

AUTOMATIC PROGRESSION TRUNK TEST CIRCUIT SD-25938-01
BUILD-OUT RESISTOR ASSEMBLY ADJUSTMENT
NO. 5 CROSSBAR SYSTEM

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1. GENERAL

1.01 This section provides procedures for adjusting the build-out resistor assemblies located in the automatic progression trunk test circuit (APTT) SD-25938-01. The build-out resistor assembly adjustment increases the accuracy of transmission measurement results obtained by the automatic transmission measuring system (ATMS) J94051 when it is used in conjunction with the APTT.

1.02 This section is reissued to provide information for adjusting build-out resistors furnished for manual transmission test lines, and adjustment

procedures for the 2 dB pads that are provided for tandem and toll testing.

This reissue does not affect Equipment Test Lists.

1.03 The build-out resistor assemblies allow the test tone signal generated in the ATMS director to be adjusted as nearly as possible to 0 dBm at the outgoing side of the office switching equipment upon installation of the ATMS director. The actual power of the test tone signal is +0.5 dBm as it leaves the director. This power is attenuated by cumulative losses through the transmission path of the APTT, office wiring, and switching equipment, then build out to a final power of 0 dBm at the trunk link or line link frame by the insertion of more loss through the build-out resistor assemblies.

1.04 Since numerous junctor paths may be established from the appearance of the APTT at the line link or trunk link frame to the appearances of the trunks, LLP circuits, or home office transmission test lines to be tested at the trunk link or line link frame, the input test tone power will be exactly 0 dBm only for those circuits which are accessed through an average length junctor path. If the circuits are accessed through junctor paths which are shorter or longer than the average length path, the test tone power will be slightly more or less than that desired. However, building out the test tone power for an average length junctor path minimizes the error that can be caused by switching path losses and eliminates all effects due to the length of the transmission path through the APTT to the line link or trunk link frame. It is expected that variations in trunk loss measurements due to office wiring will not exceed ± 0.05 dB after the build-out adjustments have been made.

1.05 When trunks are tested with TP2 (test pad) inserted in the test tone output, the output power from the ATMS director is appropriately reduced to approximately -1.5 dBm. This reduction results in an input power to the trunks under test

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of -2 dBm after the test tone has been attenuated by the APTT transmission path, office wiring, switching equipment, and build-out resistor assemblies.

1.06 In large offices served by two or more marker groups, the transmission path to *each* marker group from the APTT is provided with build-out resistor assemblies for loss adjustment. Measurement error is thereby limited to the deviation from the *average* junctor path loss of a single marker group.

1.07 When build-out resistors provided for 2- and 4-wire home office test lines are to be adjusted, consideration must be given to those cases where *more than one* test line of a given type is available for selection from the APTT. In these cases, the individual test lines arranged in a hunting group will usually appear on different line link frames. Thus, the "average loss requirement" must be derived by working the specified measurement from the trunk link frame originating appearance of the APTT to each line link frame on which a test line in the hunting group is located. Where *only one* test line of a particular type is provided in a marker group, only one measurement (from the trunk link frame originating appearance of the APTT to the line link frame on which the test line is located) is required to determine the loss to be inserted by the build-out resistors.

1.08 Build-out resistor assemblies are provided as pairs, one assembly for each lead of a transmission path. The two assemblies of a pair must be identically strapped to prevent the introduction of an unbalance in the transmission path. In 4-wire systems, two pairs of build-out resistor assemblies are provided for the transmission paths of each marker group and are separately built out to provide the same loss in each direction of transmission. Because of the different techniques required, separate build-out procedures are provided in this section for 2-wire and 4-wire offices.

1.09 Build-out resistor assemblies are adjusted to provide 0 dBm in 600 ohms by use of a 22A milliwatt reference meter (22A MRM) or equivalent test set. The 22A MRM, or equivalent, in conjunction with a 36A attenuator, *must* be used when performing the build-out adjustments. Measurements made with a 22A MRM approach a high degree of accuracy only within the red lines of the light beam scale. It is necessary, therefore, to use the 36A attenuator with the 22A MRM to

make accurate predictions of required loss from initial measurements.

Note: It is important that the transmission test equipment is known to be accurately calibrated.

1.10 Four precautions should be taken when making these adjustments. First, the 22A MRM, or equivalent, *must* be calibrated each time it is moved, and recalibrated at 15-minute intervals when it is in continuous use. Failure to calibrate as required may result in significant errors. The calibration procedure is engraved on the face of the meter panel and should be precisely followed. Second, the recommended cords for connection of the 22A MRM, or equivalent, to the circuit to be measured must be used. Other cords may introduce excessive loss and cause errors in the adjustment. Third, all measurements in this section are made at a 600-ohm impedance. Note that the FUNCTION switch of the 22A MRM and the switch on the 36A attenuator must both be set to the 600-ohm position to obtain an accurate measurement. Fourth, low resistance wire and tight fitting connections must be used when providing temporary straps on the build-out resistor assemblies during the build-out process. Once the proper resistance strapping has been determined, the temporary straps are to be replaced with permanent soldered connections.

1.11 Before performing the build-out adjustment procedures, the source of test tone power (a 1000-Hz generator circuit in the ATMS director) must be adjusted. This procedure is given in Part 3. Since build-out measurements and adjustments are being made to accuracies of hundredths of a dB, it is essential that the director test tone power be precisely adjusted.

1.12 A build-out adjustment consists of six basic steps. First, the build-out resistor assemblies are strapped so that no loss is introduced to the test tone signal. Second, a representative sample of trunks that can be accessed by the marker group are seized, in turn. Each trunk is then disconnected from its trunk link appearance on the switching equipment so that measurements can be made at the trunk link frame appearance without having the trunk circuits bridged to the transmission path. Third, the average loss to be inserted by the build-out resistor assemblies is calculated from the measurement results of Step 2. Fourth, the

two build-out resistor assemblies of a pair are strapped as shown in Table A to provide the average loss required. Fifth, a previously measured trunk circuit with a junctor path loss which is the same (or approximately the same) as the calculated average loss is resealed. The test tone power output is remeasured to determine that the build-out adjustment has achieved the requirement of 0 ± 0.03 dBm. Sixth, the build-out resistor assemblies are readjusted if necessary, then permanent straps are placed on the assemblies to complete the adjustment. Step 5 should then be repeated as a final check of the adjustment.

These six steps are also required when adjustment of build-out resistors is being done for LLP circuit tests or for home office transmission test line tests. Since, in these cases, the originating appearance of the APTT is on the trunk link frame, isolation of the connected circuit is made at the line link frame appearance of the LLP circuit or home office transmission test line.

1.13 Table A provides terminal strapping information for use in these procedures. Figure 1 shows the designations of each build-out resistor terminal. Note that adjustments can be made by 0.03-dB increments. Careful attention to detail and the use of accurate measuring equipment is necessary to assure that the required accuracy is obtained on loss and noise measurements when using the ATMS and APTT.

1.14 When building out in a 4-wire office, the average loss for the two directions of transmission should not differ by more than 0.2 dB. If the average losses as calculated exceed this difference, the reason for the difference must be located and corrected before the build-out adjustment can be completed.

1.15 When adjusting 2-wire or 4-wire transmission test lines, access to the transmission test line is provided by programming the test frame as a LLP circuit.

1.16 Before making manual transmission tests, build-out procedures must be performed on the terminating test line and originating test line associated with the manual trunk transmission test lines.

1.17 *Use of the wheatstone bridge is mandatory to insure accurate measurements.* Refer

TABLE A
BUILD-OUT RESISTOR ASSEMBLY STRAPPING

REQUIRED LOSS (DB)	TERMINAL STRAPPING (EACH SIDE OF LINE)
0.00	1 to 5
0.03	1 to 4
0.06	1 to 3 and 4 to 5
0.09	1 to 3
0.12	1 to 2 and 3 to 5
0.15	1 to 2 and 3 to 4
0.18	1 to 2 and 4 to 5
0.21	1 to 2
0.24	2 to 5
0.27	2 to 4
0.30	2 to 3 and 4 to 5
0.33	2 to 3
0.36	3 to 5
0.39	3 to 4
0.42	4 to 5
0.45	None

BUILD-OUT RESISTOR ASSEMBLY (TYPICAL)



(See Fig. 1 for terminal and resistor designations.)

Note: The same type of assembly with the same terminal numbers is used in each side of the line.

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to Section 100-815-101 for description and application of the portable wheatstone bridge.

1.18 When instructed to strap the tip (T) and ring (R) at various locations in the APTT or line link frame, connections must be secure. If wire-spring, wire wrap the connection; if non-wire spring, a soldered connection is preferred.◆

2. APPARATUS

2.01 The following apparatus is used in performing the build-out resistor assembly adjustments:

- (a) One 22A milliwatt reference meter (22A MRM) J94022A, ◆(or equivalent).◆

Note: ◆If another type of measuring set is used in lieu of the 22A MRM, it should be ascertained whether its accuracy is as good or better than that of the 22A MRM. If another type of set is used, reference should be made to the manufacturer's instruction manual for operating and calibrating procedures pertaining to the set.◆

- (b) One 36A attenuator for use with the 22A MRM.
- (c) One ATMS director calibration unit CP101DT. (Obtain from the ATMS alignment unit.)
- (d) One 3P15A cord.
- (e) One 2W48A cord.
- (f) Two KS-6278 connecting clips (for making connections to nonwire-wrap terminals).

- (g) Two 624B tools (for making connections to wire-wrap terminals).

- (h) Blocking and insulating tools as required.

- (i) Six-inch straps, as required, with KS-6270 connecting clips (for making temporary connections on build-out resistor assemblies).

- (j) ◆KS-14959 test set (portable wheatstone bridge).

- (k) Two 1W13B testing cords, (893 cord, 6 feet long, equipped with two 360A tools).

- (l) One KS-16492 wire unwrapping tool.

- (m) One 635B wire wrapping tool.

- (n) One KS-14440 soldering copper or equivalent.◆

3. TEST TONE SUPPLY ADJUSTMENT

3.01 Circuit pack CP205C of the ATMS director contains a 1000-Hz test tone supply. This supply must be accurately adjusted before it is used to perform the build-out procedures or to make trunk measurements. The test tone supply generates a stable output and does not require frequent adjustment. However, the supply should be aligned before any build-out procedure is begun since the accuracy of future measurements depends upon this initial adjustment.

CHECK AND ADJUSTMENT OF ATMS DIRECTOR TEST TONE SUPPLY

STEP	PROCEDURE
1	Connect the 22A MRM to the MW CAL jack of the director limits cross-connect unit CP317D, using a 3P15A cord. Calibrate the 22A MRM, set the FUNCTION switch to 600, the REFERENCE LEVEL switch to 0, and operate the 36A attenuator to .0 in the 600-ohm range.
2	Place the director milliwatt supply unit CP205C on an extender and adjust potentiometer R3 until the light beam on the 22A MRM reading is exactly 0.
3	Replace the director connector compensation unit CP101D with the director calibration unit CP101DT. Set all keys on CP101DT to the vertical position.

