TM 9-4910-456-14

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

OPERATOR, 0RGANIZATIONAL, DIRECT SUPPORT,

AND GENERAL SUPPORT MAINTENANCE MANUAL,

(INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST AND

DEPOT MAINTENANCE REPAIR PARTS AND SPECIAL TOOLS)

TEST SET, GENERATOR AND VOLTAGE REGULATOR

AUTOMOTIVE: 12-AND 24-VOLT SYSTEMS

(ALLEN ELECTRIC AND EQUIPMENT COMPANY

MODEL NO. 30-92) (4910-092-9136)

This copy is a reprint which includes current pages from Changes 1 and 2.

HEADQUARTERS, DEPARTMENT OF THE ARMY

15 0CTOBER 1971

TM 9-4910-456-14
Change No. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, D. C. *4 April 1972*

OPERATOR, ORGANIZATIONAL, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE MANUAL, (INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST AND DEPOT MAINTENANCE REPAIR PARTS AND SPECIAL TOOLS) FOR TEST SET, GENERATOR AND VOLTAGE REGULATOR AUTOMOTIVE: 12-AND 24-VOLT SYSTEMS (ALLEN ELECTRIC AND EQUIPMENT COMPANY MODEL NO. 30-92) (4910-092-9136)

This change is current to 23 February 1972

TM 9-4910-456-14, 15 October 1971, is changed as follows:

The following pen-and-ink changes will be made.

COVER, below the technical manual title, add: FOR

Page 3, LIST OF ILLUSTRATIONS.

The following illustrations are deleted from the list:

Page 21.2-4 Individual Battery Test

Page 23. 2-5 Individual Battery Test (Companion)

The following illustrations are added to the list:

Page 21.2-4.1 Individual Battery Test

Page 22. 2-5.1 Individual Battery Test (Companion)

Page 54.2-25 Primary Ignition Test

Page 54.2-26 Breaker Point Resistance Test

Page 5. Paragraph 1-3 is rescinded.

Page 7 paragraph 1-8b(2)-continued. After "Load * * * OFF" add: "Load bank voltage . . . 12-24-volts".

Page 9 paragraph 2-3a(l), In line 13, "positive (-)" is changed to read "positive (+)".

Page 12, paragraph 2-3a(4). In line 16, "positive (-)" is changed to read "positive (+)". In line 17, "negative (+)" is changed to read "negative (-)".

Page 19. Paragraph 2-6b(9) is rescinded.

Page 19. Paragraph 2-6c is superseded as follows:

c. *Individual Battery Test.*

Note: The key numbers shown below in parentheses refer to figure 2-4.1.

(1) This test is for 12-volts. The 12-volt load bank link (1) will be in the CLOSE position.

(2) Connect the red voltmeter positive(+)test lead (9) from the voltmeter positive (+) binding post (7) on the tester (5) to the positive (+) battery terminal (13).

(3) Connect the black voltmeter negative (-) test lead (10) from the voltmeter negative (-) binding post (8) on the tester to the negative (-) battery terminal (19).

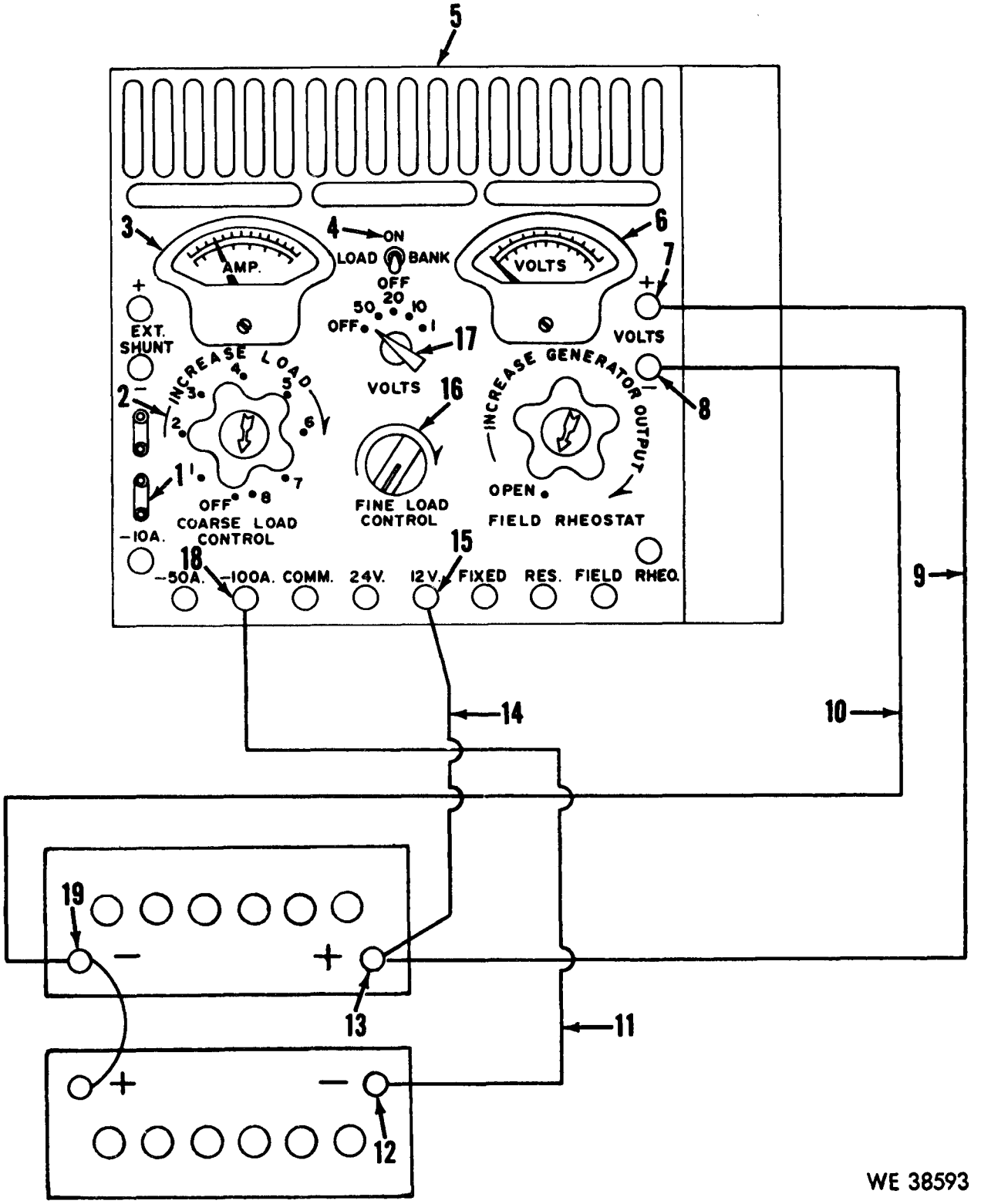
(4) Connect the red ammeter positive (+) test lead (14) from the 12-volt binding post (15) on the tester to the positive (+) battery terminal (13).

(5) Connect the black ammeter negative (-) test lead (11) from the -100 AMP binding post (18) on the tester to the negative (-) battery terminal (12).

(6) Place the voltmeter range selector switch (17) in the 20 volt position.

(7) Position the load bank switch (4) to ON and rotate load bank control knobs (2 and 16) clockwise, watching the ammeter scale (3) until the specified amperage for unit being tested is indicated. Voltmeter (6) should indicate 9 volts or more and not have a maximum variation of ±2 volts of the other battery.

(8) Return switches to OFF position. Return load bank control knobs to maximum counterclockwise position.



KEY to fig. 2-4.1:

1. 12-Volt load bank link
2. Coarse load bank control knob
3. Ammeter scale
4. Load bank switch
5. Tester
6. Voltmeter
7. Voltmeter positive binding post
8. Voltmeter negative binding post
9. Red voltmeter positive test lead
10. Black voltmeter negative test lead
11. Black ammeter negative test lead
12. Negative battery terminal
13. Positive battery terminal
14. Red ammeter positive test lead
15. 12-Volt binding post
16. Fine load bank control knob
17. Voltmeter range selector switch
18. -100 AMP binding post
19. Negative battery terminal

Figure 2-4.1. Individual battery test.

Page 19. Paragraph 2-6d is superseded as follows:

d. *Individual Battery Test (Companion).*

Note: The key numbers shown below in parentheses refer to figure 2-5.1.

(1) This test is for 12-volts. The 12-volt load bank link (1) will be in the CLOSE position.

(2) Connect the red voltmeter positive (+) test lead (9) from the voltmeter positive (+) binding post (7) on the tester (5) to the positive (+) battery terminal (19).

(3) Connect the black voltmeter negative (-) test lead (10) from the voltmeter negative (-) binding post (8) on the tester to the negative (-) battery terminal (18).

(4) Connect the red ammeter positive (+) test lead (16) from the 12-volt binding post (13) on the tester to the positive (+) battery terminal (17).

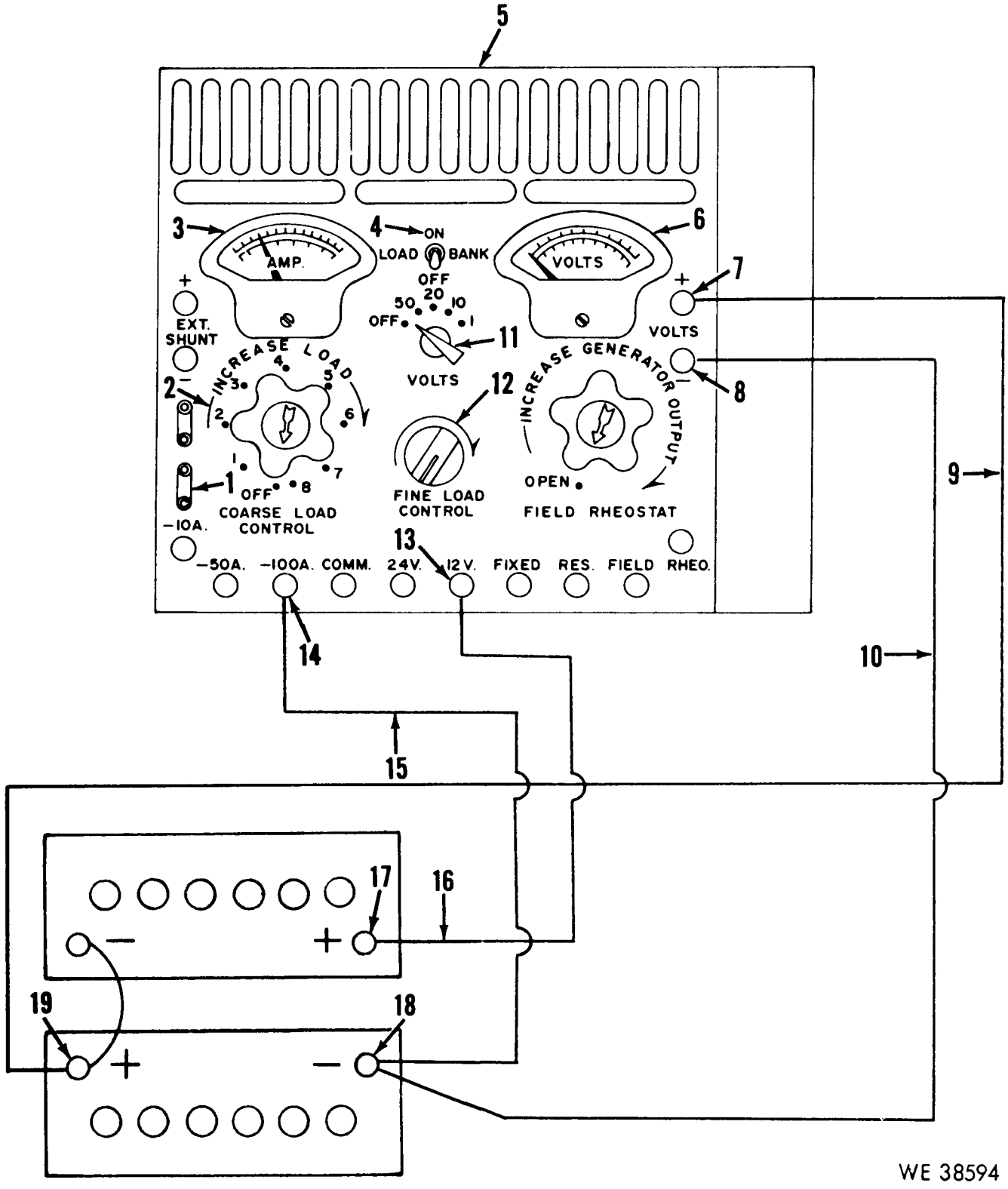
(5) Connect the black ammeter negative (-) test lead (15) from the -100 AMP binding post (14) on the tester to the negative (-) battery terminal (18).

(6) Place the voltmeter range selector switch (11) in the 20 volt position.

(7) Position the load bank switch (4) to ON and rotate load bank control knobs (2 and 12) clockwise, watching the ammeter scale (3) until the specified amperage for unit being tested is indicated. Voltmeter (6) should indicate 9 volts or more and not have a maximum variation of ±2 volts of the other battery.

(8) Return switches to OFF position. Return load bank control knobs to maximum counterclockwise position.

(9) Disconnect test leads from binding posts on the tester and terminals on the batteries.



KEY to fig. 2-5.1:

1. 12-Volt load bank link
2. Coarse load bank control knob
3. Ammeter scale
4. Load bank switch
5. Tester
6. Voltmeter
7. Voltmeter positive binding post
8. Voltmeter negative binding post
9. Red voltmeter positive test lead
10. Black voltmeter negative test lead
11. Voltmeter range selector switch
12. Fine load bank control knob
13. 12-Volt binding post
14. -100 AMP binding post
15. Black ammeter negative test lead
16. Red ammeter positive test lead
17. Positive battery terminal
18. Negative battery terminal
19. Positive battery terminal

Figure 2-5.1. Individual battery test (Companion).

Chapter 1
INTRODUCTION

Section I. GENERAL

1-1. Scope.

a. This manual contains instructions on the test set for operation and organizational maintenance by the using organization, and field maintenance at direct and general support levels.

b. Appendix A contains a list of current references, including supply catalogs, forms, technical manuals, and other available publications applicable to the test set.

c. Appendix B contains the Maintenance Allocation Chart for the test set, listing all maintenance and repair operations authorized by maintenance echelons.

d. Appendix C contains Repair Parts and Special Tools List (including Depot maintenance repair parts and special tools) for operating and performing organizational Direct Support, and General Support maintenance on the test set.

1-2. Forms and Records.

Maintenance forms, records, and reports which are to be used by maintenance personnel at all maintenance levels are listed in and prescribed by TM 38-750.

1-3. Equipment Serviceability Criteria (ESC).

Deleted.

1-4. Reporting of Errors.

Report of errors, omissions, and recommendations for improving this publication by the individual user is encouraged. Reports should be submitted on DA Form 2028, (Recommended Changes to Publications) and forwarded direct to: Commander, Headquarters, U.S. Army Weapons Command, ATTN: AMSWE-MAS-SP, Rock Island, IL 61201.

1-5. Destruction of Army Materiel to Prevent Enemy Use.

Refer to DOD 4160.21-M-1 for destruction of materiel to prevent enemy use.

1-6. Calibration.

Refer to TB 9-4910-521-50 for calibration procedure of circuit tester.

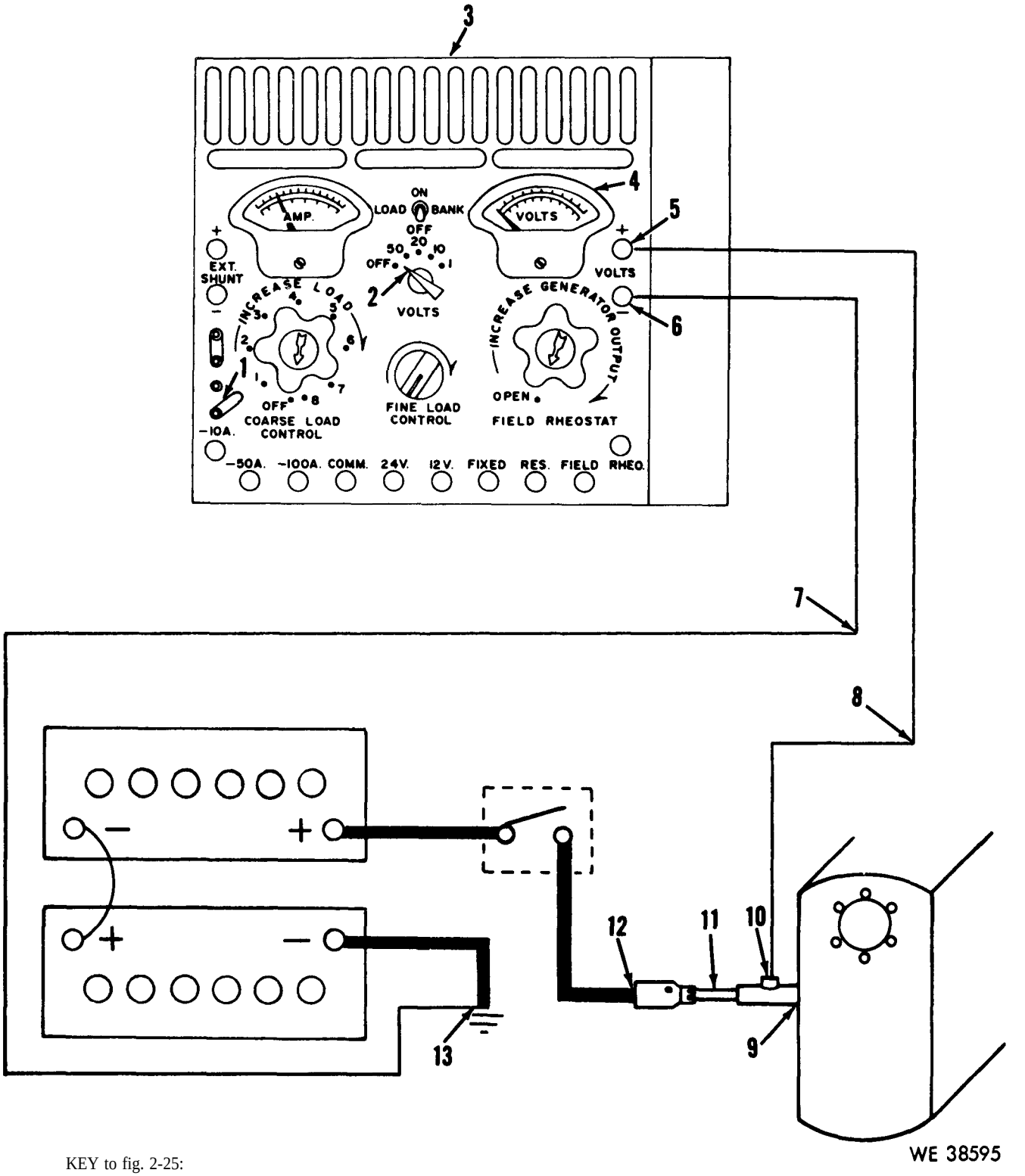
Section II. DESCRIPTION AND DATA

1-7. Description.

The test set (Fig. 1-1) is a self-contained, portable instrument, used for checking and analyzing the low voltage direct current electrical circuits of vehicles. The test set consists of four independent sections: voltmeter circuit, field rheostat circuit, ¼-OHM load resistor and a combination ammeter and load bank circuit. The ammeter and load bank may be used independently or in series, as they are interconnected by the load bank switch. The test set is equipped with the necessary test leads and a separate external shunt assembly to perform the tests described in this manual. A compartment is provided in the test set for stowing the test leads and external shunt. A bracket is provided in the cover for retaining any pertinent publications provided. Refer to table 1-1 for component items.

Table 1-1. Component Items

Part	Part no.	FSCM
LEAD TEST NEGATIVE	TV186B	0205
LEAD TEST POSITIVE	TV186R	02805
LEAD TEST POSITIVE	TV188R	02805
LEAD TEST NEGATIVE	TV188B	02805
LEAD TEST FIELD	TV167	02805
LEAD TEST	TV189	02805
SHUNT ASSEMBLY	TV102	02805



KEY to fig. 2-25:

1. 12-Volt load bank link
2. Voltmeter range selector switch
3. Tester
4. Voltmeter
5. Voltmeter positive binding post
6. Voltmeter negative binding post
7. Black voltmeter negative test lead
8. Red voltmeter positive test lead
9. Distributor
10. Terminal - ignition unit adapter
11. ADAPTER, ENGINE, ELECTRICAL TEST, ignition unit 4910-356-7508
12. Primary cable connector
13. Ground

Figure 2-25. Primary ignition test.

b. *Breaker Point Resistance Test.*

Note: The key numbers shown below in parentheses refer to figure 2-26.

(1) *Purpose.* This test is performed to determine a good distributor ground to engine. This test will also determine if there is a resistance between breaker points and internal primary connections.

(2) *Test procedures.*

(a) With the vehicle engine stopped, remove access screw from distributor cover, and install ADAPTER, ENGINE, ELECTRICAL TEST, primary circuit 4910-356-7492 (10) on distributor (9).

(b) This test is for 24 volts. The 12-volt load bank link (1) will be in the OPEN position.

(c) Connect the red voltmeter positive (+) test lead (8) from the voltmeter positive (+) binding post (5) on the tester (3) to the primary circuit adapter.

(d) Connect the black voltmeter negative (-) test lead (7) from the voltmeter negative (-) binding post (6) on the tester to any good ground (11).

(e) Place the voltmeter range selector switch (2) in the 50 volt position.

(f) Turn the ignition switch of the vehicle to ON position.

(g) If the voltmeter (4) indicates 24 volts, actuate starter switch of the vehicle for short intervals until voltmeter reads zero. Breaker points are now closed.

(h) Switch the voltmeter range selector switch to a lower range until a reading is obtained or the l-volt range is reached. A reading of 0.2 volt or less, indicates that breaker points, internal primary connections and distributor ground are normal. A reading of more than 0.2 volt indicates a poor distributor ground to engine or burned and pitted breaker points.

(i) After the test is completed, return switches to OFF position. Remove all test leads. Remove the primary circuit adapter. Replace access screw on distributor cover. Close link on the tester to prevent damage.

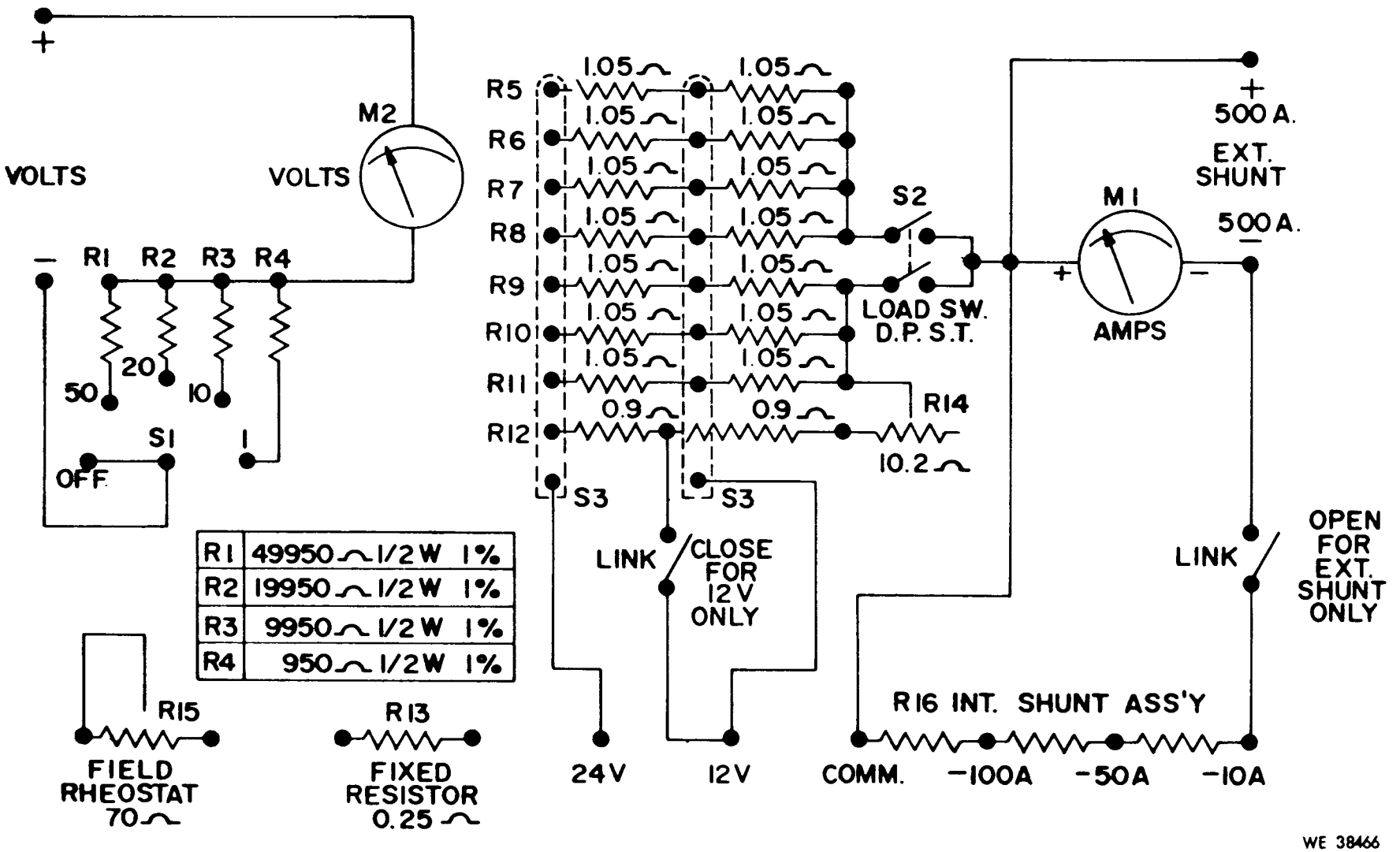


Figure 1-2. Schematic diagram.

Page 55. Paragraph 3-7a is superseded as follows:

3-7. Cleaning.

a. *General.* Any special cleaning instructions required for specified components or parts are contained in the pertinent section. General cleaning instructions are as outlined in (1) through (4) below:

(1) *Metal parts.*

(a) Use self-emulsifying decreasing solvent compound, mineral spirits paint thinner, or dry-cleaning solvent to clean or wash grease or oil from all metal parts of the test set.

(b) Use clean water or a solution of either 1/4 pound of soap chips or 6 ounces of painted-surface detergent to 1 gallon of hot water for all parts and overall general cleaning of painted surfaces.

(c) After parts are clean, dry them thoroughly. Apply a light film of special preservative lubricating oil to all parts having a polished surface to prevent misting.

(d) Before installing new parts, remove any rust-preventing compound, protective grease, etc.

(2) *Electrical parts.* Use technical trichloroethane (methylchloroform) (O-T-620) for cleaning electrical parts. Clean painted parts and plastics by wiping, brushing, or spraying but never by immersing in trichloroethane. Do not use trichloroethane for cleaning leather or rubber parts (other than neoprene).

(3) *Rubber parts other than electrical.* Clean rubber parts with soap and warm water. Apply coating of powdered technical talcum to preserve the rubber.

(4) *Meters.* Clean each meter window glass using a soft cloth dampened with a solution of common detergent and water. After cleaning, allow the meter window to dry without rubbing. Apply antistatic compound.

Page 61, paragraph 4-1. In line 2, "and equipment" is changed to read "equipment".

Page 65, column headers in Table 4-2.

a. Header in column one, "Corrective action" is changed to read "Malfunction".

b. Header in column two, "Malfunction" is changed to read "Probable cause".

c. Header in column three, "Probable cause" is changed to read "Corrective action".

Page 75. All lines in column "Item * * * Number" should be moved down one line each to match up with other columns.

Page 80, paragraph 5-23c(l)(a). In line 3, "(see a. and b. above," is changed to read "(see a. above),".

Page 84, paragraph 5-29. In lines 1,2 and 3, "5-29. Voltmeter Range Selector Switch Disassembly (Fig. 5-l0). Selector Switch Disassembly (Fig. 5-10)." is changed to read "5-29. Voltmeter Range Selector Switch Disassembly (Fig. 5-10).".

Page 103, A-3c. Lines 3 and 4, "Storage Serviceability Standard for USA WECOM Materiel: Tools and Equipment . . . . . SB 740-95-501" are rescinded.

Page 105, paragraph B-2f. In line 5, "is" is changed to read "is a".

Page 106, column (2), group no. 3. After "RESISTOR PANEL ASSEMBLY" add: "WIRING".

Page 109, paragraph C-6. In line 1, "C-6. Abbreviations." is changed to read:

"C-6. Abbreviations.

Abbreviations Explanation".

Page 112. Column (3) header "VOLTMETER POSITIVE TEST LEAD (6625-885-5760)" is rescinded.

Page 114, tabular header. The description of Section "Section V. FEDERAL STOCK NUMBER AND REFERENCE NUMBER INDEX - Continued" is changed to read "Section IV. REPAIR PARTS LIST-Continued".

Page 114, column (9)(B) for column (2) FSN 6145-060-0387. Item No. "lB, 2B, 3B, 4B, 5B, 6B, 7B" is changed to read Item No. "l, lB, 2B, 3B, 4B, 5B, 6B, 7B".

Page 117, column (9)(A)(B), "Fig. No. 5-10, Item No. BLANK" appearing between Fig. No. 5-9, Item No. 19 and Fig. No. 5-10, Item No. 2 is corrected to read "Fig. No. 5-10, Item No. l".

Page 127, headers. In column 5, add *"Reference No.".* In column 6, add: *"Mfg Code".* In column 7, add: *"Fig. No.".* In column 8, add: *"Item No.".*

Page 129, INDEX, B. After "Binding posts (See Controls and instruments)" add: "Breaker point resistance test (See Ignition system tests)".

Page 129, INDEX, E. Lines 4 and 5, "Equipment serviceability criteria (ESC) . . . . 1-3 (Paragraphs), 5 (Pages)" are rescinded.

Page 130, INDEX - Continued, I. After "I" add:

"Ignition system tests. 2-10 54
Breaker point resistance test . . 2-10b 54
Primary ignition test . . . . . 2-10a 54".

Page 130, INDEX - Continued, P. After "Preventive * * *l 56" add: "Primary ignition test (See Ignition system tests)".

Page 131, INDEX - Continued, T. Under "Tests:-Continued" after "Battery to battery cable (See Starting system tests)" add: "Breaker point resistance test (See Ignition system tests)", and after "Load bank (See Operation under usual conditions (See Tables))" add: "Primary ignition test (See Ignition system tests)".

By Order of the Secretary of the Army:

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General United States Army
Chief of Staff

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Major General, United States Army,
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Edgewood Arsenal (1)
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ACTIV (2)
1st AD GM Bde (1)
RSA (1)
Rg Comd USA Ad Cen (1)
USAAPSA (4)
USACOMZEUR (3)
USA Sig Comm Agcy Taiwan (1)
USATTU (3)
USABRL (1)
JUSMAG Philippines (1)
US Mil Gp Ecuador (1)
4th USASA Fld Sta (1)
Engr FLDMS (3)
QM FLDMS (2)

ARNG & USAR: None.
For explanation of abbreviations used, see AR 310-50.

TECHNICAL MANUAL
NO. 9-4910-456-14

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, D. C., 20025 *15 October 1971*

OPERATOR, ORGANIZATIONAL, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE MANUAL, (INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST AND DEPOT MAINTENANCE REPAIR PARTS AND SPECIAL TOOLS) FOR TEST SET, GENERATOR AND VOLTAGE REGULATOR AUTOMOTIVE: 12-AND 24-VOLT SYSTEMS (ALLEN ELECTRIC AND EQUIPMENT COMPANY MODEL NO. 30-92) (4910-092-9136)

This manual is current to 1 September 1971

*This manual supersedes TM 9-4910-456-10, 17 August 1965.

LIST OF ILLUSTRATIONS

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1-1. Scope

a. This manual contains instructions on the test set for operation and organizational maintenance by the using organization, and field maintenance at direct and general support levels.

b. Appendix A contains a list of current references, including supply catalogs, forms, technical manuals, and other available publications applicable to the test set.

c. Appendix B contains the Maintenance Allocation Chart for the test set, listing all maintenance and repair operations authorized by maintenance echelons.

d. Appendix C contains Repair Parts and Special Tools List (including Depot maintenance repair parts and special tools) for operating and performing organizational Direct Support, and General Support maintenance on the test set.

1-2. Forms and Records. Maintenance forms, records, and reports which are to be used by maintenance personnel at all maintenance levels are listed in and prescribed by TM 38-750.

1-3. Equipment Serviceability Criteria (ESC). Equipment serviceability criteria for the test set are found in SB 740-95-501.

1-4. Reporting of Errors. Report of errors, omissions, and recommendations for improving this publication by the individual user is encouraged. Reports should be submitted on DA Form 2028, (Recommended Changes to DA Publications) and forwarded direct to: Commanding General, Headquarters, U.S. Army Weapons Command, ATTN: AMSWE-MAP, Rock Island, IL 61201.

1-5. Destruction of Army Materiel to Prevent Enemy Use. Refer to DOD 4160.21-M-1 for destruction of materiel to prevent enemy use.

1-6. Calibration Refer to TB 9-4910-521-50 for calibration procedure of circuit tester.

Section II. DESCRIPTION AND DATA

1-7. Description. The test set (Fig. 1-1) is a self-contained, portable instrument, used for checking and analyzing the low voltage direct current electrical circuits of vehicles. The test set consists of four independent sections: voltmeter circuit, field rheostat circuit, 1/4-OHM load resistor, and a combination ammeter and load bank circuit. The ammeter and load bank may be used independently or in series, as they are interconnected by the load bank switch. The test set is equipped with the necessary test leads and a separate external shunt assembly to perform the tests described in this manual. A compartment is provided in the test set for stowing the test leads and external shunt. A bracket is provided in the cover for retaining any pertinent publications provided.

1-8. Identification and Tabulated Data.

a. Identification. The data plate is located on front of case. Specifies the nomenclature, manufacturer, model, FSN, serial and contract number.

b. Tabulated Data.

(1) *Manufacturer's name and model.*

Manufacturer . . . . . Allen Electric and Equipment Company

Model 30-92

(2) *Electrical characteristics.*

Ammeter with four ranges . . . . -3 to 10, -15 to 50, -30 to 100, -150 to 500 am-

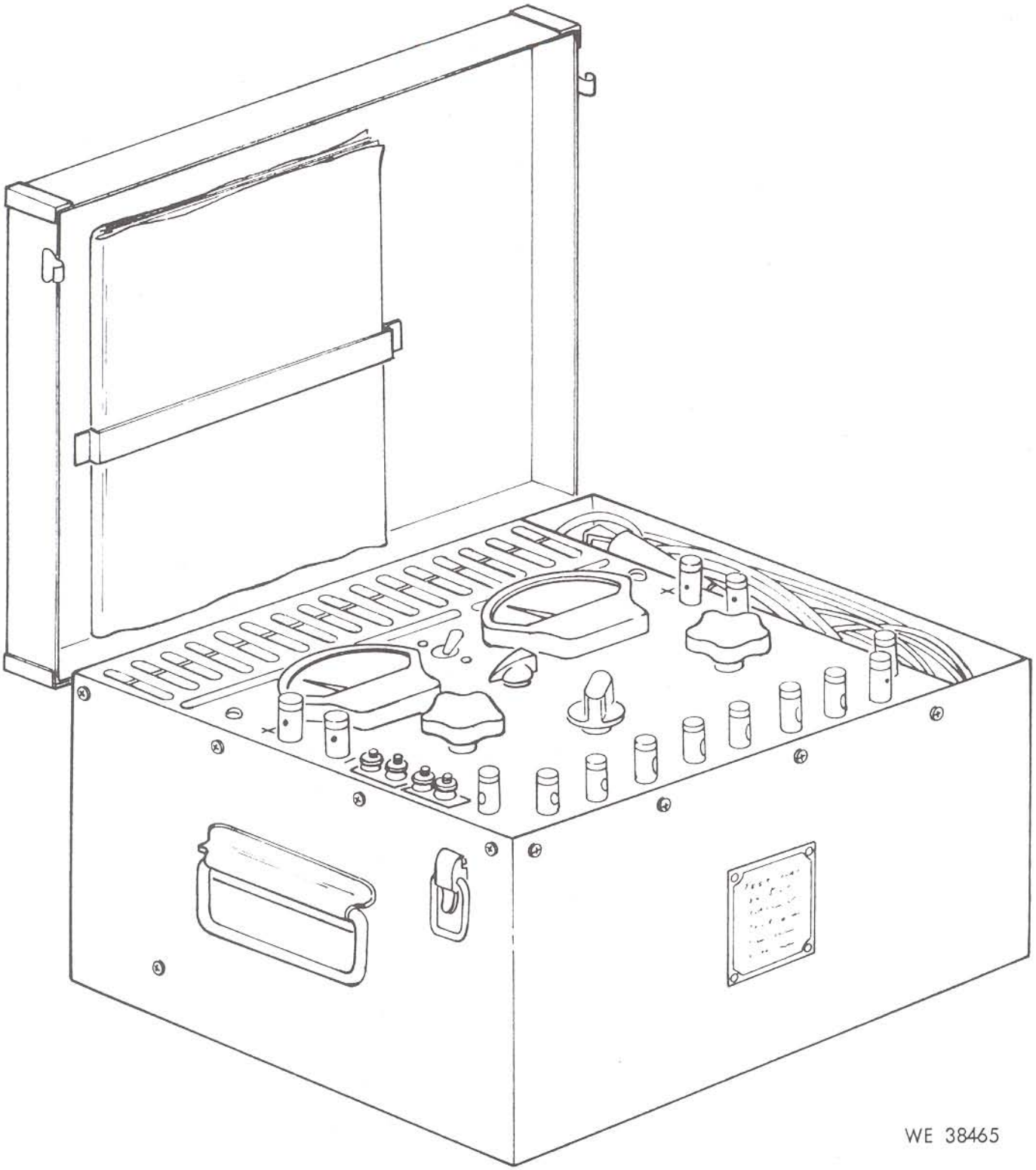


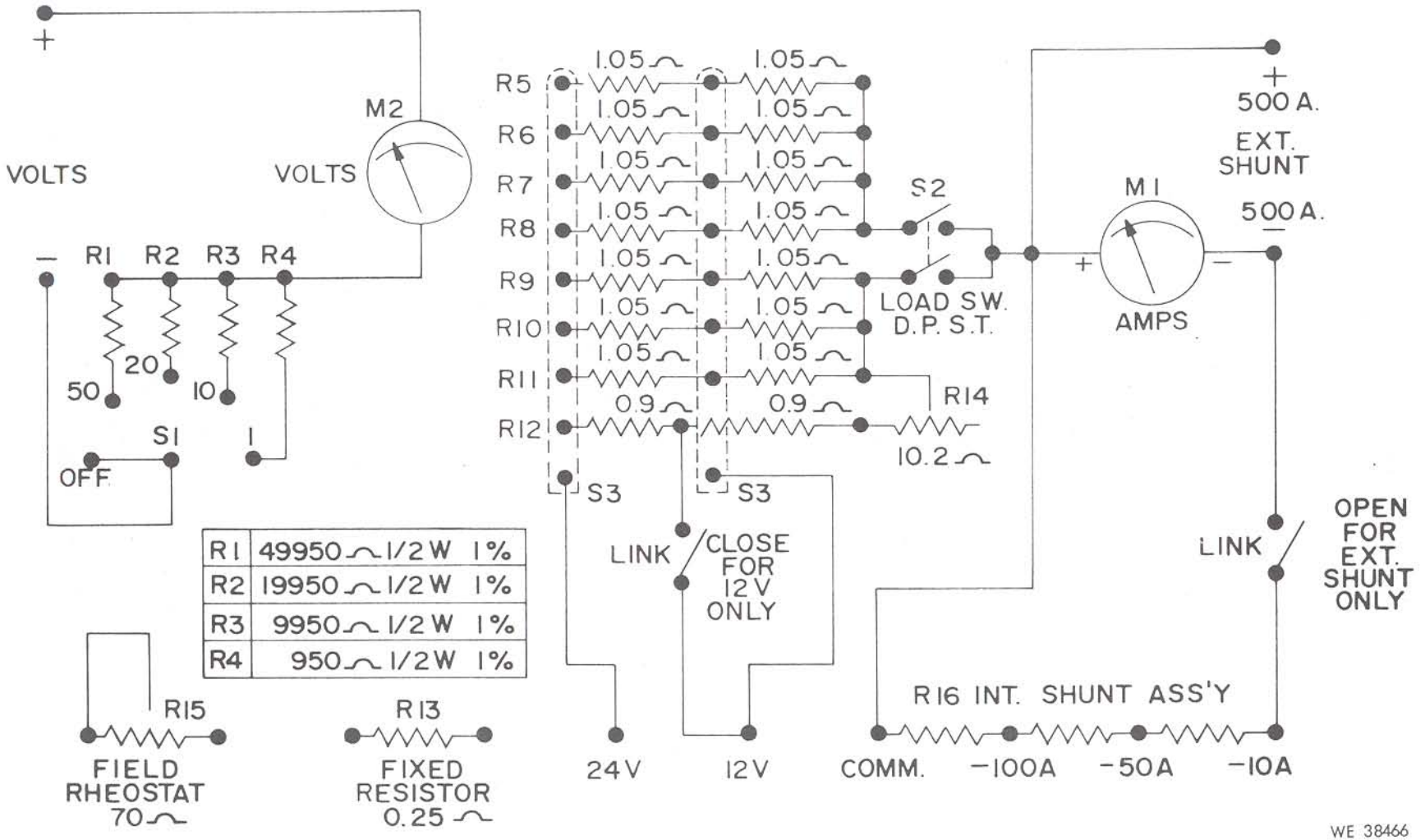
Figure 1-1. Test set - Allen model 30-92. WE 38465

peres full scale, dc
External shunt ampere rating . . . -150 to 500 amperes
Field rheostat current range . . 9.7 - 0.96 amperes
Field rheostat ohms range . . . 0-70-ohms and "off"
Fine load control rheostat current range . . . . . 10 - 2.42 amperes
Fine load control rheostat ohms range . . . . . 0-10.2-ohms and "off"
Fixed resistor ampere rating (max) . . . . . 10 amperes
Fixed resistor valve . . . . . 1/4 ohm
Load bank current rating . . . . 2.5 - 100 amperes
Load bank duty cycle . . . 3 minutes ON and 27 minutes OFF
Voltmeter with two scales utilizing four readable ranges . . . 0 to 1 volt read on the 0 to 10 volt range, 0 to 10 volts, 0 to 20 volts, and 0 - 50 volts read on their own respective ranges, dc

(3) *Dimensions and weight.*

Overall length . . . . . 19 in.
Overall width . . . . . 16 in.
Overall height 13-1/8
Maximum shipping weight . . . . . 60 lb.

(4) *Schematic diagram.* (See Fig. 1-2).



R1	49950	1/2 W 1%
R2	19950	1/2 W 1%
R3	9950	1/2 W 1%
R4	950	1/2 W 1%

Figure 1-2. Schematic diagram. WE 38466

CHAPTER 2

OPERATING INSTRUCTIONS

WARNING
If equipment fails to operate, refer to troubleshooting procedures in chapter 3.

