DEPARTMENT OF THE ARMY TECHNICAL MANUAL

DEPARTMENT OF THE AIR FORCE TECHNICAL ORDER

TM 11-2017

TO 33A1-12-38-1

TEST SETS

TS-26/TSM, TS-26A/TSM AND TS-26B/TSM

DEPARTMENTS OF THE ARMY AND THE AIR FORCE

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TECHNICAL MANUAL No. 11-2017
TECHNICAL ORDER No. 33A1-12-38-1

DEPARTMENTS OF THE ARMY AND THE AIR FORCE,
WASHINGTON 25, D. C., *24 March 1955*

TEST SETS TS-26/TSM, TS-26A/TSM, AND TS-26B/TSM

*This manual supersedes TM 11-2017, 26 July 1944, including C 1, 15 November 1945, and C 2, 25 September 1951.

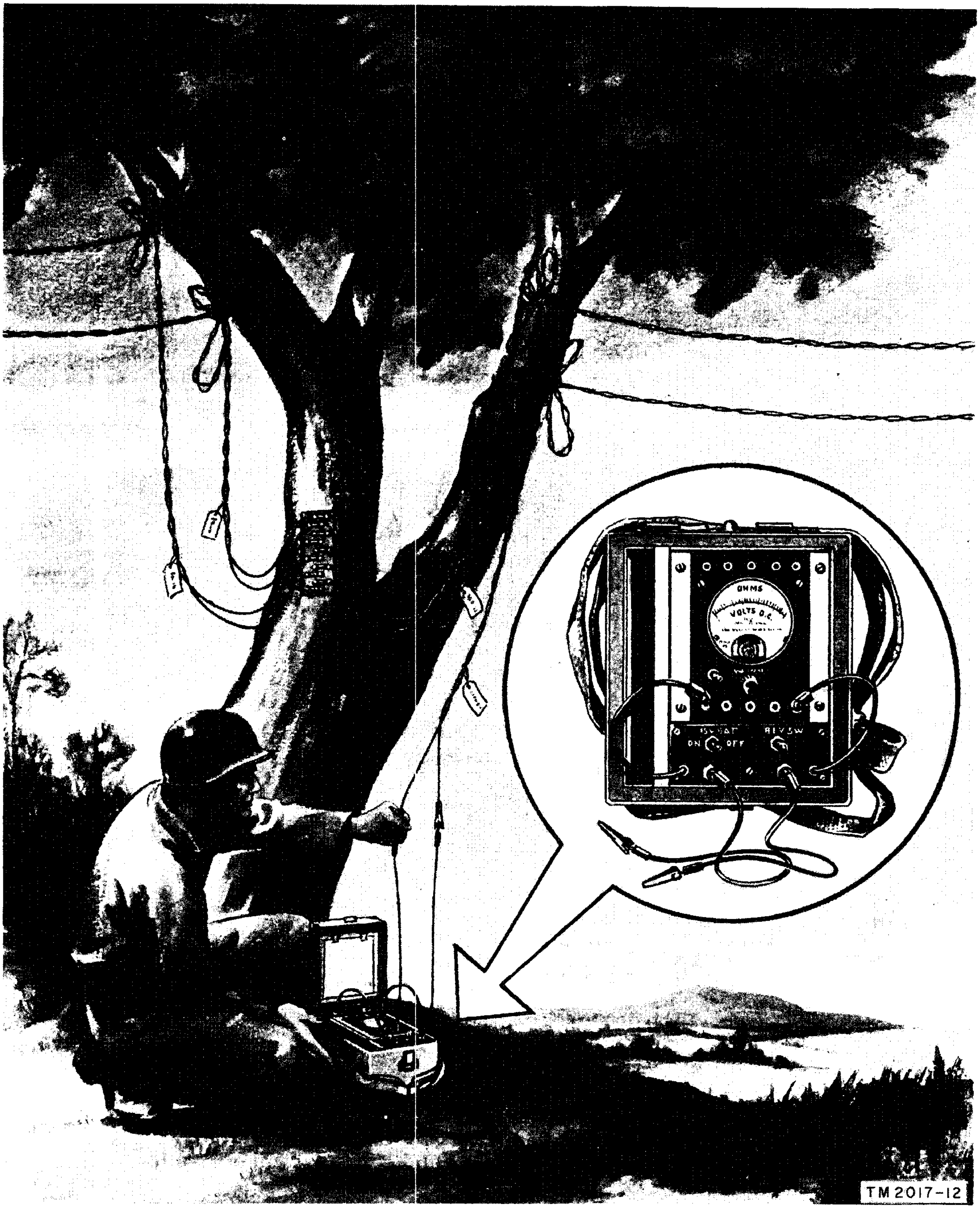

Figure 1. Test Set TS–26(*)/TSM, in use.

CHAPTER 1
INTRODUCTION

Section I. GENERAL

1. Scope

a. This manual contains information for the installation, operation, and maintenance of Test Sets TS–26/TSM, TS–26A/TSM, and TS–26B/TSM. Official nomenclature followed by (*) is used to represent all models of test equipment covered in this manual; thus, Test Set TS–26(*)/TSM represents Test Set TS–26/TSM, Test Set TS–26A/TSM, and Test Set TS–26B/TSM. Test Set TS–26(*)/TSM will be referred to as *test set* throughout the manual.

b. Any comments on this manual should be forwarded directly to the Commanding Officer, Signal Corps Publications Agency, Fort Monmouth, New Jersey, ATTN: Standards Division.

2. Forms and Records

The following forms will be used for reporting unsatisfactory conditions of Army equipment and when performing preventive maintenance:

a. DD Form 6, Report of Damaged or Improper Shipment, will be filled out and forwarded as prescribed in SR 745–45–5 (Army), Navy Shipping Guide, Article 1850–4 (Navy), and AFR 71–4 (Air Force).

b. DA Form 468, Unsatisfactory Equipment Report, will be filled out and forwarded to the Office of the Chief Signal Officer as prescribed in SR 700–45–5.

c. DD Form 535, Unsatisfactory Report, will be filled out and forwarded to the Commanding General, Air Materiel Command, Wright-Patterson Air Force Base, Dayton, Ohio, as prescribed in SR 700–45–5 and AF TO 00–35D–54.

d. DA Form 11–238, Operator First Echelon Maintenance Check List for Signal Corps Equipment (Radio Communication, Direction Finding, Carrier, Radar), will be prepared in accordance with instructions on the back of the form (fig. 38).

e. DA Form 11–239, Second and Third Echelon Maintenance Check List for Signal Corps Equipment (Radio Communication, Direction Finding, Carrier, Radar), will be prepared in accordance with instructions on the back of the form (fig. 39).

f. Use other forms and records as authorized.

Section II. DESCRIPTION AND DATA

3. Purpose and Use

a. Purpose. Test Set TS–26(*)/TSM is a portable test set for use by pole linemen and field wiremen in identifying and locating grounds, crosses, shorts, and opens on a telephone line. It can also measure insulation and conductor resistance and direct current (dc) voltages.

b. Use. Test Set TS–26(*)/TSM is used mainly for testing field wire such as Wire W–110–B, Wire WD–1/TT, Wire WD–14/TT, Wire W–130, Wire W–130–A, and Wire W–143. It can be used also for testing cable assemblies such as Cable Assembly CC–345, Cable Assembly CC–355–A, Cable Assembly CC–358–E, and Cable Assembly CX–1065/G.

4. Technical Characteristics

Type of test set	Voltohmmeter (1,000 ohms per volt), battery-operated.
Voltages ranges	0 to 3 volts dc. 0 to 30 volts dc. 0 to 300 volts dc. 0 to 600 volts dc.
Resistance ranges	0 to 1,000 ohms. 0 to 10,000 ohms. 0 to 100,000 ohms. 0 to 1 megohm. 0 to 10 megohms.
Internal resistance of meter:	
Test Set TS–26/TSM	2,000 ohms.
Test Sets TS–26A/TSM and TS–26B/TSM.	760 ohms.
Batteries required	One 4½-volt battery and one 45-volt battery.

5. Packaging Data

(fig. 4)

a. Test Set TS-26(*)/TSM may be packaged individually or in quantity.

(1) When packaged individually, the packaging is the same for domestic or export shipment. The test set is placed within a corrugated fiberboard box and sealed with gummed tape.

(2) When several test sets are packed for domestic shipment, they are placed within a close-fitting fiberboard box and sealed with gummed tape.

(3) When several test sets are packed for export shipment, a water-vaporproof barrier and a water-resistant fiberboard box are added and the test sets are placed within a close-fitting, nailed, wooden box, and reinforced with metal strapping.

b. The size, weight, and volume of individual test sets, packed for shipment, are indicated in the following chart.

Type of Shipment	Height (in.)	Width (in.)	Depth (in.)	Volume (cu ft)	Unit weight (lb)
Domestic	9½	8⅜	9¼	0. 4237	9
Export	9¾	8⅞	9¾	. 4885	9½

c. Each test unit is packed with test leads and two technical manuals. The components of the test set are described in paragraph 7.

6. Table of Components

Component	Reqd No.	Length (in.)	Width (in.)	Height (in.)	Volume (cu ft)	Weight (lb)
Test unit	1	8	7	7	0. 22	7¾
Red test lead	1	48	-----	-----	-----	1/32
Black test lead	1	48	-----	-----	-----	1/32

Note. This list is for general information only. See appropriate supply publications for information pertaining to requisition of spare parts.

7. Description of Components

(figs. 2 and 3)

a. Test Unit. The test set is a voltohmmeter that consists of two panel assemblies (meter panel assembly and switch panel assembly). Both panel assemblies are mounted in the same wooden case. The meter, controls, and test jacks are mounted on the front of the panel assemblies. The test set case has a removable hinged cover which protects both panel assemblies when the test set is not in use. Several labels (either mounted on sheet aluminum or plastic covered) are attached to the inside of the test set cover. The test set cover is secured to the test set case with a hinge clamp. A web carrying strap is looped through three brackets on the outside of the test set case. A storage compartment is provided in the test set case for the two test leads (*b* below). The test unit contains a battery clip and battery spacing blocks for mounting the batteries.

b. Test Leads. Two insulated test leads are provided with each test set. One test lead has red insulation and the other has black insulation. Each test lead is 4 feet long and is provided with an alligator clip on one end and a pin plug on the other end.

8. Additional Equipment Required

The items in the following chart are *not* supplied with Test Set TS-26(*)/TSM but are required for its operation.

Quantity reqd	Item
1	Ground Rod MX-148/G.
1	Clamp TM-106.
1	Battery BA-31.
1	Battery BA-59*.

*Test Sets TS-26A/TSM, bearing Order No. 3048-P-52, have been designed to accommodate either Battery BA-59 or Battery BA-63. Two Batteries BA-2, connected in series, may be used in all models if Battery BA-59 is not available.

9. Differences in Models

Test Sets TS-26/TSM, TS-26A/TSM, and TS-26B/TSM have the same technical characteristics and perform the same functions. However, there are several differences among the three models. The user of Test Set TS-26(*)/TSM should be familiar with the differences described in *a* and *b* below.

Note. Differences between models that affect repair of the test set or replacement of parts are described in chapter 6.

a. The meter zero-adjustment screw on Test Sets TS-26/TSM and TS-26B/TSM is located on a metal rim at the bottom of the meter (figs.

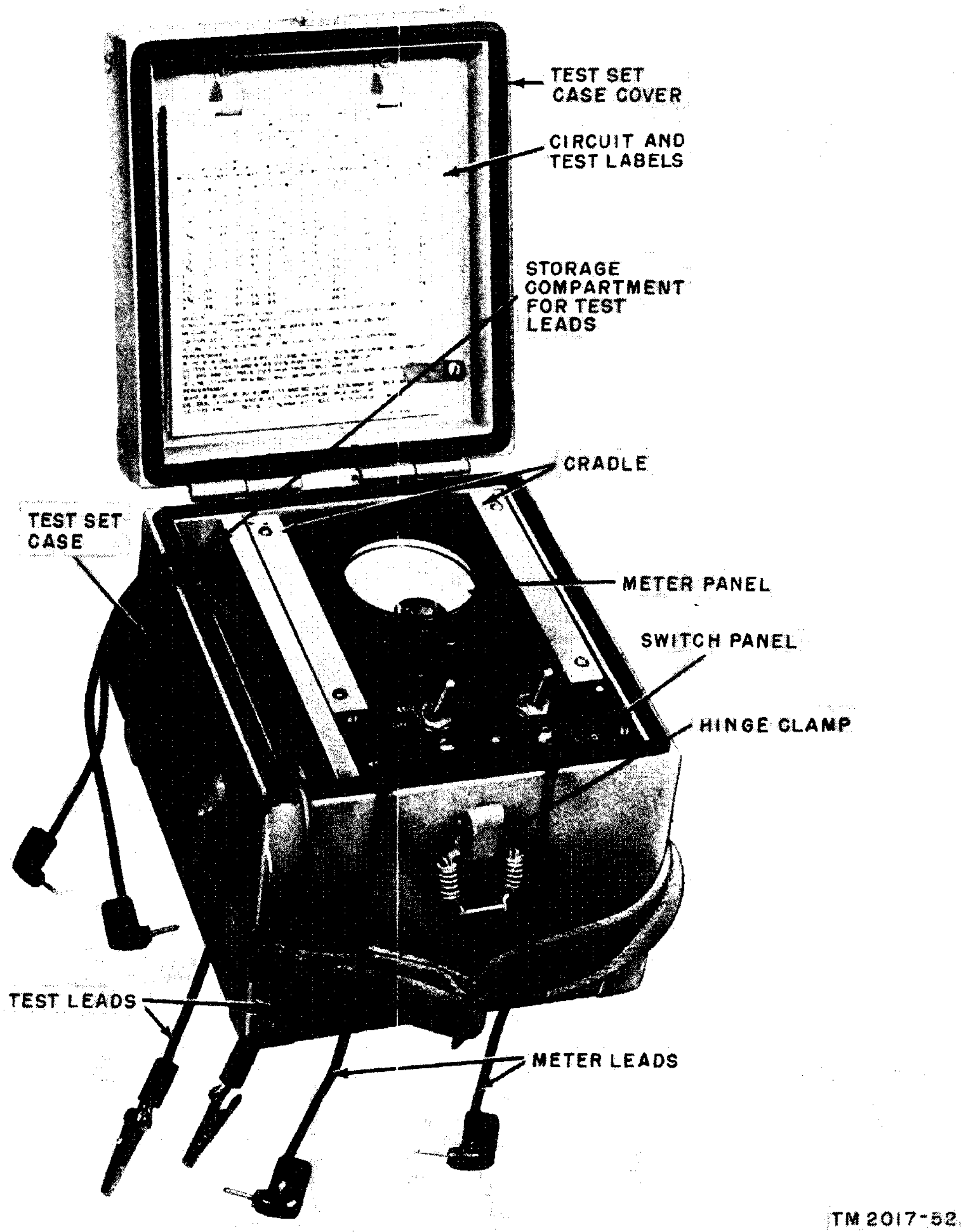

Figure 2. Test Set TS–26/TSM or TS–26A/TSM, main components.

40 and 41). On Test Set TS–26A/TSM, the meter zero-adjustment screw is located on the glass window of the meter (fig. 7).

b. Battery BA–31 is installed in the meter panel assembly of Test Set TS–26/TSM so that the battery terminals face the top edge of the meter panel (fig. 8). Battery BA–31 is installed in Test Sets TS–26A/TSM and TS–26B/TSM so that the battery terminals face the bottom edge of the meter panel (figs. 9 and 10).

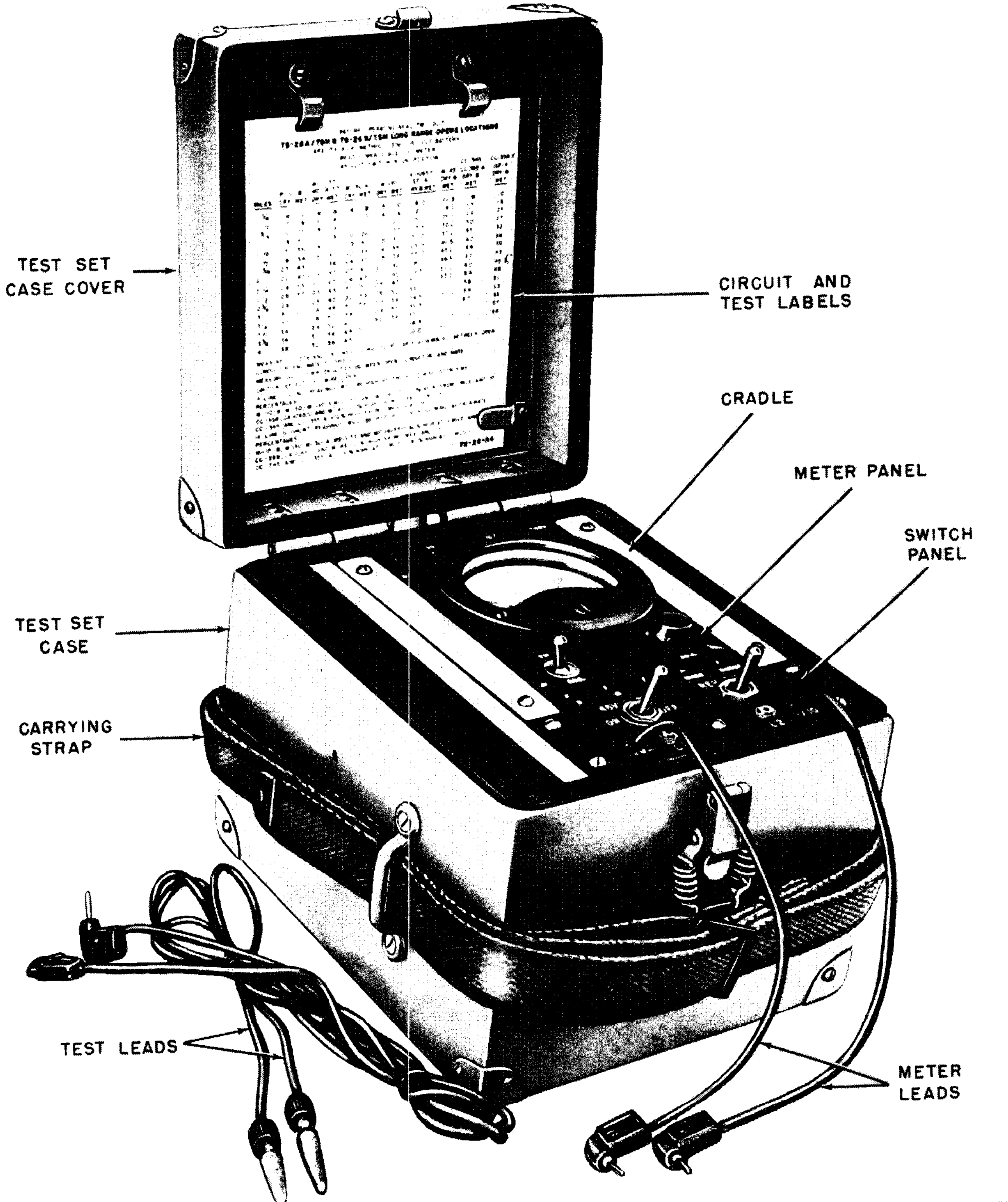

Figure 3. Test Set TS–26B/TSM, main components.

CHAPTER 2
INSTALLATION

10. Siting

When using the test set, place it on a firm support within 3 feet of the equipment under test. Position the test set so that its controls are within easy reach and the meter can be read easily. Figure 1 shows a test set in use.

Caution: Do not allow the test leads to drape across high-voltage circuits. Severe burns or shock to the user and damage to the equipment may result.

11. Uncrating, Unpacking, and Checking New Equipment

(fig. 4)

Note. For used or reconditioned equipment, refer to paragraph 14.

a. General. Test Set TS–26(*)/TSM may be packaged in quantities of one or more for either oversea or domestic shipment (par. 5). When new equipment is received, select a location where the equipment may be unpacked without exposure to dust, dirt, or moisture.

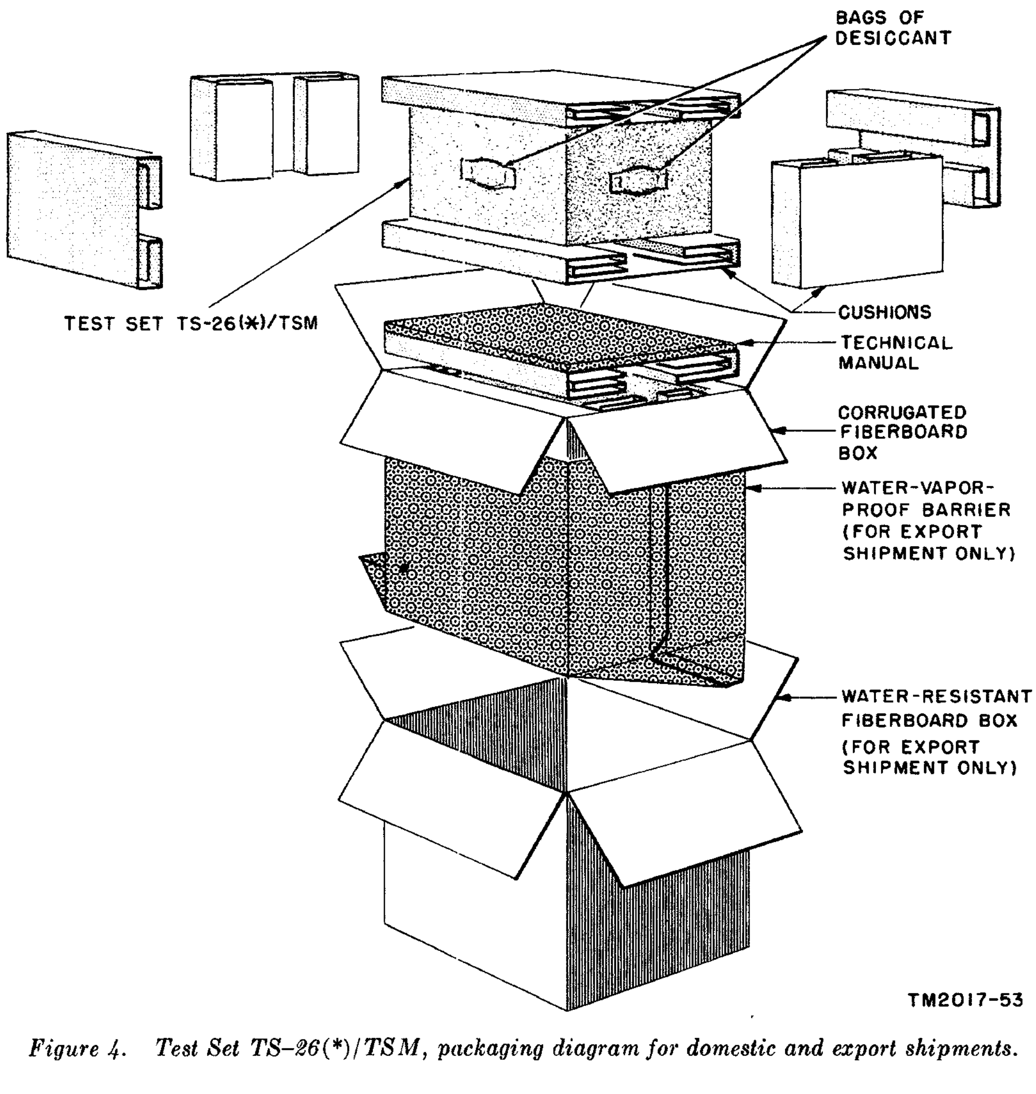

Figure 4. Test Set TS–26(*)/TSM, packaging diagram for domestic and export shipments.

Caution: Be careful when uncrating and unpacking the test sets. They are easily damaged. Avoid thrusting tools into the interior of the shipping container or damaging the packing material.

b. Uncrating and Unpacking Test Sets Packed for Domestic Shipment. If there is more than one test set in a box, follow steps given in (1) through (5) below. If there is one test set, follow steps given in (3) through (5) below.

(1) Cut the tape that seals the flaps of the outer corrugated box carefully to avoid damage.

(2) Remove the inner corrugated fiberboard boxes containing the individual test sets.

(3) Cut the tape on each individual corrugated fiberboard box carefully to avoid damage to the test set within.

(4) Lift each test set out of its corrugated fiberboard box.

(5) Check the contents of the packing case against the master packing slip.

c. Uncrating and Unpacking Test Sets Packed For Export Shipment. If there is more than one test set in the box, follow steps given in (1) through (8) below. If there is one test set, follow steps given in (4) through (8) below.

(1) Cut the metal straps with a suitable cutting tool.

(2) Remove the nails from the cover of the box with a nail puller and remove the cover.

(3) Remove the inner boxes that contain the individual test sets.

(4) Carefully cut the water-resistant, pressure-sensitive tape on the water-resistant fiberboard box of each test set (fig. 4).

(5) Carefully cut the second heat-sealed water-vaporproof barrier placed around each fiberboard box.

(6) Carefully cut the tape on each individual corrugated fiberboard box.

(7) Lift each test set from its corrugated fiberboard box.

(8) Check the contents of the packing case against the packing slip.

12. Battery Installation

A 4½-volt battery (BA–31) and a 45-volt battery (BA–59) must be installed in the test set case before the test set is ready for operation. These batteries can be obtained through local supply channels.

a. Place the test set on a clean flat surface so that the nameplate (on the cover) is facing upward.

b. Open the hinge clamp (fig. 2) on the test set case.

c. Lift the test set cover and swing it to the side of the test set case.

d. Remove the test set cover from the test set case by sliding the cover to the left on Test Set TS–26/TSM or to the right on Test Sets TS–26A/TSM and TS–26B/TSM.

e. Place the cover (top-side down) beside the test set case.

f. Remove the test leads from the storage compartment and place them in the cover.

g. Remove the four screws that are located on the cradle of the test set (fig. 2) and place them in the cover.

h. Carefully place the end of a screwdriver under one edge of the cradle. Pry the cradle upward until it can be grasped with the fingers.

i. Lift the cradle and the meter panel assembly out of the test set case and set them to one side.

j. Reach into the test set case and carefully lift out the 45-volt battery connector (fig. 5) and insert it into the 45-volt battery (BA–59).

k. Install the 45-volt battery in the test set case between the spacing blocks as shown in figure 6. The end of the 45-volt battery that is attached to the connector must face the top edge of the switch panel.

l. To install the 4½-volt battery, slide the meter panel assembly from the cradle as shown in figure 7.

m. Remove the four screws on the front of the meter panel assembly.

n. Lift the meter panel out of the meter panel case and place the four screws inside the case.

o. Connect the red wire to the positive (+) battery terminal. Connect the black wire to the negative (−) battery terminal.

p. Install the 4½-volt battery in Test Set TS–26/TSM, with the battery terminals facing the *top edge* of the meter panel (fig. 8). Install the 4½-volt battery in Test Sets TS–26A/TSM and TS–26B/TSM, with the battery terminals facing the *bottom edge* of the meter panel (figs. 9 and 10).

q. Install the meter panel into the meter panel case and replace the four screws.

r. Slide the meter panel assembly into the cradle as shown in figure 7.

s. Install the cradle and meter assembly in the test set case and replace the four screws.

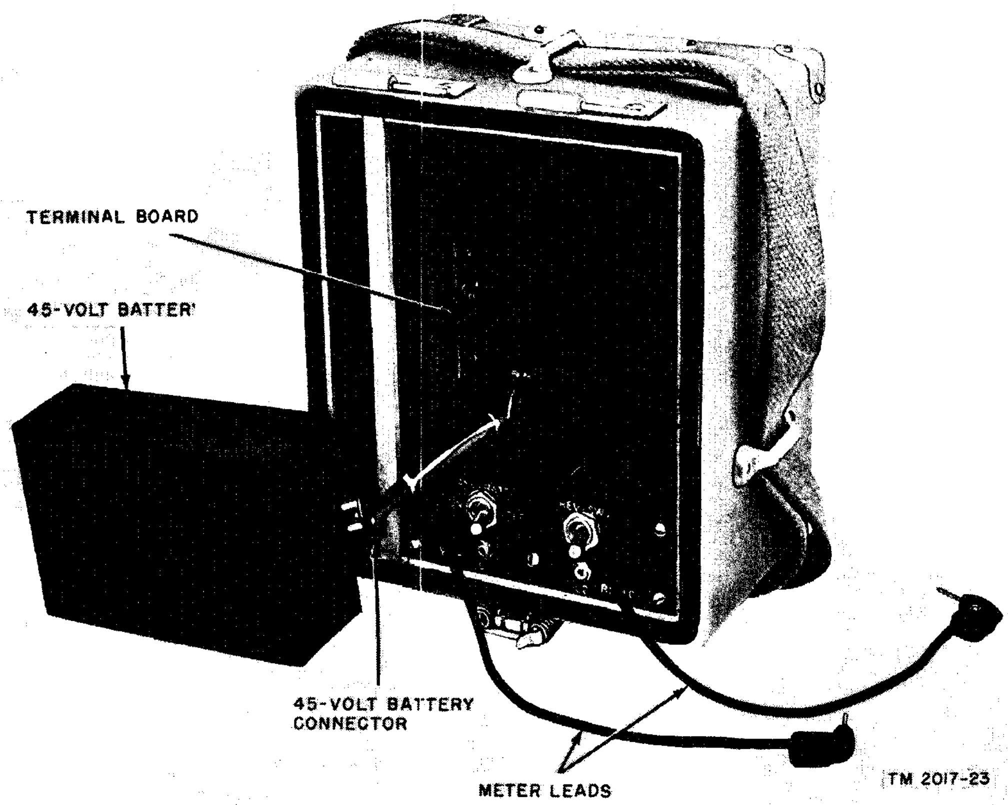

Figure 5. Test Set TS-26(*)/TSM, meter panel assembly removed, connection for 45-volt battery.

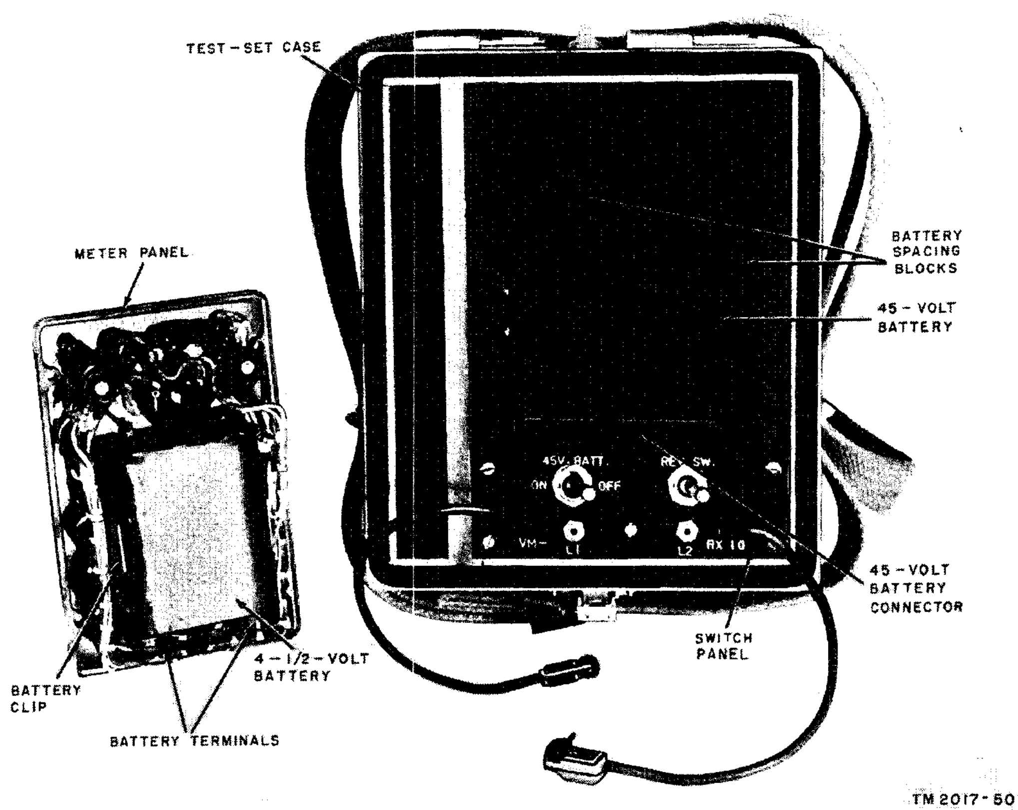

Figure 6. Test Set TS-26A/TSM, meter panel assembly removed, batteries installed.

