SELECTION OF OFFICE NBO IN LARGE CLASS 5 OFFICES SERVED BY NO. 5 CROSSBAR OFFICE

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1. GENERAL

1.01 This section provides the procedures for determining a value for NBO capacitor strapping in large class 5 offices where the office cabling capacitance is great enough to degrade the expected balance between compromise networks (COMP NET) in 4-wire terminating sets (4WTS) and the 2-wire lines.

1.02 This section does not affect the Equipment Test Lists.

1.03 The procedures in this section apply only to trunks which are assigned to 4-wire interoffice facilities between toll and class 5 offices. ***Trunks equipped with E- or F-type signaling units having built-in 4WTSs and fixed network build-out (NBO) values or trunks with return losses which are marginal as a result of design should not be included.*** The procedures will, in general, only be necessary when the class 5 office has cabling lengths approximating 1000 feet or more from the 4WTS to the switch. The initial ***terminal*** balance testing work at the toll office will indicate that this section is applicable when there is consistent difficulty in meeting echo return loss (ERL) and singing point/singing return loss (SP/SRL) requirements to a class 5 office.

> ***Note:*** The procedures of this section are not applicable if at least a 5-dB improvement in ERL measurement occurs on an IT-to-TC trunk connection when the transmit and receive ports of the TC trunk 4WTS in the toll office end of the trunks are terminated with 600 ohms.

When equipment additions, modifications, or rearrangements are made in a class 5 office served by a toll office which has been certified as balanced, this section may become applicable and affect verification measurement results at the toll office. This means that additional verification measurements will be required in the toll office. When balancing at the toll office indicates that the procedures of this section are applicable, this section must be coordinated with the ***terminal*** balance testing at the toll office and must be completed before the verification measurement tests of Section 660-472-502 can be performed. Whenever this section is indicated as applicable, the transmission engineering force responsible for the toll office involved must be notified before the procedures are performed.

1.04 All trunks tested in this section must have met a 1000-Hz loss and noise limit requirement before these procedures are performed.

1.05 The class 5 end of trunks outgoing from the toll office are tested from the balance test (BAL TST) circuit in the toll office to a dialed balance test termination (BAL TST TERM) in the class 5 office (Fig. 1). The class 5 office end of trunks incoming to the toll office are tested over a completed connection to the BAL TST circuit in the toll office after one of the various arrangements of off-hook terminations available at class 5 offices has been made (Fig. 2). The proper methods of originating, terminating, and holding connections from the various class 5 offices are described in Section 660-576-500.

1.06 The procedures are performed on selected samples in each trunk group interconnecting the toll and class 5 offices. These selected samples must be representative of the office cable lengths in the class 5 office for each trunk group. To be representative, the selected trunk samples should include the longest and shortest cabling paths in the trunk group and trunks randomly selected from the trunk group. The selections should be made from trunks mounted near the middle of equipment bays. The locations of equipment bays should also be randomly selected in larger trunk groups having several equipment locations. The number of trunks required for an adequate sample size in a trunk group is shown in Table A.

1.07 Capacitance values used in these procedures may vary ± 0.005 μF from the stated value.

TABLE A

TRUNK GROUP SAMPLE SIZES

TOTAL NUMBER OF TRUNKS	NUMBER IN SAMPLE
5 or less	All trunks
6 to 10	5
11 to 15	6
16 to 25	7
26 to 50	8
Over 50	Approximately 18 percent of total

2. PROCEDURES

A. Trunks Outgoing *From* Toll Offices to Class 5 Offices—TS, 2-Way OO From Machine or Switchboard

STEP	PROCEDURE
1	***In the toll office,*** perform (a) or (b): (a) When testing ***machine-switched connections:*** At the master test frame, connect the toll originating test line to the trunk to be tested and to the subscriber number assigned to the BAL TST TERM in the class 5 office. Transfer the connection to the TRK TST jack and patch the TRK TST jack to the 2-wire line of the BAL TST 2 circuit. (b) When testing ***connections via toll switchboard:*** Use the toll testboard appearance of the BAL TST 1 circuit to key pulse (dial) 121 and establish a connection to the toll switchboard. At the toll switchboard, answer the incoming signal and, using the same cord circuit, seize the trunk to be tested. Key pulse (dial) the number assigned to the BAL TST TERM in the class 5 office. Proceed to Step 2.
2	Set up the test equipment to perform ERL measurements as described in Section 660-472-504, and connect test equipment to the transmit and receive ports of the BAL TST 1 circuit.
3	***In the class 5 office,*** verify that no straps are present on the NBO capacitor in the 4WTS associated with the trunk under test.
4	***In the toll office,*** measure and record the ERL value on the connection.
5	***In the class 5 office,*** connect a 7A capacitor box (or equivalent), adjusted to 0.025 μF, across the COMP NET, or strap the NBO capacitor to parallel the COMP NET with 0.025-μF value.
6	***In the toll office,*** measure and record the ERL value of the connection.
7	***In the class 5 office,*** change the capacitance value of the capacitor box or NBO strapping to 0.050 μF.
8	***In the toll office,*** measure and record the ERL value on the connection.
9	Repeat Steps 1 through 8 for all trunks in all trunk group samples.
10	Perform measurements on incoming trunks (Part 2B).

