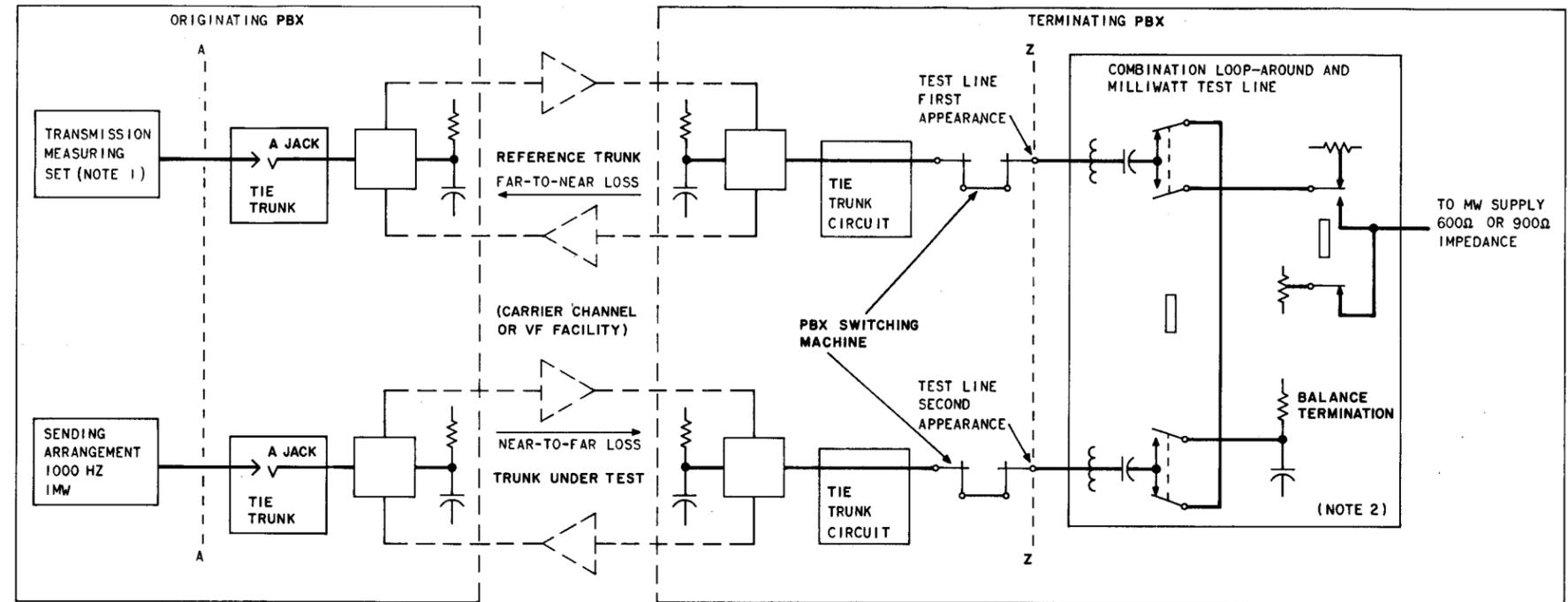
**3.14** The reference trunk is connected to the first appearance of the loop-around test line in the terminating office. One of the other trunks to be tested is then connected to the second appearance of the loop-around test line (Fig. 10). The near-to-far loss of the reference trunk may be obtained by selecting a second reference trunk and looping it with the original reference trunk. Section 660-501-500 contains additional loop-around instructions.

**3.15** The following procedure using the TTS 15-type Northeast Electronics Transmission Test Set may be used for loop-around tests.



- NOTES:
1. THE FAR-TO-NEAR LOSS INCLUDES ALL EQUIPMENT LOSSES, OFFICE WIRING AND SWITCHING LOSSES, FACILITY LOSSES, AND AMPLIFIER (CARRIER) GAINS FROM THE "OUTGOING SWITCH" (Z-Z) IN THE TERMINATING OFFICE TO THE TESTING POINT (A-A) IN THE ORIGINATING OFFICE.
  2. THE 1000-HZ 1-MW TEST LINE MUST BE ADJUSTED TO DELIVER THE PROPER LEVEL AT THE "OUTGOING SWITCH" (Z-Z) IN THE TERMINATING OFFICE. PROCEDURES ARE COVERED IN SECTION 103-335-500.

Fig. 9—Loop-around Measurement Far- to Near-end Loss



NOTES:

1. THE MEASURED LOSS EQUALS THE NEAR-TO-FAR LOSS OF THE TRUNK UNDER TEST (A-A TO Z-Z) PLUS THE FAR-TO-NEAR LOSS OF THE REFERENCE TRUNK (Z-Z TO A-A).
2. THE 1000-HZ LOSS OF THE LOOP-AROUND EQUIPMENT (SD-98100-01) AND ITS ASSOCIATED WIRING (TO Z-Z) IS REQUIRED TO BE LESS THAN 0.1 DB AND HENCE MAY BE NEGLECTED.

Fig. 10—Loop-around Measurement Near- to Far-end Loss

STEP	PROCEDURE
1	Test the condition of the batteries and calibrate the send level at 1000 Hz for 0 dB according to test set instructions.
2	Set the following switches as indicated: <ul style="list-style-type: none"><li data-bbox="469 495 997 520">● MEAS/900 OHM TERM switch at MEAS</li><li data-bbox="469 558 760 583">● HOLD switch at OFF</li><li data-bbox="469 621 899 646">● TERM BRIDGE switch at TERM</li><li data-bbox="469 684 1175 709">● SEND IMP switch at circuit impedance (normally 600Ω)</li><li data-bbox="469 747 1154 772">● REC IMP switch at circuit impedance (normally 600Ω)</li><li data-bbox="469 810 756 835">● FILTER switch at IN</li><li data-bbox="469 873 841 898">● SEND FREQ switch at 1000</li><li data-bbox="469 936 792 961">● REC LEVEL switch at 0</li><li data-bbox="469 999 915 1024">● FUNCTION switch at SEND ADJ.</li></ul>
3	Adjust the SEND ADJ potentiometer for 0 on the meter.
4	Operate the FUNCTION switch to LINE EXT.
5	Patch the reference trunk A jack to the TTS 15 LINE jack.
6	Connect a 1013A handset (or equivalent) to the EXT binding post.
7	Operate the 1013A handset switch to TALK; this will seize the circuit, and dial tone from the distant PBX should be heard.
8	Dial the distant end milliwatt test line number; a 1000-Hz tone should be heard.
9	Operate the TTS 15 HOLD switch to ON.
10	Operate the handset switch to MON.
11	Operate the TTS 15 FUNCTION switch to REC.
12	Adjust the TTS 15 REC LEVEL switch setting to obtain a meter reading between +3 and -3 or as close to this range as the set will permit.
13	Record the measured level. This is the far-to-near loss of the reference trunk.
14	Patch the A jack of the trunk under test to the TTS 15 EXT jack.

