

**“ A ” SWITCHBOARD**  
**CORD CIRCUITS AND ASSOCIATED**  
**OPERATORS’ TELEPHONE CIRCUITS**

**1. GENERAL**

1.01 This section covers the detailed methods to be followed in making transmission tests on “ A ” switchboard cord circuits and associated operators’ telephone circuits in step-by-step offices.

1.02 Information covered in this section of practices is outlined in the following table.

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1.03 Reference should be made to Section K20.01 for general testing methods and to Section K20.11 for general testing apparatus requirements.

**2. SPECIAL SERVICE CORD CIRCUITS AND ASSOCIATED OPERATORS’ TELEPHONE CIRCUITS**

**(a) Cord Circuits**

2.01 These circuits may be arranged to provide, or not provide, talking battery on either or both the answering and calling cords. For each of these combinations there is a different arrangement of the equipment associated with the tip and ring conductors of the cord circuit which is controlled by the sleeve circuit.

**Preliminary Connections**

2.02 Provide two regular double-ended patching cords equipped with 110 type plugs, one regular double-ended patching cord equipped with 109 type plugs and two switchboard cords equipped on one end with 109 type plugs and having the sleeve conductors available on the other end.

2.03 Connect the TMS and TMR jacks of the auxiliary test unit, respectively, to the sending and receiving jacks of the transmission measuring set using the patching cords equipped with the 110 type plugs.

2.04 Connect the B-GRD (24V) jack of the auxiliary test unit to 24 volt battery and ground (battery on tip, and ground on sleeve) using the patching cord equipped with the 109 type plugs.

2.05 Connect the sleeve conductors of the two switchboard cords to the S-1 and S-2 binding posts of the auxiliary test unit and insert the plugs of these cords in switchboard jacks which will provide the proper sleeves to place the cord circuit in the “ dial circuit condition.”

**Testing Procedure**

2.06 Insert the No. 220 plug in the telephone set jack associated with the position under test, with the key of the plug in the normal position.

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### (a.) Battery Supply Condition

- 2.07 Operate the following keys of the auxiliary test unit to the positions specified. Keys not mentioned should remain in the normal position.

Key 1 to HOLD  
Key 2 to HOLD  
Key 3 to MET  
Key 4 to MET

- 2.08 Insert the answering and calling cords of the cord circuit respectively in the LS and LR jacks of the auxiliary test unit.

Note: On circuits equipped with the audible flashing and recall signal, operate momentarily the listening key to the talking position.

- 2.09 Restore to normal any keys associated with the cord circuit of the position under test.
- 2.10 With the transmission measuring set in the measuring condition, perform the operations outlined in paragraphs 2.11, 2.12 and 2.13.
- 2.11 Rotate the plugs of the cord circuit slowly in the test jacks to detect cut-outs due to defective or dirty plugs.
- 2.12 Test the cords for cut-outs by holding the plugs firmly in the jacks and rotating the cords slowly with a cranking motion.
- 2.13 Test all keys associated with the cord circuit for cut-outs in the normal and operated position (except ringing and flashing keys in the operated position) by tapping the key tops lightly.

**For lever type keys**, move the levers slightly forward and backward while exerting a reasonable pressure to the left and right to take up any play or side lash.

**For plunger type keys**, connected in the transmission circuit move the plungers with a circular motion and test for plunger-spring clearance by depressing the plungers slightly.

- 2.14 Measure the transmission loss with the keys of the cord circuit normal.
- 2.15 Measure the current supply of each cord that provides talking battery.

### (a<sub>2</sub>) Battery Supply to Dial Condition

- 2.16 Establish this circuit condition by operating the following keys of the auxiliary test unit to the positions specified. Keys not mentioned should remain in the normal position.

Key 1 to HOLD                      Key 6 to S-2  
Key 2 to HOLD                      Key 8 to S-2  
Key 3 to MET  
Key 4 to MET

- 2.17 Connect a 500-ohm ground to the S-2 terminal of the auxiliary test unit.