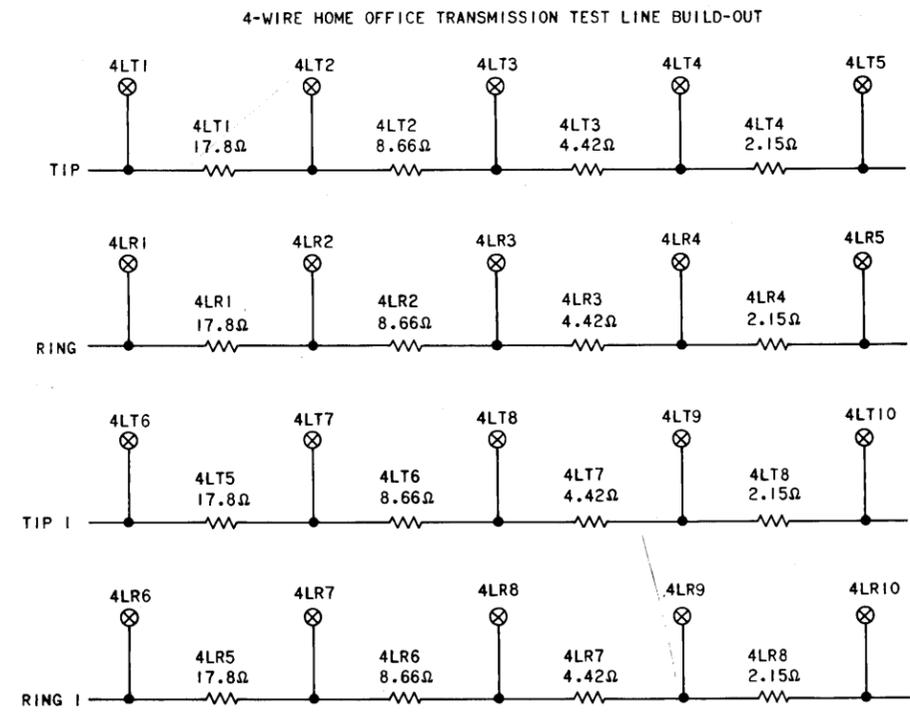
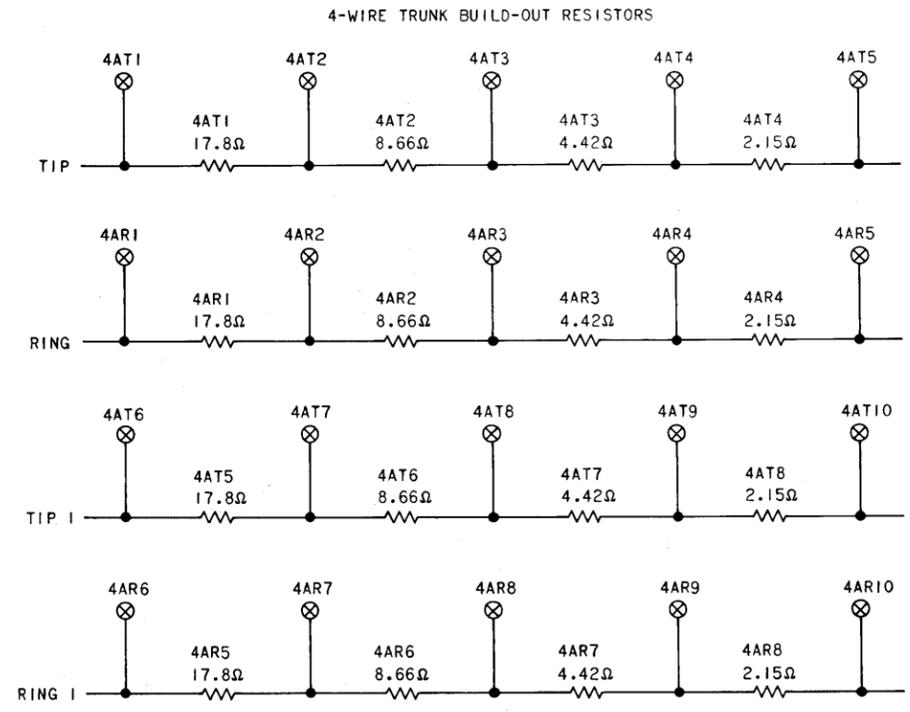
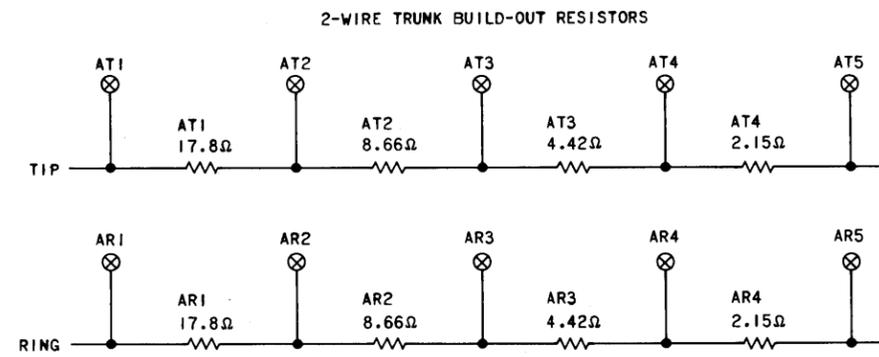
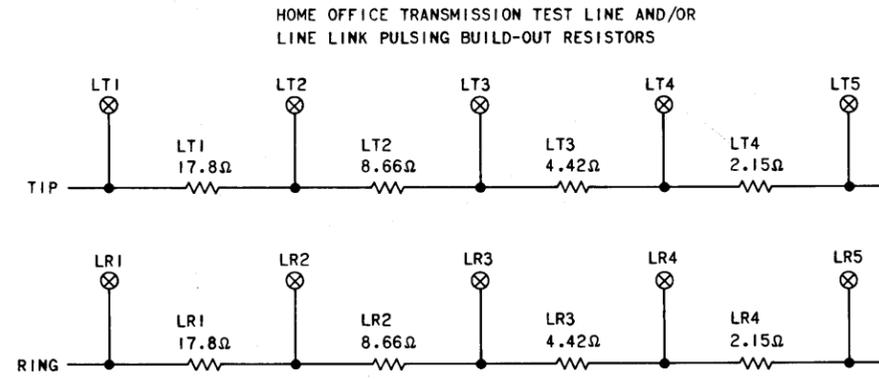


Fig. 1—Build-Out Resistors

STEP	PROCEDURE
4	Transfer the connection of the 22A MRM from the MW CAL jack of CP317D to the 2W jack of CP101DT.
5	Adjust the R7 potentiometer on CP205C until the light beam on the 22A MRM reading is exactly 0.
6	Replace CP205 and repeat measurements at MW CAL and 2W jacks to ensure that no changes have occurred.
7	Disconnect the 22A MRM, remove CP101DT, and reinstall CP101D.

4. BUILD-OUT PROCEDURES

4.01 Separate build-out procedures are provided for 2-wire and 4-wire trunk access circuits, home office transmission test lines, and LLP access circuits. Choose the appropriate build-out procedure and perform the procedure once for each marker group through which trunks, LLP, and home office transmission test line circuits can be reached. Choose the appropriate build-out procedure and perform the procedure once for each marker group through which trunks can be reached by the APTT.

4.02 Before starting the procedures, verify that the build-out resistors in circuit pack CP101D are strapped out. The build-out adjustments in No. 5 crossbar offices are always made in the APTT.

Note: Resistor R5 and thermistors RT1 and RT2, associated with each transmission path lead, are provided for temperature compensation and are *not* to be strapped out.

4.03 A test setup is provided for each build-out procedure. The illustration shows the circuits involved in a single marker group. Sample worksheets are also provided for convenience in performing the procedure. Separate worksheets should be prepared for each marker group.

4.04 The APTT must be primed with pertinent information on trunks that are seized during the procedure as shown in Table B. Some of this information must be taken from the office records and should be obtained from the records at the time the trunk sample is assembled.

TABLE B

APTT KEY OPERATION FOR SELECTING A 2-WIRE OR 4-WIRE TRUNK, LLP CIRCUIT, OR HOME OFFICE TRANSMISSION TEST LINE

SUB-STEP	WHEN THIS LAMP LIGHTS	OPERATE DESIGNATED KEY OR DIGIT	SUB-STEP	WHEN THIS LAMP LIGHTS	OPERATE DESIGNATED KEY OR DIGIT
a	—	PM	aa	—	FIG
b	—	FIG	ab	FE	5
c	MKG	*	ac	TPL	0
d	TMT	*	ad	DBH	0
e	TMU	*	ae	DBT	0
f	A	*	af	DBU	0
g	B	*	ag	LDT	0
h	C	*	ah	LDU	0
i	OA-DDA	*	ai	NRT	0
j	OB-DDB	*	aj	NRU	0
k	OC-DDC	*	ak	NDL	0
l	X	*	al	ANT	0
m	NTH	*	am	ANU	0
n	NH	*	an	DR	0
o	NT	*	ao	—	FIG
p	NU	*	ap	IHT	**
q	CLT	*	aq	ITT	**
r	CLU	*	ar	TH	0
s	TIT	*	as	HN	0
t	TIU	*	at	TEN	0
u	AGRA	*	au	UNT	0
v	CRG	*	av	FTCD	*
w	CRU	*	aw	FU	*
x	CST-ASN	*	ax	TT	*
y	CSU-ASH	*	ay	TU-SSN	*
z	—	PT			

* Indicates numerical information from office records.

** Indicates numerical information from office records for line link pulsing only, no key operation required.

A. 2-Wire Trunk Build-Out (Fig. 2)

STEP

PROCEDURE

Note: This procedure must be performed separately for each marker group through which 2-wire trunks may be accessed by the APTT. The build-out resistor assemblies for each marker group can be adjusted separately.

- 1 Determine from the office records the location of representative 2-wire trunks by which access can be obtained through the marker group. Select a balance sample of six trunks

STEP

PROCEDURE

which have trunk link frame appearances at the longest, the shortest, and medium electrical distance from the link link appearance of the APTT.