STEP	PROCEDURE
15	Operate the handset switch to TALK; this will seize the circuit, and dial tone from the distant PBX should be heard.
16	Dial the distant end test termination number; this will connect the two trunks at the distant PBX.
17	Operate the TTS 15 FUNCTION switch to LINE REC EXT SEND.
18	Operate the handset switch to MON.
19	Adjust the TTS 15 REC LEVEL switch setting to obtain a meter reading between +3 and -3 or as close to this range as the set will permit.
20	Record the loop-around measured level and compute the near-to-far loss by subtracting the far-to-near loss of the reference trunk recorded in Step 13.
	<p><i>Example:</i> Loop-around measured level -6.5 dBm          Minus reference trunk loss 3.0 dB          Near-to-far loss -3.5 dB</p>
21	Remove the patch cord from the A jack of the trunk under test.
22	Repeat Steps 14 through 21 for the remaining trunks to be tested.

#### 4. SIGNALING TESTS

**4.01** The tie trunk circuits SD-65718-01, -02, and SD-66799-01 may employ E&M lead signaling or a built-in DX signaling unit. The DX unit consists essentially of a balanced bridge circuit. The balance circuit must be matched to the line for the DX unit to operate properly. In addition, components of the tie trunk unit itself should be checked by using percent break measurements. In the case of the pulse correcting relays, resistor strapping associated with the pulse correcting relays can be used to vary the break achieved. After all tests and adjustments have been made, a thorough operational test should be performed to ensure that the tie trunk performs properly with all of the other circuits to which it can be connected.

#### A. DX Balance Measurements

**4.02** DX signaling arrangements should be examined to assure that the DX line balance network resistors and capacitors in the DX signaling circuit are correctly strapped and that type 1 terminating set SX SHORT INDR switch screws are **down**. The 1F terminating set should not be used because the inductor cannot be shorted.

**4.03** Resistor strapping information is contained in the notes on SD-65718-01, -02 (Note 1), and SD-66799-01. More detailed information on resistor strapping is given in the following procedure (SD-65718-01, -02, and SD-66799-01 include built-in DX signaling equipment).

STEP	PROCEDURE
1	<p>Measure the conductor loop resistance of the DX signaling link. A suggested method follows:</p> <p>(a) Remove the DX dc potential at the PBX end by unscrewing the two SX NORM or SX REV screws, whichever pair is in the down position. These screws should be restored to the down position after the measurement.</p> <p>(b) Short the DX A and B leads at the far end of the DX link. This may be done by shorting pins 5 and 7 on DX units SD-95487-01 or SD-95488-01; the DX A and B leads may also be shorted by placing a 4-wire short on the cable pair at the cable access point shown in Fig. 8.</p> <p>(c) At the near end, measure with an ohmmeter across the type 1 terminating set SX SHORT INDR screws. (On terminating sets without SX SHORT INDR screws, measure across the rear jack panel jack pins 16 and 17.)</p>
2	Add 1250 ohms to the value obtained in Step 1.
3	Strap the line balancing network resistors in the DX units at <i>both</i> ends of the DX link to a value within 125 ohms of the value obtained in Step 2. The strapping is accomplished on the terminal strips as specified in Table O. Leave these straps in place. They are required for normal service.
4	Restore all screw settings to normal and remove any temporary wiring used for testing.
	<p><b>Note 1:</b> SD-65718, Issue 5B shows the loop balancing resistors arranged in the wrong sequence and the resistance values of resistor NB reversed. Issue 8, dated June 21, 1972, is correct. Therefore, many SD-65718-02 tie trunk units are incorrectly strapped. The strapping information contained in Table O should be used.</p>
	<p><b>Note 2:</b> The same resistance value is used at each end of the tie trunk only if the tie trunk is cable from end to end. If the tie trunk makeup includes carrier facilities, separate balance measurements must be made at each end of the trunk. In any case, each <b>DX link</b> should have the same total balance resistance at both ends.</p>

**4.04** The correct DX line balance network capacity is obtained when the proper DX circuit options shown on the appropriate schematic drawings are selected. These options and the strapping assignments are also shown in Table P.

#### **B. Pulsing Tests**

**4.05** The pulsing requirements in this section allow reasonable latitude in the results, and the equipment is considered to be correctly lined up if results fall within the limits for these tests. If the results exceed the limits, adjustment procedure

limits are generally tighter than those of initial tests. The purpose is to avoid adjustment of relays, etc, unless absolutely necessary.

**4.06** Pulsing tests and requirements involving the 2B-1 signaling test set or the Northeast TTS 26B pulse signaling test set at the PBX on initial installation or maintenance of tie trunks are described in the following paragraphs.

**4.07** The tests covered are:

(A) Pulsing Tests at Customer Location

TABLE O  
DX SIGNALING  
LINE BALANCE NETWORK – RESISTOR STRAPPING

DESIRED RESISTANCE IN OHMS	TIE TRUNK CIRCUITS				DX SIGNALING CIRCUITS							
	SD-65718-01 J58824BC-2, AND SD-66799-01		SD-65718-02 J58824CF-1		SD-95487-01 (FIG. 4)				SD-95488-01 (FIG. 4)			
	TS-C		TS-B		CKT 1 TS-B		CKT 2 TS-B		CKT 3 TS-C	CKT 4 TS-C	CKT 1 & 2 TS-B	CKT 3 & 4 TS-D
1126-1375	4 to 5	6 to 9	38 to 48	28 to 47	11 to 22	12 to 13	14 to 25	15 to 16	Same terminals as CKT 1	Same terminals as CKT 2	Same terminals as SD-95487-01 CKT 1 & 2	Same terminals as SD-95487-01 CKT 3 & 4 (except use TS-D)
1376-1625	5 to 9		38 to 47		11 to 21	12 to 13	14 to 24	15 to 16				
1626-1875	6 to 9		28 to 47		12 to 13		15 to 16					
1876-2125	3 to 8		57 to 58		12 to 21	13 to 23	15 to 24	16 to 26				
2126-2375	3 to 5	6 to 8	28 to 57	38 to 58	13 to 23	11 to 12	16 to 26	14 to 15				
2376-2625	7 to 9		38 to 57	48 to 58	13 to 23	12 to 22	16 to 26	15 to 25				
2626-2875	3 to 6	8 to 9	28 to 57	48 to 58	11 to 21		14 to 24					
2876-3125	4 to 8		48 to 57		12 to 22	13 to 23	15 to 25	16 to 26				
3126-3375	4 to 5	6 to 8	28 to 57	38 to 48	13 to 23	21 to 22	16 to 26	24 to 25				
3376-3625	4 to 5	6 to 8	28 to 57		11 to 22	13 to 23	14 to 25	16 to 26				
3626-3875	5 to 8		38 to 57		11 to 21	13 to 23	14 to 24	16 to 26				
3876-4125	6 to 8		28 to 57		13 to 23		16 to 26					
4126-4375	3 to 7		18 to 58		12 to 23	21 to 22	15 to 26	24 to 25				
4376-4625	3 to 5	6 to 7	18 to 28	38 to 58	12 to 23	11 to 22	15 to 26	14 to 25				
4626-4875	3 to 4	5 to 7	18 to 38	48 to 58	11 to 21	12 to 23	14 to 24	15 to 26				
4876-5125	3 to 6		28 to 58		12 to 23		15 to 26					
5126-5375	4 to 7		18 to 48		12 to 21		15 to 24					
5376-5625	4 to 5	6 to 7	18 to 28	38 to 48	11 to 12		14 to 15					
5626-5875	5 to 7		18 to 38		12 to 22	11 to 21	15 to 25	14 to 24				
5876-6125	6 to 7		28 to 48		12 to 22		15 to 25					
6126-6375	4 to 5		38 to 48		21 to 22		24 to 25					
	5 to 6		28 to 38		11 to 22		14 to 25					