Section I. SERVICE UPON RECEIPT OF MATERIEL

2-1. Inspecting and Servicing the Equipment.

a. When a new or reconditioned test set is first received, it is the responsibility of the Officer in charge to determine whether the materiel has been properly prepared for service by the supply organization and to be sure it is in condition to perform its function. For this purpose, inspect assemblies and parts to be sure they are properly assembled, secured, cleaned, adjusted, and/or lubricated. Check all repair parts, tools and support equipment with the listing in Appendix C to be sure every item is present and in good condition.

b. Make a record of any missing parts, tools and/or support equipment, and of any malfunctions. Correct any deficiencies as quickly as possible.

c. Unpacking and Checking. Pry off the top of the exterior container, turn the container on its side, and slide the test set out of the container. Remove the barrier material enveloping the test set. Remove all cushioning materials, seals, and wrappings from the case, and remove the equipment stored inside the case. Check all equipment with the listing in Appendix C, to be sure every item is present and in good condition.

d. Cleaning. Clean all parts of the test set as prescribed in paragraph 3-7.

e. Inspection.

(1) Perform a general inspection of the test set to assure all parts are properly and securely assembled and in good working condition.

(2) Inspect to see that all connections are secure and that the test leads show no indication of frayed insulation or other deficiency.

(3) Inspect to see that the air intake grilles are not restricted.

(4) Perform the preventive-maintenance services as prescribed in tables 3-1 and 4-1.

Section II. CONTROLS AND INSTRUMENTS

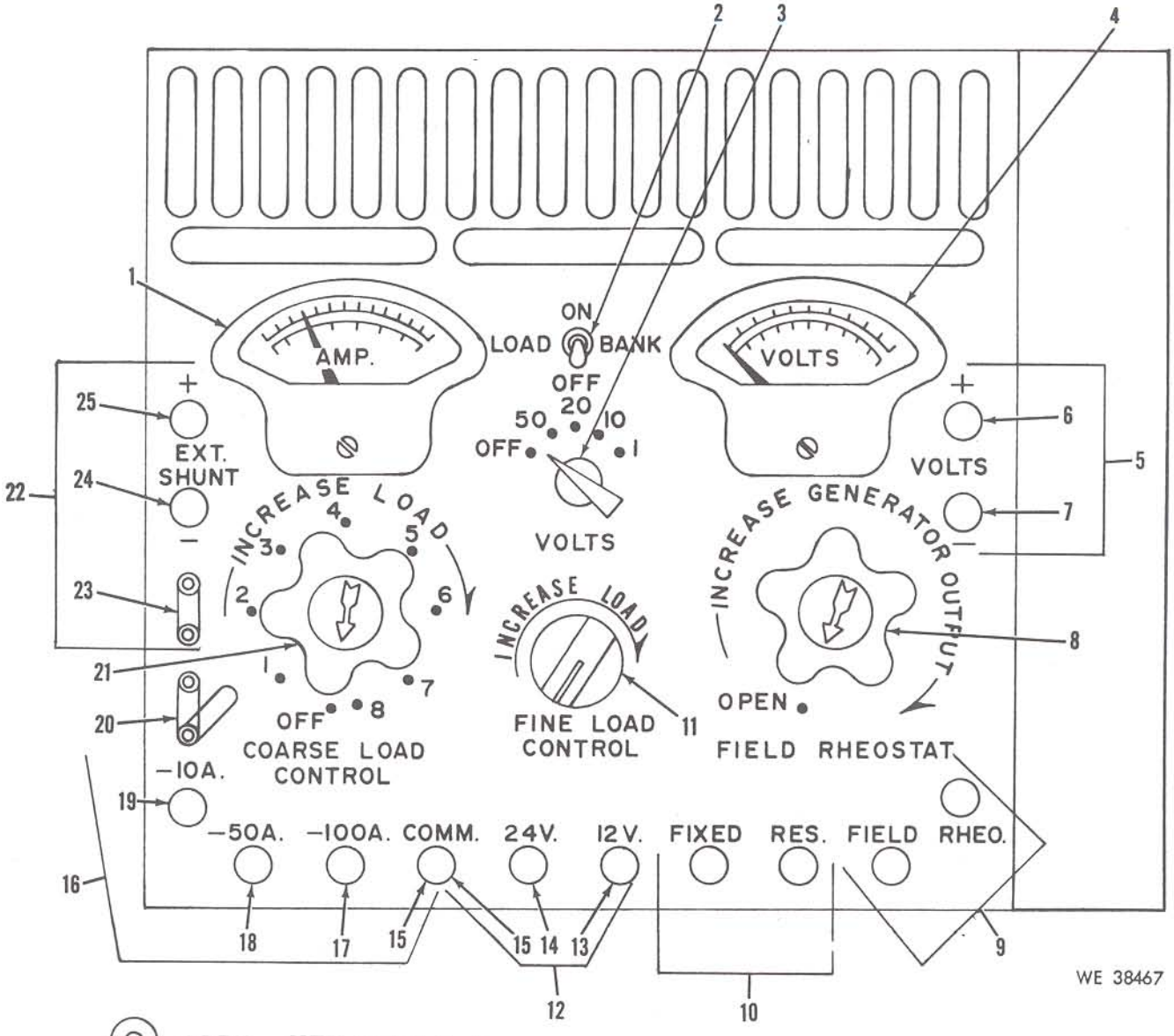
2-2. General. This section describes the various controls and instruments and provides sufficient information to insure proper operation of the test set.

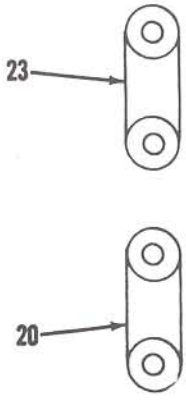
2-3. Controls and Instruments.

a. Test Set.

Note: The key numbers shown below in parentheses refer to figure 2-1, except where otherwise noted.

(1) *Ammeter.* The ammeter, located on the upper left section of the panel, is a four range meter used to indicate dc current. The four ranges are: -3 to 10, -15 to 50, -30 to 100, -150 to 500 amperes full scale. The ammeter can be used independently or in series with the load bank (12) as they are internally interconnected by the load bank switch (2). A set of two color-coded 6 gauge cables (1 and 2, Fig. 2-2) is provided for use with the adjustable load bank, the ammeter circuit, and the 1/4-OHM resistor. The red positive (-) cable is inserted into the COMMON binding



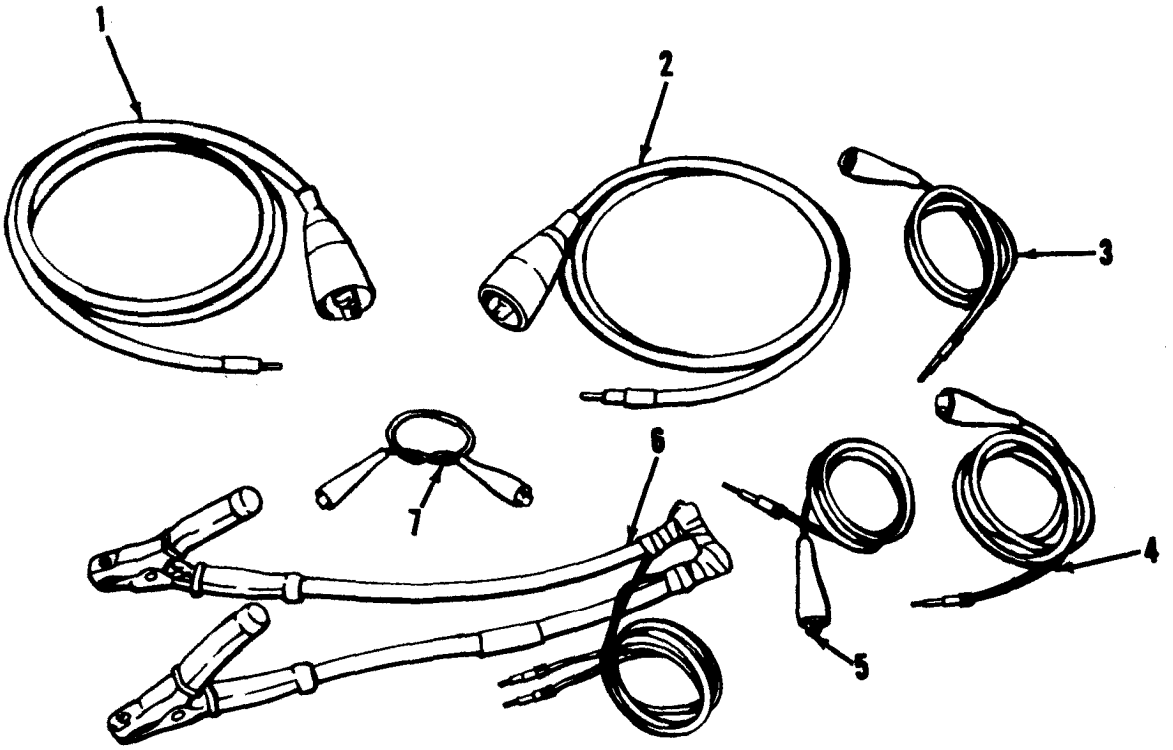


KEY to fig. 2-1:

1. Ammeter
2. Load bank switch
3. Voltmeter range selector switch
4. Voltmeter
5. Voltmeter binding posts
   6. Positive
   7. Negative
8. Field rheostat control
9. Field rheostat binding posts
10. 1/4-OHM resistor binding posts
11. Load bank control, fine
12. Load bank binding posts
    13. 12-Volts
    14. 24-Volts
    15. COMMON
16. Ammeter binding posts
    15. COMMON
    17. 100 AMP negative
    18. 50 AMP negative
    19. 10 AMP negative
20. Load bank link, 12-volt
21. Load bank control, coarse
22. External shunt binding posts
    23. Disconnect link
    24. Negative
    25. Positive

Figure 2-1. Panel assembly before disassembly - top view. WE 38467

post (15) and the black negative (-) cable is inserted into the binding post of the needed range, -10A. (19), -50A. (18), or -100A. (17). To use with load bank, insert red cable into 12V. (13) or 24V. (14) post.



WE 38468

KEY to fig. 2-2:
1. LEAD, TEST: negative, ammeter
2. LEAD, TEST: positive, ammeter
3. LEAD, TEST: positive, voltmeter
4. LEAD, TEST: negative, voltmeter
5. LEAD, TEST: field
6. SHUNT ASSEMBLY INSTRUMENT: external, 500 AMP
7. LEAD, TEST: jumper

Figure 2-2. Tools and support equipment. WE 38468

(2) *Voltmeter range selector switch.* The voltmeter range selector switch (3), located on center section of the panel to the right of ammeter (l), is a five position, rotary type switch used for selecting the proper volt range to be observed on the voltmeter (4), determined by the unit being tested. Turn the switch to the "50" position for 0-50 volt range, to the "20" position for 0-20 volt range, to the "10" position for 0-10 volt range, and to the ''1" position for 0-1 volt range. Turn the switch to the OFF position prior to connecting voltmeter test leads (3 and 4, Fig. 2-2) to the unit being tested.

CAUTION

The load bank switch (2) must be in the OFF position when the test set is not in use and prior to making a connection to the load bank binding posts (12) or the ammeter circuit.

(3) *Load bank switch.* The load bank switch, located above the voltmeter range selector switch (3), is a two position toggle switch used to make or break the circuit between the ammeter COMMON post (15) and the load bank posts (13 and 14).

(4) *Voltmeter.* The voltmeter (4), located to the right of the load bank switch

(2), is a two scale meter, utilizing four readable ranges, used for indicating dc voltage when loading the field circuit or checking voltage output of the unit being tested. The ranges are: O to 1 volt read on the O to 10 volt range, O to 10 volts, O to 20 volts, and O to 50 volts read on their own respective ranges. The scale to be used is determined by the position of the voltmeter range selector switch (3). A set of two color-coded 16 gauge voltmeter leads is provided for use with the voltmeter. The red positive (+) lead is inserted into the voltmeter positive (-) binding post (6), and the black negative (+) lead is inserted into the voltmeter negative (-) binding post (7). The voltmeter range selector switch, marked "VOLTS" is used to select proper volt range.

CAUTION

The binding posts (5, 9, 10, 12, 16, 20 and 22) should be kept finger tight only, do not use pliers to tighten.

(5) *Voltmeter binding posts.* The voltmeter binding posts (6 and 7) are located to the right of voltmeter (4), with the voltmeter positive (t) binding post (6) above the voltmeter negative (-) binding post (7). They are used to place the voltmeter and selector switch (3) in the circuit with the unit being tested. The binding posts are lettered (+) and (-), so that correct polarity is maintained when connecting the unit to be tested to the test set. Keep binding post clean.

(6) *Field rheostat control.* The field rheostat control, located below voltmeter (4) is a 225-watt, 70-OHM rheostat used to control the output of a generator and check the operation of voltage generator -regulator. Turn the knob (8) clockwise to decrease the resistance (increasing the field current) and counterclockwise to increase the resistance, (decreasing the field current). A set of two black 16 gauge leads (5, Fig. 2-2) are used by inserting in the field rheostat binding posts (9).

(7) *Field rheostat binding posts.* The field rheostat binding posts (9), located in the lower right corner of panel, are used for placing the field rheostat (8) in the circuit with the unit being tested. The binding posts are lettered FIELD RHEOSTAT. Keep binding posts clean.

CAUTION

The l/4-OHM fixed resistor (10) should not be inserted into the battery circuit until the charge rate is 10 amperes or less. This is necessary to insure a proper generator-regulator setting according to specifications and to protect the fixed resistor from overload.

(8) *1/4-OHM resistor binding posts.* The two l/4-OHM resistor binding posts (10), located to the left of field rheostat binding posts (9), connected internally with a 1/4-OHM fixed resistor (par. 5-35), are used in adjusting the voltage generator-regulator setting. The resistor is inserted in series with the battery by using the large 6 gauge ammeter leads. The voltmeter leads are then connected from the voltmeter posts (6 and 7) to the battery and a good ground. With the engine running, the generator-regulator is adjusted to the specified requirement of the generator and generator-regulator being tested. The binding posts are lettered FIXED RESISTOR. Keep binding posts clean.

CAUTION

Do not exceed the load bank duty cycle of three minutes ON and 27 minutes OFF.

The load bank switch (2) should be in OFF position when making connections, and when the test set is not in use.

(9) *Load bank control, fine.* The fine load bank control (11), located to the left of the field rheostat control (8), is utilized to adjust the load between the positions of the coarse load bank control (21).

(10) *Load bank binding posts.* The load bank binding posts (1 2), located to the left of 1/4-OHM resistor binding posts (10), are used in conjunction With the ammeter binding posts (16) to place the ammeter (1) and the load bank controls (11 and 21) in the circuit with the unit being tested. The binding posts (12) are lettered 12 V. (13), 24 V. (14), and COMMON (15). Keep binding posts clean.

(11) *Ammeter* binding posts. The ammeter binding posts located to the left of load bank binding posts (12), are used when placing the ammeter (1) in series with the unit being tested. The inding posts (16) are lettered -10A. (19), -50A. (18), -100A. (17), and COMMON (15). Keep binding posts clean.

(12) *Load bank link, 12-volt.* The 12-volt load bank link (20) is located on lower left section of panel above the -10A. binding post (19). The 12-volt load bank link marked "CLOSE FOR 12 V ONLY" is opened during the 24-volt mode of operation, and closed during the 12-volt mode of operation.

CAUTION

Do not exceed the load bank duty cycle of three minutes ON and 27 minutes OFF. The load bank switch (2) should be in OFF position when making connections, and when the test set is not in use.

(13) *Load bank control, coarse.* The coarse load bank control (21) is located to the left of the fine load bank control (11). The unit provides an adjustable load of from 2.5 amperes to 100 amperes for 12-volt and 24-volt direct current systems. Two controls are used for load adjustment. They are the coarse load bank control and fine load bank control. A set of two color-coded 6 gauge ammeter cables is provided for use with the adjustable load bank and the ammeter circuit. The ammeter (1) can be inserted into the circuit by placing the black negative (-) cable into the -10A. (19), -50A. (18), or -100A, (17) binding posts. Then place the red positive (t) cable into the 12 V. (13) or 24 V. (14) binding post. Turn the load bank switch (2) to the ON position to close the circuit. To increase the load on the circuit being tested, turn the control knob (21) clockwise, to decrease the load, turn the knob counter-clockwise. In 12-volt operation of the load bank, the 12-volt load bank link (20) marked "CLOSE FOR 12 V ONLY" is closed. In the 12-volt mode of operation, position 1 of the coarse load bank control has no control. Positions 2 thru 8 will insert or remove a load of 6.5 amperes (approximately) per position. In 24-volt operation of the load bank, the 12-volt load bank link marked "CLOSE FOR 12 V ONLY" is opened. In the 24-volt mode of operation, positions 1 thru 8 of the coarse load bank control will insert or remove a load of 12.5 amperes (approximately) per position.

CAUTION

These binding posts (23, 24, and 25) will not be used directly to measure current. Remove all other ampere leads when using the shunt assembly, external (6, Fig. 2-2). Do not apply battery voltage to them, or any other ammeter binding post (16), or have the load bank switch (2) in the ON position, otherwise the ammeter (1) will be burned out.

(14) *External shunt binding posts.* The external shunt binding posts (22), located above load bank link, 12-volt (20), are used in conjunction with the the external shunt and the ammeter (1) when making dc current draw tests on vehicle starter motors. The binding posts are lettered (+) (25) on top post, EXT. SHUNT between (+) (25) and (-) (24) posts, (-) (24) post below EXT. SHUNT on panel, and disconnect link (23) marked "OPEN FOR EXT SHUNT ONLY". The external shunt is used in reading loads ranging from -150 to 500 amperes. In using the external shunt the "OPEN FOR EXT SHUNT ONLY" disconnect link is opened to remove the shunt (par. 5-38) from the ammeter circuit. The external shunt is inserted into the circuit by placing the small 16 gauge leads of the external shunt into their appropriate binding posts, red positive (+) lead to post marked (+) (25) and black negative (-) lead to post marked (-) (24). The big clips of the external shunt are hooked in series with the load observing polarity. Keep binding posts clean.

b. Adapter Set, Engine Electrical Test. Refer to SC 4910-95-CL-A55, dated 27 February 1968 for description of components.

c. Tools and Equipment.

Note: The key numbers shown below in parentheses refer to figure 2-2, except where otherwise noted.

(1) *External shunt assembly.* The external shunt assembly (6) consists of two (red and black) nine feet 16 ga leads. When it is used the red (+) lead is connected to the external shunt positive (+) binding post (25, Fig. 2-1). The black (-) lead is connected to the external shunt negative (-) binding post (24, Fig. 2-1). The heavy cables (red and black) consist of welding cable #1 with (red and black) insulation. The heavy cables have solid copper clips on one of the red and one of the black ends.

(2) *Ammeter negative and positive test leads.*

(a) *Description.* The ammeter negative (-) test lead (1) or positive (+) test lead (2) consists of 9 feet of AWG No. 6 electrical wire with 2 straight type tip plug

on one end and a battery style electrical clip on the other end. The electrical clip is insulated with an electrical connector cover. The black cover is designated negative (-) lead, and the red cover is designated positive (+) lead for identification.

(b) *Inspection.* Inspect test leads as prescribed in paragraph 4-10.

(3) *Field test leads and voltmeter nega - tive test lead.*

(a) *Description.* Two field (5) and one voltmeter negative (-) (4) test lead is supplied with each test set. Each lead consists of 9 feet of AWG No. 16 electrical wire with a step type tip plug soldered to one end, and a battery style electrical clip secured to the opposite end. The electrical clip is insulated with a black electrical cable nipple. A black electrical cable nipple identifies the lead as negative (-).

(b) *Inspection.* Inspect test leads as prescribed in paragraph 4-11.

(4) *Voltmeter positive test lead.*

(a) *Description.* The voltmeter positive (+) test lead (3) is identical to that of the field test leads and the voltmeter negative (-) test lead in (3) (a) above, except that the electrical cable nipple is red to identify the lead as positive (+).

(b) *Inspection.* Inspect test lead as prescribed in paragraph 4-11.

(5) *Jumper test lead.*

(a) *Description.* The jumper test lead (7) consists of 1 foot of AWG No). 16 electrical wire with a battery style electrical clip fastened to each end. Each electrical clip is insulated with a black electrical Cable nipple.

(b) *Inspection.* Inspect test lead as prescribed in paragraph 4-12.

Section III. OPERATION UNDER USUAL CONDITIONS

Note: The key numbers noted in parentheses are in figure 2-1, except where otherwise noted.

2-4. General. This section contains instructions for operation of the test set under conditions of moderate temperatures and humidity. Every organization equipped with this item must thoroughly train its personnel in the procedure for its operation.

a. Preparation for Operation.

(1) Adjust the pointer on each meter to the zero reference line on the scale by turning the zero corrector screw, located on each meter directly below the scale lens, clockwise to swing the pointer to the right or counterclockwise to swing the pointer to the left.

CAUTION

Be sure to have the load bank switch (2) in the OFF position. The fine load bank control (11), coarse load bank control (21), field rheostat control (8), and voltmeter range selector switch (3) shall be in the extreme counterclockwise position to prevent damage to the test set and the unit undergoing test.

(2) Turn the load bank switch and the voltmeter range selector switch to the OFF positions.

(3) Turn the knob of the load bank controls and the knob of the field rheostat to the maximum counterclockwise positions.

(4) Remove all test leads (Fig. 2-2) from the stowage compartment of the test set.

(5) Prior to using the external shunt assembly (6, Fig. 2-2) to perform a test, make sure all test leads are disconnected from the binding posts (5, 9, 10, 12, 16, and 22) except the two small leads of the shunt assembly which will be connected to the external shunt negative (-) and positive (+) binding posts (24 and 25).

(6) Determine the ampere and/or voltage range to be used on the test set by referring to the pertinent technical publication and/or manufacturer's data covering the unit to be tested, before any test procedures are started.

Note: Select the range of sufficient capacity to exceed the amperage and/or voltage characteristics of the item to be tested.

(7) Select a well ventilated place near the vehicle under test. Place the test set on a bench or other suitable support and open the cover. Remove the cover from

the test set by sliding it to the left and removing it from the hinge pins. as described in paragraph 5-18,

(8) When performing tests on electrical components, make sure that the storage battery in the vehicle is in good condition and is fully charged. Refer to TM 9-6140 - 200-15 for data on batteries.

(9) Before test procedures are started. make sure that the unit heir.g tested is at its normal operating temperature. Refer to pertinent technical publication and/or manufacturer's manual covering the item for correct temperature data.

Table 2-1. Ammeter Readings

Test leads - binding posts connections	Scale	Read	Calibration value
COMMON and -100 AMP (15 and 17. Fig. 2-1).	1st (top) ----------	-30. -20. 0. +20. +40. +60. +80. and +100.	2.0 amperes
COMMON and -10 AMP (15 and 19. Fig. 2-1).	2d----------	-3. -2. -1. 0. +1. +2. +3. +4. +5. +6. +7. +8. +9. and +10.	0.2 amper
COMMON and -50 AMP (15 and 18. Fig. 2-1).	3d----------	-15. -10. 0. +10. +20. +30. +40. and +50.	1.0 ampere
Negative (-) and positive (+) (24 and 25. Fig. 2-1).	4th (bottom) ----------	-100. 0. +100. +200. +300. +400. and +500.	10.0 amperes

Test leads of the shunt assembly external (6. Fig. 2-2) are utilized for making these connections.

b. Operation.

(1) *Reading meters.*

(a) *General.* The scale to be observed, the figures to read, and the values for the calibrations on the ammeter (1) and the voltmeter (4) vary according to the range selected. The range to select depends on the chosen ammeter binding post (16), or the position of the voltmeter range selector switch. Examples of ammeter and voltmeter readings are given in (b) and (c) below.

(b) *Ammeter readings.* With the electrical component or circuit undergoing test connected in series with the ammeter COMMON and -10 ampere binding posts (15 and 19) and with the electrical component or circuit in operation, assume that the pointer on the ammeter indicates a reading of 3 calibrations past the figure marked "5" on the 2d scale. Table 2-1 indicates that the 2d scale is to be observed. The figures to be read are -3, -2, -1, 0, +1, +2, +3, +4, +5, +6, +7, +8, +9, and +10, and the value to be given each calibration is 0.2 ampere. Therefore, the reading in this instance is 5.6 amperes.

(c) *Voltmeter readings.* With the component or circuit undergoing test, connected in parallel with the voltmeter positive (+) and negative (-) binding posts (6 and 7), the voltmeter range selector switch turned to the "50" volts position, and with the electrical component or circuit in operation, assume that the pointer on the voltmeter indicates a reading of 4 calibrations past the figure marked "20" on the 3d (bottom) scale. Table 2-2 indicates that the 3d (bottom) scale is to be observed, the figures to be read are 0, 10, 20, 30, 40, and 50, and the value to be given each calibration is 0.5 volt. Therefore, the reading in this instance is 22 volts.

Table 2-2. Voltmeter Readings

Position of voltmeter range selector switch	Scale	Read	Calibration value
50	3d (bottom)	0, 10, 20, 30, 40, and 50	0.5 V
20	1st (top)	0, 1, 2, 3, 4, 5, 6, 7, 3, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, and 20	0.2 V
10	2d	0, 1, 2, 3, 4, 5, 6, 7, 8, 9, and 10	0.1 V
1	2d	0, 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, and 1.0	0.01 V

(2) *Ampering tests up to 100 amperes.* When making direct current test up to 100 amperes, the ammeter and the ammeter binding posts are utilized. Refer to paragraphs 2-5 through 2-9 for specific tests.

(a) Connecting the circuit, when ampere range is known.

CAUTION

Do not use pliers to tighten the binding posts when making these connections. Connecting the ammeter binding posts across a circuit (in parallel) will burn out the ammeter. Always make connections in series with the circuit. When connecting to the ammeter binding posts, always select a range to exceed the amperage characteristics of the item undergoing test.

1. When the ampere range of the circuit being tested is known (par. 2-4a (6)), connect the male terminal end of the ammeter positive (+) test lead (2, Fig. 2-2) to the ammeter COMMON binding post (15) and the male terminal end of the ammeter negative (-) test lead (1, Fig. 2-2) to the ammeter binding post marked -10 AMP (19), -50 AMP (18), or -100 AMP (17), whichever will cover the known specified amperage range. Tighten the binding posts finger-tight to secure the test leads in place.

2. Connect the other end of the ammeter negative (-) and positive (t) test leads in series with circuit being tested. With the electrical component to be tested in operation, observe the ammeter and take the reading from the appropriate scale as instructed in table 2-1, paragraph 2-4b(1) (b). After completing the test, disconnect the leads from the circuit and the binding posts.

(b) Connecting the circuit when ampere range is not known.

1. When the ampere range of the circuit being tested is not known, connect the amrneter positive (+) and negative (-) test leads as prescribed in (a) 1 and *2* above, except that the male terminal end of the ammeter negative (-) test lead will be left disconnected from the ammeter binding posts marked -10 AMP, -50 AMP, or -100 AMP.

2. With the electrical circuit to be tested in operation, touch the male terminal end of the ammeter negative (-) test lead to each of the ammeter binding posts starting with the -100 AMP, then the -50 AMP, and then the -10 AMP. Observe the appropriate scale (table 2-1, par. 2-4b(1) (b)) after each contact and when the ammeter pointer is deflected sufficiently to permit an accurate reading, connect the ammeter negative (-) test lead to that binding post. After completing the test, disconnect the leads from the circuit and the binding posts.

CAUTION

Remove all other test leads from the test set binding posts prior to making this test. Connecting the external shunt binding posts (22) across a circuit (in parallel) or making connections without the external shunt assembly instrument will burn out the amme-

ter. Always make connections in series with the circuit, using the external shunt assembly.

(3) *Amperage tests over 100 and up to 500 amperes.* When making direct current tests over 100 and up to 500 amperes, the ammeter, external shunt binding posts, and the external shunt assembly are utilized. Refer to paragraphs 2-5 through 2-9 for specific tests.

(a) Connect the heavy leads of the external shunt assembly instrument in series with the unit or circuit to be tested.

(b) Connect the long negative (-) test lead of the external shunt assembly to the external shunt negative (-) binding post. Connect the positive (+) test lead to the external shunt positive (+) binding post.

(c) With the unit or circuit in operation, observe the ammeter and take the reading from the appropriate scale as indicated in table 2-1, paragraph 2-4b(1) (b).

(d) After completing the test, remove the test leads from the test set and the heavy leads from the circuit.

(4) *Voltage tests.* When making direct current voltage tests up to 50 volts, the voltmeter, voltmeter range selector switch, and the voltmeter binding posts (5) are utilized. Refer to paragraphs 2-5 through 2-9 for specific tests.

(a) Make sure that the voltmeter range selector switch is in the OFF position prior to making any connections to the voltmeter binding posts.

(b) Connect the male terminal end of the voltmeter negative (-) test lead (4, Fig. 2-2) to the voltmeter negative (-) binding post and the male terminal end of the voltmeter positive (+) test lead, (3, Fig. 2-2) to the voltmeter positive (+) binding post.

(c) Connect the other end of the voltmeter negative (-) and positive (+) test leads across the terminals of the unit to be tested.

(d) If the voltage rating of the electrical unit or circuit being tested is known (par. 2-4a(6)), turn the voltmeter range selector switch to the position which will cover this range.

(e) Put the unit or circuit in operation and take reading from the appropriate voltmeter scale as instructed in table 2-2, paragraph 2-4b(1) (c).

Note: If the voltmeter pointer moves in reverse direction on the dial when the unit or circuit is first put into operation, reverse the voltmeter negative (-) and positive (+) test leads connections at the unit being tested.

(f) If the voltage rating of the electrical unit or circuit being tested is not known, turn the voltmeter range selector switch to the "50" position.

(g) Put the unit or circuit into operation and take reading from the appropriate voltmeter scale as instructed in table 2-2, paragraph 2-4b(1) (c). If the voltmeter pointer deflects enough to permit an accurate reading, leave the voltmeter range selector switch in this position; if not, turn the switch to the lower ranges, "20" first, "10" next, then "1". Observe the voltmeter after each setting and use the position which will allow the most accurate reading.

(h) After completing the test, turn the voltmeter range selector switch to the OFF position and remove the test leads from the test set and the unit or circuit.

(5) *1/4-OHM resistor tests.* When setting the voltage regulator unit of the generator-regulator being tested, the 1/4-OHM resistor binding posts (10) are utilized. Refer to paragraphs 2-5 through 2-9 for specific tests.

(a) Connect the male terminal ends of the two ammeter test leads (1 and 2, Fig. 2-2) to the two 1/4-OHM resistor binding posts.

(b) Connect the two ammeter test leads in series with the voltage regulating unit of the generator-regulator being tested.

(c) Connect the two voltmeter test leads to the voltmeter binding posts as prescribed in (4) (b) above.

(d) Connect the other end of the voltmeter positive (+) test lead to one of the connections ((b) above) and the voltmeter negative (-) test lead to the ground side of the electrical unit or circuit being tested.

(e) Put the unit being tested in operation and observe the voltage reading on the voltmeter, using the appropriate scale as instructed in table 2-2, paragraph 2-4b(1) (c). The voltage reading should be in accordance with the manufacturer's specification; if not, the voltage setting (voltage regulator unit) of the generator-

regulator will need adjustment.

(f) After completing the test, remove all the test leads from the test set and the circuit just tested.

(6) *Variable resistance tests.* When checking the closing voltage of the cutout unit of the generator-regulator being tested, the field rheostat and field rheostat binding posts (9) are utilized. Refer to paragraphs 2-5 through 2-9 for specific tests. Connect the rheostat as follows:

(a) Connect the two male terminal ends of the field test leads to the two field rheostat binding posts.

(b) Connect the other end of the two field test leads in series with the unit being tested.

(c) After completing the test, remove the test leads from the test set and the circuit just tested.

(7) *Load bank tests* When checking the current (ampere) output of a generator or checking the current regulator unit of a generator- regulator, the fine load bank control, coarse load bank control, load bank switch, field rheostat (when used), and the load bank binding posts (12) are utilized. The voltmeter and associated components are used in conjunction with the load bank. Refer to paragraph 2-3a(1). Connect the load bank circuit as follows:

(a) Connecting the load bank circuits.

CAUTION

Place the load bank switch in the OFF position prior to connecting test leads to the ammeter or load bank binding posts. The duty cycle of the load bank circuit is 3 minutes ON and 27 minutes OFF. Do not exceed the 3 minute "ON" limit or shorten the 27 minute "OFF" period. When removing the current load use sequence specified in paragraph 7 below.

1. Connect the male terminal end of the ammeter negative (-) test lead to one of the ammeter binding posts whichever covers the specified amperage output of the unit or circuit to be tested.

2. Connect the male terminal end of the ammeter positive (+) test lead to one of the load bank binding posts whichever covers the specified voltage output of the unit or circuit to be tested.

3. Connect the other end of the ammeter positive (+) and negative (-) test leads in series with the unit or circuit being tested.

4. Connect the male terminal end of the voltmeter positive (+) test lead to the voltmeter positive (+) binding post and connect the voltmeter negative (-) test lead to the voltmeter negative (-) binding post. Turn the voltmeter range selector switch to the voltage range position (50, 20, 10, or 1) to correspond with the voltage range selected in 2 above.

5. Connect the other end of the voltmeter positive (+) and negative (-) test leads in parallel with the unit or circuit being tested.

6. Place the load bank switch in the ON position and put the unit or circuit in operation. Turn the load bank controls, and field rheostat (when used) clockwise. Observe the ammeter and the voltmeter, and take the reading from the appropriate scale of each meter as instructed in tables 2-1 and 2-2, paragraph 2-4b. The ampere and voltage readings should be in accordance with manufacturer's specification; if not, the current regulator of the generator-regulator is not adjusted at the proper amperage setting or is defective.

7. Turn the load bank controls, and field rheostat (when used) to full counterclockwise position. Stop the unit or circuit from operation. Place the load bank switch in the OFF position.

(b) Connecting ammeter circuit (not using the load bank).

1. Select the proper binding post for the current ratings of the unit or circuit to be tested. Connect the male terminal of the ammeter negative (-) test lead to the selected binding post.

2. Connect the male terminal of the ammeter positive (+) test lead to the COMMON ammeter binding post.

3. Connect the ammeter positive (+) and negative (-) test leads in series with the unit or circuit to be tested and put the unit or circuit in operation.

2-5. Operating and Test Instructions.

a. *Purpose.* The instructions contained in the following tests cover testing of items for serviceability, and detecting and locating malfunctions using the test set. Testing for serviceability and locating malfunctions

is a detailed and exacting procedure requiring specific instructions-for each item. These instructions and available data in pertinent publications covering the unit under test are required to properly test each item and to prevent damage to the test set or the item being tested.

b. Scope. The following paragraphs provide, basic data, instructions, operations, and test procedures for specific items which can be checked and tested using the test set. Personnel performing tests should have a good understanding of the theory and operation of each circuit and unit of the item being tested. Always refer to the latest pertinent manual and/or technical bulletin for the item, as these publications will contain the latest rebuild procedures, settings, and adjustments.

Note: For the purpose of indicating connecting points clearly, equipment under test is illustrated removed from the vehicle; however, tests are to be performed with the equipment installed.

CAUTION

Before starting tests the voltmeter range selector switch (3, Fig. 2-1) and load bank switch (2, Fig. 2-1) will be in OFF position. The load bank (11 and 21, Fig. 2-1) and field rheostat (8, Fig. 2-1) controls will be turned to the maximum counterclockwise position.

2-6. Battery System Tests.

a. *Purpose.* These tests are performed to test batteries under load to determine their ability to crank the engine under starting conditions by applying specified load for 15 seconds.

b. *Battery Load Test.*

Note: The key numbers shown below in parentheses refer to figure 2-3.

(1) This test is for 24-volts. The 12-volt load bank link (1) will be in the OPEN position.

(2) Connect the red voltmeter positive (t) test lead (9) from the voltmeter positive (+) binding post (7) on the tester (5) to the positive (+) battery terminal (17).

(3) Connect the black voltmeter negative (-) test lead (10) from the voltmeter negative (-) binding post (8) on the tester to the negative (-) battery terminal (18).

(4) Connect one end of the red ammeter positive (+) test lead (14) to the 24-volt binding post (13) on the tester and the other end to positive (+) battery terminal (17).

(5) Connect one end of the black ammeter negative (-) test lead (16) to the -100 AMP binding post (15) on the tester and the other end to negative (-) battery terminal (18).

(6) Place the voltmeter range selector switch (11) in the 50 volt position.

(7) Position the load bank switch (4) to ON and rotate load bank control knobs (2 and 12) clockwise, watching the ammeter scale (3) until the specified amperage for unit being tested is indicated.

(8) The voltmeter (6) should read not less than 18 volts during test and 24 to 26 volts before and after test. If voltage is less, perform the following two individual battery tests.

(9) These two tests will use the same circuit tester setup as this test except the voltmeter test leads and link will be changed as shown in figures (2-4 and 2-5).

(10) Return switches to OFF position. Return load bank control knobs to maximum counterclockwise position.

c. *Individual Battery Test.*

Note: The key numbers shown below in parentheses refer to figure 2-4.

(1) This test is for 12-volts. The 12-volt load bank link (1) will be in the CLOSE position. (See b. (9) above).

(2) Connect the black voltmeter negative (-) test lead (8) from the voltmeter negative (-) binding post (7) on the tester (5) to the negative (-) battery terminal (11).

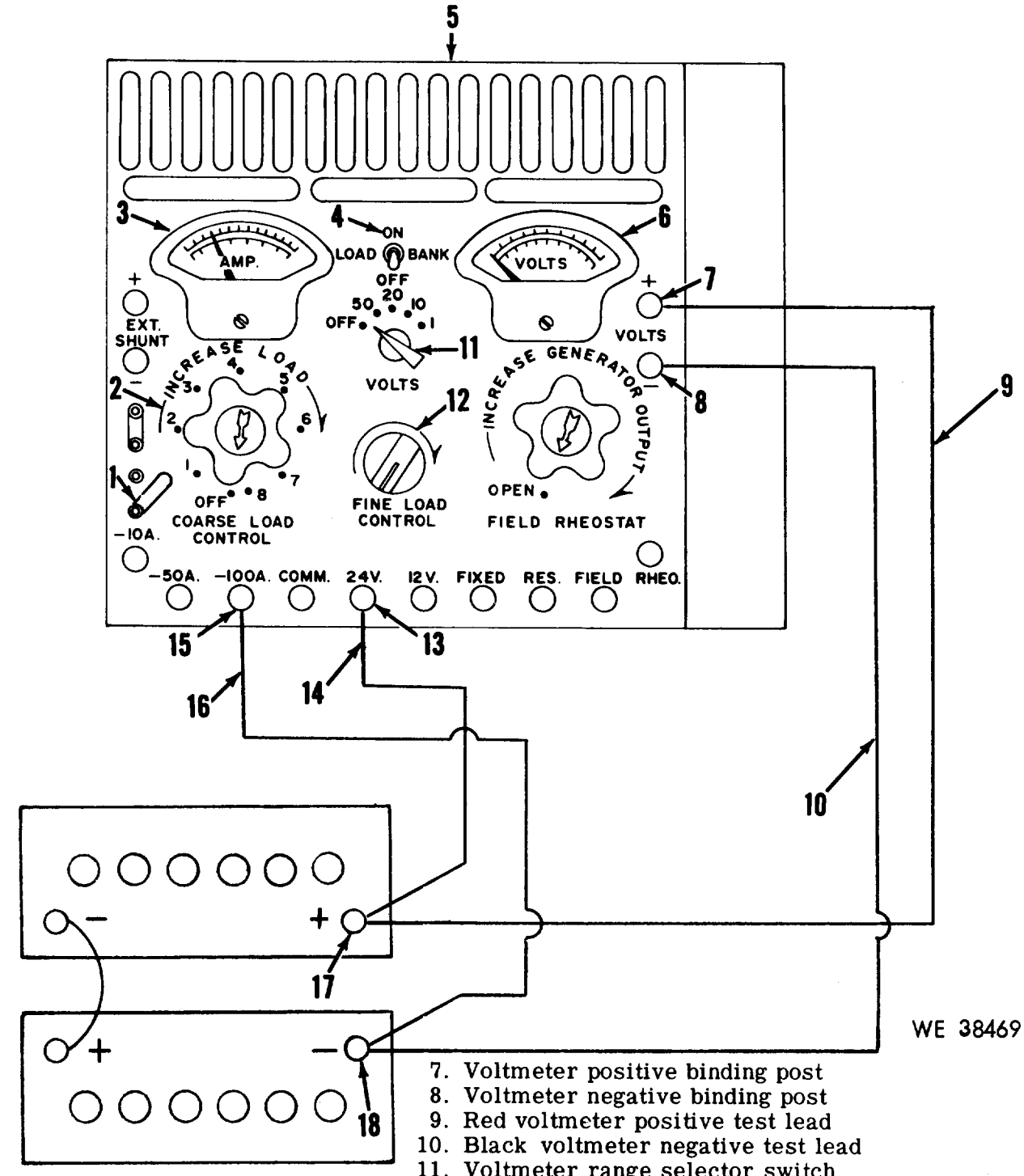
(3) Place the voltmeter range selector switch (9) in the 20 volt position.

(4) Position the load bank switch (4) to ON and rotate load bank control knobs (2 and 10) clockwise, watching the ammeter scale (3) until the specified amperage for unit being tested is indicated. Voltmeter (6) should indicate 9 volts or more and not have a maximum variation of ± 2 volts of the other battery.

