CIRCUIT ORDER OR TRUNK ORDER TESTS — TESTING METHODS
MEASUREMENT OF OFFICE WIRING AND EQUIPMENT LOSSES — 4-WIRE SWITCHING OFFICES

The practice of using estimated drop loss for selecting the values for P_T and P_R pads in 4-wire toll switching offices has been found to contribute to significant deviations in over-all measured losses. It is, therefore, extremely important that office wiring and equipment losses be measured and the pads adjusted so that the following transmission level requirements will be met:

(a) The equipment components assigned to the trunks should be lined up and correctly adjusted to meet the carrier system transmission requirements for the office, i.e., −13 and +4 or −16 and +7 db.

The requirements can be met by making the following tests and adjustments:

(a) Measure the loss between the testboard ***TST*** or ***101*** jack and the ***EQ OUT*** jack at the voice-frequency patch bay.

Adjust the transmitting P_T pad to give the proper input to the carrier terminal.

(b) Measure the loss between the voice-frequency patch bay ***EQ IN*** jack and the testboard ***TST*** or ***101*** jack.

Adjust the receiving P_R pad to obtain the desired expected measured loss (EML) for the trunk.

In order that possible inaccuracies in adjustment of plug-in SF signaling units will not affect the selected values of P_R pads, the units should be removed and replaced by a zero loss pad during the tests to determine P_R pad values.

For electron tube units, this pad consists of a KS-14160 connector in which straps have been connected between terminals 0 and 6 and between terminals 1 and 7.

For transistorized "E" type units, the pad should consist of a KS-16370, L3 connector with straps between terminals M and U and between terminals S and V.

For permanently mounted signaling units, the loss of the receiving path of the signaling unit should be adjusted carefully to 0 db at 1000 cycles immediately prior to the tests using the procedure given in the appropriate practice.

In all cases the SF signaling unit should be left in place during the tests to determine the transmit P_T pad values.

Measurement of office wiring and equipment losses must be made at each office in order to adjust the transmission levels to their correct values in advance of over-all measurements with distant offices.

In order to confine the testing effort as much as possible to the home office, Fig. 1 shows a trunk loop-back arrangement which can be used to put the transmission and signaling circuits in the same final state that they would be in when making over-all tests between trunk terminals. The loop-back arrangement should be used only for setting up the test conditions within the home office and should not be used during actual transmission measurements between the testboard and voice-frequency patch bay.

If the loop-back arrangement is not used, it will be necessary to call Code 101 at the distant office on outgoing trunks and have the trunk held while the test is made. On incoming trunks, it will be necessary for the distant office to seize the trunk and call Code 101 at the home office and to hold the trunk while the test is made. In all other respects, the procedure for making the tests is similar to the method using the loop-back arrangement discussed herein.

STEP	PROCEDURE
	OUTGOING AND 2-WAY TRUNKS AT CONTROL OFFICES
	Make sure that all assigned trunk equipment is in place, also that all milliwatt supply outlets which will be used are adjusted accurately and that all transmission measuring sets are calibrated correctly.
	When tests are to be made on intertoll trunks that are in service, the trunks should be temporarily removed from service at both offices.
	When the trunk loop-back arrangement shown in Fig. 1 is used to establish connections within the home office — ***the outgoing and incoming trunk equipment must both employ identical pulsing arrangements and be equipped with compatible SF signaling units.***
1	***At the VF patch bay:***
	The ***MOD IN*** and ***DEM OUT*** jacks of the carrier channels assigned to the trunks should be terminated in 600Ω during the tests.
	Make "A" patch as shown in Fig. 1 to the particular outgoing or 2-way trunk to be tested.
	Make "B" patch to an incoming or 2-way trunk equipped with identical pulsing and compatible SF signaling unit.
2	***At the testboard:***
	Seize the outgoing trunk (selected in Step 1) over its ***TST*** multiple jack. Dial or key pulse Code 101 and answer the call at the home office 101 trunk appearance using a separate test cord.
	When an "off-hook" condition is observed on the test cord connected to the outgoing trunk ***TST*** jack, connect the associated ***CONN*** cord to the ***TST-MEAS*** jack. Operate ***TST-101*** key to ***TST*** position.
	The ***TALK-MON*** key should be restored to normal position.
	Caution: Excessive errors will be experienced if the TALK-MON key is left in the TALK position during a measurement. This is also true if the key is left in the MON position unless the monitoring circuit has been equipped with a high-impedance V3 amplifier per SD-95112-01.
	To send 1000-cycles to the VF patch bay in Step 3, operate ***SEND-RCV*** key to ***SEND.***
3	***At the VF patch bay:***
	Remove "A" and "B" patches and terminate ***EQ IN*** jack of the trunk under test in 600Ω.
	Patch from ***EQ OUT*** jack to ***TST 600Ω*** jack (patch ① shown in upper part of Fig. 1) and advise the testboard attendant to send 1000-cycle test power. Operate the sensitivity switch to B + 10 and read the meter.