- Notes: 1. Tie trunk circuit SD-65718-01, J58824BC-1 requires cutting existing HC wiring straps as specified on T-65718-11 manufacturing note No. 9G.  
2. DX signaling circuit SD-95487-01 and SD-95488-01, Fig. 2 and 3 require strapping at the resistor terminals.

**TABLE P**  
**DX SIGNALING**  
**LINE BALANCE NETWORK – CAPACITOR STRAPPING**

TIE TRUNK CIRCUIT	MILEAGE	CAPACITY	OPTION	STRAPPING			
SD-65718-01 J58824BC-2	Under 15 15 to 60 miles 60 to 75 miles	0 $\mu\text{F}$ 1.3 $\mu\text{F}$ 2.0 $\mu\text{F}$	None VS WD	None 2 to 3 and 1 to 10 on TS-C 2 to 3 and 9 to 10 on TS-C			
SD-65718-02 J58824CF-1	Under 15 15 to 60 60 to 75	0 $\mu\text{F}$ 1.3 $\mu\text{F}$ 2.0 $\mu\text{F}$	None S T	None 27 to 54 and 17 to 37 on TS-B 27 to 54 and 37 to 47 on TS-B			
SD-66799-01	Under 15 15 to 60 60 to 75	0 $\mu\text{F}$ 1.3 $\mu\text{F}$ 2.0 $\mu\text{F}$	None W and V W	None 2 to 3, 9 to 10, 1 to 3, and 9 to 11 on TS-C 2 to 3 and 9 to 10 on TS-C			
<b>DX SIGNALING CIRCUITS</b>				<b>CKT 1</b>	<b>CKT 2 (on TS-E)</b>	<b>CKT 3</b>	<b>CKT 4</b>
SD-95487-01 (Fig. 4)	Under 15 15 to 60 60 to 75	0 $\mu\text{F}$ 1.3 $\mu\text{F}$ 2.0 $\mu\text{F}$	None H K	24 to 44 24 to 34	23 to 43 23 to 33	22 to 42 22 to 32	21 to 41 21 to 31
<b>DX SIGNALING CIRCUITS</b>				<b>CKT 1</b>	<b>CKT 2 (on TS-F)</b>	<b>CKT 3</b>	<b>CKT 4</b>
SD-95488-01 (Fig. 4)	Under 15 15 to 60 60 to 75	0 $\mu\text{F}$ 1.3 $\mu\text{F}$ 2.0 $\mu\text{F}$	None J W	28 to 48 28 to 38	26 to 46 26 to 36	24 to 44 24 to 34	22 to 42 22 to 32

*Note:* Not all DX signaling units are included in the above table. For units not listed above, the strapping may be determined from the appropriate SD and T drawings.

The following features are checked:

- Pulsing Test at Customer Location—Outgoing: Pulsing alignment of A relay is checked at 12 pulses per second.
- Pulse Correction Test at Customer Location—Incoming: Pulse correction relays are checked for pulsing alignment at 12 and 6 pulses per second.

(B) Near-end Section Test

This test checks incoming and outgoing pulsing between the customer location and the near-end testboard. The R relay of the tie trunk under test is checked.

(C) Pulsing Tests—Overall

These tests check the compatibility of the circuit components of the tie trunk circuit between the near-end and far-end customer locations.

**4.08** Tests A, B, and C are required for initial lineup of tie trunk circuits. Subsequent maintenance may not require the performance of Test C. Pulsing data used with all tests is shown in Fig. 11.

**4.09** Before Test C is performed, Tests A and B must be performed at customer locations. When Tests A and B are performed at any customer location, the location will be considered as near-end. When Test C is performed, the near-end and far-end designations of customer locations are interchanged as required.