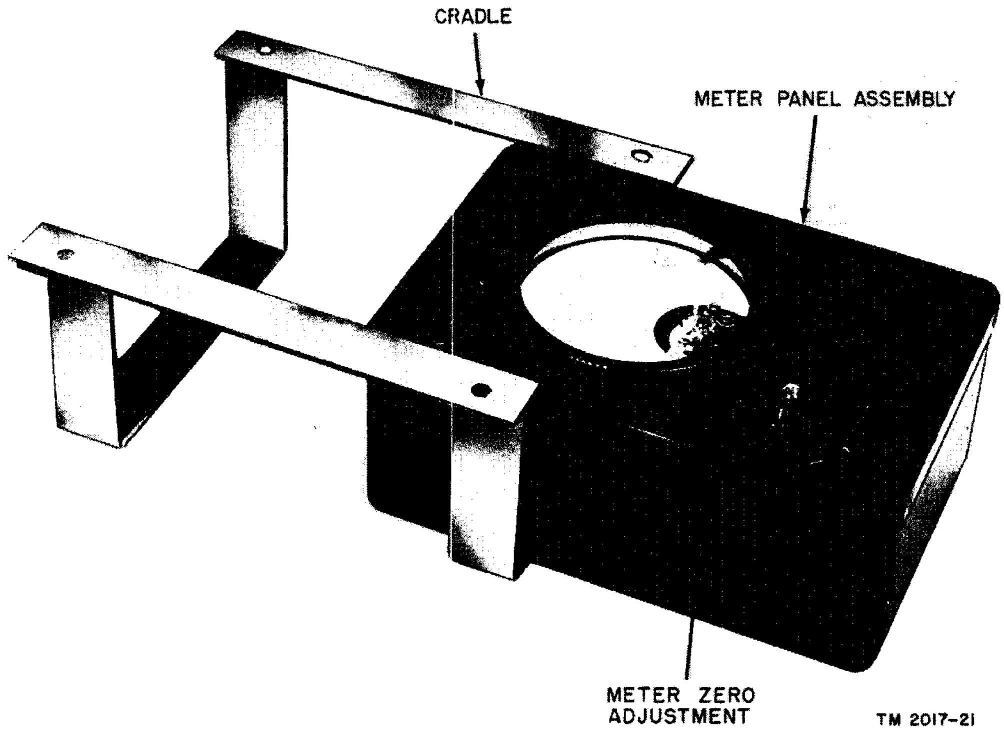

Figure 7. Test Set TS-26(*)/TSM, meter panel assembly partly removed from its cradle.

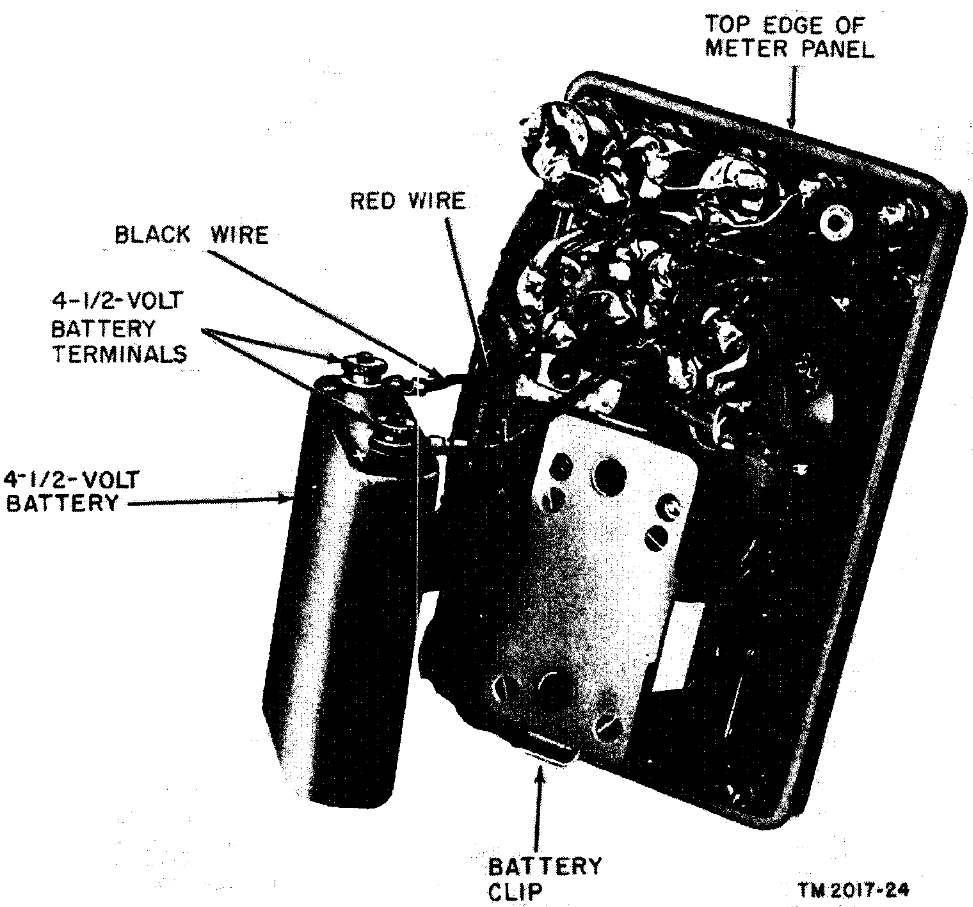

Figure 8. Test Set TS-26/TSM, meter panel assembly, rear view.

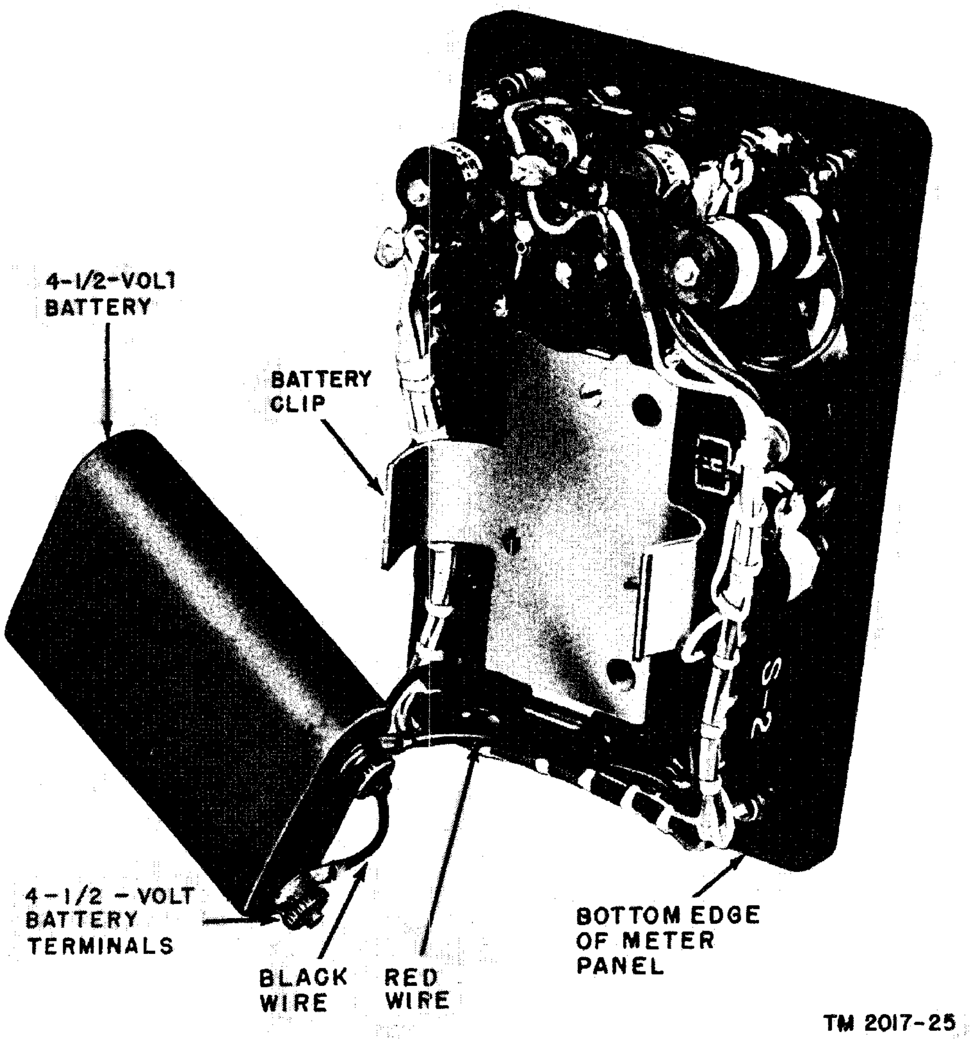

Figure 9. Test Set TS-26A/TSM, meter panel assembly, rear view.

t. Replace the test leads and test set cover.

u. Lock the test set cover in place with the hinge clamp.

13. Ground Installation

Some applications of Test Set TS-26(*)/TSM require a ground connection for proper operation. Good ground connections can ge obtained by connecting a piece of wire to the pipes of either a buried water supply or gas supply system. Any grounded metallic structure can be used; if no convenient ground connection is available, the operator of the test set must install his own ground. Ground-installation procedures are described in *a* through *e* below.

a. Select the lowest, dampest site in the vicinity, preferably in clay or loamy soil.

b. Scoop out a hole approximately 6 inches deep in the selected location.

c. Remove any paint or grease from Ground Rod MX-148/G (par. 8) and drive the rod into the hole until the top of the rod is approximately 3 inches above the bottom of the hole.

d. Connect Clamp TM-106 (par. 8) to the end of the ground rod.

e. Fill the hole with plenty of water (salt water if available).

14. Service Upon Receipt of Used or Reconditioned Equipment

a. Follow the instructions given in paragraph 11 for uncrating, unpacking, and checking the test set.

b. Check the used or reconditioned equipment for tags or other indications to see whether changes have been made in the wiring of the test set. If changes in wiring have been made, note the change in this manual, preferably on the schematic diagram.

c. Check the controls for ease of operation.

d. Install the batteries (par. 12), if the test set is to be used immediately.

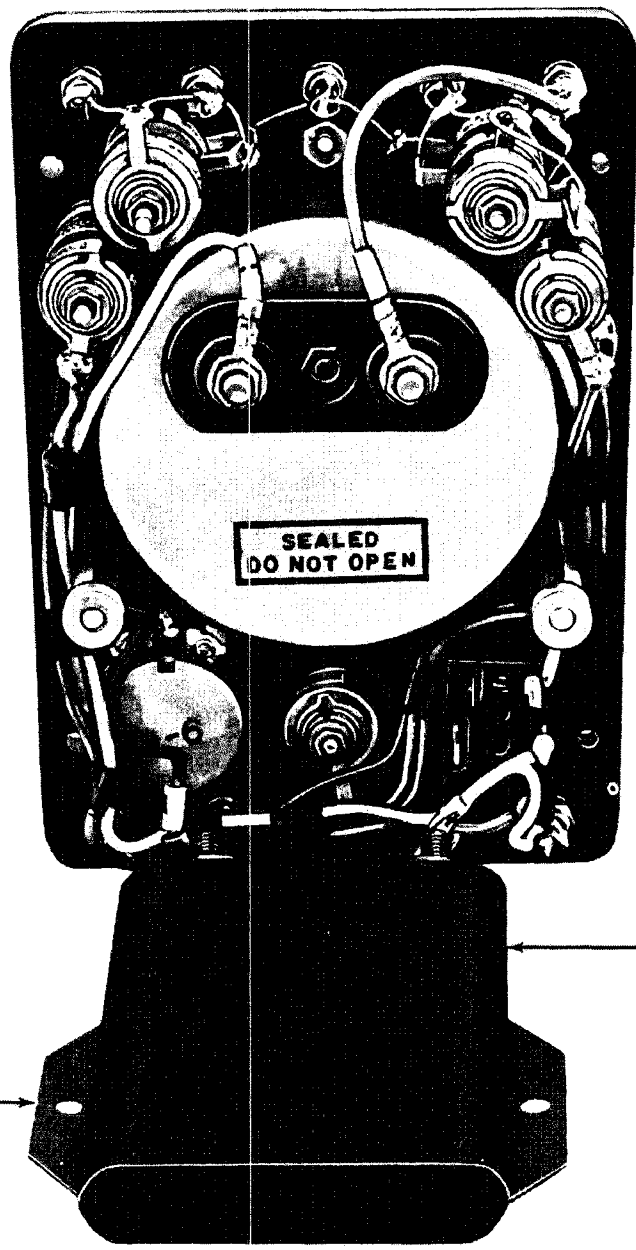

Figure 10. Test Set TS-26B/TSM, meter panel assembly, rear view.

CHAPTER 3
OPERATION

Section I. PREOPERATING PROCEDURES

15. Voltage and Resistance Measurements

a. Voltage Measurements (figs. 11 through 14). Perform the following procedures before making voltage measurements.

(1) Push the 45V. BATT. switch to the OFF position.

(2) Push the VM.-RES. switch to the VM. position.

(3) Place the pin of the black meter lead in the — (negative) jack.

(4) Place the pin of the red meter lead in one of the following jacks:

(*a*) 600V jack for measurements between 0 and 600 volts (fig. 11).

(*b*) 300V jack for measurements between 0 and 300 volts (fig. 12).

(*c*) 30V jack for measurements between 0 and 30 volts (fig. 13).

(*d*) 3V jack for measurements between 0 and 3 volts (fig. 14).

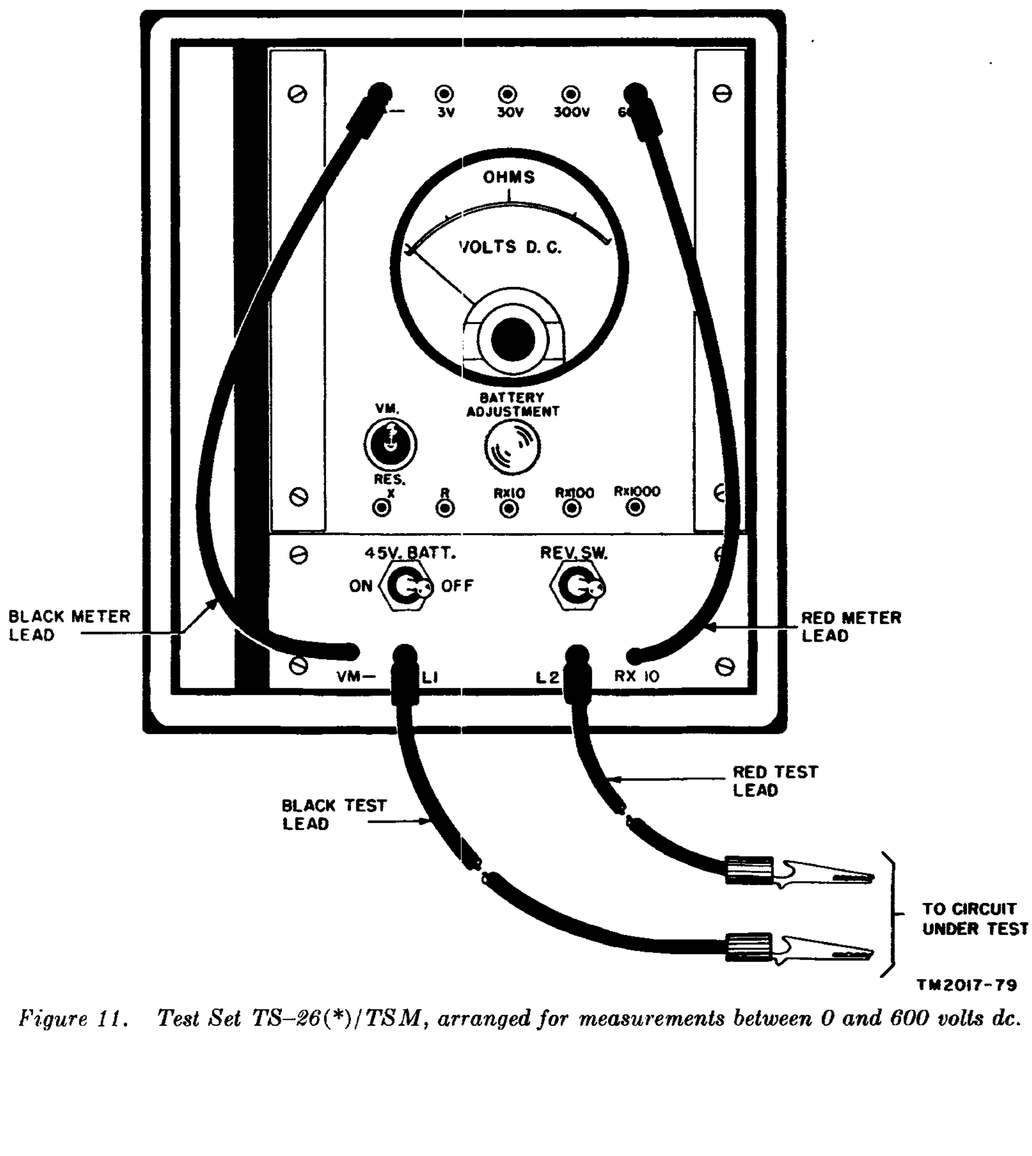

Figure 11. Test Set TS–26(*)/TSM, arranged for measurements between 0 and 600 volts dc.

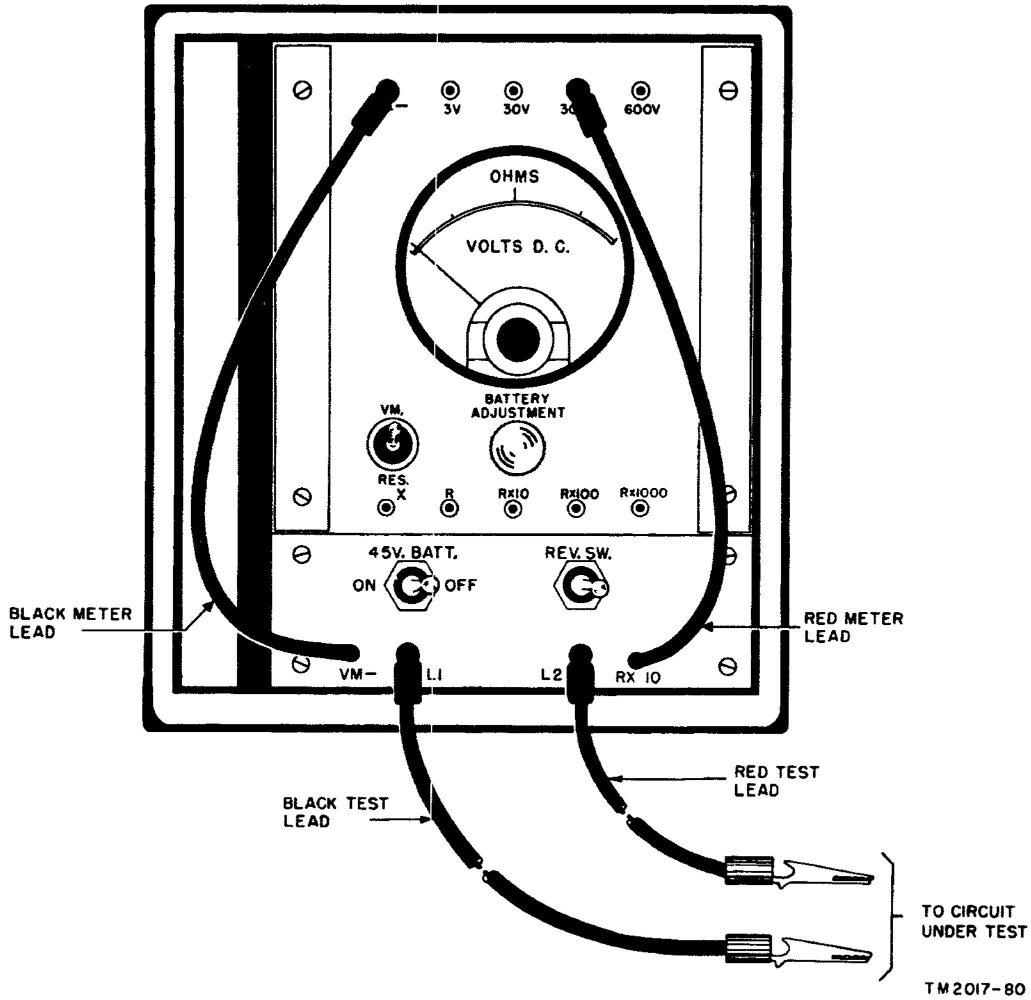

Figure 12. Test Set TS–26(*)/TSM, arranged for measurements between 0 and 300 volts dc.

(5) Place the pin of the black test lead in the L1 jack.

(6) Place the pin of the red test lead in the L2 jack.

(7) Turn the meter zero-adjustment screw (fig. 7) until the meter needle points to 0 on the VOLTS D. C. scale of the meter. *Keep the eye directly above the 0 when making this adjustment.*

b. Resistance Measurements (figs. 15 through 20). Perform the following procedures before making resistance measurements.

(1) Push the 45V. BATT. switch to the OFF position for measurements smaller than 1 megohm.

(2) Push the 45V. BATT. switch to the ON position for measurements larger than 1 megohm.

(3) Push the VM.-RES. switch to the RES. position.

(4) Place the pin of the black meter lead in the X jack. *For measurements larger than 1 megohm, with Test Sets TS–26A/TSM and TS–26B/TSM only, place the pin of the black meter lead in the — (negative) jack.*

(5) Place the pin of the red meter lead in one of the following jacks:

(*a*) R jack for measurements between 0 and 1,000 ohms (fig. 15).

(*b*) RX10 jack for measurements between 0 and 10,000 ohms (fig. 16).

(*c*) RX100 jack for measurements between 0 and 100,000 ohms (fig. 17).

(*d*) RX1000 jack for measurements between 0 and 1 megohm (fig. 18).

(*e*) RX1000 jack for measurements between 0 and 10 megohms (fig. 19 or 20).

(6) Place the pin of the black test lead in the L1 jack.

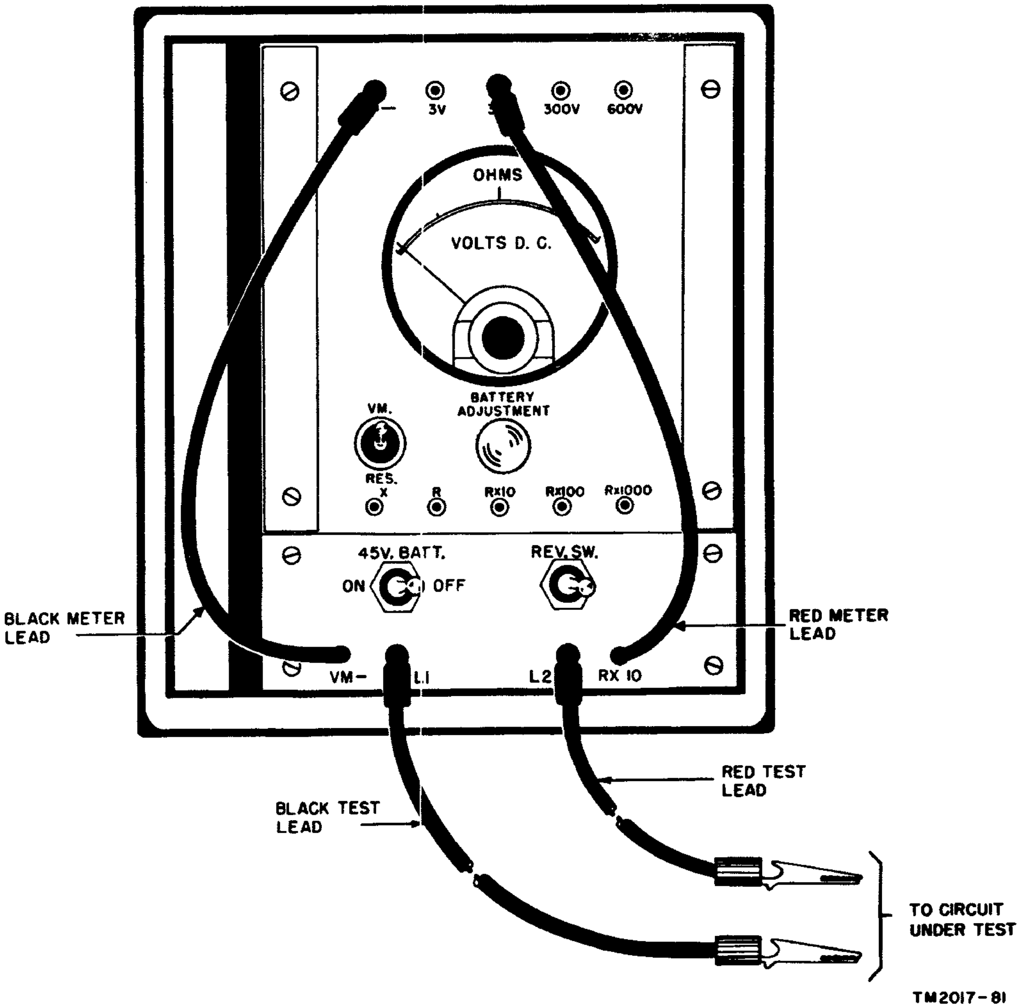

Figure 13. Test Set TS–26(*)/TSM, arranged for measurements between 0 and 30 volts dc.

(7) Place the pin of the red test lead in the L2 jack.

(8) Connect the alligator clips of the two test leads together.

(9) Turn the BATTERY ADJUSTMENT control until the meter needle points to 0 on the OHMS scale of the meter. *Keep the eye directly above the 0 when making this adjustment.*

(10) Repeat the instructions outlined in (7) and (8) above each time the test set is changed to a different resistance range.

(11) Disconnect the alligator clips.

16. Line Connections and Preoperating Checks

a. Cable stubs must be used for connections between Test Set TS–26(*)/TSM and wire pairs that are part of cable assemblies.

(1) Use Cable Stub CC–344 to connect the test set to Cable Assembly CC–355–A (fig. 21).

(2) Use Cable Stub CC–344 to connect the test set to Cable Assembly CC–345 (fig. 22).

(3) Use Cable Stub CC–356 to connect the test set to Cable Assembly CC–358–E (fig. 23).

(4) Use Telephone Cable Assembly CX–1512/U to connect the test set to Cable Assembly CX–1065/G (fig. 24).

b. Connections between Test Set TS–26(*)/TSM and field wire pairs, such as Wire WD–1/TT, are made directly.

c. Check the wire ends of the pair under test. They must be clean and free from insulation and dirt. If good electrical connections are not obtained, the meter readings will not be accurate.

d. Be sure that a good ground connection is available for use with the test set. Methods of obtaining ground connections are described in paragraph 13.

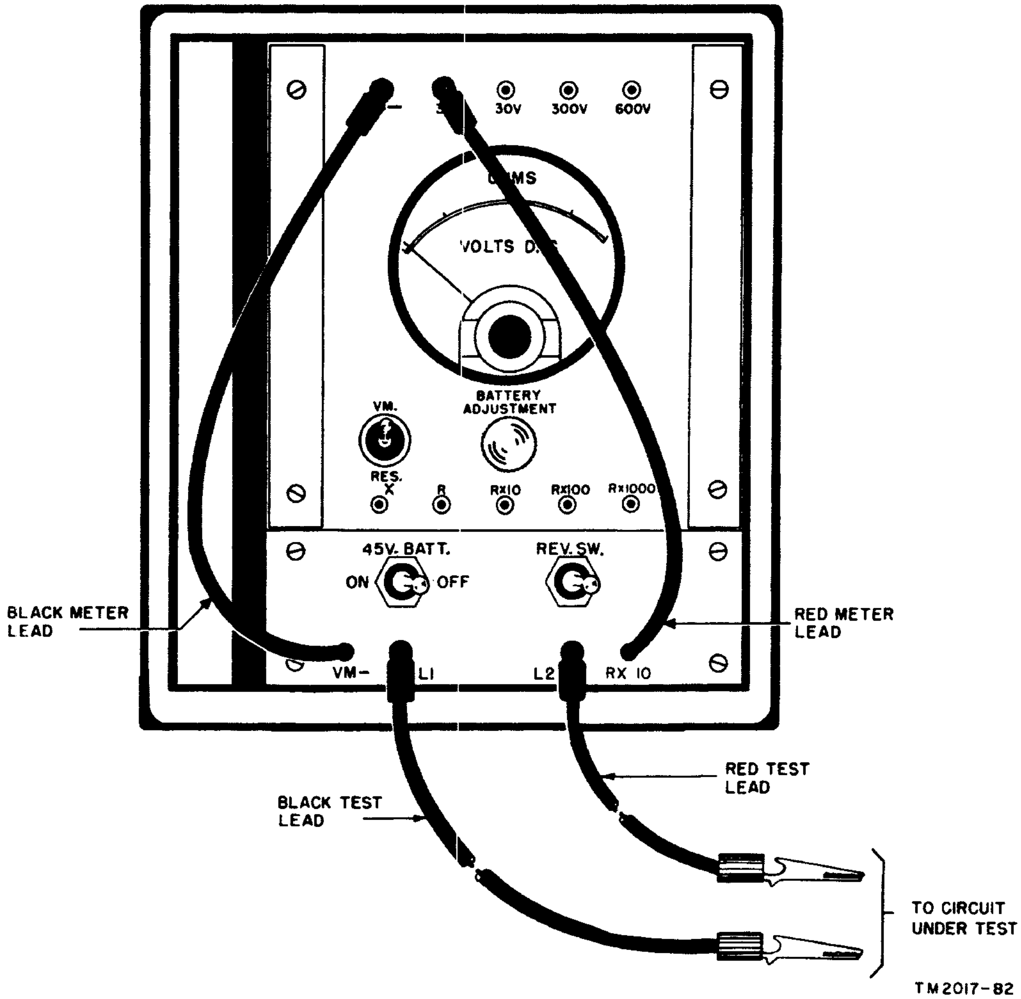

Figure 14. Test Set TS–26(*)/TSM, arranged for measurements between 0 and 3 volts dc.

17. Meter Readings

a. Meter Resistance Readings (fig. 25). The proper method of reading the meter of the test set for all five resistance ranges is explained in (1) through (5) below. Assume that the test set is arranged for operation as an *ohmmeter* (par. 15*b*) and that the loop resistance of a wire pair is being measured. Assume also that the meter needle is pointing to 20 on the OHMS scale. *If the meter needle points to any number other than the one used in this example, the methods described in (1) through (5) below still apply.*

(1) If the 0- to 1,000-ohm range is being used (fig. 15), read the OHMS scale directly. In this case, the resistance is 20 ohms.

(2) If the 0- to 10,000-ohm range is being used (fig. 16), multiply the reading on the OHMS scale by 10. In this case, the resistance is 10 x 20 or 200 ohms.

(3) If the 0- to 100,000-ohm range is being used (fig. 17), multiply the reading on the OHMS scale by 100. In this case, the resistance is 100 x 20 or 2,000 ohms.

(4) If the 0- to 1,000,000-ohm range is being used (fig. 18), multiply the reading on the OHMS scale by 1,000. In this case, the resistance is 1,000 x 20 or 20,000 ohms.

