

STEP-BY-STEP OFFICES
TEST EQUIPMENT, TEST CIRCUITS, AND TERMINATIONS
USED IN TERMINAL BALANCE TESTING

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Building-Out or Cable Capacitance Measurement	5	1. TEST EQUIPMENT	
Trans-Hybrid Loss (THL) Calibration Measurement Required to Determine Echo Return Loss	5	1.01 The information in this section covers (a) the balance testing applications of general purpose test equipment and the recently developed KS-20501 Return Loss Measuring Set (RLMS); (b) a description of the required balance test circuits, including the procedures for making the necessary build-out (BO) capacitance adjustments and the verification, when initially establishing the test circuits in an office; and (c) the portable test terminations used in balancing work.	
Echo Return Loss (ERL) Measurement	5	1.02 Whenever this section is reissued, the reason for reissue will be listed in this paragraph.	
Trans-Hybrid Loss (THL) Calibration Measurement Required to Determine Singing Point	5	1.03 This section does not affect Equipment Test Lists.	
Singing Point or Singing Return Loss (SP/SRL) Measurement	5	1.04 The test sets that may be used in step-by-step (SXS) offices for making the required through and terminal balance measurements are contained in the following list:	
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SECTION 660-474-504

BSP	TEST SET
103-106-105	2D Singing Point Test Set (manufacture discontinued) and External 207G High-Pass Filter
103-221-100	21A Transmission Measuring Set (or equivalent 600-ohm oscillator and 600-ohm detector circuit)
103-345-100	201A Noise Generator (equipped with a 455B weighting network)
103-345-100	201B Noise Generator
103-611-100	3-Type Noise Measuring Set (NMS) (equipped with a C-message weighting network)

Special Purpose

BSP	TEST SET
103-106-115	KS-20501 Return Loss Measuring Set (RLMS)

Miscellaneous

BSP	TEST SET
100-263-501*	2B Signaling Test Set
103-106-110†	54C Return Loss Measuring Set
103-202-100‡	2AB Auxiliary Transmission Test Set

*This set provides an alternate method for establishing test connections on trunks with E&M signaling.

†This set is used for structural return-loss measurements.

‡This set can also be used at the class 5 offices when making terminal balance measurements.

1.05 With the exception of the KS-20501 RLMS, 3A noise measuring set (NMS), 2B Signaling

Test Set, and 2AB Auxiliary Transmission Test Set, the test sets listed above require a warm-up time and must be calibrated before use.

1.06 In addition to the test sets, a decade capacitance box (7A or equivalent) is recommended as an aid in performing balance measurements.

2. TEST EQUIPMENT APPLICATIONS FOR BALANCE MEASUREMENTS

A. General

2.01 Balance measurements can be made with appropriate terminations and the test equipment illustrated in either Fig. 1 or 2. Each measurement [ie, capacitance buildout, trans-hybrid loss (THL) calibration, echo return loss (ERL), or singing point/singing return loss (SP/SRL)] is made using a different arrangement of the general purpose test equipment shown in Fig. 1. The KS-20501 RLMS, shown in Fig. 2, is specifically made for balance measurements and the different tests are set up with front panel controls. Measurements made with either the general purpose test equipment or the RLMS are comparable. The KS-20501 RLMS offers many advantages in time savings and reduction of measurement error, and its use is recommended.

Caution: *General purpose equipment measures ERL with a filter in the receiving input. The KS-20501 RLMS is filtered only in the transmitted signal. Thus, error in measurements made with the KS-20501 RLMS can be caused by out-of-band noise.*

2.02 The procedures for making connections to the proper test terminations prior to the connection of any balance measuring equipment when establishing the balance test circuit are given in Part 3 of this section. The connection procedures for working trunks are given in Sections 660-474-500 and -502.