- 2 Strap terminal 1 to terminal 5 in each build-out resistor assembly of the marker group access path under adjustment. No loss is then inserted by the build-out resistor assemblies.
- 3 Remove the ATMS director print control unit CP409D. This prevents the ATMS from attempting to make a measurement.
- 4 At the APTT, block the STM1 and 900 relays nonoperated. Blocking these relays prevents APTT timeout and prohibits operation of ATMS in the 900-ohm impedance mode.
- 5 Restore all keys and switches of the APTT. After 5 seconds, momentarily operate the RL key. All lamps should be extinguished.
- 6 Operate the LP key. The DW lamp should light.
- 7 Operate the PC key. The PC lamp should light.
- 8 Operate the M₋ key or set MKR₋ switch to select a combined or completing marker not associated with a line insulation test circuit.
- 9 Operate the NTTS key and set the TST switch to TM.
- 10 Make busy the trunk to be seized.
Note: If a 2-way trunk is to be seized, the trunk must be made busy at both ends.
- 11 Operate the ST key. The FIG lamp should light and the DW lamp should be extinguished.
- 12 Operate the keys of the APTT in accordance with Table B.
- 13 At the trunk circuit of the trunk which has just been seized, block the S1 relay operated.
- 14 At the trunk link frame, insulate contacts of the FA or FB relay, as required to open the T and R leads to the selected trunk.
- 15 Using a 2W48A cord and connecting clips, connect the 22A MRM to the T and R terminals of the crossbar switch at the horizontal side of the trunk link frame corresponding to the selected trunk. Set the FUNCTION switch of the 22A MRM to 600, the REFERENCE LEVEL switch to 0, and operate the 36A attenuator to .0 in the 600-ohm range.
- 16 At the ATMS director, operate and hold (or lock) the 2W-NORM-4W key on the limits cross-connect unit CP317D to 2W. The 22A MRM should read some power greater than 0 dBm.

Note: If a negative reading is obtained (light beam to the left of the two red lines) a trouble is indicated that must be cleared before proceeding with the adjustment.

STEP

PROCEDURE

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- 17 Adjust the 36A attenuator in the 600-ohm range until the light beam of the 22A MRM is closest to 0.
- 18 Record the sum of the reading of the 36A attenuator control minus any negative reading or plus any positive reading of the 22A MRM (algebraic sum) in the T and R column of the worksheet (Fig. 3).
- 19 Release the ATMS director 2W-NORM-4W key on CP317D.
- 20 At the trunk link frame, disconnect the 22A MRM from the crossbar switch terminals and remove the insulation from the FA or FB relay.
- 21 At the trunk circuit of the trunk just tested, remove the blocking tool from the S1 relay.
- 22 At the APTT, momentarily operate the RL key. All lamps except PC and DW should be extinguished.
- 23 Repeat Steps 10 through 22 for each trunk of the sample. Record, as in Step 18, the algebraic sum of the 36A and 22A MRM readings obtained by each seizure.
- 24 On the worksheet, total the recorded readings, then divide the total by the number of measurements made. The result is the average test tone power at the outgoing side of the trunk link frame and is, therefore, the amount of loss that must be added to provide a test tone power of 0 dBm (or -2 dBm) at the trunk link frame when tests are actually performed. This additional loss must be obtained by adjustment of build-out resistor assemblies for the marker group.
- 25 Using Table A, select a build-out resistor strapping arrangement which will provide, as nearly as possible, the required additional loss. Apply this strapping to the build-out resistor assemblies, using temporary straps with connecting clips.
- Note:* Make sure that each build-out resistor assembly is identically strapped in each lead of the transmission path.
- 26 Select from the worksheet a trunk which exhibited, as nearly as possible, the average loss of the trunk sample. Repeat Steps 10 through 22 to re seize and remeasure the test tone power now present at the input of the selected trunk.
- Requirement:* 22A MRM reading is between the red lines of the light beam scale.
- Note:* If this requirement is not met, the build-out resistor assemblies must be readjusted. Readjustment should require only a one-line movement up or down in Table A, depending upon whether less loss or more loss is necessary to meet the requirement. Readjust the build-out resistor assemblies if necessary, then check that the requirement is met.
- 27 Replace the temporary straps on the build-out resistor assemblies with permanently soldered connections. Be careful not to alter the final build-out configuration just achieved.

STEP	PROCEDURE
28	Repeat Steps 10 through 22 on the trunk selected in Step 26 to determine that the adjustment has not changed.
29	If no other marker group access paths are to be built out, restore the equipment to normal by replacing the ATMS director print control unit CP409D and by removing the blocking tools from the STM1 and 900 relays of the APTT.

B. 4-Wire Trunk Build-Out (Fig. 4)

STEP	PROCEDURE
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Note: This procedure must be separately performed for each marker group through which 4-wire trunks may be accessed by the APTT. The build-out resistor assemblies for each marker group can be adjusted separately.

- 1 Determine from office records the location of representative 4-wire trunks which can be accessed through the marker group. Select a balanced sample of six trunks which have trunk link frame appearances at the longest, shortest, and medium electrical distance from the line link appearance of the APTT.

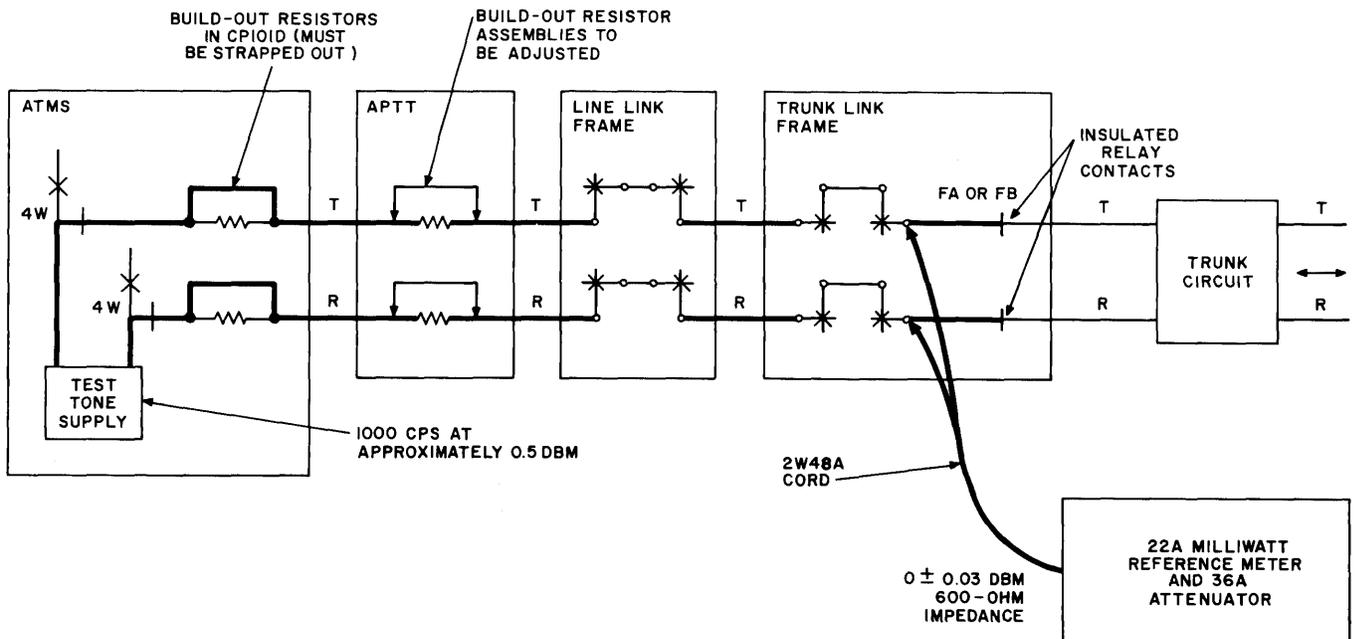


Fig. 2—Test Setup for Adjusting Build-Out Resistors for 2-Wire Trunks

STEP	PROCEDURE
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WORKSHEET FOR DETERMINING REQUIRED LOSS FOR 2-WIRE TRUNKS

	TRUNK DESIGNATIONS	LOSS REQUIRED FOR T AND R PATH
Short Junctor Path Trunks		
Medium Junctor Path Trunks		
Long Junctor Path Trunks		
Average Loss Required		

Fig. 3—Worksheet for Determining Required Loss for 2-Wire Trunks—Sample

- 2 Strap terminal 1 to terminal 5 in each build-out resistor assembly of the marker group access path under adjustment. No loss is then inserted by the build-out resistor assemblies.
- 3 Remove the ATMS director print control unit CP409D, thereby preventing the ATMS from attempting to make a measurement.
- 4 At the APTT, block the STM1 and 900 relays nonoperated. Blocking these relays prevents APTT timeout and prohibits operation of the ATMS in the 900-ohm impedance mode.
- 5 Restore all APTT keys and switches. After 5 seconds, momentarily operate the RL key. All lamps should extinguish.

STEP	PROCEDURE
6	Operate the LP key. The DW lamp should light.
7	Operate the PC key. The PC lamp should light.
8	Operate the M_ key or set MKR_ switch to select a combined or completing marker not associated with a line insulation test circuit.
9	Operate the NTTS key and set the TST switch to TM.
10	Operate the 4W key.
11	Make busy the trunk to be seized.
	<i>Note:</i> If a 2-way trunk is to be seized, the trunk must be made busy at both ends.
12	Operate the ST key. The FIG lamp should light and the DW lamp should extinguish.
13	Operate the APTT keys in accordance with Table B.
14	At the trunk circuit of the trunk which has just been seized, block the S1 relay operated.
15	At the trunk link frame, insulate contacts of the FR— and FS— relays to open the T and R, and T1 and R1 leads to the selected trunk.
16	Using a 2W48A cord and connecting clips, connect the 22A MRM to the T and R terminals of the crossbar switch at the horizontal side of the trunk link frame corresponding to the selected trunk. Set the FUNCTION switch of the 22A MRM to 600, the REFERENCE LEVEL switch to 0, and operate the 36A attenuator to .0 in the 600-ohm range.
17	At the ATMS director, operate and hold (or lock) the 2W-NORM-4W key on the limits cross-connect unit CP317D to 2W. The 22A MRM reading should be some power greater than 0 dBm.
	<i>Note:</i> If a negative reading is obtained (light beam to the left of the two red lines) a trouble is indicated that must be cleared before proceeding with the adjustment.
18	Adjust the 36A attenuator in the 600-ohm range until the light beam of the 22A MRM is closest to 0.
19	Record the sum of the reading of the 36A attenuator control minus any negative reading or plus any positive reading of the 22A MRM (algebraic sum) in the LOSS REQUIRED FOR T AND R PATH column of the worksheet (Fig. 5).
20	At the trunk link frame, transfer the 22A MRM connection from the T and R terminals to the T1 and R1 terminals of the crossbar switch at the horizontal side of the trunk link frame corresponding to the selected trunk circuit. Set the FUNCTION switch of the 22A MRM to 600, the REFERENCE LEVEL switch to 0, and operate the 36A attenuator to .0 in the 600-ohm range.