(5) Return switches to OFF position. Return load bank control knobs to maximum counterclockwise position.

d. *Individual Battery Test (Companion).*

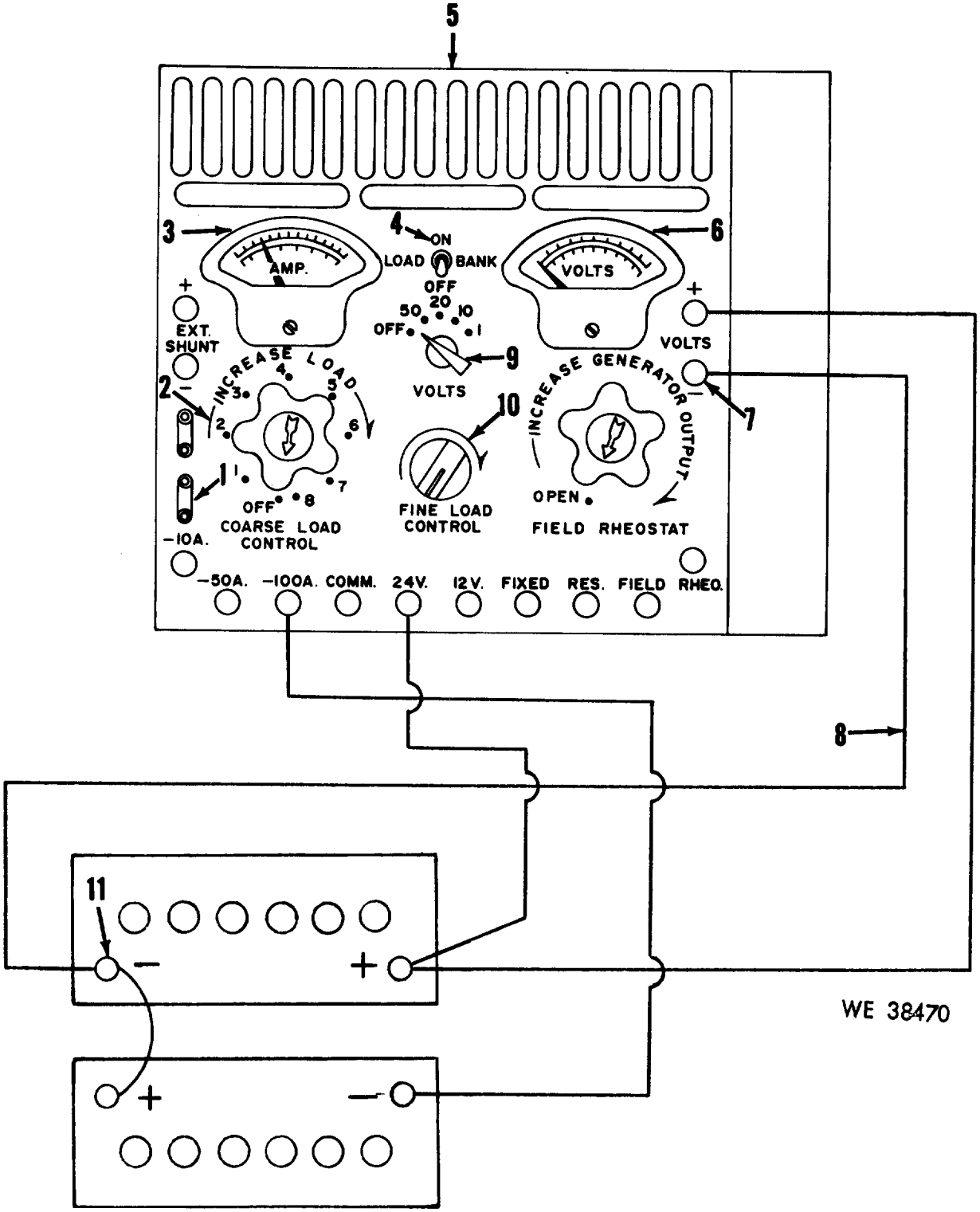
Note: The key numbers shown below in parentheses refer to figure 2-5.



KEY to fig. 2-3:

1. 12-Volt load bank link
2. Coarse load bank control knob
3. Ammeter scale
4. Load bank switch
5. Tester
6. Voltmeter
7. Voltmeter positive binding post
8. Voltmeter negative binding post
9. Red voltmeter positive test lead
10. Black voltmeter negative test lead
11. Voltmeter range selector switch
12. Fine load bank control knob
13. 24-Volt binding post
14. Red ammeter positive test lead
15. -100 AMP binding post
16. Black ammeter negative test lead
17. Positive battery terminal
18. Negative battery terminal

Figure 2-3. Battery load test. WE 38469



KEY to fig. 2-4:

1. 12-Volt load bank link
2. Coarse load bank control knob
3. Ammeter scale
4. Load bank switch
5. Tester
6. Voltmeter
7. Voltmeter negative binding post
8. Black voltmeter negative test lead
9. Voltmeter range selector switch
10. Fine load bank control knob
11. Negative battery terminal

Figure 2-4. Individual battery test. WE 38470

(1) This test is for 12 volts. The 12-volt load bank link (1) will be in the CLOSE position. (See b(9) above.)

(2) Connect the red voltmeter positive (+) test lead (9) from the voltmeter positive (+) binding post (7) on the tester (5) to the positive (+) battery terminal (14).

(3) Connect the black voltmeter negative (-) test lead (10) from the voltmeter negative (-) binding post (8) on the tester to the negative (-) battery terminal (13).

(4) Place the voltmeter range selector switch (11) in the 20 volt position.

(5) Position the load bank switch (4) to ON and rotate load bank control knobs (2 and 12) clockwise, watching the ammeter scale (3) until the specified amperage for unit being tested is indicated. Voltmeter (6) should indicate 9 volts or more and not have a maximum variation of +2 volts of the other battery.

(6) Return switches to OFF position. Return load bank control knobs to maximum counterclockwise position.

(7) Disconnect test leads from binding posts on the tester and terminals on the batteries.

2-7. Starting System Tests.

a. *Starter Motor Amperage Draw Test.*
Note: The key numbers shown below in parentheses refer to figure 2-6.

(1) Purpose. This test is performed to determine if the starter amperage draw is normal and should be made with the vehicle or equipment engine at normal operating temperature so that the cranking load is normal.

(2) *Test procedures.*

(a) This test is for 24 volts. The 12-volt load bank link (1) will be in the OPEN position.

(b) The external shunt disconnect link (2) will be in the OPEN position.

CAUTION

Remove all other test leads from the test set. Make certain that the proper polarity of the external shunt positive and negative leads is maintained at the test set binding posts. Do not connect the ammeter across the battery, as this would create a direct short.

(c) Connect the red external shunt assembly instrument, positive (+) lead (7) to the external shunt positive (+) binding post (4).

(d) Connect the black external shunt assembly instrument, negative (-) lead (8) to the external shunt negative (-) binding post (3).

(e) Disconnect the battery-to-ground cable (10) from the battery negative (-) terminal (13). ,

(f) Place the heavy cables w/clips (11 and 12) of the external shunt assembly instrument (9) in series with the battery negative (-) terminal and the battery-to - ground cable, making certain that the black clip (12) is connected to the battery negative (-) terminal.

(g) With the ignition switch in the OFF position and gear shift lever in neutral or clutch depressed, close the starter motor circuit, thereby cranking the engine.

(h) Observe the reading indicated on the ammeter (5). If ampere reading exceeds that specified for “stall test”, the starter is defective and must be repaired or replaced.

Note: For specifications on starters refer to pertinent manufacturer’s or technical manuals.

(i) After the test is completed, open the starter motor circuit. Remove the external shunt assembly instrument leads and heavy cables w/clips from the circuit.

(J) Connect the battery-to-ground cable to the battery negative (-) terminal.

(k) Close the links on the tester (6).

b. *Purpose.* These tests are performed to determine the resistance in cables, batteries, and starter ground circuit. Excessive voltage loss indicates resistance which will result in poor cranking.

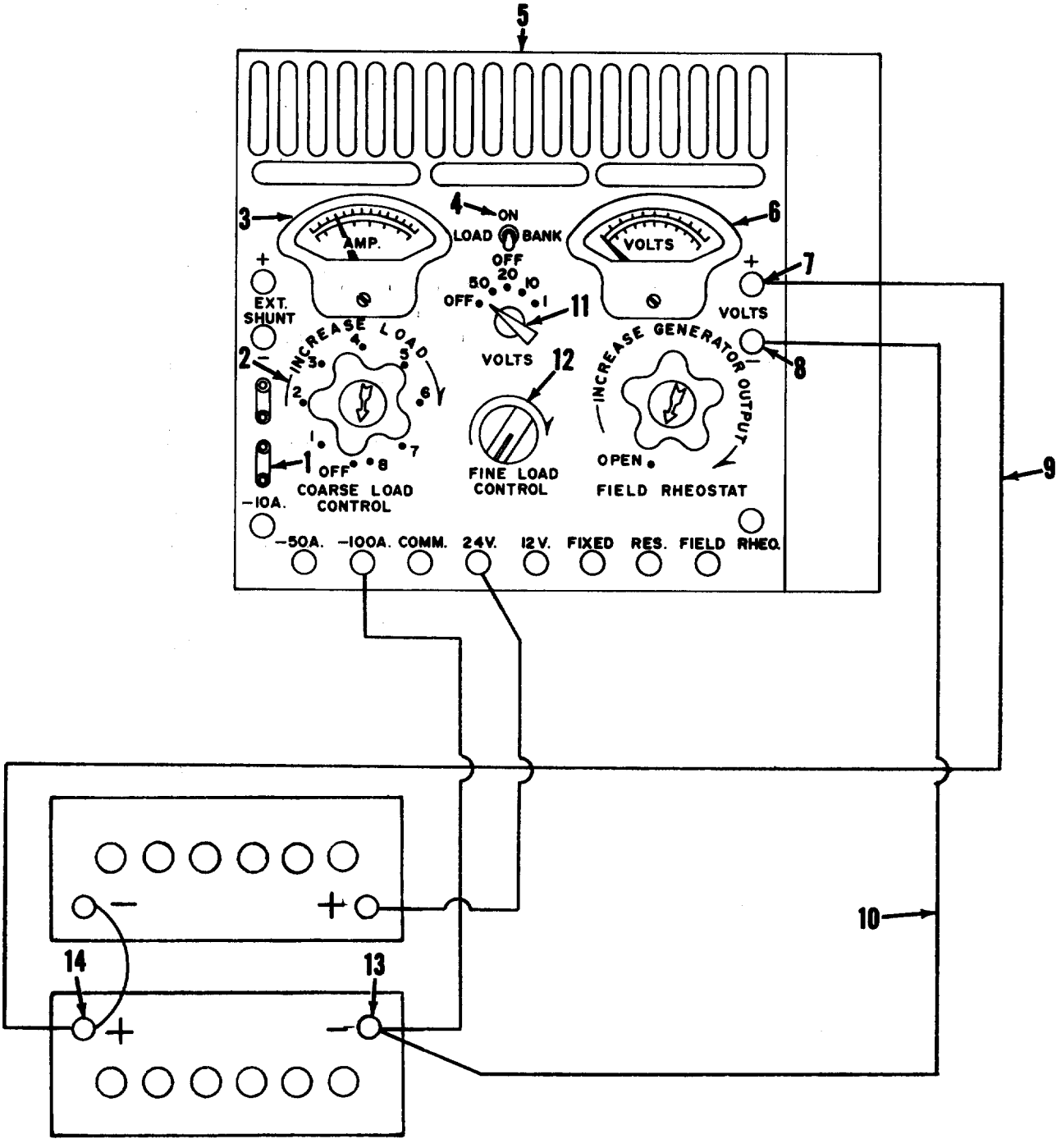
Note: When making these tests, hold meter probe firmly on battery terminal - not on clamp.

c. *Starter Voltage Test.*

Note: The key numbers shown below in parentheses refer to figure 2-7.

(1) This test is for 24 volts. The 12-volt load bank link (1) will be in the OPEN position.

(2) Connect one end of the red voltmeter positive (+) test lead (7) to the voltmeter positive (+) binding post (5) on the tester (3) and the other end to starter terminal (10).

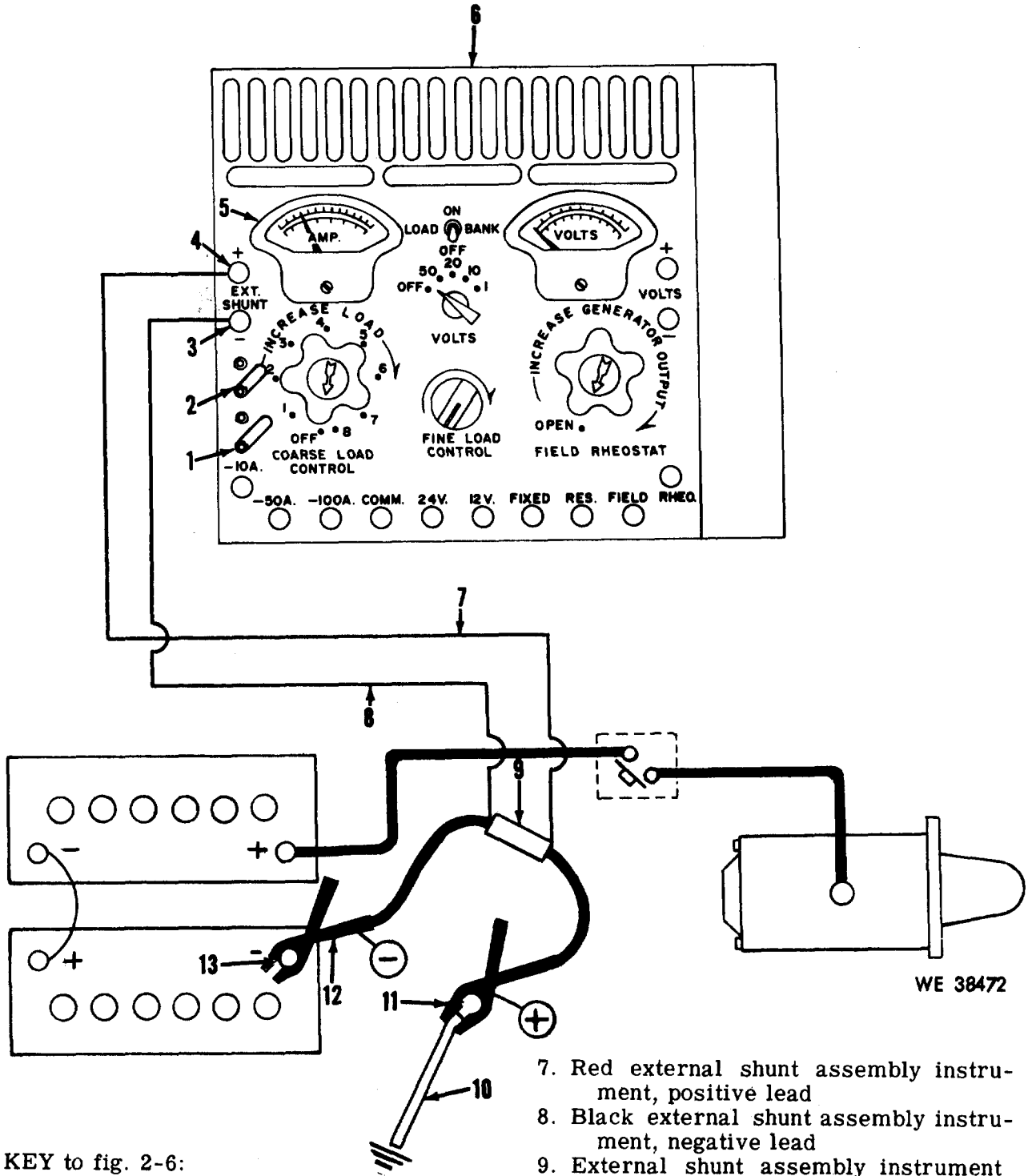


KEY to fig. 2-5:

1. 12-Volt load bank link
2. Coarse load bank control knob
3. Ammeter scale
4. Load bank switch
5. Tester
6. Voltmeter
7. Voltmeter positive binding post
8. Voltmeter negative binding post
9. Red voltmeter positive test lead
10. Black voltmeter negative test lead
11. Voltmeter range selector switch
12. Fine load bank control knob
13. Negative battery terminal
14. Positive battery terminal

WE 38471

Figure 2-5. Individual battery test (Companion). WE 38471



KEY to fig. 2-6:

1. 12-Volt load bank link
2. External shunt disconnect link
3. External shunt negative binding post
4. External shunt positive binding post
5. Ammeter
6. Tester
7. Red external shunt assembly instrument, positive lead
8. Black external shunt assembly instrument, negative lead
9. External shunt assembly instrument
10. Battery-to-ground cable
11. External shunt assembly instrument heavy cable w/red clip (+)
12. External shunt assembly instrument heavy cable w/black clip (-)
13. Battery negative terminal

Figure 2-6. Starter motor amperage draw test. WE 38472

(3) Connect one end of the black voltmeter negative (-) test lead (8) to the voltmeter negative (-) binding post (6) on the tester and the other end to starter frame (9).

(4) Place the voltmeter range selector switch (2) to the 50 volt position.

(5) With the ignition switch of the vehicle OFF, depress the starter switch.

(6) If reading on the voltmeter (4) is 18.5 volts or more, the starter switch, cables, and batteries are not the cause for slow cranking. Check for tight engine or faulty starter. If reading is less than 18.5 volts, refer to paragraph 2-7d. and perform the battery ground cable test.

(7) Return the voltmeter range selector switch to OFF position.

(8) Disconnect test leads from binding post on the tester, and terminal and frame on the starter.

d. *Battery Ground Cable Test.*

Note: The key numbers shown below in parentheses refer to figure 2-8.

(1) This test is for 24 volts. The 12-volt load bank link (1) will be in the OPEN position.

(2) Connect one end of the red voltmeter positive (+) test lead (7) to the voltmeter positive (+) binding post (5) on the tester (3) and the other end to vehicle frame (9).

(3) Connect one end of the black voltmeter negative (-) test lead (8) to the voltmeter negative (-) binding post (6) on the tester and the other end to negative (-) battery terminal clamp (12).

(4) Place the voltmeter range selector switch (2) to the 50 volt position.

(5) With the ignition switch of the vehicle OFF, depress the starter switch. If voltmeter (4) shows no or low reading, switch the voltmeter range selector switch to a lower range until a reading is obtained or the 1-volt range is reached.

(6) If reading is more than 0.1 volt, repeat the test with the clip end (11) of the black voltmeter negative (-) test lead contacting the negative (-) battery terminal (13) of the battery (14). If the voltage loss exceeds that found in the above test, there is excessive resistance between the negative (-) battery terminal and the negative (-) battery terminal clamp.

(7) If not excessive resistance between the negative (-) battery terminal and the negative (-) battery terminal clamp, there is excessive resistance in the starter ground circuit due to loose connections or defective battery-to-ground cable (10). If connections are not loose, return the voltmeter range selector switch to OFF position. Install a new battery-to-ground cable and retest.

(8) If starter still cranks slowly, refer to paragraph 2-7e. and perform battery-to-battery cable test.

(9) Return the voltmeter range selector switch to OFF position.

(10) Disconnect test leads from binding post on the tester, and vehicle frame. Disconnect black voltmeter negative test lead from negative battery terminal clamp if battery-to-battery cable test isn't needed, if needed, clip end is already loose.

e. *Battery to Battery Cable Test.*

Note: The key numbers shown below in parentheses refer to figure 2-9.

(1) This test is for 24 volts. The 12-volt load bank link (1) will be in the OPEN position.

(2) Connect one end of the red voltmeter positive (+) test lead (7) to the voltmeter positive (+) binding post (5) on the tester (3) and the other end across battery-to-battery cable (11) at the positive (+) battery terminal (9). Contact the actual battery terminal and not the terminal clamp (10).

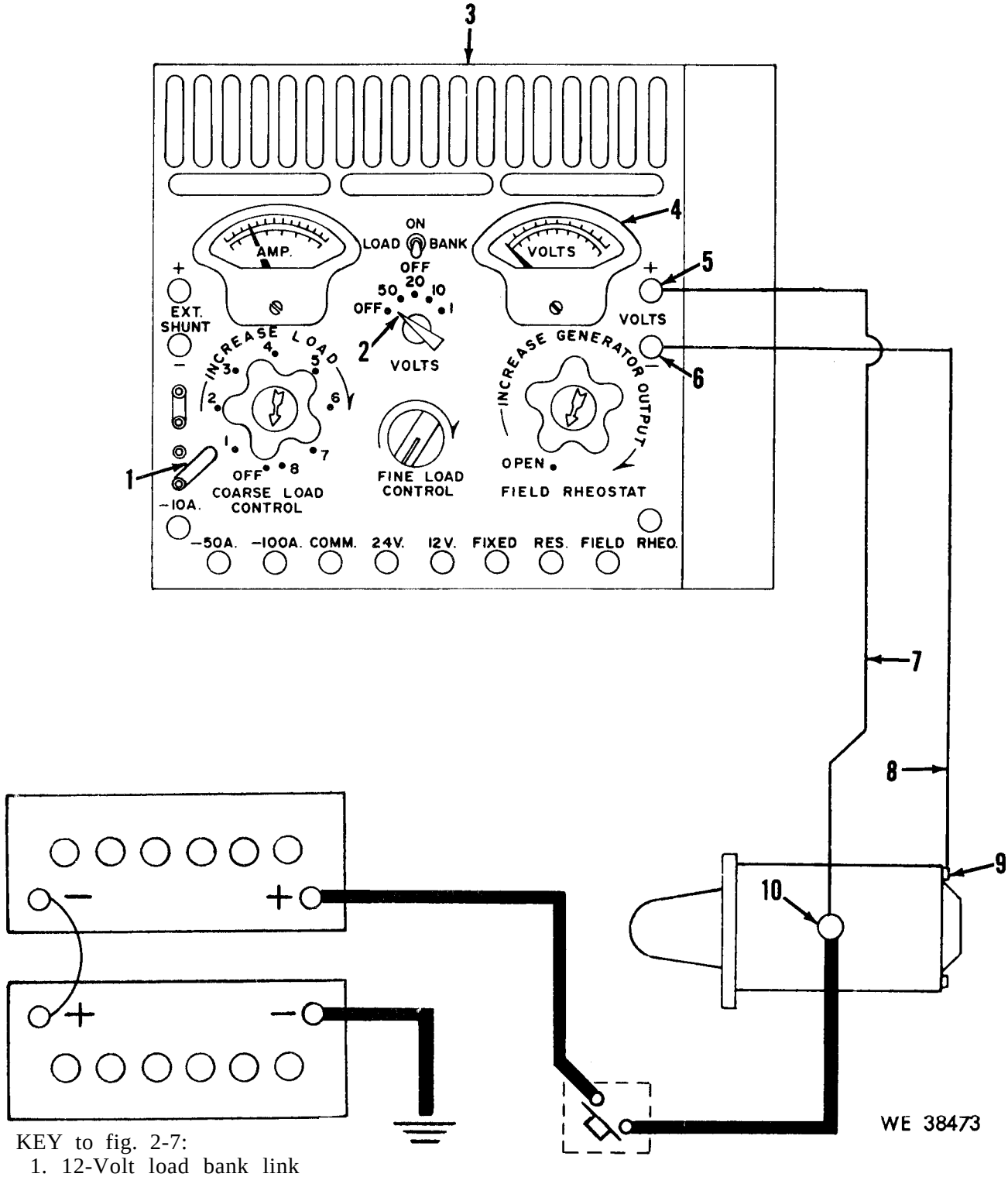
(3) Connect one end of the black voltmeter negative (-) test lead (8) to the voltmeter negative (-) binding post (6) on the tester and the other end across battery-to-battery cable at the negative (-) battery terminal (13). Contact the actual battery terminal and not the terminal clamp (12).

(4) Place the voltmeter range selector switch (2) in the 50 volt position.

(5) With the ignition switch of the vehicle OFF, depress starter switch. If voltmeter (4) shows no or low reading, switch the voltmeter range selector switch to a lower range until a reading is obtained or the 1-volt range is reached. If reading is 0.1 volts or less, battery-to-battery cable is serviceable. If reading is more than 0.1 volt, perform the following steps.

(6) Return the voltmeter range selector switch to OFF position.

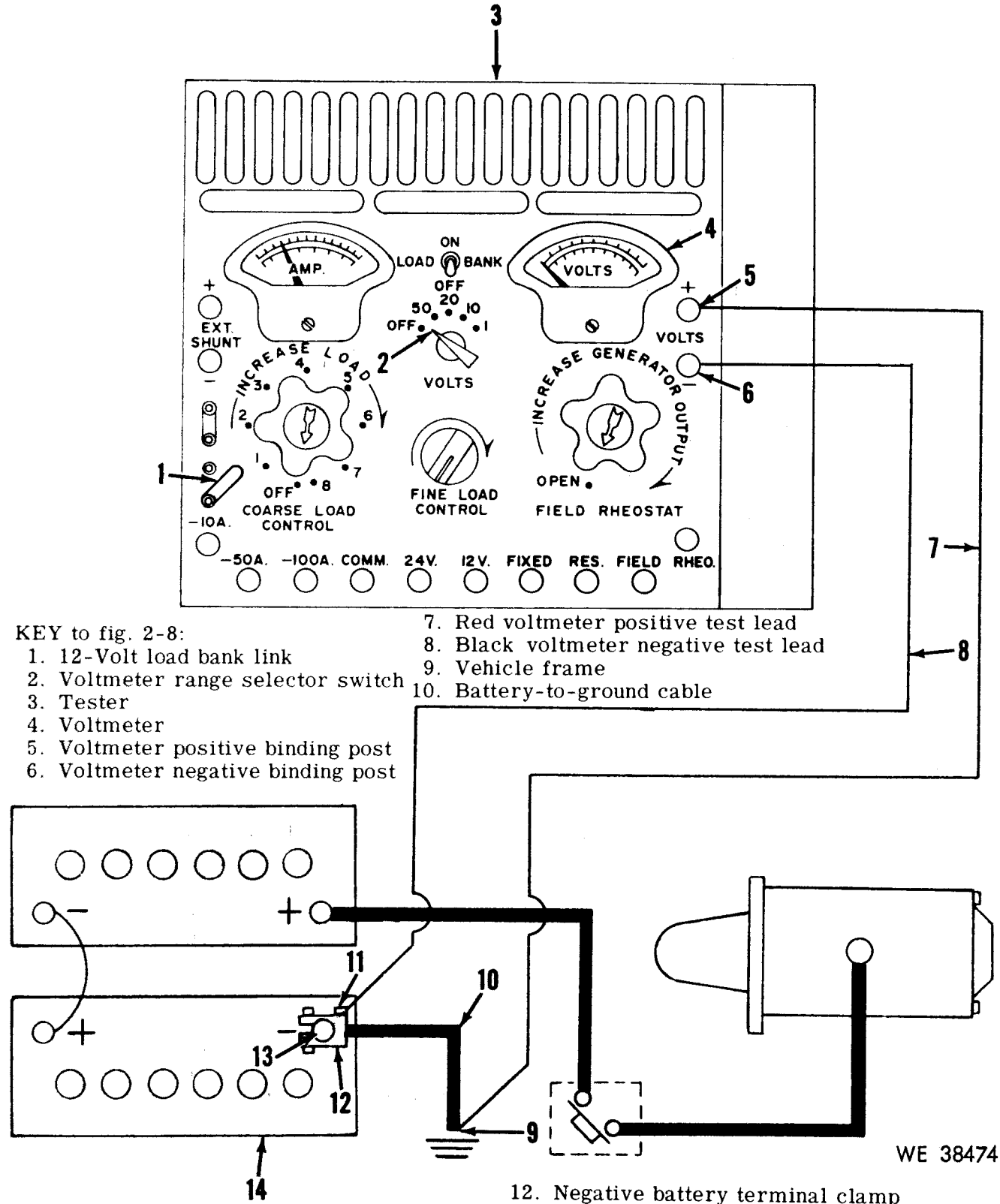
(7) Remove the battery-to-battery cable.



KEY to fig. 2-7:

1. 12-Volt load bank link
2. Voltmeter range selector switch
3. Tester
4. Voltmeter
5. Voltmeter positive binding post
6. Voltmeter negative binding post
7. Voltmeter positive test lead
8. Voltmeter negative test lead
9. Starter frame
10. Starter terminal

Figure 2-7. Starter voltage test. WE 38473



KEY to fig. 2-8:

1. 12-Volt load bank link
2. Voltmeter range selector switch
3. Tester
4. Voltmeter
5. Voltmeter positive binding post
6. Voltmeter negative binding post
7. Red voltmeter positive test lead
8. Black voltmeter negative test lead
9. Vehicle frame
10. Battery-to-ground cable
11. Clip end - black voltmeter negative test lead
12. Negative battery terminal clamp
13. Negative battery terminal
14. Battery

Figure 2-8. Battery ground cable test. *WE 38474*

(8) Clean the battery terminals (9 and 13) and the terminal clamps (10 and 12) on the battery-to-battery cable with a wire brush.

(9) Re-install the cable and tighten all bolts securely to assure a good electrical connection.

(10) Perform test again. If the voltage is still more than 0.1 volt, install a new cable, and retest. If the starter still cranks slowly, refer to paragraph 2-7f. and perform battery positive terminal test.

(11) Return the voltmeter range selector switch to OFF position.

(12) Disconnect test leads from binding posts on the tester and terminals on the batteries.

f. *Battery Positive Terminal Test.*

Note: The key numbers shown below in parentheses refer to figure 2-10.

(1) This test is for 24 volts. The 12-volt load bank link (1) will be in the OPEN position.

(2) Connect one end of the red voltmeter positive (+) test lead (7) to the voltmeter positive (+) binding post (5) on the tester (3). Contact the other end to positive (+) battery terminal (10).

(3) Connect one end of the black voltmeter negative (-) test lead (8) to the voltmeter negative (-) binding post (6) on the tester. Contact the other end to battery-to-starter switch cable terminal clamp (11).

(4) Place the voltmeter range selector switch (2) to the 50 volt position.

(5) With the ignition switch of the vehicle OFF, depress the starter switch. If voltmeter (4) shows no or low reading, switch the voltmeter range selector switch to a lower range until a reading is obtained or the 1-volt range is reached. If the reading is more than 0.1 volt, perform the following steps.

(6) Return the voltmeter range selector switch to OFF position.

(7) Remove the battery-to-starter switch cable terminal clamp.

(8) Clean the positive (+) battery terminal and the cable terminal clamp on the battery-to-starter switch cable (9) with a wire brush.

(9) Re-install the cable and tighten all bolts securely to assure a good electrical connection.

(10) Perform test again. If the voltage is still more than 0.1 volt, install a new cable, and retest. If the starter still cranks slowly, refer to paragraph 2-7g. and perform starter ground circuit test.

(11) Return the voltmeter range selector switch to OFF position.

(12) Disconnect test leads from binding post on the tester and positive (+) battery terminal and cable terminal clamp on the battery (12).

g. *Starter Ground Circuit Test.*

Note: The key numbers shown below in parentheses refer to figure 2-11.

(1) This test is for 24 volts. The 12-volt load bank link (1) will be in the OPEN position.

(2) Connect one end of the red voltmeter positive (+) test lead (7) to the voltmeter positive (+) binding post (5) on the tester (3) and the other end to starter frame (9).

(3) Connect one end of the black voltmeter negative (-) test lead (8) to the voltmeter negative (-) binding post (6) on the tester and the other end to negative (-) battery terminal clamp (11).

(4) Place the voltmeter range selector switch (2) to the 10 volt position.

(5) With the ignition switch of the vehicle OFF, depress the starter switch. If voltmeter (4) shows no or low reading, switch the voltmeter range selector switch to the 1-volt range.

(6) If reading is more than 0.2 volts, there is excessive resistance in the starter ground circuit due to loose connections or defective battery-to-ground cable (10).

(7) Repeat the test with the clip end (12) of the black voltmeter negative (-) test lead contacting the negative (-) battery terminal (13) of the battery (14). If the voltage loss exceeds that found in the above test, there is excessive resistance between the negative (-) battery terminal clamp and the negative (-) battery terminal.

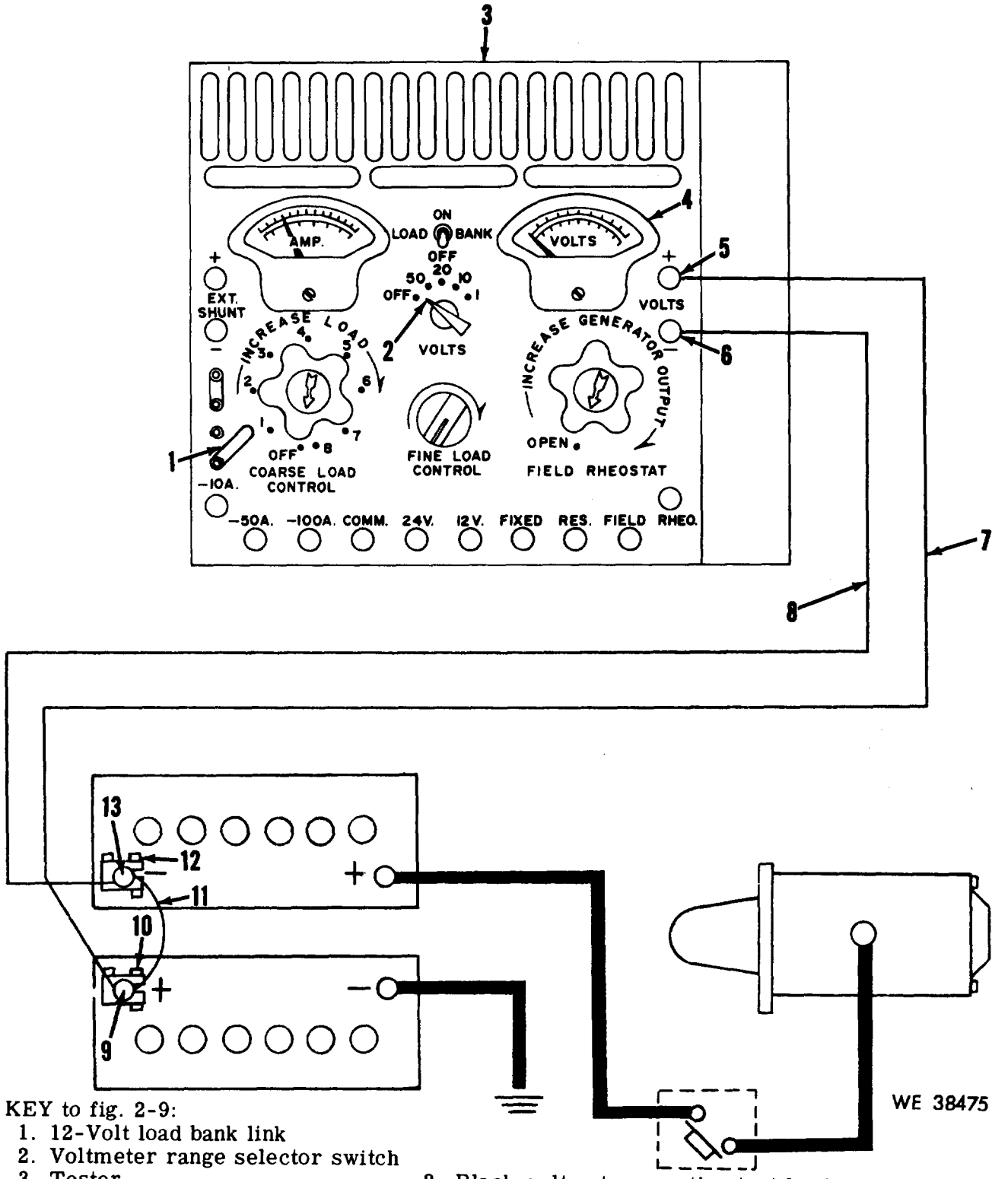
(8) Return the voltmeter range selector switch to OFF position.

(9) Disconnect test leads from binding posts on the tester, and starter frame.

2-8. Generating System Tests.

WARNING

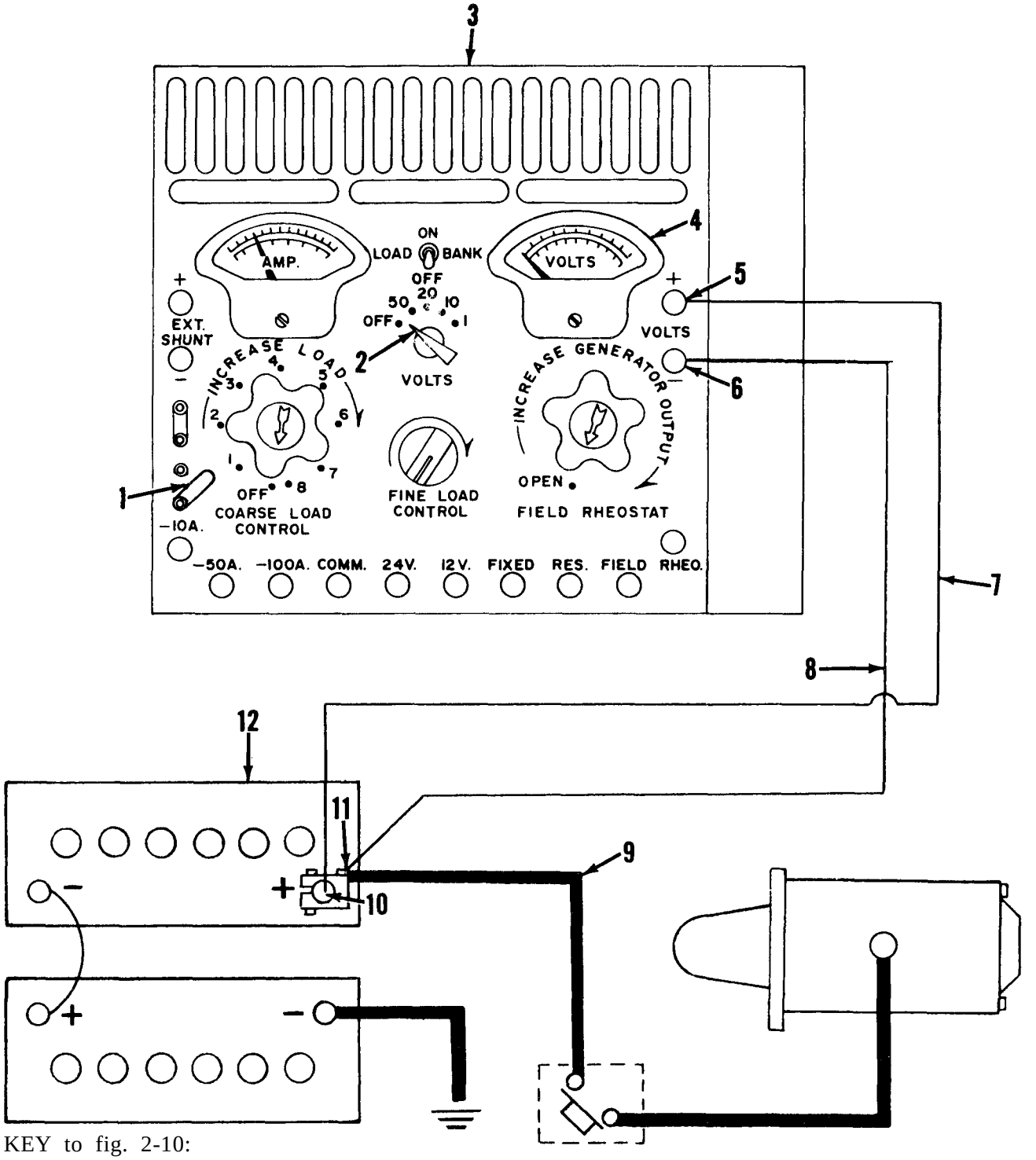
Contact with exhaust pipe may burn hands. Check pipe before connecting or disconnecting adapters.



KEY to fig. 2-9:

1. 12-Volt load bank link
2. Voltmeter range selector switch
3. Tester
4. Voltmeter
5. Voltmeter positive binding post
6. Voltmeter negative binding post
7. Red voltmeter positive test lead
8. Black voltmeter negative test lead
9. Positive battery terminal
10. Terminal clamp
11. Battery-to-battery cable
12. Terminal clamp
13. Negative battery terminal

Figure 2-9. Battery to battery cable test. WE 38475

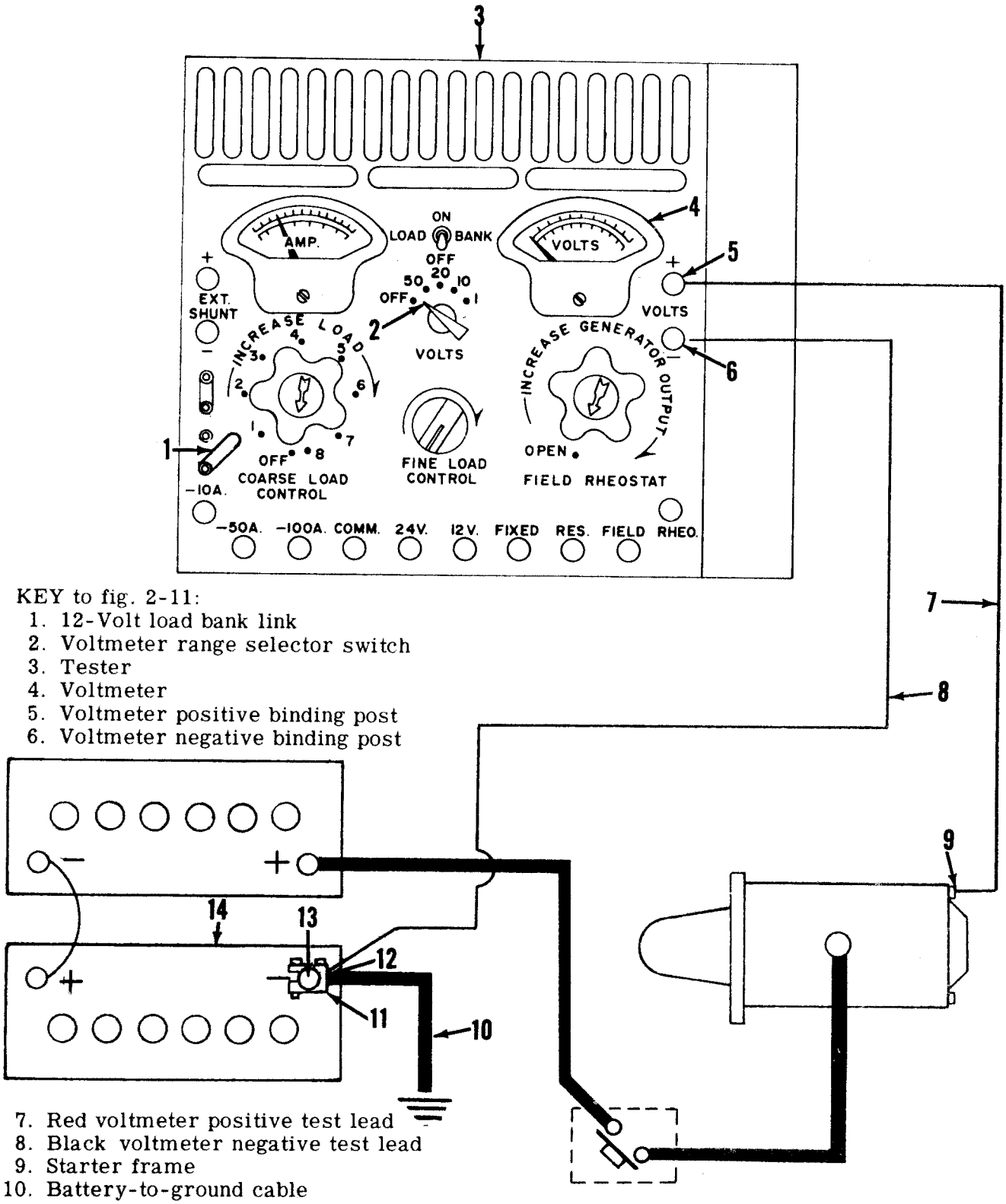


KEY to fig. 2-10:

1. 12-Volt load bank link
2. Voltmeter range selector switch
3. Tester
4. Voltmeter
5. Voltmeter positive binding post
6. Voltmeter negative binding post
7. Red voltmeter positive test lead
8. Black voltmeter negative test lead
9. Battery-to-starter switch cable
10. Positive battery terminal
11. Battery-to-starter switch cable terminal clamp
12. Battery

WE 38476

Figure 2-10. Battery positive terminal test. WE 38476



KEY to fig. 2-11:

1. 12-Volt load bank link
2. Voltmeter range selector switch
3. Tester
4. Voltmeter
5. Voltmeter positive binding post
6. Voltmeter negative binding post
7. Red voltmeter positive test lead
8. Black voltmeter negative test lead
9. Starter frame
10. Battery-to-ground cable
11. Negative battery terminal clamp
12. Clip end - black voltmeter negative test lead
13. Negative battery terminal
14. Battery

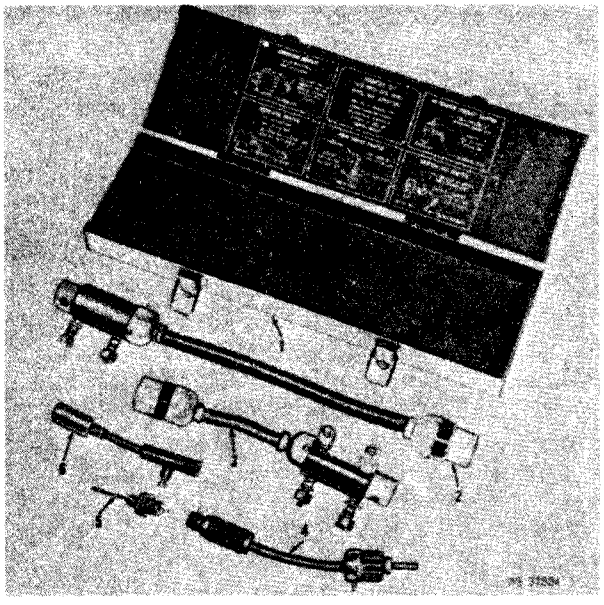
Figure 2-11. Starter ground circuit test. *WE 38477*

CAUTION

Observe the load bank duty cycle and the sequence for removing the current load specified in paragraph 2-4b. (7)(a).