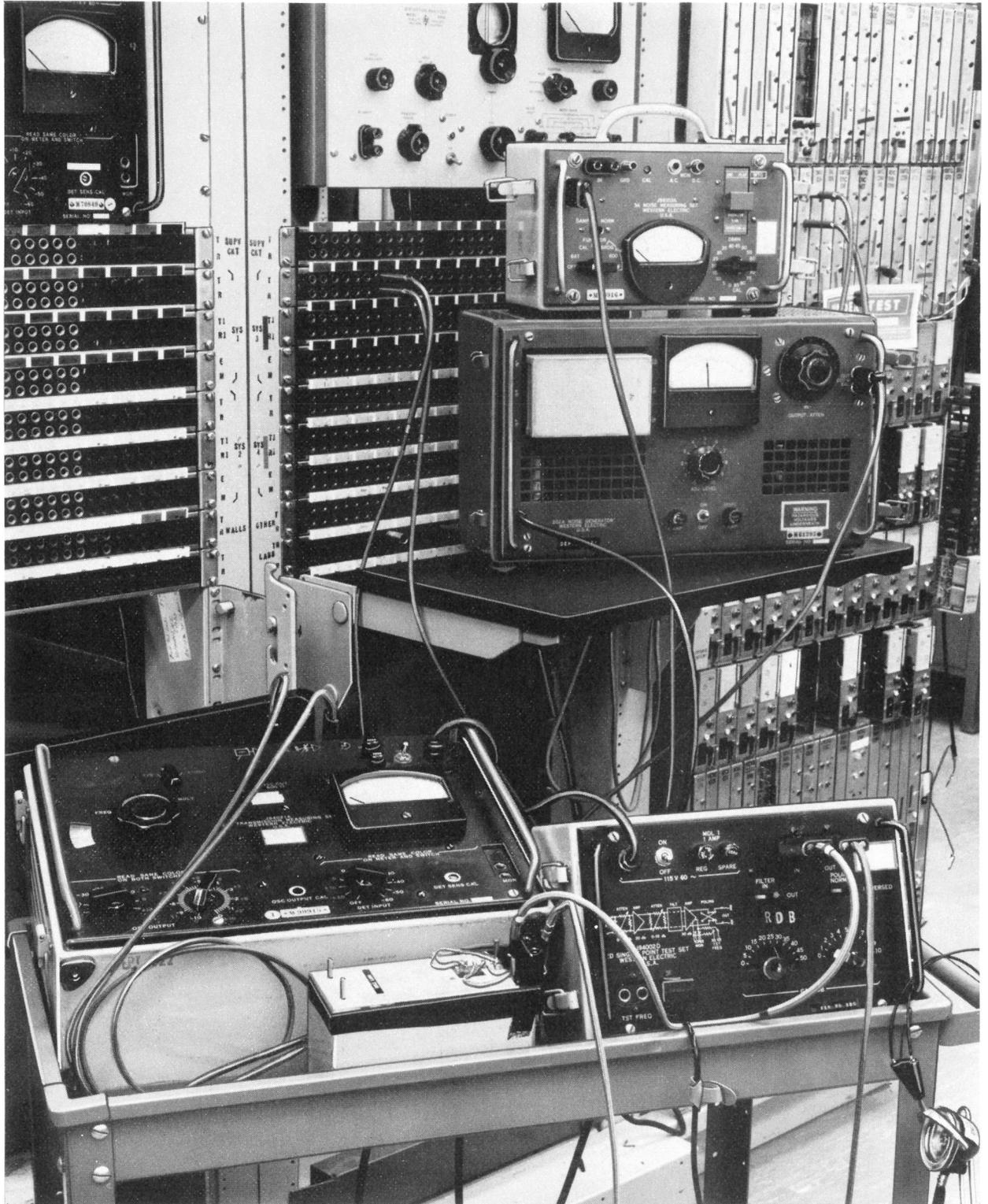


Fig. 1—Balance Measurement Using General Purpose Test Sets

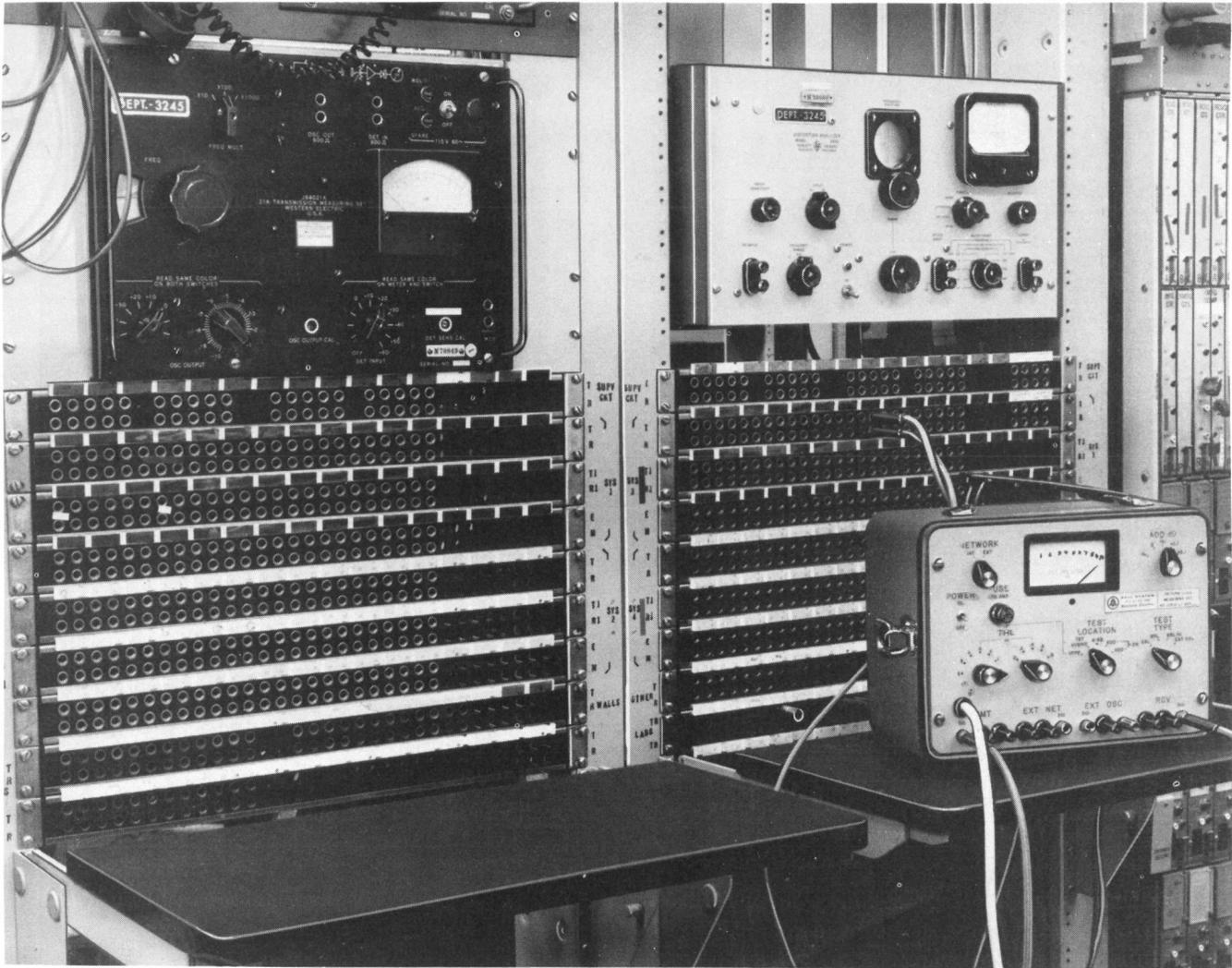


Fig. 2—Balance Measurements Using KS-2051 Return Loss Measuring Set

B. Applications Chart

2.03 The various types of measurements required in office balancing are given in the following chart:

TEST NO.	TYPE OF MEASUREMENT	GENERAL PURPOSE PORTABLE TEST EQUIPMENT				KS-20501 RETURN LOSS MEASURING SET (RLMS)			
		TEST CONNECTIONS	TEST EQ	SWITCH FUNCTION	SETTING	TEST CONNECTIONS	SWITCH FUNCTION	SETTING	
1	ADJUSTMENT OF BUILD-OUT (BO) CAPACITORS OR OFFICE CABLE CAP. MEASUREMENT		21A	POWER FREQ FREQ MULT OSC OUTPUT DET INPUT	ON 20 X100 BLACK 0 ON BOTH SWITCHES ON SCALE READING		POWER NETWORK TEST LOCATION THL ADD DB TEST TYPE	ON NOT USED TEST HYBRID - WHEN BALANCE TEST CIRCUIT TRANS-HYBRID LOSS IS 10.8 -DB OR LESS VFPB - WHEN CIRCUIT UNDER TEST HAS TRANS-HYBRID LOSS EQUAL TO OR GREATER THAN 23 DB THIS INCLUDES BALANCE TEST CIRCUIT. 4XB - WHEN TESTING FROM TEST FRAMES IN 4-TYPE CROSSBAR OFFICES. WITH SHORT ON 2-WIRE T+R OF HYBRID OF CIRCUIT UNDER TEST ADJUST FOR 0-DB RETURN LOSS WITH ADD DB SWITCH SET TO 0. SET TO 0 ON BOTH SWITCHES WHEN TESTING TRUNKS IN 4-TYPE CROSSBAR OFFICES. ADJUST FOR ON-SCALE READING. RETURN LOSS MEASUREMENT SRL-HI	
	-2000-HZ RETURN LOSS READING				EQUAL TO DET IN SETTING PLUS METER			EQUAL TO ADD DB SETTING PLUS METER READING	
2A	ERL - TRANS-HYBRID LOSS CALIBRATION PROCEDURE (SHORT THE 2W T+R OF THE HYBRID OF THE CIRCUIT UNDER TEST)		201-TYPE NOISE GEN WITH 455B NETWORK	POWER OUTPUT ATTEN ADJ LEVEL	ON 15 RED LINE - (CHECK CAL PER 103-345-100)	SAME AS TEST 1	POWER NETWORK TEST LOCATION THL TEST TYPE	ON NOT USED SAME AS TEST 1 SAME AS TEST 1 ERL	
	-TRANS-HYBRID LOSS CALIBRATION FIGURE		3-TYPE NOISE MEASURING SET WITH "C" MSG NETWORK	FUNCTION DAMP-NORM CAL	600 DAMP ON SCALE READING				EQUAL TO THE SUM OF THE NMS CAL SWITCH. THE READING TAKEN IN TEST 2B IS SUBTRACTED FROM THIS NUMBER TO OBTAIN THE ERL. SAME AS TEST 1 THE THL SETTING OF TEST 1 COMPENSATES FOR THE CORRECTIONS

TEST NO.	TYPE OF MEASUREMENT	GENERAL PURPOSE PORTABLE TEST EQUIPMENT				KS-20501 RETURN LOSS MEASURING SET (RLMS) *			
		TEST CONNECTIONS	TEST EQ	SWITCH FUNCTION	SETTING	TEST CONNECTIONS	SWITCH FUNCTION	SETTING	
2B	ERL - MEASUREMENT PROCEDURE	SAME AS TEST 2A	201(NG)	POWER OUTPUT ATTEN ADJ LEVEL	ON 15 SAME AS TEST 2A	SAME AS TEST 1	POWER NETWORK TEST LOCATION THL	ON NOT USED SAME AS TEST 1 SAME AS TEST 1	
	FINAL ERL READING		3 TYPE NMS WITH "C" MSG NETWORK	FUNCTION DAMP-NORM CAL	600 DAMP ON SCALE READING			EQUAL TO THE SUM OF NMS CAL SWITCH SETTING PLUS METER READING. SUBTRACT THIS NUMBER FROM THE TRANS-HYBRID LOSS CALIBRATION FIGURE MEASURED IN TEST 2A ERL ADJUST FOR ON-SCALE READING	
3A	SP-TRANS HYBRID LOSS CALIBRATION (SHORT THE 2W T+R OF THE HYBRID OF THE CIRCUIT UNDER TEST)	SAME AS TEST 1	21A	POWER FREQ FREQ MULT OSC OUTPUT DET INPUT	ON 10 X100 BLACK 0 ON BOTH SWITCHES ON SCALE READING	NOT REQUIRED			
	-TRANS-HYBRID LOSS CALIBRATION FIGURE				EQUAL TO THE SUM OF THE DET IN SETTING PLUS METER READING				
3B	SP OR SRL-MEASUREMENT PROCEDURE		2D (OR EQUIV) SP TEST SET	POWER FILTER MON GAIN DB POLING	ON IN CONNECT TEST REC. ADJUST TO DETERMINE SINGING POINT PER BSP 103-106-105 PART 5	SAME AS TEST 1	POWER NETWORK TEST LOCATION THL	ON NOT USED SAME AS TEST 1 SAME AS TEST 1	
	FINAL SP OR SRL READING				EQUAL TO SUM OF GAIN DB SETTINGS (LOWER OF THE POLINGS) MINUS THE TRANS-HYBRID LOSS CAL. FIGURE MEASURED IN 3A.			EQUAL TO THE SUM OF THE ADD DB SETTING PLUS THE METER READING. THE LOWER OF THE SRL/SRL-HI MEASUREMENT IS THE SRL READING.	

