SELECTION OF OFFICE NBO IN LARGE CLASS 5 OFFICES SERVED BY NO. 1/1A ELECTRONIC SWITCHING SYSTEM (ESS) WITH HILO 4-WIRE SWITCHING FEATURE

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1. GENERAL

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

1.02 Whenever this section is reissued, the reasons for reissue will be given in this paragraph.

1.03 This section does not affect Equipment Test Lists.

1.04 The procedures in this section apply only to trunks which are assigned to 4-wire interoffice facilities between toll and class 5 offices. ***Toll switchboard terminated trunks with E- or F-type signaling units having built-in 4WTSs and fixed NBO values or trunk relay equipment with return losses that are marginal due to 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. The initial ***terminal*** balance testing work at the toll office will indicate this section as 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:*** This section is not applicable unless 5 dB or more improvement in the ERL measurement occurs on intertoll (IT) to toll connecting (TC) trunk connections including those connections via a secondary intertoll (SI) when the transmit and receive ports of the TC trunk 4WTS in the toll office end of the trunk are terminated with 600 ohms.
>
> ***Caution: Incorrect adjustment of the 4WTS in the class 5 office will also cause low ERL measurements.***

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 will require additional verification measurements in the toll office. When balancing at the toll office indicates this section is 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 660-470-502. Whenever this section is indicated as applicable, the transmission engineering force responsible for the toll office involved must be notified before performing the procedures.

1.05 All trunks tested in this section must have met a 1000-Hz transmission loss and noise limit requirement before performing these procedures.

1.06 The procedures are performed on both outgoing and incoming trunks from the toll office. The outgoing trunks are tested from a Manual Trunk Test Position (MTTP), interfaced with Test Access Trunk circuits (TAT 1 or TAT 2), in the toll office to a dialable balance test termination (BAL TST TERM) in the class 5 office (Fig. 1). The incoming trunks are tested over a completed connection to the MTTP, interfaced with TAT 1 or TAT 2, 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.

1.07 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 the 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.

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. Outgoing Trunks From Toll Offices (TS, 2-Way 00 From Machine or Switchboard)

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

STEP	PROCEDURE
1	***In the toll office,*** perform (a) or (b): (a) When testing ***machine-switched connections:*** At the MTTP, perform that portion of Balance Test Routine 1 as described in Section 660-470-504 to outpulse the assigned number or directory number (DN) of the class 5 office BAL TST TERM over the TC trunk to be tested. Transfer the TC trunk to TAT 1 or TAT 2 and connect the RLMS to the TAT (refer to Fig. 1A). (b) When testing ***connections via toll switchboard:*** At the MTTP, perform that portion of Balance Test Routine 1 as described in Section 660-470-504 to initiate an outgoing call to the switchboard (do not dial DN). Transfer the trunk to TAT 1 or TAT 2 and connect the RLMS to the TAT. (Any SI trunk may be used.) Refer to Fig. 1B. At the switchboard, answer the incoming signal with one end of a cord circuit. Use the other end of the cord circuit to seize one of the TC trunks to be tested and keypulse (dial) the assigned number or DN of the class 5 office BAL TST TERM. Close the TALK MON key of the cord circuit.
2	***In the class 5 office,*** verify that no straps are present on the NBO capacitor in the 4WTS associated with the trunk under test.
3	At the MTTP, measure the ERL value and record (see Table B).
4	***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 a 0.025-μF value.
5	At the MTTP, measure the ERL value and record (see Table B).
6	***In the class 5 office,*** change the capacitance value of the capacitor box or NBO strapping to 0.050 μF.
7	At the MTTP, measure the ERL value and record (see Table B).
8	Repeat Steps 1 through 7 for all trunks in all trunk group samples.
9	Perform measurements on incoming trunks (Part 2B).

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)	41
	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 3.01) and the range of office cable capacitance as 0.0 to 0.050 μF (see 3.03).

B. Incoming Trunks to Toll Offices (AMA, LAMA, CAMA, TSPS, RC, 2-Way 00)

STEP	PROCEDURE

1 ***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) At the class 5 office, use a test facility to seize one of the TC trunks to be tested and keypulse (dial) 970 or the assigned number (DN) to the MTTP (refer to Fig. 2A).

