

**CIRCUIT ORDER OR TRUNK ORDER TESTS
FOR
ALL TYPES OF MESSAGE TRUNKS**

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| B. Measurement of Office Wiring and Equipment Losses | 3 | 1. GENERAL | |
| C. Through and Terminal Balance Tests | 4 | 1.01 This section covers the circuit order or trunk order tests required on all types of message trunks before they are placed in service in the Direct Distance Dialing (DDD), Extended Area Service (EAS), and local dialing telephone networks. | |
| D. Summary of Preliminary Tests | 4 | 1.02 This section is reissued for the following reasons: | |
| 4. TESTING OF TRUNKS THAT REQUIRE SPECIAL CONSIDERATIONS | 4 | (a) To revise Table L to show that it is permissible to adjust the total gain of repeaters up to ± 1.0 dB to meet the estimated measured loss (EML) requirements on voice-frequency repeatered trunks. | |
| A. Trunks Containing E-Type SF Signaling Circuits With Built-In 4-Wire Terminating Circuits | 4 | (b) To revise Table N to show that 400 and 2800 Hz are used for making gain-slope measurements to determine the overall gain-slope differences compared to 1000 Hz. These tests replace the frequency response measurements previously required. Frequency response measurements involving the upper test frequency (UTF) are not required because this particular parameter is checked, where appropriate, before the facilities are made available for assignment to trunks. | |
| B. Trunks Containing T1 Carrier Channels With D1 Channel Units | 4 | (c) To bring the section up to date. | |
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SECTION 660-450-301

Since this reissue covers a general revision, arrows ordinarily used to indicate changes have been omitted.

1.03 Before making any of the tests outlined in this section, all persons responsible for circuit order or trunk order testing should be thoroughly familiar with Section 660-450-300, which covers the following information:

- (a) Importance of making the tests and meeting the test requirements
- (b) Explanation of the terms used in making circuit order or trunk order tests
- (c) The three basic parts or segments making up a trunk
- (d) Testing arrangements provided at testboards and at locations other than testboards.

1.04 All persons responsible for making circuit order or trunk order tests should also be thoroughly familiar with the following:

- (a) All of the sections that define the codes and abbreviations appearing on circuit or trunk layout record cards
- (b) All of the sections that provide methods and procedures for making tests and adjustments at the specific test location.

1.05 The circuit or trunk layout record card and the appropriate testing procedures must be understood and followed exactly when measuring the trunks so that errors such as the following may be avoided:

- (a) Failure to consider correct levels of test power when inserting test equipment into a trunk
- (b) Failure to use test equipment having the proper impedance
- (c) Failure to provide or to allow for test pads as specified on the circuit layout or trunk record card
- (d) Failure to apply proper levels of test power.

1.06 The following tables, which are attached, list the sections that provide circuit layout record (CLR) card information, testing methods and procedures, test requirements, and, in some cases, references to sections in which the requirements are covered:

Table A—Information on Circuit Layout Record Cards—Abbreviations, Codes, and Common Language

Table B—Information on Testing Cable and Open-Wire Facilities

Table C—Circuit Layout Record Cards and Circuit Order Testing Information—Voice-Frequency Telephone Repeaters

Table D—Circuit Layout Record Cards and Circuit Order Testing Information—Echo Suppressors

Table E—Circuit Layout Record Cards and Circuit Order Testing Information—Signaling Equipment

Table F—Circuit Layout Record Cards and Circuit Order Testing Information—Carrier Telephone Systems

Table G—Information on Measurement of Office Wiring and Equipment Losses

Table H—Information on Balance Testing Procedures

Table I—Information on Test Power Sources and Transmission Measuring Sets

Table J—Information on Message Circuit Noise Measurements

Table K—Information on Transmission Testing at Testboards and at Locations Other Than Testboards

Table L—Permissible Deviations From Expected Measured Loss (EML) Shown on Circuit Order or Trunk Order Layout Cards—All Types of Message Trunks

Table M—Summary of Preliminary Tests Required to be Made on Equipment Components and Facilities

Table N—Summary of Overall Lineup Tests Required to be Made Between Trunk Terminals.

2. APPLICATION OF CIRCUIT ORDER OR TRUNK ORDER TESTS

2.01 The term "circuit order or trunk order tests" is used in this section to indicate the transmission and operational tests required on all types of message trunks, as follows:

- (a) When circuit or trunk orders authorize a new trunk group or add trunks to an existing group
- (b) When circuit or trunk orders authorize rearrangements of equipment and/or facilities assigned to existing trunk groups.

2.02 The need for making a given test depends upon whether the equipment components or facilities have been in use previously. Also, it depends on whether the equipment components have been spare or in use with other equipment that has been tested periodically.

2.03 Preliminary tests and adjustments need not be made on equipment components that have been in service immediately prior to their installation in the present layout. However, when rearrangements in layouts of existing trunks involve 4-wire terminating sets and/or trunk equipment, additional tests are required. These tests are discussed in Parts 3B and 3C.

2.04 Only partial circuit order tests are required for the following types of layout changes:

- (a) When a circuit order merely renumbers a trunk, make only talking, listening, and automatic test frame access check tests.
- (b) When the only change is a carrier channel reassignment between the same offices retaining the same office transmission levels, make overall talking and listening tests; 1000-Hz loss, gain-slope, and message circuit noise measurements; and automatic test frame access check tests.

3. PRELIMINARY TESTS REQUIRED ON EQUIPMENT COMPONENTS AND FACILITIES

A. General

3.01 Before making any tests between the trunk terminals, it is necessary to verify that suitable service and acceptance tests have been made on the various units or elements that make up the trunks, such as cable and/or open-wire facilities and line and office equipment, including telephone repeaters, signaling equipment, carrier telephone systems, etc.

3.02 When build-out capacitors and/or loading coils are cross-connected, it is important that they be installed in the order indicated on the circuit or trunk order and that the capacitors be strapped to the specified values.

3.03 When multiterminal repeating coils, such as the 120G or 120P, are specified, they should be checked to verify that they are strapped for the ratio (such as 1:1.5) specified by the circuit or trunk order and that they are connected properly in the circuit.

3.04 On trunks where building-out networks, impedance compensators, pads, or low-frequency correctors are used, it is important that they be correctly installed and adjusted according to the circuit or trunk order.

3.05 Trunks equipped with repeaters of any type should have the repeaters connected and adjusted to the required gain before any overall transmission measurements are made. The repeaters should meet all stability tests as specified in the appropriate sections listed in Table C.

3.06 Signaling units should be checked for proper operation and loss as covered in the appropriate sections listed in Table E.