(5) If the 0- to 10,000,000-ohm range is being used (figs. 19 and 20), multiply the reading on the OHMS scale by 10,000. In this case, the resistance is 10,000 x 20 or 200,000 ohms.

b. Meter Voltage Readings (fig. 25). The proper method of reading the meter of the test set for all four voltage ranges is explained in (1) through (4) below. Assume that the test set is arranged for operation as a *voltmeter* (par. 15*a*) and that a

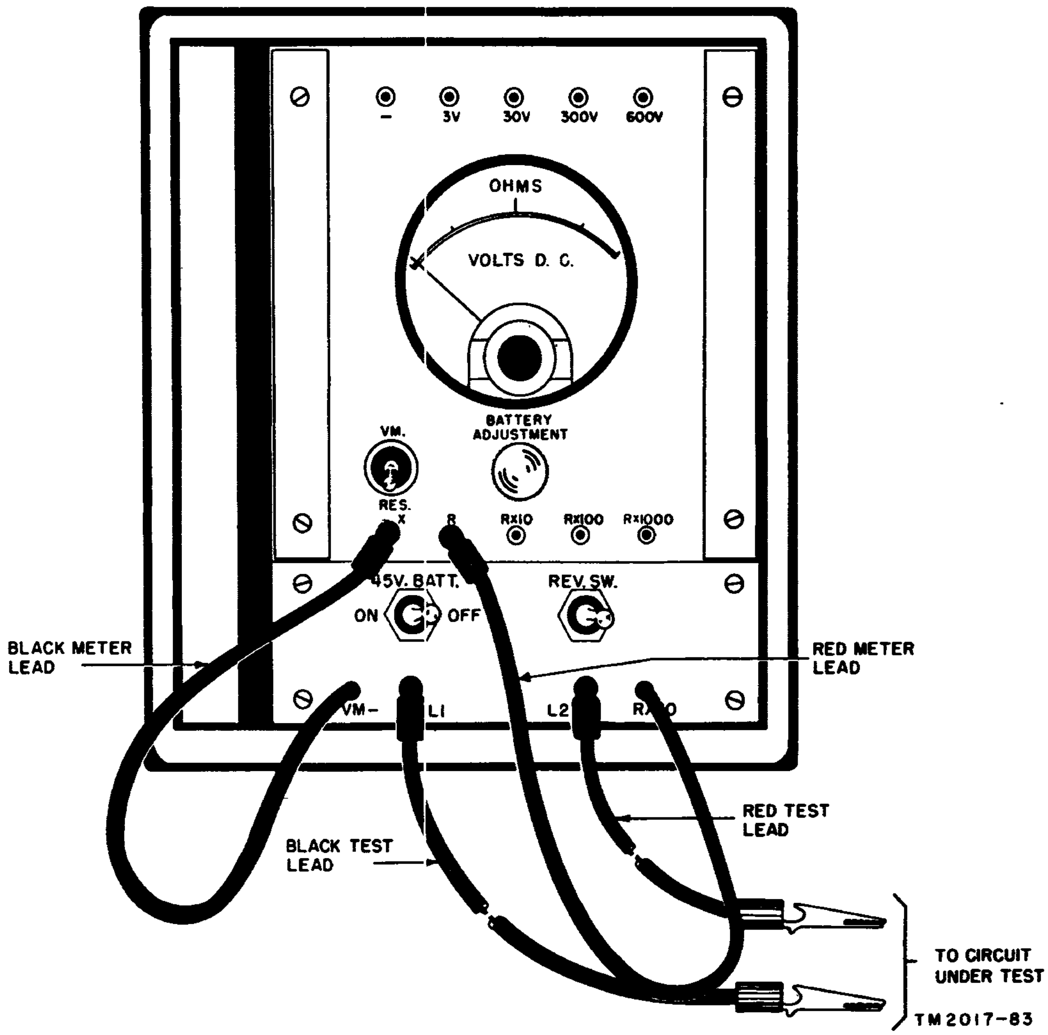

Figure 15. Test Set TS-26(*)/TSM, arranged for measurements between 0 and 1,000 ohms.

dc voltage is being measured. Assume also that the meter needle is pointing to 100 on the 0 to 300 VOLTS D. C. scale (200 on the 0 to 600 VOLTS D. C. scale). *If the meter needle points to any number other than those used in this example, the methods described in (1) through (4) below still apply.*

(1) If the 0- to 3-volt range is used (fig. 14), divide the reading on the VOLTS D. C. scale by 100. In this case, the dc voltage is 100 ÷ 100 or 1 volt.

(2) If the 0- to 30-volt range is being used (fig. 13), divide the reading on the VOLTS D. C. scale by 10. In this case, the dc voltage is 100 ÷ 10 or 10 volts.

(3) If the 0- to 300-volt range is being used (fig. 12), read the VOLTS D. C. scale directly. In this case, the dc voltage is 100 volts.

(4) If the 0- to 600-volt range is being used (fig. 11), read the VOLTS D. C. scale directly. In this case, the dc voltage is 200 volts.

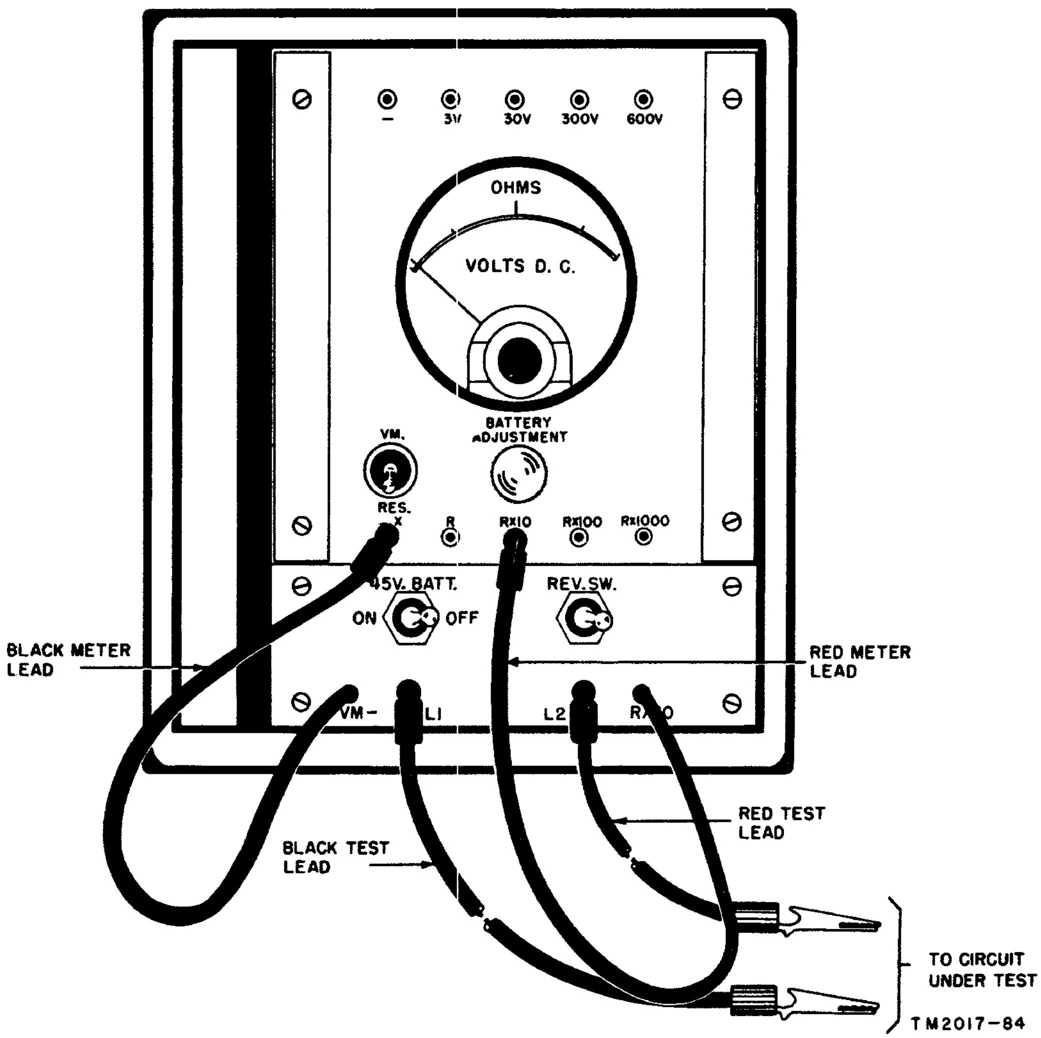

Figure 16. Test Set TS-26(*)/TSM, arranged for measurements 0 and 10,000 ohms.

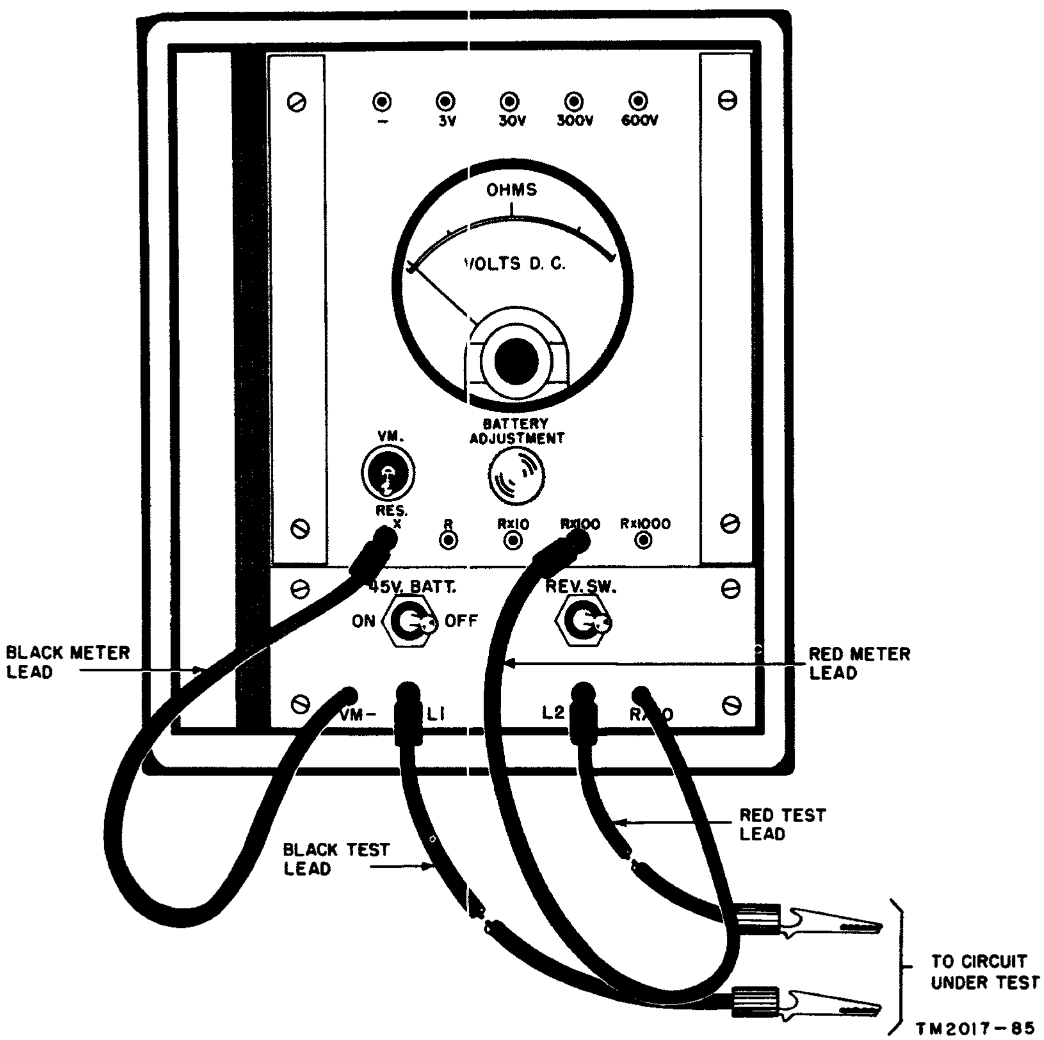

Figure 17. Test Set TS-26(*)/TSM, arranged for measurements between 0 and 100,000 ohms.

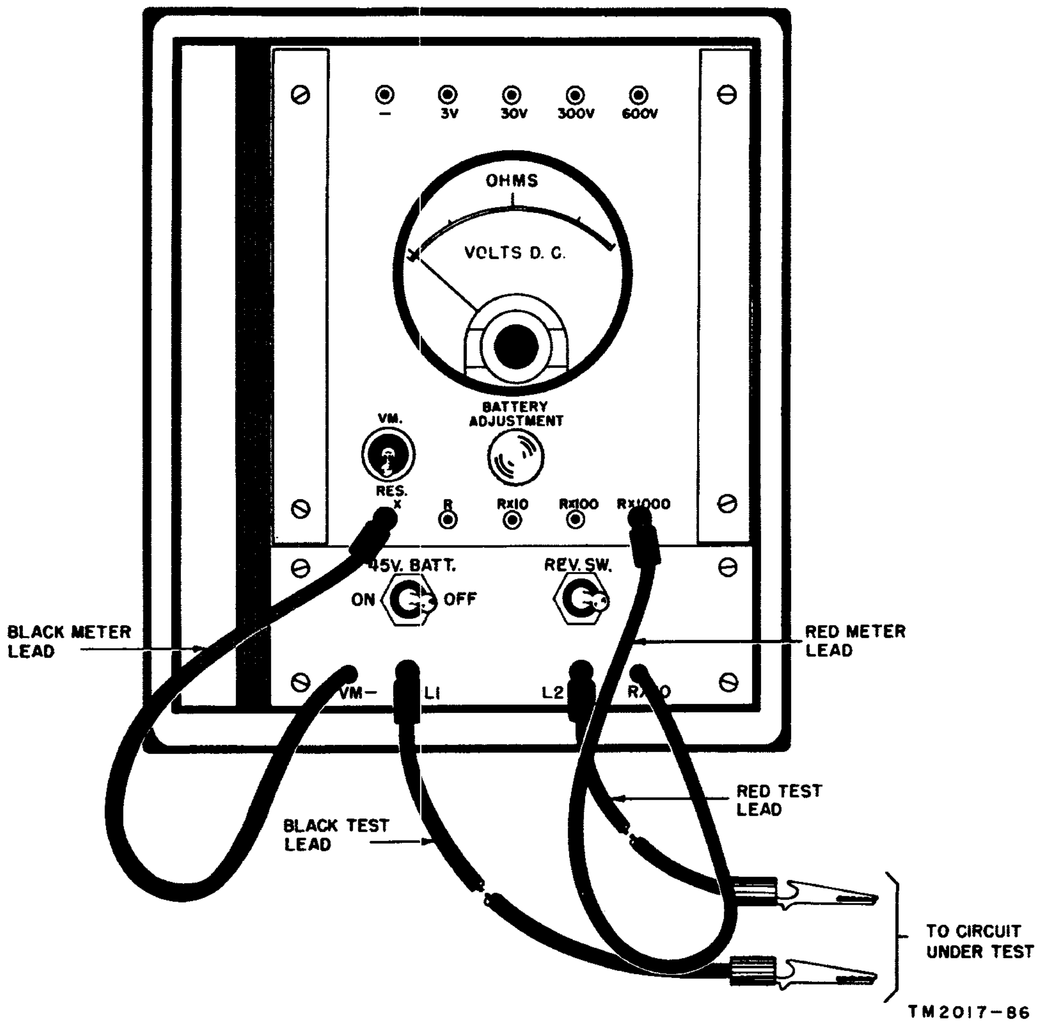

Figure 18. Test Set TS-26(*)/TSM, arranged for measurements between 0 and 1 megohm.

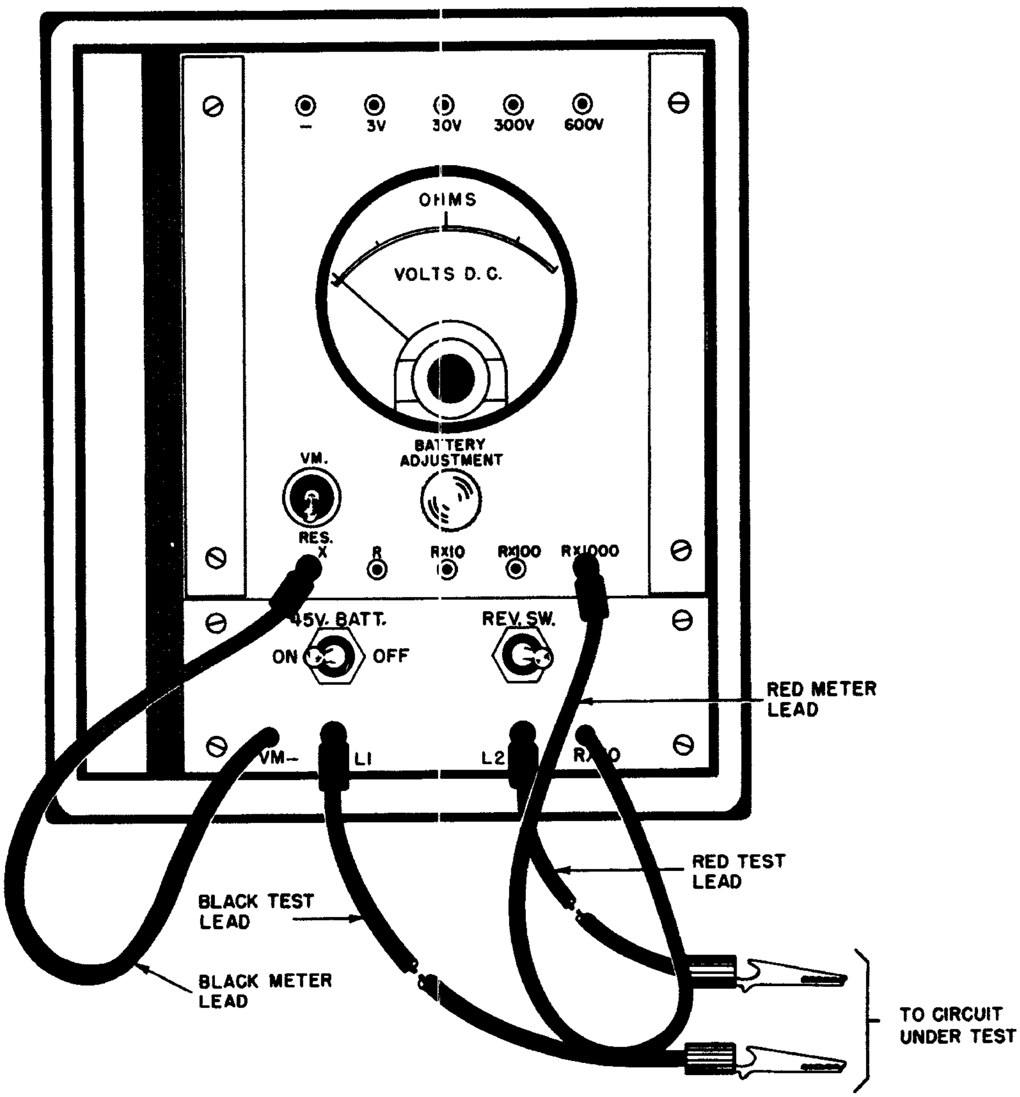

Figure 19. Test Set TS-26/TSM, arranged for measurements between 0 and 10 megohms.

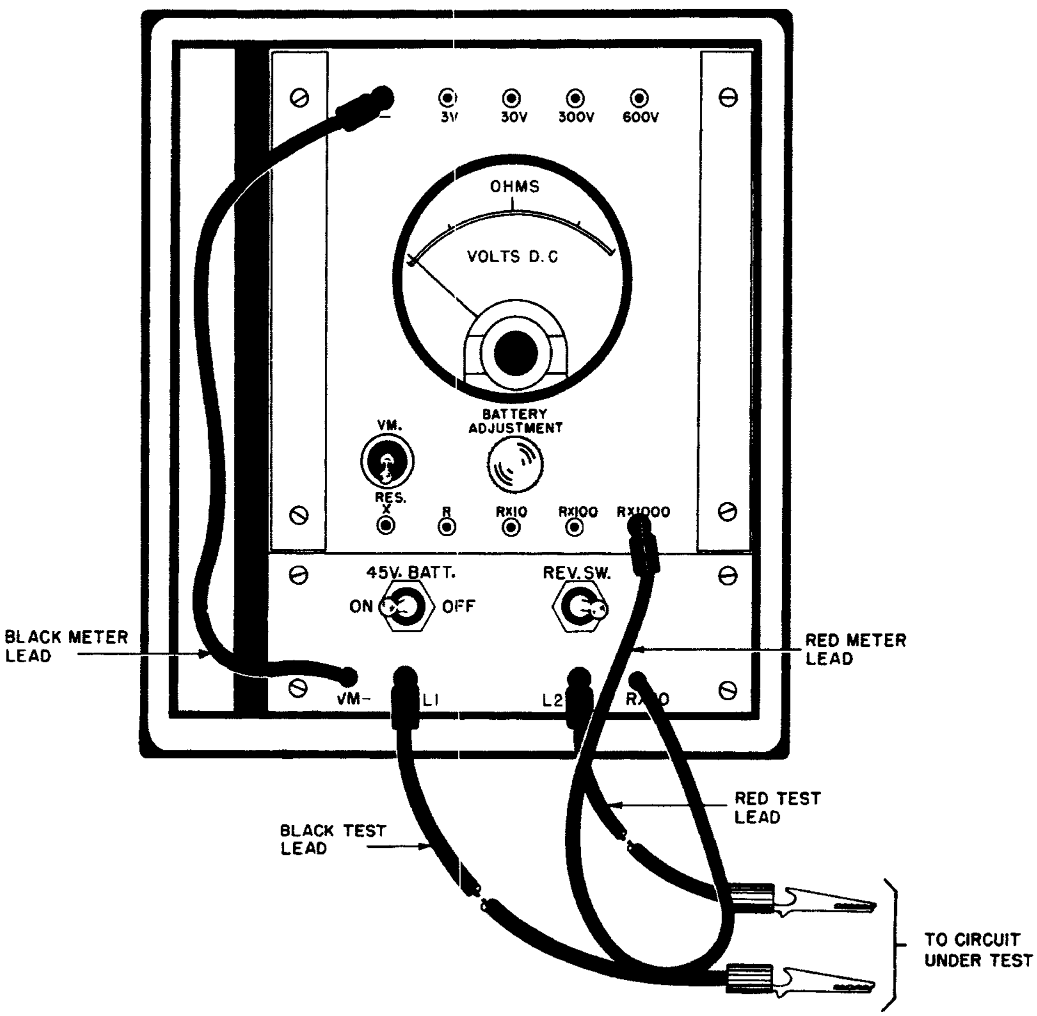

Figure 20. Test Set TS–26A/TSM or TS–26B/TSM, arranged for measurements between 0 and 10 megohms.

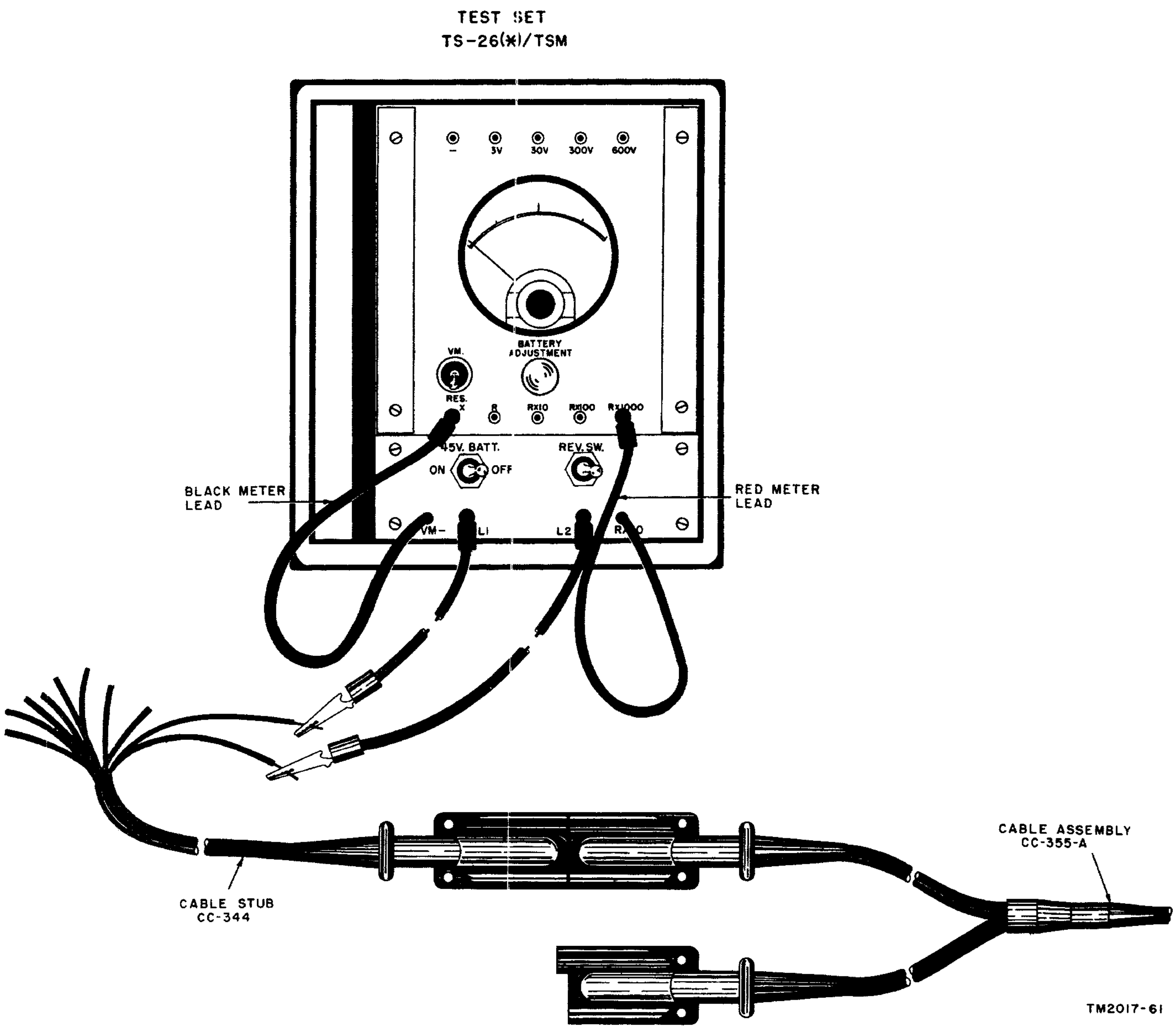

Figure 21. Proper method of connecting Test Set TS–26(*)/TSM to Cable Assembly CC–355–A, using Cable Stud CC–344.

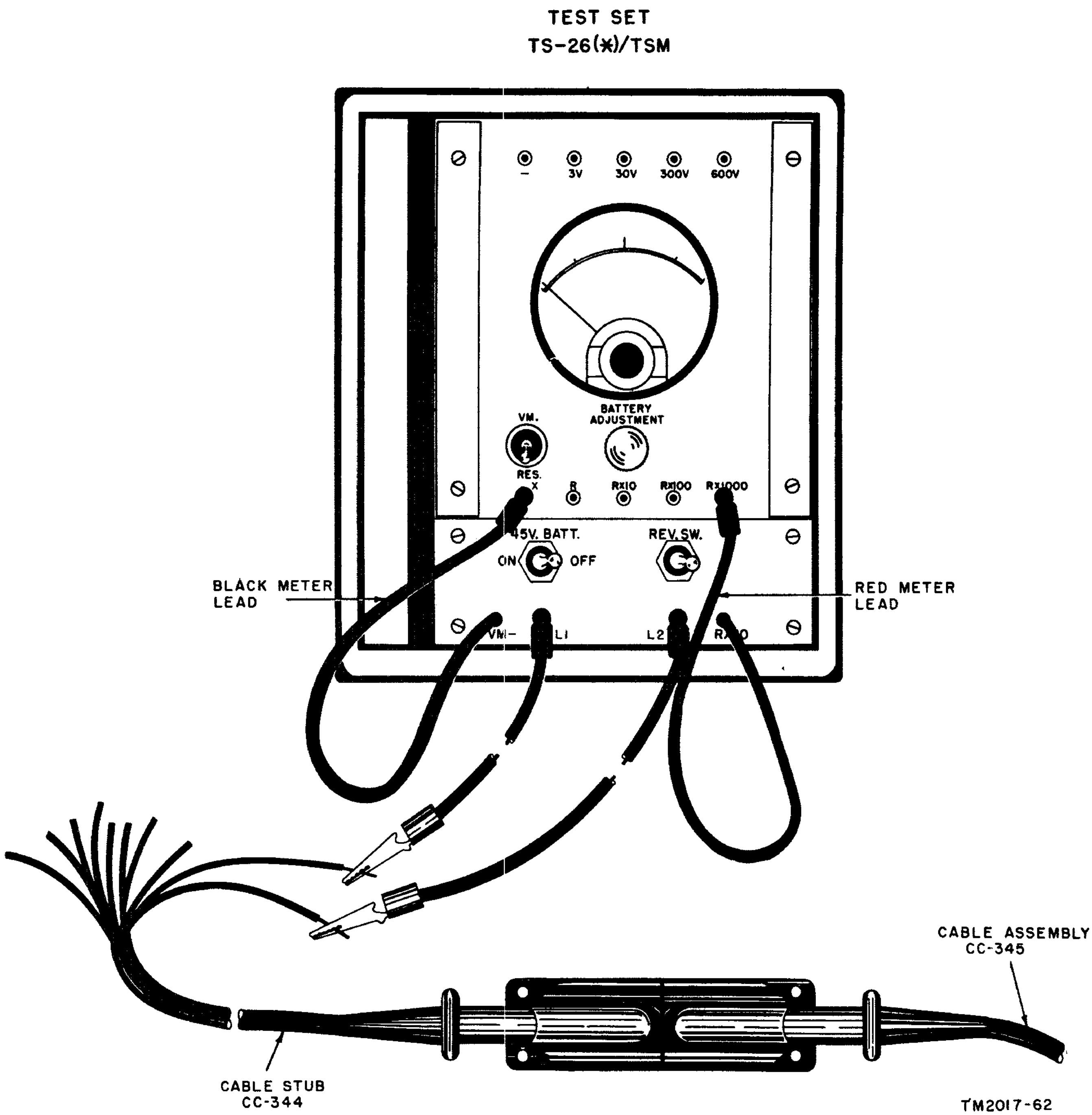

Figure 22. Proper method of connecting Test Set TS-26(*)/TSM to Cable Assembly CC-345, using Cable Stub CC-344.

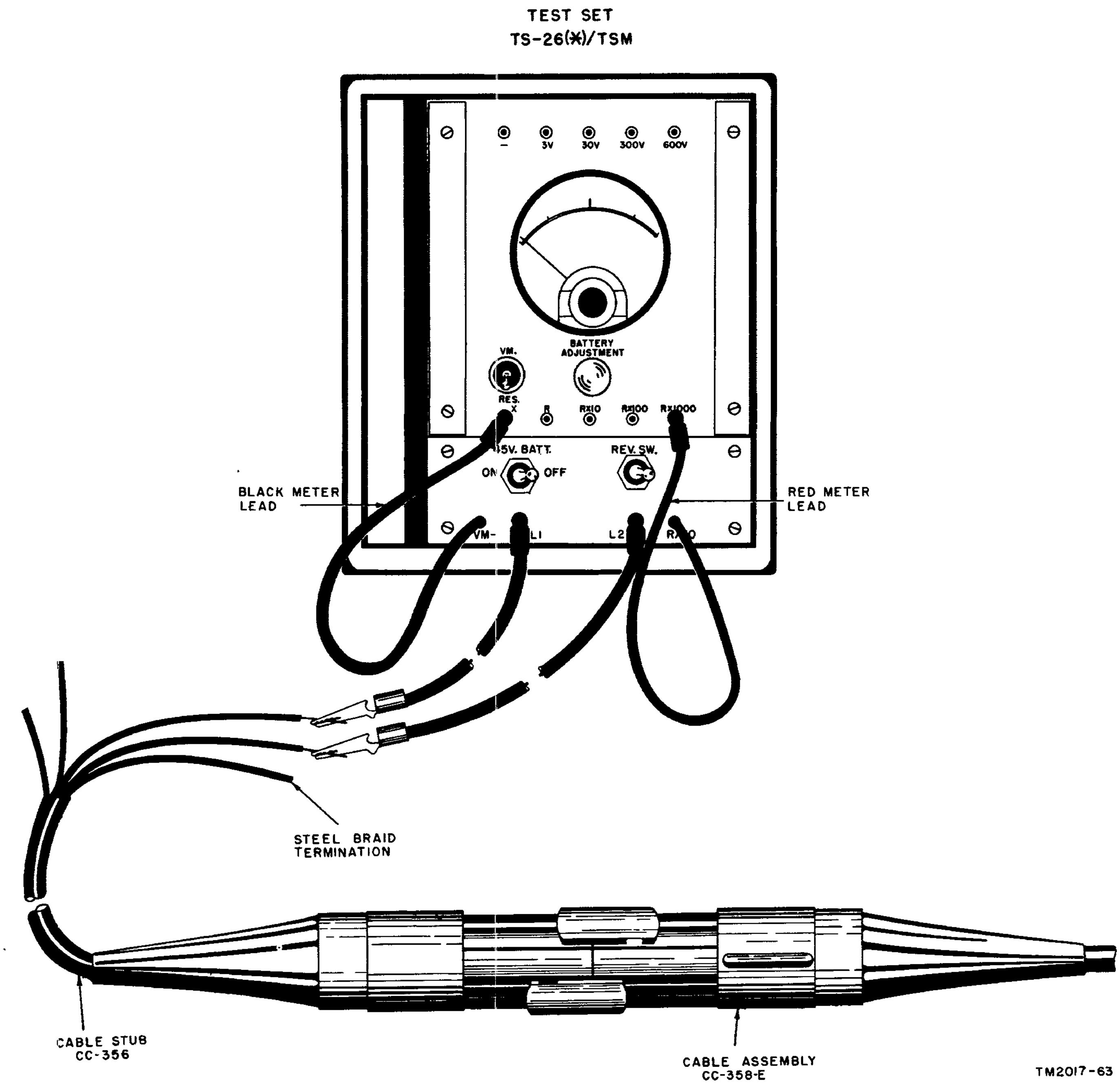

Figure 23. Proper method of connecting Test Set TS–26(*)/TSM to Cable Assembly CC–358–E, using Cable Stub CC–356.