When performing the following tests, make sure none of the exposed parts or links of the adapters touch the engine or frame of the vehicle.

Disconnect battery ground cable before connecting or disconnecting adapters to generator-regulator or generator. Reconnect battery ground cable after adapters are installed or removed.



KEY to fig. 2-12:

1. CASE, ADAPTER SET, ENGINE: 4910-348-7691
2. ADAPTER, ENGINE, ELECTRICAL TEST: regulator testing 4910-092-9025
3. ADAPTER, ENGINE, ELECTRICAL TEST: generator testing 4910-092-9026
4. ADAPTER, ENGINE, ELECTRICAL TEST: spark plug 4910-356-7504
5. ADAPTER, ENGINE, ELECTRICAL TEST: primary circuit 4910-356-7492
6. ADAPTER, ENGINE, ELECTRICAL TEST: ignition unit 4910-356-7508

Figure 2-12.

Engine electrical test adapter set 4910-348-7600.

WE 31884

NOTE

Start and operate engine until temperature is normal. The generator and regulator test adapters are components of the engine electrical test adapter set 4910-348-7600 (Fig. 2-12) which is supplied under the TOE covering the test set.

a. *Generator Output Test.*

Note: The key numbers shown below in parentheses refer to figure 2-13, except where otherwise noted.

(1) *Purpose.* This test is performed to determine generator output capacity and check the generator drive belt for slippage. During this test the generator is operated at the rpm (revolutions per minute) specified in pertinent manufacturer's or technical manual. Refer to TM 9-1825 B (Auto-Lite) and TM 9-8627 (Delco-Remy) for general information.

(2) *Test procedures.*

(a) With the vehicle engine stopped, install ADAPTER, ENGINE, ELECTRICAL TEST, regulator testing 4910-092-9025 (16) at the generator-regulator (13) and ADAPTER, ENGINE, ELECTRICAL TEST, generator testing 4910-092-9026 (27) at the generator (28). Polarize generator by connecting a LEAD, TEST, jumper (7, Fig. 2-2) to terminal 1 (17) of the regulator testing adapter and briefly touching loose end of jumper to field terminal no. 1 (18) on generator testing adapter.

(b) This test is for 24 volts. The 12-volt load bank link (1) will be in the OPEN position.

(c) Place the two switch links (15) on generator testing adapter in the OPEN position.

(d) Connect one end of the red voltmeter positive (+) test lead (11) to the voltmeter positive (+) binding post (7) on the tester (5) and the other end to the armature terminal no. 1 (19) on the generator testing adapter.

(e) Connect one end of the black voltmeter negative (-) test lead (12) to the voltmeter negative (-) binding post (8) on the tester and the other end to the generator or other suitable ground point on the vehicle.

(f) Connect the two field test leads (14 and 20) to the field rheostat binding

posts (10).

(g) Connect the field test lead (20) to the armature terminal no. 1 (19) located on the generator testing adapter.

(h) Connect the field test lead (14) to the field terminal no. 1 (18) located on the generator testing adapter.

(i) Connect one end of the red ammeter positive (+) test lead (21) to the 24-volt load bank binding post (22) on the tester and the other end to the armature terminal no. 1 (19) on generator testing adapter.

(j) connect one end of the black ammeter negative (-) test lead (26) to the ammeter negative -100 AMP binding post (25) on the tester and the other end to the generator or other suitable ground point on the vehicle.

(k) Start the engine and operate at high idle (1000-1200 RPM).

(l) Place the voltmeter range selector switch (24) in the 50 volt position.

(m) Turn the field rheostat control (9) slowly clockwise until the voltmeter (6) indicates 30 volts.

(n) Place the load bank switch (4) in the ON position.

(o) Turn coarse load bank control knob (2) clockwise slowly until ammeter (3) indicates 25 amperes. The field rheostat control, and coarse and fine load bank control knobs (2 and 23) must be adjusted because as amperage increases, voltage falls off. Adjust load bank and field rheostat controls until a reading of at least 25 amperes and 30 volts is obtained. Refer to pertinent manufacturer's or technical manual for other generator data.

(p) If a reading of 25 amperes can't be obtained, check for loose generator drive belt. If drive belt is not slipping, generator should be replaced.

(q) After the test is completed, shut OFF the engine. Remove all test leads.

(r) Remove testing adapters. Close the links to prevent damage.

b. *Voltage Regulator Unit Test.*

Note: The key numbers shown below in parentheses refer to figure 2-14.

(1) *Purpose*. This test is performed to determine whether the voltage setting of the voltage generator-regulator unit is set at the predetermined value specified in pertinent manufacturer's or technical manual. The proper setting is essential in maintaining a constant generator voltage value. In maintaining a constant voltage, the generator supplies varying amounts of current (amperes) to meet the varying state of battery charge and electrical load conditions.

(2) *Test procedures.*

(a) With the vehicle engine stopped, install ADAPTER, ENGINE, ELECTRICAL TEST, regulator testing 4910-092-9025 (13) at the generator-regulator (9). Open the switch link (12).

(b) This test is for 24 volts. The 12-volt load bank link (1) will be in the OPEN position.

(c) Connect one end of the red voltmeter positive (+) test lead (7) to the voltmeter positive (+) binding post (5) on the tester (3) and the other end to the terminal 2 (11) on the regulator testing adapter.

(d) Connect one end of the black voltmeter negative (-) test lead (8) to the voltmeter negative (-) binding post (6) on the tester and the other end to a ground (10) on the generator-regulator.

(e) Start the vehicle engine and set the throttle at a fast idle (approximately 1000 rpm) to obtain approximately 1800 generator rpm.

(f) Place the voltmeter range selector switch (2) in the 50 volt position.

(g) The reading on the voltmeter (4) indicates the setting of the voltage regulator unit and should be the same as specified in pertinent manufacturer's or technical manual for the generator-regulator being tested.

(h) After the test is completed, shut OFF the engine. Remove all test leads.

(i) Remove the regulator testing adapter. Close the links to prevent damage.

c. *Cutout Relay Unit Test.*

Note: The key numbers shown below in parentheses refer to figure 2-15, except where otherwise noted.

(1) *Purpose*. This test is performed to determine the voltage at which the generator- regulator cutout relay closes and opens the generator to battery circuit.

(2) *Test procedures.*

(a) With the vehicle engine stopped, install ADAPTER, ENGINE, ELECTRICAL TEST, regulator testing 4910-092-9025 (18) at the generator-regulator (14)

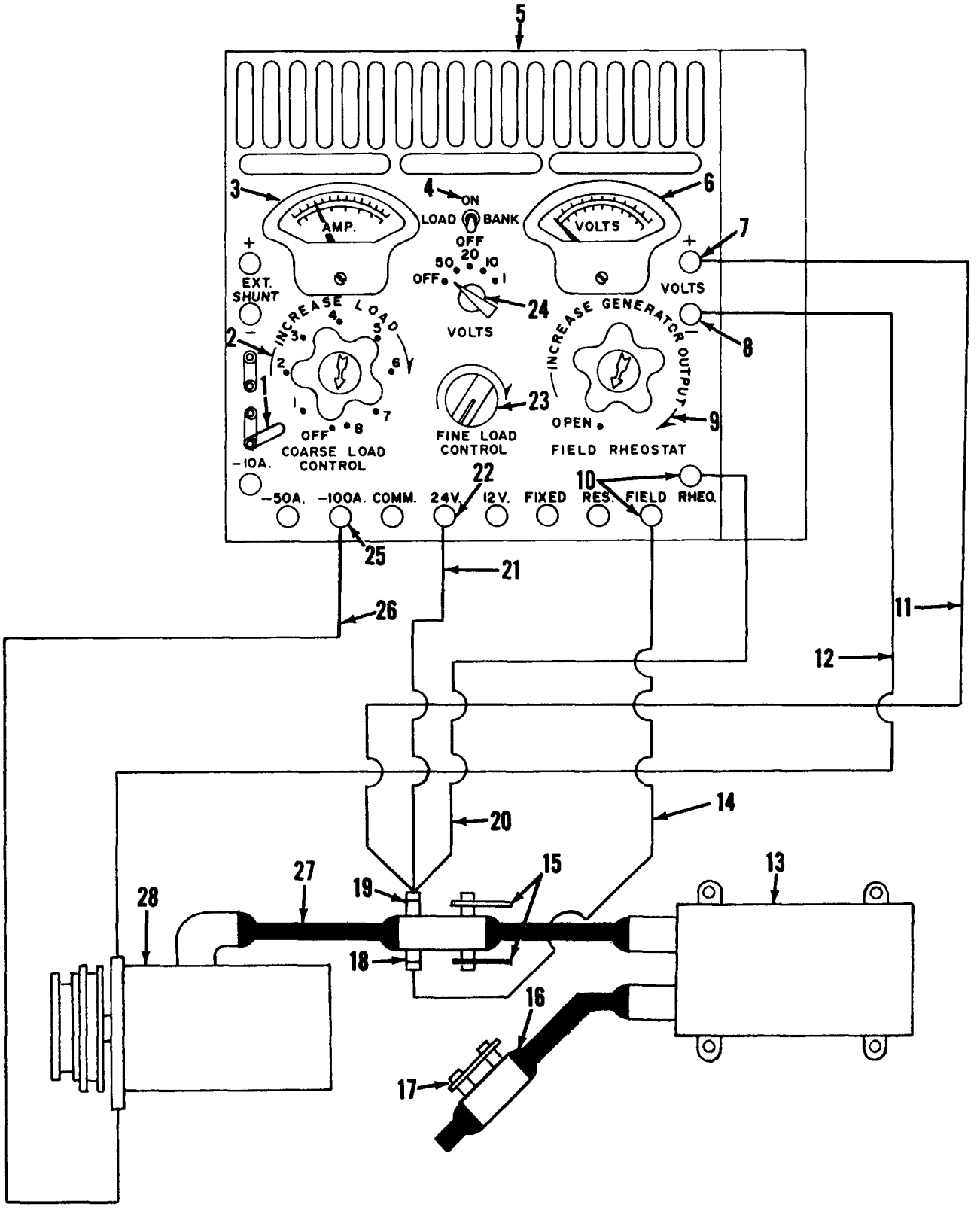


Figure 2-13. Generator output test. WE 38478

KEY to fig. 2-13:

1. 12-Volt load bank link
2. Coarse load bank control knob
3. Ammeter
4. Load bank switch
5. Tester
6. Voltmeter
7. Voltmeter positive binding post
8. Voltmeter negative binding post
9. Field rheostat control
10. Field rheostat binding post
11. Red voltmeter positive test lead
12. Black voltmeter negative test lead
13. Generator-regulator
14. Field test lead
15. Switch link
16. ADAPTER, ENGINE, ELECTRICAL TEST: regulator testing 4910-092-9025
17. Terminal 1 - regulator testing adapter
18. Field terminal no. 1 - generator testing adapter
19. Armature terminal no. 1 - generator testing adapter
20. Field test lead
21. Red ammeter positive test lead
22. 24-Volt load bank binding post
23. Fine load bank control knob
24. Voltmeter range selector switch
25. Ammeter negative - 100 AMP binding post
26. Black ammeter negative test lead
27. ADAPTER, ENGINE, ELECTRICAL TEST: generator testing 4910-092-9026
28. Generator

and ADAPTER. ENGINE. ELECTRICAL TEST, generator testing 4910-092-9026 (20) at the generator (24). Polarize generator by connecting a LEAD, TEST, jumper **(7,** Fig. 2-2) to terminal 1 (16) of the regulator testing adapter and briefly touching loose end of jumper to field terminal no. 1 (21) on generator testing adapter.

(b) This test is for 24 volts. The 12-volt load bank link (1) will be in the OPEN position.

(c) Place the switch link (23) on the field side of the generator testing adapter in the OPEN position.

(d) Place the switch link (17) on regulator testing adapter in the OPEN position.

(e) Connect one end of the red voltmeter positive (+) test lead (10) to the voltmeter positive (+) binding post (6) on the tester (4) and the other end to the armature terminal no. 2 (19) on the generator testing adapter.

(f) Connect one end of the black voltmeter negative (-) test lead (11) to the voltmeter negative (-) binding post (7) on the tester and the other end to the generator or other suitable ground point on the vehicle.

(g) Connect the two field test leads (12 and 13) to the field rheostat binding posts (9).

(h) Connect the field test lead (12) to the field terminal no. 1 located on the generator testing adapter.

(i) Connect the field test lead (13) to the armature terminal no. 1 (22) located on the generator testing adapter.

(j) Connect one end of the red ammeter positive (+) test lead (26) to the COMMON binding post (27) on the tester and the other end to the terminal 2 (15) on the regulator testing adapter.

(k) Connect one end of the black ammeter negative (-) test lead (25) to the ammeter negative -50 AMP binding post (28) on the tester and the other end to the terminal 1 on the regulator testing adapter.

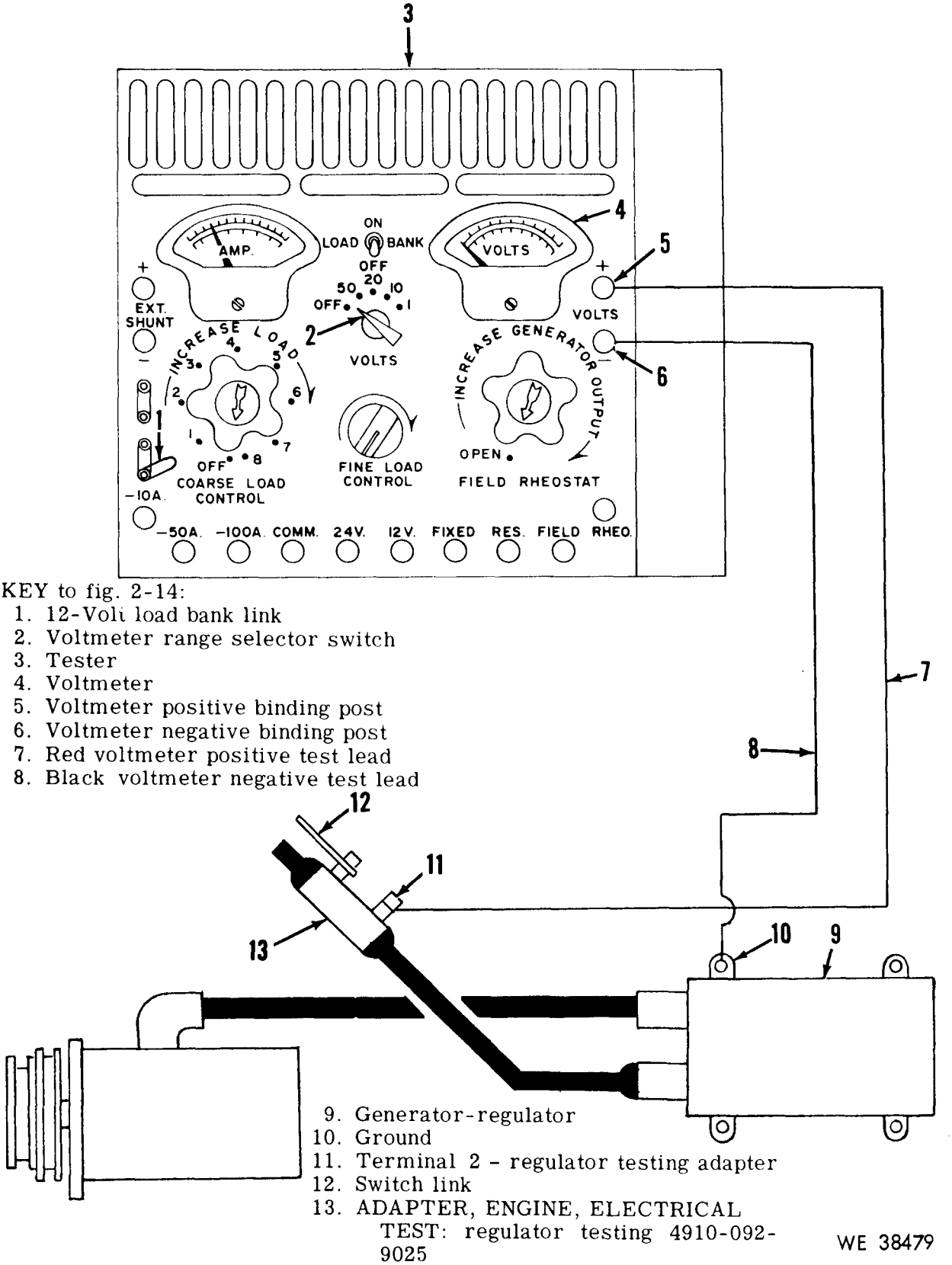
(1) Start the engine and operate at high idle (1000 -1200 RPM).

(m) Place the voltmeter range selector switch (2) in the 50 volt position.

(n) Turn the field rheostat control (8) slowly clockwise and observe the pointers on the voltmeter (5) and the ammeter (3).

(o) The closing voltage of the cutout relay unit is the highest reading on the voltmeter that can be obtained before the pointer on the ammeter moves.

(p) After observing the closing voltage, continue to turn the field rheostat control slowly clockwise until 10 amperes is indicated on the ammeter. Turn the field rheostat control slowly counterclockwise until the ammeter returns to zero and continues below zero. Keep rotating field rheostat control counterclockwise until reverse current relay opens and ammeter returns to zero. The opening amperage of the cutout relay unit will be the discharge reading obtained just before the pointer drops to a zero reading. Note: Refer to pertinent man-



KEY to fig. 2-14:

1. 12-Volt load bank link
2. Voltmeter range selector switch
3. Tester
4. Voltmeter
5. Voltmeter positive binding post
6. Voltmeter negative binding post
7. Red voltmeter positive test lead
8. Black voltmeter negative test lead
9. Generator-regulator
10. Ground
11. Terminal 2 - regulator testing adapter
12. Switch link
13. ADAPTER, ENGINE, ELECTRICAL TEST: regulator testing 4910-092-9025

WE 38479

Figure 2-14. Voltage regulator unit test. WE 38479

ufacturer's or technical manual to obtain the correct closing voltage of the generator-regulator being tested.

(q) After the test is completed, shut OFF the engine. Remove all test leads.

(r) Remove testing adapters. Close the links to prevent damage.

d. *Current Regulator Unit Test.*

Note: The key numbers shown below in parentheses refer to figure 2-16.

(1) *Purpose.* This test is performed to make certain that the generator ampere output does not rise above a predetermined value. Excessive output will cause overheating and other damage to the generator. The current regulator must operate correctly when the battery voltage is low and also when the electrical load on the battery exceeds the maximum safe ampere output of the generator.

(2) *Test procedures.*

(a) With the vehicle engine stopped, install ADAPTER, ENGINE, ELECTRICAL TEST, regulator testing 4910-092-9025 (15) at the generator-regulator (13).

(b) This test is for 24 volts. The 12-volt load bank link (1) will be in the OPEN position.

(c) Place the switch link (16) on regulator testing adapter in the OPEN position.

(d) Connect one end of the red voltmeter positive (+) test lead (10) to the voltmeter positive (+) binding post (8) on the tester (6) and the other end to terminal 2 (14) on the regulator testing adapter.

(e) Connect one end of the black voltmeter negative (-) test lead (11) to the voltmeter negative (-) binding post (9) on the tester and the other end to the base (12) of the generator-regulator or other suitable vehicle ground.

(f) Connect one end of the red ammeter positive (+) test lead (18) to the 24-volt load bank binding post (19) on the tester and the other end to terminal 2 on the regulator testing adapter.

(g) Connect one end of the black ammeter negative (-) test lead (17) to the ammeter negative -50 AMP binding post (21) on the tester and the other end to the base of the generator-regulator or other suitable vehicle ground.

(h) Start the engine and operate at high idle (1000 -1200 RPM).

(i) Place the voltmeter range selector switch (3) in the 50 volt position.

(j) Place the load bank switch (5) in the ON position.

(k) Adjust the coarse and fine load bank control knobs (2 and 20) until the voltmeter (7) indicates 25 volts.

(l) Observe the reading on the ammeter (4). The reading should be as specified in pertinent manufacturer's or technical manual.

(m) After the test is completed, shut OFF the engine. Remove all test leads.

(n) Remove the regulator testing adapter. Close the links to prevent damage.

e. *Voltage Regulator Unit-Fixed Resistor Method- Test.*

Note: The key numbers shown below in parentheses refer to figure 2-17, except where otherwise noted.

(1) *Purpose.* This test is performed to determine whether the voltage output of the voltage regulator unit (using the fixed l/4-OHM resistor (10, Fig. 2-1) in the output circuit) is at the predetermined value specified in pertinent manufacturer's or technical manual.

Note: No adjustments are to be made as a result of this test. If results are not as specified, the generator-regulator must be removed for repair or replacement by field service maintenance personnel.

(2) *Test procedures.*

(a) With the vehicle engine stopped, install ADAPTER, ENGINE, ELECTRICAL TEST, regulator testing 4910-092-9025 (15) at the generator-regulator (17). Open the switch link (13).

(b) This test is for 24 volts. The 12-volt load bank link (1) will be in the OPEN position.

(c) Connect one end of the red voltmeter positive (+) test lead (7) to the voltmeter positive (+) binding post (5) on the tester (3) and the other end to the terminal 2 (16) on the regulator testing adapter.

(d) Connect one end of the black voltmeter negative (-) test lead (8) to the voltmeter negative (-) binding post (6) on the tester and the other end to the base (18) of the generator-regulator or other suitable vehicle ground.

(e) Connect one end of the red ammeter positive (+) test lead (11) to the l/4-OHM resistor binding post (9) on the tester and the other end to the terminal

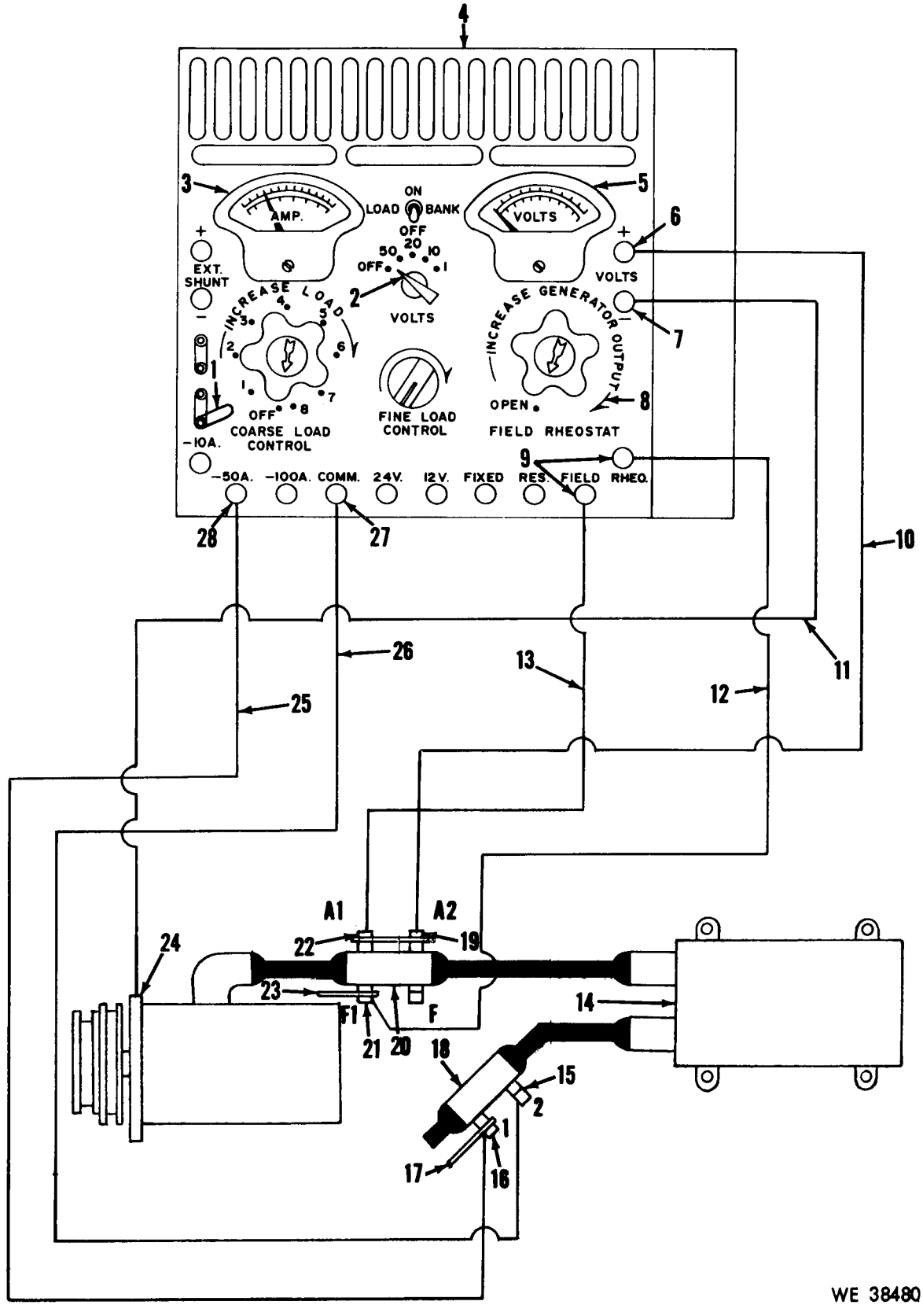


Figure 2-15. Cutout relay unit test. WE 38480

KEY to fig. 2-15:
1. 12-Volt load bank link
2. Voltmeter range selector switch
3. Ammeter
4. Tester
5. Voltmeter
6. Voltmeter positive binding post
7. Voltmeter negative binding post
8. Field rheostat control
9. Field rheostat binding post
10. Red voltmeter positive test lead
11. Black voltmeter negative test lead
12. Field test lead
13. Field test lead
14. Generator-regulator
15. Terminal 2 - regulator testing adapter
16. Terminal 1 - regulator testing adapter
17. Switch link
18. ADAPTER, ENGINE, ELECTRICAL TEST: regulator testing 4910-092-9025
19. Armature terminal no. 2 - generator testing adapter
20. ADAPTER, ENGINE, ELECTRICAL TEST: generator testing 4910-092-9026
21. Field terminal no. 1 - generator testing adapter
22. Armature terminal no. 1 - generator testing adapter
23. Switch link
24. Generator
25. Black ammeter negative test lead
26. Red ammeter positive test lead
27. COMMON binding post
28. Ammeter negative -50 AMP binding post

2 on the regulator testing adapter.

(f) Connect one end of the black ammeter negative (-) test lead (12) to the 1/4-OHM resistor binding post (10) on the tester and the other end to the terminal 1 (14) on the regulator testing adapter.

(g) Start the engine and operate at high idle (1000 - 1200 RPM).

(h) Place the voltmeter range selector switch (2) in the 50 volt position.

(i) Observe the reading on the voltmeter (4). The reading should be the predetermined value specified.

Note: Refer to pertinent manufacturer's or technical manual to obtain predetermined value. Refer to TM 9-1825B (Auto-Lite) and TM 9-8627 (Delco-Remy) for general information.

(j) After the test is completed, shut OFF the engine. Remove all test leads.

(k) Remove the regulator testing adapter. Close the links to prevent damage.

f. *Charging Circuit Insulated Cable Test.*

Note: The key numbers shown below in parentheses refer to figure 2-18.

(1) *Purpose*. This test is performed to determine whether there is excessive resistance in the insulated side of the charging circuit which would cause undercharging of the battery.

(2) *Test procedures*.

(a) With the vehicle engine stopped, install ADAPTER, ENGINE, ELECTRICAL TEST, generator testing 4910-092-9026 (16) at the generator (17).

(b) This test is for 24 volts. The 12-volt load bank link (1) will be in the OPEN position.

(c) Place the two switch links (14) on the generator testing adapter in the OPEN position.

(d) Connect one end of the red voltmeter positive (+) test lead (10) to the voltmeter positive (+) binding post (6) on the tester (4) and the other end to the armature terminal no. 1 (19) on the generator testing adapter.

(e) Connect one end of the black voltmeter negative (-) test lead (11) to the voltmeter negative (-) binding post (7) on the tester and the other end to the battery positive (+) terminal (20).

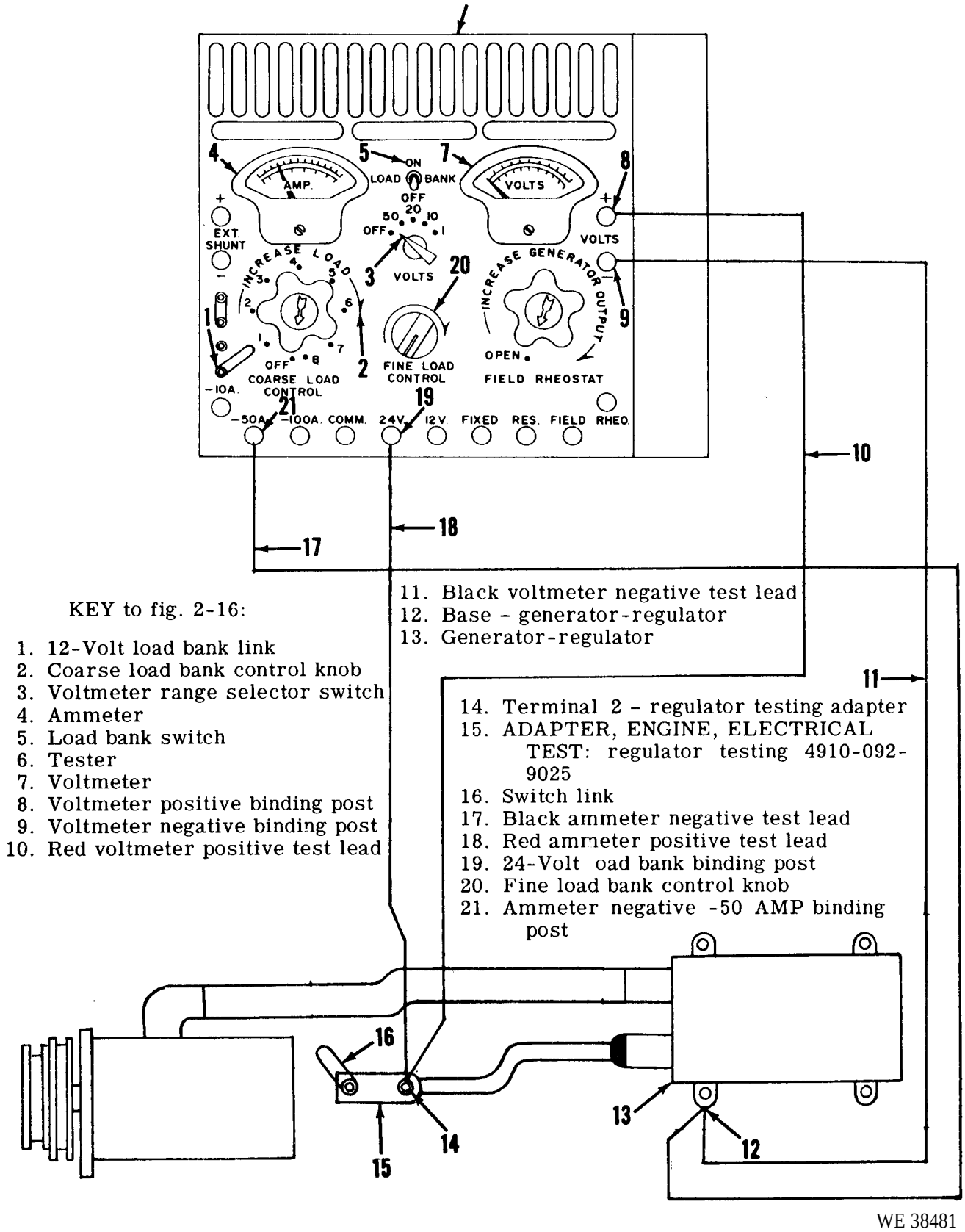
(f) Connect the two field test leads (12 and 13) to the field rheostat binding posts (9).

(g) Connect the field test lead (12) to the field terminal no. 1 (18) located on the generator testing adapter.

(h) Connect the field test lead (13) to the armature terminal no. 1 located on the generator testing adapter.

(i) Connect one end of the red ammeter positive (+) test lead (21) to the COMMON binding post (22) on the tester and the other end to the armature terminal no. 1 on the generator testing adapter.

(j) Connect one end of the black ammeter negative (-) test lead (23) to the ammeter negative -50 AMP binding post (24) on the tester and the other end to the armature terminal no. 2 (15) on the generator testing adapter.

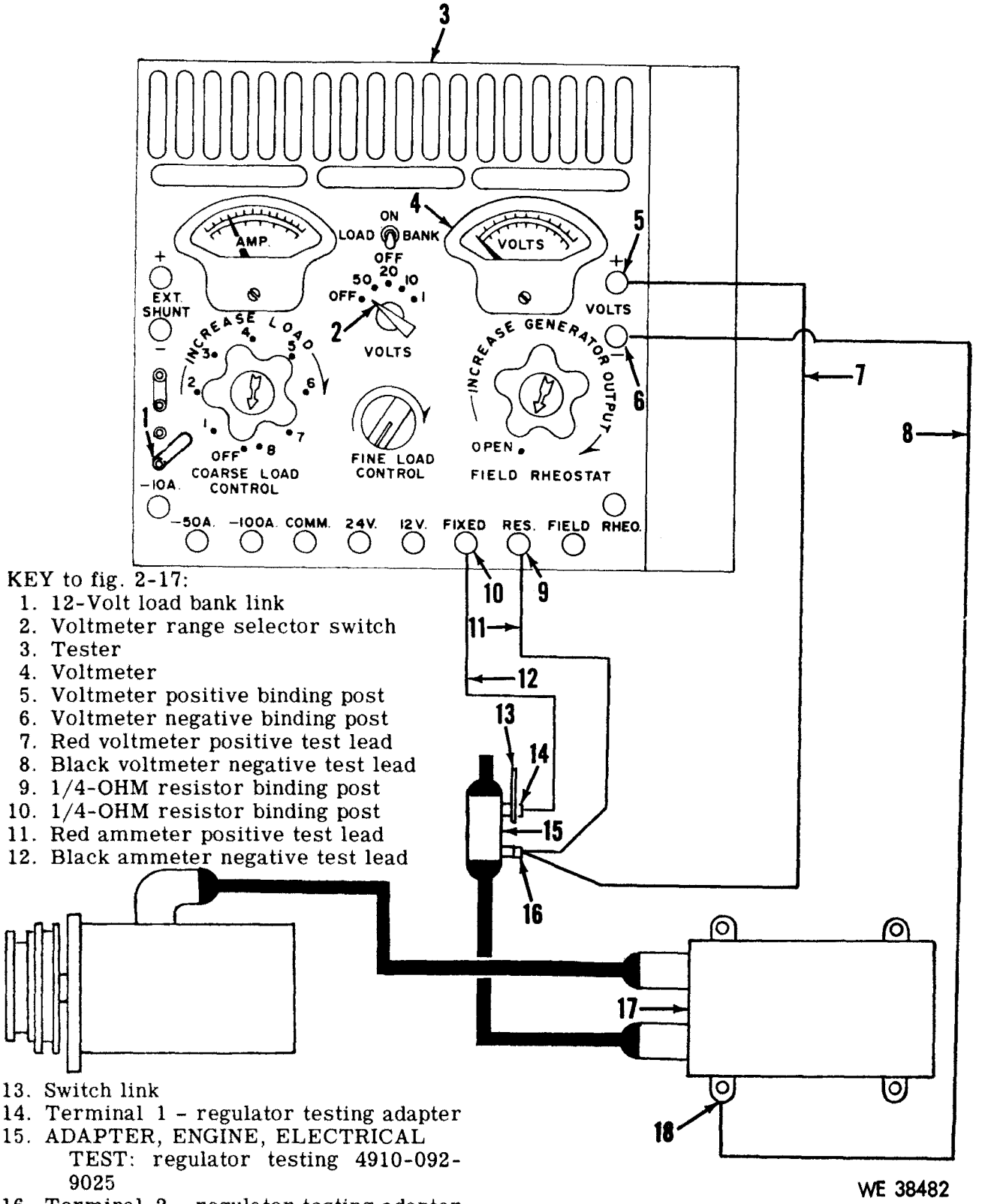


KEY to fig. 2-16:

1. 12-Volt load bank link
2. Coarse load bank control knob
3. Voltmeter range selector switch
4. Ammeter
5. Load bank switch
6. Tester
7. Voltmeter
8. Voltmeter positive binding post
9. Voltmeter negative binding post
10. Red voltmeter positive test lead
11. Black voltmeter negative test lead
12. Base - generator-regulator
13. Generator-regulator
14. Terminal 2 - regulator testing adapter
15. ADAPTER, ENGINE, ELECTRICAL TEST: regulator testing 4910-092-9025
16. Switch link
17. Black ammeter negative test lead
18. Red ammeter positive test lead
19. 24-Volt oad bank binding post
20. Fine load bank control knob
21. Ammeter negative -50 AMP binding post

WE 38481

Figure 2-16. Current regulator unit test. WE 38481



KEY to fig. 2-17:

1. 12-Volt load bank link
2. Voltmeter range selector switch
3. Tester
4. Voltmeter
5. Voltmeter positive binding post
6. Voltmeter negative binding post
7. Red voltmeter positive test lead
8. Black voltmeter negative test lead
9. 1/4-OHM resistor binding post
10. 1/4-OHM resistor binding post
11. Red ammeter positive test lead
12. Black ammeter negative test lead
13. Switch link
14. Terminal 1 - regulator testing adapter
15. ADAPTER, ENGINE, ELECTRICAL TEST: regulator testing 4910-092-9025
16. Terminal 2 - regulator testing adapter
17. Generator-regulator
18. Base - generator-regulator

Figure 2-17. Voltage regulator unit - fixed resistor method - test. WE 38482

(k) Start the engine and adjust the speed to approximately 1000 RPM.

(l) Adjust the field rheostat control (8) until a reading of 20 amperes indicated on the ammeter (3).

(m) Turn the voltmeter range selector switch (2) to the 10 volt position.

Note: If no ampere reading is obtained after steps (l) and (m), but the generator voltage rises above 0.4 volt, the cutout relay is not closing or there is an opening elsewhere in the charging circuit. If the voltmeter (5) will not rise above zero the trouble is in the generator.

(n) With the ammeter indicating exactly 20 amperes, the voltmeter reading should not exceed 0.4 volt.

Note: Turn the voltmeter range selector switch to the 1-volt position to obtain a more accurate reading.

(o) If the voltmeter reading is more than 0.4 volt, there is excessive resistance in the insulated side of the circuit.

(p) After the test is completed, shut OFF the engine. Remove all test leads.

(q) Remove the generator testing adapter. Close the links to prevent damage.

g. *Charging Circuit Resistance -Grounded Side - Test.*

Note: The key numbers shown below in parentheses refer to figure 2-19, except where otherwise noted.

(1) *Purpose.* This test is performed to determine whether there is excessive resistance on the ground side of the charging circuit. Excessive resistance causes more than the normal amount of voltage loss in the circuit, resulting in an undercharged battery.

(2) *Test procedures.*

(a) With the vehicle engine stopped, install ADAPTER, ENGINE, ELECTRICAL TEST, regulator testing 4910-092-9025 (20) at the generator-regulator (15) and ADAPTER, ENGINE, ELECTRICAL TEST, generator testing 4910-092-9026 (23) at the generator (24). Polarize generator by connecting a LEAD, TEST, jumper (7, Fig. 2-2) to terminal 1 (18) of the regulator testing adapter and briefly touching loose end of jumper to field terminal no. 1 (21) on generator testing adapter.

(b) This test is for 24 volts. The 12-volt load bank link (1) will be in the OPEN position.

(c) Place the switch link (16) on the field side of the generator testing adapter in the OPEN position.

(d) Place the switch link (19) on regulator testing adapter in the OPEN position.

(e) Connect one end of the red voltmeter positive (+) test lead (10) to the voltmeter positive (+) binding post (6) on the tester (4) and the other end to the negative (-) battery terminal (26).

(f) Connect one end of the black voltmeter negative (-) test lead (11) to the voltmeter negative (-) binding post (7) on the tester and the other end to a generator ground point (25) on the generator or mounting bracket.

(g) Connect the two field test leads (12 and 13) to the field rheostat binding posts (9).

(h) Connect the field test lead (12) to the field terminal no. 1 located on the generator testing adapter.

(i) Connect the field test lead (13) to the armature terminal no. 1 (22) located on the generator testing adapter.

(J) Connect one end of the red ammeter positive (+) test lead (27) to the COMMON binding post (29) on the tester and the other end to terminal 2 (17) on the regulator testing adapter.

(k) Connect one end of the black ammeter negative (-) test lead (28) to the ammeter negative -50 AMP binding post (30) on the tester and the other end to terminal 1 on the regulator testing adapter.

(l) Start the engine and operate at high idle (1000 -1200 RPM).

(m) Place the voltmeter range selector switch (2) in the 10 volt position.

(n) Adjust the field rheostat control (8) slowly clockwise until a reading of 20 amperes is indicated on the ammeter (3).

(o) With the ammeter indicating 20 amperes, the voltmeter (5) reading should not exceed 0.1 volt.

Note: Turn the voltmeter range selector switch to the 1-volt position to obtain a more accurate reading.

(P) Move the black voltmeter negative (-) test lead (11) from the generator ground point to the base (14) of the generator-regulator (15). With the ammeter reading 20 amperes, the voltmeter should read 0.1 volt or less.