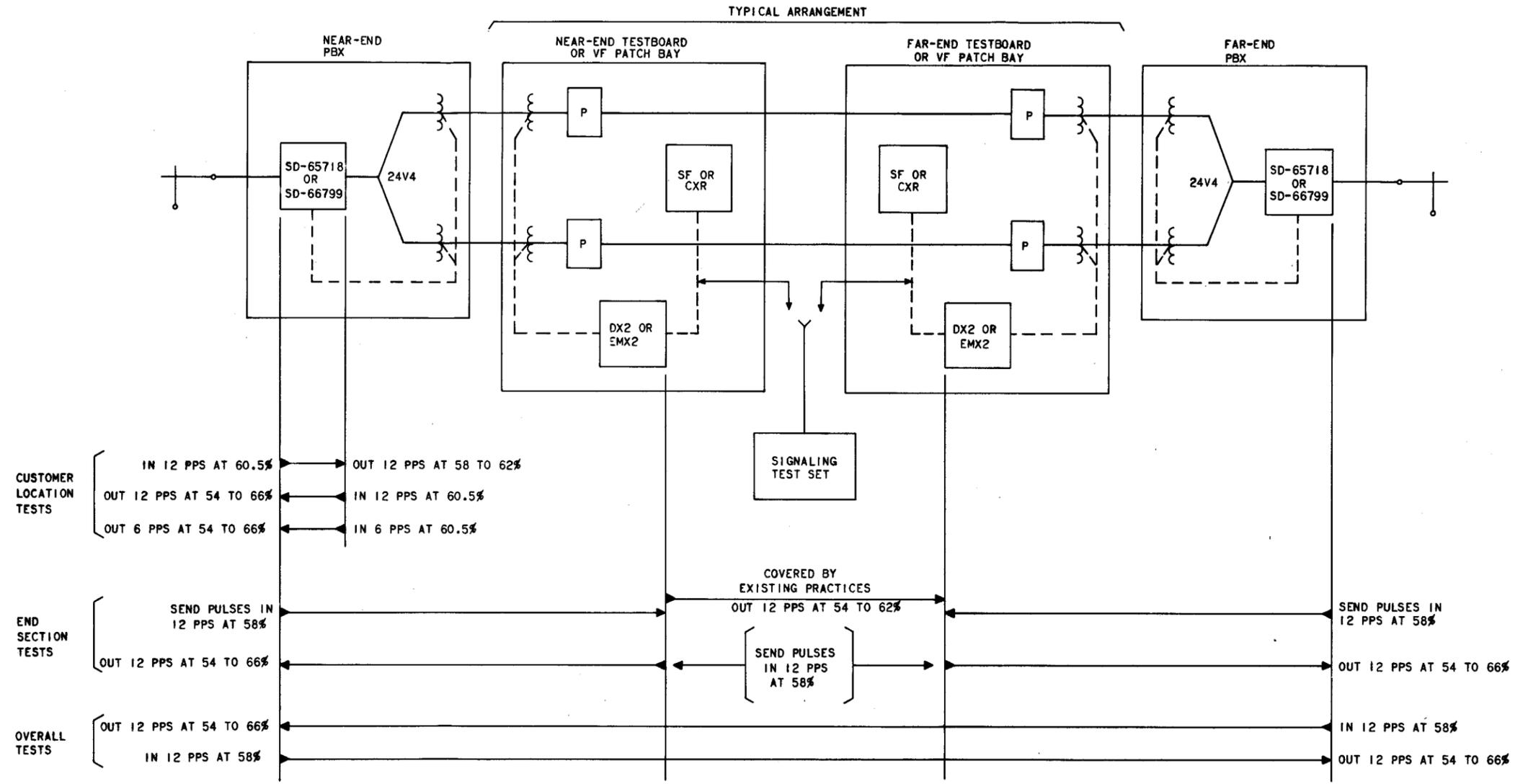


Fig. 11—Pulse Testing Setup and Requirements

**4.10** Before any pulsing tests are attempted, all wiring, cross-connections, and strapping must be completed in accordance with information contained in SD-65718-01, SD-65718-02, SD-66799-01, and SD-95488-01.

**4.11** When section tests are performed, action and verification are required at the near-end testboard. When overall tests are performed, action and verification are required at the distant customer location.

**4.12** Arrangements to perform these tests should be made with the customer.

**4.13** The apparatus required for each test with the 2B-1 is shown in Table Q. Apparatus required for each test with the TTS 26B is shown in Table R. The details of each item are covered in the paragraph indicated by the number in parentheses.

#### APPARATUS

**4.14** 2B-1 Signaling Test Set J64730B (SD-56134-02)

**4.15** Pulse Repeating Adapter (PRA) J64730B (SD-56134-02) and accompanying KS-19653, L1 power supply

**4.16** Volt-ohm-milliammeter (VOM) KS-14510, or equivalent

**4.17** P2A Patching Cord, 6 feet long, equipped with two 347B Plugs (2P3B Cord) for patching E Jack of 2B-1 Signaling Test Set to E1 Jack of Pulse Repeating Adapter

**4.18** P2A Patching Cord, 6 feet long, equipped with two 347A Plugs (2P1D Cord) for patching M Jack of 2B-1 Signaling Test Set to M1 Jack of Pulse Repeating Adapter

TABLE Q

#### APPARATUS REQUIREMENTS—2B1

APPARATUS		TESTS		
CUSTOMER LOCATION	CENTRAL OFFICE TESTBOARD OR EQUIVALENT LOCATION	A	B	C
Test Set (4.15)		1	1	1
Test Set (4.16)		1	1	1
Meter (4.17)		1	1	1
Cord (4.18)		1	1	1
Cord (4.19)		1	1	1
Cord (4.20)		2	1	1
Cord (4.21)		1	—	—
Tools (4.26)		√	√	—
258-Type (Dummy) Plug		1	1	—
	Test Set (4.23)		1	

TABLE R

#### APPARATUS REQUIREMENTS—TTS 26B

APPARATUS		TESTS		
CUSTOMER LOCATION	CENTRAL OFFICE TESTBOARD OR EQUIVALENT LOCATION	A	B	C
Test Set (4.24)		1	1	1
Cord (4.25)		1	1	1
Cord (4.26)		1	1	1
Cord (4.27)		—	—	1
258-Type (Dummy) Plus		1	1	—
	Test Set (4.23)	—	1	—

**SECTION 311-300-500**

- 4.19** P3E Patching Cord, 6 feet long, equipped with two 310 Plugs (3P7A cord)
- 4.20** W2W Testing Cord, 6 feet long, equipped with a 310 Plug, a 360B Tool, a 360C Tool (2W17A Cord), and two 419A Tools (used to establish test connections to relay springs)
- 4.21** 2B or 2B1 Signaling Test Set J64730B (SD-56134-02), or equivalent, and associated patching cords
- 4.22** Northeast Electronics Signal Test Set (TTS 26B)
- 4.23** P2J Patching Cords (two), 9 feet long, equipped with two 310 Plugs (2P9A)
- 4.24** 2W16A Patching Cord, 9 feet long, equipped with a 310 Plug at one end and spade clips on tip and sleeve of the other end
- 4.25** Clip cords (two)
- 4.26** Blocking and insulating tools as required (use tools as covered in Section 069-020-801).
- 4.27** The following procedure should be used when tests are made with the 2B-1 signaling test set at the PBX.

<b>STEP</b>	<b>ACTION</b>	<b>REQUIREMENT</b>
-------------	---------------	--------------------

**All Tests With 2B-1 Signaling Test Set at PBX**

*At Customer Location*

- 1 Insert the 310 plug of the 2B-1 signaling test set power cord into the A jack on the KS-19653, L1 power supply.
- 2 Insert the 309 plug of the 2B-1 power cord into the B jack on the KS-19653, L1.
- 3 Connect 14-gauge or larger wire between the GROUND binding post on the KS-19653, L1 and the office equipment frame.
- 4 Connect the ac cord of the KS-19653, L1 to the 117-volt ac service outlet.
- 5 Using the VOM KS-14510, measure the voltage of the office battery and the dc output of the KS-19653, L1.
- 6 Adjust the 48-volt ADJUST control on the KS-19653, L1 to obtain equal voltage between office battery voltage and KS-19653, L1 output voltage.
- 7 Patch the E jack of the 2B-1 to the E1 jack of the PRA.
- 8 Patch the M jack of the 2B-1 to the M1 jack of the PRA.
- 9 After the PRA has been connected to the 2B-1, allow it to warm up for several minutes.