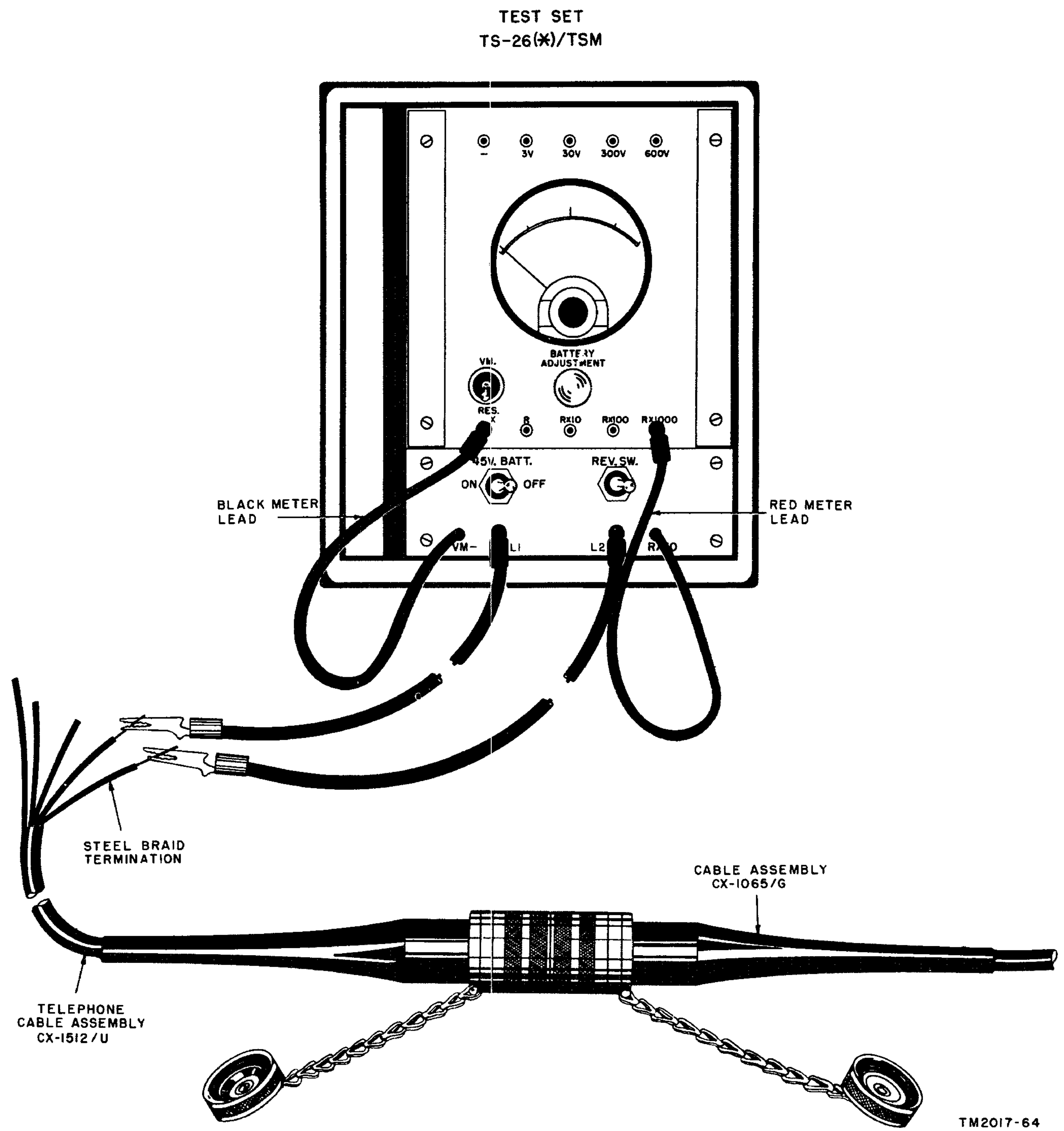

Figure 24. Proper method of connecting Test Set TS-26(*)/TSM to Cable Assembly CX-1065/G, using Telephone Cable Assembly CX-1512/U.

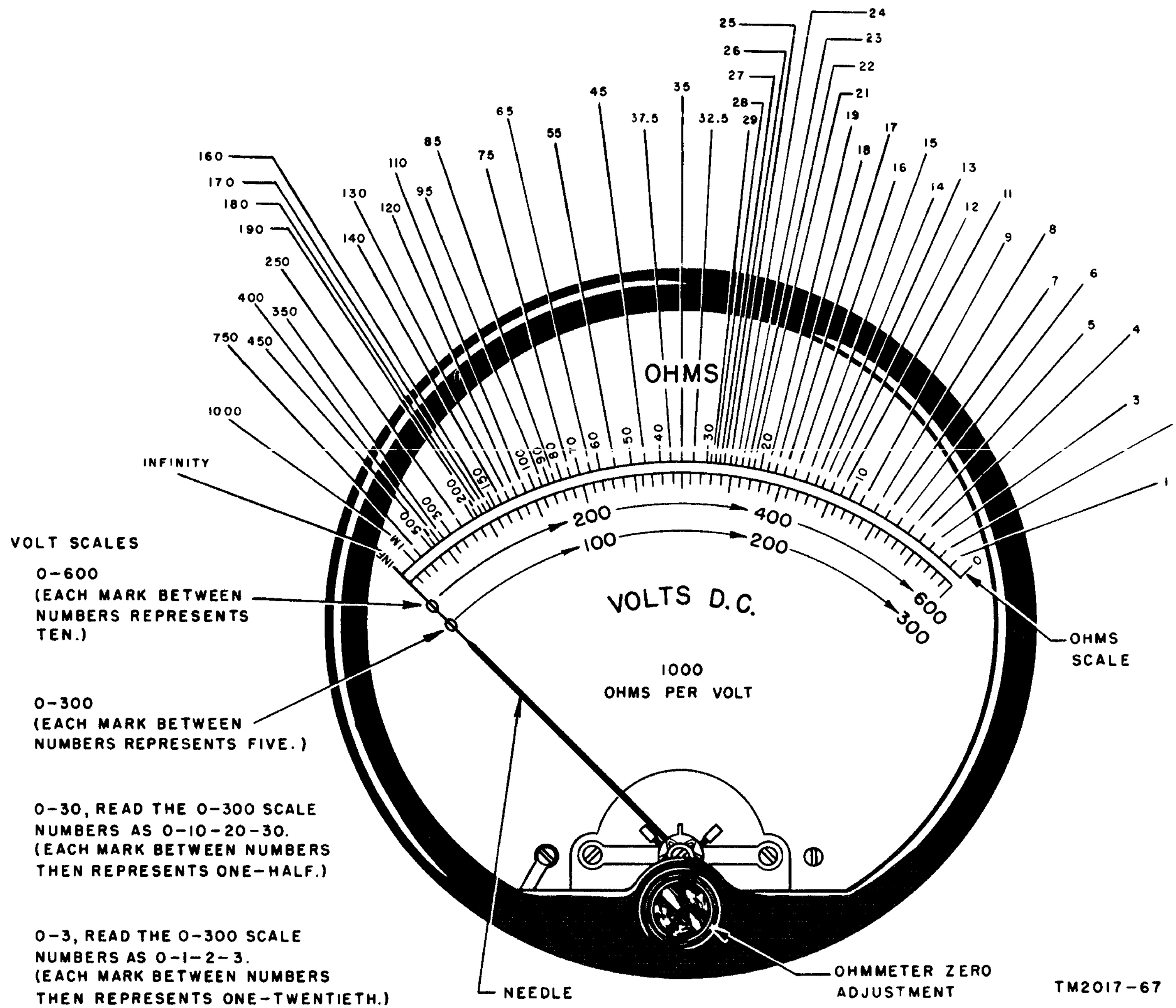

Figure 25. Test Set TS-26(*)/TSM, meter dial.

Section II. VOLTAGE MEASUREMENTS

18. Battery Voltage

Perform the procedures outlined in *a* through *e* below to measure the voltage of a battery. Make the measurement under load conditions (battery connected to a working circuit).

a. Arrange Test Set TS–26(*)/TSM as a voltmeter (par. 15*a*).

b. Connect the red test lead to the + (positive) terminal of the battery (fig. 26).

c. Connect the black test lead to the — (negative) terminal of the battery.

d. Read the VOLTS D. C. scale (par. 17*b*). *Keep the eye directly above the meter needle when obtaining this measurement.*

e. Disconnect the test leads.

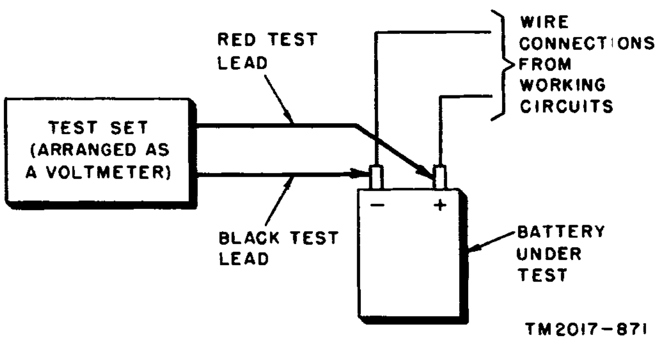

Figure 26. Simplified test setup for battery voltage measurements.

19. Circuit Voltage

a. Use the procedures outlined in (1) through (5) below to measure the voltage between wires of a pair.

(1) Arrange Test Set TS–26(*)/TSM as a voltmeter (par. 15*a*). *Use the 0- to 600-volt range.*

(2) Connect the red test lead to one wire of the pair under test (fig. 27).

(3) Connect the black test lead to the other wire of the pair under test.

(4) Read the VOLTS D. C. scale (par. 17*b*). Push the REV. SW. switch in the other direction if the meter needle moves off scale on the left side of the meter. The meter needle should be on the scale. *Keep the eye directly above the meter needle when obtaining this measurement.*

(*a*) If an accurate meter reading cannot be obtained with the 0- to 600-volt range, arrange the test set for use with the 0- to 300-volt range.

(*b*) If an accurate meter reading cannot be obtained with the 0- to 300-volt range, arrange the test set for use with the 0- to 30-volt range.

(*c*) If an accurate meter reading cannot be obtained with the 0- to 30-volt range, arrange the test set for use with the 0- to 3-volt range.

(*d*) If a reading cannot be obtained with the 0- to 3-volt range (meter needle remains on 0), there is no voltage present between the wires of the pair under test.

(5) Disconnect the test leads.

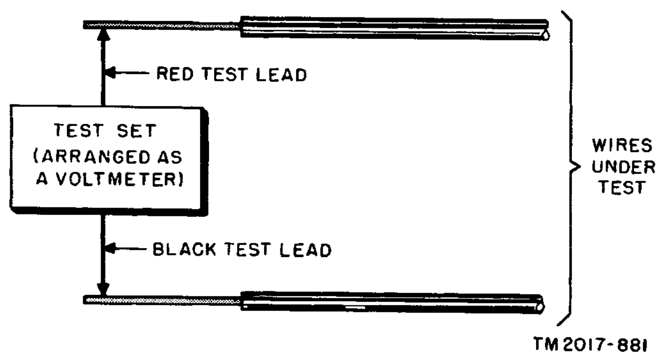

Figure 27. Simplified test setup for measuring dc voltage between two wires.

b. Use the procedures outlined in (1) through (5) below to measure the voltage between one wire of a pair and ground.

(1) Arrange Test Set TS–26(*)/TSM as a voltmeter (par. 15*a*). *Use the 0- to 600-volt range.*

(2) Connect the red test lead to the wire under test (fig. 28).

(3) Connect the black test lead to ground (par. 13).

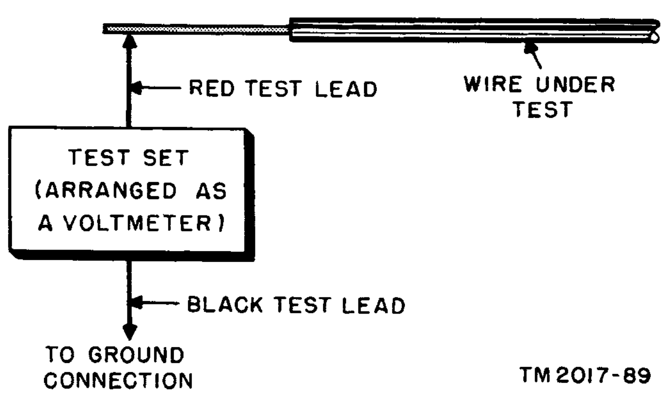

Figure 28. Simplified test setup for measuring dc voltage between wire and ground.

(4) Read the VOLTS D. C. scale (par. 17*b*). Push the REV. SW. switch if the meter needle moves off scale on the left side of the meter. *Keep the eye directly above the meter needle when obtaining this measurement.*

(*a*) If an accurate meter reading cannot be obtained with the 0- to 600-volt range, arrange the test set for use with the 0- to 300-volt range.

(*b*) If an accurate meter reading cannot be obtained with the 0- to 300-volt range, arrange the test set for use with the 0- to 30-volt range.

(*c*) If an accurate meter reading cannot be obtained with the 0- to 30-volt range, arrange the test set for use with the 0- to 3-volt range.

(*d*) If a reading cannot be obtained with the 0- to 3-volt range (meter needle remains on 0), there is no voltage present between the wire under test and ground.

(5) Disconnect the test leads.

Section III. FAULT IDENTIFICATION

Note. First, identify the fault using the tests in section III. Then locate the fault using the tests in sections IV or V.

20. Shorts

Perform the procedures described in *a* through *d* below to determine whether the wires of a pair are shorted together (in contact with each other).

a. Disconnect the line under test from the equipment at both ends.

b. Arrange Test Set TS–26(*)/TSM as an ohmmeter (par. 15*b*). *Use the 0- to 10-megohm range.*

c. Connect the black test lead to one wire of the pair under test.

d. Connect the red test lead to the other wire of the pair under test.

e. Look at the meter needle.

(1) If the needle moves to 0 (or very close to 0) on the OHMS scale of the meter, the wires of the pair are shorted together. *A short usually is caused by worn or crushed insulation which allows the wires of a pair to touch each other (fig. 29).*

(2) If the needle does not move close to 0 on the OHMS scale of the meter, the wires of the pair are not shorted together.

f. Disconnect the test leads.

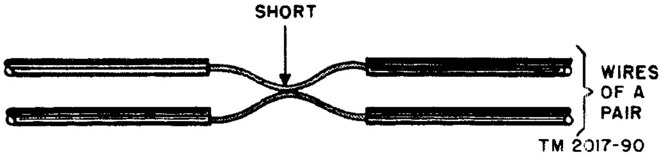

Figure 29. Simplified drawing of shorted pair.

21. Crosses

Perform the procedures outlined in *a* through *h* below to determine whether the wires of two different pairs are crossed (in contact with each other).

a. Disconnect the two pairs under test from the equipment at both ends.

b. Arrange Test Set TS–26(*)/TSM as an ohmmeter (par. 15*b*). *Use the 0- to 10-megohm range.*

c. Tag each wire of both pairs as shown in A, figure 30.

d. Connect the black test lead to T1 and the red test lead to T2 as shown in B, figure 30. Wires T1 and T2 are crossed if the meter needle moves to 0 (or very close to 0) on the OHMS scale of the meter. *A cross usually is caused by worn or crushed insulation which allows a wire of one pair to touch a wire of a second pair (fig. 31).*

e. Disconnect the red test lead from T2 and connect it to R2 (C, fig. 30). Wires T1 and R2 are crossed if the meter needle moves to 0 (or very close to 0) on the OHMS scale of the meter.

f. Disconnect the black test lead from T1 and connect it to R1 (D, fig. 30). Wires R1 and R2 are crossed if the meter needle moves to 0 (or very close to 0) on the OHMS scale of the meter.

g. Disconnect the red test lead from R2 and connect it to T2 (E, fig. 30). Wires T2 and R1 are crossed if the meter needle moves to 0 (or very close to 0) on the OHMS scale of the meter.

h. Disconnect both test leads from the wires under test.

22. Opens

Perform the procedures outlined in *a* through *f* below to determine whether the wires of a pair are open (broken).

a. Disconnect the line under test from the equipment at both ends.

b. At the distant end of the line under test, connect together the wires of the pair.

c. Arrange Test Set TS–26(*)/TSM as an ohmmeter (par. 15*b*). *Use the 0- to 10-megohm range.*

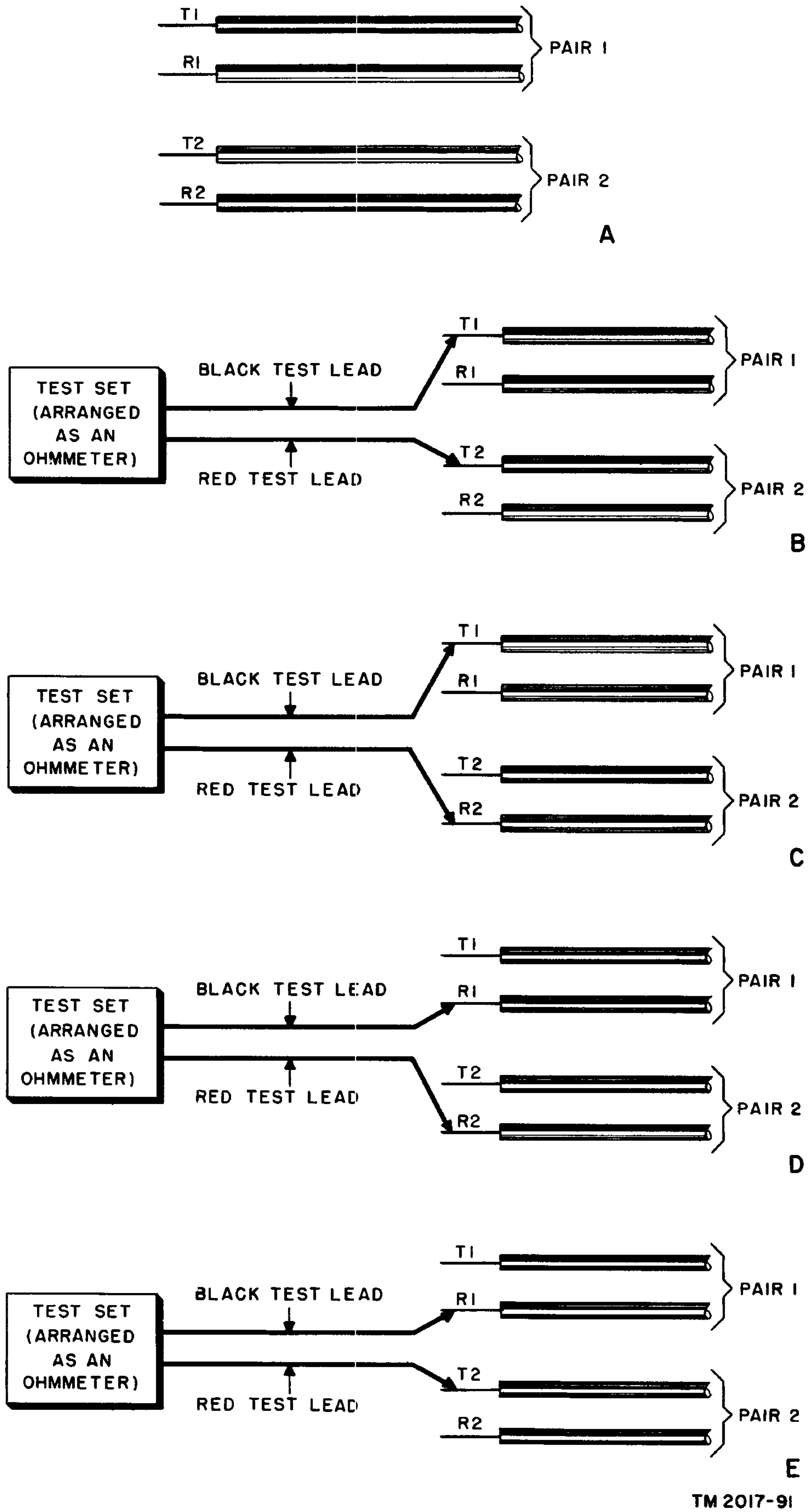

Figure 30. Simplified test setups for identifying crossed pairs.

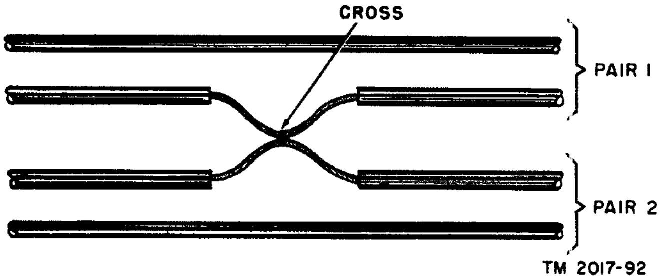

Figure 31. Simplified drawing of crossed pairs.

d. At the local end of the line under test, connect the black test lead to one wire of the pair and the red test lead to the other wire of the pair.

e. Look at the meter.

(1) If the meter needle remains on the INF. position of the OHMS scale after the initial kick, the line under test is open. *Opens are caused by a break in one or both wires of a pair (fig. 32).*

(2) If the meter needle moves to 0 (or very close to 0) on the OHMS scale of the meter and remains there, the line under test is not open.

f. Disconnect the test leads at the local end and also disconnect the two wires that were connected together at the distant end (*b* above).

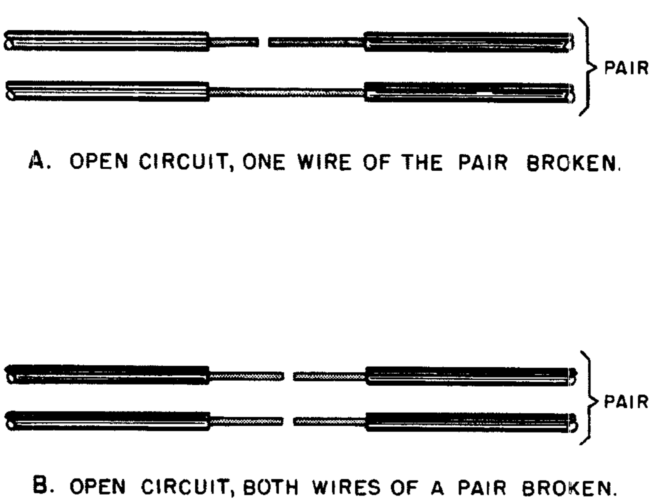

Figure 32. Simplified drawings of open pairs.

23. Grounds

Perform the procedures outlined in *a* through *g* below to determine whether one or both wires of a pair are grounded.

a. Disconnect the line under test from the equipment at both ends.

b. Arrange Test Set TS–26(*)/TSM as an ohmmeter (par. 15*b*). *Use the 0- to 10-megohm range.*

c. Connect the black test lead to ground (par. 13).

d. Connect the red test lead to one wire of the pair under test.

e. Look at the meter.

(1) If the meter needle moves to 0 (or close to 0) on the OHMS scale of the meter, the wire under test is grounded. *A break in the insulation may allow one or both wires of a pair to touch ground (fig. 33).*

(2) If the meter needle remains on (or near) the INF. position of the OHMS scale after the initial kick, the wire under test is not grounded.

f. Disconnect the red test lead from the wire under test and connect it to the other wire of the pair. Repeat the procedures given in *a* through *e* above.

g. Disconnect the test leads.

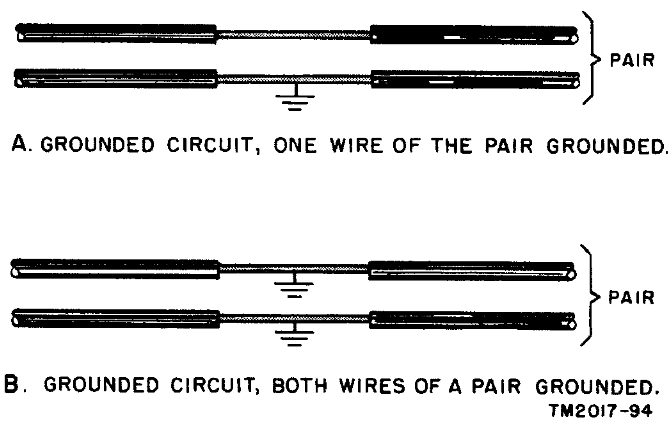

Figure 33. Simplified drawings of grounded pairs.

24. Insulation Resistance

Perform the procedures outlined in *a* through *e* below to determine whether the insulation resistance between wires of a pair is below minimum requirements. Minimum acceptable values for insulation resistance between wires of a pair are established when the line is installed initially. These values are based on the type and length of line being used, the type of line construction, prevailing weather conditions, and equipment requirements.

a. Disconnect the line under test from the equipment at both ends.

b. Arrange Test Set TS–26(*)/TSM as an ohmmeter (par. 15*b*). *Use the 0- to 10-megohm range.*

c. Connect one test lead to each wire of the pair under test as shown in figure 34.

d. Read the OHMS scale of the meter (par. 17*a*) to obtain the insulation resistance measurement. *This measurement must be larger than the established minimum; otherwise, the insulation does not meet minimum requirements.*

e. Disconnect the test leads.

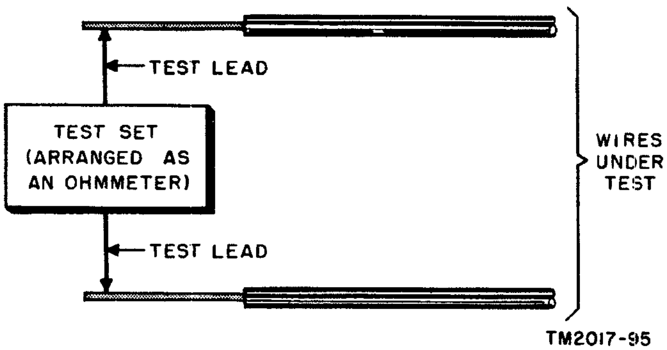

Figure 34. Simplified test setup for measuring insulation resistance.

25. Leakage Resistance

Perform the procedures outlined in *a* through *f* below to determine whether the leakage resistance between wires of a pair and ground is below minimum requirements. Minimum acceptable values for leakage resistance between wires of a pair and ground are established when the line is initially installed. These values are based on the type and length of line used, the type of line construction, prevailing weather conditions, and equipment requirements.

a. Disconnect the line under test from the equipment at both ends.

b. Arrange Test Set TS–26(*)/TSM as an ohmmeter (par. 15*b*). *Use the 0- to 10-megohm range.*

c. Connect the red test lead to one wire of the pair under test and the black test lead to ground as shown in figure 35.

d. Read the OHMS scale of the meter (par. 17*a*) to obtain the leakage resistance measurement. *This measurement must be larger than the established minimum; otherwise, the insulation does not meet minimum requirements.*

e. Disconnect the red test lead from the wire under test and connect it to the other wire of the pair. Repeat the procedures outlined in *a* through *d* above.

f. Disconnect the test leads.

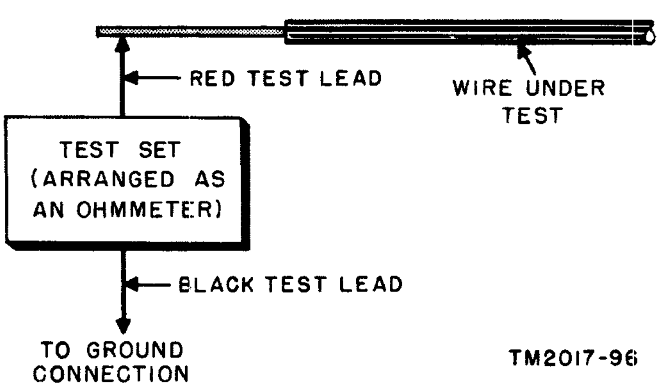

Figure 35. Simplified test setup for measuring leakage resistance.

26. Unwanted Dc Voltages

Perform the procedures outlined in *a* through *h* below to determine whether unwanted dc voltages are present on the wires of a pair.

a. Disconnect the line under test from the equipment at both ends

b. Arrange Test Set TS–26(*)/TSM as a voltmeter (par. 15*a*). *Use the 0- to 600-volt range.*

c. Connect the black test lead to ground (par. 13) and the red test lead to one wire of the pair under test as shown in figure 28.

d. Look at the position of the meter needle on the VOLTS D. C. scale of the meter.

(1) If the meter needle remains on 0, remove the red meter lead from the 600V jack and touch it to each of the following jacks in this order: 300V, 30V, and 3V. Each time the red meter lead touches one of the jacks, check the position of the meter needle. If it moves from the 0 position, a voltage is present on the wire under test. *Unwanted dc voltages may appear on the wires of a pair if they are crossed with a wire that is connected to a dc voltage source (fig. 36).*

(2) If the meter needle remains on the 0 position, even when the red test lead is touching the 3V jack, dc voltage is not present on the wire under test.

e. Place the red meter lead in the 600V jack.

f. Connect the red test lead to the other wire of the pair under test.

g. Repeat the procedures given in *d* above.

h. Disconnect the test leads.

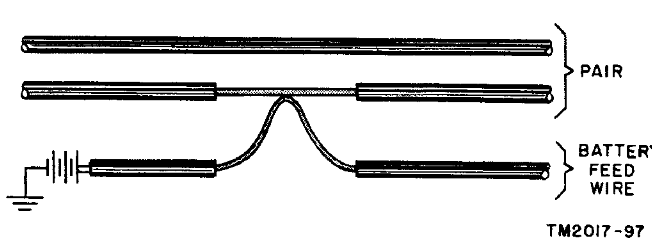

Figure 36. Simplified drawing of a cross between one wire of a pair and a battery-feed wire.

27. Shorts

Perform the procedures outlined in *a* through *k* below to locate a short on a pair of wires.

a. Disconnect the pair under test from the equipment at both ends.

b. Arrange Test Set TS–26(*)/TSM as an ohmmeter (par. 15*b*).

c. Connect one test lead to each wire of the shorted pair.

d. Read the OHMS scale of the meter (par. 17*a*) to obtain the actual resistance of the wire loop between the test set and the short.

e. Refer to table I to obtain the loop resistance for 1 mile of the wire under test. *For example, the table shows that the loop resistance of 1 mile of Cable Assembly CC–355–A, at a temperature of 68° F., is 87 ohms for each pair.*

f. Divide the resistance reading (*d* above) by the loop resistance (*e* above) to obtain the approximate distance (in miles) between the test set and the short. *For example, if the resistance reading obtained (d above) is 435 ohms and the loop resistance (e above) is 87 ohms; then 435÷87=5. In this example the short is located approximately 5 miles along the line route from the place where the test is being made.*

g. Disconnect the test leads, proceed to the location of the fault, and inspect the pair for a short. If the pair is part of a cable assembly, inspect the outer covering for damage.

h. If the short cannot be located, open the line and test each section for a short (par. 20). *Do not cut cable assemblies; open them at the nearest connection point.*

i. When the section containing the short is identified, repeat the procedures outlined in *b* through *f* above.

j. Disconnect the test leads, close the pair, proceed to the location of the fault, and again inspect the pair for a short.

k. Repeat the procedures described in *h* through *j* above until the short is located.