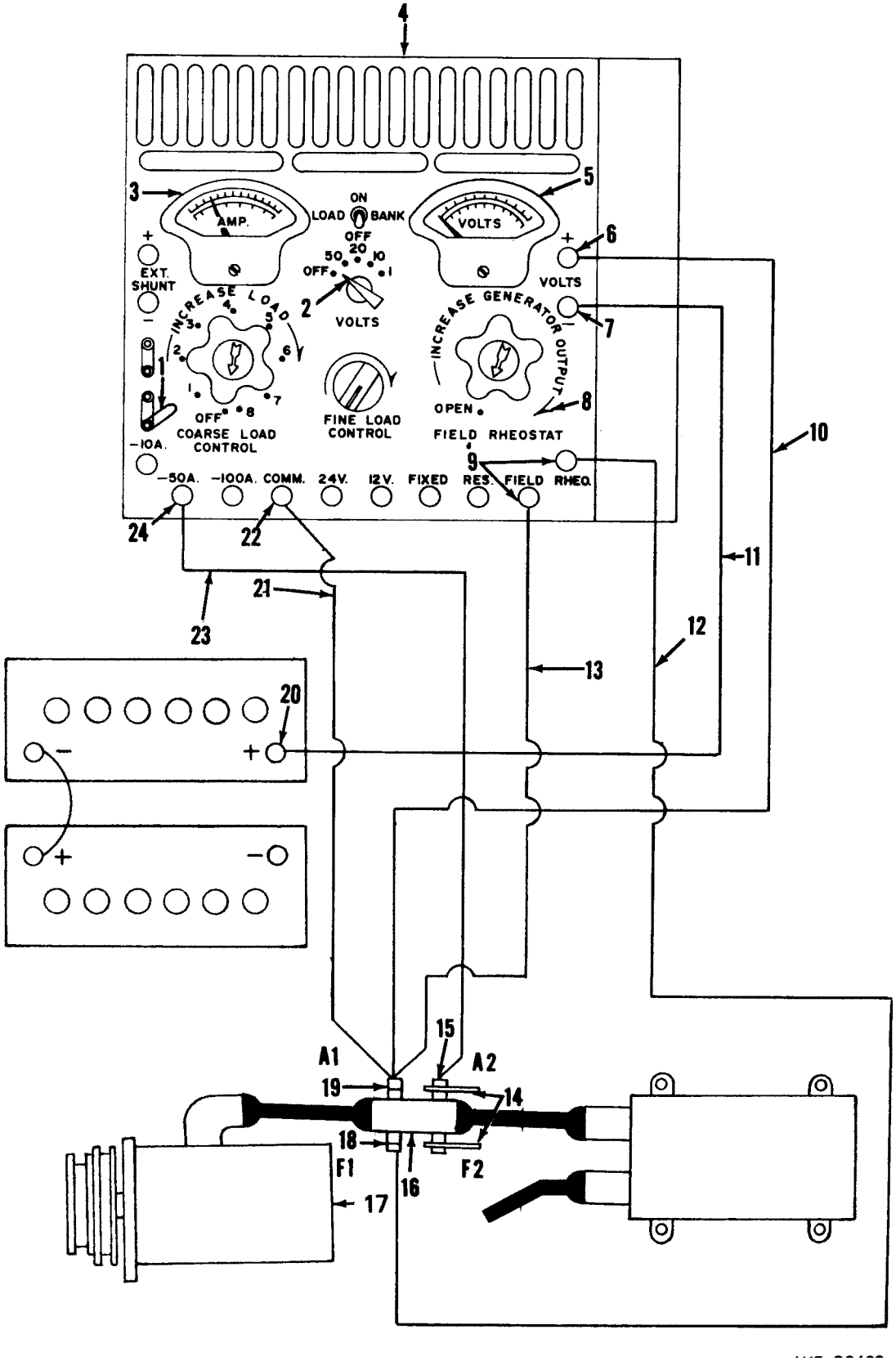


Figure 2-18. Charging circuit insulated cable test. WE 38483

KEY to fig. 2-18:
1. 12-Volt load bank link
2. Voltmeter range selector switch
3. Ammeter
4. Tester
5. Voltmeter
6. Voltmeter positive binding post
7. Voltmeter negative binding post
8. Field rheostat control
9. Field rheostat binding post
10. Red voltmeter positive test lead
11. Black voltmeter negative test lead
12. Field test lead
13. Field test lead
14. Switch link
15. Armature terminal no. 2 - generator testing adapter
16. ADAPTER, ENGINE, ELECTRICAL TEST: generator testing 4910-092-9026
17. Generator
18. Field terminal no. 1 - generator testing adapter
19. Armature terminal no. 1 - generator testing adapter
20. Battery positive terminal
21. Red ammeter positive test lead
22. COMMON binding post
23. Black ammeter negative test lead
24. Ammeter negative -50 AMP binding post

(q) If the voltmeter indicates more than 0.1 volt when making the ground circuit resistance test ((o) above) or the generator-regulator ground test ((p) above), there is excessive resistance in the circuit being tested.

(r) After the tests are completed, shut OFF the engine. Remove all test leads.

(s) Remove testing adapters. Close the links to prevent damage.

2-9. Alternator System Tests.

CAUTION

The alternator is relatively new and unfamiliar in military vehicles. It is very important that the following precautions are observed to prevent damage to the alternator and regulator.

1. NEVER reverse the battery connections. ALWAYS check the battery connecting cables with a voltmeter before any attachments are made to be sure that the negative cable will be connected to the alternator frame and the positive cable to the alternator positive terminal.

2. NEVER disconnect the voltage regulator sensing lead (ignition lead) while the engine is running. This is the only information the regulator has on the battery voltage. If the lead is removed, the alternator will burn itself out trying to reach 28 volts.

3. NEVER ground the alternator output terminal. The internal resistance is very low and an external short circuit will overload all the regulating and generating circuits, resulting in burnout.

4. NEVER operate the alternator with the ignition sensing terminal energized unless a load is connected to the alternator output.

5. NEVER try to polarize an alternator. It is not necessary and could result in expensive damage.

KEY to fig. 2-19:
1. 12-Volt load bank link
2. Voltmeter range selector switch
3. Ammeter
4. Tester
5. Voltmeter
6. Voltmeter positive binding post
7. Voltmeter negative binding post
8. Field rheostat control
9. Field rheostat binding post
10. Red voltmeter positive test lead
11. Black voltmeter negative test lead
12. Field test lead
13. Field test lead
14. Base------generator-regulator
15. Generator-regulator
16. Switch link
17. Terminal 2 - regulator testing adapter
18. Terminal 1 - regulator testing adapter
19. Switch link
20. ADAPTER, ENGINE, ELECTRICAL TEST: regulator testing 4910-092-9025
21. Field terminal no. 1 - generator testing adapter
22. Armature terminal no. 1 - generator testing adapter
23. ADAPTER, ENGINE, ELECTRICAL TEST: generator testing 4910-092-9026
24. Generator
25. Generator ground point
26. Negative battery terminal
27. Red ammeter positive test lead
28. Black ammeter negative test lead
29. COMMON binding post
30. Ammeter negative -50 AMP binding post

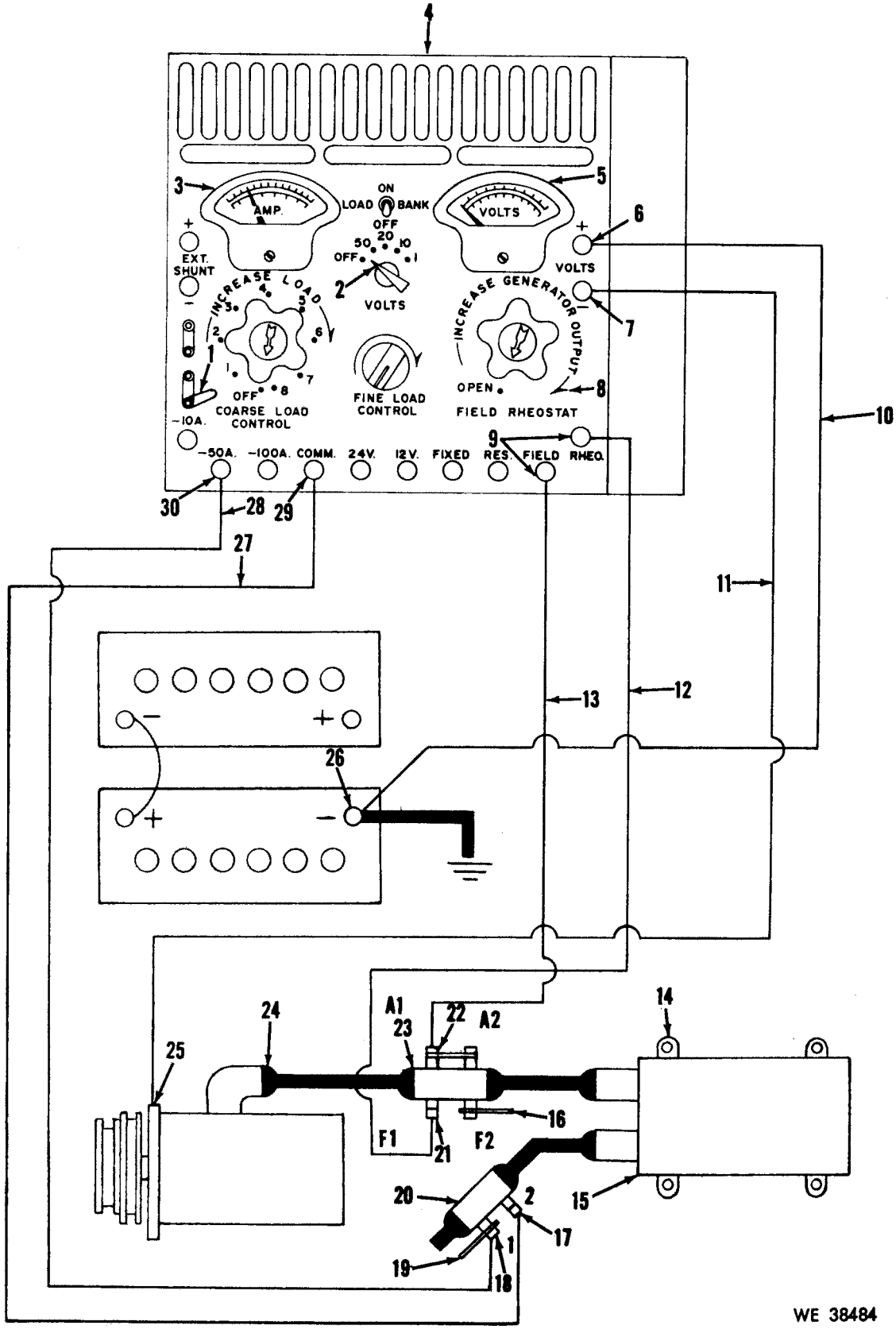


Figure 2-19. Charging circuit resistance -grounded side-test.

NOTE

A 60 ampere alternator was used in the following tests. Remove cap on alternator to make connections on terminal stud (-).

a. *Alternator Output Test.*

Note: The key numbers shown below in parentheses refer to figure 2-20.

(1) *Purpose.* This two-part test is performed to determine whether the voltage setting of the alternator is set at the predetermined value specified in pertinent manufacturer's or technical manual. The proper setting is essential in maintaining a constant alternator voltage value. In maintaining a constant voltage, the alter nator supplies varying amounts of current (amperes) to meet the varying state of battery charge and electrical load conditions.

(2) *Test procedures.*

(a) This test is for 24 volts. The 12-volt load bank link (1) will be in the OPEN position.

(b) Connect one end of the red voltmeter positive (+) test lead (7) to the voltmeter positive (+) binding post (5) on the tester (3) and the other end to the alternator output (+) terminal (12) on the alternator (13).

(c) Connect one end of the black voltmeter negative (-) test lead (8) to the voltmeter negative (-) binding post (6) on the tester and the other end to the alternator ground terminal (11) on the alternator.

(d) Start the vehicle engine and set the throttle at a fast idle (1000 to 2000 RPM) for 15 minutes.

(e) Place the voltmeter range selector switch (2) in the 50 volt position.

(f) The reading on the voltmeter (4) should indicate 28 ± 1 volts.

(g) If the voltage reading is less than 27 volts, STOP the engine and note the voltage indicated. If the voltage reading remains the same as when the engine was running, disconnect the ignition sensing lead (10).

(h) Disconnect one end of the red voltmeter positive (+) test lead (7) from the alternator output (t) terminal (12) on the alternator (13) and connect it to the end (9) of the ignition sensing lead (10) from the ignition switch.

(i) DO NOT START THE ENGINE. Turn on the ignition switch. The voltmeter should indicate 24 ± 1 volts. If the voltmeter indicates no or very low volts, repair or replace ignition sensing lead, and retest. If 24 volts is now indicated, reconnect the ignition sensing lead.

(j) Reverse configuration and repeat the alternator output test as described in steps (a) through (f) above. Remove the plug from the front flange of the alternator and adjust the output control until the voltmeter indicates exactly 28 volts. If the output voltage cannot be adjusted to this voltage, replace the alternator with a known good one.

(k) After the test is completed, shut OFF the engine. Return voltmeter range selector switch to OFF position. Remove all test leads. Close link on the tester to prevent damage.

b. *Alternator Load Test.*

Note: The key numbers shown below in parentheses refer to figure 2-21.

(1) *Purpose.* This test is performed to determine alternator output capacity. Refer to pertinent manufacturer's or technical manual for test data or specifications.

(2) *Test Procedures.*

(a) This test is for 24 volts. The 12-volt load bank link (1) will be in the OPEN position.

(b) Connect the red voltmeter positive (+) test lead (11) from the voltmeter positive (+) binding post (9) to the 24-volt load bank binding post (17) on the tester (7).

(c) Connect the black voltmeter negative (-) test lead (12) from the voltmeter negative (-) binding post (10) to the ammeter negative -100 AMP binding post (18) on the tester.

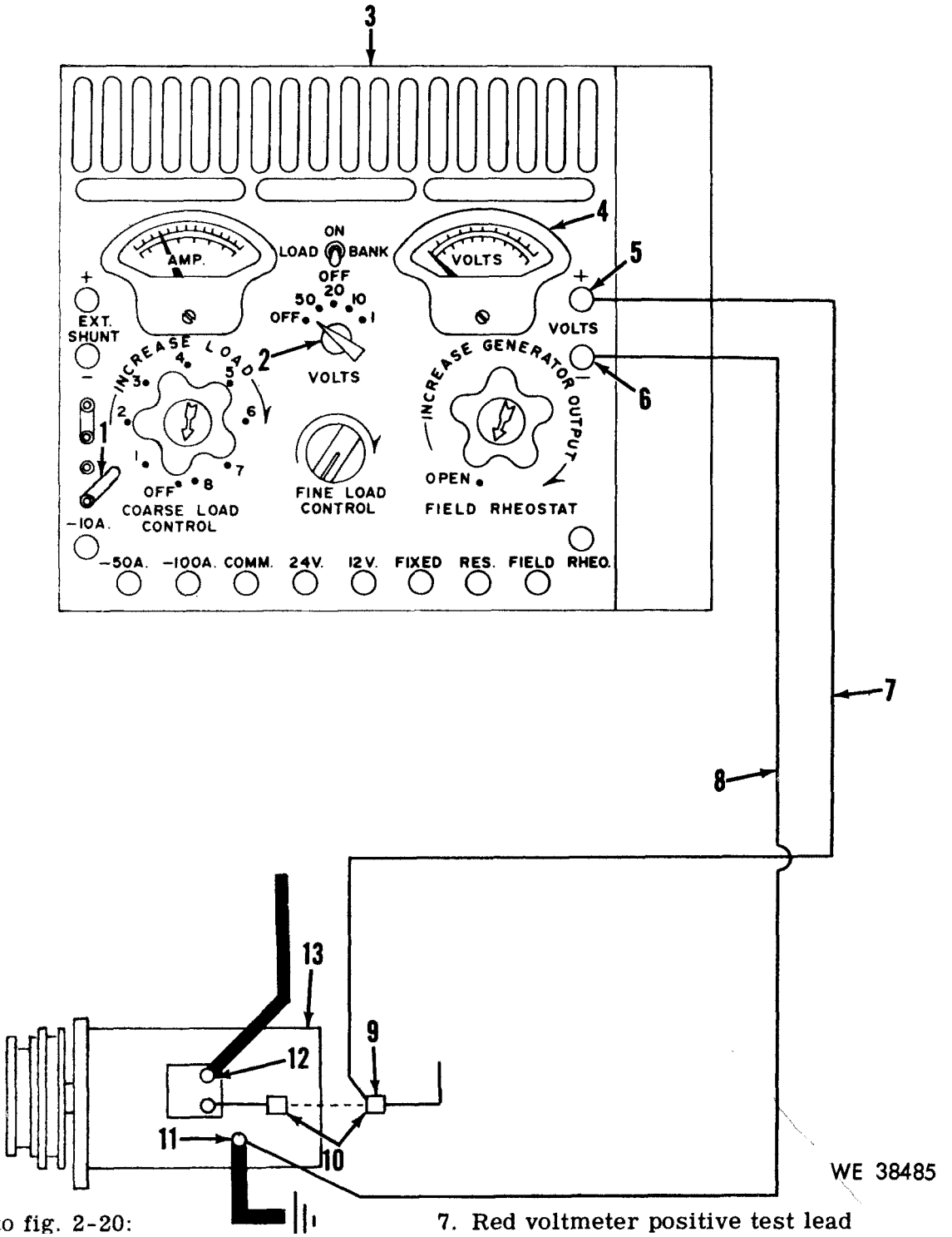
(d) Connect one end of the red ammeter positive (+) test lead (16) to the 24-volt load bank binding post on the tester and the other end to positive (+) battery terminal (14).

(e) Connect one end of the black ammeter negative (-) test lead (15) to the ammeter negative -100 AMP binding post on the tester and the other end to vehicle ground (13).

(f) Start the engine and run at 1000 to 2000 RPM.

(g) Place the voltmeter range selector switch (4) in the 50 volt position.

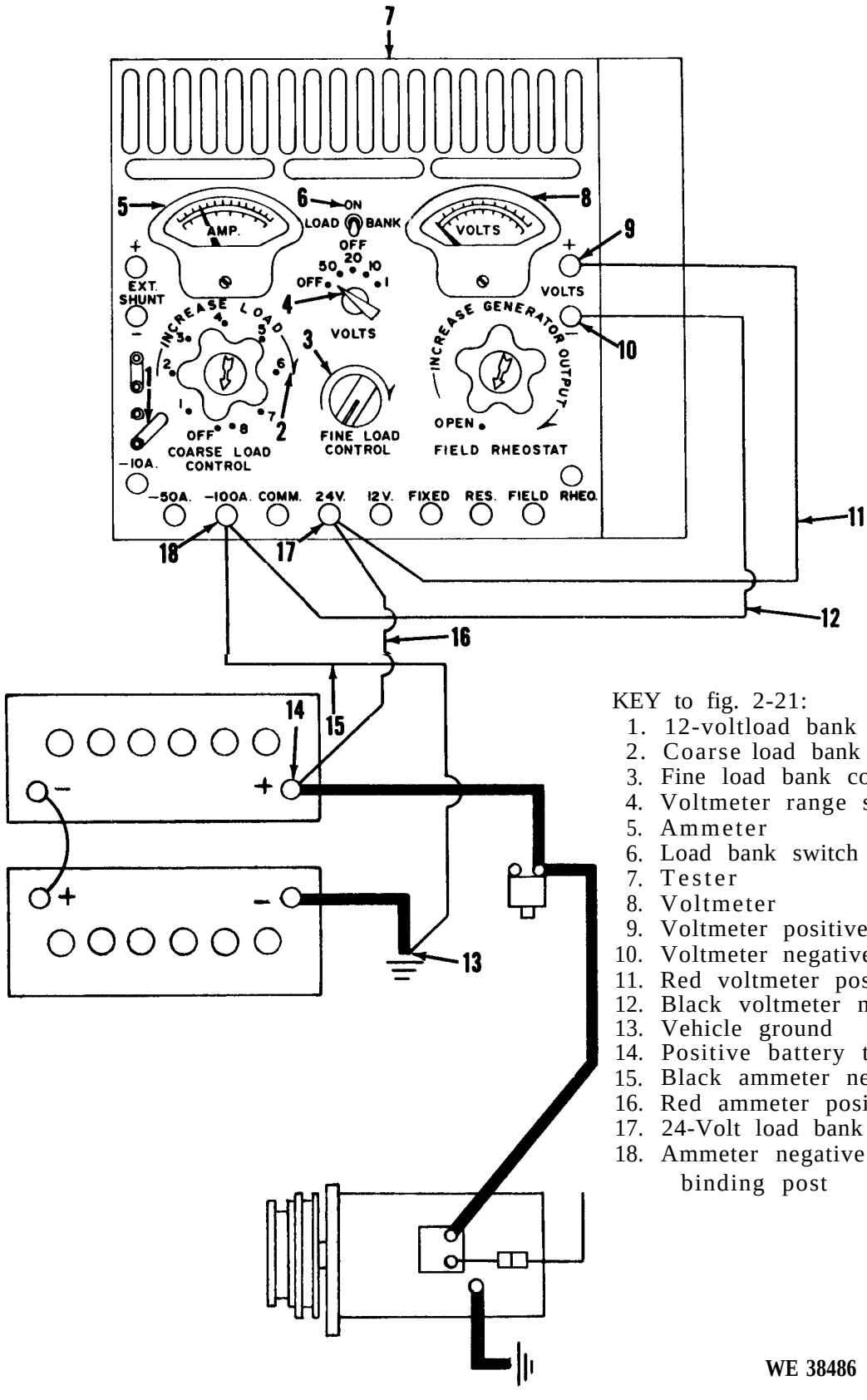
(h) Set the load bank switch (6) to ON position.



KEY to fig. 2-20:

1. 12-Volt load bank link
2. Voltmeter range selector switch
3. Tester
4. Voltmeter
5. Voltmeter positive binding post
6. Voltmeter negative binding post
7. Red voltmeter positive test lead
8. Black voltmeter negative test lead
9. End - ignition sensing lead
10. Ignition sensing lead
11. Alternator ground terminal
12. Alternator output (+) terminal
13. Alternator

Figure 2-20. Alternator output test. WE 38485



KEY to fig. 2-21:

1. 12-voltload bank link
2. Coarse load bank control
3. Fine load bank control
4. Voltmeter range selector switch
5. Ammeter
6. Load bank switch
7. Tester
8. Voltmeter
9. Voltmeter positive binding post
10. Voltmeter negative binding post
11. Red voltmeter positive test lead
12. Black voltmeter negative test lead
13. Vehicle ground
14. Positive battery terminal
15. Black ammeter negative test lead
16. Red ammeter positive test lead
17. 24-Volt load bank binding post
18. Ammeter negative -100 AMP binding post

WE 38486

Figure 2-21. Alternator load test. WE 38486

(i) Adjust the coarse and fine load bank controls (2 and 3) until the ammeter (5) indicates 60 amperes. Note the voltmeter (8) indication at this time. If the voltmeter indicates 27 volts or more, the alternator is operating satisfactorily. If the voltmeter indicates less than 27 volts and cannot be raised to 28 volts, refer to paragraphs 2-9.c. and d., and perform the cable tests.

(j) After the test is completed, shut OFF the engine. Return switches to OFF position. Return coarse and fine load bank controls to maximum counterclockwise position. Remove all test leads. Close link on the tester to prevent damage.

c. *Alternator to Battery Cable Test.*

Note: The key numbers shown below in parentheses refer to figure 2-22.

(1) *Purpose*. This test is performed to determine excessive resistance between alternator cable, starter switch, and battery cable terminals.

(2) *Test procedures*.

(a) This test is for 24 volts. The 12-volt load bank link (1) will be in the OPEN position.

(b) Connect one end of the red voltmeter positive (+) test lead (10) to the voltmeter positive (+) binding post (8) on the tester (7) and the other end to the alternator output (+) terminal (12) on the alternator (13).

(c) Connect one end of the black voltmeter negative (-) test lead (11) to the voltmeter negative (-) binding post (9) on the tester and the other end to the positive (+) battery terminal (18).

(d) Connect one end of the red ammeter positive (+) test lead (21) to the 24-volt load bank binding post (22) on the tester and the other end to the positive (+) battery terminal.

(e) Connect one end of the black ammeter negative (-) test lead (20) to the ammeter negative -100 AMP binding post (23) on the tester and the other end to vehicle ground (16).

(f) Start the engine and run at 1000 to *2000* RPM for 15 minutes.

(g) Place the voltmeter range selector switch (4) in the 50 volt position.

(h) Set the load bank switch (6) to ON position.

(i) Adjust the coarse and fine load bank controls (2 and 3) until the ammeter (5) indicates 60 amperes.

(j) Adjust the voltmeter range selector switch until a reading is obtained or the 1-volt range is reached. If the meter reading exceeds 1.0 volt, turn OFF engine and examine all connections between the alternator and battery (19) for loose connections, frayed wires and dirt. Clean and tighten all connections.

(k) Repeat the test. If the total voltage drop is still more than 1.0 volt, connect the red voltmeter positive (+) test lead (10) directly on the alternator output (+) terminal (12), and successively touch each test point (alternator cable (14), starter switch (15), battery cable terminals (17). As each test point is touched, a small voltage drop of about 0.1 should be seen. If there is a sudden voltage jump at any connection touched, investigate the previous connection or cable, and adjust, repair, or replace as needed. When a 1.0 volt or less drop has been obtained, and the alternator output is still much less than 27 volts in alternator load test, in 2-9.b. above; refer to paragraph 2-9.d. and perform the alternator ground cable test.

(l) After the test is completed, shut OFF the engine. Return switches to OFF position. Return coarse and fine load bank controls to maximum counterclockwise position. Remove all test leads. Close link on the tester to prevent damage.

d. *Alternator Ground Cable Test.*

Note: The key numbers shown below in parentheses refer to figure 2-23.

(1) *Purpose*. This test is performed to determine excessive resistance in cable between alternator and ground.

(2) *Test procedures*.

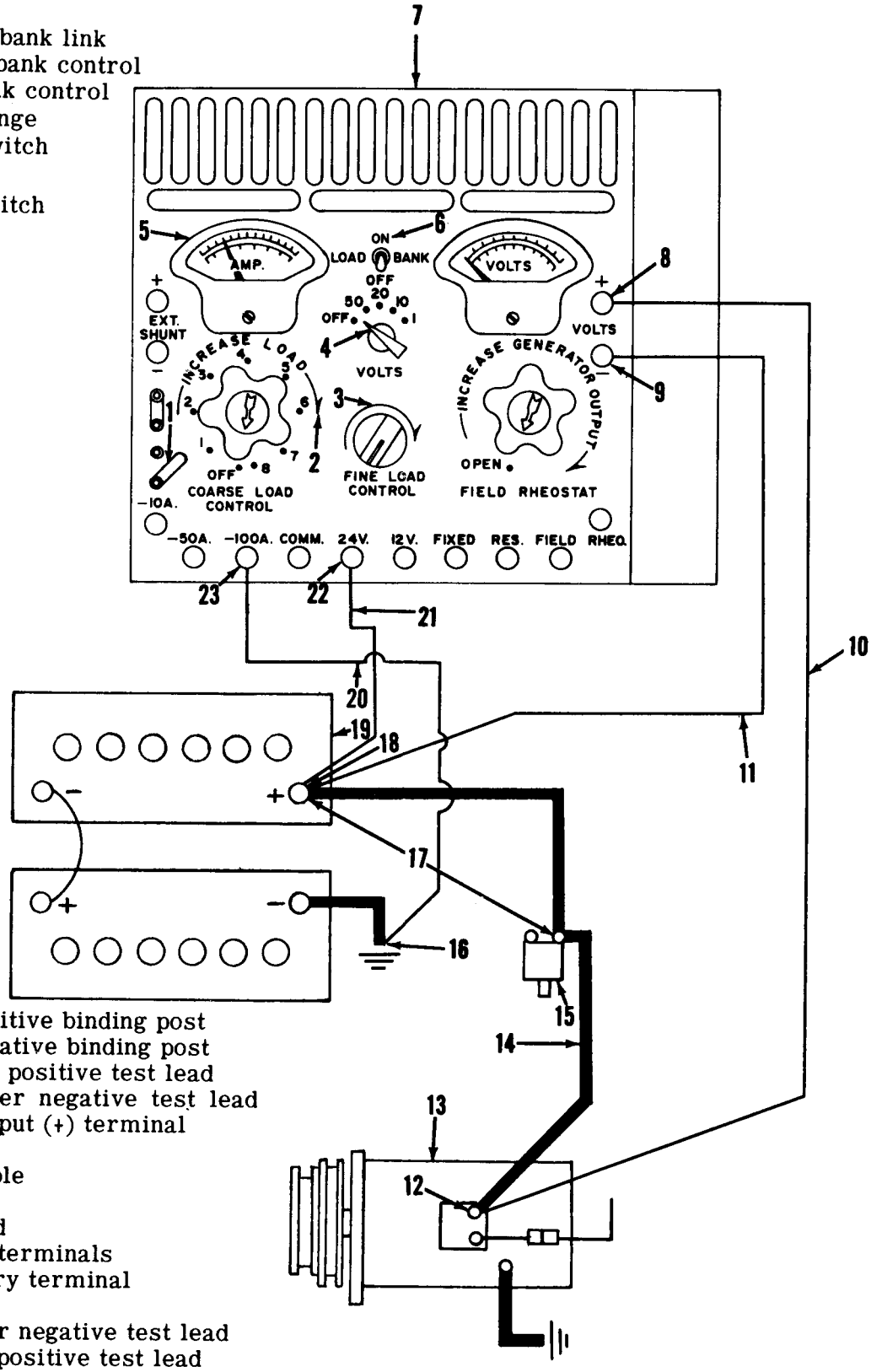
(a) This test is for 24 volts. The 12-volt load bank link (1) will be in the OPEN position,

(b) Connect one end of the red voltmeter positive (+) test lead (11) to the voltmeter positive (+) binding post (9) on the tester (7) and the other end to the ground terminal (16) on the alternator (17). Be sure to touch the ground terminal - not the alternator ground cable end (15).

(c) Connect one end of the black voltmeter negative (-) test lead (12) to the voltmeter negative (-) binding post (10) on the tester and the other end to the alternator ground (13).

KEY to fig. 2-22:

1. 12-Volt load bank link
2. Coarse load bank control
3. Fine load bank control
4. Voltmeter range selector switch
5. Ammeter
6. Load bank switch
7. Tester



8. Voltmeter positive binding post
9. Voltmeter negative binding post
10. Red voltmeter positive test lead
11. Black voltmeter negative test lead
12. Alternator output (+) terminal
13. Alternator
14. Alternator cable
15. Starter switch
16. Vehicle ground
17. Battery cable terminals
18. Positive battery terminal
19. Battery
20. Black ammeter negative test lead
21. Red ammeter positive test lead
22. 24-Volt load bank binding post
23. Ammeter negative -100 AMP binding post

WE 38487

Figure 2-22. Alternator to battery cable test. WE 38487

(d) Connect one end of the red ammeter positive (+) test lead (21) to the 24-volt load bank binding post (22) on the tester and the other end to the positive (+) battery terminal (19).

(e) Connect one end of the black ammeter negative (-) test lead (20) to the ammeter negative -100 AMP binding post (23) on the tester and the other end to vehicle ground (18).

(f) Start the engine and run at 1000 to 2000 RPM for 15 minutes.

(g) Place the voltmeter range selector switch (4) in the 50 volt position.

(h) Set the load bank switch (6) to ON position.

(i) Adjust the coarse and fine load bank controls (2 and 3) until the ammeter (5) indicates 60 amperes.

(j) Adjust the voltmeter range selector switch until a reading is obtained or the 1-volt range is reached. The voltmeter (8) should read less than 0.1 volt. If more, investigate and clean the alternator ground cable (14). Repeat alternator load test, in 2-9.b. above.

(k) After the test is completed, shut OFF the engine. Return switches to OFF position. Return coarse and fine load bank controls to maximum counterclockwise position. Remove all test leads. Close link on the tester to prevent damage.

e. *Rectifier Integrity Check (Meter Test).* Note: The key numbers shown below in parentheses refer to figure 2-24.

(1) *Purpose*. This test is performed to determine if the alternator has internal leakage.

(2) *Test procedures.*

(a) This test is for 24 volts. The 12-volt load bank link (1) will be in the OPEN position.

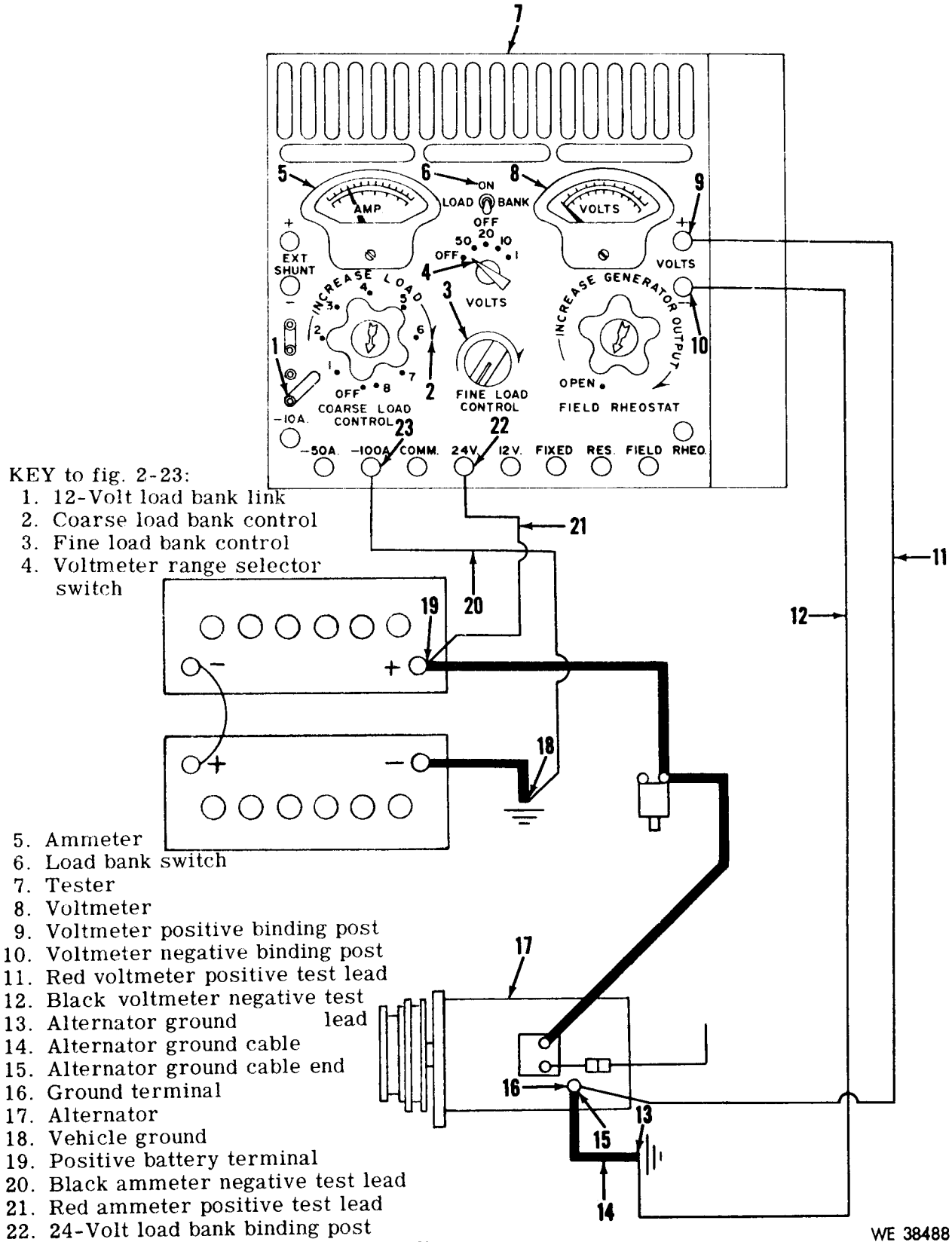
(b) Be sure engine and ignition switches are OFF.

(c) Remove the cable (8) from the alternator output (+) terminal (6). Touch lug (7) to terminal, If no sparks appear continue to step (d) below.

(d) Connect one end of the red ammeter positive (+) test lead (9) to the COMMON binding post (10) on the tester (3) and the other end to loose lug of cable removed in (c) above.

(e) Connect one end of the black ammeter negative (-) test lead (4) to the ammeter negative -10 AMP binding post (11) on the tester and use other end to perform test by touching the alternator output (+) terminal (6). There shouldn't be any indication on the ammeter (2) except a small jump at the moment of contact. If there is any indication on the ammeter, the alternator (5) has internal leakage and will discharge the battery in a day or two, depending on the severity of the leakage. If the ammeter shows an indication, replace the alternator with a known good one. If the ammeter doesn't show an indication, reinstall the cable to the alternator output (+) terminal and tighten securely.

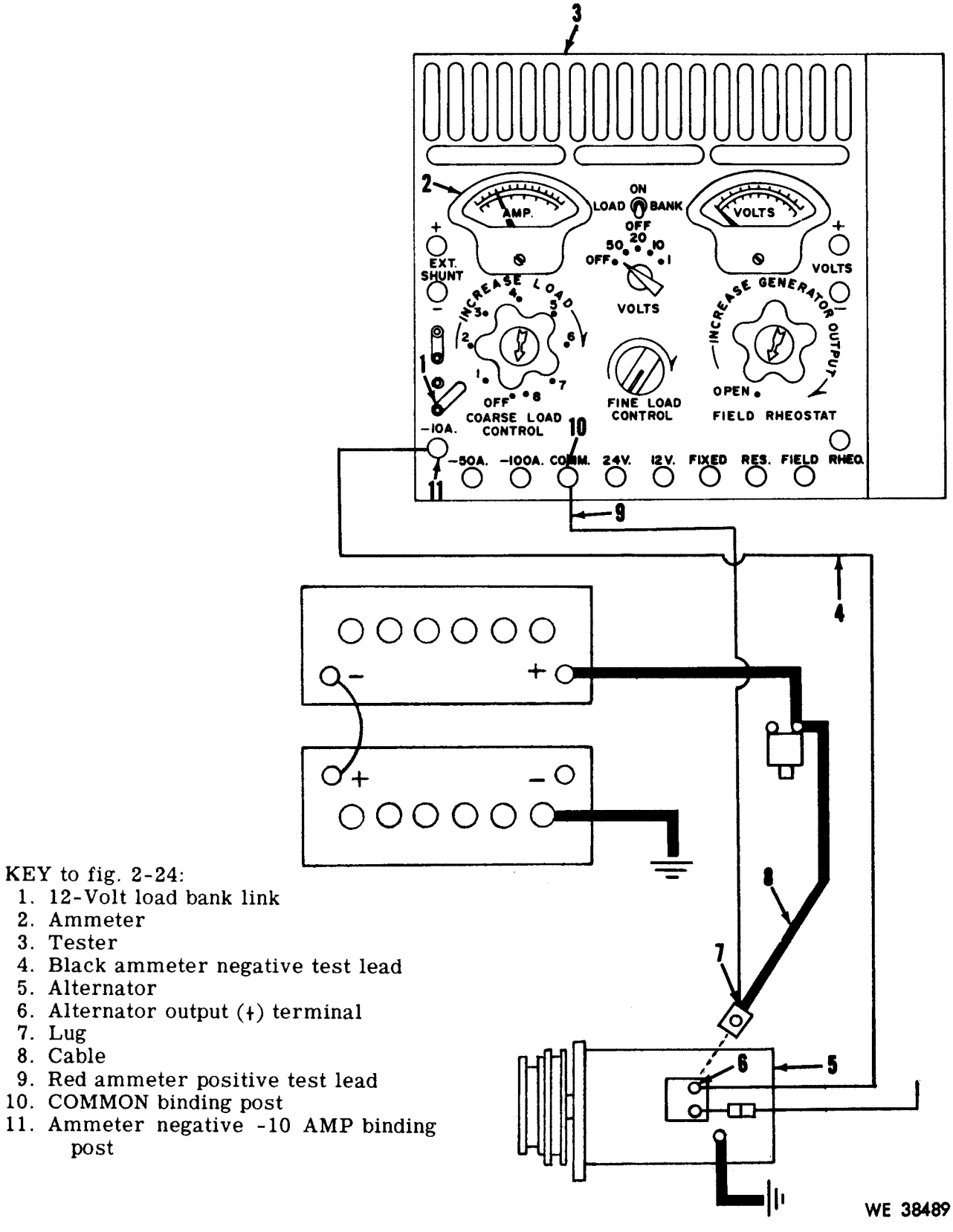
(f) After the test is completed, remove all test leads. Close link on the tester to prevent damage.



KEY to fig. 2-23:

1. 12-Volt load bank link
2. Coarse load bank control
3. Fine load bank control
4. Voltmeter range selector switch
5. Ammeter
6. Load bank switch
7. Tester
8. Voltmeter
9. Voltmeter positive binding post
10. Voltmeter negative binding post
11. Red voltmeter positive test lead
12. Black voltmeter negative test lead
13. Alternator ground lead
14. Alternator ground cable
15. Alternator ground cable end
16. Ground terminal
17. Alternator
18. Vehicle ground
19. Positive battery terminal
20. Black ammeter negative test lead
21. Red ammeter positive test lead
22. 24-Volt load bank binding post
23. Ammeter negative -100 AMP binding post

Figure 2-23. Alternator ground cable test. WE 38488



KEY to fig. 2-24:
1. 12-Volt load bank link
2. Ammeter
3. Tester
4. Black ammeter negative test lead
5. Alternator
6. Alternator output (+) terminal
7. Lug
8. Cable
9. Red ammeter positive test lead
10. COMMON binding post
11. Ammeter negative -10 AMP binding post

Figure 2-24. Rectifier integrity check (Meter test). WE 38489

CHAPTER 3

OPERATOR/CREW MAINTENANCE INSTRUCTIONS

Section I. BASIC ISSUE ITEMS

3-1. General. No basic issue items are supplied to the operator for replacement on the test set.

3-2. Repair Parts. No repair parts are supplied to the operator for replacement on the test set.

3-3. Common Tools and Equipment. No common tools or equipment are supplied or required by the operator for operation or maintenance.

3-4. Special Tools and Equipment. No tools or equipment specially designed for operation or operator maintenance are supplied or required for the test set.

Section II. LUBRICATION INSTRUCTIONS

3-5. Lubrication. No lubrication is required on the test set.

Section III. PREVENTIVE MAINTENANCE CHECKS AND SERVICES

3-6. General. To insure that the Test Set, Generator and Voltage Regulator Automotive is ready for operation at all times, it must be inspected systematically so that defects may be discovered and corrected before they result in serious damage or failure. The necessary preventive maintenance checks and services to be performed are listed as described in paragraph 3-8. The item numbers indicate the sequence of minimum inspection requirements. Defects discovered during operation of the unit will be noted for future correction to be made as soon as operation has ceased. Stop operation immediately if a deficiency is noted during operatior which would damage the equipment if operation were continued. All deficiencies and shortcomings will be recorded together with the corrective action taken on DA Form 2404 at the earliest possible opportunity.

a. *Responsibility and Interuals.* The primary function of preventive-maintenance is to prevent breakdowns and, therefore, the need for repair. These services consist generally of before-operation and after-operation services performed by the operator. Intervals are based on normal operations. Reduce intervals for abnormal operations for severe conditions. Intervals during the inactive periods may be extended accordingly.

b. *Definition of Terms.* The general inspection of each item applies also to any supporting member or connection and is generally a check to see whether the item is in good condition, correctly assembled, secure, and not excessively worn.