STEP	ACTION	REQUIREMENT
<i>At the 2B-1</i>		
10	Set all keys on the bottom row to the normal position.	
11	Operate the BG-OG key to OG.	
12	Set the SCALE SELECT switch to the PPS position.	
13	Set the ADJ % BK switch to the M position.	
<i>At the PRA</i>		
14	Operate the CF key to S.	
15	Set the LEAK switch to the OUT position.	
16	Set the ADJ REC LOOP control to OUT.	
17	Operate the SEND LOOP keys to OUT.	
<b>(A) Pulsing Tests at Customer Location—Outgoing</b>		
<i>At the PRA</i>		
18	Set the FUNCTION switch to the P/C position.	
<i>At the 2B-1</i>		
19	Adjust the ADJ PPS control to obtain an indication of 12 pps on the PULSES PER SECOND meter.	
20	Operate the TWD L key to OFF HK.	
21	Operate the MEAS % BK key to LINE.	
22	Adjust the CAL % BK control to obtain a zero indication on the PERCENT BREAK meter.	
23	Restore the TWD L key to the normal position.	
24	Operate the PLS key to LINE.	
25	Adjust the ADJ % BK control to obtain an indication of 60.5 on the red scale of the PERCENT BREAK meter.	

**Note:** Only the red scale of the PERCENT BREAK meter is used during the test.

**SECTION 311-300-500**

<b>STEP</b>	<b>ACTION</b>	<b>REQUIREMENT</b>
26	Patch the R jack of the PRA to the C jack of the tie trunk under test.	
27	Patch the S jack of the PRA to the A jack of the tie trunk under test.	
<i>At the PRA</i>		
28	Set the FUNCTION switch to the LP1 position.	The PERCENT BREAK meter indicates 58 to 62 percent at the 2B-1.
29	Restore the PLS key.	
30	If the requirement in Step 2B is not met, adjust the A relay (280 AJ) in accordance with the procedures given in Section 040-267-701, then recheck for the proper percent break. <b><i>Do not maladjust the A relay to meet pulsing limits if electrical and mechanical requirements of the A relay are met.</i></b>	
<i>At the 2B-1</i>		
31	Operate the PLS key to LINE.	The PERCENT BREAK meter indicates 58 to 62 percent at the 2B-1.
32	Restore the PLS key to the normal position.	
<i>At the Tie Trunk Under Test</i>		
33	Remove the patching cords from the A and C jacks.	
<b>Pulse Correction Test at Customer Location—Incoming</b>		
34	If the tie trunk unit does not have a B2 relay, insulate 4M of the TO relay.	
35	If the tie trunk unit has a B2 relay, insulate 4M of the B2 relay. On SD-65718-01 this is the bottom right contact. On SD-65718-02 it is the first contact up from the bottom of the relay.	
36	Block the LU1 and D1 relays so that they are nonoperated.	
<i>At the PRA</i>		
37	Set the FUNCTION switch to the P/C position.	

STEP	ACTION	REQUIREMENT
<i>At the 2B-1</i>		
38	Operate the PLS key to LINE.	
39	Adjust the ADJ % BK control to obtain an indication of 60.5 on the red scale of the PERCENT BREAK meter.	
	<b>Note:</b> Only the red scale of the PERCENT BREAK meter is used during the test.	
40	Patch the S jack of the PRA to the C jack of the tie trunk unit. Strap terminals 2 and 3 of the B jack.	
41	Patch the R jack of the PRA to the B jack of the tie trunk unit. Release the TR relay if it has been operated.	
<i>At the PRA</i>		
42	Set the FUNCTION switch to the LP1 position. If the requirement is met, go directly to Step 58.	The PERCENT BREAK meter indicates 54 to 66 percent at the 2B-1.
43	If the requirement of Step 42 cannot be met, restore the PLS key at the 2B-1.	
44	Remove the patching cord from the R jack of the PRA and the B jack of the tie trunk under test.	
45	Insert the plug of the W2W test cord into the R jack of the PRA.	
<i>At the Tie Trunk Under Test</i>		
46	Connect the other end of the W2W cord to 2T of the TO relay and to 2T of the LU1 relay by using 419A tools.	
47	Insert a dummy plug into the B jack.	
48	Insulate 1T and 2T of the LU1 relay.	
<i>At the 2B-1</i>		
49	Operate the PLS key to LINE.	

**SECTION 311-300-500**

<b>STEP</b>	<b>ACTION</b>	<b>REQUIREMENT</b>
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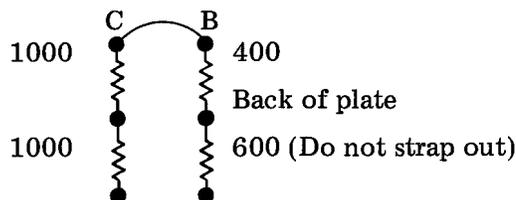
*At the Tie Trunk Under Test*

50 Strap B and C resistance per note 302 of SD-65718 or SD-66799. See Table S for the method.

**TABLE S  
PULSE CORRECTING RELAY STRAPPING**

RESISTANCE IN OHMS	SD-65718-01* J58824-BC2	SD-65718-02 J58824-CF1	
	TS-C	TS-B	
600	12-15	12-31	MIN % Break
1000	13-15	31-51	
1600	12-14	12-41	
2000	14-15	31-41	
2600	12-13	12-51	
3000	No Straps	No Straps	MAX % Break

\*Strapping of the B and C resistors on SD-65718-01 (J58824-BC1) must be done on the resistor mounting plate as shown below.



*Note:* Note 302 of SD-65718-01 and -02 specifies that the B and C resistors must be strapped to meet percent break limits at 12 pps. The B and C resistors control the release time of the TC relay. Lower resistance yields a slower release time and a smaller percent break. A change in the B and C resistor combinations from 3000 to 600 ohms decreases the percent break by approximately 10 percent. The above table lists the resistance value and strapping information for various combinations of the B and C resistors. If the percent break requirement cannot be met at 12 pps using the B and C resistor strapping, then a relay readjustment is necessary.

- 51 Make mechanical adjustment and current flow tests of LU, TC, and TO relays.
- 52 If the 12-pps requirement is still not met, touch up the armature travel of the LU relay.
- 53 If the 6-pps requirement is still not met, adjust the biasing springs on the TO relay.

STEP	ACTION	REQUIREMENT
<i>At the 2B-1</i>		
54	Restore the PLS key.	
<i>At the Tie Trunk Under Test</i>		
55	Disconnect the W2W test cord from the TO and LU1 relays.	
56	Remove the insulating tool from the LU1 relay.	
57	Remove the dummy plug from the B jack.	
58	Disconnect the W2W test cord from the R jack of the PRA.	
59	Patch the R jack of the PRA to the B jack of the tie trunk unit.	
<i>At the 2B-1</i>		
60	Operate the PLS key to LINE.	The PERCENT BREAK meter indicates 54 to 66 percent at 12 pps.
<i>At the PRA</i>		
61	Set the FUNCTION switch to the P/C position.	
<i>At the 2B-1</i>		
62	Adjust the ADJ PPS control to obtain an indication of 6 pps on the PULSES PER SECOND meter.	
63	Adjust the ADJ % BK control to obtain an indication of 60.5 on the PERCENT BREAK meter.	
<i>At the PRA</i>		
64	Operate the FUNCTION switch to the LP1 position.	The PERCENT BREAK meter indicates 54 to 66 percent at the 2B-1.
65	If the requirement of Step 61 is not met, perform the operation outlined in Steps 43 through 57 for the 6-pps requirement only.	Circuit requirement specifications and Section 040-011-712 requirements are met.
<i>At the 2B-1</i>		
66	Restore the PLS key.	