Table I. Temperature Correction Table

Temp (°F.)	Wire resistances in ohms-per-loop mile							
	Wire W-110-B	Wires W-130, W-130-A, W-130-C, and WD-3/TT	Wire W-143	Wire W-153	Cable Assemblies CC-345 and CC-355-A	Cable Assembly CC-358-E	Wire WD-1/TT and WD-14/TT	Cable Assembly CX-1065
0	162. 4	518. 2	27. 4	18. 31	74. 1	65. 6	179. 7	73. 4
10	166. 4	535. 9	28. 1	18. 75	76. 0	67. 3	184. 3	75. 3
20	170. 5	553. 7	28. 7	19. 20	77. 9	68. 9	188. 9	77. 1
30	174. 5	571. 5	29. 4	19. 63	79. 8	70. 6	193. 5	79. 0
40	178. 6	589. 2	30. 1	20. 10	81. 7	72. 3	198. 1	80. 9
50	182. 7	607. 0	30. 8	20. 55	83. 6	74. 0	205. 5	82. 8
60	186. 7	624. 8	31. 5	21. 00	85. 5	75. 7	207. 3	84. 7
68	190. 0	639. 2	32. 0	21. 39	87. 0	77. 0	211. 0	86. 2
70	190. 8	642. 6	32. 1	21. 47	87. 3	77. 3	211. 9	86. 6
80	194. 9	660. 1	32. 8	21. 91	89. 3	79. 2	216. 5	88. 5
90	198. 9	678. 1	33. 5	22. 35	91. 2	80. 7	221. 1	90. 4
100	203. 0	695. 9	34. 2	22. 80	93. 1	82. 6	225. 7	92. 3

Note. The resistance values in table I are average values which may vary ±2 percent.

28. Crosses

Perform the procedures described in paragraph 27 to locate a cross between pairs in a cable assembly or between pairs of the same type of field wire which are installed side by side along a line route. Consider the two crossed wires as a shorted pair.

29. Grounds

Perform the procedures outlined in *a* through *e* below to locate grounds on one or both wires of a pair.

a. Disconnect the pair under test from the equipment at both ends.

b. Proceed to the midpoint of the line and open the pair. *Do not cut cable assemblies; open them at the nearest connecting point.*

c. Test for grounds on each wire in both directions (par. 23) to localize the ground to a section of the line.

d. Close the pair, proceed to the midpoint of the section of line that contains the ground, and again open the pair.

e. Repeat the procedures outlined in *c* and *d* above until the section of line containing the ground is very small and can be replaced or until the ground is located by inspection.

30. Unwanted Dc Voltage

Perform the procedures outlined in *a* and *b* below to locate the cause of unwanted dc voltages on cable assembly pairs or on pairs of field wire which are installed side by side with outer field wires of the same type. The presence of unwanted dc voltage on wires of a pair is caused by a cross.

a. Test for a cross between the pair under test and all other pairs on the same line route (par. 21).

b. When the crossed wires have been identified, use the procedures described in paragraph 27 to locate the cross. *The procedures for locating crosses are the same as those for locating shorts. Consider the two crossed wires as a shorted pair.*

Section V. FAULT LOCATION—OPENS—CAPACITANCE KICK METHOD

31. General

The *capacitance kick method* is used to locate opens on wire pairs. To use this method, proceed as follows:

a. Obtain the necessary meter readings; use the procedures outlined in paragraph 32.

b. Correct the meter readings; use the procedures outlined in paragraph 33.

c. Locate the open; use the procedures outlined in paragraph 34.

32. Meter Readings

a. Disconnect the line under test from the equipment at both ends.

b. Arrange Test Set TS–26(*)/TSM as an ohmmeter (15*b*). Use the 0- to 10-megohm range if the line under test is less than 4 miles long. If the line is between 4 and 18 miles long, use the 0- to 1-megohm range.

c. Connect one test lead to each wire of the pair under test. If the pair under test is part of Cable Assembly CC–358–E or CX–1065/G, connect *one* test lead to *both* wires of the pair under test and the other test lead to the cable assembly shield.

d. Count the meter divisions between 0 and the resting position of the meter needle on the VOLTS D. C. scale (fig. 25). This number is the *leakage reading.* Meter divisions are the spaces between the scale markings.

e. Push the REV.SW. switch back and forth, wait 2 or 3 seconds between each movement, and count the meter divisions between 0 and the largest kick of the meter needle on the VOLTS D. C. scale. *This number is the kick reading.* If the test set is arranged for use with a line that is less than 4 miles long and the meter needle kicks off scale to the right each time the REV.SW. switch is pushed, rearrange the test set for use with the 0- to 1-megohm range and repeat the procedures outlined herein and *d* above.

f. Subtract the *leakage reading* from the *kick reading* to obtain the *net kick reading.*

g. Perform the procedures described in paragraph 33.

33. Corrected Meter Readings

a. On the scale along the bottom of the graph in figure 37, find the vertical line that corresponds to the *net kick reading* (par. 32).

b. Locate the point on the graph where the vertical line touches the leakage curve that corresponds to the *leakage reading* (par. 32).

c. Count the spaces between the bottom of the graph and the point where the vertical line touches the leakage curve. This number is the *corrected kick reading.*

Example: If the *net kick reading* is 13 and *leakage reading* is 10, the vertical line (dashed) is 13 spaces to the right of 0, at the bottom of the graph (A, fig. 37). The vertical line touches leakage curve 10 exactly 18 spaces above the bottom of the graph (B, fig. 37). The *corrected kick reading* is 18 (C, fig. 37).

34. Location of Opens

a. Use table II if the 45V.BATT. switch is in the ON position when the kick reading is obtained (par. 32); use table III if the 45V.BATT. switch is in the OFF position.

b. Select the column that represents the type of wire that is under test.

c. Select the subcolumn that represents the condition of the wire under test (dry or wet).

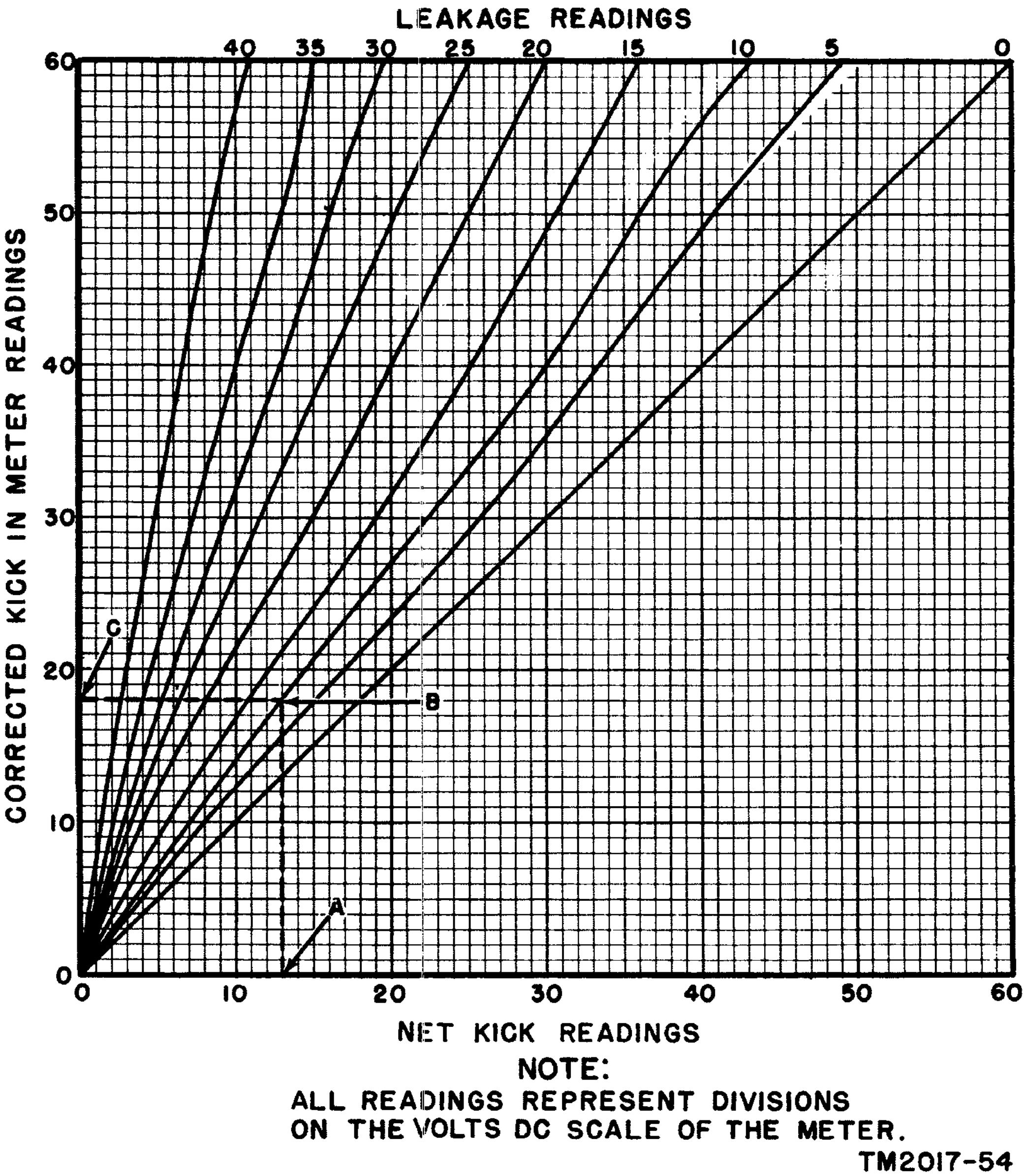

Figure 37. Leakage correction graph.

d. Read down the subcolumn and find the number that is closest to the *corrected reading* (par 33).

e. Read across the table, to the left, to a number in the *Miles* column. This number is the approximate distance between the test set and the open on the line.

Example—

Problem:

Type of line under test	Wire W-143
Condition of the line	Wet
Position of the 45V.BATT. switch	OFF
Corrected kick reading	18

Example—Continued

Solution:

Table used	Table III
Column used	Wire W-143
Subcolumn used	Wet
Corrected kick reading	18
Distance to open (in miles)	4 (See note.)

Note. The closest *corrected kick reading* in the table is 17.5. Since the *corrected kick reading* in the example is 18, the distance to the open is a little more than 4 miles.

Table II. Data for Locating Opens on Short Lines Using the Capacitance Kick Method

Miles	Corrected kick reading*												
	Wire W-110-B		Wire WD-1/TT		Wire WD-14/TT		Wire W-130		Wire W-130-A		Wire-W-143	Cable Assemblies CC-345 and CC-355-A	Cable Assembly CC-358-E
	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry and wet	Dry and wet	Dry and wet
¼	4	11	4	8	3	7	5	10	6	9	11.5	9	10
½	7	18	6	14	6	12	8	16	10	15	19.0	17	18
¾	10	25	9	19	8	17	10	22	13	21	26.0	24	23
1	13	21	11	23	10	22	12	27	16	26	32.0	30	27
1¼	15	36	13	27	12	26	15	31	19	30	37.0	35	32
1½	18	39	15	31	15	29	16	35	22	33	41.5	40	36
1¾	20	43	17	34	17	32	18	39	24	37	45.0	44	39
2	22	47	19	37	18	35	20	42	27	41	48.5	47	43
2¼	24	53	21	40	20	38	22	45	29	47	51.0	50	45
2½	26	57	23	43	22	40	25	47	30	50	53.0	54	48
2¾	28	-------	25	45	23	43	26	50	32	53	-------	56	51
3	30	-------	26	48	25	45	28	54	35	56	-------	58	53
3¼	32	-------	28	50	26	48	29	57	38	-------	-------	60	55
3½	34	-------	29	52	28	49	30	59	40	-------	-------	-------	57
3¾	36	-------	31	54	30	51	-------	-------	43	-------	-------	-------	59
4	38	-------	32	56	31	53	-------	-------	45	-------	-------	-------	-------

***Caution:** Effect of one-wire. If line is short (5 miles or less), readings will be high by the following approximate percentages: Wires W-110-B, W-130, W-130-A, WD-1/TT, and WD-14/TT, 30 percent high at 1 mile and up; Cable Assembly CC-358-E and Wire W-143, 10 percent high from 1 mile and up; Cable Assemblies CC-345 and CC-55-A, 25 percent high at 1 mile and 40 percent high at 2 miles.

Table III. Data for Locating Opens on Long Lines Using the Capacitance Kick Method

Miles	Corrected kick reading*												
	Wire W-110-B		Wire WD-1/TT		Wire WD-14/TT		Wire W-130		Wire W-130-A		Wire W-143	Cable Assemblies CC-345 and CC-355-A	Cable Assembly CC-358-E
	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry and wet	Dry and wet	Dry and wet
2	2.5	7.0	3	6	2	5	2.0	6.5	3.0	10.0	9.0	5.0	4.0
4	6.0	13.5	5	11	4	10	5.0	12.5	6.0	18.5	17.5	10.0	8.5
6	8.5	19.5	7	15	6	14	7.0	17.5	10.0	26.0	23.0	14.5	12.5
8	11.0	25.0	9	19	8	18	9.0	23.0	12.0	32.0	27.5	18.5	16.0
10	13.5	29.0	11	23	10	21	11.5	27.0	15.5	38.0	31.0	22.5	19.5
12	16.0	34.0	12	26	12	25	14.0	31.0	17.5	43.0	34.0	26.0	22.5
14	18.0	37.5	14	29	13	27	16.0	35.0	20.0	47.0	36.0	29.0	25.5
16	21.0	41.0	16	32	15	30	17.5	38.5	22.0	-------	-------	32.5	28.0
18	23.0	44.5	17	34	16	33	19.5	41.5	24.5	-------	-------	35.5	31.0

***Caution:** Effect of one-wire open. If line is long (5 miles or more), readings will be high by the following approximate percentages: Wire W-110-B, W-130, W-130-A, WD-1/TT, and WD-14/TT, 40 percent high from 1 mile and up; Cable Assembly CC-358-E and Wire W-143, 20 percent high from ½ mile and up; Cable Assemblies CC-345 and CC-355-A, 100 percent high from 1 mile and up.

Section VI. OPERATION UNDER UNUSUAL CONDITIONS

35. General

Test Set TS–26(*)/TSM will operate satisfactorily in climates that are subject to extreme weather conditions. Some precautions are necessary, however, to insure *efficient* operation and *accurate* measurements. Precautions necessary for operation in cold, hot, or humid regions are described in paragraphs 36, 37, and 38.

36. Operation in Arctic Climates

Subzero temperatures and climatic conditions associated with cold weather affect efficient operation of a test set. Instructions and precautions for operation under such conditions are explained in *a* through *c* below.

a. Handle the test set carefully.

b. Keep the test set dry. When equipment that has been exposed to the cold is brought into a warm room, it will sweat until it reaches room temperature. After it has reached room temperature, dry it thoroughly.

c. Use any improvised means to protect the batteries from the cold and to prevent their failure. It is sometimes advisable to preheat the batteries before the test set is used. When available, special arctic Batteries BA–2031 and BA–2059 should be used.

37. Operation in Desert Climates

The main problem that arises when the test set is used in desert areas is the accumulation of sand, dust, or dirt in the equipment. A special effort must be made to keep sand out of the pin jacks. This can be accomplished by keeping the test set cover closed when the test set is not in use. This precaution will also prevent condensation in the test set when the temperature drops each night.

38. Operation in Tropical Climates

When the test set is operated in tropical climates, the high relative humidity causes condensation of moisture on the equipment whenever the temperature of the equipment becomes lower than the temperature of the surrounding air. When possible, place the test set near a heater or lighted electric light bulbs to dry out.

CHAPTER 4

ORGANIZATIONAL MAINTENANCE

Section I. ORGANIZATIONAL TOOLS AND EQUIPMENT

39. General

The type of organizational maintenance that can be performed by the operator of Test Set TS–26(*)/TSM is limited by standard operating procedure, available tools, materials and replaceable parts, and by the existing tactical situation. No tools, materials, or spare parts are issued with the test set. The items that are authorized should be obtained through the organization supply officer.

40. Tools and Materials

Tools and materials used, but not supplied, with Test Set TS–26(*)/TSM are listed in the chart opposite.

Item and description	Use
Abrasive paper: flint; No. 0000; 9" x 12" sheets.	Remove corrosion caused by batteries.
Paste polish	Clean pin plugs.
Cheesecloth: lint-free; 36" wide.	Remove dust and dirt.
Cleaning compound	Remove grease and oil (general cleaning).
Tape TL–83: friction; ¾" wide.	Repair test lead insulation.
Pocket knife, TL–29	Disassembling test set to replace batteries; clean battery corrosion deposits; zero the meter needle.
Long-nosed pliers, TL–126	Tighten battery terminals.

Section II. PREVENTIVE MAINTENANCE SERVICES

41. Definition of Preventive Maintenance

Preventive maintenance is work performed on equipment (usually when the equipment is not in use) to keep it in good working order. Preventive maintenance, properly performed, will keep breakdowns and needless interruptions in service to a minimum. Preventive maintenance differs from troubleshooting and repair since its object is to *prevent the occurrence of troubles* rather than to repair troubles. See AR 750–5.

42. General Preventive Maintenance Techniques

a. Use No. 0000 sandpaper to remove corrosion.

b. Use a clean, dry, lint-free cloth for cleaning.

(1) For general cleaning, except for electrical contacts, use a cloth moistened with cleaning compound. After cleaning, wipe the parts with a dry cloth.

(2) Clean electrical contacts, such as pin plugs, with paste polish. After cleaning, wipe the contacts with a dry cloth.

c. If available, dry compressed air may be used at line pressures not exceeding 60 pounds per square inch to remove dust from inaccessible places; be careful, however, or mechanical damage from the air blast may result.

43. Use of Preventive Maintenance Forms (figs. 38 and 39)

a. The decision as to which items on DA Forms 11–238 and 11–239 are applicable to this equipment is a tactical decision to be made in the case of first echelon maintenance by the communication officer/chief or his designated representative, and in the case of second or third echelon maintenance, by the individual making the inspection. Instructions for the use of each form appear on the reverse side of the form.

b. Circled items in figures 38 and 39 are partially or totally applicable to Test Set TS–26(*)/TSM. References in the ITEM column refer to paragraphs in the text that contain additional maintenance information.

44. Performing Preventive Maintenance

The chart below is a guide for the performance of preventive maintenance on Test Set TS–26(*)/TSM. Reference to chapter 6 indicates that repair or replacement is required by qualified field maintenance personnel. The checks listed in the following chart should be performed on a weekly basis.

Item No.	Item	Checking procedure	Preventive maintenance procedures	Notes
1	Test set case	Check the finish for scratches, chipped paint, loose screws, damaged hinges, and general condition.	If necessary, touch up bared surfaces with paint. Tighten all screws, replace damaged hinges, and thoroughly clean the case.	Screws, bolts, and nuts should not be tightened carelessly. They may break if tightened beyond the pressure for which they were designed.
2	Web carrying strap	Inspect for damage caused by excess wear.	Clean thoroughly	Replace if necessary.
3	Switches (VM.-RES., 45V. BATT., and REV. SW.)	Push each switch back and forth several times. They should not bind and there should be a positive snapping action. Check to see that each switch is mounted securely on its panel.	Clean recesses around each switch. Tighten the mounting nut for each switch.	If a switch is broken, refer to chapter 6 for replace ment or repair procedures.
4	Knob (BATTERY ADJUSTMENT).	Turn the knob. No binding should occur.	Clean underside of knob	Do not attempt to pry off knob while cleaning. If the knob is broken, refer to chapter 6 for replacement procedures.
5	Pin jacks (ohmmeter, voltmeter, and line).	Insert the pin end of a test lead or meter lead into each pin jack. The pin should fit snugly and should not encounter any obstruction until the bakelite holder of the pin rests on the panel of the meter.	Clean the recess around each pin jack and remove any dirt or sand from the jack. Use a piece of steel wire to remove small particles of dirt from the jacks.	If foreign material is wedged in any pin jack preventing the insertion of a test lead or meter lead pin, refer to chapter 6 for replacement or repair procedures.
6	Leads (test and meter).	Inspect leads for worn, frayed, or broken insulation, broken wires, damaged pins or alligator clips.	Apply friction tape to worn, frayed, or broken insulation. Splice broken leads and tape. Clean dirt from pins and alligator clips. Remove all kinks.	
7	Batteries	Remove battery and measure voltage using a test set that is known to be in working condition. Inspect the battery for indications of corrosion or deterioration of the battery container.	Replace defective batteries (par. 12).	Battery BA-31 should measure at least 4½ volts; Battery BA-59 at least 45 volts.
8	Battery clip and spacing blocks.	Inspect for corrosion caused by battery deterioration.	Clean all corrosion and touch up spacing blocks with paint if necessary.	
9	Meter window	Inspect for cracks or broken glass.	Clean window	If window is cracked or broken, refer to chapter 6 for replacement instructions.

OPERATOR FIRST ECHELON MAINTENANCE CHECK LIST FOR SIGNAL CORPS EQUIPMENT

RADIO COMMUNICATION, DIRECTION FINDING, CARRIER, RADAR

INSTRUCTIONS: *See other side*

EQUIPMENT NOMENCLATURE	EQUIPMENT SERIAL NO.

LEGEND FOR MARKING CONDITIONS: ✓ Satisfactory; X Adjustment, repair or replacement required; (X) Defect corrected.

NOTE: Strike out items not applicable.

DAILY

NO.	ITEM	CONDITION S	M	T	W	T	F	S
1	COMPLETENESS AND GENERAL CONDITION OF EQUIPMENT (*receiver, transmitter, carrying cases, wire and cable, microphones, tubes, spare parts, technical manuals and accessories*). **Par. 11**							
2	LOCATION AND INSTALLATION SUITABLE FOR NORMAL OPERATION.							
3	CLEAN DIRT AND MOISTURE FROM ANTENNA, MICROPHONE, HEADSETS, CHESTSETS, KEYS, JACKS, PLUGS, TELEPHONES, CARRYING BAGS, COMPONENT PANELS. **Par. 44**							
4	INSPECT SEATING OF READILY ACCESSIBLE "PLUCK-OUT" ITEMS: TUBES, LAMPS, CRYSTALS, FUSES, CONNECTORS, VIBRATORS, PLUG-IN COILS AND RESISTORS.							
5	INSPECT CONTROLS FOR BINDING, SCRAPING, EXCESSIVE LOOSENESS, WORN OR CHIPPED GEARS, MISALIGNMENT, POSITIVE ACTION. **Par. 44**							
6	CHECK FOR NORMAL OPERATION. **Par. 54**							

WEEKLY

NO.	ITEM	CONDITION	NO.	ITEM	CONDITION
7	CLEAN AND TIGHTEN EXTERIOR OF COMPONENTS AND CASES, RACK MOUNTS, SHOCK MOUNTS, ANTENNA MOUNTS, COAXIAL TRANSMISSION LINES, WAVE GUIDES, AND CABLE CONNECTIONS.		13	INSPECT STORAGE BATTERIES FOR DIRT, LOOSE TERMINALS, ELECTROLYTE LEVEL AND SPECIFIC GRAVITY, AND DAMAGED CASES.	
8	INSPECT CASES, MOUNTINGS, ANTENNAS, TOWERS, AND EXPOSED METAL SURFACES, FOR RUST, CORROSION, AND MOISTURE.		14	CLEAN AIR FILTERS, BRASS NAME PLATES, DIAL AND METER WINDOWS, JEWEL ASSEMBLIES. **Par. 44**	
9	INSPECT CORD, CABLE, WIRE, AND SHOCK MOUNTS FOR CUTS, BREAKS, FRAYING, DETERIORATION, KINKS, AND STRAIN. **Par. 44**		15	INSPECT METERS FOR DAMAGED GLASS AND CASES.	
10	INSPECT ANTENNA FOR ECCENTRICITIES, CORROSION, LOOSE FIT, DAMAGED INSULATORS AND REFLECTORS.		16	INSPECT SHELTERS AND COVERS FOR ADEQUACY OF WEATHERPROOFING.	
11	INSPECT CANVAS ITEMS, LEATHER, AND CABLING FOR MILDEW, TEARS, AND FRAYING.		17	CHECK ANTENNA GUY WIRES FOR LOOSENESS AND PROPER TENSION.	
12	INSPECT FOR LOOSENESS OF ACCESSIBLE ITEMS: SWITCHES, KNOBS, JACKS, CONNECTORS, ELECTRICAL TRANSFORMERS, POWERSTATS, RELAYS, SELSYNS, MOTORS, BLOWERS, CAPACITORS, GENERATORS, AND PILOT LIGHT ASSEMBLIES. **Par. 44**		18	CHECK TERMINAL BOX COVERS FOR CRACKS, LEAKS, DAMAGED GASKETS, DIRT AND GREASE.	

19 IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION.

DA FORM 11-238 1 MAY 51 REPLACES DA AGO FORM 419, 1 DEC 50, WHICH IS OBSOLETE.

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Figure 38. DA Form 11-238.

SECOND AND THIRD ECHELON MAINTENANCE CHECK LIST FOR SIGNAL CORPS EQUIPMENT

RADIO COMMUNICATION, DIRECTION FINDING, CARRIER, RADAR

INSTRUCTIONS: See other side

EQUIPMENT NOMENCLATURE	EQUIPMENT SERIAL NO.

LEGEND FOR MARKING CONDITIONS: ✓ Satisfactory; X Adjustment, repair or replacement required; ⓧ Defect corrected.
NOTE: Strike out items not applicable.

NO.	ITEM	CONDITION	NO.	ITEM	CONDITION
1	COMPLETENESS AND GENERAL CONDITION OF EQUIPMENT (*receiver, transmitter, carrying cases, wire and cable, microphones, tubes, spare parts, technical manuals and accessories*). Par. 11		19	ELECTRON TUBES - INSPECT FOR LOOSE ENVELOPES, CAP CONNECTORS, CRACKED SOCKETS: INSUFFICIENT SOCKET SPRING TENSION; CLEAN DUST AND DIRT CAREFULLY; CHECK EMISSION OF RECEIVER TYPE TUBES.	
2	LOCATION AND INSTALLATION SUITABLE FOR NORMAL OPERATION.		20	INSPECT FILM CUT-OUTS FOR LOOSE PARTS, DIRT, MISALIGNMENT AND CORROSION.	
3	CLEAN DIRT AND MOISTURE FROM ANTENNA, MICROPHONE, HEADSETS, CHESTSETS, KEYS, JACKS, PLUGS, TELEPHONES, CARRYING BAGS, COMPONENT PANELS. Par. 44		21	INSPECT FIXED CAPACITORS FOR LEAKS, BULGES, AND DISCOLORATION.	
4	INSPECT SEATING OF READILY ACCESSIBLE "PLUCK-OUT" ITEMS: TUBES, LAMPS, CRYSTALS, FUSES, CONNECTORS, VIBRATORS, PLUG-IN COILS AND RESISTORS.		22	INSPECT RELAY AND CIRCUIT BREAKER ASSEMBLIES FOR LOOSE MOUNTINGS; BURNED, PITTED, CORRODED CONTACTS; MISALIGNMENT OF CONTACTS AND SPRINGS; INSUFFICIENT SPRING TENSION; BINDING OF PLUNGERS AND HINGE PARTS.	
5	INSPECT CONTROLS FOR BINDING, SCRAPING, EXCESSIVE LOOSENESS, WORN OR CHIPPED GEARS, MISALIGNMENT, POSITIVE ACTION. Par. 44		23	INSPECT VARIABLE CAPACITORS FOR DIRT, MOISTURE, MISALIGNMENT OF PLATES, AND LOOSE MOUNTINGS.	
6	CHECK FOR NORMAL OPERATION. Par. 54		24	INSPECT RESISTORS, BUSHINGS, AND INSULATORS, FOR CRACKS, CHIPPING, BLISTERING, DISCOLORATION AND MOISTURE.	
7	CLEAN AND TIGHTEN EXTERIOR OF COMPONENTS AND CASES, RACK MOUNTS, SHOCK MOUNTS, ANTENNA MOUNTS, COAXIAL TRANSMISSION LINES, WAVE GUIDES, AND CABLE CONNECTIONS.		25	INSPECT TERMINALS OF LARGE FIXED CAPACITORS AND RESISTORS FOR CORROSION, DIRT AND LOOSE CONTACTS.	
8	INSPECT CASES, MOUNTINGS, ANTENNAS, TOWERS, AND EXPOSED METAL SURFACES, FOR RUST, CORROSION, AND MOISTURE.		26	CLEAN AND TIGHTEN SWITCHES, TERMINAL BLOCKS, BLOWERS, RELAY CASES, AND INTERIORS OF CHASSIS AND CABINETS NOT READILY ACCESSIBLE.	
9	INSPECT CORD, CABLE, WIRE, AND SHOCK MOUNTS FOR CUTS, BREAKS, FRAYING, DETERIORATION, KINKS, AND STRAIN. Par. 44		27	INSPECT TERMINAL BLOCKS FOR LOOSE CONNECTIONS, CRACKS AND BREAKS.	
10	INSPECT ANTENNA FOR ECCENTRICITIES, CORROSION, LOOSE FIT, DAMAGED INSULATORS AND REFLECTORS.		28	CHECK SETTINGS OF ADJUSTABLE RELAYS.	
11	INSPECT CANVAS ITEMS, LEATHER, AND CABLING FOR MILDEW, TEARS, AND FRAYING.		29	LUBRICATE EQUIPMENT IN ACCORDANCE WITH APPLICABLE DEPARTMENT OF THE ARMY LUBRICATION ORDER.	
12	INSPECT FOR LOOSENESS OF ACCESSIBLE ITEMS: SWITCHES, KNOBS, JACKS, CONNECTORS, ELECTRICAL TRANSFORMERS, POWERSTATS, RELAYS, SELSYNS, MOTORS, BLOWERS, CAPACITORS, GENERATORS, AND PILOT LIGHT ASSEMBLIES. Par. 44		30	INSPECT GENERATORS, AMPLIDYNES, DYNAMOTORS, FOR BRUSH WEAR, SPRING TENSION, ARCING, AND FITTING OF COMMUTATOR.	
13	INSPECT STORAGE BATTERIES FOR DIRT, LOOSE TERMINALS, ELECTROLYTE LEVEL AND SPECIFIC GRAVITY, AND DAMAGED CASES.		31	CLEAN AND TIGHTEN CONNECTIONS AND MOUNTINGS FOR TRANSFORMERS, CHOKES, POTENTIOMETERS, AND RHEOSTATS. Par. 53	
14	CLEAN AIR FILTERS, BRASS NAME PLATES, DIAL AND METER WINDOWS, JEWEL ASSEMBLIES. Par. 44		32	INSPECT TRANSFORMERS, CHOKES, POTENTIOMETERS, AND RHEOSTATS FOR OVERHEATING AND OIL-LEAKAGE.	
15	INSPECT METERS FOR DAMAGED GLASS AND CASES. Par. 44		33	BEFORE SHIPPING OR STORING - REMOVE BATTERIES. Par. 12	
16	INSPECT SHELTERS AND COVERS FOR ADEQUACY OF WEATHERPROOFING.		34	INSPECT CATHODE RAY TUBES FOR BURNT SCREEN SPOTS.	
17	CHECK ANTENNA GUY WIRES FOR LOOSENESS AND PROPER TENSION.		35	INSPECT BATTERIES FOR SHORTS AND DEAD CELLS.	
18	CHECK TERMINAL BOX COVERS FOR CRACKS, LEAKS, DAMAGED GASKETS, DIRT AND GREASE.		36	INSPECT FOR LEAKING WATERPROOF GASKETS, WORN OR LOOSE PARTS.	
			37	MOISTURE AND FUNGIPROOF. Par. 45	
38	IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION.				

DA FORM 1 MAY 51 11-239 REPLACES DA AGO FORM 419, 1 DEC 50, WHICH IS OBSOLETE. a8—16—64382-1

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Figure 39. DA Form 11-239.