- 2.18 Measure the transmission loss.

### (a<sub>3</sub>) Dial to Battery Supply Condition

- 2.19 Establish this circuit condition by operating the following keys of the auxiliary test unit to the positions specified. Keys not mentioned should remain in the normal position.

Key 1 to HOLD                      Key 5 to S-1  
Key 2 to HOLD                      Key 7 to S-1  
Key 3 to MET  
Key 4 to MET

- 2.20 Connect a 500-ohm ground to the S-1 terminal of the auxiliary test unit.

- 2.21 Measure the transmission loss.

### (a<sub>4</sub>) Dial Condition

- 2.22 Establish this circuit condition by operating the following keys of the auxiliary test unit to the positions specified. Keys not mentioned should remain in the normal position.

Key 1 to HOLD                      Key 5 to S-1  
Key 2 to HOLD                      Key 6 to S-2  
Key 3 to MET                        Key 7 to S-1  
Key 4 to MET                        Key 8 to S-2

- 2.23 Measure the transmission loss.

### (b) Operators' Telephone Circuits

- 2.24 Figure 1 shows schematically the connections for the test.

- 2.25 On the transmission measuring set connect the sending T and R terminals respectively, to the receiving T and R terminals.

Note: When a transmission measuring set of the No. 3 type is used, these connections are made through the jack contacts of the set when a dummy plug is removed from a jack other than the one to be used in the test.

- 2.26 Connect the sending jack of the transmission measuring set to the TMS jack of the auxiliary test unit.

- 2.27 Operate the following keys of the auxiliary test unit to the positions specified. Keys not mentioned should remain in the normal position.

Key 1 to HOLD  
Key 2 to HOLD  
Key 3 to MET  
Key 4 to MET

- 2.28 From the results of tests on the cord circuits of the position, choose a cord circuit which shows no transmission troubles and use it to make the following tests of the operator's telephone circuit:

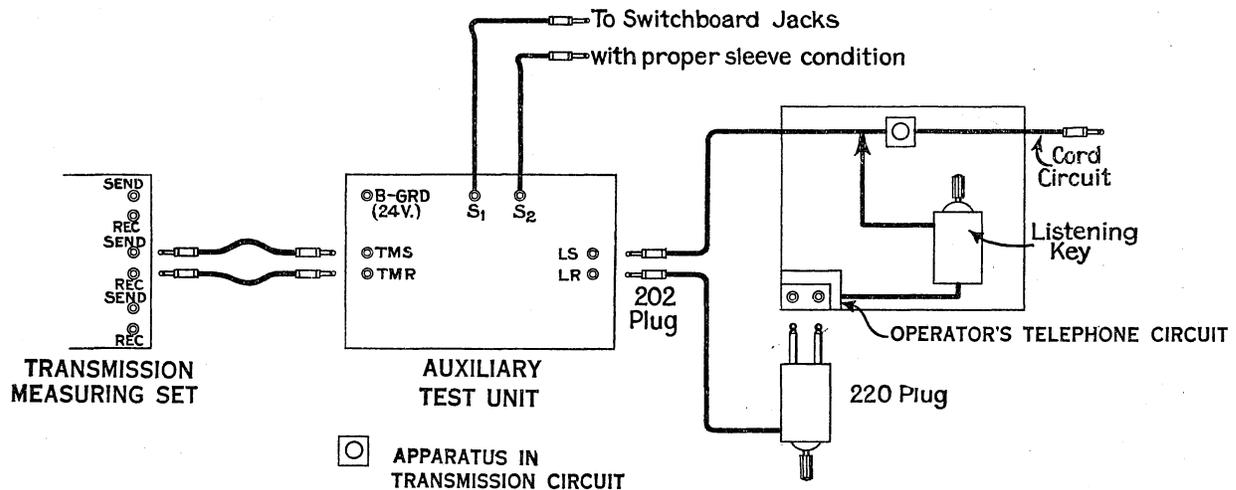


Figure 1

- 2.29 Insert the plug of the calling cord in the LS jack of the auxiliary test unit.
- 2.30 Measure the transmission loss with the keys of the cord circuit normal.
- 2.31 Operate the listening key associated with the cord circuit so that the operator's telephone circuit is connected across the cord circuit in the talking condition.
- 2.32 Measure the transmission loss.