**SECTION 311-300-500**

<b>STEP</b>	<b>ACTION</b>	<b>REQUIREMENT</b>
-------------	---------------	--------------------

*At the Tie Trunk Unit*

- |    |   |  |
|----|---|--|
| 67 | Remove all insulating and blocking tools. |  |
| 68 | Remove patching cords from B and C jacks. |  |

**(B) Near-End Section Test**

**Section Test—Incoming**

**Note:** Complete Steps 1 through 17.

*At the 2B-1*

- |    |                                    |  |
|----|------------------------------------|--|
| 18 | Operate the MEAS % BK key to LINE. |  |
|----|------------------------------------|--|

*At the PRA*

- |    |  |  |
|----|--|--|
| 19 | Set the FUNCTION switch to the LP1 position.                           |  |
| 20 | Patch the R jack of the PRA to the B jack of the tie trunk under test. |  |

*At the Tie Trunk Under Test*

- |    |  |  |
|----|--|--|
| 21 | Block the TR relay so that it is nonoperated.  |  |
| 22 | Establish a talking circuit with the near-end testboard. Have the testboard attendant connect a 2B signaling test set or equivalent to the tie trunk circuit to pulse the drop side. |  |
| 23 | Have the testboard attendant send a steady seizure signal (off-hook) toward the customer location.   |  |

*At the 2B-1*

- |    |   |  |
|----|---|--|
| 24 | Adjust the CAL % BK control to obtain a zero indication on the PERCENT BREAK meter.                                       |  |
| 25 | Request that the testboard attendant remove the OFF-HOOK signal and send continuous pulses of 12 pps at 58 percent break. |  |
| 26 | Request that the testboard attendant remove continuous pulses.  |  |

At the 2B-1 the PERCENT BREAK meter indicates 54 to 66 percent break.

STEP	ACTION	REQUIREMENT
27	If the requirement of Step 25 is met, proceed with Step 29. If the requirement of Step 25 is not met, perform current flow relay adjustment tests for the R relay in accordance with circuit requirement tables.	Circuit requirement specifications are met.
28	Repeat Steps 25 and 26.	
<i>At the Tie Trunk Under Test</i>		
29	Remove the patching cord between the tie trunk and the PRA.	
30	Remove the blocking tool from the TR relay.	
<b>Section Test Outgoing</b>		
<i>At the Near-end Customer Location</i>		
31	Patch the S jack of the PRA to the A jack of the tie trunk under test.	
<i>At the PRA</i>		
32	Set the FUNCTION switch to the P/C position.	
<i>At the 2B-1</i>		
33	Operate the PPS key to LINE.	
34	Adjust the ADJ PPS control to obtain an indication of 12 pps on the PULSES PER SECOND meter.	
35	Operate the TWD L key to OFF HK.	
36	Operate the MEAS % BK key to LINE.	
37	Adjust the CAL % BK control to obtain a zero indication on the PERCENT BREAK meter.	
38	Restore the TWD L key to the normal position.	
39	Adjust the ADJ % BK control to obtain an indication of 58 on the PERCENT BREAK meter.	
40	Restore the PPS key to the normal position.	
<i>At the PRA</i>		
41	Set the FUNCTION switch to the LP1 position.	

**SECTION 311-300-500**

<b>STEP</b>	<b>ACTION</b>	<b>REQUIREMENT</b>
<i>At the 2B-1</i>		
42	Operate the TWD L key to OFF HK.	
<i>At the Near-end Testboard</i>		
43	Adjust the 2B test set to obtain a zero indication on the PERCENT BREAK meter.	
<i>At the Near-end Customer Location</i>		
44	Restore the TWD L key on the 2B-1.	
45	Operate the PLS key to LINE.	At the near-end testboard, the PERCENT BREAK meter indicates 54 to 62 percent break. If pulses from the near-end customer location are transmitted through an M lead pulse corrector unit SD-99766-01, the PERCENT BREAK meter indicates 54 to 66 percent at 12 pps.
46	Restore the PLS key to the normal position.	
47	If the requirement in Step 45 is met, proceed to Step 49. If the requirement in Step 45 is less than 54 percent and if the near-end customer location has the following equipment arrangement:  (a) capacitor A in the tie trunk under test is less than 4 $\mu$ F, (b) the tie trunk under test is at a common control switching point, and (c) no dials have access to the tie trunk under test  replace capacitor A with a 1- or 2- $\mu$ F capacitor until the tie trunk can be modified to agree with the latest issue of the SD.	
48	Repeat Steps 45 and 46.	
49	Have the testboard attendant restore the tie trunk to service.	
<i>At the Tie Trunk Under Test</i>		
50	Remove the patching cord from the A jack.	

STEP	ACTION	REQUIREMENT
<b>(C) Pulsing Tests—Overall</b>		
<i>Note:</i> Complete Steps 1 through 17.		
<i>At the PRA</i>		
18	Set the FUNCTION switch to the P/C position.	
<i>At the 2B-1</i>		
19	Adjust the ADJ PPS control to obtain an indication of 12 pps on the PULSES PER SECOND meter.	
20	Operate the TWD L key to OFF HK.	
21	Operate the MEAS % BK key to LINE.	
22	Adjust the CAL % BK control to obtain a zero indication on the PERCENT BREAK meter.	
23	Restore the TWD L key to the normal position.	
24	Operate the PLS key to LINE.	
25	Adjust the ADJ % BK control to obtain an indication of 58 on the red scale of the PERCENT BREAK meter.	
<i>Note:</i> Only the red scale of the PERCENT BREAK meter is used during the test.		
26	Establish a talking connection between the near-end and far-end customer locations.	
<i>At the Far-end Customer Location</i>		
27	After the far-end tie trunk under test has been tested in accordance with Tests A and B, patch the R jack of the PRA to the B jack of the tie trunk under test.	
<i>At the Near-end Customer Location</i>		
28	Restore the PLS key on the 2B-1.	
<i>At the PRA</i>		
29	Set the FUNCTION switch to the LP1 position.	
30	Patch the S jack of the PRA to the A jack of the tie trunk under test.	