3. TEST CIRCUITS AND TEST TERMINATIONS

A. General

3.01 When initially balancing an office, a balance test (BAL TST) circuit should be established with spare equipment on a local basis. (In some offices more than one BAL TST circuit may be required.) The circuit consists of a 4-wire terminating set (4WTS), an intertoll (IT) trunk circuit, and auxiliary trunk equipment. The circuit should be terminated at convenient locations on spare jack circuits in toll testboards, toll switchboards, and circuit patchbays to meet local conditions. The IT selector bank appearance of the BAL TST circuit should be assigned an ABC code (preferably 970) for machine switching.

3.02 A typical arrangement of the BAL TST circuit is shown in Fig. 3. The circuit simulates a complete intertoll drop for an intertoll line facility. The complete BAL TST circuit should be retained after completion of the initial balancing in an office to facilitate subsequent circuit order testing. Local arrangements should be made to indicate in central office records that all equipment used in establishing the circuit is assigned for service.

3.03 *The IT trunk relay equipment selected for the BAL TST circuit should have a physically shorter wiring path relative to all switching paths in the office to allow for adjustments with build-out capacitance.*

3.04 The BAL TST circuit can be terminated on spare jacks at any locally selected testing appearance. For illustration, a 2-way IT trunk arrangement is shown in Fig. 3; however, separate one-way trunks, incoming and outgoing, may be used to obtain an appearance incoming and outgoing

to machine switching. The direct access path from the toll switchboard is also required in offices where IT connections are made in this manner. The BAL TST circuit 2-wire appearances should include the same multiple arrangements as the working IT appearances on the machine and switchboard.

3.05 The toll testboard appearances of TST, LINE, and SIG jacks should be used in the same manner as those on working IT trunks.

3.06 In SXS switching offices, proper termination and supervision is provided for incoming IT trunk connections through the machine to a code 100 test line and balance test termination (BAL TST TERM) furnished by, or similar to, SD-96000-01 or SD-98100-01. These circuits are also furnished to appear on toll switchboards in jack appearances (SWBD BAL TST TERM) that provide termination and supervision for connections via the toll switchboard. Proper strapping of the build-out capacitors in these circuits is made *after* the office network build-out (NBO) value is known and the BAL TST circuit buildout is completed. The test termination impedances are made to represent an average of all toll connecting (TC) trunks.

3.07 Machine-switched connections to test terminations are also furnished at class 5 office ends of TC trunks. These test line and balance test terminations are furnished by, or are similar to, terminations contained in SD-96000-01 or SD-98100-01 and appear on the subscriber line side of the class 5 office. These terminations are assigned subscriber-type numbers. No build-out capacitor is normally provided for these terminations since their impedance is selected as a compromise value representing subscriber lines in off-hook conditions (900 ohms plus 2.16 μ F in series).

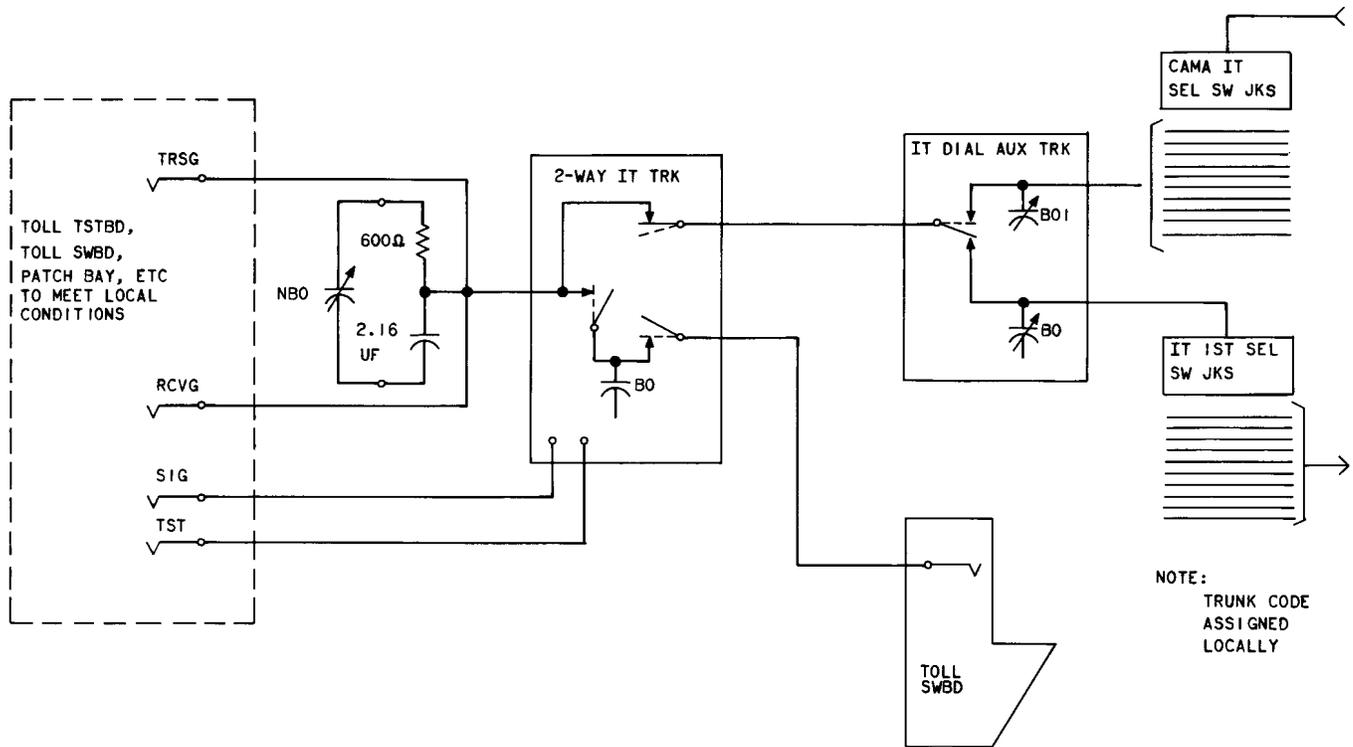


Fig. 3—Suggested Arrangement of Balance Test Circuit—Step by Step Office

B. Preliminary Buildout of Balance Test Circuit Before Determining Office NBO Value

Incoming Path

3.08 This procedure is made when initially balancing an office to establish an incoming path equivalent to the average incoming IT trunk path in the office. The procedure permits the BAL TST circuit to then be used for selective connections without the introduction of varying capacitances.

3.09 The IT trunk used should have the *average* length path as determined from office records, visual inspection, and/or return-loss measurements.

In some offices where the incoming IT trunk 2-wire office path length differences are greater than 200 feet, the deviation from average capacitance in the paths will be too large. In these cases, the shorter paths must be built out to reduce the range of the IT path capacitances. The shorter paths should not be considered when determining the average IT trunk path length. This condition is likely to occur only in downgraded class 3 or higher ranking offices. In this case, the average path should be no more than 100 feet less than the longest IT path. The shorter paths (paths with cable lengths 200 feet or more less than the longest path) must be built out after the office NBO is selected, using connections set up as in verification measurements of Section 660-474-502, Part 3B.