(1) The inspection for "good condition" is usually an external visual inspection to determine whether the unit is damaged beyond serviceable limits. The term "good condition" is explained further by the following: not bent or twisted, not chaffed or burred, not broken or cracked, not bare or frayed, not dented or collapsed, not torn or cut, not deteriorated.

(2) The inspection of a unit to see that it is "correctly assembled" is usually an external visual inspection to see whether it is in normal assembled position.

(3) Inspection of a unit to determine if it is "secure" is usually an external visual examination by hand or wrench for looseness. Such an examination must include any brackets, lockwashers, locknuts, locking wires, or cotter pins used.

(4) By "excessively worn" is meant worn beyond serviceable limits or to a point likely to result in failure if the unit is not replaced before the next scheduled inspection.

3-7. Cleaning.

a. *General.* Any special cleaning instructions required for specified com-

b. *General Precautions in Cleaning.*

(1) Provide adequate ventilation both during and after use of trichloroethane. Avoid prolonged inhalation of vapor. Rubber gloves should be worn since this cleaner has a drying effect on the skin.

(2) Self-emulsifying degreasing solvent compound, mineral spirits paint thinner, and dry-cleaning solvent are flammable and should not be used near an open flame. Fire extinguishers should be provided when these materials are used. Use only in well ventilated places. These cleaners evaporate quickly and have a drying effect on the skin. If used without gloves, they may cause cracks in the skin, and in the case of some individuals, a mild irritation or inflammation.

(3) Avoid getting petroleum products, such as mineral spirits paint thinner, dry-cleaning solvent, engine fuels, or lubricants, on rubber parts, as they will deteriorate the rubber.

(4) The use of Diesel fuel oil, gasoline, or benzene (benzol) for cleaning is prohibited.

c. *Rust Removal.* Remove rust or corrosion from all parts of the material. To remove rust or corrosion from unfinished surfaces, use steel cleaning brushes or abrasive cloth. On finished surfaces, other than highly polished surfaces, remove rust or corrosion by buffing with a rotary wheel wire brush constructed of steel wire between 0.010 and 0.025 inch in diameter. Crocus cloth may be used manually to remove rust or corrosion from polished surfaces.

3-8. Preventive Maintenance Checks and Services.

a. *Purpose.* To insure efficient operation, it is necessary that the test set be systematically inspected at intervals each day it is operated, so defects may be discovered and corrected before they result in serious damage or failure. Certain scheduled maintenance services will be performed at these designated intervals. The correction of any defect or unsatisfactory operating characteristics beyond the scope of the operator must be reported at the earliest opportunity to organization maintenance personnel for correction.

b. *Services.* Operator's preventive-maintenance services are listed in table 3-1. Every operator equipped with the test set must be thoroughly familiar with maintenance procedures for the materiel.

Table 3-1. Operator's Preventive Maintenance Services

Item No.	Procedures	Intervals		
		Paragraph reference	Before operation	After operation
1	Binding posts. Clean the binding posts (Fig. 2-1) by brushing dirt and other foreign matter from threaded posts and knurled screws.	3-7	X	X
2	Test leads and external shunt assembly.	3-7	X	
	a. Clean the test leads and external shunt assembly (Fig. 2-2) by wiping dirt and other foreign material from them.			
	b. Roll the test leads neatly and see that the leads, other equipment and publications are properly stored to prevent deterioration and/or damage.			
3	Carrying case.			
	a. Inspect the air intake grilles on top and bottom of carrying case for obstructions. Clean dirt and other foreign material from the vents.	. . .	X	
	b. Remove all test leads and other equipment from the stowage compartment.	2-4a	X	
4	Meters.			
	a. Clean meters (Fig. 2-1) by wiping dirt and other foreign material from the surface of the meter lens.	3-7	X	
	b. Adjust the pointer (needle) on each meter to zero.	2-4a	X	

Section IV. TROUBLESHOOTING

CAUTION

Operation of materiel without a preliminary examination can cause further damage to disabled component. Be careful during inspection and troubleshooting so that damage can be avoided.

3-9. Purpose. Troubleshooting is a systematic determination of malfunctions and defective components by indications, symptoms, and tests. Close adherence to the procedures covered herein will materially reduce the time required to locate trouble and restore the materiel to normal operation.

3-10. Scope. This section covers troubleshooting which is peculiar to the operator's (first echelon) maintenance operations.

3-11. Procedure. Malfunctions which may occur with the test set are listed in table 3-2. Upon observing any one of these malfunctions, take immediate steps to locate and correct the cause. Causes are listed opposite each malfunction and are arranged according to the ease of correction.

Table 3-2. Troubleshooting

Malfunction	Probable cause	Corrective action
1. Ammeter or voltmeter pointer (needle) not centered on zero (under no load).	a. Pointer (needle) needs zero adjustment.	a. Adjust pointer (needle) to zero (par. 2-4.a.(1).
	b. Other causes.	b. Refer other causes to higher echelon maintenance personnel for correction.
2. Ammeter pointer (needle) swings counterclockwise.	Wrong polarity.	Reverse test leads on unit or circuit being tested.
3. Ammeter not operating.	a. Loose connections at unit or circuit being tested.	a. Tighten connections at the unit or circuit.
	b Loose connections at binding posts.	b. Tighten binding posts on test leads.
	c Too high a range chosen.	c. Select a lower range (par. 2-4.b. (l)(b)).
	d Other causes.	d. Refer other causes to higher echelon maintenance personnel for correction.
4. Ammeter shows erratic reading.	. . . . .	Refer malfunction to higher echelon maintenance personnel for correction.
5. No deflection of voltmeter pointer (needle).	a Wrong polarity.	a. Reverse test lead on unit or circuit being tested.
	b Too high a range chosen.	b. Select a lower range (par. 2-4.b. (4) (g)).
	c Loose connections.	c. Tighten all connections.
	d Other causes.	d. Refer other causes to higher echelon maintenance personnel for correction.
6. No resistance across 1/4-OHM resistor binding posts when in series with unit being tested.	a. Loose connections at binding posts or at the unit or circuit being tested.	a. Tighten connections at binding posts on the unit or circuit being tested.
	b. Other causes.	b. Refer other causes to higher echelon maintenance personnel for correction.
7. Load bank switch not functioning.	. . . . .	Refer malfunction to higher echelon maintenance personnel for correction.
8. Voltmeter range selector switch not functioning.		Refer malfunction to higher echelon maintenance personnel for correction.
9. Field rheostat (70-OHM) not functioning.	a. Test leads loose at binding posts or circuit being tested.	a. Tighten test leads at binding posts and/or circuit being tested.
	b. Other causes.	b. Refer other causes to higher echelon maintenance personnel for correction.
10 Load bank control not functioning.	a. Loose connections at binding posts or circuit being tested.	a. Tighten connections at binding posts and/or circuit being tested.
	b. Other causes.	b. Refer other causes to higher echelon maintenance personnel for correction.

CHAPTER 4

ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

Section I. REPAIR PARTS, SPECIAL TOOLS, AND EQUIPMENT

4-1. General. Repair parts, tools, and and equipment over and above those avail - able to the operator are supplied to the using organization for maintaining the test set. Tools and equipment should not be used for purposes other than prescribed and, when not in use, should be properly stored.

4-2. Tools and Equipment. Common tools and equipment having general application to this materiel are authorized by tables of allowances and tables of organization and equipment.

4-3. Special Tools and Equipment. No tools or equipment specially designed for organizational maintenance are supplied or required for the test set.

4-4. Maintenance Repair Parts. Repair parts are supplied to the using organization for replacement of those parts most likely to become worn, broken, or otherwise unserviceable, providing replacement of these parts is within the scope of organizational maintenance functions. Repair parts are listed and illustrated in Appendix c.

Section II. PREVENTIVE MAINTENANCE CHECKS AND SERVICES

4-5. General Refer to paragraphs 3-6 through 3-8 for preventive-maintenance services for the operator. These instructions apply equally to maintenance personnel of the using organization.

4-6. Organizational Preventive Maintenante Checks and Services. . The using organization is further responsible for services listed in table 4-1 and must thoroughly train its personnel in performing the maintenance procedures for this materiel.

Table 4-1. Organizational Preventive Maintenance Services

Item No.	Procedures	Intervals			
		Paragraph references	Weekly	Monthly	Quarterly
1	Binding posts.				
	a. Remove corrosion from all binding posts (Fig. 2-l).	3-7	...	x	
	b. Inspect the transverse holes in the posts for burs or flat spots, and remove if necessary using a round file.	. .	...	**x**	...
	c. Apply a coating of automotive and artillery grease (MIL-G-10924) to the threaded parts of the posts to prevent further corrosion.	2-1	...	x	...
2	Test leads and external shunt assembly.				
	a. Inspect test leads and external shunt assembly instrument (Fig. 2-2) for frayed, broken, cracked, or burned insulation.	...	x	...	
	b. Remove corrosion from the tip plugs and electrical clips on test leads and external shunt.	3-7	...	x	
	c. Apply a coating of automotive and artillery grease (MIL-G-10924) to tip plugs and electrical clips to prevent further corrosion.	2-1	...	x	
	d. Tape any frayed or cracked insulation.	...	...	**x**	
3	Switches, rheostats, and knobs.				
	a. Inspect the knobs on switches and rheostats for being secure. Tighten setscrew in knob if loose fit is determined.	2-1	...	x	
	b. Make sure that the rheostats functions smoothly and the switches have a positive action.	...	...	x	...
4	Carrying case.				
	a. Inspect the hinge pins and clasps on the carrying case for distorted or damaged condition. Straighten distorted pins and aline fasteners with the catches on the cover of the case.	...	...	...	x
	b. Inspect the air intake grilles on the top and bottom of the carrying case for obstructions which may interfere with proper ventilation of the test set.	...	. .	**x**	...

Section III. TROUBLESHOOTING

CAUTION

Operation of materiel without a preliminary examination can cause further damage to a disabled component. Be careful during inspection and troubleshooting, so that damage can be avoided.

4-7. Purpose. Troubleshooting is a systematic determination of malfunctions and defective components by indications, symptoms, and tests. Close adherence to the procedures covered herein will materially reduce the time required to locate trouble and restore the materiel to normal operation.

4-8. Scope. This section covers troubleshooting which is peculiar to organizational (second echelon) maintenance operations. For troubleshooting procedures performed by the operator, refer to chapter three, paragraphs 3-9 through 3-11.

4-9. Procedure. Malfunctions which may occur with the test set are listed in tables 3-2 and 4-2. In effect, table 4-2 is the continuation of table 3-2, paragraph 3-11. Causes are listed opposite each malfunction and are arranged according to the ease of correction.

Table 4-2. Troubleshooting

Malfunction	Probable cause	Corrective action
1. Ammeter or voltmeter pointer (needle) not resting on zero (under no load).	. . . . .	Refer malfunction to higher echelon maintenance personnel for correction.
2. Ammeter not functioning.	a. Broken test lead(s).	a. Check continuity of test lead(s), using a test light or ohmmeter. Replace unserviceable test lead(s).
	b. Corrosion on binding posts and/or terminals on test lead(s).	b. Clean corrosion from binding posts and/or the terminals on test lead(s) (par. 3-7).
	c. Other causes.	c. Refer other causes to higher echelon maintenance personnel for correction.
3. Ammeter shows erratic reading.	a. Corrosion on binding posts and/or terminals on test lead(s).	a. Clean corrosion from binding posts and/or terminals on test lead(s) (par. 3-7).
	b. Broken or nearly broken test lead(s).	b. Check continuity of test lead(s), using a test light or ohmmeter. Replace unserviceable test lead(s).
	c. Other causes.	c. Refer other causes to higher echelon maintenance personnel for correction.
4. Voltmeter not functioning.	a. Broken test lead(s).	a. Check continuity of test lead(s), using a test light or ohmmeter. Replace unserviceable test lead(s).
	b. Corrosion on binding posts and/or terminals on test lead(s).	b. Clean corrosion from binding posts and/or terminals on test lead(s) (par. 3-7).
	c. Other causes.	c. Refer other causes to higher echelon maintenance personnal for correction.

Table 4-2. ***Troubleshooting - Continued***

Corrective action	Malfunction	Probable cause
5. Voltmeter shows erratic reading.	a. Corrosion on binding posts and/or terminals on test lead(s).	a. Clean corrosion from binding posts and/or terminals on test lead(s) (par. 3-7).
	b. Broken or nearly broken test lead(s).	b. Check continuity of test lead(s), using a test light or ohmmeter. Replace unserviceable test lead(s).
	c. Other causes.	c. Refer other causes to higher echelon maintenance personnel for correction.
6. l/4-OHM resistor circuit not functioning.	a. Corrosion on binding posts and/or terminals on test lead(s).	a. Clean corrosion from binding posts and/or terminals on test lead(s) (par. 3-7).
	b. Broken test lead(s).	b. Check continuity of test lead(s), using a test light or ohmmeter. Replace unserviceable test lead(s).
	c. Other causes.	c. Refer other causes to higher echelon maintenance personnel for correction.
7. Load bank switch not functioning.	. . . . .	Refer malfunction to higher echelon maintenance personnel for correction.
8. Voltmeter range selector switch not functioning.	. . . . .	Refer malfunction to higher echelon maintenance personnel for correction.
9. Field rheostat (70-OHM), not functioning.	. . . . .	Refer malfunction to higher echelon maintenance personnel for correction.
10. Load bank control not functioning.	. . . . .	Refer malfunction to higher echelon maintenance personnel for correction.

Section IV. MAINTENANCE OF LEAD ASSEMBLIES

4-10. Ammeter Negative and Positive Test Leads.

Note: The kev numbers shown below in parentheses refer to figure 4-1.

a. *Description*. The ammeter negative (-) test lead or positive (+) test lead consists of 9 feet of AWG No. 6 electrical wire (1) with a straight type tip plug (7) on one end and a battery style electrical clip (5) on the other end. The electrical clip is insulated with an electrical connector cover. The black electrical connector cover (3) is designated negative (-) lead, and the red electrical cable nipple (6) is designated positive (+) lead for identification. A machine screw (4) on the electrical clip connects the terminal lug (2) on the electrical wire.

b. *Maintenance*.

(1) *General*. Organizational maintenance is limited to such disassembly and assembly required to replace the electrical clip, black electrical connector cover or red electrical cable nipple, tip plug, terminal lug, electrical wire, and machine screw.

(2) Disassembly.

(a) Remove the tip plug by first heating it with a hot soldering iron until the solder melts, then using a pair of pliers, pull it from the electrical wire.

(b) Slide the black electrical connector cover or red electrical cable nipple up the electrical wire, and remove the machine screw from the electrical clip. Remove the electrical clip and the black electrical connector cover or red electrical cable nipple from the electrical wire. Install the machine screw in the electrical clip to prevent loss.

(c) Remove the terminal lug from the electrical wire, using pliers and a hot soldering iron as prescribed in (a) above.

(3) *Inspection*.

(a) Inspect the insulation on the electrical wire for being hard, brittle, spongy, oil soaked, cracked, or worn.

(b) Inspect the electrical clip for stripped threads, loss of tension, and distortion.

(c) Inspect the tip plug and the terminal lug for distortion and blunted or misshaped tip or eyelet.

(d) Inspect the black electrical connector cover or red electrical cable nipple, for being spongy, oil soaked, brittle, or cracked.

(e) Replace any components determined to be unserviceable.

(4) *Assembly*.

(a) Slide the black electrical connector cover or red electrical cable nipple, over one end of the electrical wire and solder a terminal lug on the end of the electrical wire. Solder a tip plug on the opposite end of the electrical wire.

(b) Install the electrical clip on the terminal lug and secure the electrical clip to the terminal lug with the machine screw. Slide the black electrical connector cover or red electrical cable nipple over the electrical clip.

4-11. Field Test Leads and Voltmeter Negative and Positive Test Leads.

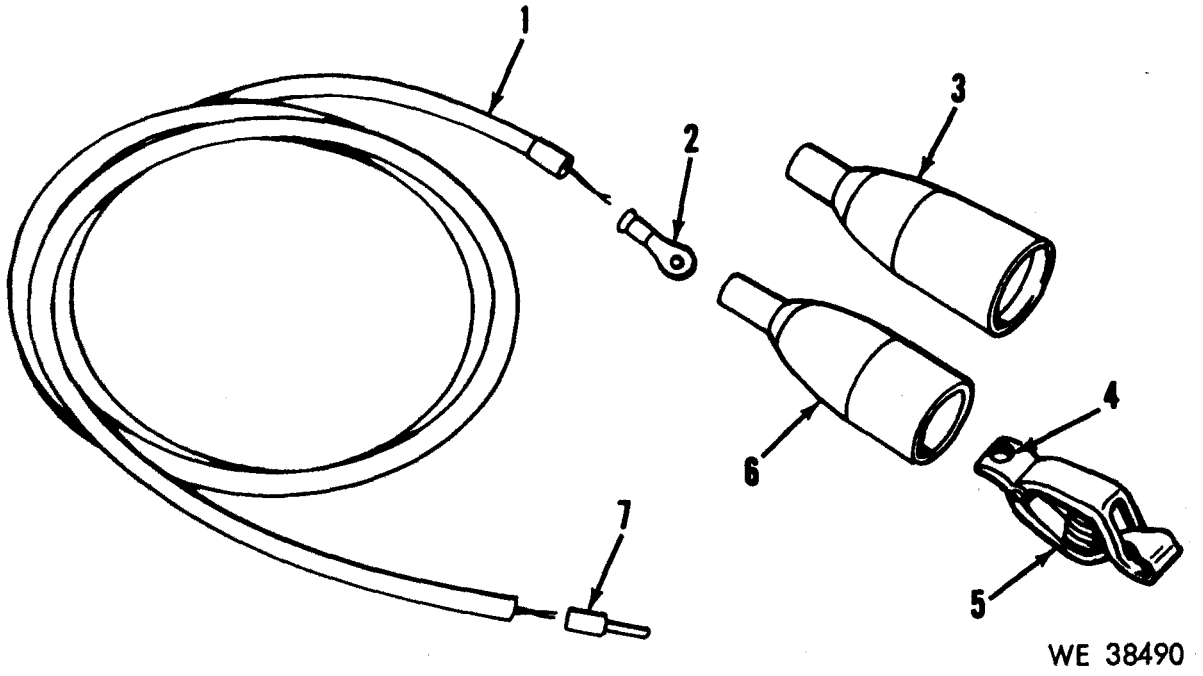
Note: The key numbers shown below in parentheses refer to figure 4-2.

a. *Description*.

(1) *Field test leads*. Two field test leads are supplied with each test set. Each lead consists of 9 feet of AWG No. 16 electrical wire (4) with a step type tip plug (5) soldered to one end, and a battery style electrical clip (1) secured to the opposite end. The electrical clip is insulated with a black electrical cable nipple (3). A machine screw (2) secures the electrical wire to the electrical clip.

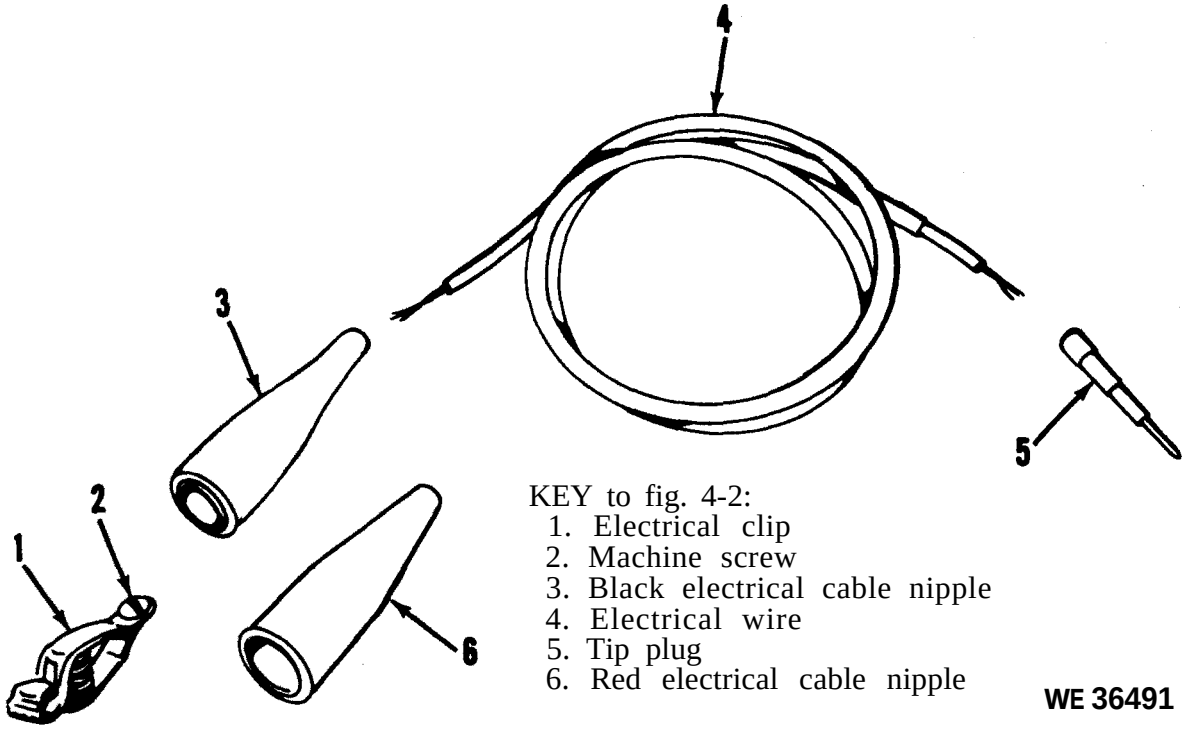
(2) *Voltmeter negative test lead*. The voltmeter negative (-) test lead is identical to that of the field test lead in (1) above. A black electrical cable nipple identifies the lead as negative (-).

(3) *Voltmeter positive test lead*. The voltmeter positive (+) test lead is identical to that of the field test lead and the voltmeter negative (-) test lead in (1) and (2) above, except that the red electrical cable nipple (6) identifies the lead as positive (+).



KEY to fig. 4-1:
1. Electrical wire
2. Terminal lug
3. Black electrical connector cover
4. Machine screw
5. Electrical clip
6. Red electrical cable nipple
7. Tip plug

Figure 4-1. *Ammeter negative or positive test lead.* WE 38490



KEY to fig. 4-2:
1. Electrical clip
2. Machine screw
3. Black electrical cable nipple
4. Electrical wire
5. Tip plug
6. Red electrical cable nipple

Figure 4-2. *Field test leads and voltmeter negative and positive test leads.* WE 38491

b. *Maintenance.*

(1) *General.* Organizational maintenance is limited to such disassembly and assembly required to replace the electrical clip, electrical cable nipple (red or black), tip plug, machine screw, and electrical wire.

(2) Disassembly.

(a) Hold a hot soldering iron on the tip plug until the solder melts and then using pliers, pull the tip plug off the electrical wire.

(b) Slide the electrical cable nipple (red or black) up the electrical wire, and remove the machine screw from the electrical clip. Remove the electrical clip and the electrical cable nipple (red or black) from the electrical wire. Install the machine screw in the electrical clip to prevent loss.

(3) *Inspection.*

(a) Inspect the tip plug for distortion and blunted or misshaped end.

(b) Inspect the electrical clip for stripped threads, loss of tension, and distortion.

(c) Inspect the electrical cable nipple (red or black) for being spongy, oil soaked, brittle, or cracked.

(d) Inspect the insulation on the electrical wire for being hard, brittle, spongy, oil soaked, cracked, or worn.

(e) Replace any components determined to be unserviceable.

(4) *Assembly.*

(a) Slide an electrical cable nipple (red or black) over one end of the electrical wire and secure the electrical wire to the electrical clip, using the machine screw. Slide the electrical cable nipple (red or black) over the electrical clip.

(b) Solder a tip plug on the opposite end of the electrical wire, using a hot soldering iron.

4-12. Jumper Test Lead.

Note: The key numbers shown below in parentheses refer to figure 4-3.

a. *Description.* The jumper test lead consists of one foot of AWG No. 16 electrical wire (3) with a battery style electrical clip (4) fastened to each end. Each electrical clip is insulated with a black electrical cable nipple (2). A machine screw (1) secures the electrical wire to the electrical clip.

b. *Maintenance.*

(1) *General.* Organizational maintenance is limited to such disassembly and assembly required to replace the electrical clips, black electrical cable nipples, machine screws, and electrical wire.

(2) *Disassembly.*

(a) Slide the black electrical cable nipple up the electrical wire and loosen the machine screw securing the electrical wire to the electrical clip. Remove the electrical clip and black electrical cable nipple.

(b) Remove the remaining black electrical cable nipple and electrical clip from the opposite end of the electrical wire, using the same method as in (a) above.

(3) *Inspection.*

(a) Inspect the two electrical clips for stripped threads, loss of tension, and distortion.

(b) Inspect the two black electrical cable nipples for being spongy, oil soaked, brittle, or cracked.

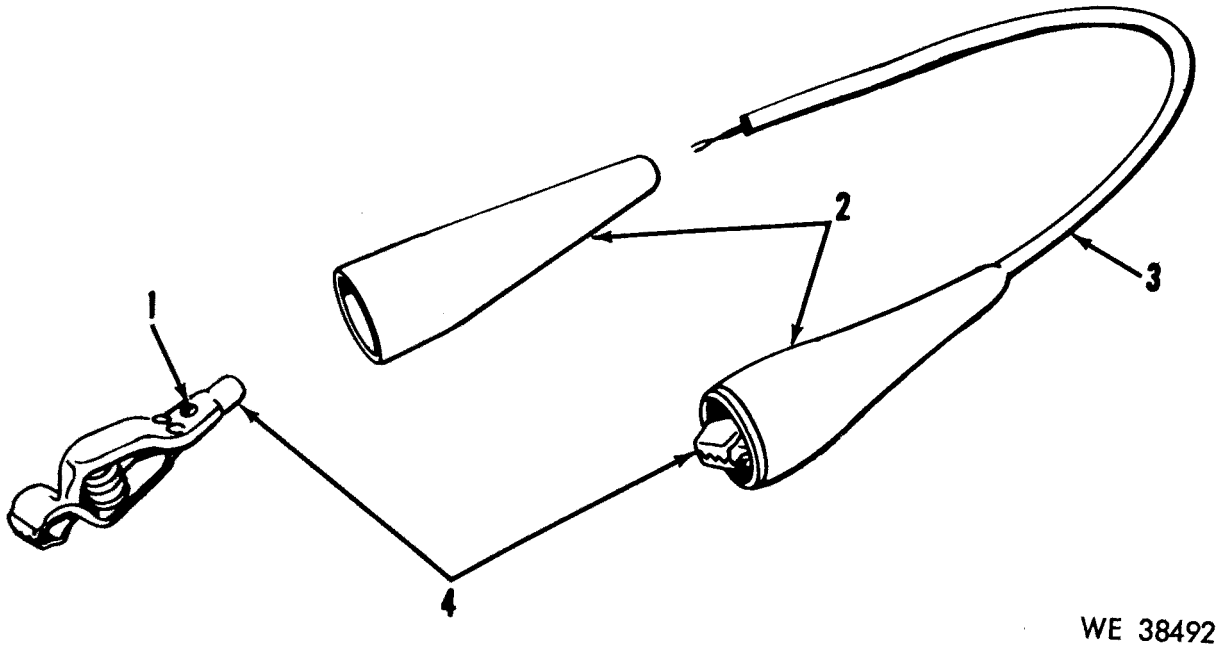
(c) Inspect the insulation on the electrical wire for being hard, brittle, spongy, oil soaked, cracked, or worn.

(d) Replace any components determined to be unserviceable.

(4) *Assembly.*

(a) Slide a black electrical cable nipple over one end of the electrical wire and wrap the bared end of the electrical wire around the machine screw which is screwed into the electrical clip. Tighten the machine screw to secure the electrical wire in place. Slide the black electrical cable nipple over the electrical clip.

(b) Install the remaining black electrical cable nipple and electrical clip on the opposite end of the electrical wire, using the same methods in (a) above.



KEY to fig. 4-3:
1. Machine screw
2. Black electrical cable nipple
3. Electrical wire
4. Electrical clip

Figure 4-3. *Jumper test lead.* WE 38492

CHAPTER 5

DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE INSTRUCTIONS

Section I. REPAIR PARTS, SPECIAL TOOLS, AND EQUIPMENT

5-1. General. Repair parts, tools, and equipment over and above those available to the using organization are supplied to direct support and general support maintenance units for repairing the test set. Tools and equipment should not be used for purposes other than prescribed and, when not in use, should be properly stored.

5-2. Tools and Equipment. Common tools and equipment having general application to this materiel are authorized by tables of allowances and tables of organization and equipment.

5-3. Special Tools and Equipment. No special tools or equipment are supplied or required for direct support and general support maintenance of test set.

5-4. Maintenance Repair Parts. Repair parts are supplied to direct support and general support maintenance units for replacement of those parts most likely to become worn, broken, or otherwise unserviceable, providing replacement of these parts is within the scope of direct support and general support maintenance functions. Repair parts are listed and illustrated in Appendix C.

Section II. TROUBLESHOOTING

CAUTION

Operation of materiel without a preliminary examination can cause further damage to a disabled component. Be careful during inspection and troubleshooting, so that damage can be avoided.

5-5. Purpose. Troubleshooting is a systematic determination of malfunctions and defective components by indications, symptoms, and tests, Close adherence to the procedures covered herein will materially reduce the time required to locate trouble and restore the materiel to normal operation.

5-6. Scope. This section covers troubleshooting which is peculiar to direct support (third echelon) and general support (fourth echelon) maintenance operations. For troubleshooting procedures performed by lower echelons of maintenance, refer to chapters three and four.

5-7. Procedure. Malfunctions which may occur with the test set are listed in tables 3-2, 4-2, and 5-1. In effect, table 5-1 is the continuation of table 3-2, paragraph 3-11; and table 4-2, paragraph 4-9. Causes are listed opposite each malfunction and are arranged according to the ease of correction.

Table 5-1. Troubleshooting

Malfunction	Probable cause	Corrective action
1. Rheostats not working properly	a. Loose knob	a. Tighten knob.
	b. Broken terminals	b. Replace rheostat (par. 5-31).
	c. Damaged windings	c. Replace rheostat (par. 5-31).
	d. Sliding brush contact worn	d. Replace rheostat (par. 5-31).
	e. Stripped threads	e. Replace rheostat (par. 5-31).
	f. Binding shaft	f. Replace rheostat (par. 5-31).
2. Switches not working properly	a. Loose knob	a. Tighten knob.
	b. Broken terminals	b. Replace switch (par. 5-27, and 5-29).
	c. Sticking or binding contacts	c. Replace switch (par. 5-27, and 5-29).
	d. Cracked case	d. Replace switch (par. 5-27, and 5-29).
	e. Weak or broken spring	e. Replace switch (par. 5-27, and 5-29).
3. Overheating evidenced by smoke, smell, or burned insulation	a. Obstruction to air intake	a. Remove all obstructions.
	b. Loose terminal connections	b. Tighten terminal connections.
4. Binding post not holding leads securely	a. Binding post w/screw cracked or broken	a. Replace binding post.
	b. Stripped threads	b. Replace binding post.
	c. Misalinement	c. Replace binding post.
5. Load resistors not functioning properly	a. Loose connection	a. Tighten connection.
	b. Unserviceable resistor	b. Replace resistor (par. 5-29).
6. No voltage or erratic voltage indicated on voltmeter when 70-OHM field rheostat is utilized	a. Loose connection	a. Tighten connections.
	b. Defective 70-OHM field rheostat	b. Replace defective 70-OHM field rheostat (par. 5-31).
7. No voltage indicated on voltmeter when l/4-OHM resistor is utilized	a. Loose connection	a. Tighten connections.
	b. Unserviceable l/4-OHM resistor	b. Replace l/4-OHM resistor (par. 5-35).
8. Meters not functioning	a. Loose connections on meters	a. Tighten and/or resolder connections (par. 5-28).
	b. Meter burned out	b. Replace meter (par. 5-28).
9. Electrical circuits not functioning	a. Loose connections	a. Tighten connections,
	b. Components short-circuited	b. Make resistance or continuity test and replace defective parts.

Section III. GENERAL MAINTENANCE

5-8. General. Special repair procedures required for specific components or parts are contained in chapter 6. Bolts, nuts, screws, spacers, washers, and other small common parts will be replaced if multilated in anyway.

5-9. Lubrication. No lubrication is required on the test set.

5-10. Cleanlng. Any special cleaning instructions required for specific components or parts are contained in pertinent sections. Refer to paragraph 3-7 for general cleaning instructions and general cleaning precautions. Additional instructions for cleaning and paint and rust removal are given in a. through c. below.

a. *Paint Removal.* To remove paint from ferrous parts, use paint remover, alkali-type, class 1; from nonferrous parts, use paint remover, alkali-type, class 2.

CAUTION

Paint removers (alkali-type) contain caustic soda which is very destructive to the body and dissolves woolen clothing. Wear rubber apron, gloves, and goggles while handling this alkali. Special care must be taken to avoid getting any in the eyes. Precautions must be taken to prevent inhaling small particles while in the dry form. Solutions must be kept in containers of iron, glass, or in emergency, in a wooden container - do not use aluminum or galvanized containers. If taken internally, call a physician and give large dosage of vinegar or lemon juice, followed by butter, olive oil, or cottonseed oil. Assist vomiting by drinking large quantities of lukewarm water. When the skin has been exposed to caustic soda, wash thoroughly with water, then vinegar or a 5 percent solution of acetic acid. Bandage after applying emollient such as petroleum jelly or olive oil.

b. *Rust Removal.* Rust may be removed as prescribed in paragraph 3-7 or as follows, when necessary materials are available. To remove rust or corrosion from unfinished surfaces, use sandblast or vaporblast equipment, metal conditioner, and rust remover (phosphoric acid base) or rust-removing acid. On highly polished surfaces, remove rust or corrosion by buffing with a cloth buffing wheel charged with buffing compound and apply very light buffing pressure,

c. *Precautions in Use of Acids.* When using acid for cleaning, pour acid into water; do not pour water into acid. Avoid contact with skin and eyes. Avoid breathing vapor. In case of contact, immediately flush skin and bathe the eyes with plenty of water for at least 15 minutes; for eyes, get medical attention.

5-11. Removing Setscrews.

a. *Removal of Undamaged Setscrews.* When a setscrew is to be removed, it may be necessary to dig out or scrape off dirt or covering paint. A sharpened piece of hardwood or brass wire are good tools for this purpose. Do not use a screwdriver, as this action may damage both the screwdriver blade and the threads in the screw hold. When the head of the screw can be seen, insert a screwdriver or wrench of the proper size and design and remove the screw.

b. *Precautions.* If the screw will not back out when normal torque is applied with a screwdriver or wrench, do not force it. It may have been sealed in position with shellac or another fixing agent. If so, apply a few drops of alcohol to the screw head and allow it to soak for a few minutes. Again insert the screwdriver or wrench, and exert a slight back and forth pressure. Repeat this process until the screw can be removed by normal torque.

c. *Removal of Damaged Setscrews.*

(1) If the slot of a setscrew below the surface is damaged, the best method, usually, is to drill out the setscrew and tap the hole for the next larger size setscrew. If this is to be done, set up the parts to be drilled in a firm position on a drill press, with the drill parallel to the setscrew, and carefully drill out the screw. It is good practice to use the tap drill corresponding to the size of the setscrew to be used as a replacement. If the setscrew is not too small, it may be possible to drill a small hole in it and remove it with a screw extractor. If the setscrew is near the surface, it may be possible to slot it sufficiently, thus saving time that would be spent in drilling and tapping.

(2) A setscrew that can be turned but

which does not back out indicates a stripped thread condition. It may be possible to back out the screw if the part held in place by the setscrew can be turned enough to put slight stress on it, thus allowing those threads still undamaged to engage. It may then be possible to work the screw out of the hole.

5-12. Painting. Preparation for painting and painting procedures are described in detail in TM 9-213. Internal sliding surfaces, and screw threads (except screws assembled to painted surfaces), will not show any traces of paint. Painting of the test set or parts may be done at the most practical stage of assembly, but all surfaces that should not be painted must be carefully masked.

5-13. Welding. Welding of parts may be done in accordance with standards set forth in TM 9-237.

5-14. Soldering. Soldering of parts may be done in accordance with standards set forth in TB Sig 222.

5-15. Fabrication. Heat board, binding posts/w screws, copper plates, fiber washers, rubber gaskets, and spacers may be fabricated from stock material when it is considered economically practicable. When fabricating adhere to all specified tolerances on drawings.

5-16. Final Inspection. Final inspection is performed to insure that the materiel is serviceable after all repairs have been completed and the test set has been reassembled.

a. *Visual Inspection.* Perform visual inspection to assure that all components are properly installed, adjusted, connected, and secured. This will assure the following items are in acceptable condition.

(1) Meter dials not obliterated; lens not scratched, cracked, or broken; needle pointer not distorted; and case not cracked, chipped, or broken.

(2) Switch, switch toggle, and knobs are present and secure; not loose, cracked, chipped, or broken; pointers on switch and knobs not distorted and markings not obliterated.

(3) Binding posts not cracked, chipped, or broken; distorted or bent.

(4) Case cover secure on hinges; not dented, bulged, or distorted; latches secure on case and case cover, and operating correctly. Handles secure on case.

(5) Air intake grilles on the top and bottom are free of obstructions which may interfere with proper ventilation of the test set.

(6) Check Appendix C to be sure every item is present and in serviceable condition.

b. *Functional Inspection.* Operate the test set by performing several test procedures. Refer to Chapter 2, paragraphs 2-6 through 2-9 for instructions for performing these tests.

Section IV. REMOVAL AND INSTALLATION OF MAJOR COMPONENTS AND AUXILIARIES

Note: The key numbers shown in parentheses refer to figure number in parentheses shown after description of paragraph unless otherwise annotated.

5-17. General. This section contains procedures for the removal and installation of all major units and auxiliaries. Paragraphs are arranged in the order in which the units should logically be removed. This is the responsibility of direct support and general support maintenance as authorized by the Maintenance Allocation Chart. The procedure is for removal of parts. Use reverse procedure to reassemble or replace parts. Figure 1-1 is top view of Allen model 30-92 test set before disassembly.

5-18. Remove cover (Fig. 5-1). Release locks (3) on side of case (4) and slide cover (1) to left until pins (2) are free of case. A rubber foot w/screw (not shown) on each underside corner is used to support unit.

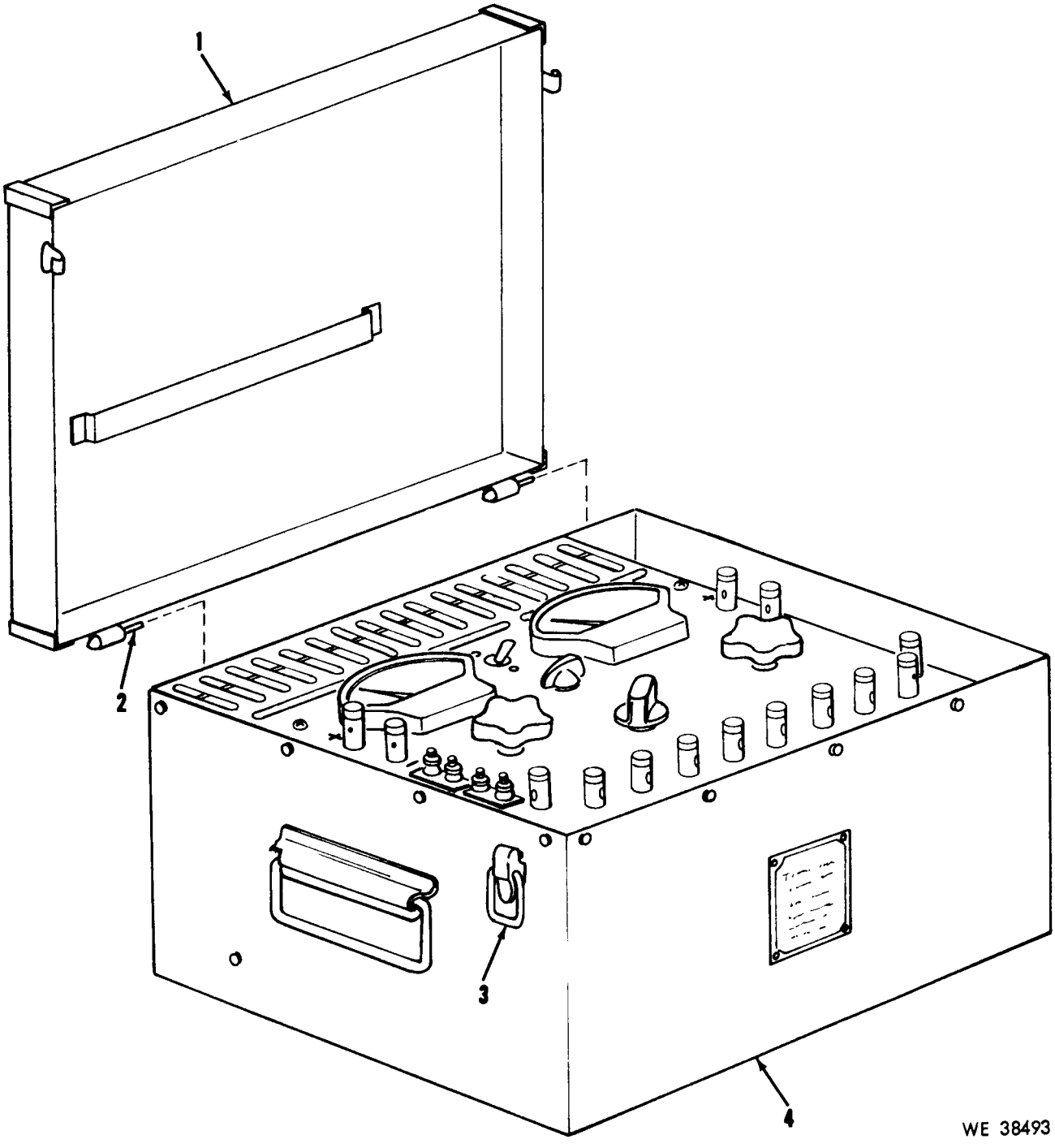
5-19. Remove Panel (Fig. 5-2). Remove all machine screws (1) and lock washers (2). There are 15 of each. All except one machine screw (4) can be removed from outside of case (6). The one exception is located inside of test lead compartment (5). There is an opening on the right side of case (6) where a Phillips screwdriver can be inserted to reach this screw (4), after the test leads have been removed from compartment (5). Slide panel assembly (3) from case (6).

5-20. Remove Panel Assembly from Load Bank Resistor Board Assembly (Fig. 5-3). Remove two machine screws (3) and two lock washers (4) connecting panel assembly (2) and load bank resistor board assembly (l).

5-21. View of Wiring before Disassembly (Fig. 5-4).