B. Measurement of Office Wiring and Equipment Losses

3.07 It is extremely important that office wiring and equipment losses be measured and adjusted to meet the transmission requirements for each trunk. The detailed procedures for making the necessary tests are covered in the appropriate sections listed in Table G.

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C. Through and Terminal Balance Tests

3.08 In 2-wire switching offices of class 3 or higher rank, all new or rearranged intertoll trunks are required to meet the through balance test requirements before they are placed in service. Through balance tests should be made as covered in the appropriate sections listed in Table H.

3.09 In all 2- and 4-wire switching offices of class 4 or higher rank, including decentralized toll offices (class 4P), terminal balance tests are required. In addition, individual echo return-loss tests are required on all 4-wire terminating sets which are associated with an intertoll trunk in a 2-wire class 4 office. Terminal balance tests should be made as covered in the appropriate sections listed in Table H.

3.10 Once an office has been balanced, the required tests and adjustments must be made on all new and rearranged trunks before placing them in service.

D. Summary of Preliminary Tests

3.11 Table M lists the preliminary tests required on equipment components and facilities assigned to new installations and on existing installations involving rearrangements or trunk additions.

4. TESTING OF TRUNKS THAT REQUIRE SPECIAL CONSIDERATIONS

A. Trunks Containing E-Type SF Signaling Circuits With Built-In 4-Wire Terminating Circuits

4.01 When making transmission measurements on trunks containing some types of E-type single frequency (SF) signaling circuits with built-in 4-wire terminating circuits, the loss to the input of the carrier channel is approximately 16 dB and is *not* adjustable. If these trunks are tested with a test pad (TP2), extra alertness is required for the following reasons while investigating transmission troubles:

- (a) The input to the carrier will be approximately -18 dBm instead of -16 dBm when sending through the test pad. Also, the output from the carrier at the distant end will be approximately $+5$ dBm instead of $+7$ dBm.

- (b) The carrier channel itself is always measured with -16 dBm test power at the voice-frequency patching bay in order to obtain $+7$ dBm at the distant terminal when making the initial alignment or trouble investigations.

- (c) The input to the carrier on all intertoll trunks in the same office will be -16 dBm when measured through the 2-dB test pad.

B. Trunks Containing T1 Carrier Channels With D1 Channel Units

4.02 The T1 carrier 2-wire D1 channel unit contains a built-in, unadjustable, 4-wire terminating circuit. When a transmission measurement is made, 0 dBm is applied to the 2-wire input, the input level to the carrier is nominally -9 dBm, and the level output of the carrier in the distant office is nominally $+3$ dBm.

4.03 If trunks assigned to D1 channel units are measured with a test pad (TP2), extra alertness is required for the following reason while investigating transmission troubles:

- When sending through the test pad, the input to the carrier will be approximately -11 dBm instead of -9 dBm. In addition, the output from the carrier channel at the distant end will be approximately $+1$ dBm instead of $+3$ dBm.

4.04 Although arrangements provided with the 4-wire E and M D1 channel unit permit the establishment of the proper transmitting level with or without a test pad (TP2) at the 4-wire switching office, introduction of the required additional loss at the distant 2-wire switching office to permit design with TP2 is impossible. Hence, the above precautions are necessary in *all* cases involving D1 channel units.

5. OVERALL TESTS REQUIRED BETWEEN TRUNK TERMINALS

A. General

5.01 Overall tests are required between the trunk terminals before the trunks are placed in service. These tests are required to ensure that any message trunk likely to be switched into service in the DDD or other networks will meet the overall established objectives for service. *Since most*

trunks are selected by automatic switching systems, the importance of making the tests before the trunks are placed in service cannot be too strongly emphasized.

B. Modes of Operation

5.02 One-way trunks are always used as outgoing trunks at one of the terminal offices and as incoming trunks at the other terminal office. Two-way trunks are used as outgoing trunks at either of their terminal offices. When a 2-way trunk is first aligned to meet EML requirements, it is considered to be an outgoing trunk at the control office and an incoming trunk at the noncontrol office. However, as part of the circuit order or trunk order tests, it *must* also be tested and measured as an outgoing trunk from the noncontrol office.

C. Multiple Access Modes of Operation

5.03 Some trunks are so arranged that they can be accessed and/or terminated in two or more modes of operation. These modes involve different paths through the office, different wiring arrangements, and, sometimes, different apparatus. During circuit or trunk order tests, it is necessary to check each mode of operation to determine that the trunk meets all of its requirements. Where different apparatus is involved and where significant differences in wiring loss are encountered, different values of EML may apply. It will be necessary, therefore, to obtain the EML in each mode where

a difference exists. The different modes of operation are as follows:

(a) **Two-way trunks**—Different paths through the office and within the trunk equipment at each end for calls originating at the two ends.

(b) **Trunks with switchboard and machine access**—Different paths and, in some cases, different EMLs for calls originated from the switchboard and from the testboard or test frame.

(c) **Incoming trunks to 2-train No. 4-type crossbar offices**—All incoming trunks have two modes of operation, ie, interconnection with outgoing trunks located on the intertoll train as well as on the toll-completing train. These trunks should be able to complete to outgoing trunks located on either train.

(d) **Incoming trunks to No. 5 crossbar and step-by-step**—Some trunks can complete to (1) an intertoll, a toll connecting, or a tandem trunk, and (2) directly to a subscriber line. Figure 1 shows a typical example of this arrangement in a No. 5 crossbar office.

(e) **Outgoing trunks from No. 5 crossbar**—Some trunks can be accessed directly from (1) a subscriber line, (2) an incoming tandem or toll connecting trunk, and (3) an incoming intertoll trunk. The EML is usually different for each mode. Figure 2 shows a typical example of this arrangement.