STEP	PROCEDURE
	<i>Note:</i> This makes the BAL TST circuit equivalent to the selected IT trunk for use in determining the office NBO value in Section 660-474-500.
11	Release the connection and disconnect test equipment.
12	Proceed to paragraph 3.10.

STEP	PROCEDURE
1	Using the testboard appearance of the selected IT trunk (any trunk with an average capacitance), seize and key pulse (dial) 100 to establish a connection to the code 100 BAL TST TERM.
2	Verify that no straps are connected on the BAL TST TERM BO capacitor or the NBO capacitor in the IT trunk 4WTS.
3	Connect a 7A capacitor box (or equivalent) across the NBO capacitor in the IT trunk 4WTS. (See Fig. 4A.)
4	Set up test equipment to perform capacitance measurements as described in Part 2B of this section and connect test equipment to the transmit and receive ports of the IT trunk 4WTS.
5	Adjust the capacitor box to obtain the greatest return loss.
6	Record the capacitor box setting. Release the connection, disconnect the test equipment, and disconnect the capacitor box from the NBO capacitor of the IT trunk.
7	Using the testboard appearance of the BAL TST circuit, seize the trunk and key pulse (dial) 100 to establish a connection to the code 100 BAL TST TERM.
8	Connect the capacitor box with the same value of capacitance as that recorded in Step 6 across the NBO capacitor of the BAL TST circuit 4WTS. (See Fig. 4B.)
9	Connect the test equipment setup used in Step 4 to the transmit and receive ports of the BAL TST circuit.
10	Adjust the BO capacitor in the BAL TST circuit IT trunk equipment for the greatest return loss. Tighten screws or solder straps in place.

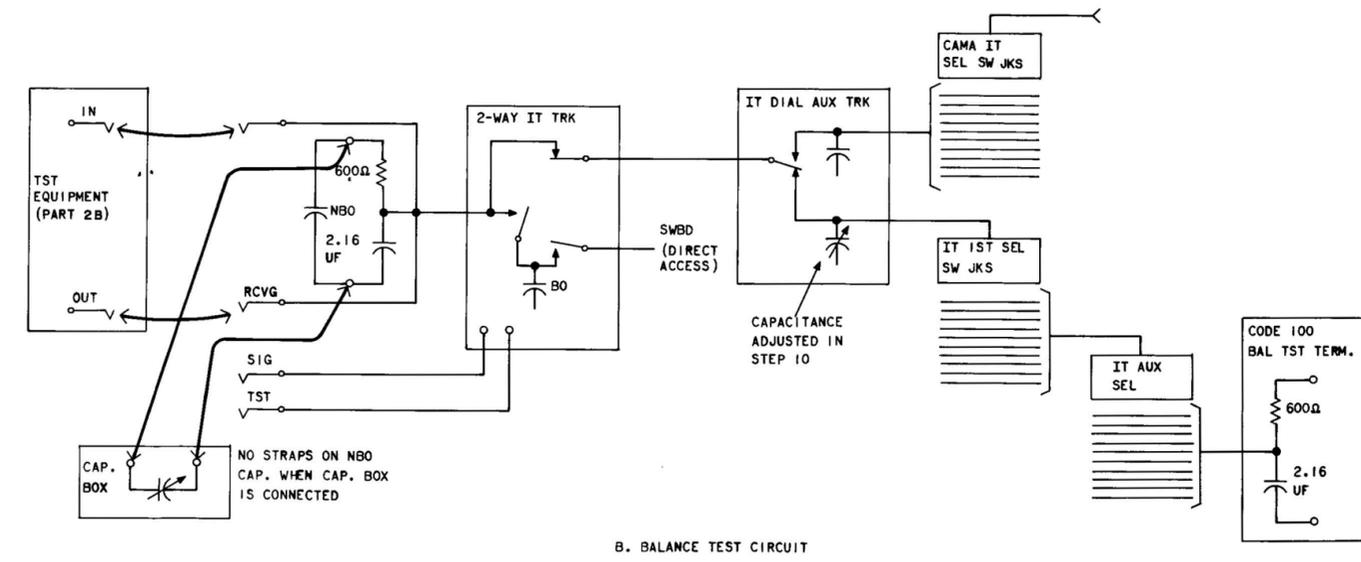
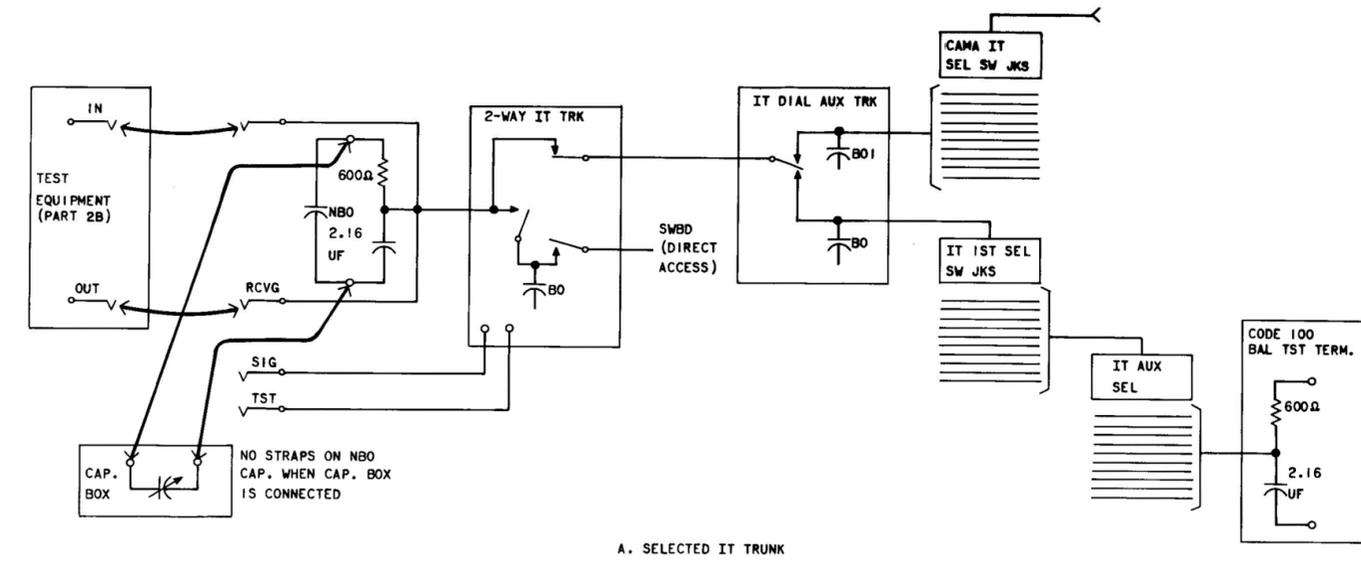


Fig. 4—Buildout of Balance Test Circuit Before Determining Office NBO Value—Incoming Path

Outgoing Path

3.10 An incoming TC trunk (CAMA) having approximately the average office cabling capacitance is used to adjust the BAL TST circuit outgoing path. When possible, the selected incoming TC trunk should be a trunk that has 4-wire facilities from the class 5 office. The outgoing IT used to measure capacitance should be selected for average length from record information, visual inspection, and/or return-loss measurements. In some offices where outgoing IT trunk 2-wire path length differences are greater than 200 feet, the deviation from average capacitance in the paths will be too

large. In these cases, the shorter paths must be built out to reduce the range of the IT path capacitances. The shorter paths should not be considered when determining the average outgoing IT trunk path length. This condition is likely to occur only in downgraded class 3 or higher ranking offices. In this case, the average path should be no more than 100 feet less than the longest IT path. The shorter paths (paths with cable lengths 200 feet or more less than the longest path) must be built out after the office NBO is selected, using connections set up as in verification measurements of Section 660-474-502, Part 3B.