STEP

PROCEDURE

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- 21 At the ATMS director, operate and hold (or lock) the 2W-NORM-4W key on CP317D to 4W. The 22A MRM reading should be some power greater than 0 dBm.
- Note:* If a negative reading is obtained, a trouble is indicated that must be cleared before proceeding with the adjustment.
- 22 Adjust the 36A attenuator in the 600-ohm range until the light beam of the 22A MRM is closest to 0.
- 23 Record the algebraic sum of the reading of the 36A attenuator control minus any negative reading or plus any positive reading of the 22A MRM in the LOSS REQUIRED FOR T1 AND R1 PATH column of the worksheet. This reading must not differ by more than 0.2 dB from the reading obtained in Step 19.
- 24 Release the ATMS director 2W-NORM-4W key on the CP317D.
- 25 At the trunk link frame, disconnect the 22A MRM from the crossbar switch terminals and remove the insulator from the FR— and FS— relays.
- 26 At the trunk circuit of the trunk just tested, remove the blocking tool from the S1 relay.
- 27 At the APTT, momentarily operate the RL key. All lamps except PC and DW should extinguish.
- 28 Repeat Steps 11 through 27 for each trunk of the sample. Record, as in Steps 19 and 23, the algebraic sum of the 36A and 22A readings obtained by each seizure.
- 29 On the worksheet, total the recorded readings separately for the T and R and the T1 and R1 leads, then divide the totals by the number of measurements made. The results are the two average test tone power levels for each transmission path at the outgoing side of the trunk link frame. They are, therefore, the amount of loss that must be added to provide a test tone power of 0 dBm (or -2 dBm) at the trunk link frame when tests are actually performed. The additional loss must be obtained by adjustment of build-out resistor assemblies of the marker group.
- 30 Using Table A, select a build-out resistor strapping arrangement which will provide, as nearly as possible, the required additional loss for each transmission path. Apply this strapping to the build-out resistor assemblies, using temporary straps with connecting clips.
- Note:* Be sure each build-out resistor assembly is identically strapped in each lead of the separate transmission paths (the T and R path and the T1 and R1 path).
- 31 Select from the worksheet a trunk which exhibited, as nearly as possible, the average loss of the trunk sample. Repeat Steps 11 through 27 to re seize and remeasure the test tone power now present at the input of the selected trunk.
- Requirement:* 22A MRM reading is between the red lines of the light beam scale for each transmission path.

STEP	PROCEDURE
	<p>Note 1: Since the average loss for both directions of transmission may not have been exhibited by the same trunk, it may be necessary to reseize two trunks to check the results of build-out, one to check the T and R path, a second to check the T1 and R1 path.</p> <p>Note 2: If the requirement is not met for one or both of the transmission paths, the build-out resistor assemblies must be readjusted. Readjustment should require only a one-line movement up or down in Table A, depending upon whether less loss or more loss is necessary to meet the requirement. Readjust the build-out resistor assemblies if necessary, then check that the requirement is met.</p>
32	Replace the temporary straps on the build-out resistor assemblies with soldered, permanent connections. Be careful not to alter the final build-out configuration just achieved.
33	Repeat Steps 11 through 27 on the trunk selected in Step 31 to determine that the adjustment has not changed.
34	If no other marker group access paths are to be built out, restore the equipment to normal by replacing the ATMS director print control unit CP409D and by removing the blocking tools from the STM1 and 900 relays of the APTT.

C. 2-Wire Line Link Pulsing Circuits and Home Office Transmission Test Lines in the Same Marker Group (Fig. 6)

STEP	PROCEDURE
	<p>Note: This procedure must be performed separately for each marker group through which LLP circuits may be accessed by the APTT. The build-out resistor assemblies for each marker group must be adjusted separately.</p>
1	Determine from office records the location of representative LLP circuits by which access can be obtained through the marker group. Select a balanced sample of six LLP circuits which have line link frame appearances at the longest, shortest, and medium electrical distance from the trunk link frame appearance of the APTT. Also, select the locations of the transmission test lines that are accessed at the line link frame. If a terminal hunting group is used for access to test lines or a park-on circuit, make all locations busy except the line used in the test.
2	Strap terminal 1 to terminal 5 in each build-out resistor assembly for the marker group access path under adjustment. No loss is then inserted by the build-out resistor assemblies.
3	Remove the ATMS director print control unit CP409D. This prevents the ATMS from attempting to make a measurement.

STEP

PROCEDURE

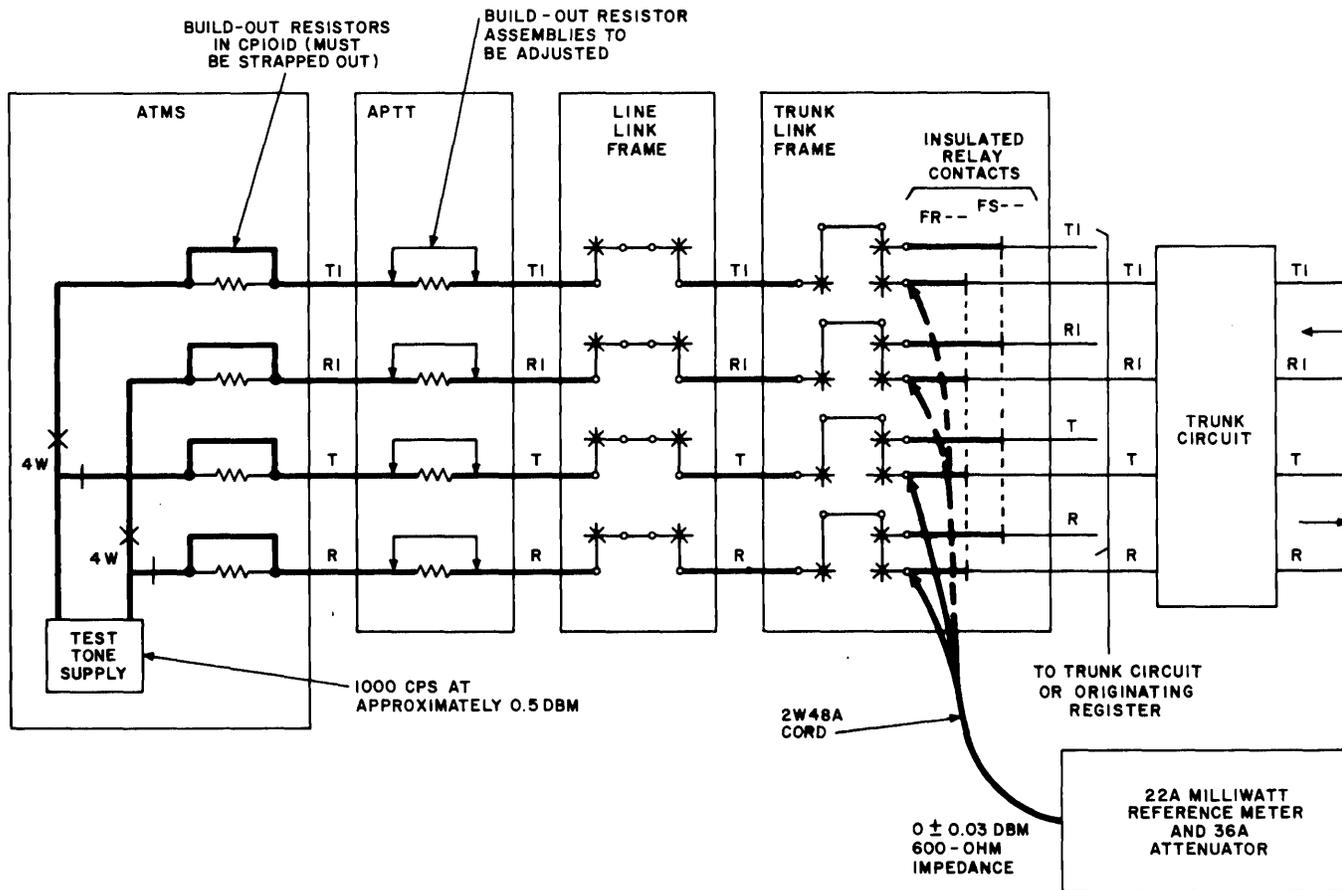


Fig. 4—Test Setup for Adjusting Build-Out Resistors for 4-Wire Trunks

- 4 At the APTT, block the STM1 and 900 relays nonoperated. Blocking these relays prevents APTT timeout and prohibits operation of ATMS in the 900-ohm impedance mode.
- 5 Restore all APTT keys and switches. After 5 seconds, momentarily operate the RL key. All lamps should extinguish.
- 6 Operate the LP key. The DW lamp should light.
- 7 Operate the PC key. The PC lamp should light.
- 8 Operate the M_— key or set MKR_— switch to select a combined marker not associated with a line insulation test circuit.
- 9 Set TST switch to TM.

STEP	PROCEDURE
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**WORKSHEET FOR DETERMINING REQUIRED LOSS FOR 4-WIRE TRUNKS
TRUNK CIRCUITS**

	TRUNK DESIGNATION	LOSS REQUIRED FOR T AND R PATH	LOSS REQUIRED FOR T1 AND R1 PATH
Short Junctor Path Trunks			
Medium Junctor Path Trunks			
Long Junctor Path Trunks			
Average Loss Required			

Fig. 5—Worksheet for Determining Required Loss for 4-Wire Trunks—Sample

10 If LLP circuit is under test, operate the NTTS key, and make busy the LLP circuit to be used in test connection.

Note: If a 2-way LLP circuit is to be seized, the LLP circuit must be made busy at both ends.

If a home office test line is under test, the NTTS key is not necessary. See Step 1.

11 Operate the ST key. The FIG lamp should light and the DW lamp should extinguish.

12 Operate the APTT keys in accordance with Table B.

STEP

PROCEDURE

-
- 13 At line switch of line link frame, using Bell Seal Bond paper KS-7178, insulate tip and ring crosspoints associated with LLP circuit or home office test line seized.
- 14 Using a 2W48A cord and two KS-6278 connecting clips (soldered terminals) or two 624B tools (wire-wrapped terminals), connect the 22A MRM to the rear of the tip and ring movable contacts of the crosspoint associated with the selected circuit. Set the FUNCTION switch of the 22A MRM to 600, the REFERENCE LEVEL switch to 0, and operate the 36A attenuator to .0 in the 600-ohm range.
- 15 At the ATMS director, operate and hold (or lock) the 2W-NORM-4W key on the limits cross-connect unit CP317D to 2W. The 22A MRM reading should be some power greater than 0 dBm.
- Note:* If a negative reading is obtained (light beam to the left of the two red lines) a trouble is indicated that must be cleared before proceeding with the adjustment.
- 16 Adjust the 36A attenuator in the 600-ohm range until the light beam of the 22A MRM is closest to 0.
- 17 Record the reading of the 36A attenuator control minus any negative reading or plus any positive reading of the 22A MRM (algebraic sum) in the LOSS REQUIRED FOR T AND R PATH column of the worksheet (Fig. 7).
- 18 Release the ATMS director 2W-NORM-4W key on the CP317D.
- 19 At the line link frame, disconnect the 22A MRM from the tip and ring movable contacts and remove insulator from tip and ring crosspoints.
- 20 At the APTT, momentarily operate the RL key. All lamps except PC and DW should extinguish.
- 21 Repeat Steps 10 through 20 for each LLP circuit or home office test line of the sample. Record, as in Step 17, the algebraic sum of 36A attenuator and 22A MRM readings obtained for each seizure.
- 22 On the worksheet, total the recorded readings, then divide the total by the number of measurements made. The result is the average test tone power at the outgoing side of the line link frame and is, therefore, the amount of loss that must be added to provide a test tone power of 0 dBm at the line link frame when tests are actually performed. This additional loss must be obtained by adjustment of build-out resistor assemblies, using temporary straps and connecting clips.
- 23 Select from Table A, a build-out resistor strapping arrangement which will provide, as nearly as possible, the required additional loss. Apply this strapping to the build-out resistor assemblies, using temporary straps with connecting clips.