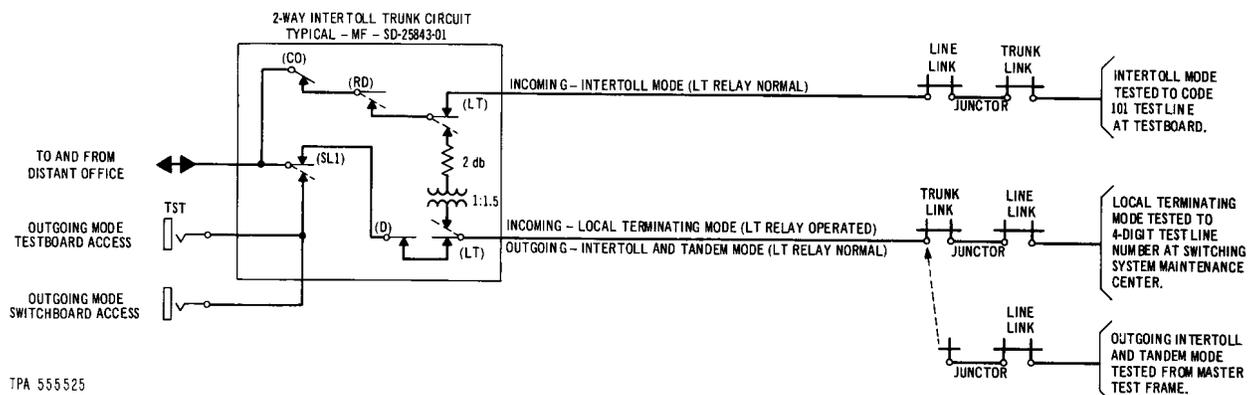


Fig. 1—Schematic Showing Modes of Operation—2-Way Intertoll Trunk Circuit—No. 5 Crossbar Offices

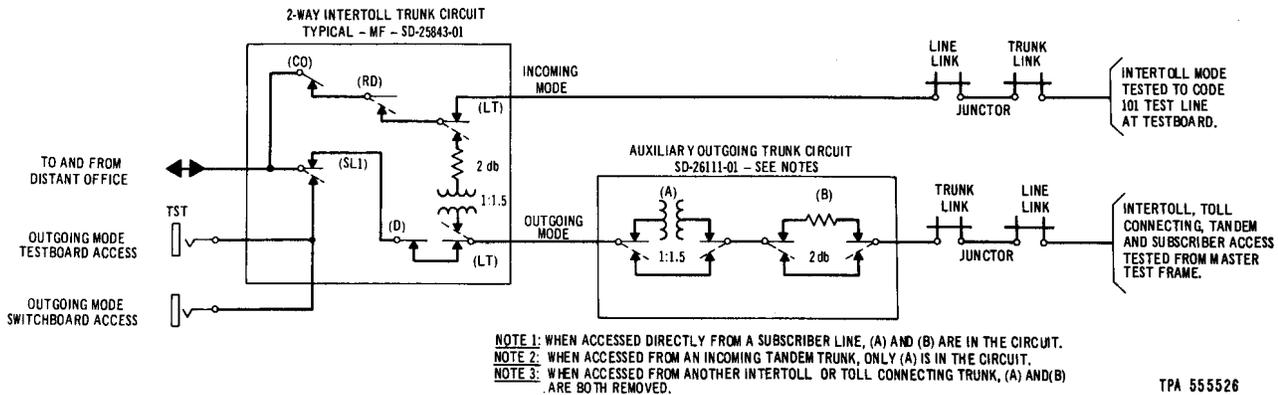


Fig. 2—Schematic Showing Modes of Operation—2-Way Intertoll Trunk Circuit and Auxiliary Outgoing Trunk Circuit—No. 5 Crossbar Offices

D. Transmission and Noise Measurements

5.04 *When transmission and noise measurements are being made on the trunks, it is important that the trunk be in the off-hook condition at both terminals.* This is necessary in order to remove SF signaling tone, to disable the SF signaling unit filter, and to place the trunk in the condition under which it is normally used. All test lines used for transmission and noise testing, such as the milliwatt (mW) supply (102-type) test line, the balance (100-type) test line, or the 101-type test line, should be checked to ensure that off-hook supervision is provided. The above requirement does not apply, of course, to trunks incoming to switchboards where supervision is not normally passed through the switchboard.

E. 1000-Hz Loss Measurements

5.05 Two-way manual 1000-Hz loss measurements are made with the use of 101-type test lines that appear at distant testboards and maintenance centers. Because each direction of transmission is essentially independent of the other and may not have the same losses and gains, 2-way measurements are required on the following:

- Two-wire voice-frequency trunks equipped with hybrid-type repeaters
- Four-wire voice-frequency repeated trunks
- Trunks assigned to carrier channels

(d) All trunks terminated in 4-wire switching systems.

F. Gain-Slope Measurements

5.06 The procedures for making gain-slope measurements are similar to those used for 2-way manual 1000-Hz loss measurements discussed in 5.05, except that a variable-frequency oscillator or other suitable means are used to obtain the source of test power for the frequencies used in making the tests.

5.07 Gain-slope measurements are made using test frequencies of 400 and 2800 Hz. Table N shows the gain-slope requirements relative to those at 1000 Hz. Gain-slope measurements are required on *all* message trunks.

5.08 When gain-slope measurements are made on a trunk that is equipped with SF signaling equipment, precautions should be taken to prevent false disconnects as covered in Section 660-401-010.

G. Message Circuit Noise Measurements

5.09 *It is always desirable to measure the 1000-Hz loss of a trunk before a noise measurement is made.* The value of the actual measured loss (AML) should be recorded along with the noise measurement. Before the reasons for excessive noise are investigated, the cause for any abnormal deviation from the trunk EML should be determined and corrected. In some cases, the cause of the excessive difference between the

EML and AML may also be the reason for the excessive noise.

5.10 Noise measurements should be made at *both* ends of all trunks. However, in the case of 2-wire trunks with or without E-type repeaters, the noise at the distant end may be estimated by adding the AML to the noise measurement at the near end. If the estimated noise exceeds the requirements, the actual noise at the distant end should be measured.

H. Summary of Overall Lineup Tests

5.11 The overall lineup tests listed in Table N are required between the originating and terminating terminals of *all* trunks. The tests are required to ensure that the complete trunk meets the requirements for which it was designed and that the trunks are in satisfactory adjustment before placing them in service.

5.12 The overall AML of any trunk should not differ from the EML by more than the permissible deviations listed in Table L, and the message circuit noise should not exceed the circuit order and maintenance limits in Section 660-403-500. When an overall measurement indicates the need for corrective action, the trunk segments should be checked individually and corrected. *No change in any of the segments is made on the basis of an overall measurement, nor is any segment changed to compensate for departures from requirements in any other segment.*

Note: An exception is made in the case of voice-frequency repeatered trunks where it is permissible to adjust the total gain of the repeaters up to ± 1.0 dB to meet the EML requirements. Adjusted value(s) of repeater gain should be recorded on circuit layout record cards and other locally prepared records in the office(s) making the change.

5.13 *Any trunk failing to meet requirements should not be turned up for service except upon specific authorization of supervision in each individual case.*

I. Automatic Test Frame Access Check Tests

5.14 In offices equipped with automatic trunk test frames or remote office test lines (ROTL), a check should be made to ensure that the test frame or ROTL can obtain access to each new or rearranged trunk before the trunk is placed in service. The methods for making these checks will be found in the sections applying to the specific test frames and ROTL control devices (CAROT).