STEP	PROCEDURE
1	Using the selected CAMA trunk, perform (a) or (b): (a) At the class 5 office end of the trunk, use the ABC-XXXX code for the selected IT trunk and the proper method described in Section 660-576-500 to originate and terminate a test call to the desired outgoing IT trunk. (See Fig. 5.) (b) At the main distributing frame (MDF), use a 2AB auxiliary transmission test set to originate and hold a connection to the desired outgoing IT trunk. <i>Note:</i> Busy trunks or manually step switches to reach the desired IT trunk.
2	If (a) was performed in Step 1, terminate the incoming TC trunk with 900 ohms plus 2.16 μ F in series at a point of good impedance, ie, office side of pad, office side of impedance compensator, or 4-wire ports of a hybrid. (If the selected TC trunk has 4-wire facilities to the class 5 office, use 600-ohm resistive terminations in the transmit and receive ports of the 4WTS in the TC trunk.) If (b) was performed in Step 1, terminate the incoming TC trunk per Fig. 5, Note 3B.
3	Set up test equipment to perform capacitance measurements as described in Part 2B of this section and connect test equipment to the transmit and receive ports of the outgoing IT trunk.
4	Connect a 7A capacitor box (or equivalent) across the NBO capacitor of the outgoing IT trunk 4WTS.
5	Adjust the capacitor box to obtain the greatest return loss. Note the capacitance value required for use in Step 8.
6	Release the connection and disconnect test equipment and capacitor box.
7	Repeat Step 1(a) or (b) using ABC-XXXX code for the BAL TST circuit then perform Step 2 to establish a terminated connection to the BAL TST circuit outgoing path.

STEP	PROCEDURE
8	Connect the test equipment to the transmit and receive ports of the BAL TST circuit 4WTS, and connect the capacitor box, with the same value of capacitance as measured in Step 5, across the NBO capacitor of the BAL TST circuit. <i>Note:</i> This makes the BAL TST circuit equivalent to the average outgoing IT trunk for use in determining the NBO value in Section 660-474-500.
9	Adjust the BO capacitor in the BAL TST circuit trunk equipment to obtain the greatest return loss. Tighten screws or solder straps in place.
10	Release the connection and disconnect test equipment.
11	Proceed to paragraph 3.11.

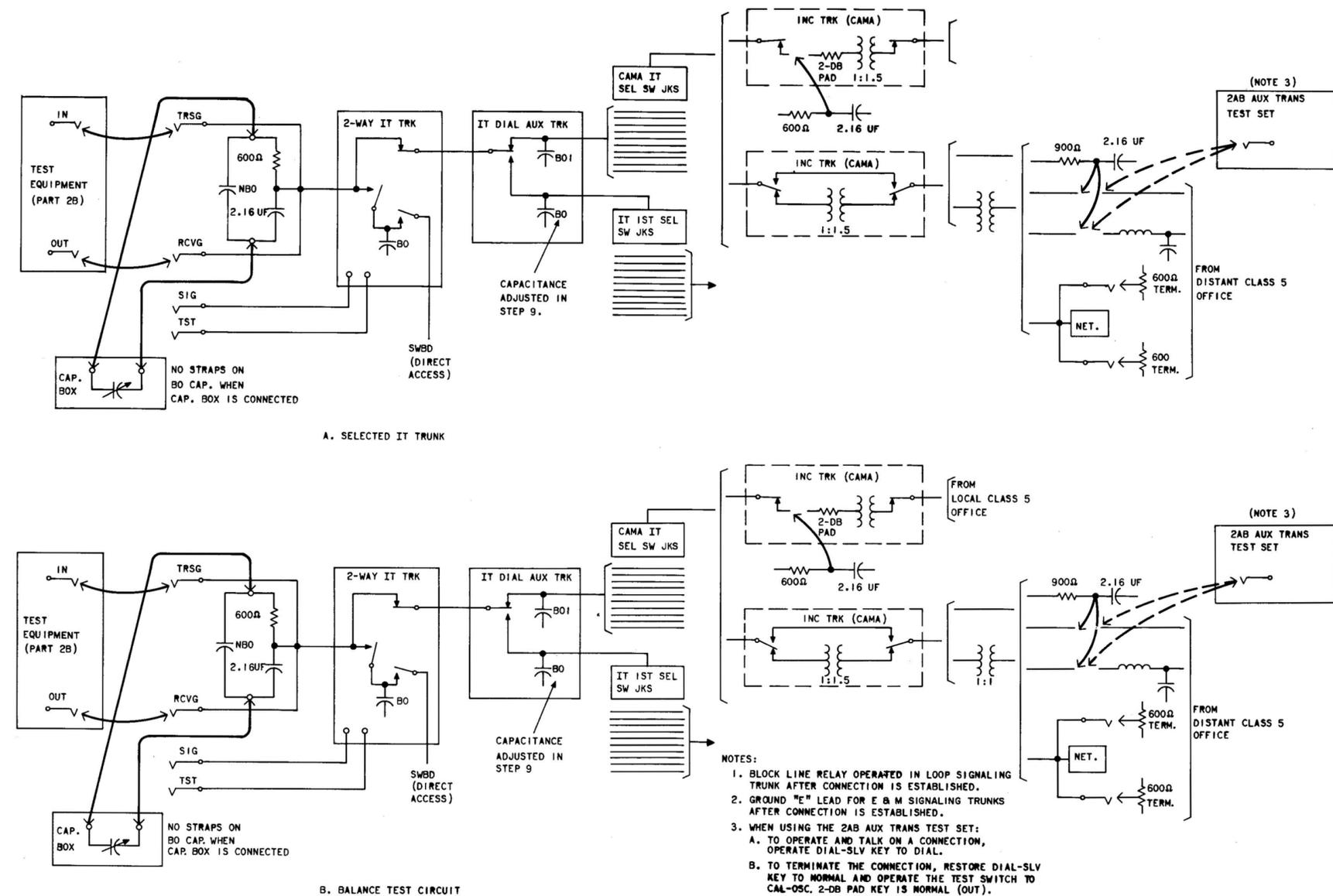


Fig. 5—Buildout of Balance Test Circuit Before Determining Office NBO Value—Outgoing Path

Direct Access Path From Switchboard

3.11 This procedure is required when IT trunks in the offices having jack appearances on the switchboard for direct access by the operator. The IT trunk selection is made from visual inspection, record information, and/or return-loss measurements. The selected IT trunk should be the average length office cable path in the office. Where direct access path length differences are greater than 200 feet, the deviation of capacitance in the paths is too large. In these cases, the shorter paths must be

built out to reduce the range of the direct access path capacitances. The shorter paths should not be considered when determining the average direct access path length. This condition is likely to occur only in downgraded class 3 or higher ranking offices. In this case, the average path should be no more than 100 feet less than the longest IT path. The shorter paths (paths with cable lengths 200 feet or more less than the longest path) must be built out after the office NBO is selected, using connections set up as in verification measurements of Section 660-474-502, Part 3B.

STEP	PROCEDURE
1	At the switchboard, connect the calling cord of a cord circuit to the jack appearance of the selected average length direct access IT trunk path.
2	Connect the answering cord of the circuit to the SWBD BAL TST TERM. (See Fig. 6A.)
3	Verify that no straps or screw settings are present on the BO capacitor of the SWBD BAL TST TERM or the BO capacitor in the IT trunk circuit.
4	Set up test equipment to perform capacitance measurements as described in Part 2B of this section and connect test equipment to the transmit and receive ports of the selected IT trunk 4WTS.
5	Connect a 7A capacitor box (or equivalent) across the NBO capacitor in the selected IT trunk 4WTS. Verify that no screw settings or straps are present on the NBO capacitor.
6	Adjust the capacitor box to obtain the greatest return loss. Note the value of capacitance required for use in Step 8.
7	Disconnect the test equipment and capacitor box, and release the calling cord connection from the selected IT trunk. Then connect calling cord to the switchboard jack appearance of the BAL TST circuit.
8	Connect the test equipment to the BAL TST circuit 4WTS transmit and receive ports (see Fig. 6B) and the capacitor box to the NBO capacitor with the same capacitance value as measured in Step 6.
9	Adjust the BO capacitor in the BAL TST circuit to give the greatest return loss.
	Note: This makes the BAL TST circuit direct access from the switchboard equivalent to the average IT trunk direct access path for use in determining the office NBO value in Section 660-474-500.
10	Release the connection and disconnect test equipment.