Note: Be certain that each build-out resistor assembly is identically strapped in each lead of the transmission path.

STEP	PROCEDURE
24	Select from the worksheet a home office test line or LLP circuit which exhibited, as nearly as possible, the average loss of the home office test line or LLP circuit sample. Repeat Steps 10 through 20 to reseat and remeasure the test tone power now present at the input of the selected LLP circuit or home office test line. <i>Requirement:</i> 22A MRM reading is between the red lines of the light beam scale. <i>Note:</i> If this requirement is not met, the build-out resistor assemblies must be readjusted. Readjustments should require only a one-line movement up or down in Table A, depending upon whether less loss or more loss is necessary to meet the requirement. Readjust the build-out resistor assemblies if necessary, then check that the requirement is met.
25	Replace the temporary straps on the build-out resistor assemblies with soldered, permanent connections. Be careful not to alter the final build-out configuration just achieved.
26	Repeat Steps 10 through 20 on the LLP circuit or home office test line selected in Step 24, to determine that the adjustment has not changed.
27	If no other marker access paths are to be built out, restore the equipment to normal by replacing the ATMS director print control unit CP409D and by removing the blocking tools from the STM1 and 900 relays of the APTT.

**D. Home Office Transmission Test Lines—Without
LLP in the Same Marker Group (Fig. 6)**

STEP	PROCEDURE
<i>Note:</i> This procedure must be performed separately for each marker group through which home office transmission test lines may be accessed by the APTT. The build-out resistor assemblies for each marker group must be adjusted separately.	
1	Determine from office records the locations of the transmission test lines that are accessed at the line link frame. If a terminal hunting group is used for access to test lines or a park-on circuit, make all locations busy except the line used in the test.
2	Strap terminal 1 to terminal 5 in each build-out resistor assembly for the marker group access path under adjustment. No loss is then inserted by the build-out resistor assemblies.
3	Remove the ATMS director print control unit CP409D. This prevents the ATMS from attempting to make a measurement.
4	At the APTT, block the STM1 and 900 relays nonoperated. Blocking these relays prevents APTT timeout and prohibits operation of ATMS in the 900-ohm impedance mode.

STEP

PROCEDURE

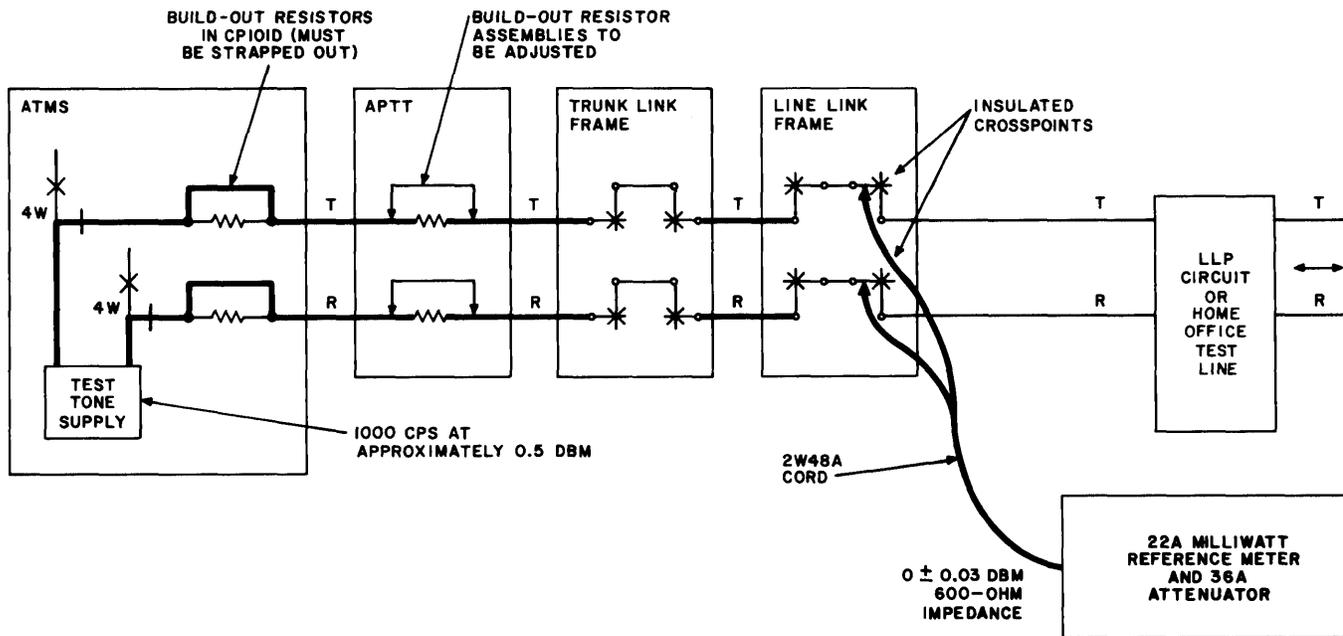


Fig. 6—Test Setup for Adjusting Build-Out Resistors for 2-Wire Access LLP Circuits or Home Office Transmission Test Lines

- 5 Restore all APTT keys and switches. After 5 seconds, momentarily operate the RL key. All lamps should extinguish.
- 6 Operate the LP key. The DW lamp should light.
- 7 Operate the PC key. The PC lamp should light.
- 8 Operate the M₁ key or set MKR₁ switch to select a combined or completing marker not associated with a line insulation test circuit.
- 9 Set TST switch to TM.
- 10 Operate the ST key. The FIG lamp should light and the DW lamp should extinguish.
- 11 Operate the APTT keys in accordance with Table B.
- 12 At line switch of line link frame, using Bell Seal Bond paper KS-7178, insulate tip and ring crosspoints associated with home office test line used in the test.
- 13 Using a 2W48A cord and two KS-6278 connecting clips (soldered terminals) or two 624B tools (wire-wrapped terminals), connect the 22A MRM to the rear of the tip and ring

STEP	PROCEDURE
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**WORKSHEET FOR DETERMINING REQUIRED LOSS FOR 2-WIRE
ACCESS LLP CIRCUITS AND/OR HOME
OFFICE TRANSMISSION TEST LINES**

	LLP CIRCUIT OR HOME OFFICE TEST LINE DESIGNATION	LOSS REQUIRED FOR T AND R PATH
Short Junctor Path LLP Circuits or Home Office Test Lines		
Medium Junctor Path LLP Circuits or Home Office Test Lines		
Long Junctor Path LLP Circuits or Home Office Test Lines		
Average Loss Required		

Fig. 7—Worksheet for Determining Required Loss for 2-Wire Access LLP Circuits or Home Office Transmission Test Lines—Sample

movable contacts of the crosspoint associated with the selected circuit. Set the FUNCTION switch of the 22A MRM to 600, the REFERENCE LEVEL switch to 0, and operate the 36A attenuator to .0 in the 600-ohm range.

- 14 At the ATMS director, operate and hold (or lock) the 2W-NORM-4W key on the limits cross-connect unit CP317D to 2W. The 22A MRM reading should be some power greater than 0 dBm.

STEP

PROCEDURE

Note: If a negative reading is obtained (light beam to the left of the two red lines) a trouble is indicated that must be cleared before proceeding with the adjustment.

- 15 Adjust the 36A attenuator in the 600-ohm range until the light beam of the 22A MRM is closest to 0.
- 16 Record the reading of the 36A attenuator control minus any negative reading or plus any positive reading of the 22A MRM (algebraic sum) in the LOSS REQUIRED FOR T AND R PATH column of the worksheet (Fig. 7).
- 17 Release the ATMS director 2W-NORM-4W key on the CP317D.
- 18 At the line link frame, disconnect the 22A MRM from the tip and ring movable contacts and remove insulator from tip and ring crosspoints.
- 19 At the APTT, momentarily operate the RL key. All lamps except PC and DW should extinguish.
- 20 Repeat Steps 10 through 19 for each circuit of the sample. Record, as in Step 16, the algebraic sum of 36A attenuator and 22A MRM readings obtained for each seizure.
- 21 On the worksheet, total the recorded readings, then divide the total by the number of measurements made. The result is the average test tone power at the outgoing side of the line link frame and is, therefore, the amount of loss that must be added to provide a test tone power of 0 dBm at the line link frame when tests are actually performed. This additional loss must be obtained by adjustment of build-out resistor assemblies, using temporary straps and connecting clips.
- 22 Select from Table A, a build-out resistor strapping arrangement which will provide, as nearly as possible, the required additional loss. Apply this strapping to the build-out resistor assemblies, using temporary straps with connecting clips.

Note: Be certain that each build-out resistor assembly is identically strapped in each lead of the transmission path.

- 23 Select from the worksheet a circuit which exhibited, as nearly as possible, the average loss of the circuit sample. Repeat Steps 10 through 19 to reseize and remeasure the test tone power now present at the input of the selected circuit.

Requirement: 22A MRM reading is between the red lines of the light beam scale.

Note: If this requirement is not met, the build-out resistor assemblies must be readjusted. Readjustments should require only a one-line movement up or down in Table A, depending upon whether less loss or more loss is necessary to meet the requirement. Readjust the build-out resistor assemblies if necessary, then check that the requirement is met.

- 24 Replace the temporary straps on the build-out resistor assemblies with soldered, permanent connections. Be careful not to alter the final build-out configuration just achieved.

STEP	PROCEDURE
25	Repeat Steps 10 through 19 on the circuit selected in Step 23 to determine that the adjustment has not changed.
26	If no other marker access paths are to be built out, restore the equipment to normal by replacing the ATMS director print control unit CP409D and by removing the blocking tools from the STM1 and 900 relays of the APTT.

**E. 4-Wire Home Office Transmission Test Line
Build-Out (Fig. 8)**

STEP	PROCEDURE
<p><i>Note:</i> This procedure must be separately performed for each marker group through which 4-wire home office transmission test lines may be accessed by the APTT. The build-out resistor assemblies for each marker group must be adjusted separately.</p>	
1	Determine from office records the location of the transmission test lines which can be accessed at the line link frame. If a terminal hunting group is used for access to test lines or a park-on circuit, make all locations busy except the line used in the test.
2	Strap terminal 1 to terminal 5 in each build-out resistor assembly of the marker group access path under adjustment. No loss is then inserted by the build-out resistor assemblies.
3	Remove the ATMS director print control unit CP409D, thereby preventing the ATMS from attempting to make a measurement.
4	At the APTT, block the STM1 and 900 relays nonoperated. Blocking these relays prevents APTT timeout and prohibits operation of the ATMS in the 900-ohm impedance mode.
5	Restore all APTT keys and switches. After 5 seconds, momentarily operate the RL key. All lamps should extinguish.
6	Operate the LP key. The DW lamp should light.
7	Operate the PC key. The PC lamp should light.
8	Operate the M_ key or set MKR_ switch to select a combined or completing marker not associated with a line insulation test circuit.
9	Set the TST switch to TM.
10	Operate the 4W key.
11	Operate the ST key. The FIG lamp should light and the DW lamp should extinguish.