STEP	PROCEDURE
	The difference between this reading and −13 or −16 (depending on the office transmission level for the carrier system) is the change required in the P_T pad. If the P_T value needs to be changed on the basis of the above test, the proper 89-type resistor should be obtained and substituted for the one already in place. Final adjustment of the P_T pad should provide the correct level (−13 or −16 ±0.13 db) to the carrier channel. Pad changes greater than 1.0 db from the computed value shown on the layout record card should be investigated for trouble in equipment components.
4	If a plug-in SF signaling unit is used in the trunk under test, replace it with the zero loss pad mentioned earlier.
5	***At the VF patch bay:*** Where a +7 or (+4) db outlet is not provided at the VF patch bay, a 21A transmission measuring set which has been calibrated using a 22A milliwatt reference meter can be used to obtain 1000-cycle test power at the correct level of +7 or +4 db. Remove termination from ***EQ IN*** jack and place it in ***EQ OUT*** jack. Patch from ***EQ IN*** jack to +7 or (+4) 600Ω or 21A ***OSC OUT*** jack (patch (2) shown in upper portion of Fig. 1).
6	***At the testboard:*** Operate ***SEND-RCV*** key to ***RCV*** position and read the meter. The difference between this reading and the assigned ***EML*** for the trunk is the change required in the P_R pad. If the P_R pad value needs to be changed on the basis of the above test, the proper 89-type resistor should be obtained and substituted for the one already in place. Final adjustment of the P_R pad should provide the correct ***EML*** ±0.13 db for the trunk. Pad changes greater than 1.0 db from the computed value shown on the layout record card should be investigated for trouble in equipment components.
7	Remove the zero loss pad at the SF bay and restore the signaling unit. Remeasure the loss between the VF patch bay and the testboard. The loss should be exactly the same as with the zero loss pad. If it is not, a minor adjustment (±0.5 db) of the voice amplifier gain of the SF signaling unit may be made to meet the requirement. If the difference in loss with the zero loss pad and with the SF signaling unit is greater than 0.5 db, an investigation should be made of the SF signaling unit and/or its testing circuit. ***Note: No adjustment of the SF signaling unit while in place in the trunk should be made unless the correct testing level of +7 or +4 dbm is applied at the VF patch bay.***
8	***At the VF patch bay:*** Remove patch cord (patch (2) shown in upper portion of Fig. 1) and all terminations.
9	***At the testboard:*** Over-all operational tests and ***AML*** measurements should be made between testboards before releasing the trunks for service.

STEP	PROCEDURE
	Record P_T and P_R pad values in ink on circuit layout record cards and line out the computed values. ***Note: When making circuit order or routine over-all transmission measurements with distant offices, no adjustment of the P_R pad should be made to bring the loss of the trunks to the required value. Adjustment of P_R pads when making over-all measurements may cover up a maladjustment of the carrier channel or a wrong transmitting pad value at the distant office.***

The procedure for setting P_T and P_R pads on incoming trunks is the same as for outgoing trunks except, transmission measurements should be made between the voice-frequency patch bay and the testboard 101 trunk appearance.

STEP	PROCEDURE
	INCOMING AND 2-WAY TRUNKS AT NON-CONTROL OFFICES Make sure that all assigned trunk equipment is in place, also that all milliwatt supply outlets which will be used are adjusted accurately and that all transmission measuring sets are calibrated correctly. When tests are to be made on intertoll trunks that are in service, the trunks should be temporarily removed from service at both offices. When the trunk loop-back arrangement shown in Fig. 1 is used to establish connections within the home office — ***the outgoing and incoming trunk equipment must both employ identical pulsing arrangements and be equipped with compatible SF signaling units.***
1	***At the VF patch bay:*** The ***MOD IN*** and ***DEM OUT*** jacks of the carrier channels assigned to the trunks should be terminated in 600Ω during the tests. Make "B" patch as shown in Fig. 1 to the particular incoming or 2-way trunk to be tested. Make "A" patch to an outgoing or 2-way trunk equipped with identical pulsing and compatible SF signaling unit.
2	***At the testboard:*** Seize the outgoing trunk (selected in Step 1) over its ***TST*** multiple jack. Dial or key pulse Code 101. Answer the call at the home office 101 trunk appearance using a separate test cord and connect the associated ***CONN*** cord to the ***101-MEAS*** jack. Operate ***TST-101*** key to ***101*** position. The ***TALK-MON*** key should be restored to normal position. ***Caution: Excessive errors will be experienced if the TALK-MON key is left in the TALK position during a measurement. This is also true if the key is left in the MON position unless the monitoring circuit has been equipped with a high-impedance V3 amplifier per SD-95112-01.*** To send 1000-cycles to the VF patch bay in Step 3, operate ***SEND-RCV*** key to ***SEND.***