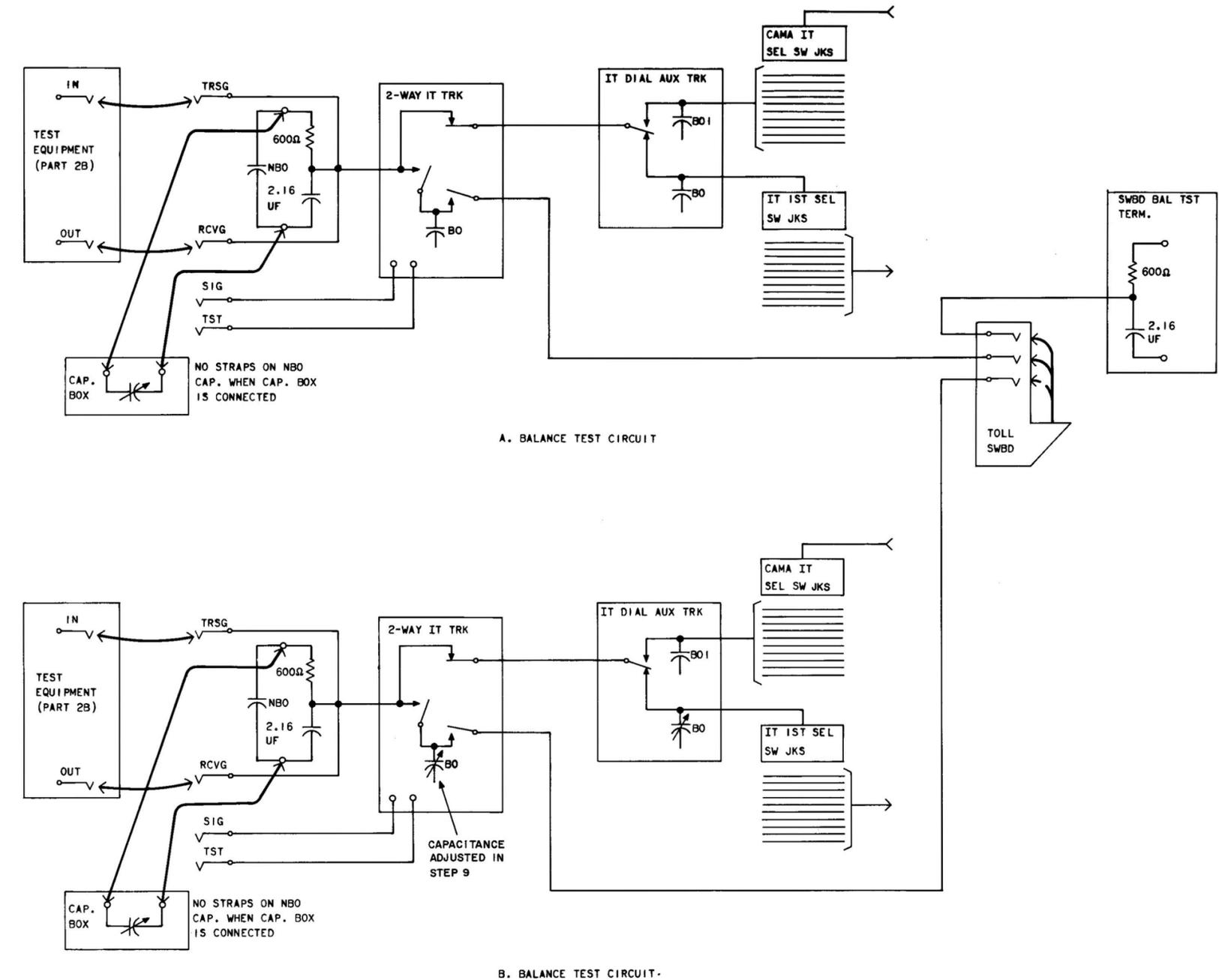


Fig. 6—Buildout of Balance Test Circuit Before Determining Office NBO Value—Direct Access Path

C. Buildout of Code 100 Balance Test Termination and Verification of Incoming Path of Balance Test Circuit

This procedure cannot be performed until the procedures of Section 660-474-500 have been completed.

3.12 This procedure must be completed before performing procedures in Section 660-474-502.

STEP	PROCEDURE
1	Using the testboard appearance of the BAL TST circuit IT trunk relay equipment, key pulse (dial) 100 to establish a connection to the code 100 BAL TST TERM. (See Fig. 7.)
2	Connect a 7A capacitor box (or equivalent) across the BO capacitor of the code 100 BAL TST TERM. Verify that no straps are connected on the BO capacitor.
3	Set up test equipment to perform capacitance measurements as described in Part 2B and connect test equipment to the BAL TST circuit 4WTS transmit and receive ports.
4	Adjust the capacitor box to a value giving the greatest return loss. Note the capacitance value.
5	Remove the capacitor box and strap the capacitance determined in Step 4 on the BO capacitor of the code 100 BAL TST TERM.
6	Verify that the return-loss measurement value is the same as in Step 4. (Due to manufacturing tolerances, the indicated values of BO capacitors may vary, and small corrections to the value strapped may be necessary.) Readjust the strapped value for small corrections if necessary. When large changes are required to obtain the same measurement as in Step 4, investigate for trouble.
7	Record the capacitance value strapped on the BO capacitor on Form E-6005 or E-6006.
8	Change the test equipment setup to measure ERL or SP/SRL as described in Part 2B of this section.
9	Measure the ERL and SP/SRL.
	Note: The ERL and SP/SRL measurement results must meet the requirements given in Section 660-474-301.
10	Record the measurement results and other information required to complete entries on Form E-6005 or E-6006.
11	Release the connection.
12	Make busy the adjusted circuit(s) and repeat Steps 1 through 11 for each code 100 BAL TST TERM in the office.
13	Remove all busy devices, disconnect test equipment, and release the BAL TST circuit.