Section III. WEATHERPROOFING

45. Weatherproofing Procedures and Precautions

a. General. When operated under severe climatic conditions such as prevail in tropical, arctic, and desert regions, Test Set TS-26(*)/TSM requires special treatment and maintenance. Fungus growth, insects, dust, corrosion, salt spray, excessive moisture, and extreme temperatures are harmful to most materials.

b. Tropical Maintenance. A special moistureproofing and fungiproofing treatment has been devised which, if properly applied, provides a reasonable degree of protection. This treatment is explained in TB SIG 13 and TB SIG 72.

Caution: When moistureproofing or fungiproofing Test Set TS-26(*)/TSM, do not separate the meter from the meter panel assembly.

c. Arctic Maintenance. Special precautions necessary to prevent poor performance or total operational failure of the test set at extremely low temperatures are explained in TB SIG 66 and TB SIG 219.

d. Desert Maintenance. Special precautions necessary to prevent equipment failure in areas subject to extremely high temperatures, low humidity, and excessive sand and dust are explained in TB SIG 75.

46. Rustproofing and Painting

a. If the finish on the case is badly scarred, touch up bared surfaces with paint. If metal parts are corroded, clean the surface with No. 0000 sandpaper to obtain a bright smooth finish and then refinish.

Caution: Do not use steel wool. Small particles of the metal may enter the case and cause a short of ground within the circuitry.

b. Remove rust from metal parts by cleaning with cleaning compound; it may be necessary to soften the rust with cleaning compound and then to use sandpaper to complete preparation for painting. The use of paint must conform with existing regulations.

Section IV. CONTROLS AND INSTRUMENTS

47. General

This section furnishes information that will aid in the proper use of the test set. Improper use of Test Set TS-26(*)/TSM will result in false measurements. For this reason, it is important to know the purpose of each control, jack, and connecting lead.

48. Controls

The following charts list and describe the functions of the controls located on the front panels of Test Set TS-26(*)/TSM.

a. Meter Panel Controls (figs. 40 and 41).

Control	Function
Meter zero-adjustment screw.	Adjusts the position of the meter needle so that it rests on 0 of the VOLTS D. C. scale before any dc voltage measurement is made.
BATTERY ADJUSTMENT knob.	Adjusts the position of the meter needle so that it rests on 0 of the OHMS scale before any resistance measurement is made. This adjustment compensates for voltage variations of the batteries in the test set because of aging.
VM.-RES. switch	In the VM, position, arranges the test set as a voltmeter. In the RES. position, arranges the test set as an ohmmeter.

b. Switch Panel Controls (fig. 42).

Control	Function
45V. BATT. switch	In the OFF position, disconnects the 45-volt battery from the ohmmeter circuits of the test set. In the ON position, connects the 45-volt battery into the ohmmeter circuits of the test set.
REV. SW. switch	Reverses the polarity of the test set battery voltages that are applied to the test leads during resistance measurements; also used to reverse the polarity of external dc voltages applied to the test set meter during voltage measurements.

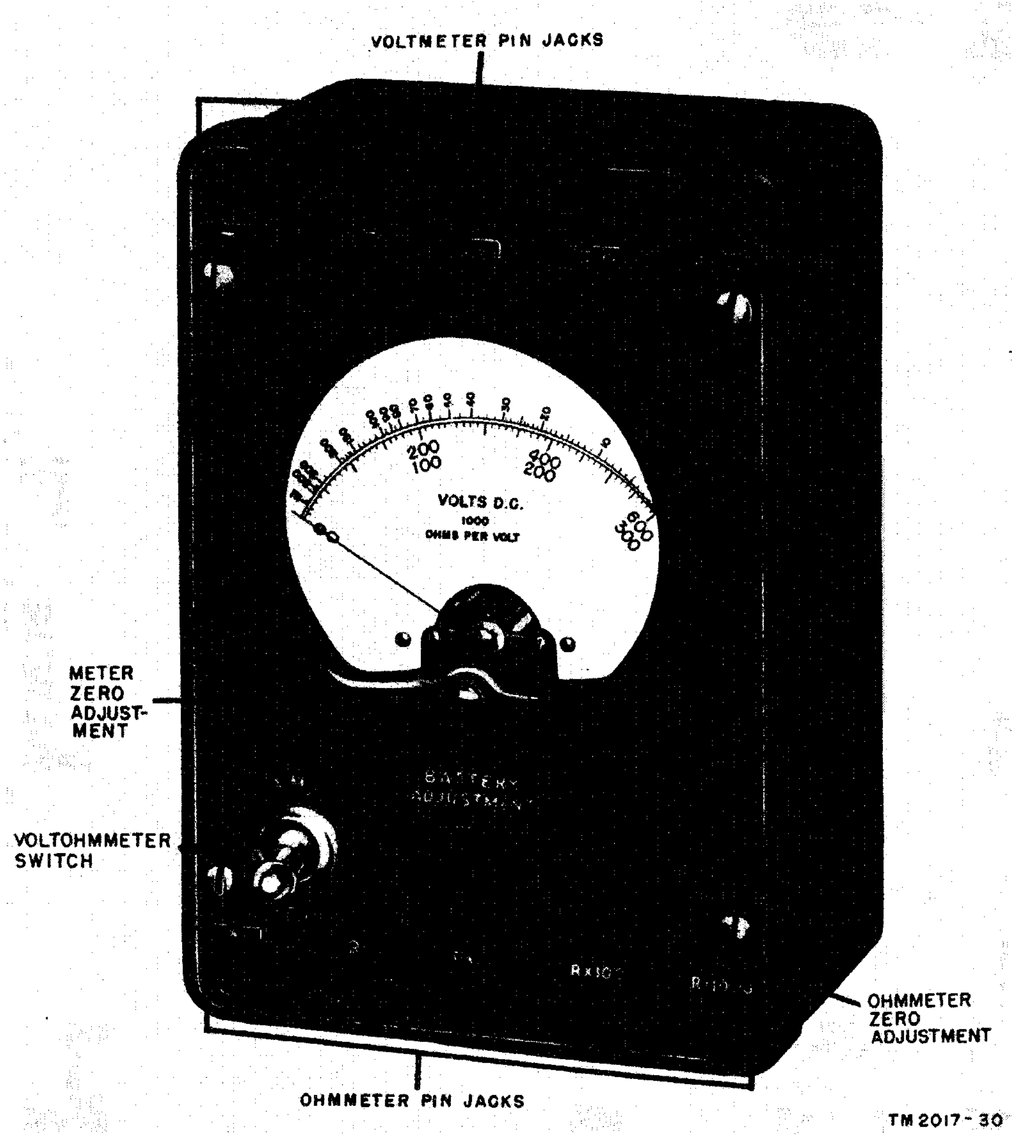

Figure 40. Test Set TS–26/TSM, meter panel assembly, front view.

49. Jacks

The following charts list and describe the functions of the pin jacks located on the front panel of Test Set TS–26(*)/TSM.

a. Meter Panel Voltmeter Jacks (fig. 40).

Jacks	Function
----------	A common jack for voltage and resistance measurements.
3V	For voltage measurements with the 0- to 3-volt range.
30V	For voltage measurements with the 0- to 30-volt range.
300V	For voltage measurements with the 0- to 300-volt range.
600V	For voltage measurements with the 0- to 600-volt range.

b. Meter Panel Ohmmeter Jacks (fig. 40).

Jacks	Function
X	Common jack for resistance measurements.
R	For resistance measurements with the 0- to 1,000-ohm range.
Rx10	For resistance measurements with the 0- to 10,000-ohm range.
Rx100	For resistance measurements with the 0- to 100,000-ohm range.
Rx1000	For resistance measurements with either the 0- to 1,000,000-ohm range or the 0- to 10-megohm range.

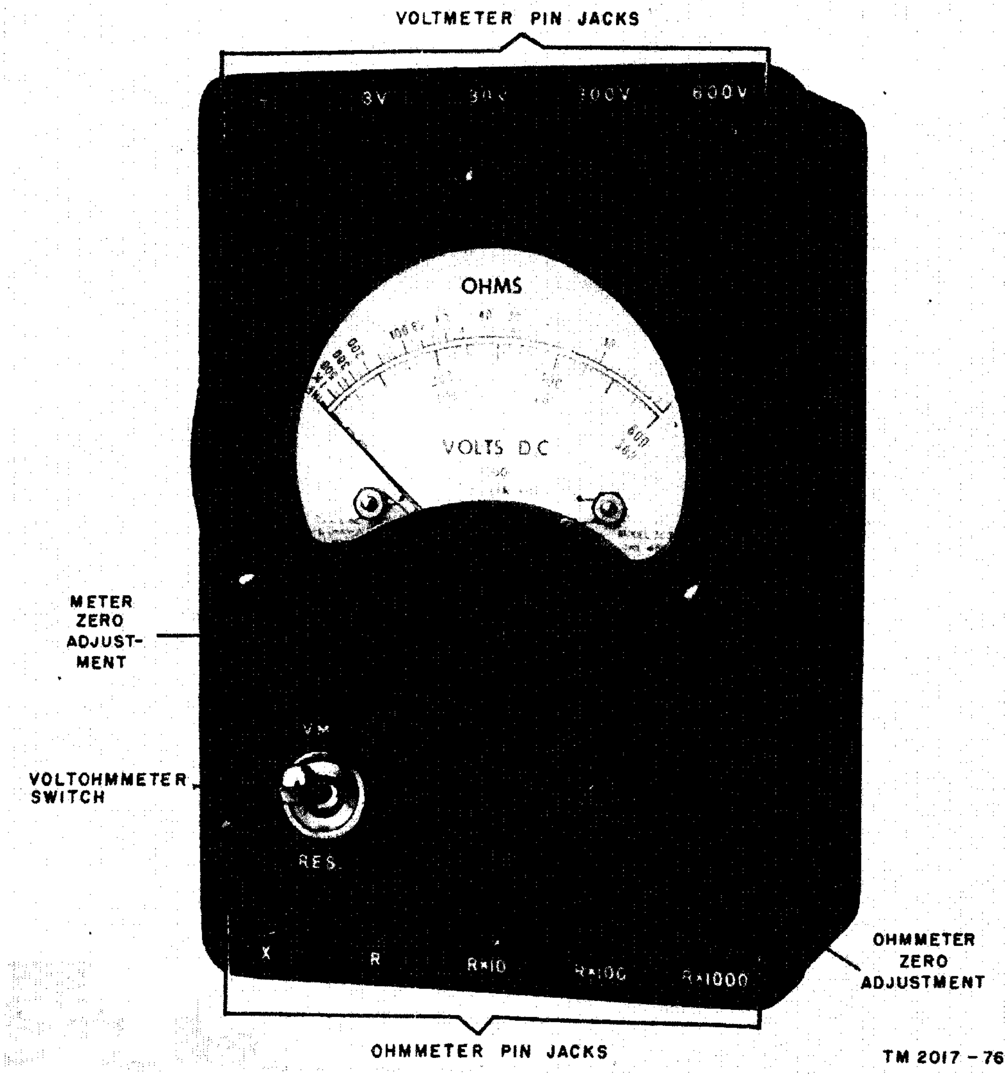

Figure 41. Test Set TS–26B/TSM, meter panel assembly, front view.

c. Switch Panel Line Jacks (fig. 42).

Jacks	Function
L1	Used with the black test lead to connect the equipment under test to the switch panel of the test set.
L2	Used with the red test lead to connect the equipment under test to the switch panel of the test set.

50. Connecting Leads

(fig. 2)

The following chart lists and describes the functions of both the *meter* leads and the *test* leads of Test Set TS–26(*)/TSM.

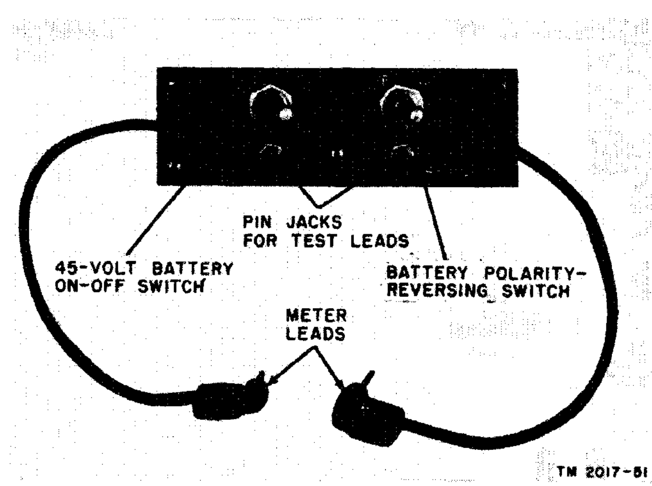

Figure 42. Test Set TS–26(*)/TSM, switch panel assembly.

Leads	Function
Black test lead	Connects the equipment under test to jack L1 on the switch panel.
Red test lead	Connects the equipment under test to jack L2 on the switch panel.
Black meter lead (VM-)	Connects switch panel circuits of the test set to the meter panel circuits.
Red meter lead (RX10)	Connects switch panel circuits of the test set to the meter panel circuits.

51. Meter

(fig. 25)

The meter on Test Set TS-26(*)/TSM has three scales. The *top* scale is the OHMS scale and is used for resistance measurements. The *bottom* scales are the VOLTS D. C. scales and are used for dc voltage measurements. The test set can be arranged so that the meter may be used for five different resistance ranges and four different dc voltage ranges (par. 4). In paragraph 17 examples are used to explain the correct method of reading the meter indications for any of the resistance or voltage ranges.

Section V. TROUBLESHOOTING AT ORGANIZATIONAL MAINTENANCE LEVEL

52. General

a. The troubleshooting and repair work that can be performed at the organizational maintenance level (operators and repairmen) is necessarily limited in scope by the tools, test equipment, and replaceable parts issued and by the existing tactical situation. Accordingly, troubleshooting is based on the performance of the equipment and the use of the senses in determining such troubles as broken wires or leads, cracked insulators, damaged resistors, and defective batteries.

b. The following paragraphs will help the operator of Test Set TS-26(*)/TSM to determine which circuit is at fault and in localizing the fault in the circuit to a particular part, such as a resistor or a switch.

53. Visual Inspection

a. Practically all trouble in Test Set TS-26(*)/TSM is caused by rough handling or improper preventive maintenance practices. Failure of the test set to operate properly usually is caused by one or more of the following faults:

(1) Worn or broken test leads or meter leads.
(2) Improperly connected batteries.
(3) Defective batteries.
(4) Broken wires (internal).

b. When failure is encountered, check as many of these items as is practicable before starting a detailed examination of the component parts. If possible, obtain information from the operator of the equipment regarding the performance at the time the trouble occurred.

54. Troubleshooting by Using Equipment Performance Check List

a. General. The equipment performance check list (par. 55) will help the operator locate trouble in Test Set TS-26(*)/TSM. The list gives the items to be checked, the conditions under which the item is checked, the normal indications and tolerances of correct operation, and the corrective measures that the operator can take. *To use this list, follow the items in numerical sequence.*

b. Action or Condition. For some items, the information given in the *Action or condition* column consists of various switch and control settings under which the item is to be checked. For other items it represents an action that must be taken to check the normal indication given in the *Normal indications* column.

c. Normal Indications. The normal indications listed include the visible and audible signs that the operator should perceive when he checks the items. If the indications are not normal, the operator should apply the recommended corrective measures.

d. Corrective measures. The corrective measures listed are those that the operator can make without turning in the equipment for repairs. If the set is completely inoperative, or if the recommended corrective measures do not yield results, troubleshooting at field maintenance level is necessary. However, if the technical situation requires that the test set be maintained and if the set is not completely inoperative, the operator must maintain the set in operation as long as it is possible to do so.

55. Equipment Performance Check List

The equipment performance check list for Test Set TS–26(*)/TSM is divided into two parts. One part is provided for checking equipment performance when the test set is arranged for use as an ohmmeter (*a* below). The other part is used when the test set is arranged for use as a voltmeter (*b* below). The checks should be made with the test set batteries installed (par. 12). If the corrective measures do not provide a remedy for satisfactory performance and if possible troubles caused by poor preventive maintenance practices have been checked and remedied, troubleshooting at field maintenance level is required. Refer to chapter 6.

Note. The check list procedures indicate only whether or not the circuits are functioning. Accuracy of measurements must be determined by comparing actual resistance and voltage readings, using several ranges, with those obtained by using a meter of known accuracy.

Equipment Performance Check List, Test Set Used as Ohmmeter.

	Item No.	Item	Action or condition	Normal indications	Corrective measures
PREPARATORY	1	45 V. BATT. switch	Push to the OFF position.		
	2	VM.-RES. switch	Push to the RES. position.		
	3	Black meter lead from VM-.	Place pin end in ohmmeter pin jack X.		
	4	Red meter lead from RX10.	Place pin end in ohmmeter pin jack R.		
	5	Black test lead	Place pin end in pin jack L1.		
	6	Red test lead	Place pin end in pin jack L2.		
EQUIPMENT PERFORMANCE	7	Red test lead and black test lead.	Connect the two alligator clips together.	The meter needle will move to the 0 position on OHMS scale of the meter.	If the meter needle does not move to the 0 position, perform all the procedures in item 8.
	8	BATTERY ADJUSTMENT knob.	Turn BATTERY ADJUSTMENT knob and observe the meter needle.	The BATTERY ADJUSTMENT knob will provide enough movement so that the meter needle can be adjusted for a resting position of 0 on the OHMS scale of the meter.	If the meter needle cannot be made to rest on the 0 position of the OHMS scale even when the BATTERY ADJUSTMENT knob is turned to its maximum clockwise position, replace the 4½-volt battery.
	9	Red meter lead from RX10.	Remove the pin end from ohmmeter jack R and place it in ohmmeter jack RX10.	Same as for item 7	Same as for item 7.
	10	Red meter lead from RX10.	Remove the pin end from ohmmeter jack RX10 and place it in ohmmeter jack RX100.	Same as for item 7	Same as for item 7.
	11	Red meter lead from RX10.	Remove the pin end from ohmmeter jack RX100 and place it in ohmmeter jack RX1000.	Same as for item 7	Some as for item 7.
	12	45 V. BATT. switch	Push to the ON position.		
	13	Black meter lead from VM-.	Remove the pin end from ohmmeter jack X and place it in voltmeter jack—*only if Test Set TS–26A/TSM is being used.*	Same as for item 7	If the meter needle does not move to the 0 position, perform all the procedures in item 14.

Equipment Performance Check List, Test Set Used as Ohmmeter—Continued

	Item No.	Item	Action or condition	Normal indications	Corrective measures
EQUIPMENT PERFORMANCE	14	BATTERY ADJUSTMENT knob.	Same as for item 8	Same as for item 8	If the meter needle cannot be made to rest on the 0 position of the OHMS scale even when the BATTERY ADJUSTMENT knob is turned to its maximum clockwise position, replace the 45-volt battery. If normal indications still cannot be obtained, troubleshooting at field maintenance level is required.
	15	Test leads and meter leads.	Remove from the pin jacks.		
	16	45 V. BATT. switch	Push to the OFF position.		

b. Equipment Performance Check List, Test Set Used as Voltmeter

	Item No.	Item	Action or condition	Normal indications	Corrective measures
PREPARATORY	1	VM.-RES. switch	Push to the VM. position.		
	2	Black meter lead from VM-.	Place the pin end in the— voltmeter pin jack.		
	3	Red meter lead from RX10.	Place the pin end in the 600V voltmeter pin jack.		
	4	Black test lead	Place the pin end in pin jack L1.		
	5	Red test lead	Place the pin end in pin jack L2.		
	6	Meter zero-adjustment screw.	Turn the meter zero-adjustment screw and observe the meter needle.	The meter needle will move to the 0 position on the VOLTS D. C. scale of the meter.	If normal indications cannot be obtained, troubleshooting at field maintenance level is required.
EQUIPMENT PERFORMANCE	7	Test leads	Connect the alligator clip of the red test lead to the positive terminal of a 45-volt battery that is known to be good. Connect the alligator clip of the black test lead to the negative terminal of the battery.	The meter needle will indicate 45 volts on the 0- to 600- volt range of the VOLTS D. C. scale of the meter. *Note.* If the meter needle tends to move off scale on the left side of the VOLTS D. C. scale, push the REV. SW. switch.	
STOP	8	Test leads and meter leads.	Remove from the pin jacks.		

CHAPTER 5
THEORY

56. General

a. Test Set TS–26(*)/TSM is designed for measurement of resistances and dc voltages. It will also indicate (not measure) relative capacitance values. The test set is used to identify and locate faults on field wires and cable assemblies.

b. Most faults can be identified and located by making resistance measurements; however, faults caused by opens cannot be located in this manner. For this reason, an extra switching circuit has been made a part of Test Set TS–26(*)/TSM. This switching circuit, when used with the *capacitance kick method* (par. 62*c*), will permit the operator to locate faults caused by opens.

c. Test Set TS–26(*)/TSM contains two types of measuring circuits (voltmeter and ohmmeter) and a meter that is common to both circuits. The basic theory of test equipment is contained in TM 11–664, and will not be discussed in this chapter.

d. A general explanation of the function of the circuits in Test Set TS–26(*)/TSM, with the aid of a block diagram and simplified schematic diagrams, is provided in paragraphs 57 through 61. Measurements that can be made with the test set are explained in paragraph 62.

57. Block Diagram
(fig. 43)

Figure 43 is a single-line block diagram that shows the two possible circuit arrangements that can be obtained with Test Set TS–26(*)/TSM. Switches, meter leads, test leads, and pin jacks are used to arrange the test set for operation either as a voltmeter (par. 15*a*) or an ohmmeter (par. 15*b*). If the test set is arranged for use as a voltmeter, the switching circuit, voltmeter resistor circuit, and the meter are used. When arranged as an ohmmeter, the switching circuit, ohmmeter resistor circuit, and the meter are used. A typical complete schematic diagram is provided in figures 55 and 56 for each model of the test set.

58. Switching Circuit
(figs. 55 and 56)

The switching circuit performs several functions in Test Set TS–26(*)/TSM. These functions and the conditions under which they are applicable are described in *a* through *c* below.

a. When the test set is used to locate faults caused by opens, the switching circuit provides a means of reversing the *polarity* of the voltage that is applied to the line under test (fig. 44). This is necessary when the capacitance kick method (par. 62*c*) is being used. It also provides a means of controlling the *amount* of voltage that is applied to the line under test (fig. 45). This is necessary so the test set can be used to locate opens on short lines as well as on long lines.

b. When the test set is used for resistance measurements, the switching circuit provides a means of selecting the battery voltage that is applied to the line under test (fig. 45). This is necessary because the use of the 0- to 10-megohm range requires more voltage than is required when any of the other resistance ranges are used.

c. When the test set is used for dc voltage measurements, the switching circuit provides a means of reversing the polarity of the voltage that is applied to the meter (fig. 46). This is necessary to prevent the meter needle from moving off scale on the left side of the VOLTS D.C. scale.

59. Voltmeter Resistor Circuit
(figs. 55 and 56)

The voltmeter resistor circuit consists of several precision-type resistors. The resistors limit the current that flows through the meter when voltage measurements are made. Resistor values are different for each model of the test set bearing different order numbers. The resistor circuit is arranged so the operator of the test set can obtain accurate dc voltage measurements in several ranges (0 to 3, 0 to 30, 0 to 300, and 0 to 600 volts).

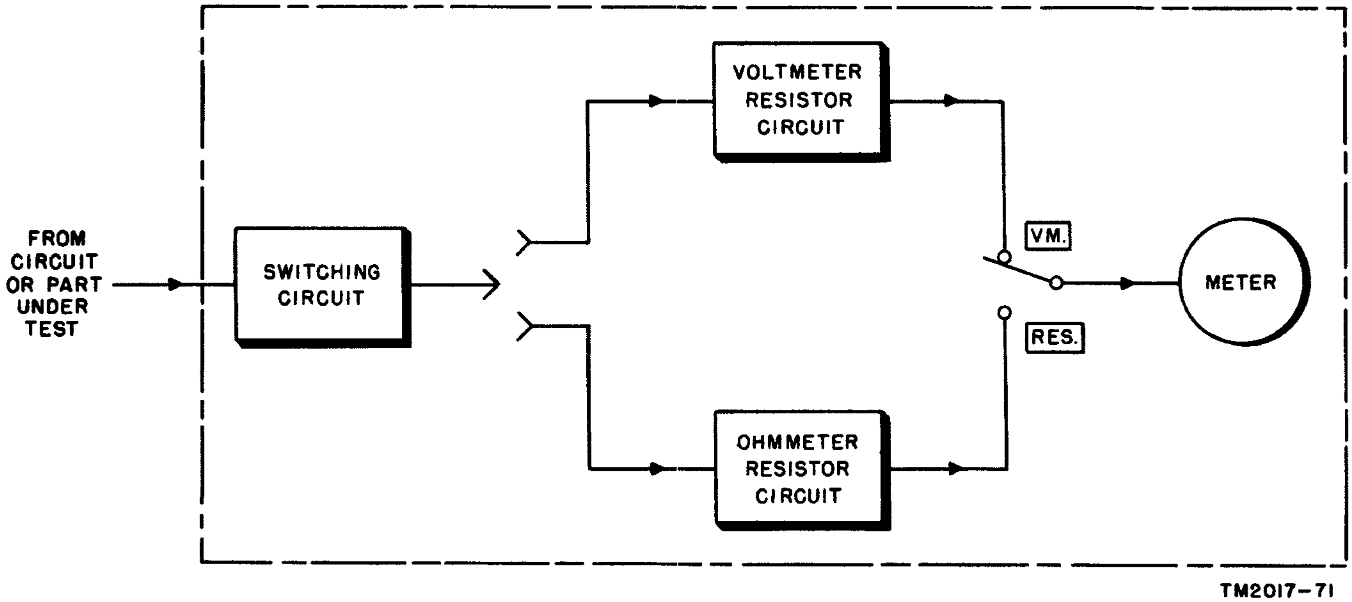

Figure 43. Test Set TS-26(*)/TSM, block diagram.

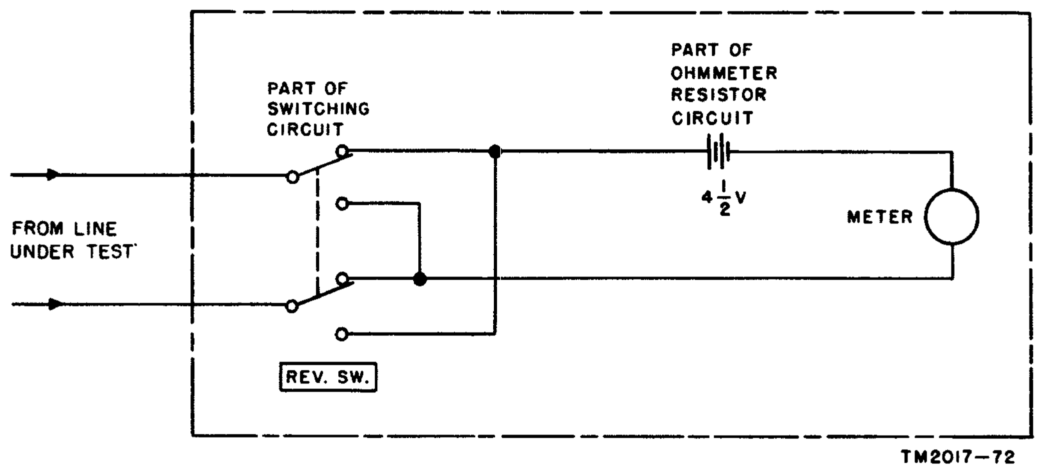

Figure 44. Switching arrangement for capacitance kick measurements, simplified schematic diagram.

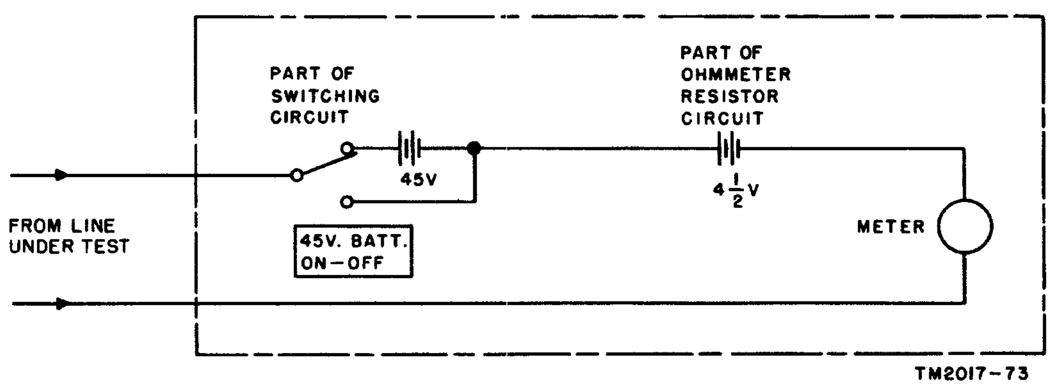

Figure 45. Switching arrangement for capacitance kick measurements and resistance measurements, simplified schematic diagram.

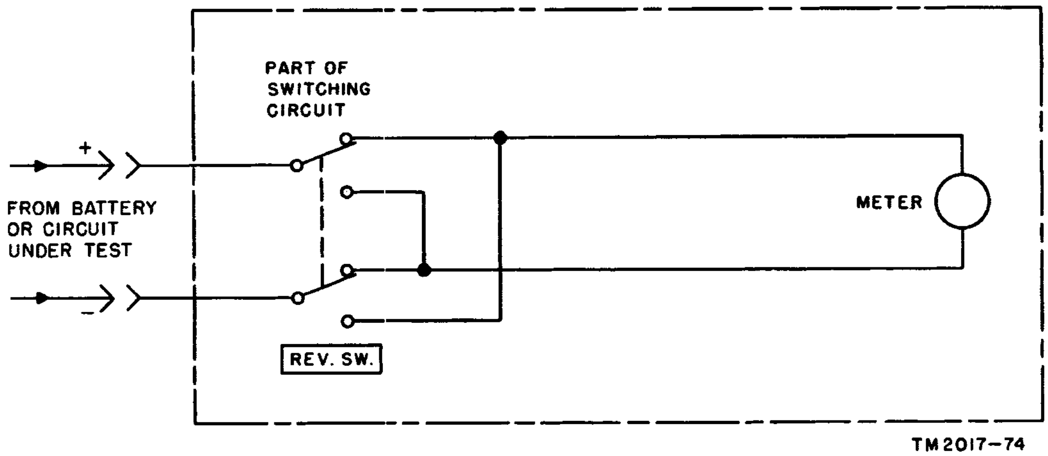

Figure 46. Switching arrangement for dc voltage measurements, simplified schematic diagram.

60. Ohmmeter Resistor Circuit

(figs. 55 and 56)

The ohmmeter resistor circuit consists of several precision-type resistors and a battery. The battery is the voltage source when the test set is used to obtain resistance measurements or capacitance kick indications. The resistors limit the current flowing through the meter. Resistor values are different for each model of the test set bearing different order numbers. The battery in the ohmmeter resistor circuit supplies sufficient voltage when the test set is used to measure resistances below 1 megohm. For measurement of resistances between 1 and 10 megohms, additional voltage is supplied to the ohmmeter resistor circuit from the battery in the switching circuit.

61. Meter Differences

(fig. 43)

The internal resistance of the meter in Test Set TS–26/TSM is 2,000 ohms; in Test Sets TS–26A/TSM and TS–26B/TSM, only 760 ohms. The reduced internal resistance of the meter in Test Sets TS–26A/TSM and TS–26B/TSM makes it more sensitive than the meter provided in Test Set TS–26/TSM. Because the meter in Test Sets TS–26A/TSM and TS–26B/TSM is more sensitive, it requires less current for operation. For this reason, the resistor values in the voltmeter and ohmmeter resistor circuits of Test Set TS–26/TSM differ from those in Test Sets TS–26A/TSM and TS–26B/TSM. For this same reason, operation with the 0- to 10-megohm range requires the use of both the 45- and 4½-volt batteries in Test Set TS–26/TSM whereas use of *only* the 45-volt battery is required for Test Sets TS–26A/TSM and TS–26B/TSM.