STEP	PROCEDURE
12	Operate the APTT keys in accordance with Table B.
13	At the line switch of the line link frame, using Bell Seal Bond paper KS-7178, insulate the T, R, T1, and R1 crosspoints associated with the transmission test line used in the test.
14	Using a 2W48A cord and connecting clips, connect the 22A MRM to the T and R movable contacts of the crossbar switch associated with the selected circuit. Set the FUNCTION switch of the 22A MRM to 600, the REFERENCE LEVEL switch to 0, and operate the 36A attenuator to .0 in the 600-ohm range.
15	At the ATMS director, operate and hold (or lock) the 2W-NORM-4W key on the limits cross-connect unit CP317D to 2W. The 22A MRM reading should be some power greater than 0 dBm. <i>Note:</i> If a negative reading is obtained (light beam to the left of the two red lines) a trouble is indicated that must be cleared before proceeding with the adjustment.
16	Adjust the 36A attenuator in the 600-ohm range until the light beam of the 22A MRM is closest to 0.
17	Record the sum of the reading of the 36A attenuator control minus any negative reading or plus any positive reading of the 22A MRM (algebraic sum) in the LOSS REQUIRED FOR T AND R PATH column of the worksheet.
18	At the line link frame, transfer the 22A MRM connections from the T and R movable contacts to the T1 and R1 movable contacts of the crossbar switch associated with the selected circuit. Set the FUNCTION switch of the 22A MRM to 600, the REFERENCE LEVEL switch to 0, and operate the 36A attenuator to .0 in the 600-ohm range.
19	At the ATMS director, operate and hold (or lock) the 2W-NORM-4W key on CP317D to 4W. The 22A MRM reading should be some power greater than 0 dBm. <i>Note:</i> If a negative reading is obtained, a trouble is indicated that must be cleared before proceeding with the adjustment.
20	Adjust the 36A attenuator in the 600-ohm range until the light beam of the 22A MRM is closest to 0.
21	Record the algebraic sum of the reading of the 36A attenuator control minus any negative reading or plus any positive reading of the 22A MRM in the LOSS REQUIRED FOR T1 AND R1 PATH column of the worksheet. This reading must not differ by more than 0.2 dB from the reading obtained in Step 17.
22	Release the ATMS director 2W-NORM-4W key on the CP317D.
23	At the line link frame, disconnect the 22A MRM from the T1 and R1 movable contacts and remove insulator from T, R, T1, and R1 crosspoints.

STEP	PROCEDURE
24	At the APTT, momentarily operate the RL key. All lamps except PC and DW should extinguish.
25	Repeat Steps 11 through 24 for each circuit of the sample. Record, as in Steps 17 and 21 the algebraic sum of the 36A and 22A readings obtained by each seizure.
26	On the worksheet, total the recorded readings separately for the T and R and the T1 and R1 leads, then divide the totals by the number of measurements made. The results are the two average test tone power levels for each transmission path at the outgoing side of the trunk link frame. They are, therefore, the amount of loss that must be added to provide a test tone power of 0 dBm (or -2 dBm) at the trunk link frame when tests are actually performed. The additional loss must be obtained by adjustment of build-out resistor assemblies of the marker group.
27	Using Table A, select a build-out resistor strapping arrangement which will provide, as nearly as possible, the required additional loss for each transmission path. Apply this strapping to the build-out resistor assemblies, using temporary straps with connecting clips. <i>Note:</i> Be sure each build-out resistor assembly is identically strapped in each lead of the separate transmission paths (the T and R path and the T1 and R1 path).
28	Select from the worksheet a trunk which exhibited, as nearly as possible, the average loss of the trunk sample. Repeat Steps 11 through 24 to re seize and remeasure the test tone power now present at the input of the selected trunk. <i>Requirement:</i> 22A MRM reading is between the red lines of the light beam scale for each transmission path. <i>Note 1:</i> Since the average loss for both directions of transmission may not have been exhibited by the same circuit, it may be necessary to re seize two circuits to check the results of build-out, one to check the T and R path, a second to check the T1 and R1 path. <i>Note 2:</i> If the requirement is not met for one or both of the transmission paths, the build-out resistor assemblies must be readjusted. Readjustment should require only a one-line movement up or down in Table A, depending upon whether less loss or more loss is necessary to meet the requirement. Readjust the build-out resistor assemblies if necessary, then check that the requirement is met.
29	Replace the temporary straps on the build-out resistor assemblies with soldered, permanent connections. Be careful not to alter the final build-out configuration just achieved.
30	Repeat Steps 11 through 24 on the trunk selected in Step 28 to determine that the adjustment has not changed.
31	If no other marker group access paths are to be built out, restore the equipment to normal by replacing the ATMS director print control unit CP409D and by removing the blocking tools from the STM1 and 900 relays of the APTT.

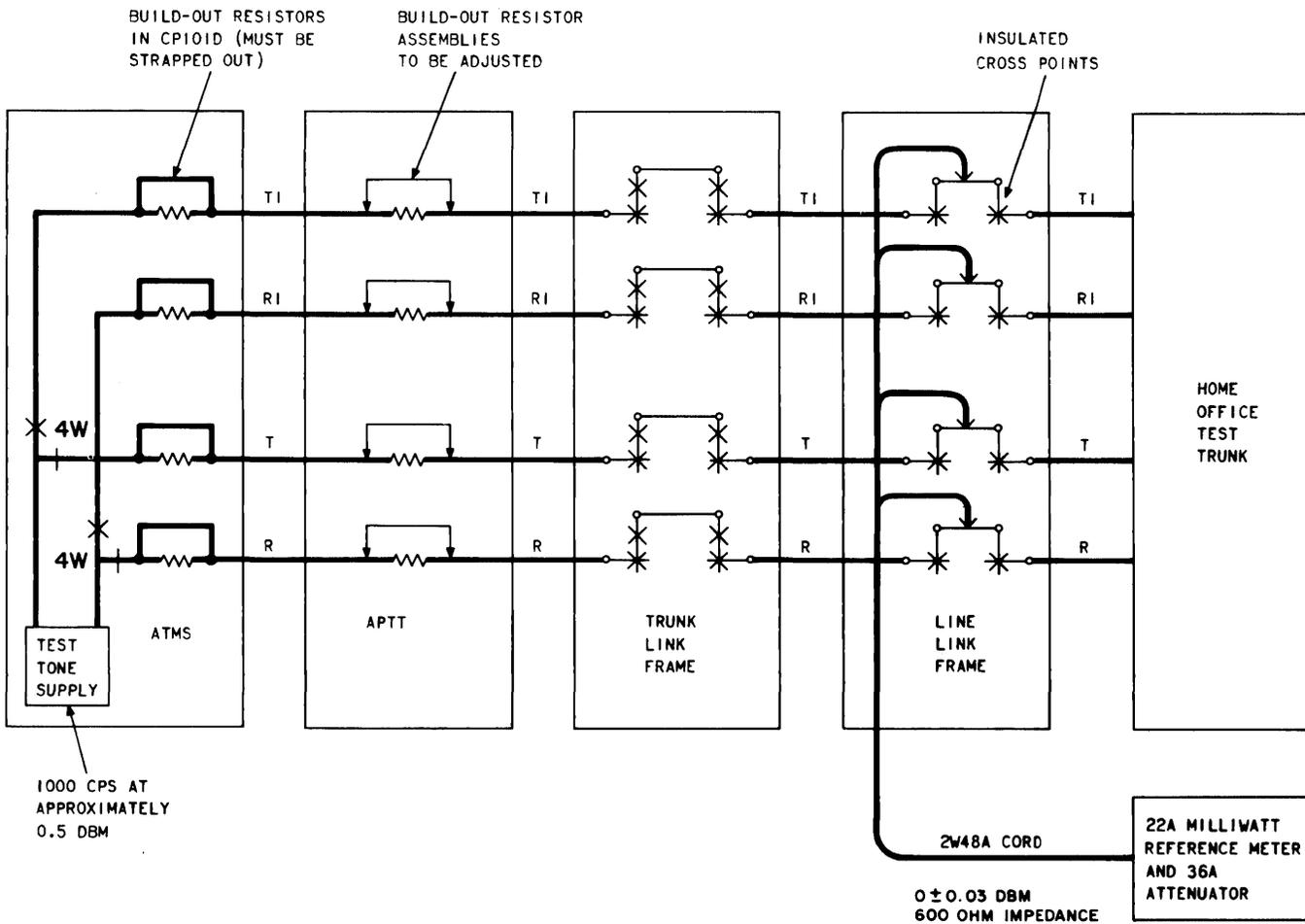


Fig. 8—Test Setup for Adjusting Build-Out Resistors for 4-Wire Home Office Transmission Test Lines

F. Manual Transmission Testing—Terminating Test Line Build-Out (Fig. 10)

STEP	PROCEDURE
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Note: When the APTT is equipped for making manual transmission measurements to loop-around and 104 test lines, this procedure must be performed separately for each marker group through which 2-wire trunks may be accessed by the APTT. The build-out resistor assemblies for each marker group can be adjusted separately.

- 1 Determine from the office records the location of representative 2-wire trunks by which access can be obtained through the marker group. Select a balance sample of six trunks which have trunk link frame appearances at the longest, the shortest, and medium electrical distance from the line link appearance of the APTT.

STEP	PROCEDURE
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WORKSHEET FOR DETERMING REQUIRED LOSS FOR 4-WIRE HOME OFFICE TRANSMISSION TEST LINES

	TEST LINE DESIGNATION	LOSS REQUIRED FOR T AND R PATH	LOSS REQUIRED FOR T1 AND R1 PATH
Short Junctor Path Trunks			
Medium Junctor Path Trunks			
Long Junctor Path Trunks			
Average Loss Required			

Fig. 9—Worksheet for Determining Required Loss for 4-Wire Home Office Transmission Test Lines—Sample

- 2 Strap terminal 1 to terminal 5 in each build-out resistor assembly of the marker group access path under adjustment. No loss is then inserted by the build-out resistor assemblies. (Fig. 11.)
- 3 Block the STM1 relay nonoperated. This prevents APTT timeout.
- 4 Restore all APTT keys and switches. After 5 seconds, momentarily operate the RL key. All lamps should extinguish.
- 5 Operate the LP key. The DW lamp should light.
- 6 Operate the PCS key.