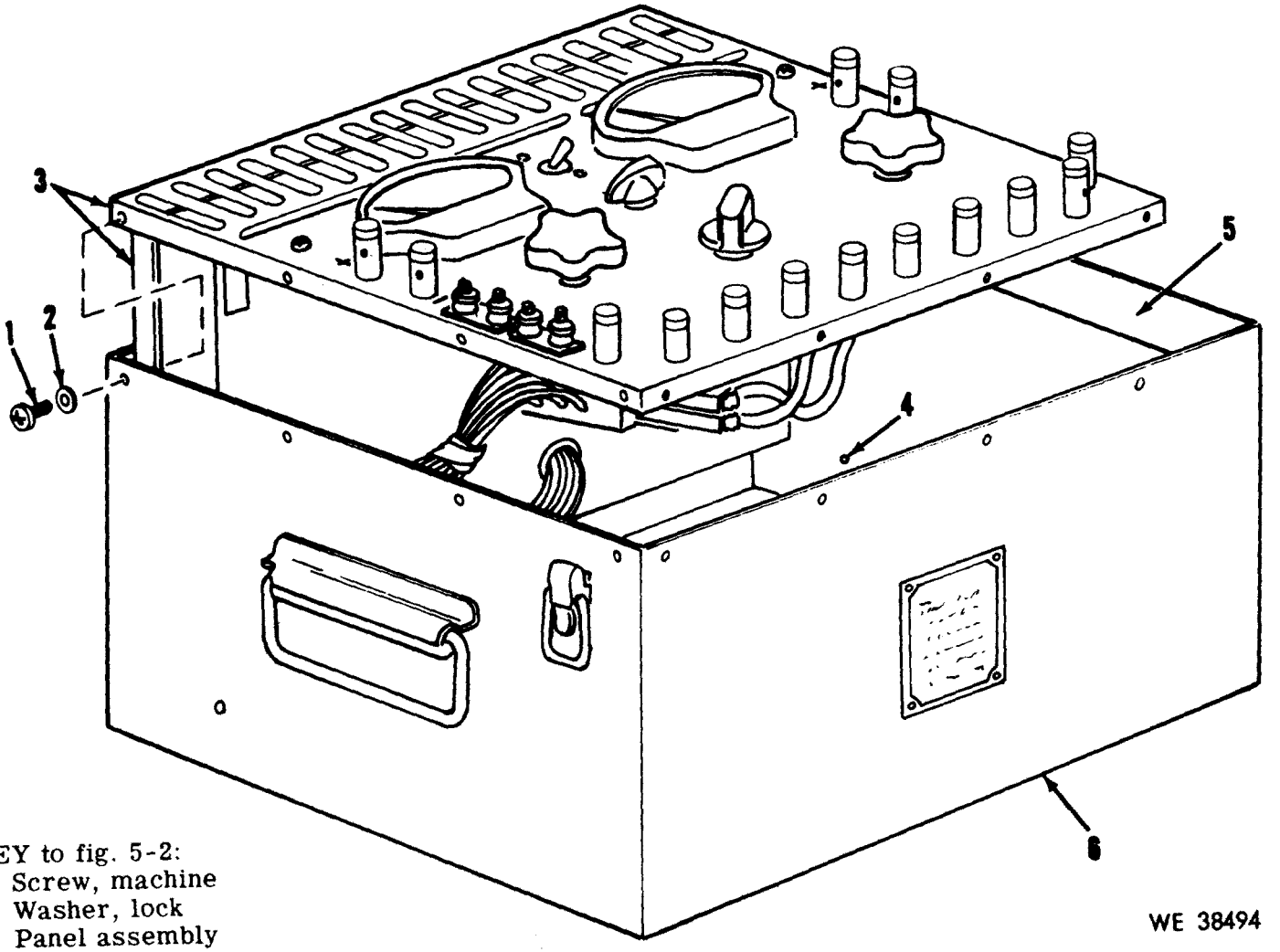
5-22. Disassemble of Load Bank Resistor Board Assembly (Fig. 5-5). Leave one end of each of the following electrical wires connected to load bank resistor board, heat board (4). Keep identification tag on electrical wires. Mark number shown on tag at position it is separated. This will aid in replacement of electrical wire. Disassembly of other end of electrical wires with key numbers in parentheses is as follows:

Electrical Wire		Disconnect Terminal Lugs		*Item Separated from and Reference Figure Number*
Qty	*AWG*	*Qty*	*Method of Separation*	
1	10(13)	. . . .	Desolder	Fine load bank control rheostat assembly (Fig. 5-4)
2	6 (7)	2 (8)	Disconnect	Load bank switch assembly (Fig. 5-4)
1	16(11)	1 (9)	Disconnect	12 V link assembly (Fig. 5-4)
15	16(12)	. . . .	Desolder	Coarse load bank control assembly (Fig. 5-4)



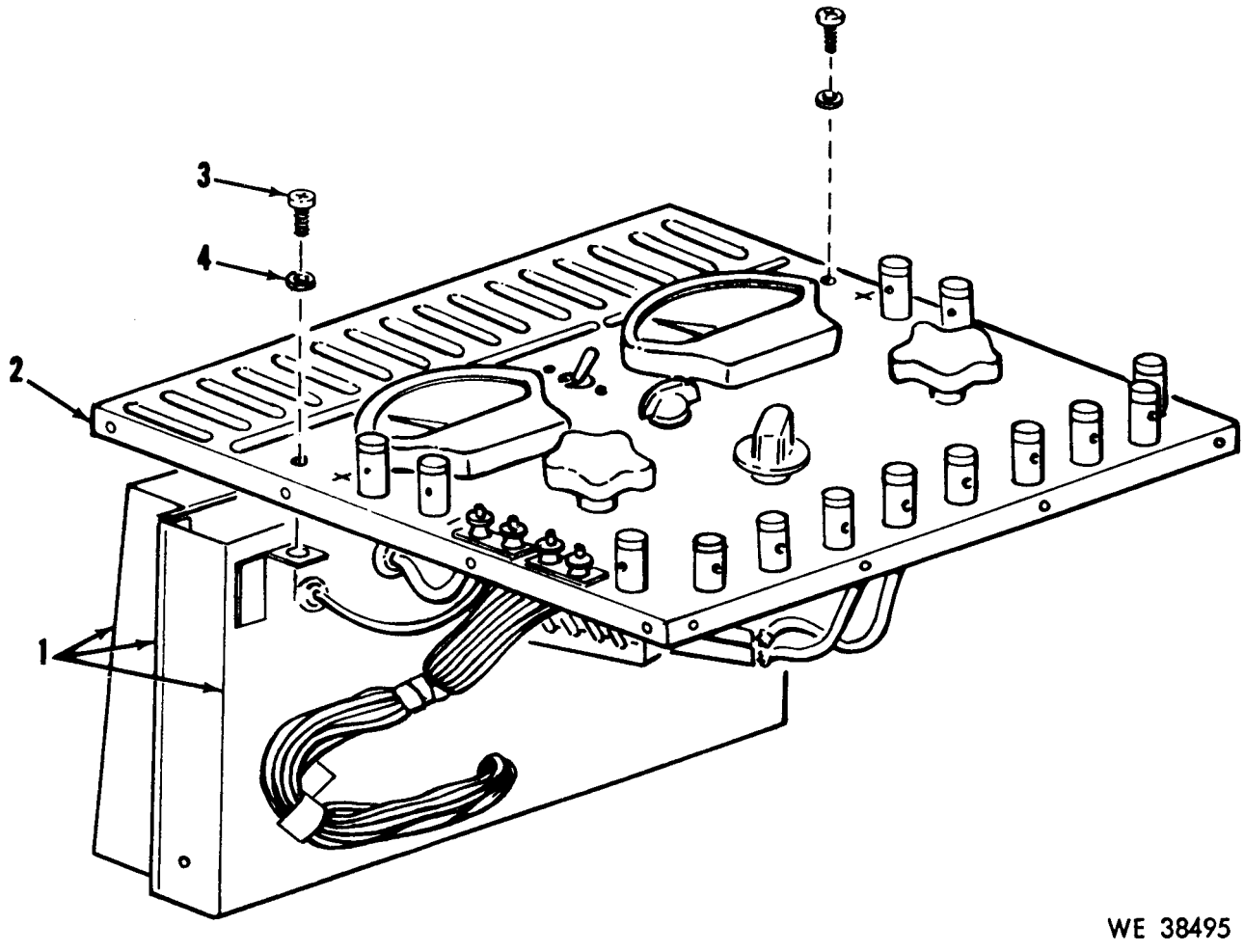
KEY to fig. 5-1:
1. Cover
2. Pins
3. Release locks
4. Case

Figure 5-1. Remove cover. WE *38493*



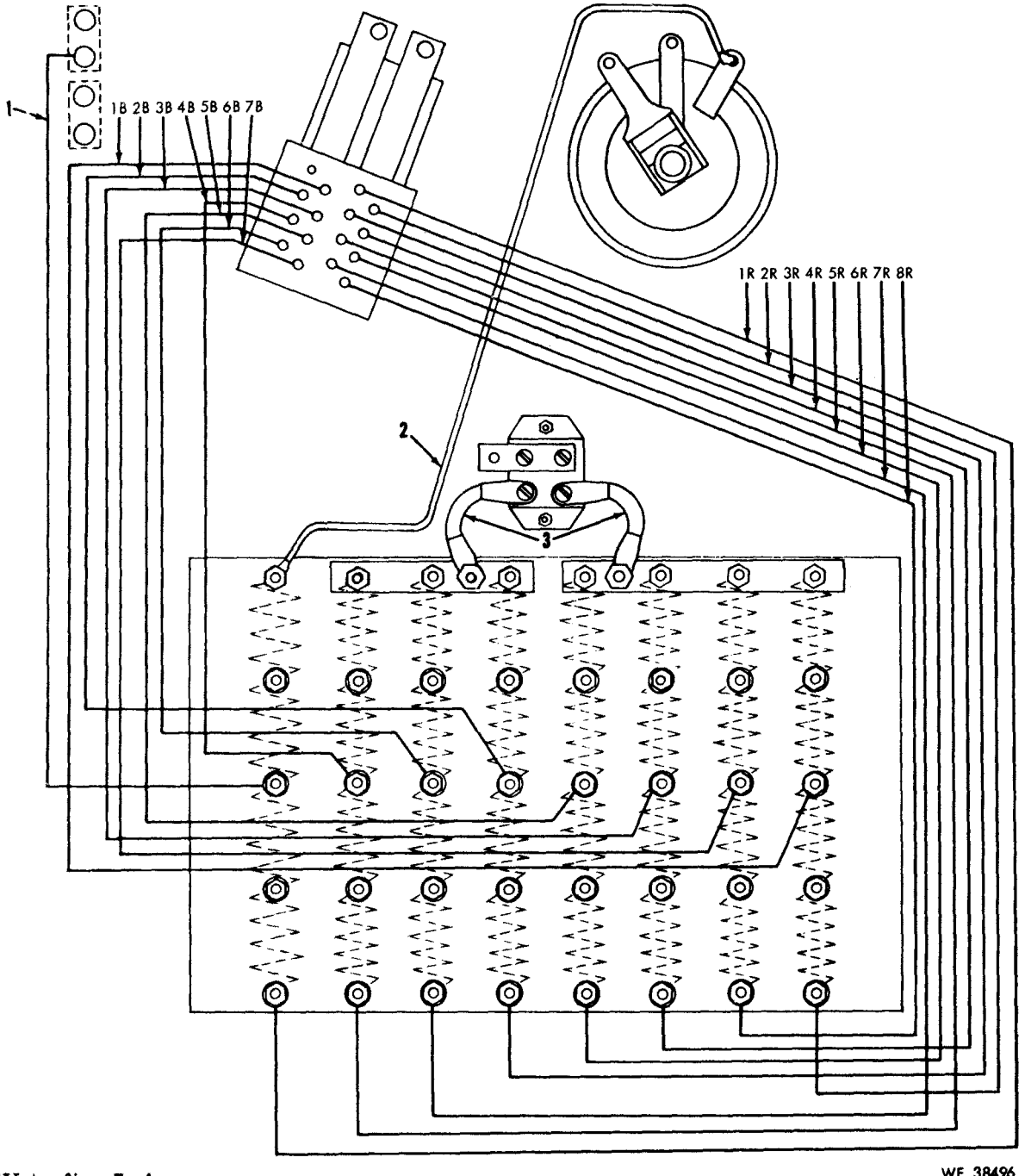
KEY to fig. 5-2:
1. Screw, machine
2. Washer, lock
3. Panel assembly
4. Screw, machine
5. Test lead compartment
6. Case

Figure 5-2. Remove panel. WE 38494



KEY to fig. 5-3:
1. Load bank resistor board assembly
2. Panel assembly
3. Screw, machine
4. Washer, lock

Figure 5-3. Remove panel assembly from load bank resistor board assembly. WE 38495



KEY to fig. 5-4:

1-16 AWG black electrical wire (12 V link assembly) w/terminal lug

1B thru 7B - 16 AWG black electrical wire (coarse load bank control assembly) w/terminal lugs

1R thru 8R - 16 AWG red electrical wire (coarse load bank control assembly) w/terminal lugs

2 - Fine load bank control rheostat assembly electrical wire w/terminal lug

3 - Load bank switch electrical wires w/ terminal lugs

Figure 5-4. View of wiring before disassembly. WE 38496

Remove four machine screws (l), and four lock washers (2). Secure electrical wire (11) and group of electrical wires (12) with tape, cord, or wire designated as (10). You can now separate the load bank resistor board assembly into three sections by pulling disconnected electrical wires and terminal lugs through openings. The heat board (4) is one section. The other two sections of the load bank resistor board assembly are designated front (3) and back (5). The back (5) has the openings for electrical wires. The two openings for electrical wires (7) between heat board (4) and load bank switch assembly (1, Fig. 5-7) have rubber grommets (6). The opening for electrical wire (13) between heat board (4) and fine load bank control rheostat assembly (4, Fig. 5-7) also has a rubber grommet (14). The wire clip (15) on back section (5) has a rubber adhesive tape (16) for ground.

5-23. Load Bank Resistor Heat Board (Fig. 5-6).

a. *Remove Electrical Wires from Heat Board (1).* One end of each electrical wire was separated in paragraph 5-22 (Fig. 5-5). The heat board (1) with electrical wires and terminal lugs, were separated at this point. Use view of wiring in paragraph 5-21 (Fig. 5-4) and identification tags when removing electrical wires. Before removing electrical wires, and terminal lugs from heat board (l), record number of electrical wire from identification tag at position it is separated. Leave identification tag on electrical wire to aid in replacement of electrical wire. To remove black electrical wires (1, lB, 2B, 3B, 4B, 5B, 6B, and 7B, Fig. 5-4) remove all screw assemblies designated (9). To remove fine load bank control rheostat assembly electrical wire (2, Fig. 5-4) remove s crew assembly designated (4) located top row left side, as shown in figure 5-6. To remove both load bank switch assembly electrical wires (3, Fig. 5-4) remove both screw assemblies designated (18). To remove red electrical wires (lR, 2R, 3R, 4R, 5R, 6R, 7R, and 8R, Fig. 5-4) remove all screw assemblies designated (15).

b. *Remove Copper Plate (2) from Heat Board (1).* Both copper plates (2) are located on top row.

(1) *Remove copper plate (2) on left side.*

(a) Remove three screw assemblies (4) top row. The first, second, and third 2.1 OHM resistors (16) are also secured with these screw assemblies (4).

(b) Remove first screw assembly (18) top row (see a. above), on left side of heat board (l).

(2) *Remove copper plate (2) on right side.*

(a) Remove four screw assemblies (4) top row. The four 2.1 OHM resistors (16) on the right side of heat board (1) are also secured with these screw assemblies (4).

(b) Remove the second screw assembly (18) (see a. above) top row, on right side of heat board (l).

c. *Remove Resistors (16, and 17) from Heat Board (1).*

(1) *Remove 1.8 OHM resistor (17).* This is the first resistor (17) on the left side of heat board (1).

(a) Remove the first screw assembly (4) on left side of heat board (1) in rows 1, (see a. and b. above), 2, and 4.

(b) Remove the first screw assembly (9), (see a. above), on left side of heat board (1) in row three.

(c) Remove the first screw assembly (15), (see a. above), on left side of heat board (1) in row five.

(2) *Remove 2.1 OHM resistors (16).* There are seven of these resistors (16) located to the right of the 1.8 OHM resistor (17). Any one of these seven resistors can be removed by removal of screw assemblies designated as (3). Remove these screw assemblies as follows:

(a) Remove screw assemblies (4) in rows 1 (see a. and b. above), 2, and 4.

(b) Remove screw assembly (9), (see a. above), in row three.

(c) Remove screw assembly (15), (see a. above), in row five.

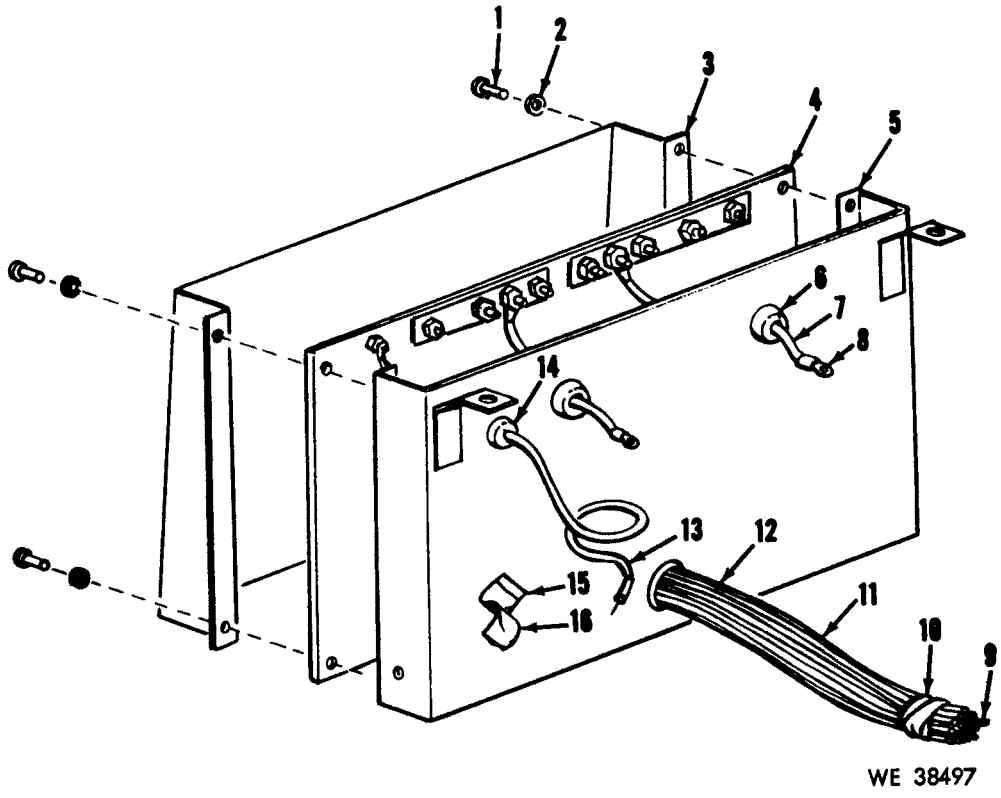
d. *To Replace Heat Board (1).*

(1) Remove all electrical wires from heat board (1). Removal described in a., above.

(2) *Remove both copper plates (2) from heat board (1).* Removal described in b., above.

(3) *Remove resistors (16, and 17) from heat board (1).* Removal described in c., above.

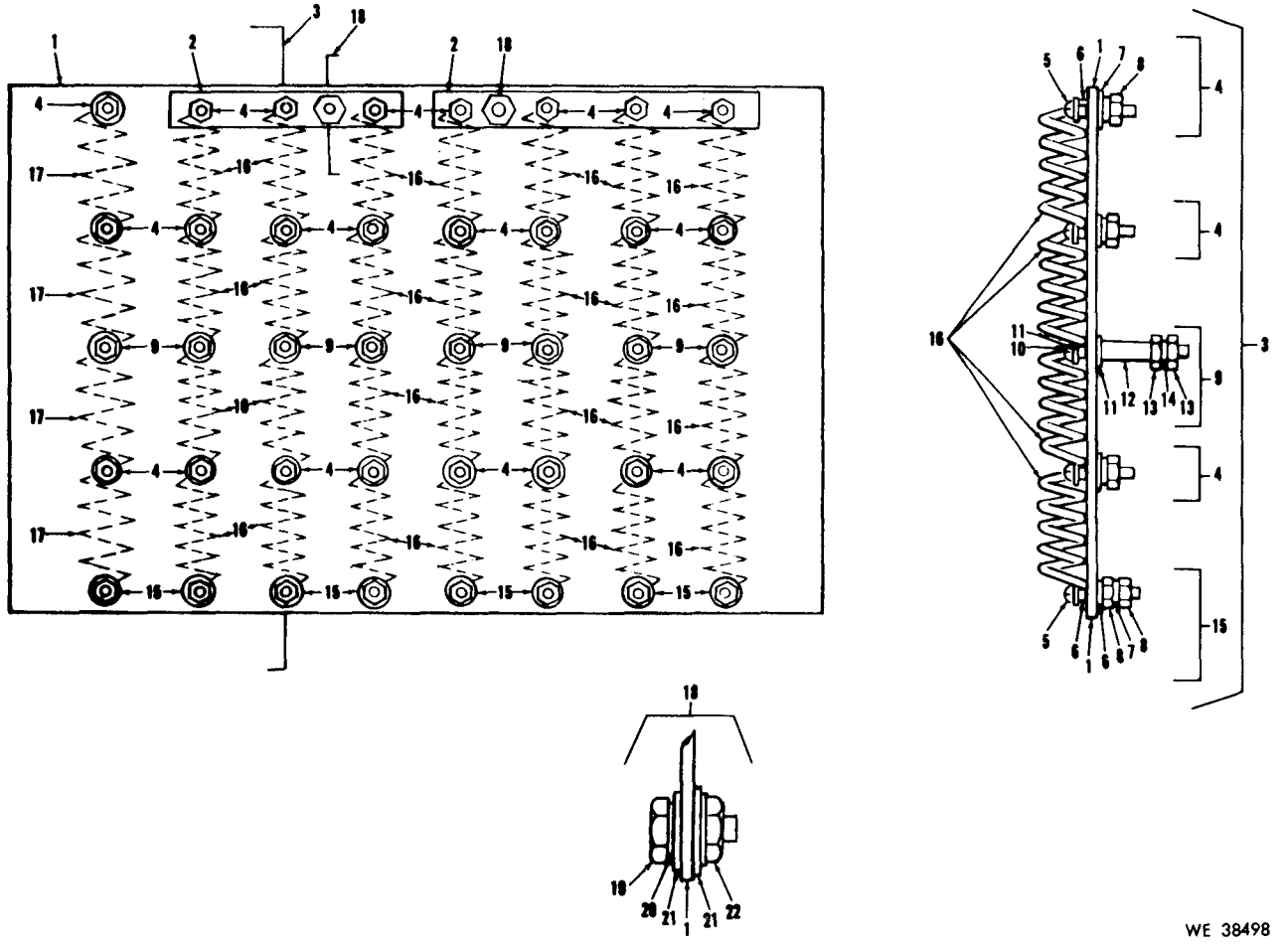
5-24. Panel Assembly before Disassembly -Top View (Fig. 2-1).



KEY to fig. 5-5:

1. Screw, machine
2. Washer, lock
3. Load bank resistor board, front
4. Load bank resistor board, heat board
5. Load bank resistor board, back
6. Rubber grommet
7. Load bank switch assembly electrical wire
8. Terminal lug
9. Terminal lug
10. Tape, cord, or wire
11. 12-Volt link assembly electrical wire
12. Coarse load bank control assembly electrical wires
13. Fine load bank control rheostat assembly electrical wire
14. Rubber grommet
15. Wire clip
16. Rubber, adhesive, tape

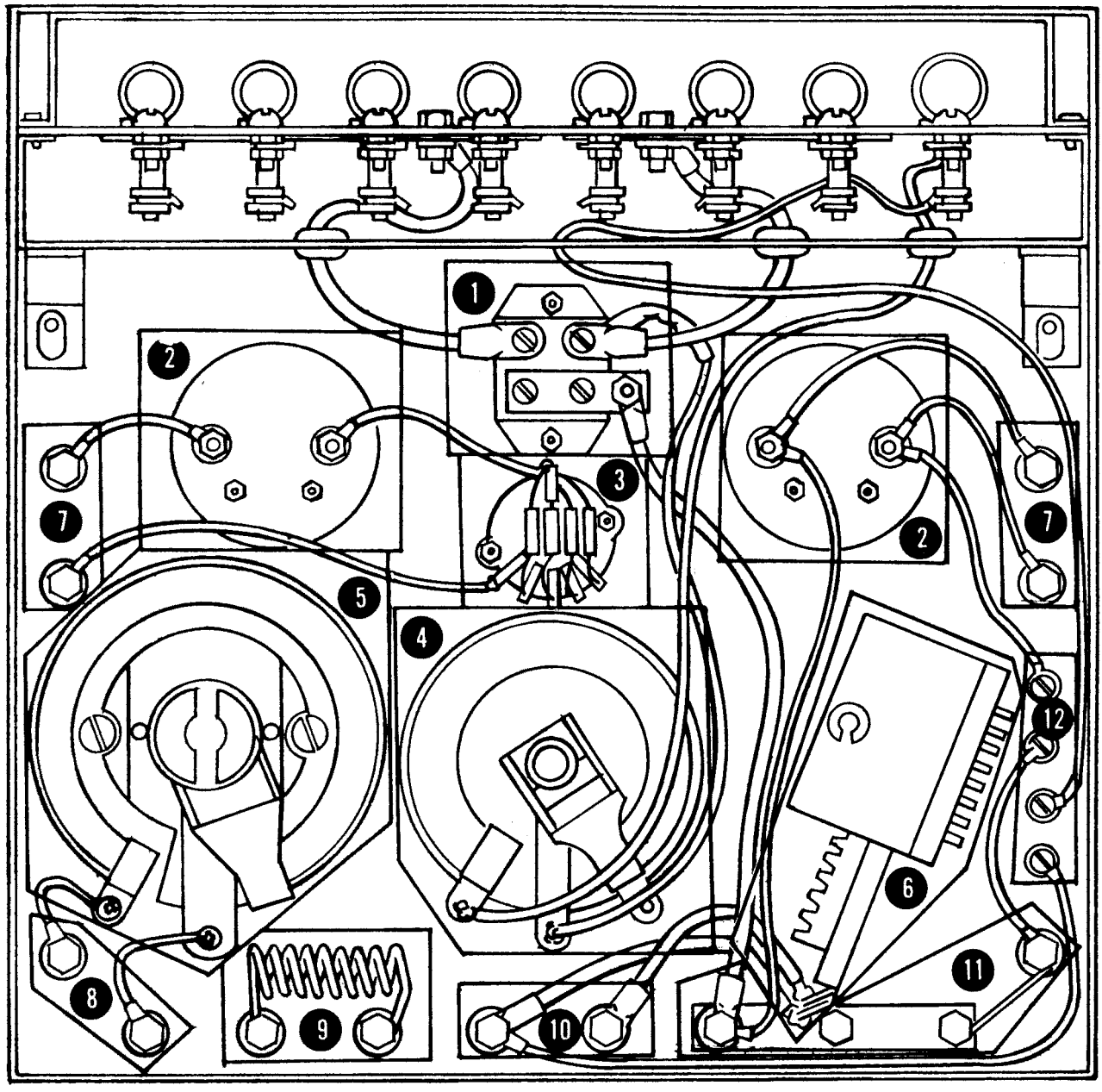
Figure 5-5. Disassembly of load bank resistor board assembly. WE *38497*



KEY to fig. 5-6:

1. Heat board
2. Copper plate
3. Column - heat board, resistor, and screw assemblies
4. Screw assembly
5. Screw, machine
6. Washer, flat
7. Washer, lock
8. Nut, plain, hexagon
9. Screw assembly
10. Screw, machine
11. Washer, lock
12. Copper tube
13. Nut, plain, hexagon
14. Washer, lock
15. Screw assembly
16. Resistor, 2.1 OHM
17. Resistor, 1.8 OHM
18. Screw assembly
19. Screw, machine
20. Washer, lock
21. Washer, flat
22. Nut, plain, hexagon

Figure 5-6. Load bank resistor heat board. WE 38498



KEY to fig. 5-7:

WE 38499

1. Load bank switch assembly
2. Ammeter and voltmeter assemblies
3. Voltmeter range selector switch assembly
4. Fine load bank control rheostat assembly
5. Field rheostat control assembly
6. Coarse load bank control assembly
7. Positive and negative binding posts for external shunt and voltmeter - assemblies
8. Field rheostat binding posts assemblies
9. l/4-OHM fixed resistor binding posts assemblies
10. 12-, 24-Volt load bank binding posts assemblies
11. 10-, 50-, 1OO-AMP negative, and COMMON binding posts assemblies
12. 12-Volt load bank link, and external shunt disconnect link binding posts assemblies

Figure 5-7. Panel assembly before disassembly - underside view. WE 38499

5-25. Panel Assembly before Disassembly -Underside View (Fig. 5-7).

5-26. Schematic Diagram (Fig. 1-2). When electrical maintenance is required, refer to schematic diagram on the inside bottom of the case.

5-27. Load Bank Switch Disassembly (Fig. 5-8). Remove two machine screws (l) and two lock washers (2) connecting panel assembly (3) and load bank switch assembly (4). Disconnect the following from the toggle switch (5): the electrical wire (13) to fine load bank control rheostat assembly (4, Fig. 5-7), the electrical wire (14) to 10-, 50-, 1OO-AMP negative (-), and COMMON binding posts assemblies (11, Fig. 5-7), the copper plate (6).

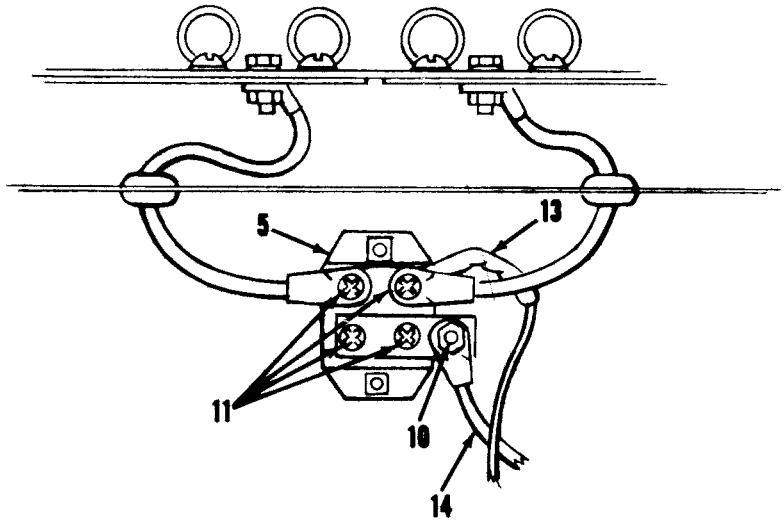
5-28. Ammeter and Voltmeter Disassemblies (Fig. 5-9). Remove plain hexagon nuts (6) and lock washers (5). Lift the ampere-hour meter (ammeter) (1) and voltmeter (3) from the panel (4). Remove the cellular rubber sheet (2) for each meter (1 and 3). Disconnect the electrical wire (8) to voltmeter positive (+) post (7); and the electrical wire (9) to voltmeter range selector switch (10) from the voltmeter (3). Disconnect the following from the ammeter (l): the electrical wire (11) to external shunt positive (±) binding post (13); the electrical wire (12) to external shunt negative (-) binding post (14); the electrical wire (16) to external shunt disconnect link binding post (15); the electrical wire (17) to 10-, 50-, 1OO-AMP negative (-), and COMMON binding posts assemblies (11, Fig. 5-7). Remove plain hexagon nut (18) and lock washer (19) to remove electrical wires. Reinstall immediately to prevent loss.

5-29. Voltmeter Range Selector Switch Disassembly (Fig. 5-10). Selector Switch Disassembly (Fig. 5-10). Remove setscrew (2) from voltmeter switch knob (1) with 5/64 Allen wrench. Remove voltmeter switch knob (l), plain hexagon nut (3), and lock washer (4) from voltmeter range selector switch assembly (6). Separate voltmeter range selector switch assembly (6) from panel (5). Desolder electrical wire (13) to voltmeter (14). Desolder electrical wire (15) to voltmeter negative (-) post (16). Desolder both ends of resistors (7, 8, 9, and 10) from voltmeter switch (11). Separate terminal lug (12) from voltmeter electrical wire (13).

5-30. Fine Load Bank Control Rheostat Disassembly (Fig. 5-11). Remove setscrew (1) from fine load bank control knob (2) with 5/64 Allen wrench. Remove fine load bank control knob (2), plain hexagon nut (3), and lock washer (4) from fine load bank control rheostat assembly (7). Separate fine load bank control rheostat assembly (7) from panel (5). Remove four flat washers (6) from fine load bank control rheostat assembly (7). Desolder electrical wire (10) to load bank switch assembly (13, Fig. 5-8). Fine load bank control rheostat assembly electrical wire (8), was resoldered in paragraph 5-22 from fine load bank control rheostat assembly (7); and removed in paragraph 5-23 from load bank resistor heat board (1, Fig. 5-6). Remove electrical insulation sleeving (9) and terminal lug (11) from load bank switch assembly electrical wire (10).

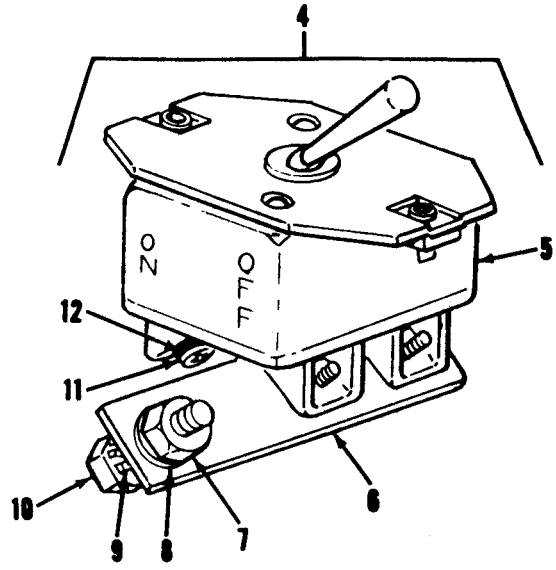
5-31. Field Rheostat Control Disassembly (Fig. 5-12). Remove setscrew (1) from field rheostat control knob (2) with 3/32 Allen wrench. Remove field rheostat control knob (2), two machine screws (3), and two spring tension washers (4) from field rheostat control assembly (7). Separate field rheostat control assembly (7) from panel (5). Remove four flat washers (6) from field rheostat control assembly (7). Disconnect each field rheostat electrical wire (12) to field rheostat binding post (11) at the field rheostat control assembly (7) end. Reinstall machine screw (10), flat washer (9), and plain hexagon nut (8) immediately to prevent loss.

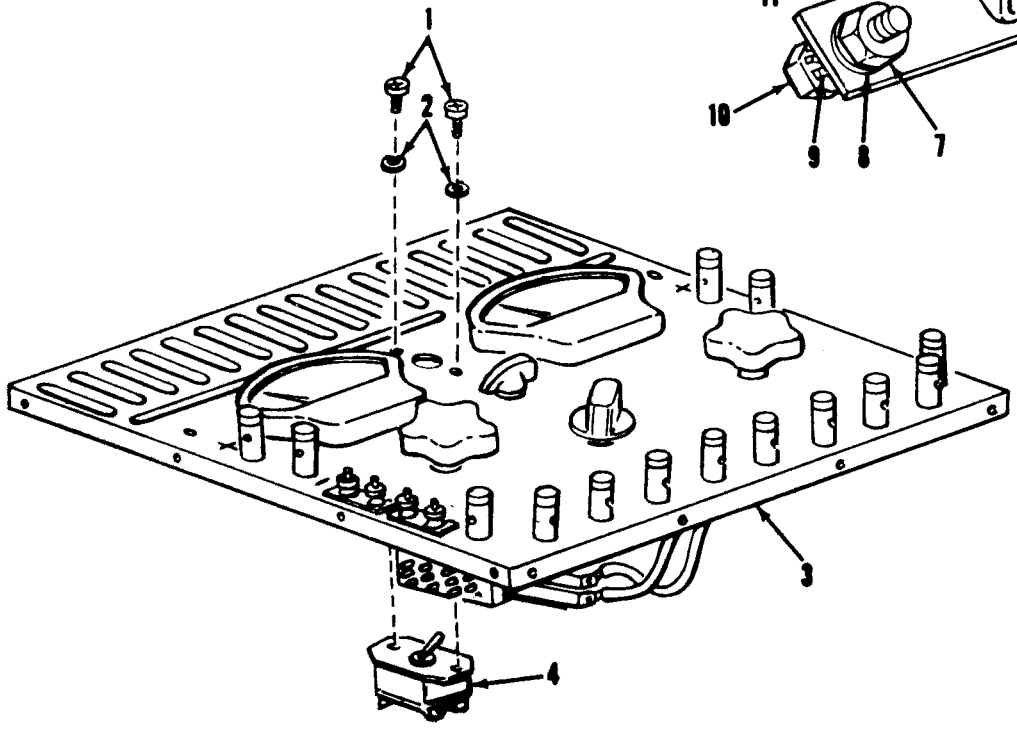
5-32. Coarse Load Bank Control Disassembly (Fig. 5-13). Remove setscrew (1) from coarse load bank control knob (2) with 3/32 Allen wrench. Remove coarse load bank control knob (2), two machine screws (3), and two lock washers (4) from load bank selector switch assembly (6). Separate load bank selector switch assembly (6) from panel (5). The plastic clamp, loop type (12) will fall free after machine screws (3) are removed, and the load bank selector switch assembly (6) is separated from panel (5). Desolder the following from cop-



KEY to fig. 5-8:

1. Screw, machine
2. Washer, lock
3. Panel assembly
4. Load bank switch assembly
5. Switch, toggle
6. Copper plate
7. Nut, plain, hexagon
8. Washer, flat
9. Washer, lock
10. Screw, machine
11. Screw, machine
12. Washer, lock
13. Fine load bank control rheostat assembly electrical wire
14. 10-, 50-, 100-AMP negative, and COMMON binding posts assemblies electrical wire





WE 38500

Figure 5-8. Lcad bank switch disassembly. WE 38500

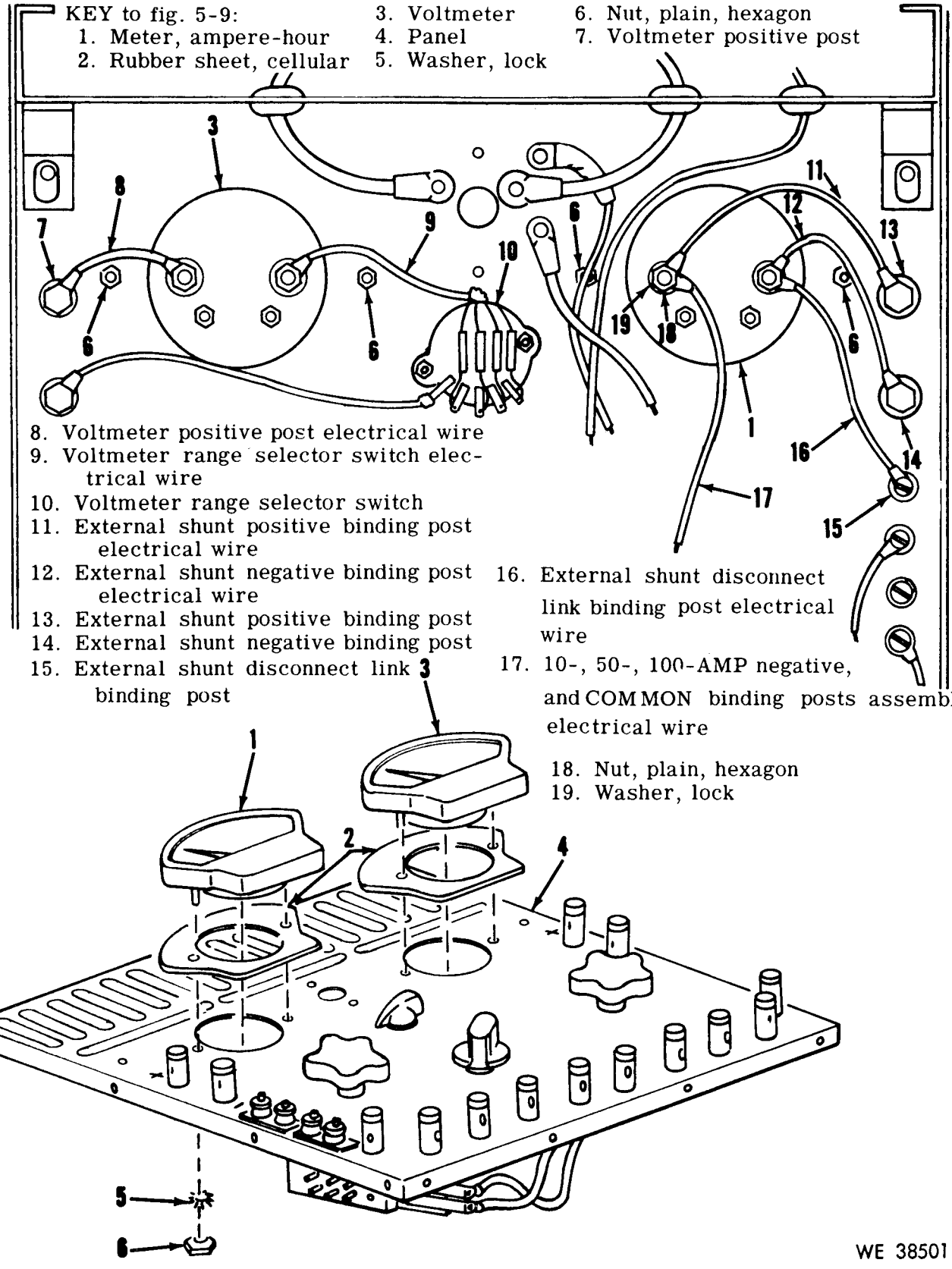
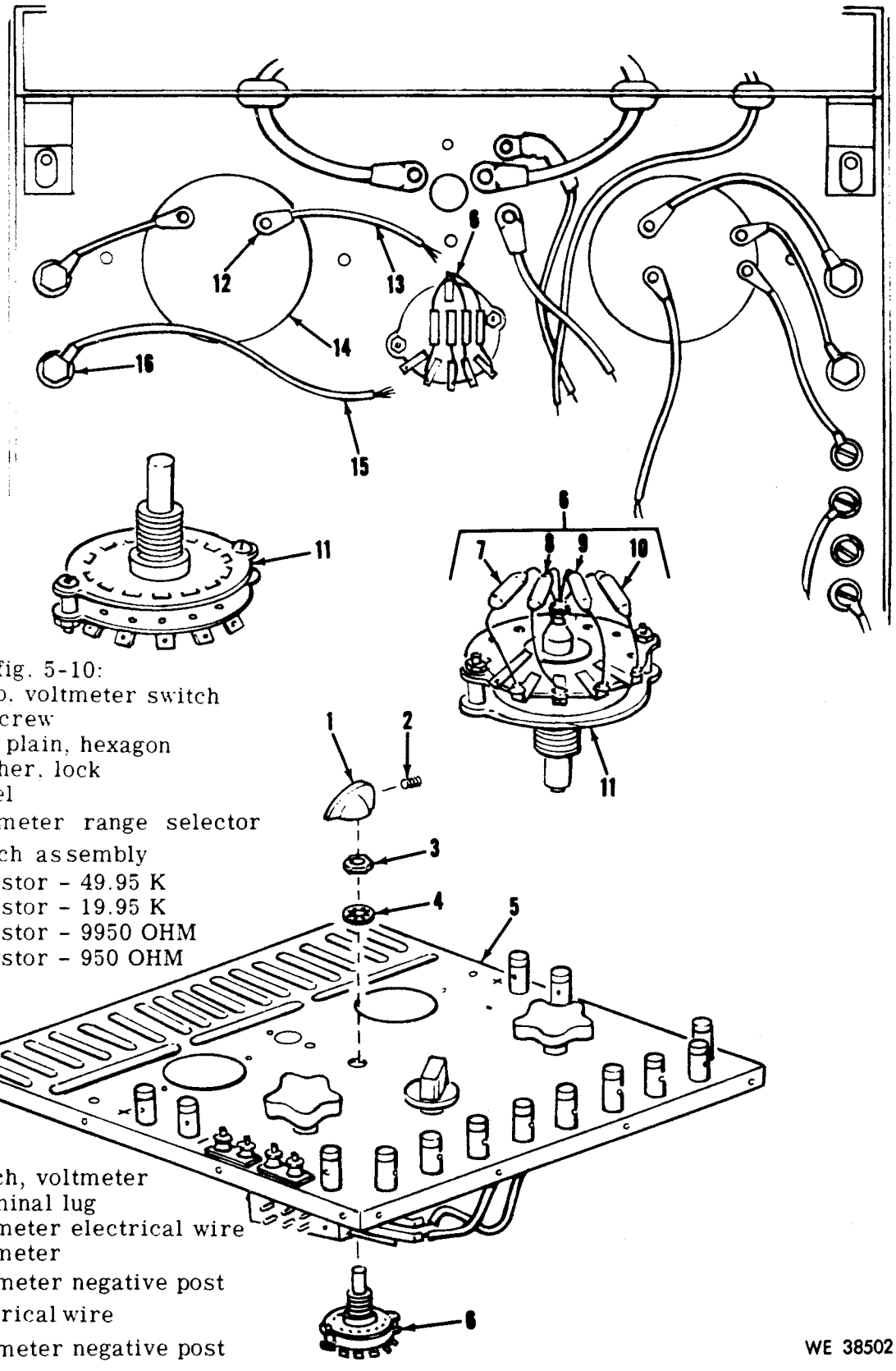