62. Measurements

Measurements made with Test Set TS–26(*)/TSM depend on the passage of current through its meter. The voltage required to cause current flow for resistance measurements, continuity checks, and capacitance kick indications is obtained from batteries that are part of the test set. The voltage required to cause current flow for dc voltage measurements is obtained from the circuit under test. Brief explanations of the different measurements and the conditions under which they are obtained are contained in *a* through *d* below.

a. Resistance Measurements. Resistance measurements are based on the fact that the amount of resistance in a circuit under test will affect the current flow through a meter and thus control the movement of the meter needle. If the circuit under test contains a lot of resistance, very little current will flow through the meter and the meter needle will be deflected only slightly. If the resistance of the circuit under test is reduced, more current will flow through the meter and a greater deflection of the meter needle will occur. The scales of the meter are calibrated and marked so that the user of the test set need only observe the position of the meter needle on the meter scale to obtain a resistance measurement.

b. Continuity Checks. Continuity checks are actually resistance measurements but they differ in purpose. The continuity check is used *only* to determine whether or not the circuit under test is open. If the circuit under test is open, no current will flow through the meter and the meter needle *will not* move from its normal resting position (except for a possible instantaneous deflection or kick when connections are being made). If the circuit under test is not open, the meter needle *will* move to a new resting position on the meter scale. The new position of the meter needle will be determined by the resistance of the circuit under test and the resistance range used.

Note. To obtain a maximum deflection of the meter needle, continuity checks are made with Test Set TS–26(*)/TSM arranged for use with the 0- to 10-megohm resistance range (figs. 19 and 20).

c. Capacitance Kick Indications. Capacitance kick indications are based on the fact that a pair of wires, used for a telephone line, is electrically equivalent to a capacitor. The conductors are the plates and the insulation is the dielectric. When Test Set TS–26(*)/TSM is arranged for use as an ohmmeter and is connected to a telephone line, the meter needle will deflect *for an instance* and then return to a normal resting position. The amount of capacitance kick is proportional to the length of the line. When the test set is connected to a long telephone line, a *large* capacitance kick will result. As the length of the line is decreased, the capacitance kick will become smaller each time that the test set is connected. the capacitance kick indication is obtained by observing the kick position of the meter needle on the VOLTS D. C. scale. Tables II and III contain information that permits the user to determine the length of the line under test by using the capacitance kick indications obtained on the meter.

Note. Each operation of the REV. SW. switch will cause one capacitance kick indication. Use of this switch makes it unnecessary to reconnect the test set to the line under test each time that a capacitance kick indication is desired.

d. Voltage Measurements. Voltage measurements are based on the fact that the amount of voltage in a circuit under test will affect the current flow through the meter of a test set and will thus control the movements of the meter needle. A larger voltage will cause a greater deflection of the meter needle than that caused by a smaller voltage. The scales of the meter are calibrated and marked so that the user need only observe the position of the meter needle on the meter scale to obtain the voltage measurement.

CHAPTER 6

FIELD MAINTENANCE

Note. This chapter contains instructions for field maintenance. The amount of repair that can be performed by units having field maintenance responsibility is limited only by the tools and test equipment available and by the skill of the repairman.

Section I. TROUBLESHOOTING AT FIELD MAINTENANCE LEVEL

63. Troubleshooting Procedures

a. General. The first step in servicing a defective test set is to sectionalize the fault. Sectionalization means tracing the fault to the major component or circuit responsible for abnormal operation of the test set The second step is to localize the fault Localization means tracing the fault to the defective part responsible for the abnormal condition. Some faults, such as burned-out resistors, often can be located by sight or smell. The majority of the faults, however, must be localized by checking voltages and resistances.

b. Trouble Sectionalization and Localization. The testing methods listed below aid in isolating the source of trouble. Follow the procedures in the order given. Use of these procedures should cause no further damage to the test set.

(1) *Visual inspection.* The purpose of visual inspection (par. 53) is to locate any visible trouble. Through inspection alone the repairman may frequently discover the trouble or determine the circuit in which the trouble exists. This inspection is valuable in avoiding additional damage that might occur to the test set, through improper servicing methods, and in forestalling future failures.

(2) *Operational tests.* The operational tests (ch. 3) are important because they indicate the general location of the trouble in the test set. In many instances, the information gained will determine the exact nature of the fault. To use this information fully, all symptoms must be interpreted in relation to one another

(3) *Troubleshooting chart.* The troubles listed in this chart (par. 67) will aid in localizing trouble. The field maintenance chart can be used to determine the defective part of circuit.

(4) *Intermittent troubles.* The possibility of intermittent troubles should never be overlooked. If present, this type of trouble may often be made to appear by tapping or jarring the test set. It is possible that some external connection may be causing the trouble. Check the wiring for loose connections and carefully move wires and parts with a fiber rod. This may show where a faulty connection or component is located.

64. Troubleshooting Data

Caution: Always check the circuit labels provided with the test set before troubleshooting the equipment. The same circuit elements in test sets bearing different order numbers have different reference symbols and, in some cases, different values.

a. The chart below lists the order numbers of Test Sets TS-26/TSM, TS-26A/TSM and TS-26B/TSM. If circuit labels are lost or destroyed use the order numbers in the chart to obtain the correct circuit labels.

Order No.		
Test Set TS-26/TSM	Test Set TS-26A/TSM	Test Set TS-26B/TSM
20831–Phila–44	25588–Phila–49	3017–Phila–52
27873–Phila–44	3048–Phila–52	
32767–Phila–45	3477–Phila–52	
40824–Phila–45	22138–Phila–53	
	37724–Phila–53	
	39151–Phila–53	

b. The chart below lists material that is useful for troubleshooting on Test Set TS-26(*)/TSM. It will help in the rapid location of faults.

Fig. No.	Title
47	Test Set TS-26A/TSM, exploded view.
48	Test Set TS-26/TSM, meter panel assembly with case removed, rear view of right side.
49	Test Set TS-26/TSM, meter panel assembly with case removed, rear view of left side.
50	Test Set TS-26A/TSM, meter panel assembly with case removed, rear view of right side.
51	Test Set TS-26A/TSM, meter panel assembly with case removed, rear view of left side.
52	Test Set TS-26B/TSM, meter panel assembly with case removed, rear view.
53	Test Set TS-26(*)/TSM, switch panel assembly, rear view.
54	MIL STD resistor color code chart.
55	Test Set TS-26/TSM, schematic diagram.
56	Test Sets TS-26A/TSM and TS-26B/TSM, schematic diagram.

65. Test and Tool Equipment Required for Troubleshooting

The items of test and tool equipment required for troubleshooting Test Set TS-26(*)/TSM are listed in the chart below. Applicable technical manuals are also listed in the chart.

Test and tool equipment	Technical manual
Meter Test Set TS-682/GSM-1 p/o Meter Test Equipment AN/GSM-1B	TM 11-2535A
Multimeter TS-352/U	TM 11-5527
Tool Equipment TK-21/G	

66. General Precautions

Observe the following precautions very carefully whenever servicing Test Set TS-26(*)/TSM. Careless replacement of parts often makes new faults inevitable.

a. Note the position of the leads before a part is unsoldered. Tag each lead if a part has a number of connections.

b. Be careful not to damage other leads by pushing or pulling them out of the way.

c. Do not use a large soldering iron when soldering small resistors or ceramic capacitors. Overheating of the small parts may ruin or change the value of the component.

d. Do not allow drops of solder to fall into parts of the chassis because they may cause short circuits.

e. Make well-soldered joints. A carelessly soldered joint may create new faults. Faults caused by poorly soldered joints are very difficult to locate.

67. Troubleshooting Chart

The troubleshooting chart is supplied as an aid for locating trouble in Test Set TS-26(*)/TSM. It lists the symptom that the repairman can observe by making a few simple operational checks with the test set. The chart can be used to localize the trouble to a particular circuit. After the trouble has been localized, resistance measurements can be made to isolate the defective part.

Note. The same circuit elements in test sets bearing different order numbers have different reference symbols and, in some cases, different values. For this reason, resistors in the troubleshooting chart are identified only in a general manner. The repairman must use the circuit schematic diagram provided with the test set that is being repaired.

Symptom	Probable trouble	Correction
1. Neither voltage nor resistance measurements can be obtained.	1. Defective test leads or meter leads.	1. Check each lead for continuity. Repair or replace defective leads.
	Defective REV. SW. switch	Check switch for continuity when operated to each position. Replace switch if defective (par. 71).
	Defective 45V. BATT. switch	Check switch for continuity when operated to each position. Replace switch if defective (par. 71).
	Defective VM.-RES. switch	Check switch for continuity when operated to each position. Replace switch if defective (par. 71).
	Defective meter M1	Check and replace meter if defective (par. 75).
	Broken wire in meter circuit or switching circuit.	Make continuity checks between elements in the test set. Repair or replace broken wires.
2. Only resistance measurements can be obtained.	2. Defective VM.-RES. switch	2. Check switch for continuity when operated to the VM. position. R7-place switch if defective (par. 71).
	Open resistor in voltmeter circuit	Check resistor in the voltmeter circuit that is in series with meter M1 (figs. 55 and 56). Replace resistor if open.
	Broken wire in voltmeter circuit	Make continuity checks between elements in the voltmeter circuit. Repair or replace broken wires.
3. Only voltage measurements can be obtained.	3. Open resistor in ohmmeter circuit	3. Check the resistors in the ohmmeter circuit that are in series with meter M1 (figs. 55 and 56). Replace any open resistor.
	Defective batteries	Check batteries and replace if defective.
	Battery connections	Check battery connections. Clean terminals and tighten connections.
	Defective VM.-RES. switch	Check for continuity when operated to RES. position.
4. Resistance measurements can be obtained on all ranges but voltage measurements can only be obtained on some of the ranges.	4. Open resistor in voltmeter circuit	4. Check resistors between voltmeter pin jacks for continuity. Replace any open resistors.
	Broken wire in voltmeter circuit	Make continuity checks between elements in the voltmeter circuit. Repair or replace broken wires.
5. Voltage measurements can be obtained in all ranges but resistance measurements can only be obtained on some of the ranges.	5. Open resistor in ohmmeter circuit	5. Check resistors between ohmmeter pin jacks for continuity. Replace any open resistors.
	Broken wire in ohmmeter circuit	Make continuity checks between elements in the ohmmeter circuit. Repair or replace any broken wires.
	Defective battery	Check batteries and replace if necessary.
6. Both voltage and resistance measurements inaccurate.	6. Defective meter M1	6. Check meter and replace if inaccurate (par. 75).
7. Only resistance measurements inaccurate.	7. Defective batteries	7. Check batteries and replace if defective.
	Defective resistors in the ohmmeter circuit.	Check value of each resistor in the ohmmeter circuit. Replace any defective resistor.
8. Only voltage measurements inaccurate.	8. Defective resistors in the voltmeter circuit.	8. Check the value of each resistor in the voltmeter circuit. Replace any defective resistor.
9. A capacitance kick cannot be obtained for *each* operation of the REV. SW. switch.	9. Defective REV. SW. switch	9 Check switch for continuity when operated to either position. Replace switch if defective (par. 71).

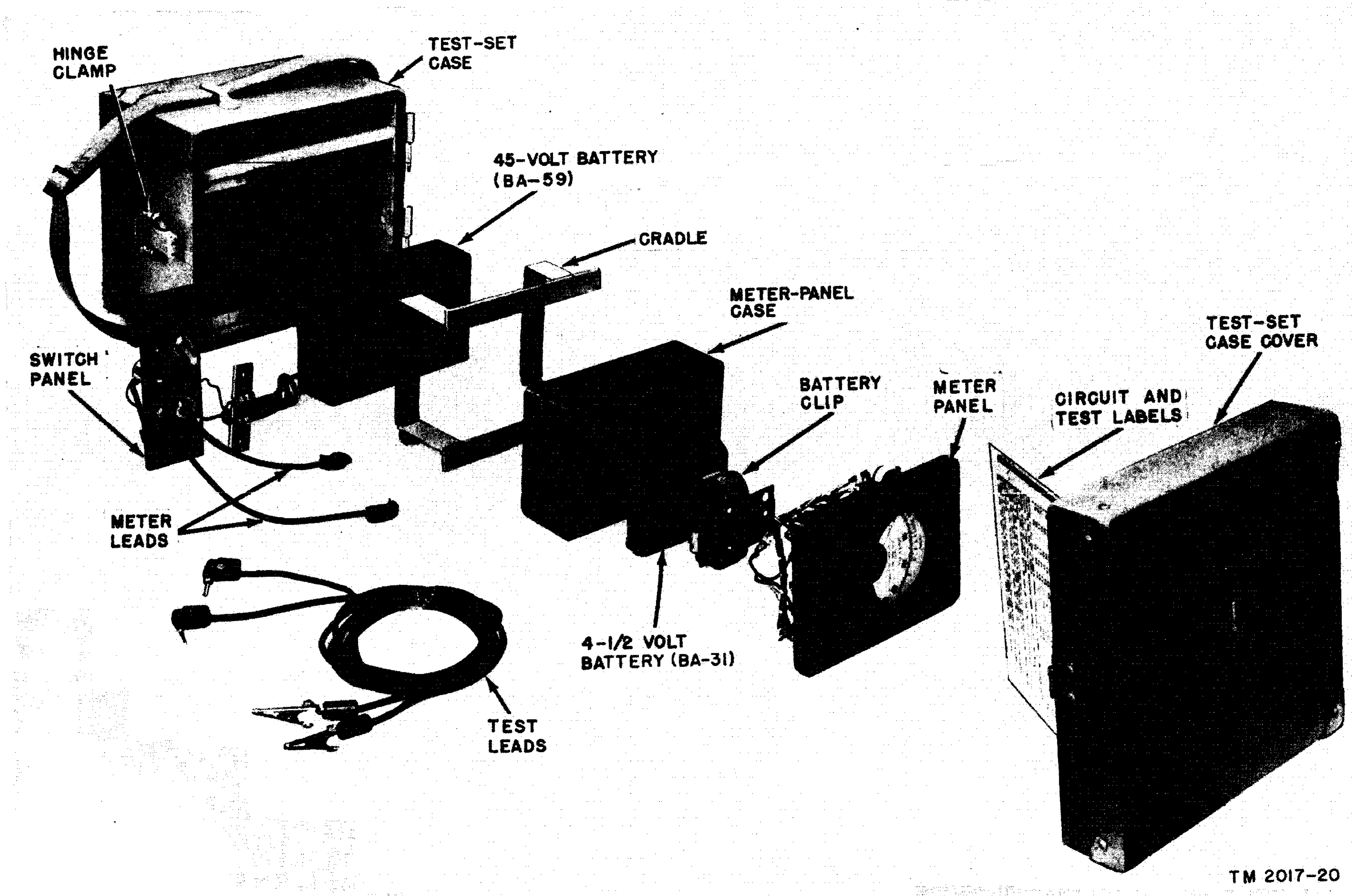

Figure 47. Test Set TS-26A/TSM, exploded view.

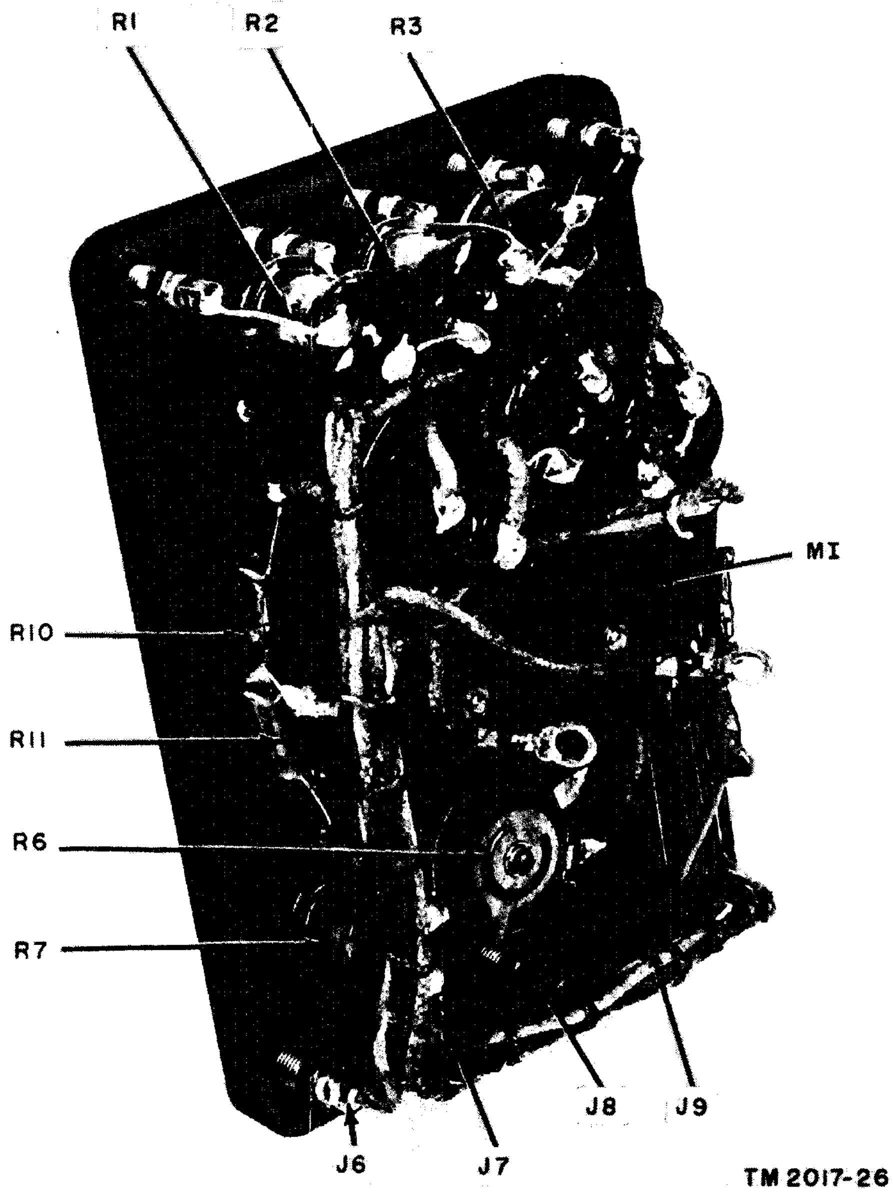

Figure 48. Test Set TS–26/TSM, meter panel assembly with case removed, rear view of right side.

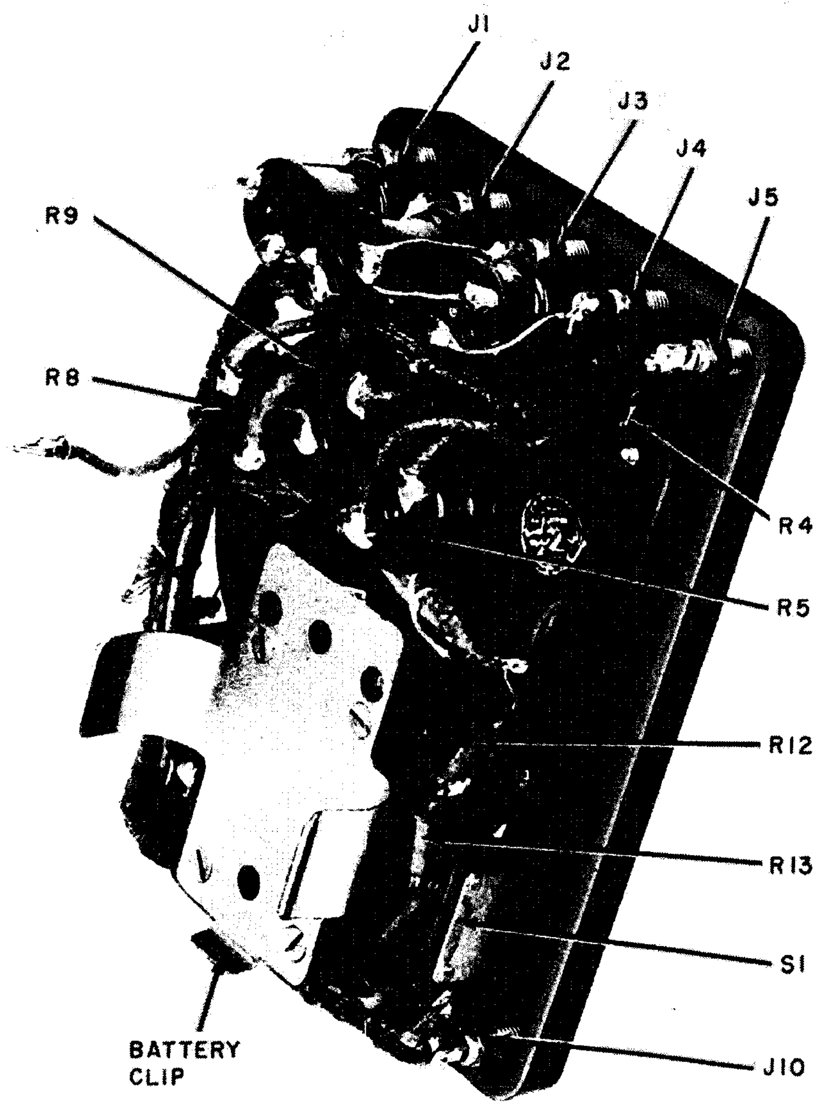

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Figure 49. Test Set TS–26/TSM, meter panel assembly with case removed, rear view of left side.

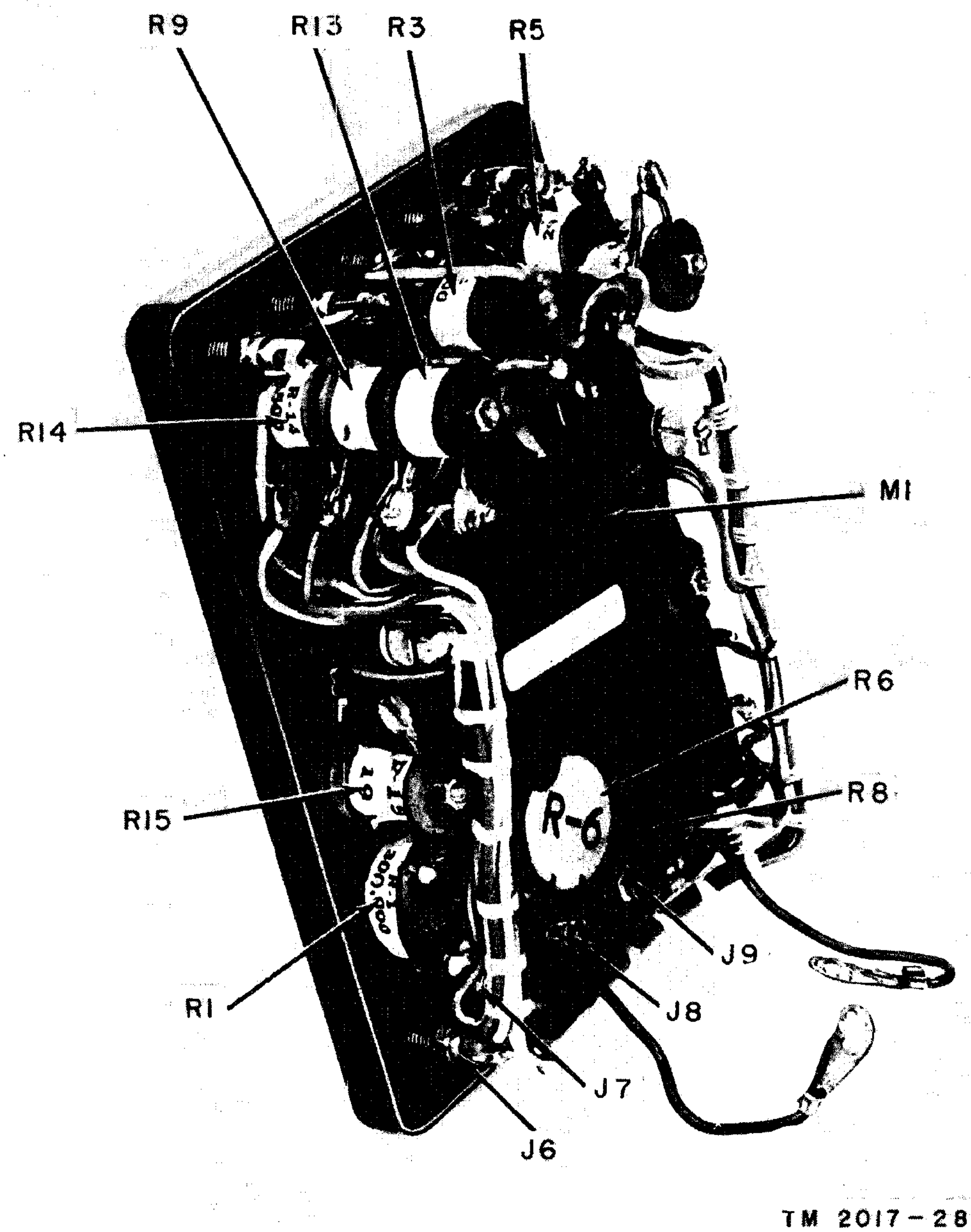


Figure 50. Test Set TS-26A/TSM, meter panel assembly with case removed, rear view of right side.

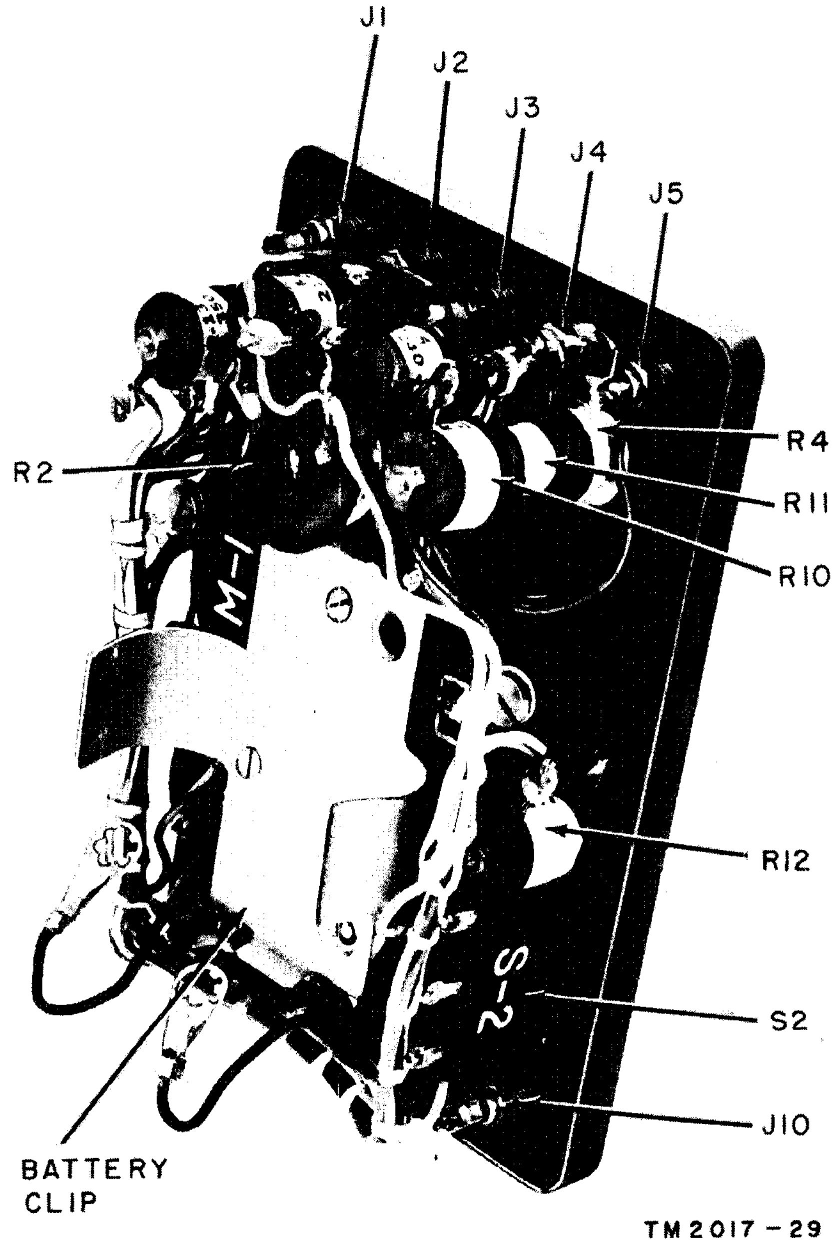


Figure 51. Test Set TS–26A/TSM, meter panel assembly with case removed, rear view of left side.

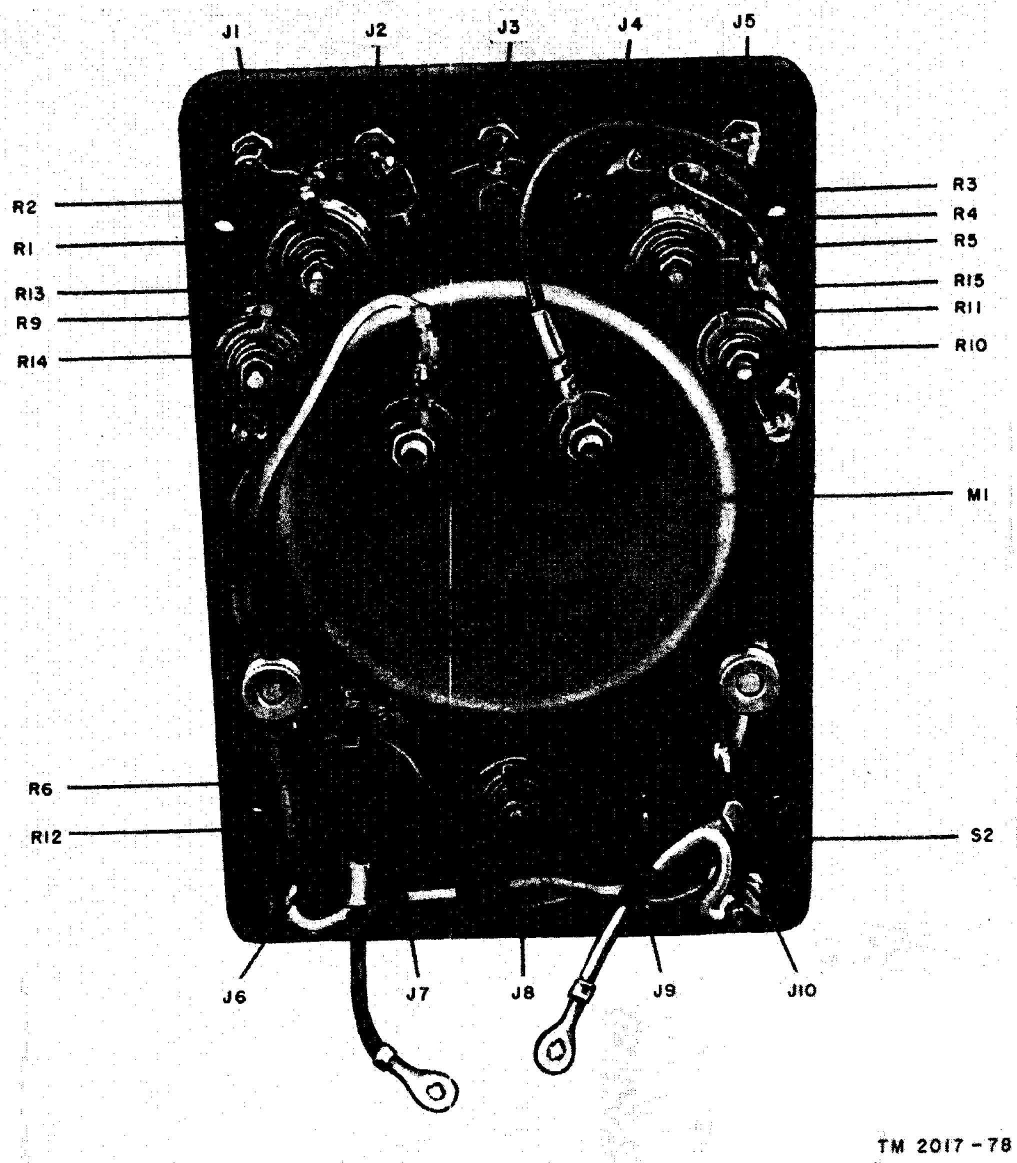


Figure 52. Test Set TS-26B/TSM, meter panel assembly with case removed, rear view.