**SECTION 311-300-500**

<b>STEP</b>	<b>ACTION</b>	<b>REQUIREMENT</b>
<i>At the 2B-1</i>		
31	Operate the TWD L key to OFF HK.	
<i>At the Far-end Customer Location</i>		
32	Set the FUNCTION switch on the PRA to the LP1 position.	
33	Operate the MEAS % BK key on the 2B-1 to LINE.	
34	Adjust the CAL % BK control on the 2B-1 to obtain a zero indication on the red scale of the PERCENT BREAK meter.	
<i>At the Near-end Customer Location</i>		
35	Restore the TWD L key at the 2B-1.	
36	Operate the PLS key to LINE.	At the far-end customer location, the PERCENT BREAK meter on the 2B-1 indicates 54 to 66 percent.
<i>At the Near-end Customer Location</i>		
37	Restore the PLS key to 2B-1.	
38	If the requirement of Step 36 is met, perform Step 40. If the requirement of Step 36 is not met, contact the near-end testboard and refer pulsing difficulty to the attendant.	
	<b>Note:</b> The old tube type of single-frequency units will not pulse at 12 pps.	
39	When pulsing difficulty between testboards has been corrected, repeat Steps 36 and 37.	
<i>At the Far-end Customer Location</i>		
40	Disconnect the patching cord from the R jack of the PRA and the B jack of the tie trunk under test.	
<i>At the Near-end Customer Location</i>		
41	Disconnect the patching cord from the S jack of the PRA and the A jack of the tie trunk under test.	
42	Repeat Test C; interchange the near-end and far-end locations.	

**4.28** The following tests should be made with the Northeast TTS 26B pulse signaling test set.

STEP	ACTION	REQUIREMENT
------	--------	-------------

**All Tests with the TTS 26B Signaling Test Set at the PBX**

- |   |  |  |
|---|--|--|
| 1 | Turn the SPARK SUP switch to the OFF position.   |  |
| 2 | Connect the 26B battery jack to a -48 volt supply by using the 2W16A cord (battery on tip and ground on sleeve). |  |

***Caution: To avoid possible grounding of the battery supply, insert the plug in the test set before connecting the spade clips and remove the plug from the test set after disconnecting the spade clips.***

- |    |   |  |
|----|---|--|
| 3  | Turn the SEND PPS switch to 12 PPS. This also turns the set on.   |  |
| 4  | Turn the SEND turnbutton switch to the RT ON 1 & 2 position.  |  |
| 5  | Turn the FUNCTION switch to SEND OFF HOOK.  |  |
| 6  | Turn the METER CIRCUIT switch to % BREAK DIRECT.  |  |
| 7  | Turn the RECEIVE switch to B & G (M).   |  |
| 8  | Turn the SEND switch to SEND LOOP, REC LOOP.  |  |
| 9  | Turn the EXT DIAL CIRCUIT switch to TALK RT.  |  |
| 10 | Place the FUNCTION toggle switch to SEND OSC.   |  |
| 11 | Place the LINE (E) and DROP (M) switch normal (upright).  | The meter reads 100 (no-current position). If it does not read 100, adjust the set screw on the meter to obtain the 100 reading. |
| 12 | Turn the FUNCTION switch to CAL MTR. Adjust the METER CAL control until the meter reads zero percent break (full current position). |  |

**SECTION 311-300-500**

<b>STEP</b>	<b>ACTION</b>	<b>REQUIREMENT</b>
13	Turn the FUNCTION switch to ADJ % BRK. The percent break meter now indicates the percent break output of the test set. Adjust the ADJ % BREAK control to give a meter reading of 58 percent break.	
<b>(A) Pulsing Tests at Customer Location—Outgoing</b>		
14	Patch the C jack of the tie trunk unit to the E and M signaling M jack of the 26B set with a P2J cord.	
15	Patch the A jack of the tie trunk unit to the LOOP SIGNALING SEND 1 jack with a P2J cord.	
16	Insert an open plug in the D jack of the tie trunk unit.	
17	Turn the FUNCTION switch to CAL MTR and zero the meter with the METER CAL control.	
18	Turn the FUNCTION switch to ADJ % BRK and adjust the ADJ % BREAK control so that the meter reads 60.5 percent break.	
19	Turn the FUNCTION switch to SEND & REC.	The PERCENT BREAK meter indicates 58 to 62 percent.
20	If the requirement in Step 19 is met, perform Step 21. If the requirement in Step 19 is not met, the A relay (280 AJ) should be adjusted per Section 040-267-701, then rechecked for the proper percent break. <i>Do not maladjust the A relay to meet pulsing limits if electrical and mechanical requirements of the A relay are met.</i>	
21	Remove cords from the A and C jacks of the tie trunk unit. Remove the plug from the D jack.	

**Pulse Correction Test at Customer Location—Incoming**

**Note:** Complete Steps 1 through 13.

- |    |  |  |
|----|--|--|
| 14 | Turn the METER CIRCUIT switch to % BREAK THRU METER RLY. |  |
| 15 | Turn the RECEIVE switch to LOOP.                         |  |

STEP	ACTION	REQUIREMENT
16	Insulate 4M of the B2 relay. On SD-65718-01 4M is the bottom right contact. On SD-65718-02 it is the first contact up from the bottom of the relay.	
17	Block the LU1 and D1 relays so that they are nonoperated.	
18	Patch the LOOP SIGNALING REC LOOP jack of the 26B to the B jack of the tie trunk unit by using a P2J cord. Release the TR relay if it has been operated.	
19	Patch the LOOP SIGNALING SEND 1 jack of the 26B to the C jack of the tie trunk unit by using a P2J cord. Strap terminals 2 and 3 of the B jack.	
20	Turn the FUNCTION switch to CAL MTR and adjust the METER CAL control for a zero percent break.	
21	Turn the FUNCTION switch to ADJ % BRK and adjust the ADJ % BREAK control so that the meter reads 60.5 percent break.	
22	Turn the FUNCTION switch to SEND & REC.	The PERCENT BREAK meter indicates 54 to 66 percent.
23	Change the PPS switch to 6.	
24	Turn the FUNCTION switch to ADJ % BRK and adjust the ADJ % BREAK control so that the meter reads 60.5 percent break.	
25	Turn the FUNCTION switch to SEND & REC.	The PERCENT BREAK meter indicates 54 to 66 percent.
26	<p>If the pulse correction circuit requirements are not met, proceed as follows:</p> <p>(a) Strap B and C resistance per note 302 of SD-65718 or SD-66799. See Table S for the method.</p> <p>(b) Make mechanical adjustment and current flow tests of LU, TC, and TO relays.</p> <p>(c) If the 12 pps requirement is still not met, touch up the armature travel of the LU relay.</p> <p>(d) If the 6 pps requirement is still not met, adjust the biasing springs on the TO relay.</p> <p>(e) If requirements still cannot be met, trouble is indicated in the D1 network or other circuit component.</p>	