6. FORMS AND RECORDS

6.01 Form E-2545A is used to record circuit order or trunk order test results on all types of message trunks. The form is always completed by the designated control office for each trunk or circuit order. The noncontrol office prepares the appropriate form for its own office, completing those items that are required at that office. Section 660-450-010 describes Form E-2545A.

TABLE A
INFORMATION ON
CIRCUIT LAYOUT RECORD CARDS — ABBREVIATIONS, CODES, AND COMMON LANGUAGE

| SUBJECT | SECTION |
|---|-------------|
| Codes for Trunk Details | 682-100-010 |
| Codes for Trunk Details | 682-100-011 |
| Codes for Repeater Data | 682-100-012 |
| Codes for Line Assignment Entries | 682-100-013 |
| Codes for Line Equipment | 682-100-014 |
| Codes for Signaling Equipment | 682-100-015 |
| Codes for Other Equipment Entries | 682-100-017 |
| Trunk Numbering | 682-100-018 |
| Abbreviations and Symbols Used in Preparing Toll Message and Special Service Layout Record Cards | 682-000-100 |
| DC Signaling Paths Used With Toll Message Circuits | 682-100-016 |
| <i>Plant Assignment — Circuit Layout Record</i> | |
| Description | 682-000-011 |
| <i>Common Language — Descriptive Information</i> | |
| Circuit Identification | 005-200-100 |
| Standard Coding Procedures — Equipment Identification | 005-202-101 |
| Central Office Equipment Configuration Identification | 005-210-101 |
| Facility Identification | 005-220-101 |
| Location Identification | 795-100-100 |

TABLE B
INFORMATION ON
TESTING CABLE AND OPEN-WIRE FACILITIES

| SUBJECT | SECTION |
|---|-------------|
| <i>Cable and Open-Wire Testing</i> | |
| Voltmeter and Wheatstone Bridge Testing | 660-807-500 |
| <i>Exchange Area Cables</i> | |
| Completion Tests | 330-300-500 |

TABLE C

**CIRCUIT LAYOUT RECORD CARDS AND CIRCUIT ORDER TESTING INFORMATION
VOICE-FREQUENCY TELEPHONE REPEATERS**

| TYPE OF TELEPHONE REPEATER | SECTION | |
|--|--|---|
| | CIRCUIT LAYOUT RECORD CARD CODES AND ABBREVIATIONS | INITIAL LINEUP AND CIRCUIT ORDER TEST INFORMATION |
| Codes for Repeater Data | 682-100-012 | |
| <i>Signaling and Transmission Systems Compatibility Information</i> | | |
| General | | 179-100-301 |
| V4 Telephone Repeater | | 179-100-303 |
| E-Type Repeater | | 179-100-305 |
| <i>Amplifier-Type Repeaters</i> | | |
| 22A1, 22A1 (HE), D-87797, and 22A2 | | 332-100-300 |
| 44A1 | | 332-101-300 |
| V1 | | 332-102-300 |
| V3 | | 332-103-300 |
| V4 | | 332-104-500 |
| <i>E-Type (Negative Impedance) Repeaters</i> | | |
| Placing E1 or E13 Repeaters in Service Using E Repeater Test Set | | 332-200-300 |
| Placing E2 or E23 Repeaters in Service Using E Repeater Test Set | | 332-200-301 |
| Placing E1 or E13 Repeaters in Service Using 2G Repeater Test Set | | 332-200-302 |
| Placing Repeaters in Service Without the Use of Repeater Test Set | | 332-200-303 |
| <i>E-Type Repeaters</i> | | |
| E6 Repeater Lineup on Nonloaded Cable | | 311-240-501 |
| E7 Repeater Lineup | | 332-207-301 |
| <i>Test Equipment</i> | | |
| 2D and 2E Singing Point Test Sets | | 103-106-105 |
| 54C Return Loss Measuring Set | | 103-106-110 |
| 2G Repeater Test Set | | 103-107-100 |
| E Repeater Test Set | | 103-107-105 |

TABLE D
CIRCUIT LAYOUT RECORD CARDS AND CIRCUIT ORDER TESTING INFORMATION
ECHO SUPPRESSORS

| TYPE OF EQUIPMENT | SECTION | |
|--|--|------------------|
| | CIRCUIT LAYOUT RECORD CARD CODES AND ABBREVIATIONS | TEST INFORMATION |
| Codes for Echo Suppressors | 682-100-017 | |
| <i>Echo Suppressors</i> | | |
| 1A and Disabler | | 332-410-500 |
| 1A and Disabler Equipped With 326-Type Mercury Relays | | 332-410-501 |
| 3A and Disabler | | 332-412-500 |
| 4A and J68914TA Test Extender | | 332-414-105 |
| 4A and Trouble Location | | 332-414-500 |
| <i>Test Equipment</i> | | |
| 5M Echo Suppressor Test Set | | 103-105-100 |
| 58-Type Echo Suppressor Measuring System — Operation | | 103-105-310 |
| Echo Suppressor Test From Trunk Terminals | | 332-410-301 |

TABLE E

**CIRCUIT LAYOUT RECORD CARDS AND CIRCUIT ORDER TESTING INFORMATION
SIGNALING EQUIPMENT**

| TYPE OF EQUIPMENT | SECTION | |
|--|--|------------------|
| | CIRCUIT LAYOUT RECORD CARD CODES AND ABBREVIATIONS | TEST INFORMATION |
| Codes for Signaling Equipment | 682-100-105 | |
| Signaling Equipment Losses at 1000 Hz | | 304-207-100 |
| <i>Signaling and Transmission Systems Compatibility Information</i> | | |
| General | | 179-100-301 |
| E-Type Signaling System | | 179-100-304 |
| F-Type Signaling System | | 179-100-305 |
| <i>Overall Signaling Arrangements and Testing</i> | | |
| Overall Dial Pulsing Tests — General | | 333-121-500 |
| Applications of the 2B or 2B-1 Test Sets and Pulse Repeating Adapter | | 333-122-501 |
| Dial Pulsing Tests on Intertoll and Toll Connecting Trunks | | 333-123-500 |
| <i>Signaling Test Extenders</i> | | |
| E-Type Test Extender | | 179-313-101 |
| Test Extender for Use With FWA and FWB Units | | 179-362-101 |