Note: The difference between the measurements of paragraphs 2.30 and 2.32 will be the loss of the operator's telephone circuit in the bridged talking condition.

- 2.33 Operate the listening key of the cord circuit to the monitoring position.
- 2.34 Measure the transmission loss.

Note: The difference between the measurements of paragraphs 2.30 and 2.34 will be the loss of the operator's telephone circuit in the bridged monitoring condition.

- 2.35 Remove the strapping between the sending and receiving T and R terminals of the transmission measuring set.
- 2.36 Connect the receiving jack of the transmission measuring set to the TMR jack of the auxiliary test unit.
- 2.37 Insert the No. 202 plug associated with the No. 220 plug in the LR jack of the auxiliary test unit.
- 2.38 Operate the key of the No. 220 plug to the R position.
- 2.39 Measure the transmission loss.

Note: The difference between the measurements of paragraphs 2.30 and 2.39

will be the loss of the operator's telephone circuit in the receiving monitoring condition.

- 2.40 Operate the listening key of the cord circuit to the talking position.
- 2.41 Operate the key of the No. 220 plug to the T position.
- 2.42 Measure the transmission loss.

Note: The difference between the measurements of paragraphs 2.30 and 2.42 will be the loss of the operator's telephone circuit in the transmitting condition.

### 3. INTERCEPTING CORD CIRCUITS AND ASSOCIATED OPERATORS' TELEPHONE CIRCUITS

#### (a) Cord Circuits

- 3.01 These circuits may be arranged to complete calls from local or toll circuits to local circuits, depending upon the polarity of battery and ground furnished to the tip and ring conductors of the answering cord.

#### Preliminary Connections

- 3.02 Provide two regular double ended patching cords equipped with 110 type plugs and one regular double ended patching cord equipped on one end with a 109 type plug and on the other end with a 110 type plug.
- 3.03 Connect the TMS and TMR jacks of the auxiliary test unit, respectively, to the sending and receiving jacks of the transmission measuring set using the patching cords equipped with 110 type plugs.
- 3.04 Connect the B-GRD (48V) jack of the auxiliary test unit to 48 volt battery and ground (battery on tip and ground on

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sleeve) using the patching cord equipped with the 110 type and 109 type plugs.

Note: This battery and ground may be obtained from any source convenient to the location of the testing apparatus.

### Testing Procedure

- 3.05 Insert the No. 220 plug in the telephone set jack associated with the position under test with the key of the plug in the normal position.

#### (a.) Local-To-Local Circuit Condition

- 3.06 Operate the following keys of the auxiliary test unit to the positions specified. Keys not mentioned should remain in the normal position.

|               |              |
|---------------|--------------|
| Key 1 to HOLD | Key 3 to REV |
| Key 2 to HOLD | Key 4 to MET |

- 3.07 Insert the calling cord of the cord circuit to be tested in the LR jack of the auxiliary test unit.
- 3.08 While depressing key 13 of the auxiliary test unit, insert the answering cord of the cord circuit in the LS jack.
- 3.09 Release key 13 of the auxiliary test unit.
- 3.10 With the transmission measuring set in the measuring condition, perform the operations outlined in paragraphs 3.11, 3.12 and 3.13.
- 3.11 Rotate the plugs of the cord circuit slowly in the test jacks to detect cutouts due to defective or dirty plugs.
- 3.12 Test the cords for cutouts by holding the plugs firmly in the jacks and rotating the cords slowly with a cranking motion.
- 3.13 Test all keys associated with the cord circuit for cut-outs in the normal and operated position (except ringing and flashing keys in the operated position) by tapping the key tops lightly.