**SECTION 311-300-500**

STEP	ACTION	REQUIREMENT
27	Remove the blocking tool from LU1 relay, D1 relay, B2 relay, contact 4M insulator, and remove cords from the B and C jacks of the tie trunk unit.	
<b>(B) Near-end Section Test</b>		
<b>Section Test—Incoming</b>		
<i>Note:</i> Complete Steps 1 through 13.		
14	By using a clip cord, short the 7th and 8th terminals on the B jack (as counted down from the top of the jack).	
15	Turn the METER CIRCUIT switch to % BREAK THRU METER RLY.	
16	Turn the RECEIVE switch to LOOP.	
17	Patch the LOOP SIGNALING REC LOOP jack of the 26B to the B jack of the tie trunk unit with a P2J cord.	
18	Turn the FUNCTION switch to CAL MTR and adjust the METER CAL control for a zero percent break.	
19	Turn the FUNCTION switch to SEND & REC.	
20	Have the testboard send a steady seizure toward the customer (operate the TWD D key on the 2B set to OFF HK).	
<i>Note:</i> If no meter reading is obtained, verify that the TR relay in the tie trunk unit is nonoperated. If it is operated, manually restore the relay to the nonoperated position.		
21	Have the testboard operate the PLS key to DROP. This operation sends 12 pps at 58 percent toward the customer.	The PERCENT BREAK meter indicates 54 to 66 percent break.
22	Remove straps and cords from the circuit.	

**Section Test—Outgoing**

*Note:* Complete Steps 1 through 13.

14	Turn the FUNCTION switch to CAL MTR and zero the meter with the METER CAL control.
----	--

STEP	ACTION	REQUIREMENT
15	Patch the A jack of the tie trunk unit to the LOOP SIGNALING SEND 1 jack by using a P2J cord.	
16	Turn the FUNCTION switch to ADJ % BREAK and adjust the ADJ % BREAK control so that the meter reads 58 percent break.	
17	Turn the FUNCTION switch to SEND & REC. This operation sends 12 pps at 58 percent break toward the testboard.	
18	At the near-end testboard, operate MEAS % BRK key to DROP on the 2B signaling test set.	
19	Turn the FUNCTION switch to SND-ON HOOK and have the testboard calibrate the percent break meter to read 100 on the black scale.	
20	Turn the FUNCTION switch to SEND & REC.	The PERCENT BREAK meter at the testboard indicates 54 to 66 percent.
	<i>Note:</i> If the requirement is not met, verify strapping of the DX2 and trunk circuit resistors. Check electrical and mechanical requirements of the R relay in DX2 equipment or of the A relay in the tie trunk unit.	

**(C) Pulsing Tests—Overall**

*Note:* Complete Steps 1 through 13.

- |    |  |  |
|----|--|--|
| 14 | Turn the FUNCTION switch to CAL MTR and zero the meter with the METER CAL control.                                   |  |
| 15 | Patch the A jack of the tie trunk unit to the LOOP SIGNALING SEND 1 jack by using a P2J cord.                        |  |
| 16 | Turn the FUNCTION switch to ADJ % BREAK and adjust the ADJ % BREAK control so that the meter reads 58 percent break. |  |
| 17 | Turn the FUNCTION switch to SEND & REC. This operation sends 12 pps at 58 percent break toward the far end.          |  |
| 18 | Establish a talking connection between near-end and far-end customer locations.                                      |  |

**SECTION 311-300-500**

<b>STEP</b>	<b>ACTION</b>	<b>REQUIREMENT</b>
19	Short the 7th and 8th terminals* on the B jack at the far end (the terminals are counted from top to bottom on the jack).	
	*The 7th and 8th terminals on the B jack are pins 2 and 3 as shown in SD-65718-02, Sheet B2.	
20	Turn the METER CIRCUIT switch to % BREAK THRU METER RLY.	
21	Turn the RECEIVE switch to LOOP.	
22	Patch the LOOP SIGNALING REC LOOP jack of the 26B to the B jack of the tie trunk unit with a P2J cord.	
23	Turn the FUNCTION switch to CAL MTR and adjust the METER CAL control for a zero percent break.	
24	Block the LU1 and D1 relays so that they are nonoperated in the tie trunk.	
25	Insulate 4M of the B2 relay.	
26	Turn the FUNCTION switch to SEND & REC. If no meter reading is obtained, verify that the TR relay in the tie trunk unit is nonoperated. If it is operated, restore it manually to the nonoperated position.	The % BK meter indicates 54 to 66 percent at the far-end customer location.
27	If the requirement of Step 26 is not met, intermediate signaling problems may exist, and the local testboard should be notified.	
28	Remove straps and cords from the circuit.	
29	Repeat Test C, interchanging near-end and far-end locations.	

**5. TEST RESULTS**

**5.01** A convenient method of following the progress and verifying the completion of installation and maintenance tests is with the use of a test record. Figures 5 and 6 illustrate such a record.

**5.02** Talk, dial, and selection tests should be completed on each trunk before turn-up to customer to insure proper circuit operation.

**6. ORDERING INFORMATION FOR FORM E-6436**

**6.01** Form E-6436 will be available only in package units of 25 forms. Orders should be placed in multiples of 25 forms and worded as follows:

(Quantity), Form E-6436

**6.02** This form will not be automatically stocked at the Western Electric Company distributing house. Each company must authorize its local distributing house to stock new forms. In case of revised forms, disposition must be given of the old forms before the revised forms can be stocked.

**7. REFERENCES**

**7.01** The following is a list of sections containing additional trunk design, installation, and lineup information:

<b>SECTION</b>	<b>TITLE</b>
311-350-100	Balance Test Considerations—PBX 4-Wire
311-350-500	Balance Test Procedure for PBX Switched 4-Wire
332-104-500	V4 Telephone Repeaters—Initial Line-Up
332-105-102	V4 Telephone Repeater—24V4B Mounting Unit—Description
332-116-201	Strapping Charts for 359A and 359D Equalizers When Using 227A, B, C, D, E, or F Amplifiers
333-126-500	Overall Signaling Arrangements and Testing—Pulsing Tests on Dial Tie Trunks
534-364-210	Tie Trunk SD-65718-02—Identification and General Installation Procedures—PBX Systems
534-364-211	Tie Trunk J58824BC and J58824BY (SD-65718-01)—Identification and General Installation Procedures—PBX Systems
534-364-501	Tie Trunk Circuits SD-65718-01, SD-65718-02, and SD-66799-01—Pulsing Tests and Requirements Using Pulse Repeating Test Set SD-31667-01 (J34720A) and Pulsing Test Set SD-31481-01 (J34717A) SXS and Crossbar-Type PBX
812-002-290	Private Line Service Terminations—Station Engineering Information—V4 Repeater—Mountings and Components
851-321-1XX	Transmission and Signaling Design of 4-Wire PBX Dial Tie Trunks
859-501-101	Signal Transmission—Engineering Considerations—Compatibility with V4 Equipment
981-010-100	Private Branch Exchange Tie Trunk Circuits—General Descriptive Information