TABLE F
CIRCUIT LAYOUT RECORD CARDS AND CIRCUIT ORDER TESTING INFORMATION
CARRIER TELEPHONE SYSTEMS

| TYPE OF SYSTEM | SECTION | |
|---|--|------------------|
| | CIRCUIT LAYOUT RECORD CARD CODES AND ABBREVIATIONS | TEST INFORMATION |
| C5 | 682-200-012 | 352-100-502 |
| H | 682-200-013 | 352-202-500 |
| J | 682-200-014 | 354-030-500 |
| K | 682-200-016 | 355-100-300 |
| N | 682-200-019 | 362-011-300 |
| O | 682-200-015 | 362-101-300 |
| ON Carrier Units and Channel Groups | 682-200-018 | 362-101-300 |
| T | 365-000-010 | 365-100-300 |
| <i>L-Type Carrier</i> | | |
| Assignment of Control Offices and Operating Responsibilities — L Carrier Sections, L Units, Message Unit Radio, Line Pilot Sections, Master-groups, Supergroups, Groups, and Channel Groups | 682-000-015 | |
| L1 | 682-200-017 | 358-010-300 |
| L3 | 682-200-017 | 359-010-300 |
| L4 | 682-200-017 | 359-001-011 |
| <i>Adjustment of Transmission Levels on Combination Trunks — Intermediate Offices</i> | | 660-450-504 |
| <i>Channel Net Gain and Frequency-Response Characteristics</i> | | 660-450-505 |

TABLE G
INFORMATION ON
MEASUREMENT OF OFFICE WIRING AND EQUIPMENT LOSSES

| SUBJECT | SECTION |
|--|-------------|
| <i>Measurement of Office Wiring and Equipment Losses</i> | |
| 2-Wire Switching Offices | 660-450-502 |
| 4-Wire Switching Offices | 660-450-503 |

TABLE H
INFORMATION ON
BALANCE TESTING PROCEDURES

| SUBJECT | SECTION |
|---|-------------|
| <i>Through Balance Testing</i> | |
| General Descriptive Information | 660-475-100 |
| <i>Testing Methods</i> | |
| 2-Wire Manual and No. 4 Crossbar Offices | 660-475-500 |
| Step-by-Step Offices | 660-475-501 |
| No. 5 Crossbar Offices | 660-475-502 |
| Crossbar Tandem Offices | 660-475-503 |
| <i>Terminal Balance Testing</i> | |
| General Descriptive Information | 660-470-100 |
| <i>Testing Methods</i> | |
| General Information | 660-470-500 |
| Crossbar Tandem Offices | 660-470-501 |
| No. 5 Crossbar Offices | 660-470-502 |
| Step-by-Step Offices | 660-470-503 |
| No. 4-Type Crossbar Offices | 660-470-504 |
| <i>Hybrids and 4-Wire Terminating Circuits</i> | |
| Equipment Losses at 1000 Hz | 304-205-100 |
| Composite Sets and Associated Hybrid Transformers | 332-450-500 |
| <i>4-Wire Terminating Sets</i> | |
| 1A and 1K | 332-800-101 |
| 1B and 1L | 332-800-102 |
| 1C and 1F | 332-800-103 |
| 1D | 332-800-104 |
| 1G | 332-800-105 |
| 1H | 332-800-106 |
| 1J | 332-800-107 |

TABLE I
INFORMATION ON
TEST POWER SOURCES AND TRANSMISSION MEASURING SETS

| SUBJECT | SECTION |
|--|-------------|
| KS-19260 Oscillator | 103-302-100 |
| KS-19353 Oscillator | 103-302-105 |
| 71A Milliwatt Reference Generator | 103-325-100 |
| 71B Milliwatt Reference Generator | 103-326-100 |
| 71C and 71F Milliwatt Reference Generators | 103-327-100 |
| Milliwatt Distributing Systems and Test Lines | 103-335-500 |
| 21A Transmission Measuring Set | 103-221-100 |
| 23A and 23D Transmission Measuring Sets | 103-223-100 |
| 23B and 23C Transmission Measuring Sets | 103-223-101 |
| Model TTS-4 Series of Transmission Test Sets — (Northeast Electronics) — Instruction Manual | 103-204-100 |
| Transmission and Noise Measuring System (SD-95900-01) | 103-231-100 |
| 2AB Auxiliary Transmission Test Set | 103-202-100 |
| Test Termination Circuit — SD-96540-01 | 103-337-100 |

TABLE J
INFORMATION ON
MESSAGE CIRCUIT NOISE MEASUREMENTS

| SUBJECT | SECTION |
|---|-------------|
| <i>Message Circuit Noise</i> | |
| Test Classifications and Intervals | 660-403-300 |
| Methods and Requirements | 660-403-500 |
| <i>Test Equipment</i> | |
| 3A and 3B Noise Measuring Sets | 103-611-100 |
| 3C Noise Measuring Set | 103-611-101 |
| 3CR Noise Measuring Set | 103-611-102 |
| Transmission and Noise Measuring System (SD-95900-01) | 103-231-100 |

TABLE K
INFORMATION ON
TRANSMISSION TESTING AT TESTBOARDS AND AT LOCATIONS OTHER THAN TESTBOARDS

| SUBJECT | SECTION |
|--|-------------|
| <i>No. 4A and 4M Toll Switching Systems</i> | |
| Incoming Toll Connecting Trunks — Transmission and Pad Tests Using Test Trunk Circuit — SD-68547-01 | 212-532-501 |
| Outgoing Toll Connecting Trunks — Overall 1000-Hz Transmission Tests | 212-564-501 |
| 17C Testboard — Transmission and Noise Measuring Circuits — SD-95900-01 | 664-500-500 |
| <i>Panel and Panel Tandem Offices</i> | |
| Trunk Transmission Tests — Offices Provided With Outgoing Trunk Test Frame or Testboard | 215-722-501 |
| <i>No. 1 Crossbar Offices</i> | |
| Trunk Transmission Tests — Offices Provided With Manual Outgoing Test Frame SD-25177-01 | 216-769-501 |
| <i>Crossbar Tandem Offices</i> | |
| Trunk Transmission Tests — Offices Provided With Manual Outgoing Trunk Test Frame SD-25177-01 or SD-95476-01 | 220-409-501 |
| 17B Testboard — Transmission and Noise Measuring Circuits — SD-95900-01 | 664-400-500 |
| <i>No. 5 Crossbar Offices</i> | |
| Trunk Transmission Tests Using Master Test Frame | 218-246-501 |
| Trunk Transmission Tests Using Office Test Frame Test Circuit SD-27633-01 (H595-950) | 218-546-501 |
| Trunk Transmission Tests Using Office Test Frame Test Circuit SD-27633-01 (J23260) | 218-549-501 |
| 17B Testboard — Transmission and Noise Measuring Circuits — SD-59500-01 | 664-300-500 |
| <i>Step-by-Step Offices</i> | |
| Trunk Transmission Tests — Offices Not Provided With Manual Trunk Test Frame | 226-588-500 |
| Trunk Transmission Tests — Offices Provided With Manual Outgoing Trunk Test Frame | 226-590-500 |
| <i>No. 1 and No. 3 Switchboards</i> | |
| Transmission Loss and Noise Tests | 211-120-501 |
| 17B Testboard — Transmission and Noise Measuring Circuits — SD-64355-01 or SD-95135-01 | 664-100-500 |
| <i>Operating Room and Information Desks</i> | |
| 2, 3, 4, 6, 7, 19, and 23 Types — Transmission Tests | 210-310-506 |
| <i>No. 1 Electronic Switching System (ESS)</i> | |
| Trunk Transmission Tests Using Master Control Center Line Trunk Test Panel and Supplementary Trunk Test Panel | 231-131-501 |