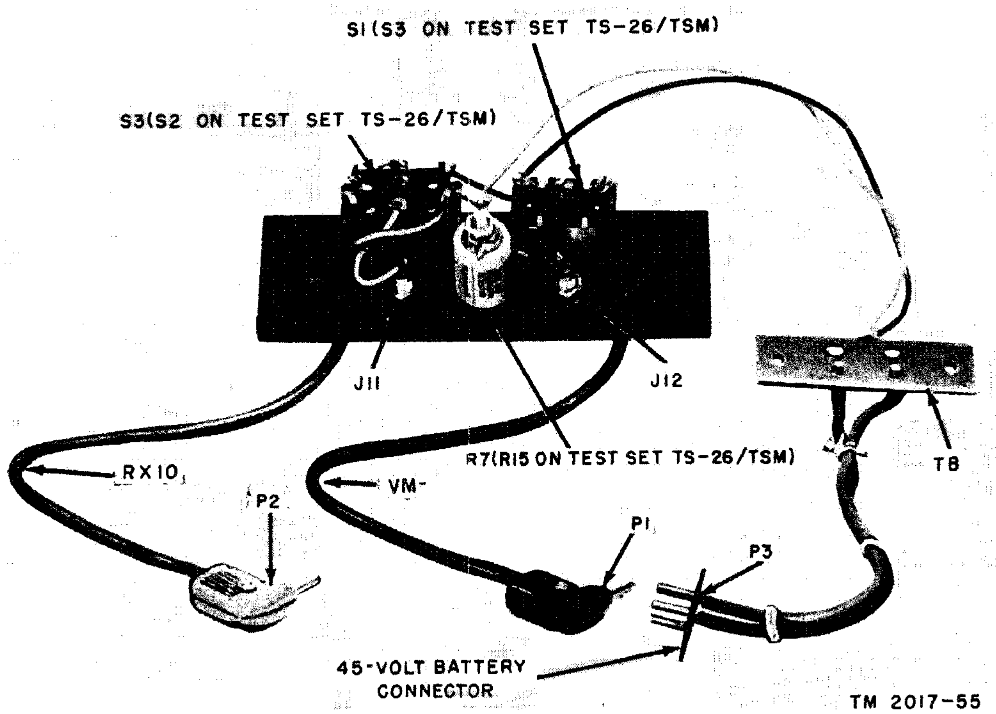


Figure 53. Test Set TS-26(*)/TSM, switch panel assembly, rear view.

68. Replacement of Parts

Note. The accuracy of measurements with Test TS-26(*)/TSM will be affected if proper replacement parts are not used. Be sure to use *only* the prescribed parts when repairing the test set.

The parts of the test set are readily accessible and are replaced easily if found to be faulty. Detailed procedures for the removal of panel assemblies and the replacement of parts are described in paragraphs 69 through 75. Refer to the precautions listed in paragraph 66 before replacing any parts. An exploded view of Test Set TS-26A/TSM is shown in figure 47. Figures 48 through 53 show the location of parts.

69. Removal of Meter Panel Assembly

Remove the meter panel assembly from the test set case as described in the procedures below:

a. Remove the four screws that are located on the test set cradle (fig. 2).

b. Carefully place the end of a screwdriver under one edge of the test set cradle and pry it upward until it can be grasped with the fingers.

c. Lift the cradle and the meter panel assembly out of the test set case.

d. Slide the meter panel assembly from the cradle (fig. 7).

e. Remove the four screws located on the front of the meter panel assembly.

f. Lift the meter panel assembly out of the meter panel case.

70. Removal of Switch Panel

Remove the switch panel assembly from the test set case as described in the procedures below:

a. Remove the four screws that are located at the corners of the switch panel assembly.

b. Carefully lift the switch panel assembly out of the test set case.

Note. The switch panel will still be connected to a terminal board in the test set case by a pair of short wires; however, all parts on the switch panel assembly will now be accessible for inspection or replacement. If the repairman desires to completely separate the switch panel assembly and the test set case without unsoldering any wires, continue with *c* through *f* below.

c. Remove the meter panel assembly (par. 69).

d. Remove the two wood screws from the ends of the terminal board located on the left side of the test case (fig. 5).

e. Remove the 45-volt battery connector plug from the 45-volt battery receptacle (fig. 5).

f. Remove the switch panel assembly and the attached terminal board (fig. 53), from the test set case.

71. Replacement of Switches

Three switches (VM.-RES., 45V. BATT., and REV. SW.) are provided on Test Set TS-26(*)/TSM. Detailed procedures for switch replacement are described below.

a. VM.-RES. Switch.

Note. The reference symbol for the VM.-RES. switch in Test Set TS-26/TSM is S1 (fig. 49); in Test Sets TS-26A/TSM and TS-26B/TSM, it is S2 (figs. 51 and 52).

(1) Remove the meter panel assembly from the test set case (par. 69).
(2) Unscrew the hexagonal nut, located at the base of the switch, on the rear side of the meter panel assembly.
(3) Push the switch toward the front of the meter panel assembly.
(4) Unscrew and remove the circular nut located on the front of the meter panel assembly.
(5) Carefully withdraw the switch from the rear side of the meter panel assembly.
(6) Unsolder the wires attached to the switch and resolder them to the replacement switch.
(7) Insert the replacement switch into the mounting hole on the meter panel assembly (rear side).
(8) Replace the circular nut on the end of the switch protruding from the front side of the meter panel assembly.
(9) Tighten the hexagonal nut located at the base of the switch until the switch is securely mounted.
(10) Replace the meter panel assembly.

b. 45V. BATT. and REV. SW. Switches. The 45V. BATT. and REV. SW. switches are replaced in the same manner.

Note. The reference symbol for the 45V. BATT switch in Test Set TS-26/TSM is S3 (fig. 53); in Test Sets TS-26A/TSM and TS-26B/TSM, it is S1. The reference symbol for the REV. SW. in Test Set TS-26/TSM is S2 (fig. 53); in Test Sets TS-26A/TSM and TS-26B/TSM, it is S3.

(1) Remove the switch panel assembly from the test set case (par. 70).
(2) Unscrew and remove the hexagonal nut located on the front of the switch panel.
(3) Withdraw the switch from its mounting hole on the switch panel assembly.

(4) Unsolder the wires that are attached to the switch and resolder them to the replacement switch.

(5) Insert the replacement switch into the mounting hole on the switch panel assembly.

(6) Replace the hexagonal nut on the front end of the switch.

(7) Tighten the hexagonal nut until the switch is securely mounted.

(8) Replace the switch panel assembly.

72. Replacement of Jacks

Replacement procedures for the ohmmeter, voltmeter, and line jacks are described below.

a. Voltmeter and Ohmmeter Jacks (figs. 48 through 52).

(1) Remove the meter panel assembly from the test set case (par. 69).

(2) Unsolder the wire connected to the jack that is to be replaced.

(3) Unscrew the jack from the bakelite mounting hole on the meter panel assembly.

(4) Screw the replacement jack into the mounting hole.

(5) Resolder the wire (removed in (2) above) to the replacement jack.

(6) Replace the meter panel assembly.

b. Line Jacks (fig. 53).

(1) Remove the switch panel assembly from the test set case (par. 70)

(2) Unsolder the wire connected to the jack that is to be replaced.

(3) Unscrew the hexagonal nut located on the rear of the switch panel.

(4) Withdraw the jack from the front side of the switch panel.

(5) Insert the replacement jack.

(6) Replace the hexagonal nut and tighten until the jack is securely fastened to the switch panel.

(7) Resolder the wire (removed in (2) above) to the replacement jack.

(8) Replace the switch panel assembly.

73. Replacement of Fixed Resistors

Every resistor in Test Set TS–26(*)/TSM is accessible for easy replacement after the panel assemblies have been removed from the test set case (pars. 69 and 70). Some fixed resistors require only unsoldering for replacement; others are mounted by a single screw (placed in the center of the resistor) which is easily removed. Refer to figures 48 through 53.

74. Replacement of Battery Adjustment Control

Replacement procedures for the battery adjustment control in Test Set TS–26/TSM are described in *a* through *o* below. Replacement procedures for the battery adjustment control in Test Sets TS–26A/TSM and TS-26B/TSM are similar.

a. Remove the meter panel assembly from the test set case (par. 69).

b. Remove the 4½-volt battery (BA-31) from the battery clip.

c. Remove the four screws located on the battery clip (fig. 49).

Note. Do not lose the small battery clip spacers.

d. Remove the battery clip.

e. Remove the small screw located in the center of the battery adjustment control (rear side).

f. Remove the BATTERY ADJUSTMENT knob (front of the meter panel assembly) and the movable resistor arm (rear of the meter panel assembly).

g. Remove the circular nut located on the front side of the meter panel assembly (below BATTERY ADJUSTMENT).

h. Withdraw the control from the rear side of the meter panel assembly.

i. Unsolder the wires on the terminals of the control and resolder them to the terminals on the replacement control.

j. Insert the replacement control (rear side of meter panel assembly).

k. Replace the circular nut (front end of the control) and tighten it until the control is securely mounted on the meter panel assembly.

l. Replace the movable resistor arm (rear of control) and the BATTERY ADJUSTMENT knob (front of the meter panel assembly).

m. Replace the battery clip.

n. Replace the battery.

o. Replace the meter panel assembly.

75. Replacement of Meter M1

Procedures for the replacement of the meter in Test Sets TS–26/TSM and TS–26A/TSM are described below. Procedures for replacing a meter in Test Set TS–26B/TSM are similar. Follow the procedures in the order given.

a. Remove the meter panel assembly from the test set case (par. 69).

b. Remove the screws at the center of any resistors mounted on the rear side of the meter (figs. 48 and 50).

c. Remove the 4½-volt battery from the battery clip.

d. Remove the screws that hold the battery clip and then remove the battery clip (figs. 49 and 51).

e. Unsolder the two wires attached to the two terminals on the rear of the meter.

f. Remove the four screws at the corners of the rectangular meter base on the rear side of the meter panel assembly.

g. Carefully remove the meter from the rear side of the meter panel assembly.

Note. Resistors and wiring can be moved to one side when the meter is being removed but care should be taken so wires are not broken.

h. Insert the replacement meter from the rear side of the meter panel assembly.

i. Replace the four screws on the rectangular meter base.

j. Resolder the wires to the terminals on the meter.

k. Replace the battery clip and the battery.

l. Secure the resistors to the meter.

m. Replace the meter panel assembly in the test set case.

76. Refinishing

Check the finish of Test Set TS-26(*)/TSM after repairs have been completed. Instructions for refinishing badly marred surfaces are given in TM 9-2851. If any parts have been replaced, moistureproof and fungiproof the new parts. Refer to TB SIG 13 and TB SIG 72.

Section III. FINAL TESTING

77. General

This section is intended as a guide to be used in determining the quality of a repaired Test Set TS-26(*)/TSM. The minimum test requirements outlined in paragraphs 79 through 81 may be performed by maintenance personnel with adequate test equipment and the necessary skills. Repaired equipment meeting these requirements will furnish uniformly satisfactory operation.

78. Test Equipment Required for Final Testing

The items of test equipment required for final testing are listed in the chart below. The applicable technical manual is also listed in the chart.

Test equipment	Technical manual
Meter Test Set TS-682/GSM-1 p/o Meter Test Equipment AN/GSM-1B.	TM 11-2535A
Capacitor Decade p/o Laboratory Standards AN/URM-2.	
Resistor Decade ZM-16/U.	

79. Accuracy of Resistance Measurements

Test the accuracy of resistance measurements of Test Set TS-26(*)/TSM by using Resistor Decade ZM-16/U. Procedures for checking the accuracy of resistance measurements are described below:

a. Arrange Test Set TS-26(*)/TSM as an ohmmeter for use with the 0- to 10-megohm range (par. 15*b* and fig. 19 or 20).

b. Connect the test leads to Resistor Decade ZM-16/U.

c. Arrange Resistor Decade ZM-16/U for use as a 4-megohm resistor.

d. Observe the resistance measurement on the OHMS scale of the test set meter. It should be 4 megohms ±1 megohm.

e. Rearrange Resistor Decade ZM-16/U for use as a 7-megohm resistor.

f. Observe the resistance measurement on the OHMS scale of the test set meter. It should be 7 megohms ±1 megohm.

g. Disconnect the test leads from Resistor Decade ZM-16/U.

80. Accuracy of Voltage Measurements

Test the accuracy of voltage measurements of Test Set TS-26(*)/TSM by using Meter Test Set TS-682/GSM-1 as described in TM 11-2535A. The accuracy of measurements should be within the tolerances listed for the ranges and test points in the chart below:

Range (volts)	Test point (volts)	Tolerance (volts)
0-3	3	±.09
0-30	30	±.9
0-300	300	±9.0
0-600	600	±18.0

81. Accuracy of Capacitance Kick Indications

Use the procedures described below to determine whether the capacitance kick indications of the meter in Test Set TS–26(*)/TSM are within the required limits.

a. Arrange Test Set TS–26(*)/TSM as an ohmmeter for use with the 0- to 1,000-ohm range (par. 15*b* and fig. 15).

b. Operate the 45V. BATT. switch to the ON position.

c. Connect the test leads to a capacitor decade arranged for use as a .1 μf (± 5 percent) capacitor.

d. Operate the REV. SW. switch (back and forth) several times at 2- or 3-second intervals and record the maximum kick indications of the meter needle on the VOLTS D. C. scale.

e. The average of the maximum readings obtained in *d* above should be within the limits described in the table below.

f. Rearrange the capacitor decade as a .25 μf (± 5 percent) capacitor and repeat the procedures in *d* and *e* above.

g. Rearrange the capacitor decade as a .4 μf (± 5 percent) capacitor and repeat the procedures in *d* and *e* above.

h. Disconnect the test leads.

Capacitance of capacitor decade (μf)	Required meter readings (divisions on VOLTS D. C. scale)
$0.1 \pm 5\%$	16.5 ± 2.0
$0.25 \pm 5\%$	34.0 ± 3.5
$0.4 \pm 5\%$	47.5 ± 5.0

CHAPTER 7

SHIPMENT AND LIMITED STORAGE AND DEMOLITION TO PREVENT ENEMY USE

Section I. SHIPMENT AND LIMITED STORAGE

82. Disassembly

The following instructions are recommended as a general guide for preparing Test Set TS-26(*)/TSM for transportation and storage.

a. Remove the test leads from the pin jacks. Fold and store them in the compartment provided on the left side of the test set case.

b. Remove the two batteries.

Note. Failure to remove batteries may result in corrosion and damage to the test set. Procedures for the removal of batteries are similar to those for the installation of batteries (par. 12).

c. Secure the cover to the test set case with the hinge clamp.

83. Repacking for Shipment or Limited Storage

a. General. The exact procedure in repacking for shipment or limited storage depends on the material available and the conditions under which the equipment is to be shipped or stored. Instructions for *packaging* individual test sets are contained in *b* and *c* below. Instructions for *packing* a quantity of test sets together are contained in *d* and *e* below.

b. Domestic Packaging (fig. 4).

(1) Cushion the test set and place it within a corrugated fiberboard box.

(2) Place TM 11-2017 between the cushioning material and the lid of the fiberboard box.

(3) Seal the box with gummed tape.

c. Oversea Packaging (fig. 4).

(1) Cushion the test set and place it within a corrugated fiberboard box.

(2) Place TM 11-2017 between the cushioning material and the lid of the fiberboard box.

(3) Seal the box with gummed tape.

(4) Inclose the fiberboard box within a heat-sealed water-vaporproof barrier.

(5) Inclose the heat-sealed water-vapor proofed fiberboard box within a water-resistant carton. Seal this carton with water-resistant pressure-sensitive tape.

d. Domestic Packing.

(1) Place a quantity of test sets (each packaged as described in *b* above) within a close-fitting corrugated fiberboard box.

Note. The weight of the box and contents should not exceed 65 pounds.

(2) Seal the box with gummed tape.

e. Oversea Packing.

(1) Place a quantity of test sets (each packaged as described in *c* above) within a close-fitting nailed wooden box.

Note. The weight of the box and contents should not exceed 150 pounds.

(2) Reinforce the nailed wooden box with metal strapping.

Section II. DEMOLITION TO PREVENT ENEMY USE

84. Authority for Demolition

The demolition procedures in paragraph 85 will be used to prevent the enemy from using or salvaging this equipment. Demolition of the equipment will be accomplished only upon order of the commander.

85. Methods of Destruction

a. Smash. Smash the meter and the test set case; use sledges, axes, pickaxes, hammers, crowbars, or other heavy tools.

b. Cut. Cut test leads and battery leads; use axes, handaxes, or machetes.

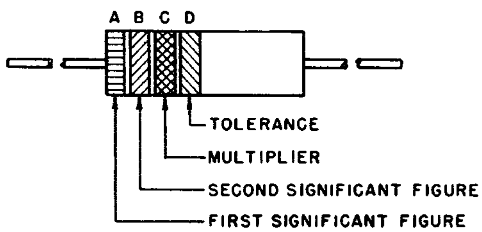
c. Burn. Burn test leads, resistors, and technical manuals; use gasoline, korosene, oil, flame throwers, or incendiary grenades.

d. Disposal. Bury or scatter the destroyed parts in slit trenches or fox holes, or throw them into streams.

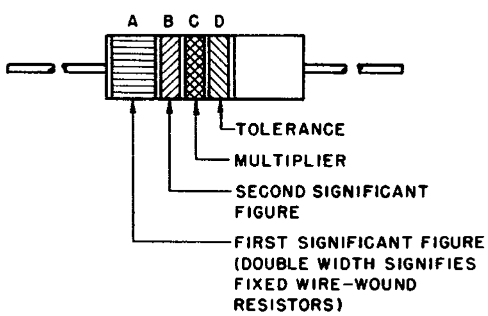
e. Destroy. Destroy everything.

RESISTOR COLOR CODE MARKING
(MIL-STD RESISTORS)

AXIAL-LEAD RESISTORS (INSULATED)

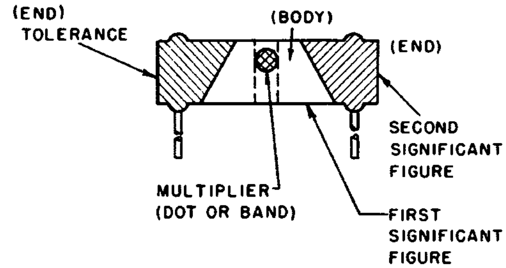


RC-COMPOSITION

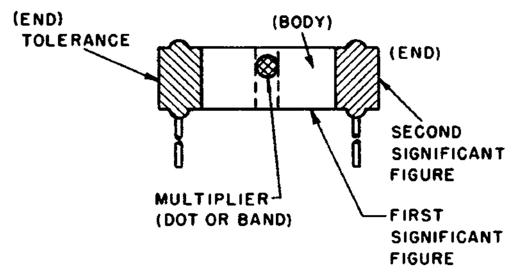


RU-WIRE-WOUND

RADIAL-LEAD RESISTORS (UNINSULATED)



RZ-COMPOSITION



RZ-COMPOSITION

RESISTOR COLOR CODE

BAND A OR BODY*		BAND B OR END*		BAND C OR DOT OR BAND*		BAND D OR END*	
COLOR	FIRST SIGNIFICANT FIGURE	COLOR	SECOND SIGNIFICANT FIGURE	COLOR	MULTIPLIER	COLOR	RESISTANCE TOLERANCE (PERCENT)
BLACK	0	BLACK	0	BLACK	1	BODY	± 20
BROWN	1	BROWN	1	BROWN	10	SILVER	± 10
RED	2	RED	2	RED	100	GOLD	± 5
ORANGE	3	ORANGE	3	ORANGE	1,000		
YELLOW	4	YELLOW	4	YELLOW	10,000		
GREEN	5	GREEN	5	GREEN	100,000		
BLUE	6	BLUE	6	BLUE	1,000,000		
PURPLE (VIOLET)	7	PURPLE (VIOLET)	7				
GRAY	8	GRAY	8	GOLD	0.1		
WHITE	9	WHITE	9	SILVER	0.01		

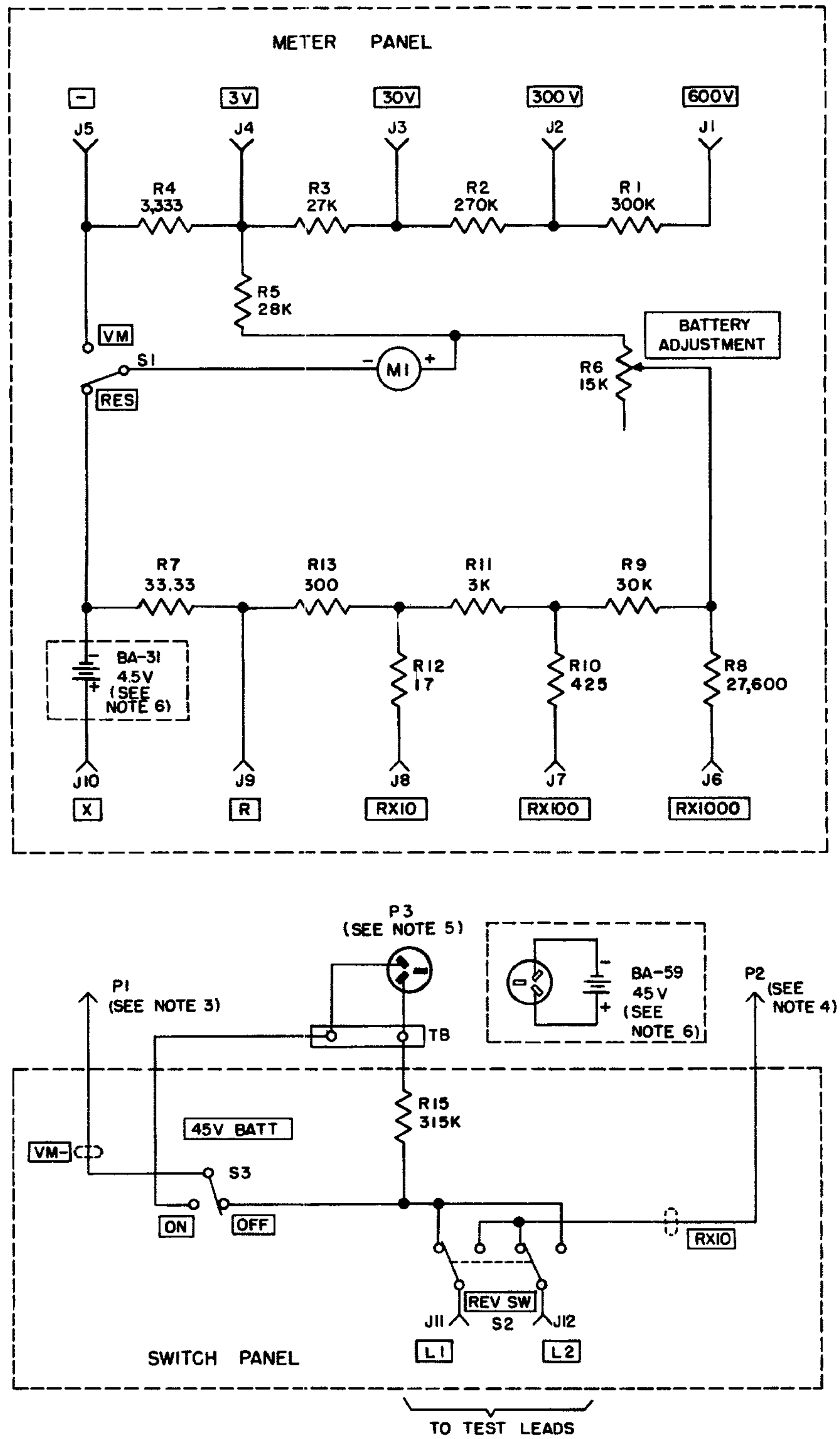
*FOR WIRE-WOUND-TYPE RESISTORS, BAND A SHALL BE DOUBLE-WIDTH. WHEN BODY COLOR IS THE SAME AS THE DOT (OR BAND) OR END COLOR, THE COLORS ARE DIFFERENTIATED BY SHADE, GLOSS, OR OTHER MEANS.

EXAMPLES (BAND MARKING):
10 OHMS ±20 PERCENT: BROWN BAND A; BLACK BAND B; BLACK BAND C; NO BAND D.
4.7 OHMS ±5 PERCENT: YELLOW BAND A; PURPLE BAND B; GOLD BAND C; GOLD BAND D.

EXAMPLES (BODY MARKING):
10 OHMS ±20 PERCENT: BROWN BODY; BLACK END; BLACK DOT OR BAND; BODY COLOR ON TOLERANCE END.
3,000 OHMS ±10 PERCENT: ORANGE BODY; BLACK END; RED DOT OR BAND; SILVER END.

STD-R1

Figure 54. MIL STD Resistor color code chart.



NOTES:

1. UNLESS OTHERWISE INDICATED, RESISTANCES ARE IN OHMS.
2. [ ] DENOTES PANEL MARKING.
3. CONNECTOR P1 CONNECTS EITHER TO JACK J5 FOR VOLTAGE MEASUREMENTS OR JACK J10 FOR RESISTANCE MEASUREMENTS.
4. CONNECTOR P2 CONNECTS TO JACK J1, J2, J3, OR J4 FOR VOLTAGE MEASUREMENTS. CONNECTOR P2 CONNECTS TO JACK J6, J7, J8, OR J9 FOR RESISTANCE MEASUREMENTS.
5. CONNECTOR P3 CONNECTS TO THE RECEPTACLE ON BATTERY BA-59.
6. BATTERY BA-31 IS MOUNTED ON THE REAR OF THE METER PANEL. BATTERY BA-59 IS MOUNTED UNDER THE METER-PANEL ASSEMBLY.

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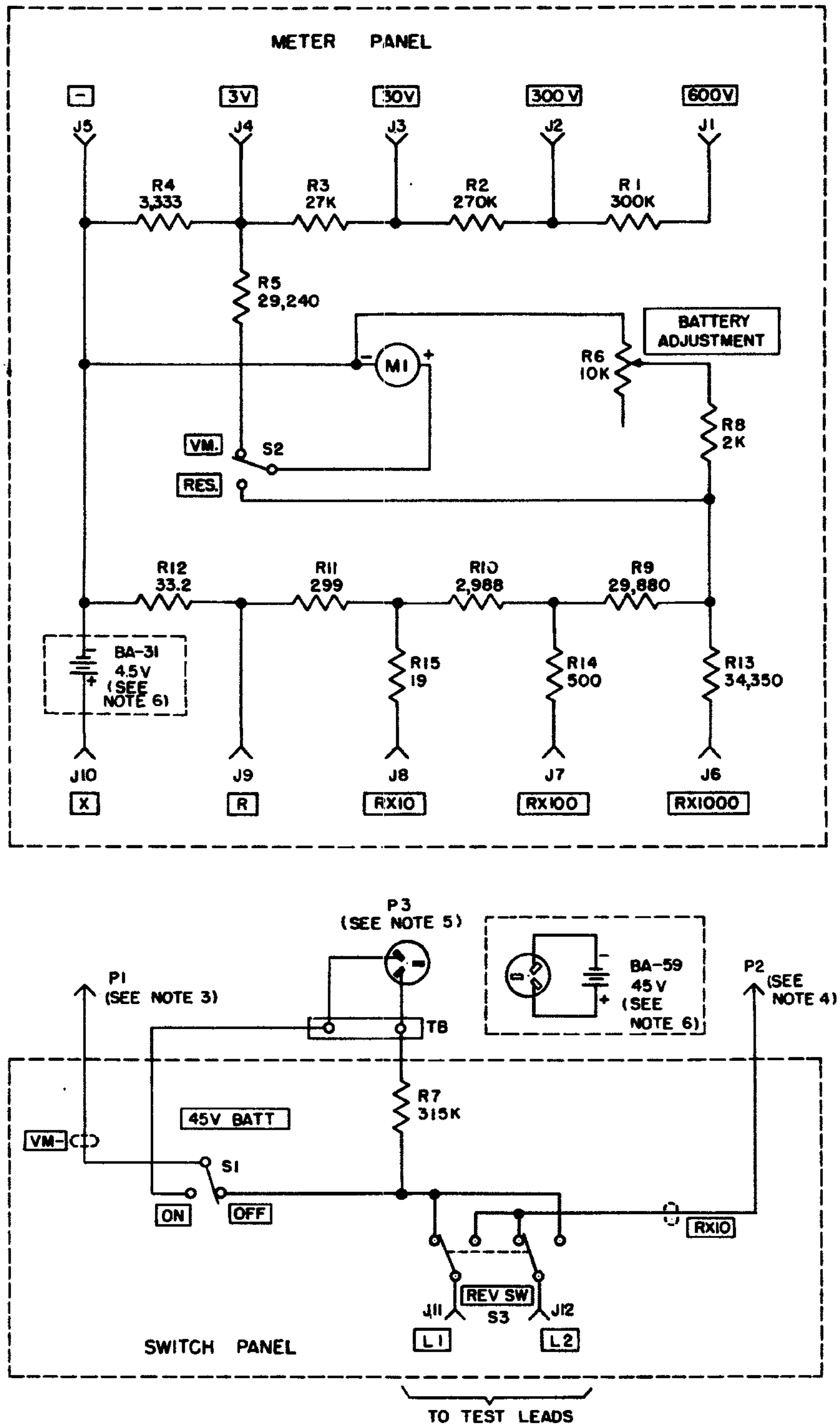
Figure 55. Test Set TS-26/TSM, schematic diagram.



NOTES:

1. UNLESS OTHERWISE INDICATED, RESISTANCES ARE IN OHMS.
2. [box] DENOTES PANEL MARKING.
3. CONNECTOR P1 CONNECTS EITHER TO JACK J5 FOR VOLTAGE MEASUREMENTS OR JACK J10 FOR RESISTANCE MEASUREMENTS.
4. CONNECTOR P2 CONNECTS TO JACK J1, J2, J3, OR J4 FOR VOLTAGE MEASUREMENTS. CONNECTOR P2 CONNECTS TO JACK J6, J7, J8, OR J9 FOR RESISTANCE MEASUREMENTS.
5. CONNECTOR P3 CONNECTS TO THE RECEPTACLE ON BATTERY BA-59.
6. BATTERY BA-31 IS MOUNTED ON THE REAR OF THE METER PANEL. BATTERY BA-59 IS MOUNTED UNDER THE METER-PANEL ASSEMBLY.

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Figure 56. Test Sets TS-26A/TSM and TS-26B/TSM, schematic diagram.

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[AG 413.6 (25 Feb 55)]

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5-262, Hq & Hq Co, Engr Maint-Sup Gp (2)
6-575, FA Obsr Bn (2)
6-577, FA Obsr Btry (2)
7A, Inf Div (2)
11-7, Sig Co Inf Div (2)
11-15, Sig Bn, Corps or Abn Corps (2)
11-16A, Hq & Hq Co, Sig Bn, Corps or Abn Corps (2)
11-18, Wire-Rad Relay Opr Co (2)
11-25, Sig Cons Bn (2)
11-27A, Sig Cons Co (2)
11-57, Armd Sig Co (2)
11-65, Sig Hv Cons Bn (2)
11-67, Sig Hv Cons Co (2)
11-95, Sig Bn-Opr (2)
11-97, Wire Opr Co, Sig Bn (2)
11-117A, Sig Spt Co (2)
11-127, Sig Rep Co (2)
Units organized under following TOE's—Continued
11-128A, Abn Sig Depot Co (2)
11-500A (AA-AE), Sig Svc Org (2)
11-537, Sig Co, Amph Spt Brig (2)
11-557A, Sig Co (2)
11-587A, Sig Base Maint Co (2)
11-592A, Hq & Hq Co, Sig Base Depot (2)
11-597A, Sig Base Depot Co (2)
17A, Armd Div (2)
20-300A, Amph Spt Brig (2)
44-7A, AAA Opr Det (2)
44-12A, Hq & Hq Btry AAA Gp (2)
44-15A, AAA Gun Bn 90 mm (2)
44-70, AAA Opr Det, Static-ConUS (2)
44-101A, Hq & Hq Btry, AAA Brig (2)
57, Abn Div (2)

NG: Same as Active Army except allowance is one copy to each unit.
USAR: None.
For explanation of abbreviations used, see SR 320-50-1.

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