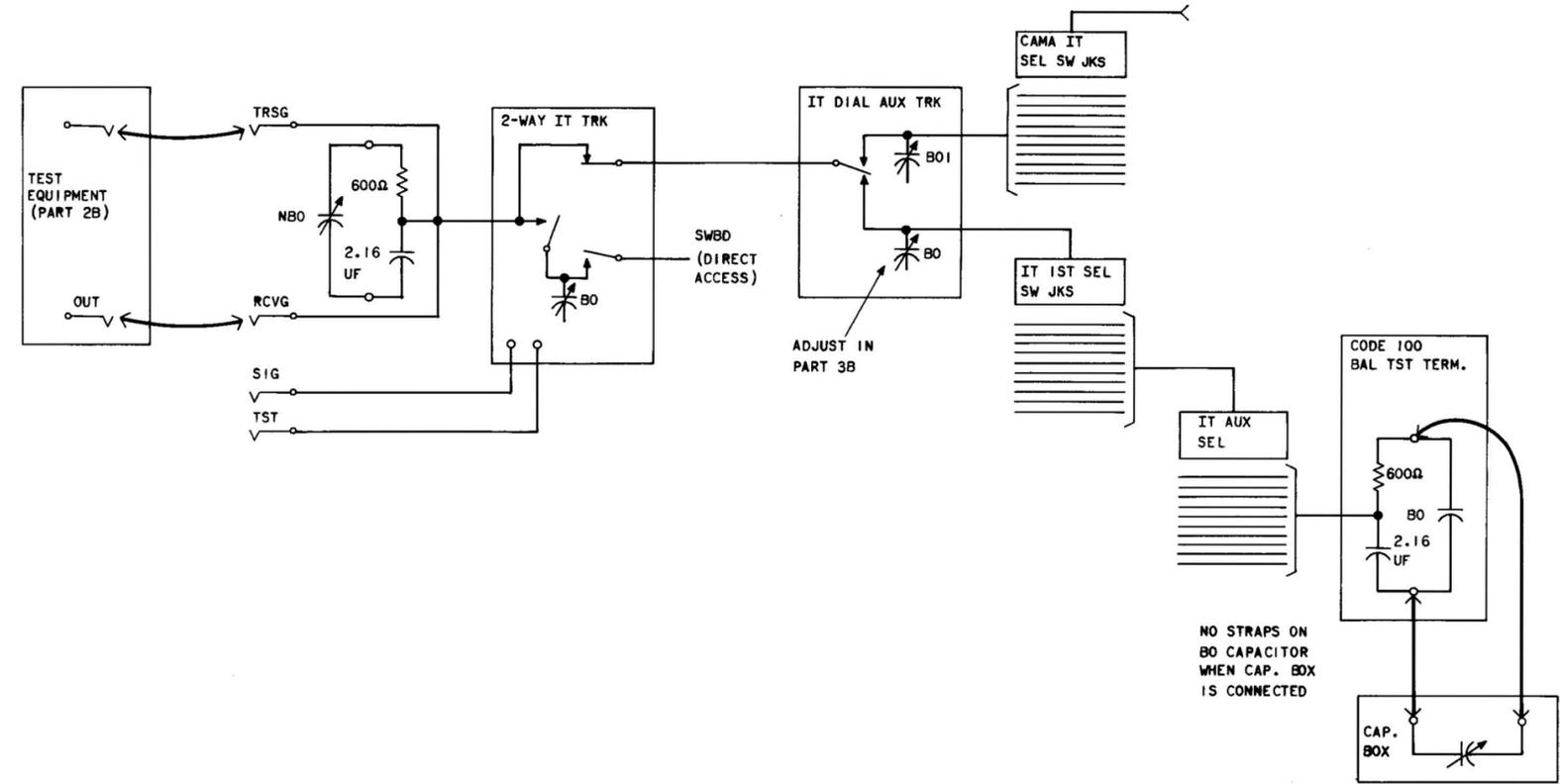


Fig. 7—Buildout of Code 100 Balance Test Incoming Path of Balance Test Circuit

D. Buildout of Switchboard Balance Test Termination and Verification (when required) of Balance Test Circuit Direct Access Path From Switchboard

3.13 This procedure must be completed before performing procedures in Section 660-474-502. This procedure cannot be performed until the procedures of Section 660-474-500 have been completed.

3.14 The SWBD BAL TST TERM is built out to the average value of capacitance in the 121, operator trunks, and the direct access path of the BAL TST circuit (average direct access path) when offices have direct paths to IT trunks from the switchboard.

STEP	PROCEDURE
1	Using the testboard appearance of the BAL TST circuit, seize the trunk and key pulse (dial) 121 to establish a connection to the toll switchboard. (See Fig. 8.)
2	At the switchboard, use a cord circuit answering cord to connect to the incoming signal.
3	Use the calling cord of the cord circuit used in Step 2 to connect to the SWBD BAL TST TERM.
4	Close the TALK-MON key at the switchboard.
5	Set up test equipment to perform capacitance measurements as described in Part 2B of this section and connect test equipment to the BAL TST circuit 4WTS transmit and receive ports.
6	Connect a 7A capacitor box (or equivalent) across the BO capacitor of the SWBD BAL TST TERM.
7	Verify that no straps are connected on the BO capacitor.
8	Adjust the capacitor box to a value giving the greatest return loss. Record the value on Form E-6005 or E-6006.
9	Release the 121 trunk from the cord circuit.
10	Repeat Steps 1 through 10 on a sufficient number of connections to adequately sample the 121 trunks (see Table B, Section 660-474-502, for sample sizes).
11	Release the last trunk tested and disconnect cord from SWBD BAL TST TERM jack appearance.
12	When the office is equipped with operator trunks, perform the following: (If the office is not equipped with operator trunks, proceed to Step 13.) (a) At the switchboard, use the calling cord to seize an operator trunk and key pulse (dial) the ABC-XXXX code to establish a connection to the BAL TST circuit. (b) Use the answering cord of the cord circuit to connect to the SWBD BAL TST TERM. (c) Perform Steps 4 through 8.

STEP	PROCEDURE
(d)	Release the calling cord connection and repeat (a), (b), and (c) on a sufficient number of operator trunks to adequately sample the total number of trunks in the office (see Table B, Section 660-474-502, for sample sizes).
(e)	If the office is not equipped for switchboard access to IT trunks, proceed to Step 14.
13	When the office is equipped with switchboard access to IT trunks, perform the following: (a) Connect the calling cord of a cord circuit at the switchboard to the direct access jack appearance of the BAL TST circuit. (b) Use the answering cord of the cord circuit to connect to the SWBD BAL TST TERM. (c) Perform Steps 4 through 8. (d) Release BAL TST circuit from and disconnect cord circuit from the SWBD BAL TST TERM jack appearance.
14	Total all the values of capacitance measured and recorded in performing Step 8. Divide the total by the number of measurements made. Connect the capacitor box across the SWBD BAL TST TERM and set the capacitance to the average value (total capacitance of measurements divided by number of measurements).
15	Repeat Steps 1 through 5.
16	Measure the return loss and note the indicated value. Remove the capacitor box from across the SWBD BAL TST TERM BO capacitor and strap the same value on the BO capacitor.
17	Verify that the return-loss measurement is the same as indicated in Step 16. If the measurement is not the same, make small changes in the BO capacitor strapping. (Due to manufacturing tolerances, the indicated values of BO capacitance may vary and small corrections to the indicated value strapped may be necessary.) When large BO capacitance changes are required to obtain the same measurement as in Step 16, investigate for trouble. Record the final capacitance value.
	Note: Verification of the 121 and operator trunks are performed in Section 660-474-502 using the SWBD BAL TST TERM. The following steps are only required in offices having direct access paths to IT trunks from the switchboard.
18	At the switchboard, connect the calling cord of a cord circuit to the direct access jack appearance of the BAL TST circuit.
19	Use the answering cord of the cord circuit, connect to the SWBD BAL TST TERM jack appearance.
20	Set up test equipment to measure ERL or SP/SRL as described in Part 2B of this section, and connect test equipment to the BAL TST circuit 4WTS transmit and receive ports.

STEP	PROCEDURE
21	Measure the ERL and SP/SRL. Note: The measurement results must meet the requirements given in Section 660-474-301.
22	Record the ERL and SP/SRL measurement and other information required to complete entries on Form E-6005 or E-6006.
23	Release the connection and disconnect test equipment.