TABLE I

**PERMISSIBLE DEVIATIONS FROM EXPECTED MEASURED LOSS (EML) SHOWN ON
CIRCUIT ORDER OR TRUNK ORDER LAYOUT CARDS—ALL TYPES OF MESSAGE TRUNKS
(NOTES 1, 2, AND 4)**

| MESSAGE TRUNKS | LENGTH IN MILES | | |
|---|-----------------|---------|----------|
| | UNDER 100 | 100-500 | OVER 500 |
| Trunks Assigned to Nonrepeated Segments | | | |
| Within the Same Building | ±0.5 | | |
| Cable or Open Wire | ±1.0 | | |
| Trunks Assigned to Repeated Segments — (Note 3) | | | |
| E-Type (Negative Impedance) E13 or E23 Repeaters | ±0.5 | | |
| E6 Repeaters | ±0.5 | | |
| V-Type and Other Type Repeaters | ±0.5 | ±0.6 | |
| Trunks Assigned to Carrier Channel Segments | | | |
| C, H, J, K, N, O, ON, T, or Similiar Systems — Single-Link Channels | ±0.5 | ±0.5 | ±0.5 |
| L, R System Without Group and Supergroup Regulation — Single-Link Channels | ±0.5 | ±0.5 | ±0.5 |
| L, R System With Supergroup Regulation Only — Single- or Multiple-Link Channels | ±0.5 | ±0.5 | ±0.5 |
| L, R System With Group and Supergroup Regulation — Single- or Multiple-Link Channels | ±0.5 | ±0.5 | ±0.5 |
| L, R System Without Group and Supergroup Regulation — Multiple-Link Channels | ±1.0 | ±1.0 | ±1.5* |
| All Other Multiple-Link Channels | ±1.0 | ±1.0 | ±1.5* |
| Combination Trunks | ±1.0 | ±1.0 | ±1.5* |

Note 1: For trunks equipped with 1A companders, increase deviation by 1.0 dB.

Note 2: For trunks equipped with E-type SF signaling circuits with built-in 4-wire terminating circuits, or T carrier with built-in 4-wire terminating circuits, increase deviation by 0.5 dB.

Note 3: It is permissible to adjust the total gain of the repeaters up to ±1.0 dB to meet the EML requirements on voice-frequency repeated trunks. Gain changes should be recorded on layout record cards and other locally prepared records in the office(s) making the change.

Note 4: When measuring trunks for modes of operation other than that for which the EML was computed, make comparison measurements. If the mode of operation so measured contains one or more repeating coils not included in the EML, add 0.3 dB per coil to the EML before comparing it with the AML.

*When the deviation exceeds ±1.0 dB, a recheck of the losses of the office equipment at both ends and at all intermediate points shall be made to see if they are within specified limits. If they are satisfactory, the trunk may be turned up if the over-500-mile deviations are met.

TABLE M

SUMMARY OF PRELIMINARY TESTS REQUIRED TO BE MADE ON EQUIPMENT COMPONENTS AND FACILITIES

| TYPE OF TEST | PROCEDURE | REFERENCES | INFORMATION ON REQUIREMENTS TO BE MET |
|--|--|--------------------------------------|---|
| 1. DC Tests on Cable and/or Open-Wire Pairs | Verify that required tests for opens, shorts, grounds, and leakage have been made. | TABLE B | Normal requirements for type of facility. |
| 2. Repeater Tests and Repeater Gains | Verify that required tests have been made and that each repeater gain has been adjusted to its required value. | TABLE C | Where repeater gains are adjusted to compensate for office wiring and equipment losses as covered in Test 7, the maximum allowable deviation in repeater gain from that originally indicated on CLR cards shall not exceed ± 1.0 dB. Adjusted value of repeater gain should be recorded on CLR cards and other locally prepared records in the office making the change. |
| 3. Singing Point Tests | Verify that singing point tests have been made on all 4- to 2-wire terminating arrangements employing hybrid-type transformers. | TABLE C | As covered in sections containing testing methods. |
| 4. Echo Suppressor and Disabler Unit Tests | When echo suppressors are provided, verify that suppressor and disabled tests have been made. | TABLE D | As covered in sections containing testing methods. |
| 5. Single-Frequency Signaling Circuits | (1) Verify that "out-of-service" tests have been made. (2) Verify that compromise networks have been correctly wired and adjusted on E-type SF units with built-in 4-wire terminating circuits. (See Test 3.) | TABLE E TABLE C AND TABLE H | As covered in sections containing testing methods. |
| 6. Carrier Telephone System Tests | Verify that the following circuit order tests have been made on the system: (1) Initial lineup (2) Overall channel noise measurements (3) Channel net gain and frequency-response measurements (4) When combination trunks are involved, adjustment of transmission levels at intermediate offices. | TABLE F | As covered in sections containing testing methods. |
| 7. Measurement of Office Wiring and Equipment Losses — 2-Wire and 4-Wire Switching Systems | <p style="text-align: center;">2-WIRE SWITCHING OFFICES</p> <p><i>For outgoing trunks</i> — Measure office wiring losses between testboard multiple jack, master test frame, or maintenance center test jack appearance and the VF patch, repeater bay, or carrier terminal appearance. <i>For incoming trunks</i> — Measure office wiring losses between VF patch, repeater bay, or carrier terminal appearance, and testboard 101 test line or maintenance center 101-type appearance.</p> | TABLE G | <p style="text-align: center;">2-WIRE SWITCHING OFFICES</p> <p>Transmission levels in each direction of transmission should be adjusted to within ± 0.13 dB by changing the T and R pads in external 4-wire terminating sets or by repeater gain adjustments. On trunks equipped with D2 channel banks or F-type signaling circuits, the transmission levels in each direction of transmission should be adjusted to within ± 0.10 dB by adjusting the T and R pad values in the associated attenuators. <i>See Notes 1 and 2.</i></p> |
| | <p style="text-align: center;">4-WIRE SWITCHING OFFICES</p> <p><i>For outgoing trunks</i> — Measure office wiring losses between testboard TST multiple jack (or equivalent access jack in AOOT, AOTT, AOCT, ATCT, or manual test frame) appearance and VF patch, repeater bay, or carrier terminal appearance. <i>For incoming trunks</i> — Measure office wiring losses between VF patch, repeater bay, or carrier terminal appearance and testboard 101 test line (or equivalent 101-type test line in AOOT, AOTT, AOCT, ATCT, or manual test frame) appearance.</p> | TABLE G | <p style="text-align: center;">4-WIRE SWITCHING OFFICES</p> <p>Transmission levels in each direction of transmission should be adjusted to within ± 0.13 dB by changing P_T and P_R pads or by repeater gain adjustments. On trunks equipped with 4-wire D2 channel banks or 4-wire F-type signaling circuits, the transmission levels in each direction of transmission should be adjusted to within ± 0.10 dB by adjusting the T and R pad values in the associated attenuators. <i>See Note 1.</i></p> |