STEP

PROCEDURE

-
- 7 Operate the M_ key or set MKR_ switch to select a combined or completing marker not associated with a line insulation test circuit.
 - 8 Set TST switch to TM and operate the NTTS key.
 - 9 Make busy the trunk to be seized.
Note: If a 2-way trunk is to be seized, the trunk must be made busy at both ends.
 - 10 Set the switches as required to establish a call to a 104 test line or, to the second termination (part 2) of the loop-around test line using the combined originating-terminating test line.
 - 11 Operate the ST key. The FIG lamp should light and the DW lamp should extinguish.
 - 12 At the trunk circuit just seized, block operated the S1 relay.
 - 13 At the trunk link frame, insulate contacts of the FA or FB relay, as required to open the T and R leads to the selected trunk.
 - 14 Using a 2W48A cord and connecting clips, connect the 22A MRM to the T and R terminals of the crossbar switch at the horizontal side of the trunk link frame corresponding to the selected trunk. Set the FUNCTION switch of the 22A MRM to 600, the REFERENCE LEVEL switch to 0, and operate the 36A attenuator to .0 in the 600-ohm range.
 - 15 At the APTT, operate the MWTM key.
 - 16 At the trunk link frame, the 22A MRM should read some power greater than 0 dBm.
Note: If a negative reading is obtained (light beam to the left of the two red lines) a trouble is indicated that must be cleared before proceeding with the adjustment.
 - 17 Adjust the 36A attenuator in the 600-ohm range until the light beam of the 22A MRM is closest to 0.
 - 18 Record the reading of the 36A attenuator control minus any negative reading or plus any positive reading of the 22A MRM (algebraic sum) in the LOSS REQUIRED FOR T AND R PATH column of the worksheet.
 - 19 At the APTT, release the MWTM key.
 - 20 At the trunk link frame, disconnect the 22A MRM from the crossbar switch terminals and remove the insulation from the FA or FB relay.
 - 21 At the trunk circuit of the trunk just tested, remove the blocking tool from the S1 relay.
 - 22 At the APTT, momentarily operate the RL key. All lamps except DW should extinguish.
 - 23 Repeat Steps 9 through 22 for each trunk of the sample. Record, as in Step 18, the algebraic sum of the 36A and 22A MRM readings obtained by each seizure.

STEP	PROCEDURE
24	On the worksheet, total the recorded readings, then divide the total by the number of measurements made. The result is the average test tone power at the outgoing side of the trunk link frame and is, therefore, the amount of loss that must be added to provide a test tone power of 0 dBm (or -2 dBm) at the trunk link frame when tests are actually performed. This additional loss must be obtained by adjustment of build-out resistor assemblies for the marker group.
25	Using Table A, select a build-out resistor strapping arrangement which will provide, as nearly as possible, the required additional loss. Apply this strapping to the build-out resistor assemblies, using temporary straps with connecting clips. <i>Note:</i> Make sure that each build-out resistor assembly is identically strapped in each lead of the transmission path.
26	Select from the worksheet a circuit which exhibited, as nearly as possible, the average loss of the circuit sample. Repeat Steps 9 through 22 to reseat and remeasure the test tone power now present at the input of the selected circuit. <i>Requirement:</i> 22A MRM reading is between the red lines of the light beam scale. <i>Note:</i> If this requirement is not met, the build-out resistor assemblies must be readjusted. Readjustments should require only a one-line movement up or down in Table A, depending upon whether less loss or more loss is necessary to meet the requirement. Readjust the build-out resistor assemblies if necessary, then check that the requirement is met.
27	Replace the temporary straps on the build-out resistor assemblies with soldered, permanent connections. Be careful not to alter the final build-out configuration just achieved.
28	Repeat Steps 9 through 22 on the circuit selected in Step 26 to determine that the adjustment has not changed.
29	If no other marker access paths are to be built out, restore all keys and switches at the APTT and remove the blocking tool from the STM1 relay.

G. Transmission Test Pad Adjustments

Note: When the APTT is equipped for making manual transmission measurements, adjustable 2dB pads are inserted and can be used as an impedance compensating device for cabling loss between the frame appearances of the originating and terminating test lines and the APTT for toll and tandem testing. The following is the procedure to follow for adjusting these test pads.

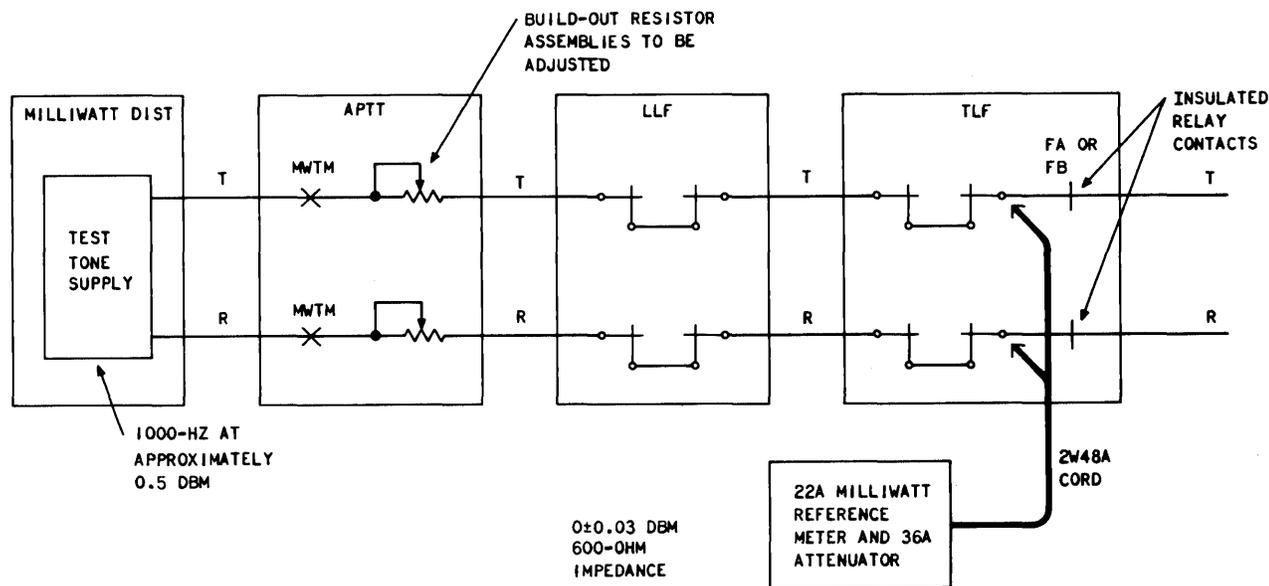


Fig. 10—Test Setup for Adjusting Build-Out Resistors for Manual Transmission Testing

STEP

PROCEDURE

Pad A

- 1 At the APTT, restore all keys and switches. After 5 seconds, momentarily operate the RL key. All lamps should extinguish.
- 2 Connect ground to the upper winding terminal of the TEST relay using an 893 cord. TEST relay operates.
- 3 Block operated the TOTL1A relay and block nonoperated the SMW relay.
- 4 At terminal strip F on the manual transmission test unit, strap the B and D leads together (terminals 13 and 42).
- 5 Measure the loop resistance between terminals 1 and 8 of component assembly 9 (CA9). (Refer to 1.17.)
- 6 Divide the loop resistance measured in Step 5 by two.
- 7 Strap out the resistance value derived in Step 6 in resistors PDA7-9 and the same amount in resistors PDA16-18 on terminal strip CA9 to compensate for this cabling loss. Refer to Table C for strapping information.
- 8 Remove strap placed in Step 4 between B and D leads on terminal strip F of manual transmission test unit.
- 9 Operate the PTTM key.

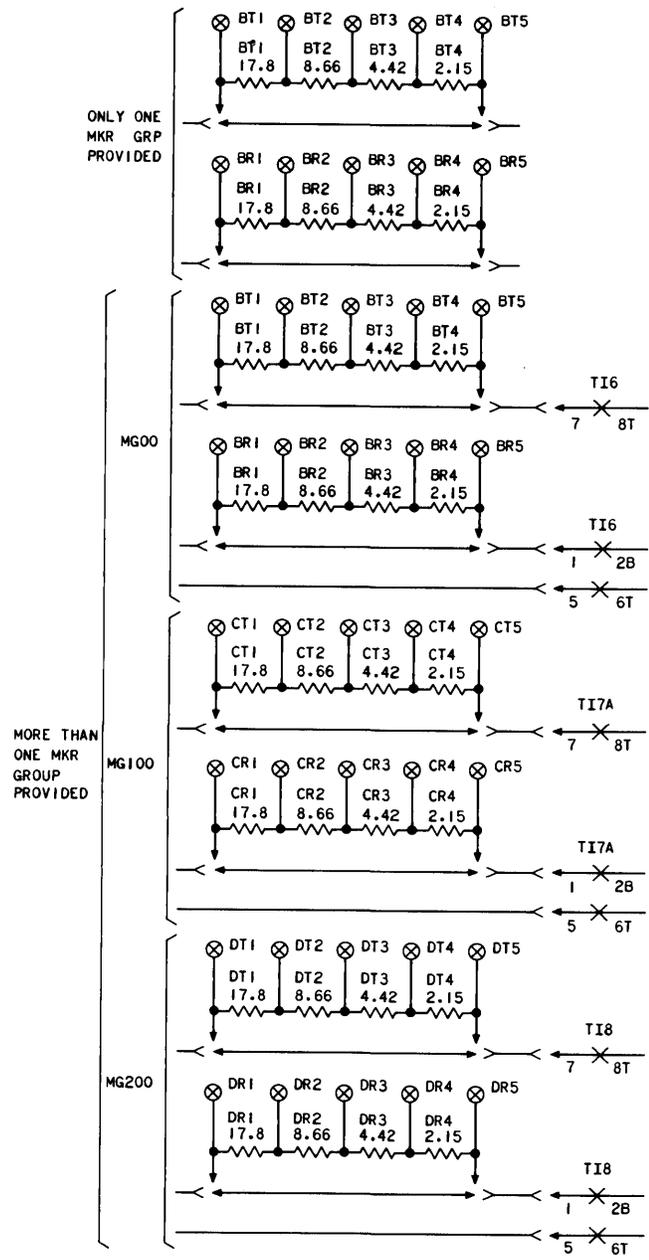


Fig. 11—Manual Transmission Testing Provided Terminating Test Line Build-Out Resistor Assembly

STEP	PROCEDURE
10a	If the line link frame is a 2-wire line link circuit, block the LK0 relay operated.
11a	At the 2-wire line link frame appearance of the toll originating test line, strap the T and R leads. (Refer to 1.18.)
12b	If the line link frame is a 4-wire line link circuit, at the APTT, block the 4WC2 and LK4 relays operated.
13b	At the 4-wire line link frame appearance of the toll originating test line, strap the T1 and R1 leads. (Refer to 1.18.)
14	At the APTT, measure the loop resistance between terminal 1 of component assembly 7 (CA7) and terminal 1 of component assembly 8 (CA8).
15	Divide the loop resistance measured in Step 14 by two.
16	Strap out the resistance value derived in Step 15 in resistors PDA1-5 and the same amount in resistors PDA10-14 on the terminal strips CA7 and CA8 to compensate for this cabling loss. Refer to Table D for strapping information.
17	Remove the blocking tool from the TOTL1A relay.
18	Release the PTTM key.
19a	If the line link frame is a 2-wire line link circuit, remove the blocking tool from the LK0 relay.
20b	If the line link frame is a 4-wire line link circuit, remove the blocking tools from the 4WC2 and LK4 relays.
21	At the line link frame appearance of the toll originating test line, remove the straps from the T and R leads or the T1 and R1 leads for 2-wire or 4-wire line link circuits, respectively.
Pad B	
1	At the APTT, restore all keys and switches. After 5 seconds, momentarily operate the RL key. All lamps should extinguish.
2	Connect ground to upper winding terminal of TEST relay using 893 cord. TEST relay operates.
3	Block operated TDM2 relay.
4	Operate MWTM key.
5	At milliwatt distributing circuit, strap the T and R leads associated with the APTT frame, after the leads are disconnected.