STEP	PROCEDURE
	(b) At the switchboard, use one end of a cord circuit to seize an SI trunk and keypulse (dial) 970 or the assigned number (DN) to the MTTP (refer to Fig. 2B).
	At the class 5 office, use a test facility to seize the TC trunk to be tested, and cause an incoming signal to appear on the switchboard.
	At the switchboard, use the other end of the cord circuit to answer the incoming signal. Close the TALK MON key of the cord circuit.
2	At the MTTP, perform that portion of Balance Test Routine 1 described in Section 660-470-504 to accept the test call. Transfer the call to TAT 1 or TAT 2 and connect the RLMS to the TAT.
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	At the MTTP, measure the ERL value and record (see Table B).
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 a 0.025-μF value.
6	At the MTTP, measure the ERL value and record (see Table B).
7	***In the class 5 office,*** change the capacitance value of the capacitor box or NBO strapping to 0.050 μF.
8	At the MTTP, measure the ERL value and record (see Table B).
9	Repeat Steps 1 through 8 for all trunks in all trunk group samples.
10	Proceed to Part 3.

3. NETWORK BUILD-OUT SELECTION

3.01 The selection of the NBO capacitance value in the class 5 office is dependent on all ERL measurements recorded in Parts 2A and 2B. The measurements correspond to values of capacitance. The correspondence can be seen when the measurements are tabulated in a manner such as 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 all NBO capacitors in the trunk groups tested.

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

3.03 Since it is desirable to use the lowest value of NBO capacitance consistent when meeting

requirements, use the following guidelines to consider the:

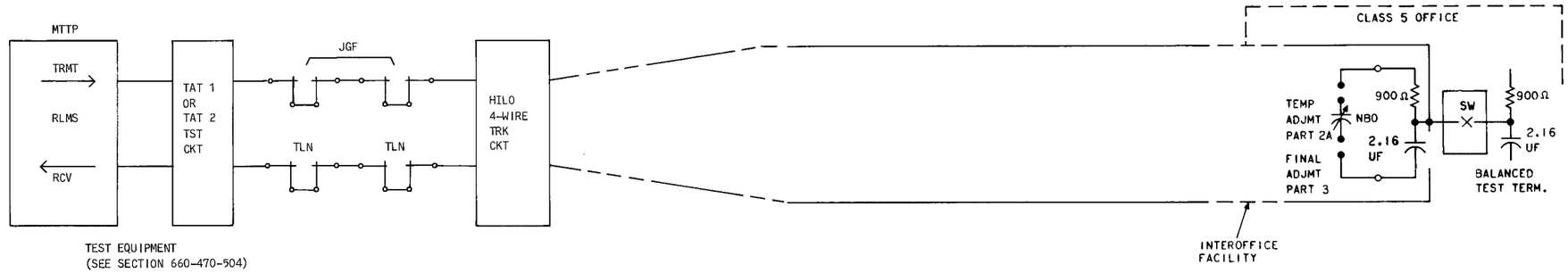
Upper limit to be 0.050 μF when ***any*** trunk requires 0.050 μF for greatest ERL

Upper limit to be 0.025 μF when ***no*** trunk requires 0.050 μF for greatest ERL

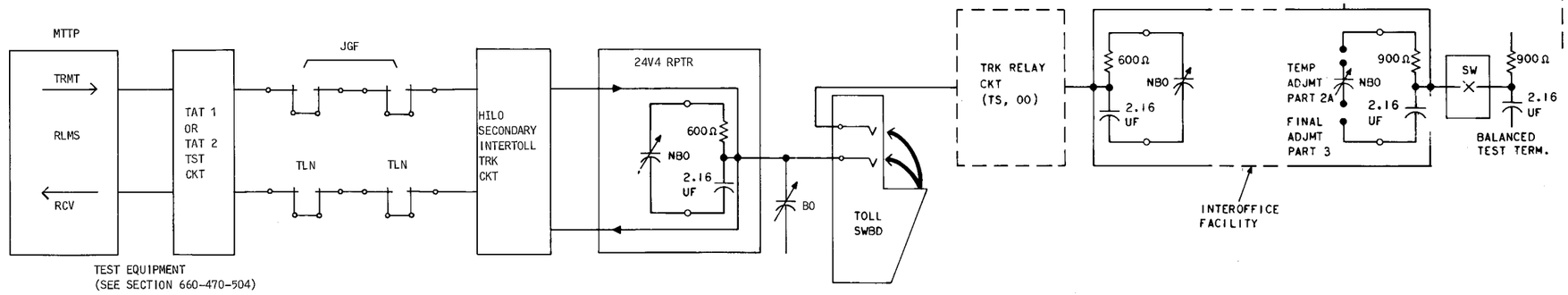
Lower limit to be zero unless ***any*** trunk has a greater ERL with 0.025 μF capacitance than with zero capacitance.

Lower limit to be 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 no 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 660-470-502). The NBO required will be greater than 0.025 μF.