Note 1: The maximum allowable deviation in the adjusted value of plug-in pads (89-type resistors), repeater gains, or attenuator values (D2 channel banks and F-type signaling circuits) from that originally indicated on circuit or trunk layout record cards shall not exceed ± 1.0 dB. The adjusted values should be recorded in ink on layout record cards and other locally prepared records in the office making the change. These values are then to be treated as the new specified values.

Note 2: On trunks that use early types of E-type signaling circuits with built-in 4-wire terminating circuits, the loss in the transmitting direction of transmission is approximately 16.0 dB and is *not* adjustable. In the receiving direction of transmission, the level adjustment is made on a voice-frequency amplifier contained in the signaling circuit.

TABLE N

SUMMARY OF OVERALL LINEUP TESTS REQUIRED TO BE MADE BETWEEN TRUNK TERMINALS

| TYPE OF TEST | PROCEDURE | REFERENCES | INFORMATION ON TEST REQUIREMENTS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|--|--|--|------------------|---|--|-----------------|---------|---------------------|---|---|------------|---|---|------------|---|---|------------|---|---|-----------------|---|---|---------------------|---|---|-------------------|---|---|----------------|---|---|
| <p>1. Overall 1000-Hz Loss and Gain-Slope Measurements</p> <p>1-A. Test of "A" Pad Operation and "A" Pad Control Signals — No. 4-Type Switching Systems</p> | <p>Make measurements in both directions of transmission between trunk terminals, using frequencies of 1000, 400, and 2800 Hz. Measurements should be made from each end of 2-way trunks. Measurements should also be made for each mode of operation. (See Test 9.)</p> <p><i>At 17C Testboard Locations</i> — When making 1000-Hz measurements (Test 1), test the operation and control of switchable "A" pads associated with the transmitting and receiving branches of all trunks measured at the testboard.</p> <p><i>At AOOT, AOTT, AOCT, ATCT, or Manual Test Frame Locations</i> — When making 1000-Hz measurements (Test 1), test the operation and control of switchable "A" pads, if any, and the "A" pad control signals associated with outgoing and incoming toll connecting trunks.</p> | <p>TABLE I AND TABLE K</p> <p>TABLE L</p> <p>TABLE L</p> | <p>1000-Hz measurements should be as close as possible to the EML shown on circuit or trunk layout record, and should not exceed requirements shown in Table L. Gain-slope measurements at 400 and 2800 Hz should be compared with the 1000-Hz loss and be within the following requirements:</p> <table border="1"> <thead> <tr> <th rowspan="2">TYPE OF FACILITY</th> <th colspan="2">GAIN-SLOPE DEVIATION RELATIVE TO 1000 HZ (NOTE 1)</th> </tr> <tr> <th>400 HZ (NOTE 2)</th> <th>2800 HZ</th> </tr> </thead> <tbody> <tr> <td>Type A Channel Bank</td> <td>within 2.0 dB more and 1.0 dB less loss</td> <td>within 0.5 dB more and 0.0 dB less loss</td> </tr> <tr> <td>N1 Carrier</td> <td>within 1.5 dB more and 1.0 dB less loss</td> <td>within 3.0 dB more and 1.0 dB less loss</td> </tr> <tr> <td>N2 Carrier</td> <td>within 1.5 dB more and 1.0 dB less loss</td> <td>within 2.0 dB more and 1.0 dB less loss</td> </tr> <tr> <td>N3 Carrier</td> <td>within 2.0 dB more and 1.0 dB less loss</td> <td>within 1.5 dB more and 1.0 dB less loss</td> </tr> <tr> <td>O, (ON) Carrier</td> <td>within 2.0 dB more and 1.0 dB less loss</td> <td>within 1.5 dB more and 1.0 dB less loss</td> </tr> <tr> <td>D1, D2 Channel Bank</td> <td>within 2.0 dB more and 1.0 dB less loss</td> <td>within 2.0 dB more and 1.0 dB less loss</td> </tr> <tr> <td>Nonrepeated Cable</td> <td>within 2.0 dB more and 1.5 dB less loss</td> <td>within 3.0 dB more and 2.5 dB less loss</td> </tr> <tr> <td>Repeated Cable</td> <td>within 3.0 dB more and 1.0 dB less loss</td> <td>within 4.5 dB more and 1.0 dB less loss</td> </tr> </tbody> </table> <p><i>Note 1:</i> On combination trunks, the total gain-slope deviation is the sum of those listed for the various types.</p> <p><i>Note 2:</i> When trunk equipment covered by SD-31674-01 and SD-31734-01, or E repeated trunks are involved, the gain-slope deviation at 400 Hz should be within 4.0 dB more and 1.5 dB less loss.</p> <p><i>At 17C Testboard Locations</i> — Requirements ± 0.1 dB — Refer to Section 664-500-500 for test methods.</p> <p><i>At AOOT, AOTT, AOCT, ATCT, or Manual Test Frame Locations</i> — As covered in Section 212-564-501.</p> | TYPE OF FACILITY | GAIN-SLOPE DEVIATION RELATIVE TO 1000 HZ (NOTE 1) | | 400 HZ (NOTE 2) | 2800 HZ | Type A Channel Bank | within 2.0 dB more and 1.0 dB less loss | within 0.5 dB more and 0.0 dB less loss | N1 Carrier | within 1.5 dB more and 1.0 dB less loss | within 3.0 dB more and 1.0 dB less loss | N2 Carrier | within 1.5 dB more and 1.0 dB less loss | within 2.0 dB more and 1.0 dB less loss | N3 Carrier | within 2.0 dB more and 1.0 dB less loss | within 1.5 dB more and 1.0 dB less loss | O, (ON) Carrier | within 2.0 dB more and 1.0 dB less loss | within 1.5 dB more and 1.0 dB less loss | D1, D2 Channel Bank | within 2.0 dB more and 1.0 dB less loss | within 2.0 dB more and 1.0 dB less loss | Nonrepeated Cable | within 2.0 dB more and 1.5 dB less loss | within 3.0 dB more and 2.5 dB less loss | Repeated Cable | within 3.0 dB more and 1.0 dB less loss | within 4.5 dB more and 1.0 dB less loss |
| TYPE OF FACILITY | GAIN-SLOPE DEVIATION RELATIVE TO 1000 HZ (NOTE 1) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 400 HZ (NOTE 2) | 2800 HZ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Type A Channel Bank | within 2.0 dB more and 1.0 dB less loss | within 0.5 dB more and 0.0 dB less loss | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| N1 Carrier | within 1.5 dB more and 1.0 dB less loss | within 3.0 dB more and 1.0 dB less loss | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| N2 Carrier | within 1.5 dB more and 1.0 dB less loss | within 2.0 dB more and 1.0 dB less loss | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| N3 Carrier | within 2.0 dB more and 1.0 dB less loss | within 1.5 dB more and 1.0 dB less loss | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| O, (ON) Carrier | within 2.0 dB more and 1.0 dB less loss | within 1.5 dB more and 1.0 dB less loss | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| D1, D2 Channel Bank | within 2.0 dB more and 1.0 dB less loss | within 2.0 dB more and 1.0 dB less loss | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Nonrepeated Cable | within 2.0 dB more and 1.5 dB less loss | within 3.0 dB more and 2.5 dB less loss | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Repeated Cable | within 3.0 dB more and 1.0 dB less loss | within 4.5 dB more and 1.0 dB less loss | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>2. Overall Echo Suppressor and Disabler Operation</p> | <p>When trunks are equipped with echo suppressors, make overall tests to verify actual operation of disablers and suppressors.</p> | <p>TABLE D AND TABLE K</p> | <p>As covered in sections containing test methods.</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>3. Overall Signaling Tests</p> | <p>Intertoll trunks equipped with rering features should be tested to Code 103 test line. Make overall signaling tests on all other trunks to "synchronous" or "nonsynchronous" test line.</p> | <p>TABLE E AND TABLE K</p> | <p>As covered in sections containing test methods.</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>4. Overall Pulsing Tests</p> | <p>Make overall pulsing tests on dial pulsing trunks.</p> | <p>TABLE E</p> | <p>As covered in sections containing test methods.</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>5. Message Circuit Noise Tests</p> | <p>Make noise measurements from both ends of the trunks.</p> | <p>TABLE J</p> | <p>As covered in sections containing test methods.</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