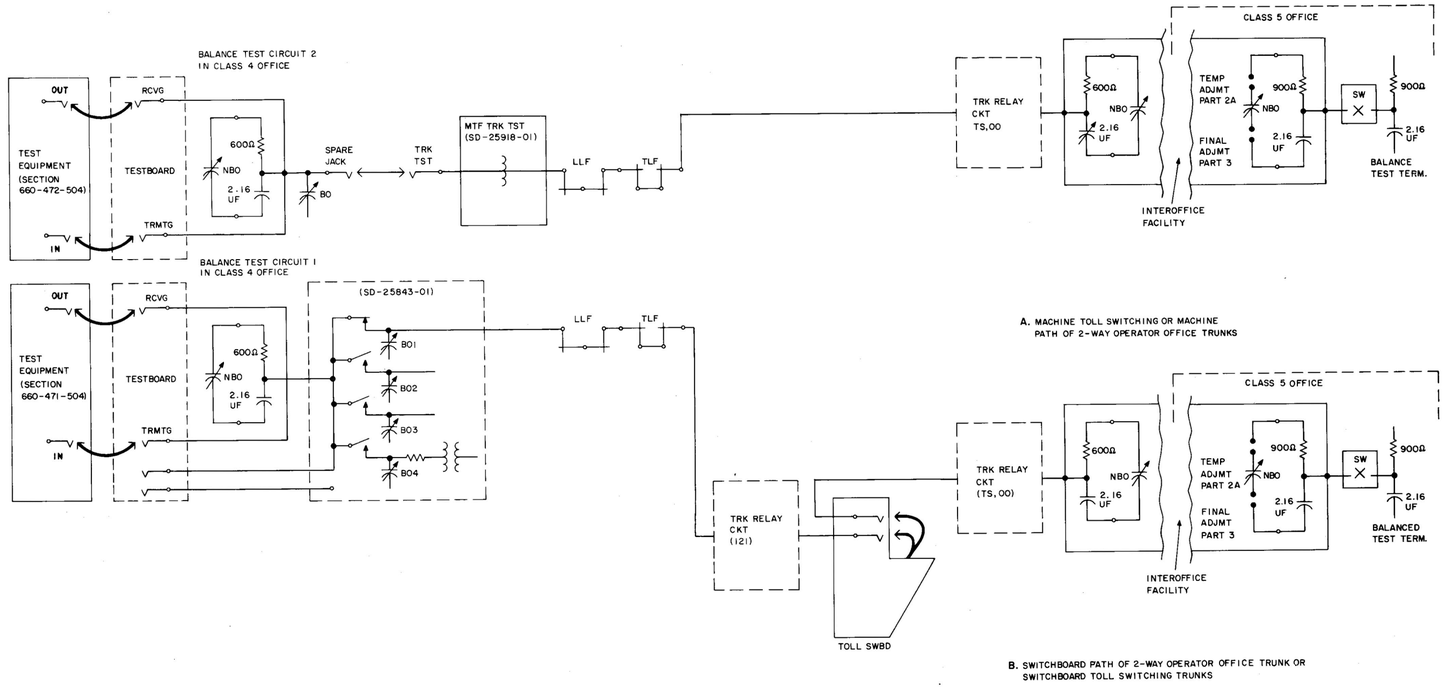
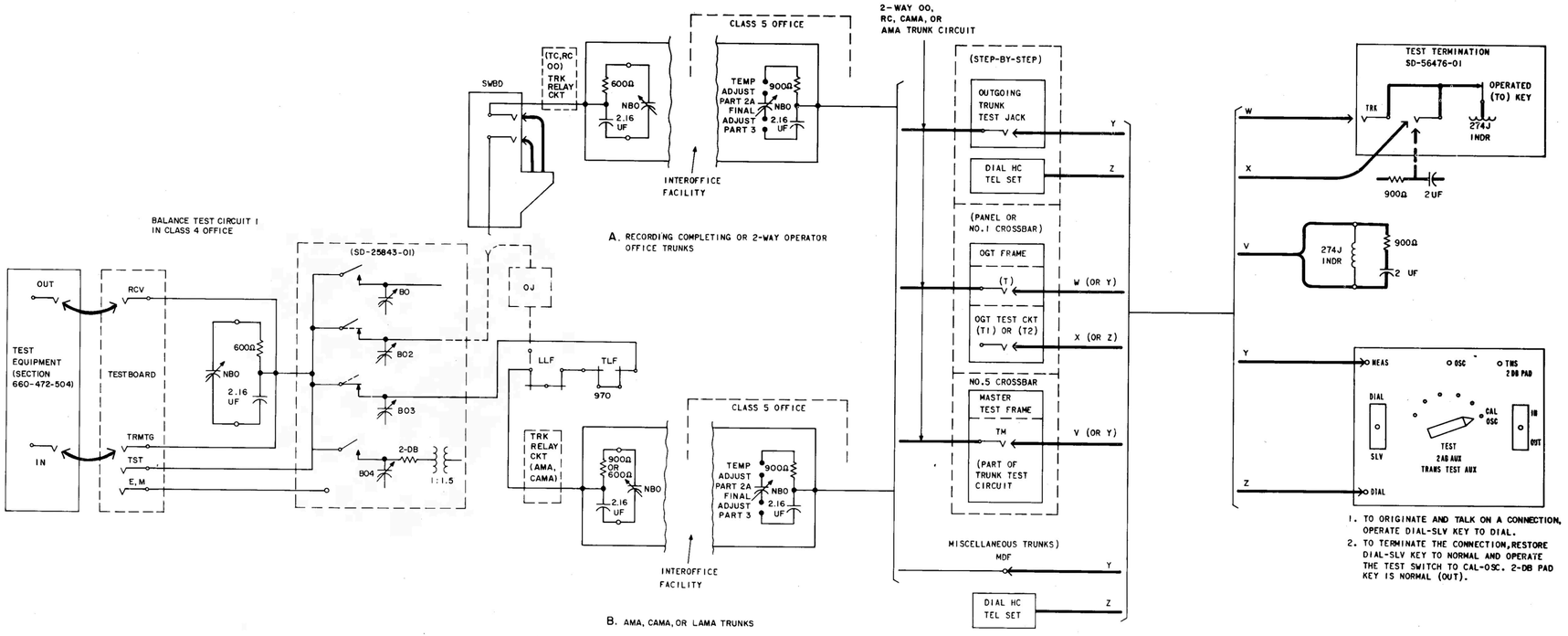