STEP	PROCEDURE
3	***At the VF patch bay:***
	Remove "A" and "B" patches and terminate ***EQ IN*** jack of the trunk under test in 600Ω. Patch from ***EQ OUT*** jack to ***TST 600Ω*** jack (patch ① shown in lower portion of Fig. 1) and advise the testboard attendant to send 1000-cycle test power.
	Operate the sensitivity switch to B+10 and read the meter.
	The difference between this reading and −13 or −16 (depending on the office transmission level for the carrier system) is the change required in the P_T pad.
	If the P_T value needs to be changed on the basis of the above test, the proper 89-type resistor should be obtained and substituted for the one already in place. Final adjustment of the P_T pad should provide the correct level (−13 or −16 ±0.13 db) to the carrier channel.
	Pad changes greater than 1.0 db from the computed value shown on the layout record card should be investigated for trouble in equipment components.
4	If a plug-in SF signaling unit is used in the trunk under test, replace it with the zero loss pad mentioned earlier.
5	***At the VF patch bay:***
	Where a +7 or (+4) db outlet is not provided at the VF patch bay, a 21A transmission measuring set which has been calibrated using a 22A milliwatt reference meter can be used to obtain 1000-cycle test power at the correct level of +7 or +4 db.
	Remove the termination from ***EQ IN*** jack and place it in ***EQ OUT*** jack. Patch from ***EQ IN*** jack to +7 or (+4) 600Ω or 21A ***OSC OUT*** jack (patch ② shown in lower portion of Fig. 1).
6	***At the testboard:***
	Operate ***SEND-RCV*** key to ***RCV*** position and read the meter.
	The difference between this reading and the assigned ***EML*** for the trunk is the change required in the P_R pad.
	If the P_R pad value needs to be changed on the basis of the above test, the proper 89-type resistor should be obtained and substituted for the one already in place. Final adjustment of the P_R pad should provide the correct ***EML*** ±0.13 db for the trunk.
	Pad changes greater than 1.0 db from the computed value shown on the layout record card should be investigated for trouble in equipment components.
7	Remove the zero loss pad at the SF bay and restore the signaling unit. Remeasure the loss between the VF patch bay and the testboard. The loss should be exactly the same as with the zero loss pad. If it is not, a minor adjustment (±0.5 db) of the voice amplifier gain of the SF signaling unit may be made to meet the requirement. If the difference in loss with the zero loss pad and with the SF signaling unit is greater than 0.5 db, an investigation should be made of the SF signaling unit and/or its testing circuit.
	Note: No adjustment of the SF signaling unit while in place in the trunk should be made unless the correct testing level of +7 or +4 dbm is applied at the VF patch bay.
8	***At the VF patch bay:***
	Remove patch cord (patch ② shown in lower portion of Fig. 1) and all terminations.

STEP	PROCEDURE
9	***At the testboard:***
	Over-all operational tests and ***AML*** measurements should be made between testboards before releasing the trunks for service.
	Record P_T and P_R pad values in ink on circuit layout record cards and line out the computed values.
	Note: When making circuit order or routine over-all transmission measurements with distant offices, no adjustment of the P_R pad should be made to bring the loss of the trunks to the required value. Adjustment of P_R pads when making over-all measurements may cover up a maladjustment of the carrier channel or a wrong transmitting pad value at the distant office.
	PRE-TEST OF TRUNK EQUIPMENT BEFORE CUTOVER
	The trunk loop-back testing arrangement shown in Fig. 1 may also be used for testing the signaling and supervision capabilities of single frequency units on a pre-cutover basis. ***The outgoing and incoming trunk equipment must both employ identical pulsing arrangements and be equipped with compatible SF signaling units.***
	Connections should be established from the ***TST*** jack or multiple of the outgoing or 2-way trunk at the testboard by dialing or keypulsing Code 103 in the home office.
	When tests are to be made on intertoll trunks that are in service, the trunks should be temporarily removed from service at both offices.
1	***At the VF patch bay:***
	Make "A" patch as shown in Fig. 1 to the particular outgoing or 2-way trunk to be tested.
	Make "B" patch to the incoming or 2-way trunk equipped with identical pulsing and compatible SF signal unit.
2	***At the testboard:***
	Seize the outgoing trunk (selected in Step 1) over its ***TST*** multiple jack. Dial or key pulse Code 103 and check the supervisory features of this test line. At those testboards equipped with neon lamp signaling test circuits, the ***SIG TST*** cord can be connected to the ***SIG LINE*** and ***SIG DROP*** jacks (where provided) of the outgoing or incoming trunk for monitoring or trouble location purposes.
3	***At the circuit patch bay:***
	A signaling test panel, 1A signal test set, neon lamp signaling test circuit or 2B signaling test set may be connected to the outgoing or incoming trunk E and M leads for monitoring or trouble location purposes.
4	***At the VF patch bay:***
	Remove "A" and "B" patches connected to tne outgoing and incoming trunk equipment.
5	***At the testboard:***
	Over-all operational tests and ***AML*** measurements should be made between testboards before releasing the trunks for service.