TABLE N (Cont)

SUMMARY OF OVERALL LINEUP TESTS REQUIRED TO BE MADE BETWEEN TRUNK TERMINALS

| TYPE OF TEST | PROCEDURE | REFERENCES | INFORMATION ON TEST REQUIREMENTS |
|---|--|---------------------------|---|
| 6. Through Balance Tests — 2-Wire Switching Class 3 and Higher Ranking Offices | <i>Intertoll trunks</i> — Make through balance tests, and record results. | TABLE H | Refer to Part 3C for discussion on through balance tests and to Section 660-475-100 for requirements. |
| 7. Terminal Balance Tests — Class 4 and Higher Ranking Offices | <i>Toll connecting trunks</i> — Make terminal balance tests, and record results. <i>Intertoll trunks</i> — At class 4 offices, 4-wire terminating sets should be tested and should meet echo return-loss requirements. | TABLE H | Refer to Part 3C for discussion on terminal balance tests. Requirements for 2-wire toll switching systems — Section 660-470-500. Requirements for 4-wire toll switching systems — Section 660-470-504. |
| 8. Operational Tests | Verify that operational tests have been made. When circuit orders involve new or rearranged trunks which are measured with automatic test frames, make certain that test frame access changes have been made. | TABLE K | Test requirements depend upon the specific location and type of office in which the trunks terminate. Use test methods specified in sections listed in the following Plant Series Indexes and Equipment Test List (ETL) sections: Manual Toll Offices and Toll Switchboards 212-000-000 No. 4A and 4M Toll Switching Offices 212-001-017 Panel Offices 215-001-026 No. 1 Crossbar Offices 216-001-025 No. 5 Crossbar — Master Test Frame Offices 218-001-017 No. 5 Crossbar — Office Test Frame Offices 218-002-015 Crossbar Tandem Offices 220-001-014 Step-by-Step and Community Dial Offices — Testing Information Applying to Specific Offices 225-000-000 Equipment Common to More Than One Type Office — Trunks and Trunk Circuits 226-001-016 General Testing Information — Common Control Equipment 227-000-000 No. 1 Electronic Switching System (ESS) 231-000-000 |
| 9. Operational and Transmission Tests — All Trunks With More Than One Mode of Operation | (1) Verify that operational and 1000-Hz loss measurements have been made at all originating and terminating access locations. (2) Verify that far-to-near 1000-Hz loss measurements have been made on one-way outgoing and 2-way trunks terminating in 2-train No. 4-type crossbar offices. Test line code 102, located on the toll completing train in 2-train offices, is used for making the measurements. | TABLE I AND TABLE K | Refer to Part 5 and to Fig. 1 and 2 for examples of an intertoll trunk with two or more access modes of operation. Refer to Table L for permissible deviation from EML requirements obtained in Test 1. |
| 10. Talking and Listening Tests | Make talking and listening observations from testing location. | TABLE K | Observe general transmission conditions such as quality, stability, volume, excessive noise or cross-talk, clipping, hits, excessive echo, hollowness, and near-singing. Observations should be satisfactory in all ways in judgment of tester. |
| 11. Trunk Placed in Service | Remove "make-busy" conditions at all appearances. | TABLE K | It is the responsibility of the control office to make certain that "make-busy" conditions have been removed at both terminals and to place the trunk in service. |