For lever type keys move the levers slightly forward and backward while exerting a rea-

sonable pressure to the left and right to take up any play or side lash.

For plunger type keys connected in the transmission circuit move the plungers with a circular motion and test for plunger-spring clearance by depressing the plunger slightly.

- 3.14 Measure the transmission loss with the keys of the cord circuit normal.
- 3.15 Measure the current supply from the calling cord of the cord circuit which is connected to the LR jack of the auxiliary test unit while depressing key 10 to remove the holding bridge from the circuit.

#### (a.) Toll-To-Local Circuit Condition

- 3.16 Establish this circuit condition by removing the answering cord from the LS jack of the auxiliary test unit and by operating the following keys of the auxiliary test unit to the position specified.

|               |               |
|---------------|---------------|
| Key 1 to HOLD | Key 3 to NORM |
| Key 2 to HOLD | Key 4 to MET  |

- 3.17 Reinsert the answering cord in the LS jack of the auxiliary test unit.
- 3.18 Measure the transmission loss.
- 3.19 Repeat the above testing procedure for the remaining cord circuits of the position.

#### (b.) Operator's Telephone Circuits

- 3.20 Figure 2 shows schematically the connections for the test.
- 3.21 On the transmission measuring set connect the sending T and R terminals respectively, to the receiving T and R terminals.

Note: When a transmission measuring set of the No. 3 type is used, these connections are made through the jack contacts of the set when a dummy plug is removed from a jack other than the one to be used in the test.