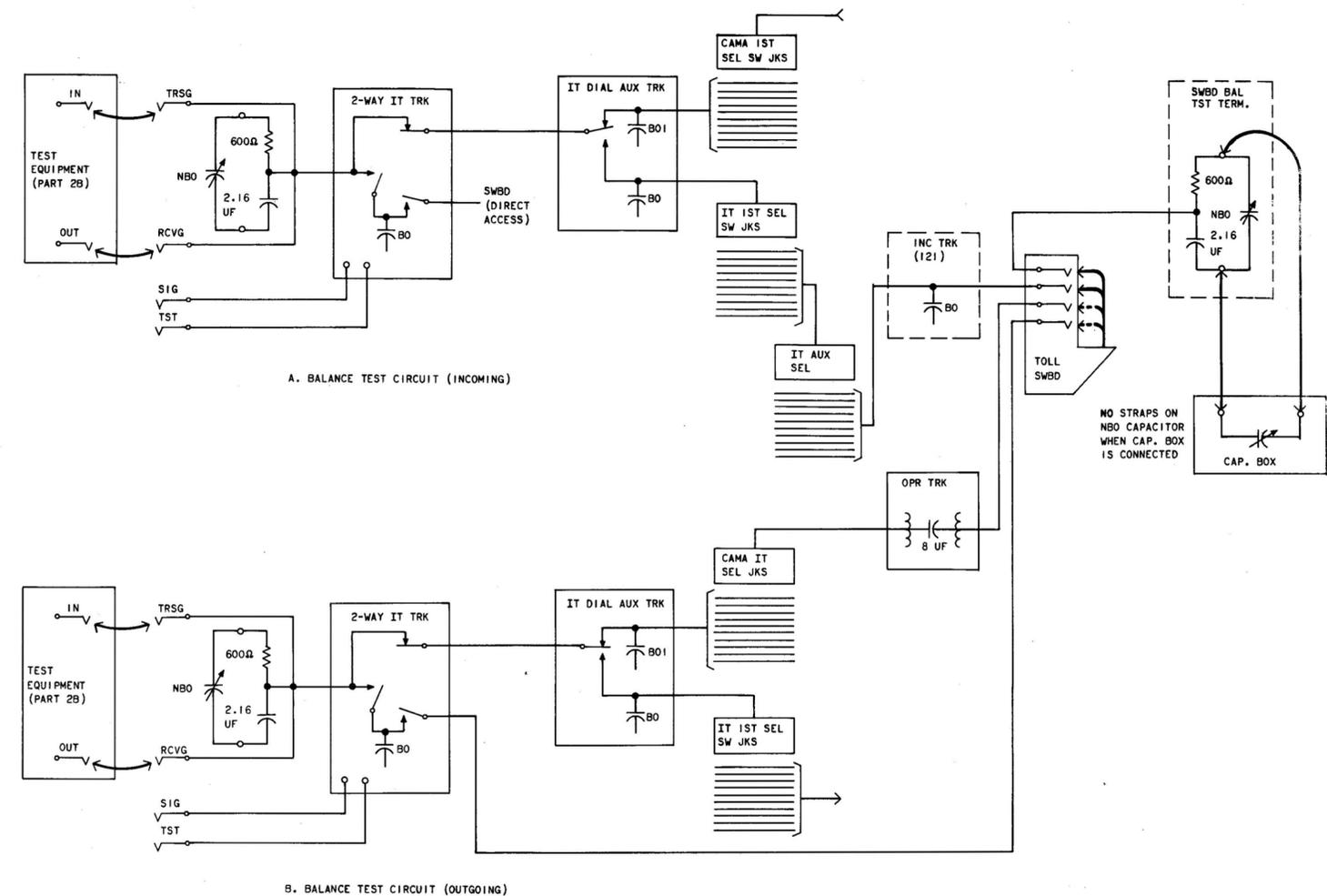


Fig. 8—Buildout of Switchboard Balance Test Termination and Verification of Balance Test Circuit Direct Access Path

E. Verification of Outgoing Path of Balance Test Circuit

3.15 The same incoming TC trunk (CAMA) used in building out the BAL TST outgoing path

in Part 3B should be used for this procedure. This procedure must be completed before performing procedures in Section 660-474-502. This procedure cannot be performed until the procedures of Section 660-474-500, Part 3C have been completed.

STEP	PROCEDURE
1	Perform (a) or (b). (a) At the class 5 office end of the trunk, use the proper method described in Section 660-576-500 to originate, hold, and terminate a test call to the ABC-XXXX code for the BAL TST circuit. (b) At the MDF, use a 2AB auxiliary transmission test set to originate and hold a connection to the ABC-XXXX code for the BAL TST circuit.
2	Open the transmission path and terminate the TC trunk with 900 ohms plus 2.16 μ F in series or use the 2AB auxiliary transmission test set at a point of good impedance, ie, office side of 2-dB pad, office side of impedance compensator, or 4-wire ports of hybrid. (If the selected CAMA trunk has 4-wire facilities from the class 5 office, use 600-ohm resistive terminations in the transmit and receive ports of the 4WTS.) (See Fig. 9.)
3	Set up test equipment to perform ERL or SP/SRL measurements as described in Part 2B of this section and connect test equipment to the transmit and receive ports of the BAL TST circuit 4WTS.
4	Measure the ERL and SP/SRL. <i>Note:</i> The ERL and SP/SRL measurements must meet the requirements given in Section 660-474-301.
5	Release the connection and disconnect test equipment.

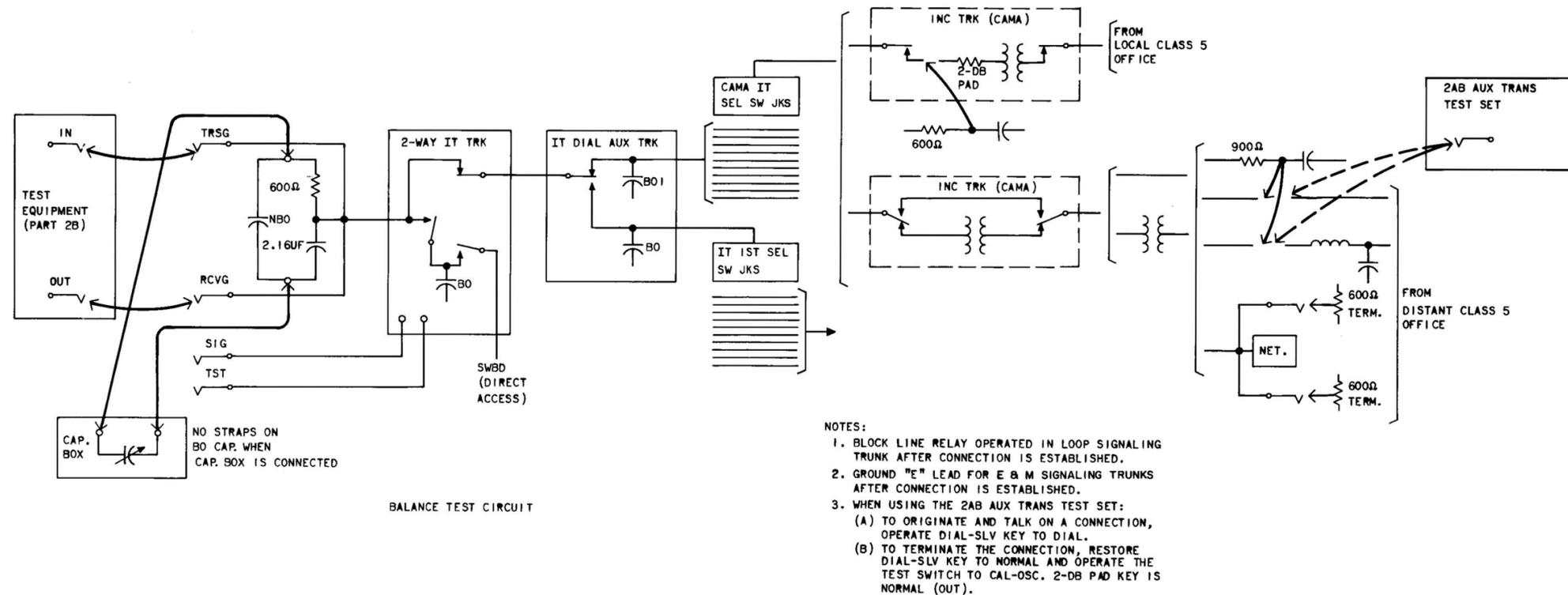


Fig. 9—Verification of Outgoing Path of Balance Test Circuit

4. PORTABLE TEST TERMINATIONS

4.01 Portable terminations used in balance testing can be made up locally. As a convenience, they should be equipped with leads and test clips. The two types required are as follows:

600-ohm—consisting of a 600-ohm (18AE) resistor connected in series with a 2.14- to 2.16- μ F (439QA) capacitor

900-ohm—consisting of a 900-ohm (18FB) resistor connected in series with a 2.14- to 2.16- μ F (439QA) capacitor.

4.02 In certain applications, the J94002AB (2AB) auxiliary transmission test set can be used

as a termination. This portable test set will also perform the following functions:

- (a) Permit connection of dialing equipment to a 2-wire trunk
- (b) Hold a seizure on trunks equipped for tip and ring supervision
- (c) Provide dc blocking for connection of transmission testing equipment to a seized trunk
- (d) Transform an impedance from 600 to 900 ohms
- (e) Provide 900-ohm plus 2.16 μ F terminations for a 2-wire trunk.