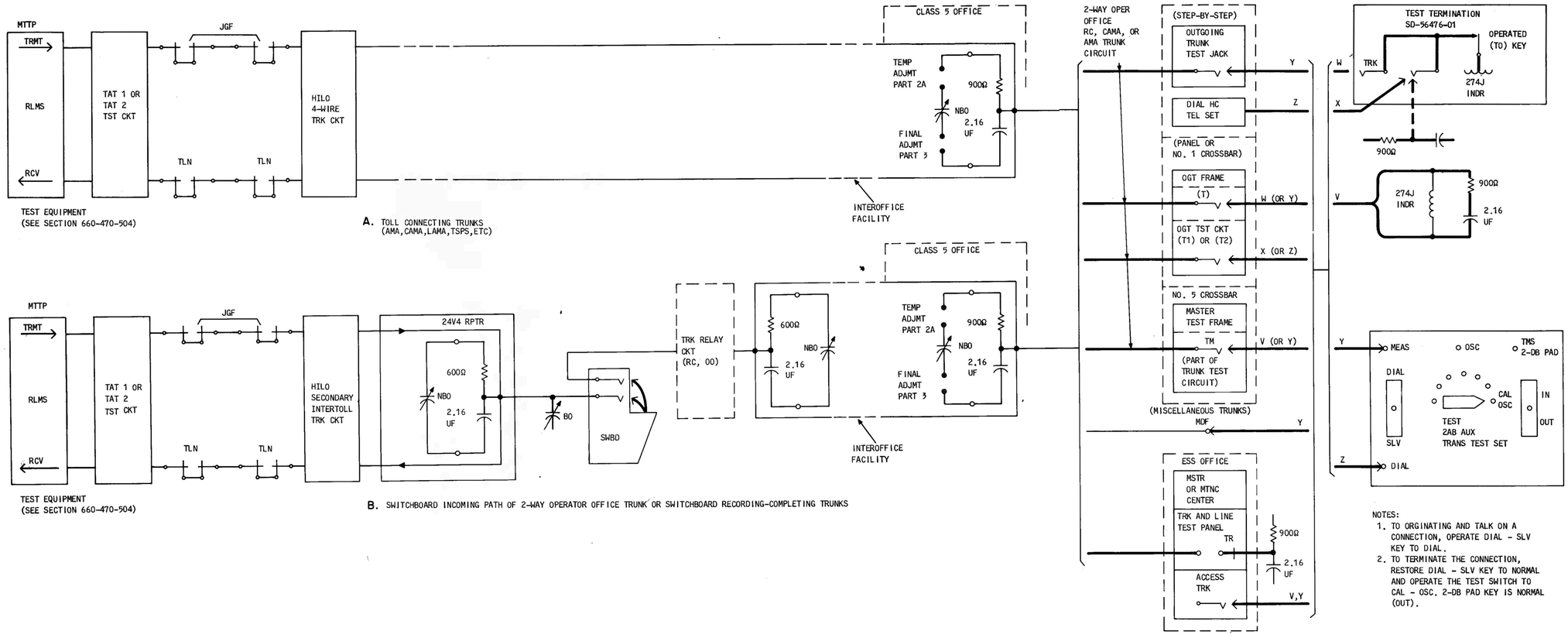


A. TOLL COMPLETING TRUNKS



B. SWITCHBOARD PATH OF 2-WAY OPERATOR OFFICE TRUNK OR SWITCHBOARD TOLL SWITCHING TRUNKS

Fig. 1—Outgoing Trunks From Toll Office



NOTES:
1. TO ORGINATING 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—Incoming Trunks to Toll Office

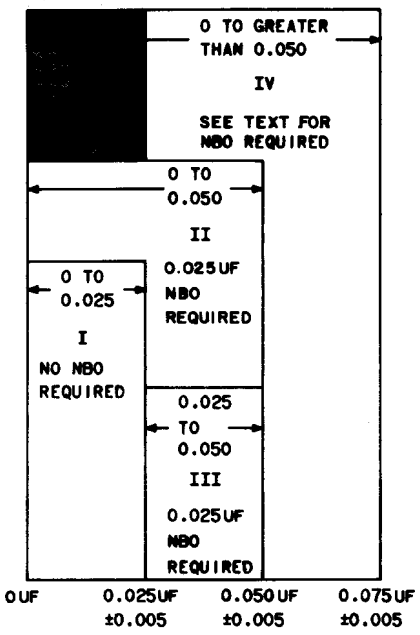


Fig. 3—Typical Capacitance Ranges in Large Class 5 Offices