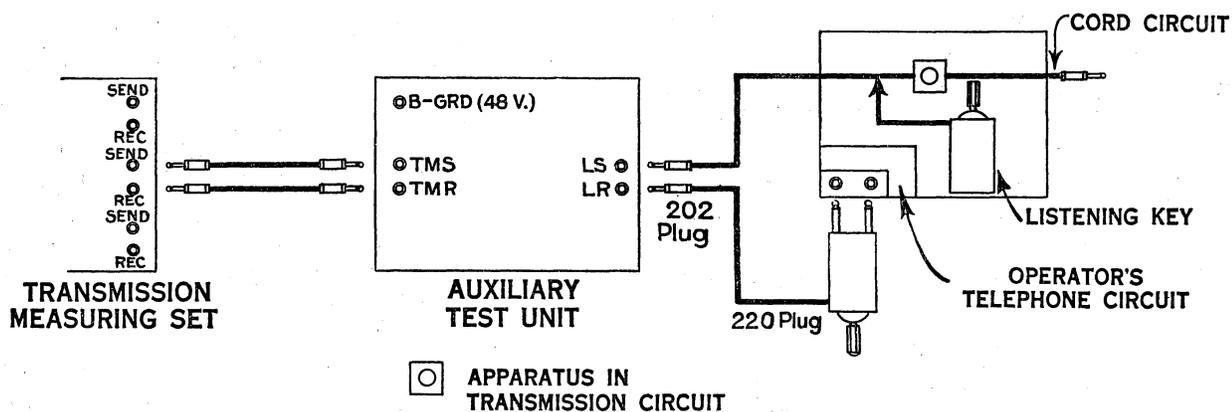


Figure 2

- 3.22 Connect the sending jack of the transmission measuring set to the TMS jack of the auxiliary test unit.
- 3.23 Operate the following keys of the auxiliary test unit to the positions specified. Keys not mentioned should remain in the normal position.
- |               |              |
|---------------|--------------|
| Key 1 to HOLD | Key 3 to MET |
| Key 2 to HOLD | Key 4 to MET |
- 3.24 From the results of tests on the cord circuits of the position, choose a cord circuit which shows no transmission troubles and use it to make the following tests of the operator's telephone circuit.
- 3.25 Insert the plug of the calling cord in the LS jack of the auxiliary test unit.
- 3.26 Measure the transmission loss with the keys of the cord circuit normal.
- 3.27 Operate the listening key associated with the cord circuit so that the operator's telephone circuit is connected across the cord circuit in the talking condition.
- 3.28 Measure the transmission loss.
- Note: The difference between the measurements of paragraphs 3.26 and 3.28 will be the loss of the operator's telephone circuit in the bridged talking condition.
- 3.29 Remove the strapping between the sending and receiving T and R terminals of the transmission measuring set.
- 3.30 Connect the receiving jack of the transmission measuring set to the TMR jack of the auxiliary test unit.
- 3.31 Insert the No. 202 plug associated with the No. 220 plug in the LR jack of the auxiliary test unit.
- 3.32 Operate the key of the No. 220 plug to the T position.
- 3.33 Measure the transmission loss.
- Note: The difference between the measurements of paragraphs 3.26 and 3.33 will be the loss of the operator's telephone circuit in the transmitting condition.
- 4. RURAL SUBSCRIBERS' CORD CIRCUITS (FULL AND SEMI-UNIVERSAL) AND ASSOCIATED OPERATORS' TELEPHONE CIRCUITS**
- (a) **Cord Circuits**
- 4.01 These circuits may be arranged to complete common battery to common battery, magneto to magneto, or common battery to magneto connections. For each of these combinations there is a different arrangement of the equipment associated with the tip and ring conductors of the cord circuit which is controlled by the sleeve circuit.
- 4.02 Connect the sleeve conductors of two switchboard cords having the same type of plug as the cord circuits under test, to the  $S_1$  and  $S_2$  terminals of the transmission measuring set.
- 4.03 Insert the plugs of these cords in the proper spare switchboard jacks to establish one of the cord circuit conditions.
- 4.04 Where cord circuits are equipped for machine ringing, trip the ringing after inserting the plugs of the cord circuit in the transmission measuring set jacks, and before proceeding with the test.
- 4.05 Insert the No. 220 plug in the telephone set jack associated with the position under test with the key of the plug in the normal position.
- 4.06 Insert the answering and calling cords of a cord circuit in the sending and receiving jacks of the transmission measuring set.
- 4.07 Restore to normal any keys associated with the cord circuits of the position under test.
- 4.08 With the transmission measuring set in the measuring condition, perform the operations outlined in paragraphs 4.09, 4.10 and 4.11.
- 4.09 Rotate the plugs of the cord circuit slowly in the test jacks to detect cutouts due to defective or dirty plugs.
- 4.10 Test the cords for cutouts by holding the plugs firmly in the jacks and rotating the cords slowly with a cranking motion.
- 4.11 Test all keys associated with the cord circuit for cutouts in the normal and operated position (except ringing and splitting keys in the operated position) by tapping the key top lightly.
- For lever type keys**, move the levers slightly forward and backward, while exerting a reasonable pressure to the left and right to take up any play or side lash.
- For plunger type keys** directly connected in the transmission circuit, move the plungers with a circular motion and test for plunger-spring clearance by depressing the plungers slightly.
- 4.12 Measure the transmission loss of the cord circuit with the keys normal.
- 4.13 Measure the current supply of each cord that provides talking battery.
- 4.14 Repeat the above procedure for the remaining cord circuits of the position.

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4.15 Establish the other cord circuit conditions by changing the sleeve connections of paragraph 4.03 to the proper switchboard jacks and proceed as follows for each condition:

4.16 Measure the transmission loss and if not previously measured, the current supply of each cord that provides talking battery.

Note: It will be unnecessary to repeat the tests for cutouts in plugs, cords and keys as mentioned in paragraphs 4.09, 4.10 and 4.11.