Fig. 1—Trunks Outgoing *From* Toll Offices to Class 5 Offices — TS, 2-Way OO From Machine or Switchboard

B. Trunks Incoming *to* Toll Offices From Class 5 Offices—AMA, CAMA, RC, 2-Way OO

STEP	PROCEDURE
1	***In the toll office,*** verify that no make-busy plug is in the OGT TST jack appearance assigned and designated 970.
2	***In the class 5 office,*** use the prescribed method for that type of office (Section 660-576-500) to originate, hold, and terminate a call to one of the following: (a) 970-1111 when testing AMA or CAMA trunks. ***Note:*** Code 970 is assigned to the BAL TST 1 circuit in the toll office. When required, a local test number must be provided to satisfy CAMA operators. (b) The toll switchboard operator at the toll office when testing RC or 2-way OO trunks. Have the operator complete to code 970 on an operator junctor trunk or through direct switchboard access to IT, and close the TALK-MON key to permit the making of transmission tests.
3	***In the toll office,*** set up the test equipment to perform ERL measurements as described in Section 660-472-504 and connect test equipment to the 4WTS transmit and receive ports of the BAL TST 1 circuit.
4	***In the class 5 office,*** verify that no straps are present on the NBO capacitor in the 4WTS associated with the trunk under test.
5	***In the toll office,*** measure and record the ERL value on the connection.
6	***In the class 5 office,*** connect a 7A capacitor box (or equivalent) adjusted to 0.025 μF across the COMP NET, or strap the NBO capacitor to a value of 0.025 μF in parallel with the COMP NET.
7	***In the toll office,*** measure and record the ERL value on the connection.
8	***In the class 5 office,*** change the capacitance value of the capacitor box or NBO strapping to 0.050 μF.
9	***In the toll office,*** measure and record the ERL value on the connection.
10	Repeat Steps 1 through 9 for all trunks in all trunk group samples.
11	Proceed to Part 3.