STEP	PROCEDURE
6	Measure the loop resistance between terminals 1 and 8 of component assembly 10 (CA10). (Refer to 1.17.)
7	Divide the loop resistance measured in Step 6 by two.
8	Strap out the resistance value derived in Step 7 in resistors PDB1-3 and the same amount in resistors PDB11-13 on terminal strip CA10 to compensate for this cabling loss. Refer to Table C for strapping information.
9	Remove strap placed in Step 5 between T and R leads at the milliwatt distributing circuit and connect the T and R leads to their original appearance.
10	Operate the PTTM key.
11a	If the line link frame is a 2-wire line link circuit and more than one marker group is provided, block operated the TI6, the TI7A, or the TI8 relay, as applicable, for marker groups 00, 100, or 200, respectively.
12a	At the 2-wire line link frame appearance of the terminating test line, strap the T and R leads. (Refer to 1.18.)
13b	If the line link frame is a 4-wire line link circuit, block operated the 4W_ relay at the APTT.
14b	If the line link frame is a 4-wire line link circuit and more than one marker group is provided, block operated the TI_ relay, as applicable, for the marker group under test.
15b	At the 4-wire line link frame appearance of the terminating test line, strap the T and R leads. (Refer to 1.18.)
16	At the APTT, measure the loop resistance between terminal 8 of component assembly 11 (CA11) and terminal 8 of component assembly 12 (CA12).
17	Divide the loop resistance measured in Step 16 by two.
18	Strap out the resistance value derived in Step 17 in resistors PDB5-10 and the same amount in resistors PDB15-20 on terminal strips CA11 and CA12 to compensate for this cabling loss. Refer to Table E for strapping information.
19	At the line link frame appearance of the terminating test line, remove the strap from the T and R leads for 2-wire or 4-wire line links as applicable.
20	At the APTT, remove the blocking tools from TDM2, TI_, and 4W_ relays, as applicable.
21	Release the PTTM key.

STEP	PROCEDURE
Pad C	
1	At the APTT, restore all keys and switches. After 5 seconds, momentarily operate the RL key. All lamps should extinguish.
2	Connect ground to upper winding terminal of TEST relay using 893 cord. TEST relay operates.
3	Block operated TDM1A relay and block nonoperated the SMW relay.
4	At terminal strip F on the manual transmission test unit, strap the A and D leads together (terminals 23 and 42).
5	Measure the loop resistance between terminals 1 and 8 of component assembly 13 (CA13). (Refer to 1.17.)
6	Divide the loop resistance measured in Step 5 by two.
7	Strap out the resistance value derived in Step 6 in resistors PDC1-3 and the same amount in resistors PDC11-13 on terminal strip CA13 to compensate for this cabling loss. Refer to Table C for strapping information.
8	Remove strap placed in Step 4 between A and D leads on terminal strip F of manual transmission test unit.
9	Operate the PTTM key.
10a	If the line link frame is a 2-wire line link circuit, block the LK0 relay operated.
11a	At the 2-wire line link frame appearance of the toll originating test line, strap the T and R leads. (Refer to 1.18.)
12b	If the line link frame is a 4-wire line link circuit, at the APTT, block the 4WC1 and LK4 relays operated.
13b	At the 4-wire line link frame appearance of the toll originating test line, strap the T1 and R1 leads. (Refer to 1.18.)
14	At the APTT, measure the loop resistance between terminal 8 of component assembly 14 (CA14) and terminal 8 of component assembly 15 (CA15).
15	Divide the loop resistance measured in Step 14 by two.
16	Strap out the resistance value derived in Step 15 in resistors PDC5-10 and the same amount in resistors PDC15-20 on terminal strips CA14 and CA15 to compensate for this cabling loss. Refer to Table E for strapping information.
17	Remove the blocking tools from TDM1, TDM1A relays and from the LK0 or LK4 and 4WC1 relays, as applicable.

STEP**PROCEDURE**

- 18 Release the PTTM key.
- 19 At the line link frame appearance of the originating test line, remove the straps from the T and R leads or, T1 and R1 leads, as applicable.

Pad D

- 1 At the APTT, restore all keys and switches. After 5 seconds, momentarily operate the RL key. All lamps should extinguish.
- 2 Connect ground to upper winding terminal of TEST relay using 893 cord. TEST relay operates.
- 3 Block operated TOTL2 relay.
- 4 Operate MWTM key.
- 5 At milliwatt distributing circuit, strap the T1 and R1 leads associated with the APTT frame, after the leads are disconnected.
- 6 Measure the loop resistance between terminals 1 and 8 of component assembly 6 (CA6). (Refer to 1.17)
- 7 Divide the loop resistance measured in Step 6 by two.
- 8 Strap out the resistance value derived in Step 7 in resistors PDD7-9 and the same amount in resistors PDD16-18 on terminal strip CA6 to compensate for this cabling loss. Refer to Table C for strapping information.
- 9 Remove strap placed in Step 5 between T1 and R1 leads at the milliwatt distributing circuit and connect the T and R leads to their original appearance.
- 10 Operate the PTTM key.
- 11a If the line link frame is a 2-wire line link circuit and more than one marker group is provided, block operated the TI6, the TI7A, or TI8 relay, as applicable, for marker groups 00, 100, or 200, respectively.
- 12a At the 2-wire line link frame appearance of the terminating test line, strap the T and R leads. (Refer to 1.18.)
- 13b If the line link frame is a 4-wire line link circuit, block operated the 4W_ relay at the APTT.
- 14b If the line link frame is a 4-wire line link circuit and more than one marker group is provided, block operated the TI6, TI7, or TI8 relay, as applicable for marker groups 00, 100, or 200, respectively.

STEP	PROCEDURE
15b	At the 4-wire line link frame appearance of the terminating test line, strap the T and R leads. (Refer to 1.18.)
16	At the APTT, measure the loop resistance between terminal 1 of component assembly 4 (CA4) and terminal 1 of component assembly 5 (CA5).
17	Divide the loop resistance measured in Step 16 by two.
18	Strap out the resistance value derived in Step 17 in resistors PDD1-5 and the same amount in resistors PDD10-14 on terminal strips CA4 and CA5 to compensate for this cabling loss. Refer to Table D for strapping information.
19	At the line link frame appearance of the terminating test line, remove the strap from the T and R leads.
20	At the APTT, remove the blocking tools from TOTL2, TL_, and 4W_ relays, as applicable.
21	Release the PTTM key.◆

TABLE C

STRAPPING INFORMATION FOR:

- CA9(PDA 7 Through 9 and 16 Through 18)
- CA10(PDB 1 Through 3 and 11 Through 13)
- CA13(PDC 1 Through 3 and 11 Through 13)
- CA6(PDD 7 Through 9 and 16 Through 18)

DERIVED RESISTANCE	STRAP	
	FROM TERMINAL	TO TERMINAL
1.5	6	8
	1	3
3.0	6	7
	2	3
4.5	7	8
	1	2
6.0	5	7
	2	4
7.5	5	7
	1	3
	6	8
	2	4
9.0	5	6
	3	4
10.5	5	8
	1	4

Note: Strap to nearest ohm figure.

TABLE D

STRAPPING INFORMATION FOR:

- CA9(PDA 1 Through 5)
- CA8(PDA 10 Through 14)
- CA4(PDD 1 Through 5)
- CA5(PDD 10 Through 14)

DERIVED RESISTANCE	STRAP	
	FROM TERMINAL	TO TERMINAL
1.5	1	2
3	2	3
4.5	1	3
6	3	6
7.5	1	2
	3	6
9	2	6
10.5	1	6
12	6	7
13.5	1	2
	6	7
15	2	3
	6	7
16.5	1	3
	6	7
18	3	7
19.5	1	2
	3	7
21	2	7
22.5	1	7
24	6	8
25.5	1	2
	6	8
27	2	3
	6	8
28.5	1	3
	6	8
30	3	8
31.5	1	2
	3	8
33	2	8
34.5	1	8

Note: Strap to nearest ohm figure.

TABLE E

STRAPPING INFORMATION FOR:
 CA11(PDB 5 Through 10)
 CA12(PDB 15 Through 20)
 CA14(PDC 5 Through 10)
 CA15(PDC 15 Through 20)

DERIVED RESISTANCE	STRAP TERMINALS		DERIVED RESISTANCE	STRAP TERMINALS		DERIVED RESISTANCE	STRAP TERMINALS	
	FROM	TO		FROM	TO		FROM	TO
1.5	7	8	20.3	3	7	34.5	1	3
3.0	6	7	21.0	2	3		6	8
4.5	6	8		5	6	35.3	2	7
6.0	5	6	21.8	3	8	36.0	1	3
7.5	5	6	22.5	2	3		5	6
	7	8		5	6	36.8	2	8
				7	8			
9.0	5	7	24.0	2	3	37.5	1	3
10.5	5	8		5	7		5	6
11.3	3	5	25.5	2	3	39.0	1	3
				5	8		5	7
12.8	3	5	26.3	2	5	40.5	1	3
	7	8					5	8
14.3	3	5	27.8	2	5			
	6	7		7	8	41.3	1	5
15.0	2	3	29.3	2	5	42.8	1	5
				6	7		7	8
15.8	3	5	30.3	1	3	44.3	1	5
	6	8					6	7
16.5	2	3	30.8	2	5	45.8	1	5
	7	8		6	8		6	8
17.3	3	6	31.5	1	3	47.3	1	6
				7	8			
18.0	2	3	32.3	2	6	48.8	1	6
	6	7					7	8
18.8	3	6	33.0	1	3	50.3	1	7
	7	8		6	7			
19.5	2	3	33.8	2	6	51.8	1	8
	6	8		7	8			

Note: Strap to nearest ohm figure.