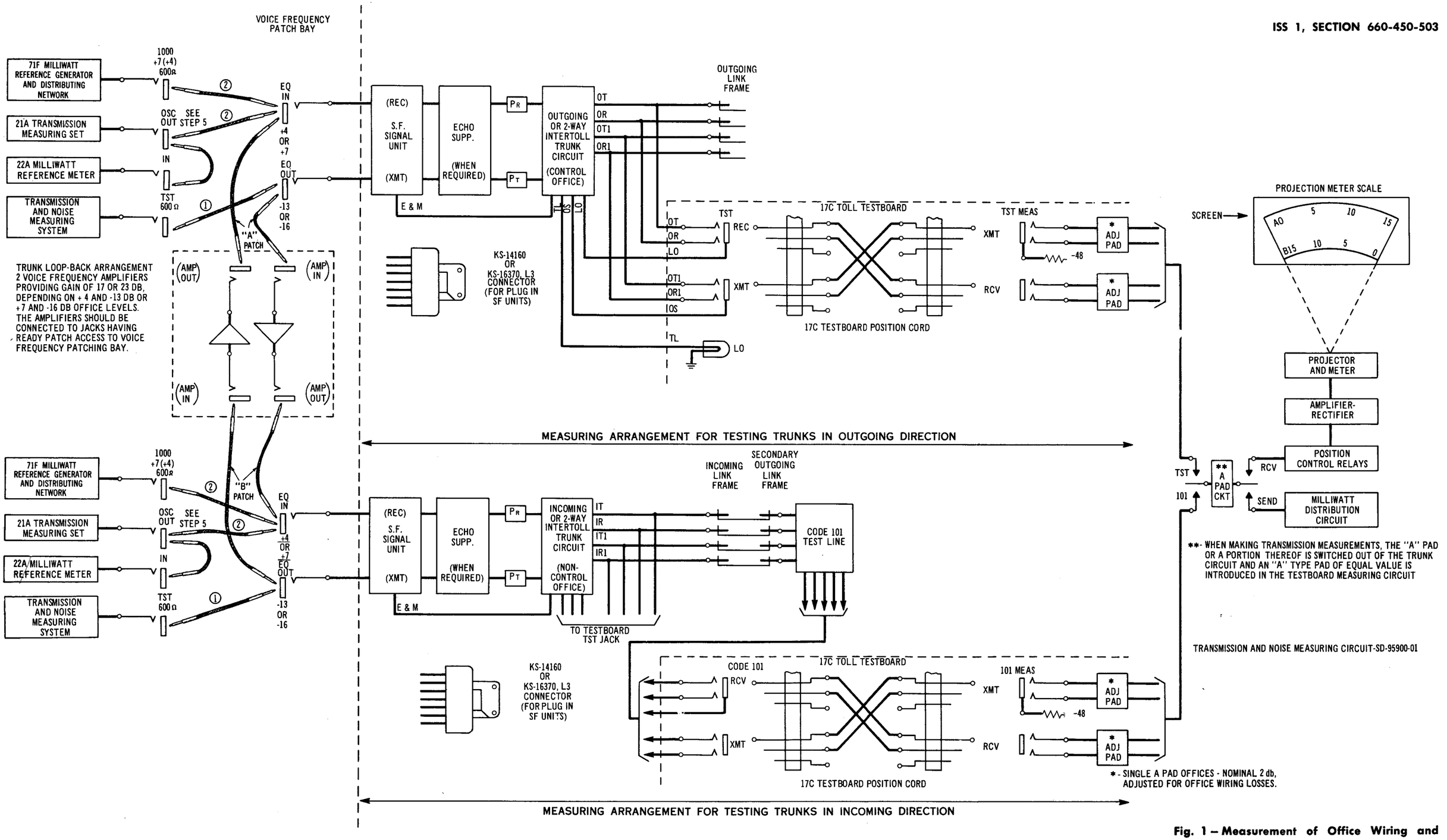

Fig. 1 — Measurement of Office Wiring and Equipment Losses — 4-Wire Toll Switching Offices