1. TO ORIGINATE AND TALK ON A CONNECTION, OPERATE DIAL-SLV KEY TO DIAL.
2. TO TERMINATE THE CONNECTION, RESTORE DIAL-SLV KEY TO NORMAL AND OPERATE THE TEST SWITCH TO CAL-OSC. 2-DB PAD KEY IS NORMAL (OUT).

Fig. 2—Trunks Incoming *to* Toll Offices From Class 5 Offices — AMA, CAMA, RC, 2-Way OO

3. NBO SELECTION

3.01 The selection of the NBO capacitance value in the class 5 office is dependent on all measurements recorded in Parts 2A and 2B. The ERL measurements correspond to values of capacitance. The correspondence can be seen when the measurements are tabulated in a manner such as that shown in Table B. From this correspondence, the best NBO value for an office is determined. The value determined will be sufficiently accurate when the samples are representative and the sample sizes of Table A have been used.

3.02 When the best ERL values have been determined, an NBO value of 0.025 μF or greater can be selected. The selected value will be the one most near the center of the range of the cabling in the office under test. This value is strapped permanently on the NBO capacitors of all trunk groups tested.

Note: Office balancing requirements can be met with office cabling capacitances within a range of 0.025 μF. The addition of the NBO capacitance across the COMP NET causes the entire balancing range to shift by an amount which is approximately the same as the NBO value.

3.03 Since it is desirable to use the lowest value of NBO capacitance consistent with the requirements, use the following guidelines:

Consider the ***upper limit*** to be ***either*** 0.050 μF when *any* trunk requires 0.050 μF for greatest ERL, ***or*** 0.025 μF when *no* trunk requires 0.050 μF for greatest ERL.

Consider the ***lower limit*** to be ***either*** zero unless *any* trunk has a greater ERL with 0.025 μF capacitance than with zero capacitance, ***or*** the least of two capacitance values when the same ERL is measured for both values (refer to Table B).

3.04 When the lower limit for an office is determined to be zero capacitance and the upper limit to be 0.025 μF, no NBO capacitance is required. This is shown in Fig. 3 as Range I. Capacitance Ranges II and III are the most likely to be encountered when this section applies. Generally, Range IV will apply to downgraded toll offices or offices where the lower limit begins to approach 0.025 μF. When a Range IV is determined, office cable buildout becomes necessary. This buildout in the class 5 office is similar to that used in terminal balancing at the toll office (Section 660-472-502). The NBO required will be greater than 0.025 μF.

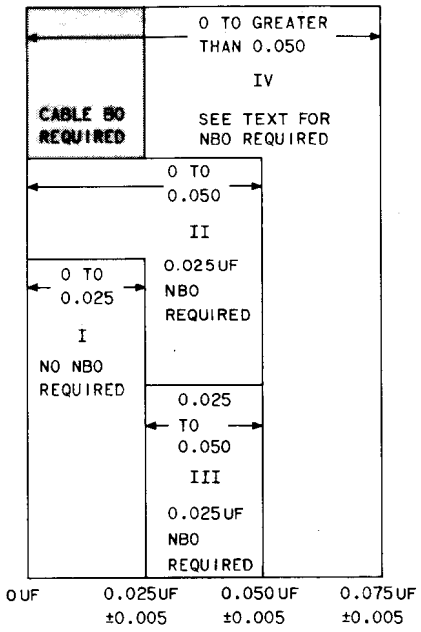


Fig. 3—Typical Capacitance Ranges in Large Class 5 Offices

TABLE B

SAMPLE TABULATION OF MEASUREMENTS TO DETERMINE OFFICE CABLE CAPACITANCE RANGE

TRUNK TESTED		ERL IN DB		
		0 μF	0.025 ±0.005 μF	0.050 ±0.005 μF
AMA	*1	25	(41)	25
	2	20	29	(41)
	3	37	(40)	27
RC	1	27	(41)	26
	2	27	(42)	25
	3	20	29	(38)
TS	*1	23	(40)	40
	2	(40)	29	20
	3	28	(41)	26
2-way OO	*1	23	(42)	23
	2	20	(42)	20
	3	27	(42)	27

Notes: 1. Asterisk (*) indicates two-value measurement (see 3.03).

2. Circled values are greatest return loss and indicate the best NBO value as 0.025 μF (see paragraph 3.01) and the range of office cable capacitance as 0.0 to 0.050 μF (see paragraph 3.03).