4.17 Repeat the procedure of paragraphs 4.15 and 4.16 for the remaining cord circuits of the position.

### (b) Operators' Telephone Circuits

4.18 Figure 3 shows schematically the connections for the tests of the operators' telephone circuits.

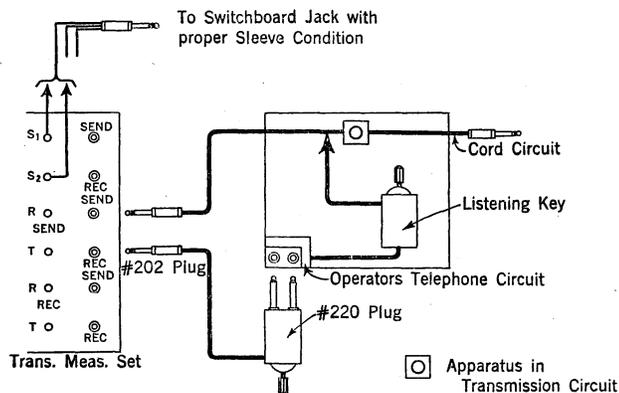


Figure 3

4.19 On the transmission measuring set connect the sending T and R terminals respectively to the receiving T and R terminals.

Note: When a transmission measuring set of the No. 3 type is used, these connections are made through the jack contacts of the set when a dummy plug is removed from a jack other than the one to be used in this test.

4.20 From the results of tests on the cord circuits of the position, choose a cord circuit which shows no transmission troubles and use it to make the following tests of the operators' telephone circuit.

4.21 Insert the plug (answering or calling as the case may be) of the cord circuit to which the operator's telephone circuit is connected when in the talking condition, in the sending jack of the transmission measuring set.

Note: When the listening key of a cord circuit is operated, the telephone circuit

is bridged on either the answering or calling end of the cord circuit, depending on the wiring arrangement of the latter circuit. Transmission measurements of the telephone circuit wiring should be made using the cord adjacent to the telephone circuit bridge.

4.22 Measure the transmission loss with all keys of the cord circuit normal.

4.23 Operate the listening key associated with the cord circuit so that the operator's telephone circuit is connected across the cord circuit in the talking condition.

4.24 Measure the transmission loss.

Note: The difference between the measurements of paragraphs 4.22 and 4.24 will be the loss of the operator's telephone circuit in the bridged talking condition.

4.25 Where cord circuits are equipped for monitoring, operate the listening key to the monitoring position.

4.26 Measure the transmission loss.

Note: The difference between the measurements of paragraphs 4.22 and 4.26 will be the loss of the operator's telephone circuit in the bridged monitoring condition.

4.27 Remove the strapping between the sending and receiving T and R terminals of the transmission measuring set.

4.28 Insert the No. 202 plug associated with the No. 220 plug in the receiving jack of the transmission measuring set.

4.29 Operate the key of the No. 220 plug to the R position.

4.30 Measure the transmission loss.

Note: The difference between the measurements of paragraphs 4.22 and 4.30 will be the loss of the operator's telephone circuit in the receiving monitoring condition.

4.31 Operate the listening key of the cord circuit to the talking position.

4.32 Operate the key of the No. 220 plug to the T position.

4.33 Measure the transmission loss.

Note: The difference between the measurements of paragraphs 4.22 and 4.33 will be the loss of the operator's telephone circuit in the transmitting condition.

5. OPERATOR RECORDING-COMPLETING  
CORD CIRCUITS AND ASSOCIATED  
TELEPHONE CIRCUITS

(a) Cord Circuits

5.01 These cord circuits have no equipment in the transmission circuit during the talking condition and do not require transmission tests.

(b) Operators' Telephone Circuits

5.02 Since the operator's telephone circuit will also be used with the special service switchboard cord circuits of the position, and transmission tests will be made in conjunction with special service cord circuits it will not be necessary to repeat the tests using the operator recording-completing cord circuits.