Figure 5-9, Ammeter and voltmeter disassembles, WE *38501*

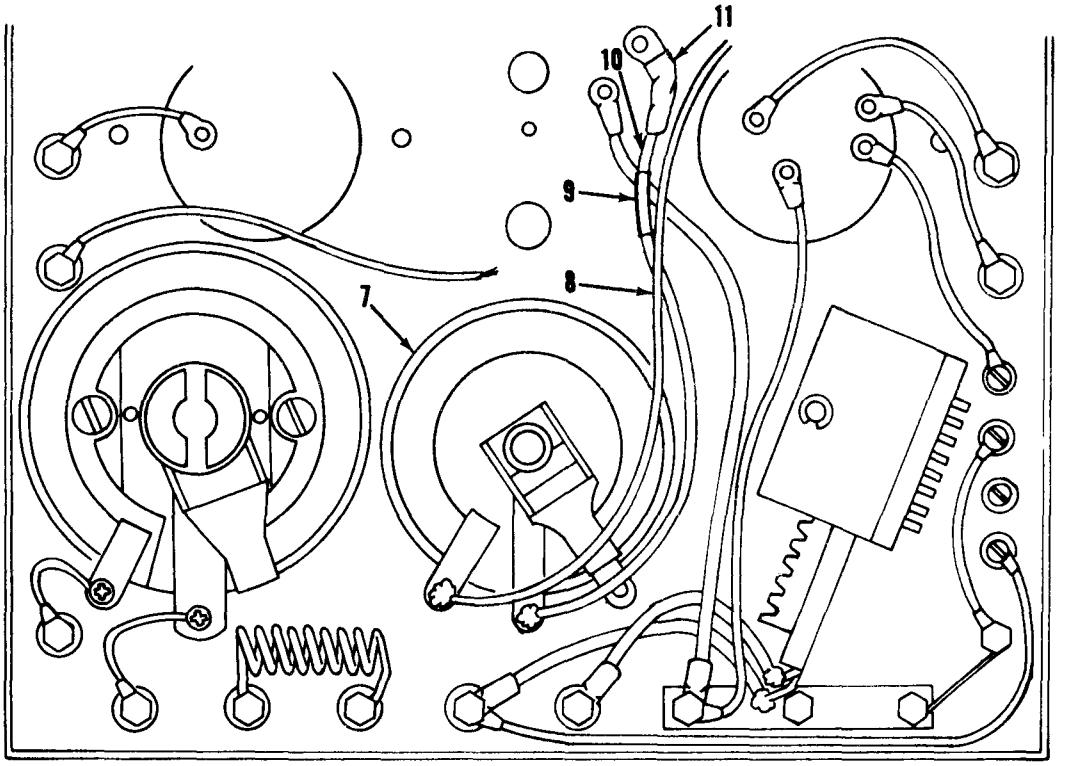


KEY to fig. 5-10:

1. Knob, voltmeter switch
2. Setscrew
3. Nut, plain, hexagon
4. Washer, lock
5. Panel
6. Voltmeter range selector switch assembly
7. Resistor - 49.95 K
8. Resistor - 19.95 K
9. Resistor - 9950 OHM
10. Resistor - 950 OHM
11. Switch, voltmeter
12. Terminal lug
13. Voltmeter electrical wire
14. Voltmeter
15. Voltmeter negative post electrical wire
16. Voltmeter negative post

WE 38502

Figure 5-10. Voltmeter range selector switch disassembly. WE 38502



KEY to fig. 5-11:

1. Setscrew
2. Knob, fine load bank control
3. Nut, plain, hexagon
4. Washer, lock
5. Panel
6. Washer, flat
7. Fine load bank control rheostat assembly
8. Fine load bank control rheostat assembly electrical wire
9. Electrical insulation sleeving
10. Load bank switch assembly electrical wire
11. Terminal lug

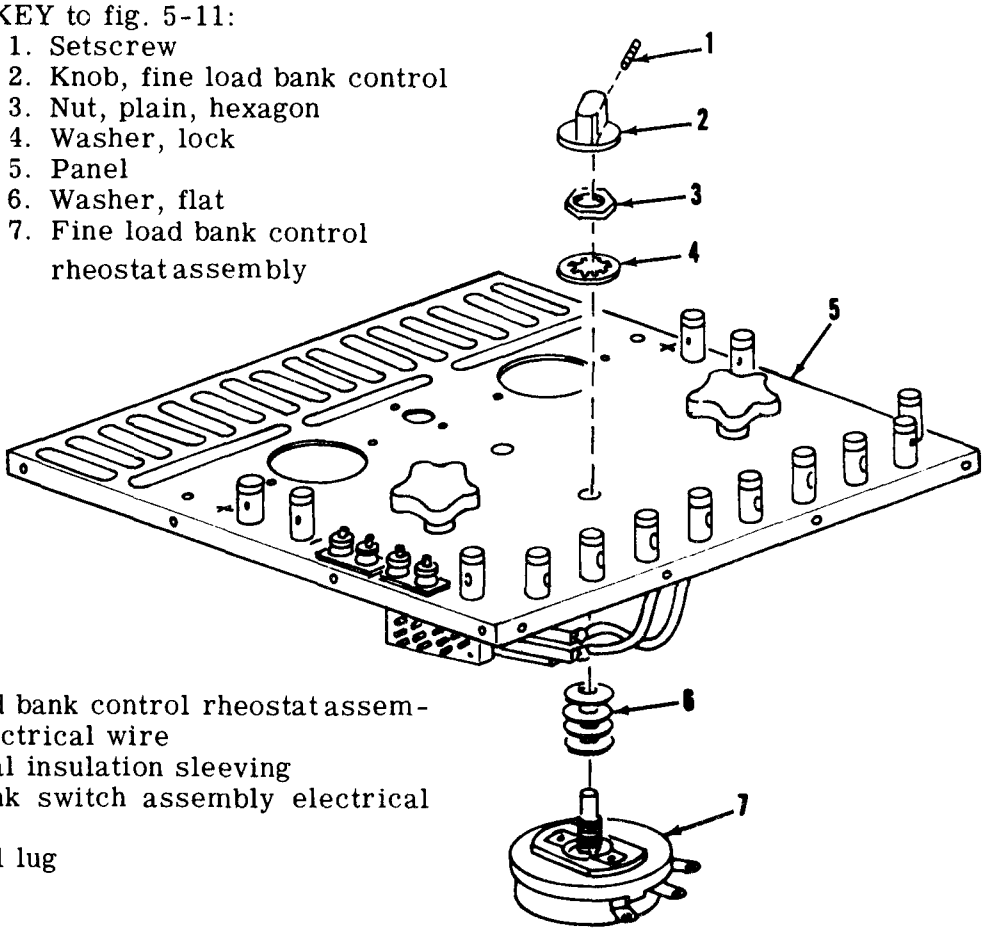
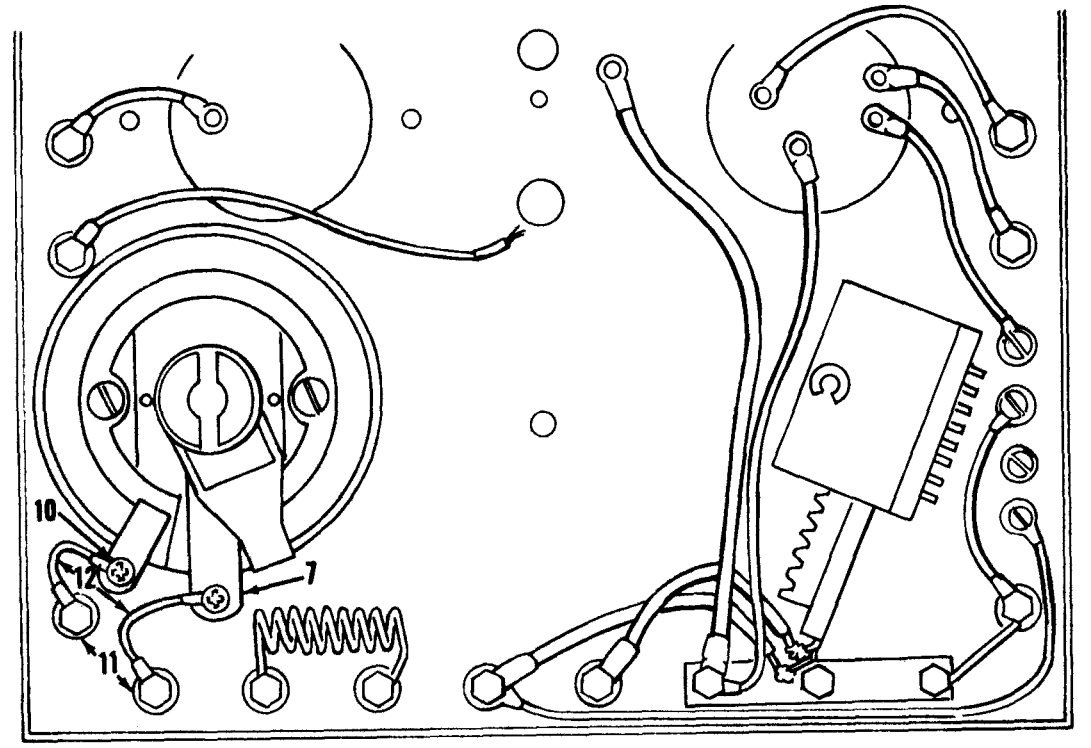
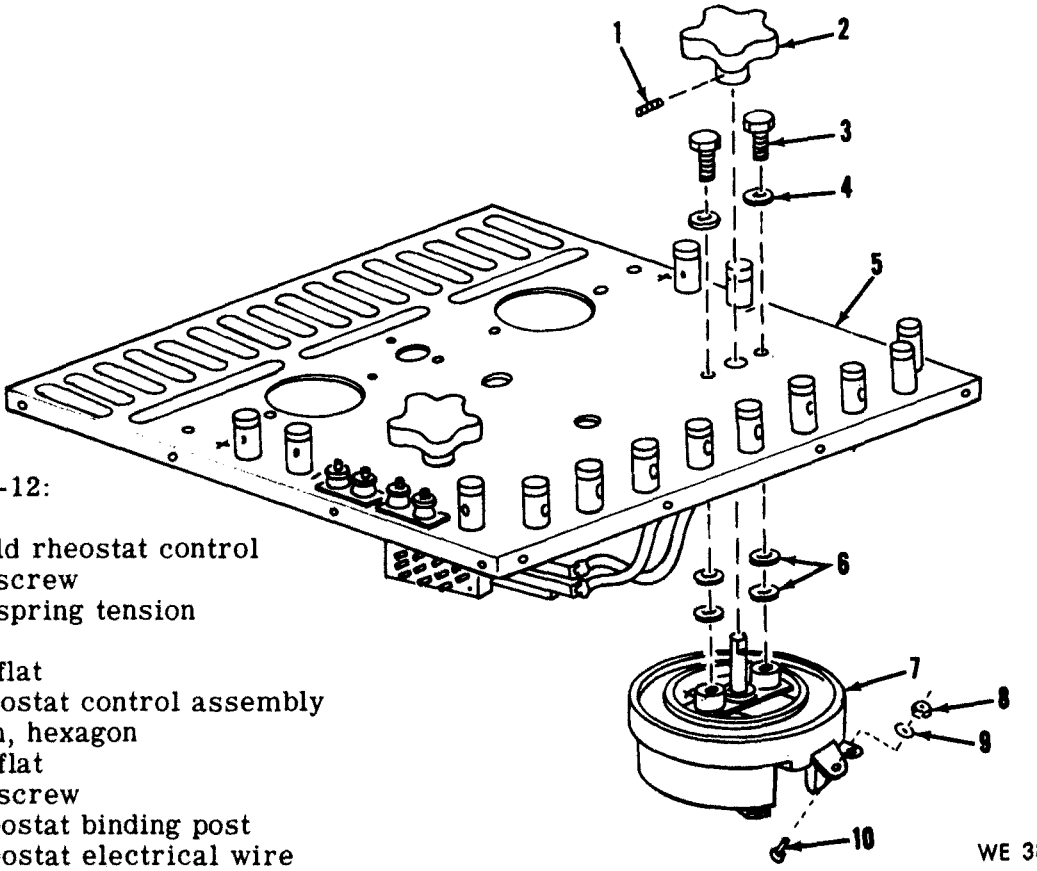


Figure 5-11. Fine load bank control rheostat disassembly. WE 38503

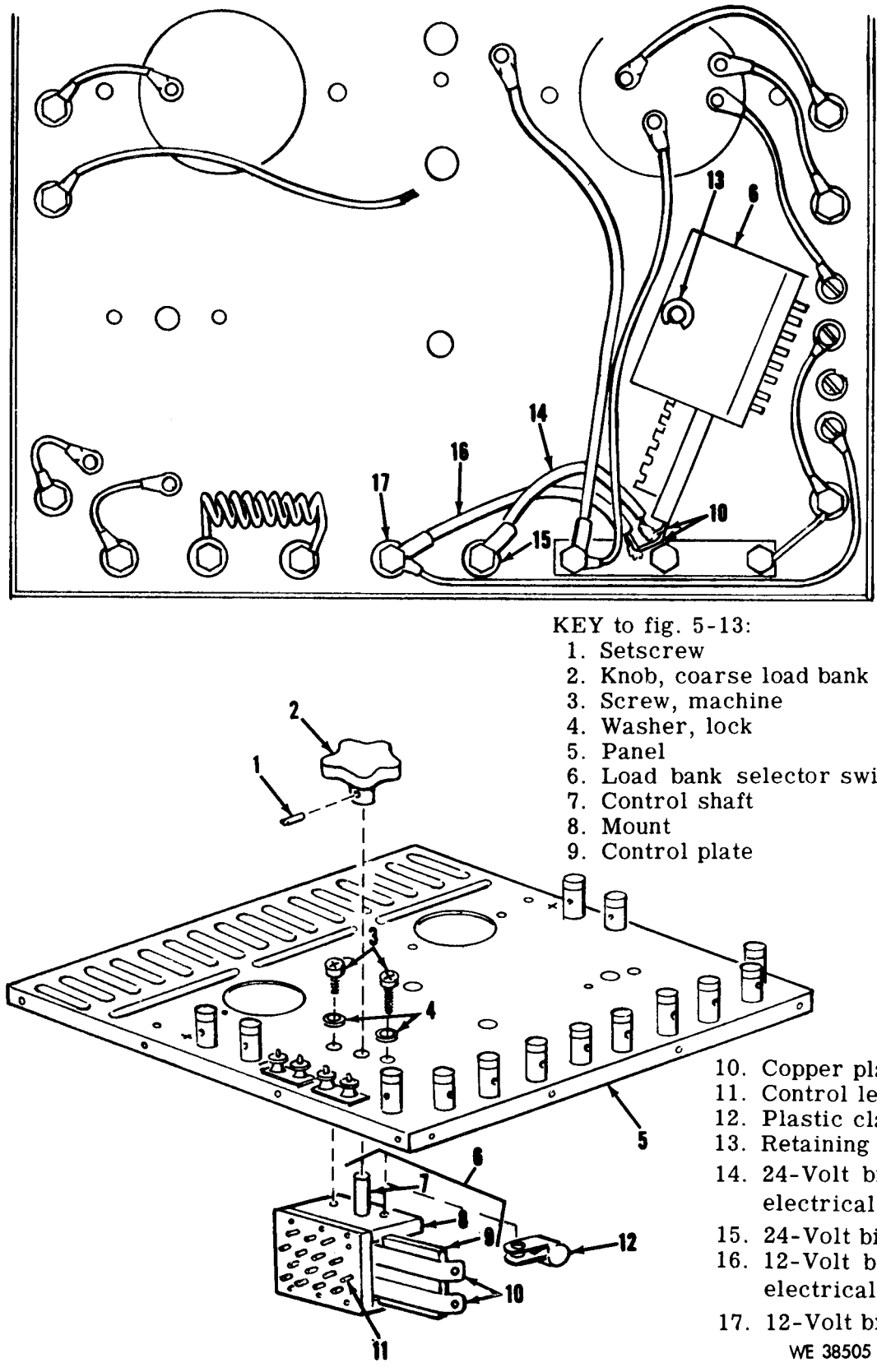




KEY to fig. 5-12:

1. Setscrew
2. Knob, field rheostat control
3. Machine screw
4. Washer, spring tension
5. Panel
6. Washer, flat
7. Field rheostat control assembly
8. Nut, plain, hexagon
9. Washer, flat
10. Machine screw
11. Field rheostat binding post
12. Field rheostat electrical wire

Figure 5-12. Field rheostat control disassembly. WE 38504



KEY to fig. 5-13:

1. Setscrew
2. Knob, coarse load bank control
3. Screw, machine
4. Washer, lock
5. Panel
6. Load bank selector switch assembly
7. Control shaft
8. Mount
9. Control plate
10. Copper plate
11. Control lead
12. Plastic clamp, loop type
13. Retaining ring, E-type
14. 24-Volt binding post electrical wire
15. 24-Volt binding post
16. 12-Volt binding post electrical wire
17. 12-Volt binding post

Figure 5-13. Coarse load bank control disassembly.

per plate (10): the electrical wire (16) to 12-volt binding post (17); and the electrical wire (14) to 24-volt binding post (15). Remove retaining ring, E-type (13) to release control shaft (7). Disengage control plate (9) from control shaft (7) on one side and the control lead (11) end on the other side. Slide control plate (9) from mount (8).

5-33. Positive and Negative Binding Posts for External Shunt and Voltmeter Disas - semblies (Fig. 5-14). Each binding post (8, 10, 20, and 22) that secures electrical wires (14, 12, 18, and 17 consecutively), consists of machine screw (7), lock washer (6), flat washer (5), two flat washers (3), binding post (2) w/thumbscrew (l). Remove machine screw (7) to separate from panel (4). Use 1/1 6 pin in hole of binding posts (8, 1O, 20, and 22) to loosen. Separate terminal lugs (9, 11, 13, 15, 19, 16, and 21) from electrical wires (14, 12, 18, and 17 successionally).

5-34. Field Rheostat Binding Posts Disassemblies (Fig. 5-15). Each binding post (11) that secures the field rheostat electrical wires (8), consist of machine screw (7), lock washer (6), flat washer (5), two flat washers (3), binding post (2) w/thumbscrew (1), Remove machine screw (7) to separate from panel (4). Use 1/16 pin in hole of binding posts (11) to loosen. Separate electrical wires (8) from terminal lugs (9 and 10 successionally).

5-35. 1/4-OHM Fixed Resistor Binding Posts Disassemblies (Fig. 5-16). Each binding post (10) that secures the l/4-OHM resistor assembly (7), consists of machine screw (9), lock washer (8), two flat washers (5), plain hexagon nut (6), two flat washers (3), binding post (2) w/machine screw (l). Remove machine screw (9) to separate from panel (4). Use 1/4 pin in hole of binding post (10) to loosen.

5-36. 12-, 24-Volt Load Bank Binding Post Disassembles (Fig. 5-17). Each binding post (9 and 14) that secures electrical wires (11, 15, and 12 consecutively), consists of machine screw (8), lock washer (7), plain hexagon nut (6), flat washer (5), two flat washers (3), binding post (2) w/machine screw (l). Remove machine screw (8) to separate from panel (4). Use 1/4 pin in hole of binding posts (9 and 14) to loosen. Separate electrical wires (11 and 12) from terminal lugs (10 and 13 successionally). Electrical wire (15) remains connected at the 12-volt load bank link binding post (16).

5-37. 10-, 50-, 10O-AMP Negative (-), and COMMON Binding Post Disassembles (Fig. 5-18). Binding post (18) that secures electrical wire (16) and part of internal shunt assembly (9); and binding post (19) that secures part of internal shunt assembly (9); and binding post (20) that secures part of internal shunt assembly (9); and binding post (22) that secures electrical wires (12 and 15) and part of internal shunt assembly (9); consist of machine screw (10), two lock washers (8), plain hexagon nut (7), flat washer (6), two flat washers (4), binding post (2) w/machine screw (1) for each binding post (18, 19, 20 and 22). Binding post (18) has additional electrical insulation sleeving (3). Desolder and remove machine screw (10) to separate from panel (5). Use 1/4 pin in hole of binding posts (18, 19, 20, and 22) to loosen, Separate electrical wires (12 and 15 from terminal lugs (11, 13, 14, and 21 successionally). Electrical wire (16) remains connected at the lower external shunt disconnect link binding post (17).

5-38. 12-Volt Load Bank Link, and External Shunt Disconnect Link Binding Post Disassembles (Fig. 5-19). The link (2) secured by binding posts (12 and 13) (OPEN FOR EXT SHUNT ONLY) and the link (2) secured by binding posts (15 and 16) (CLOSE FOR 12V ONLY) may be opened or closed depending on test. Close link (2) when not in use. Binding post (12) secures ammeter electrical wire (10). Binding post (13) secures 10 AMP negative electrical wire (20). Binding post (16) secures 12-volt load bank binding post electrical wire (18). The electrical wire and terminal lugs from binding post (15) were removed in paragraph 5-23. Each binding post (12, 13, 15, and 16) consist of machine screw (8), lock washer (7), two plain, hexagon nuts (3), two flat washers (4), two flat washers (5), and plain knurled nut (1). Remove machine screw (8) to separate from panel (6). Separate electrical wires (10, 20, and 18) from terminal lugs (9, 11, 14, 19, 17, and 21 successionally).

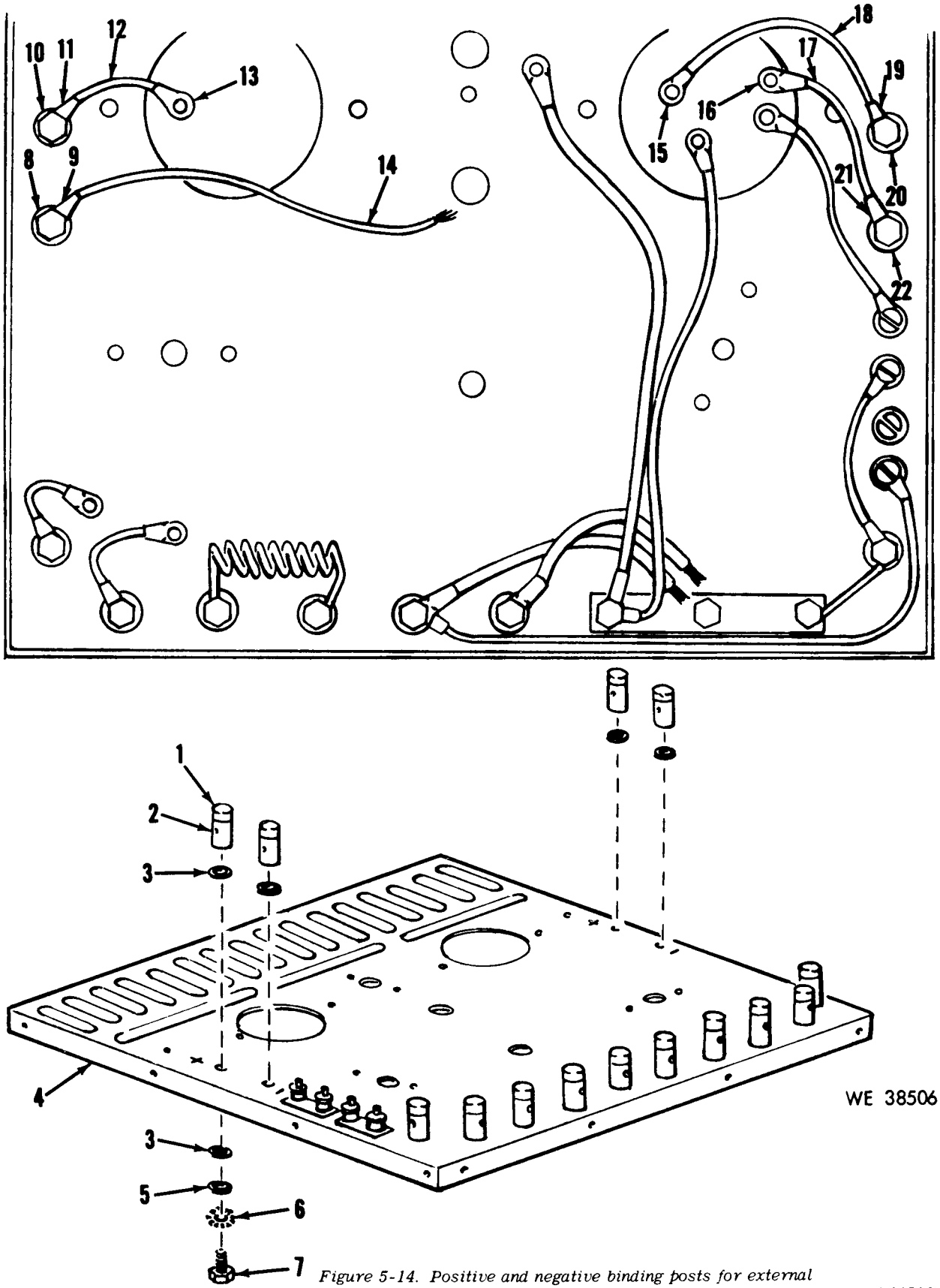
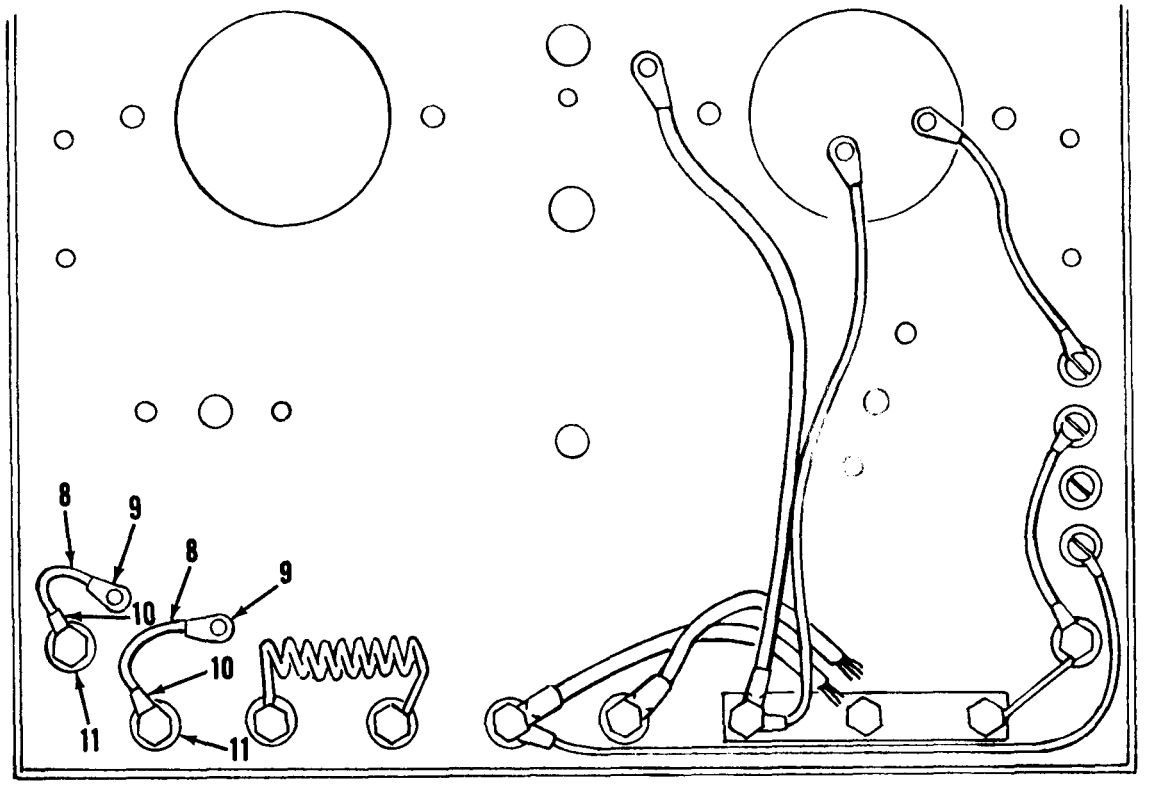


Figure 5-14. Positive and negative binding posts for external shunt and voltmeter - disassembles. WE 38506

KEY to fig. 5-14:

1. Thumbscrew
2. Binding post
3. Washer, flat
4. Panel
5. Washer, flat
6. Washer, lock
7. Machine screw
8. Voltmeter negative binding post
9. Terminal lug
10. Voltmeter positive binding post
11. Terminal lug
12. Voltmeter positive post electrical wire
13. Terminal lug
14. Voltmeter negative post electrical wire
15. Terminal lug
16. Terminal lug
17. External shunt negative post electrical wire
18. External shunt positive post electrical wire
19. Terminal lug
20. External shunt positive binding post
21. Terminal lug
22. External shunt negative binding post



KEY to fig. 5-15:

1. Thumbscrew
2. Binding post
3. Washer, flat
4. Panel
5. Washer, flat
6. Washer, lock
7. Machine screw
8. Field rheostat electrical wire
9. Terminal lug
10. Terminal lug
11. Field rheostat binding post

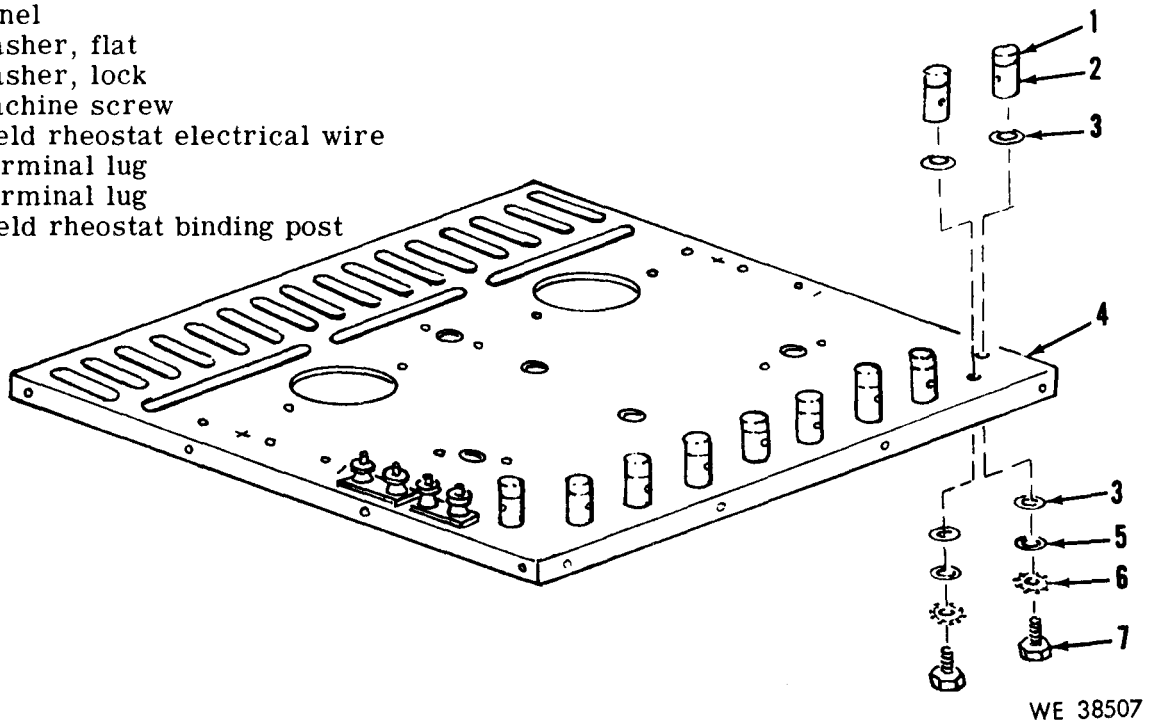
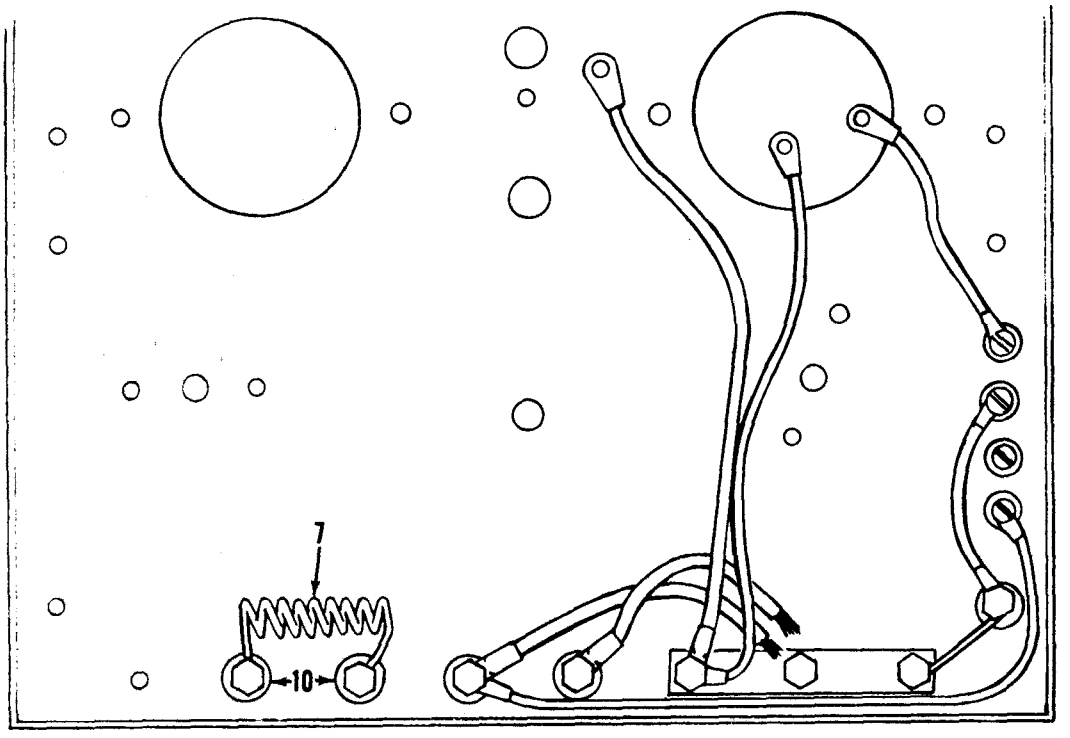
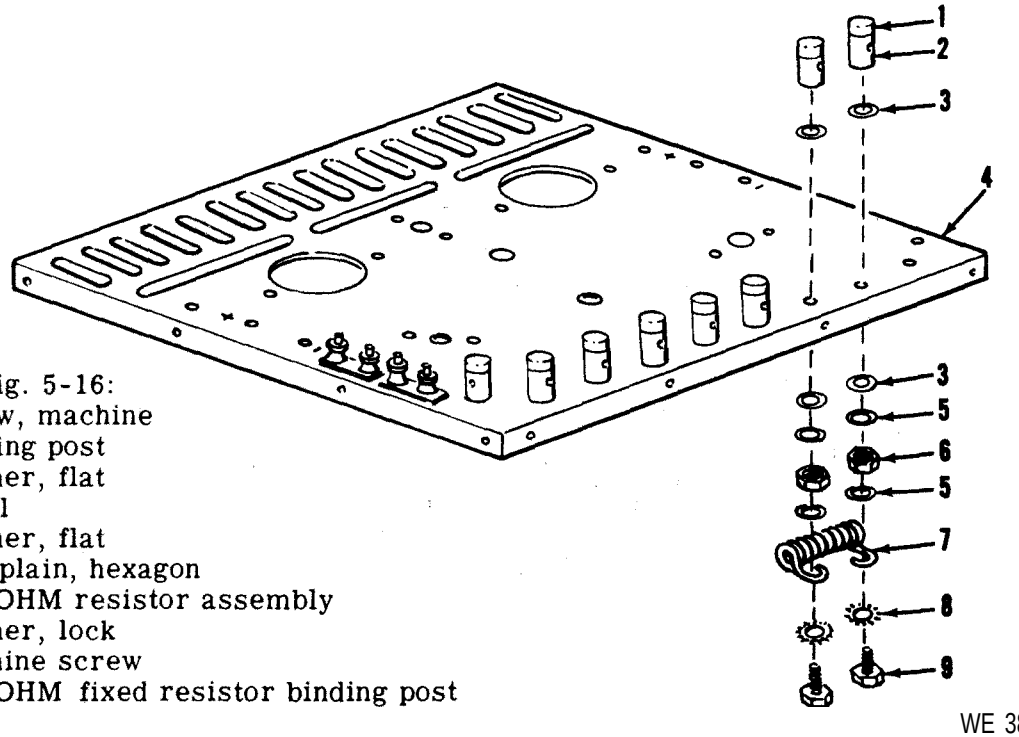


Figure 5-15. Field rheostat binding posts disassembles. WE 38507

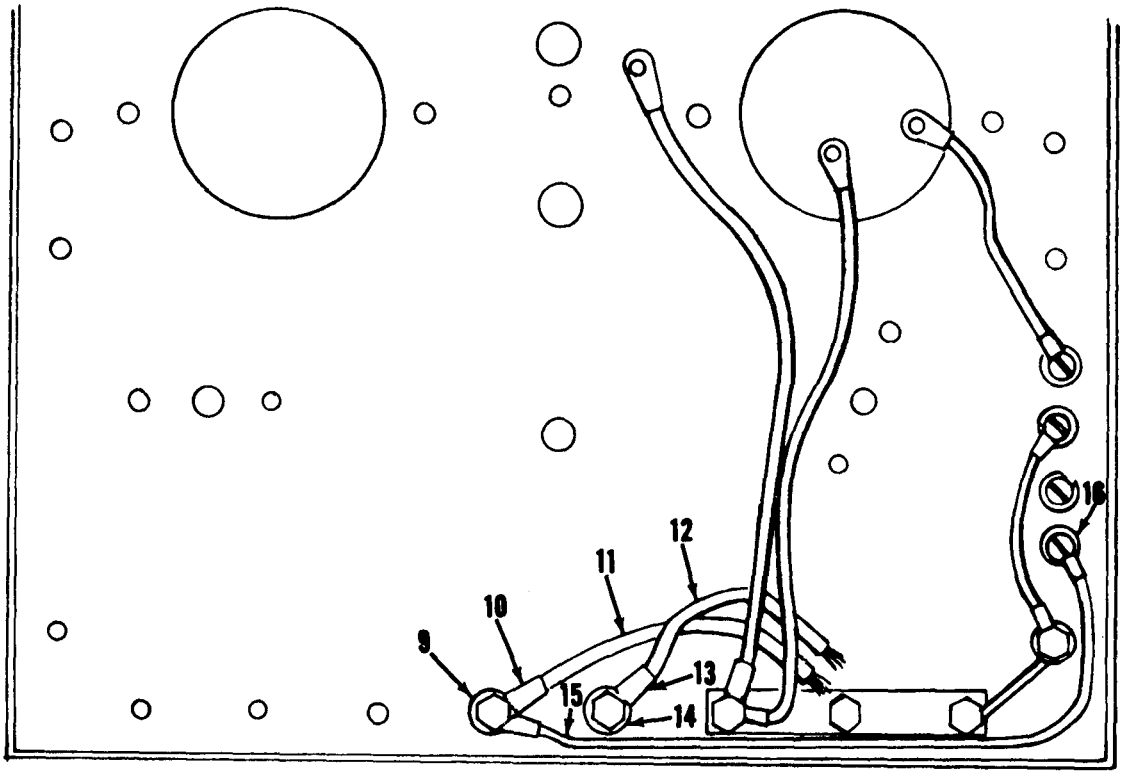




KEY to fig. 5-16:
1. Screw, machine
2. Binding post
3. Washer, flat
4. Panel
5. Washer, flat
6. Nut, plain, hexagon
7. 1/4-OHM resistor assembly
8. Washer, lock
9. Machine screw
10. 1/4-OHM fixed resistor binding post

WE 38508

Figure 5-16. 1/4-OHM fixed resistor binding jests disassembles. WE 38508



KEY to fig. 5-17:

1. Screw, machine
2. Binding post
3. Washer, flat
4. Panel
5. Washer, flat
6. Nut, plain, hexagon
7. Washer, lock
8. Machine screw
9. 12-Volt load bank binding post
10. Terminal lug
11. 12-Volt load bank post electrical wire
12. 24-Volt load bank post electrical wire
13. Terminal lug
14. 24-Volt load bank binding post
15. 12-Volt load bank link post electrical wire
16. 12-Volt load bank link binding post

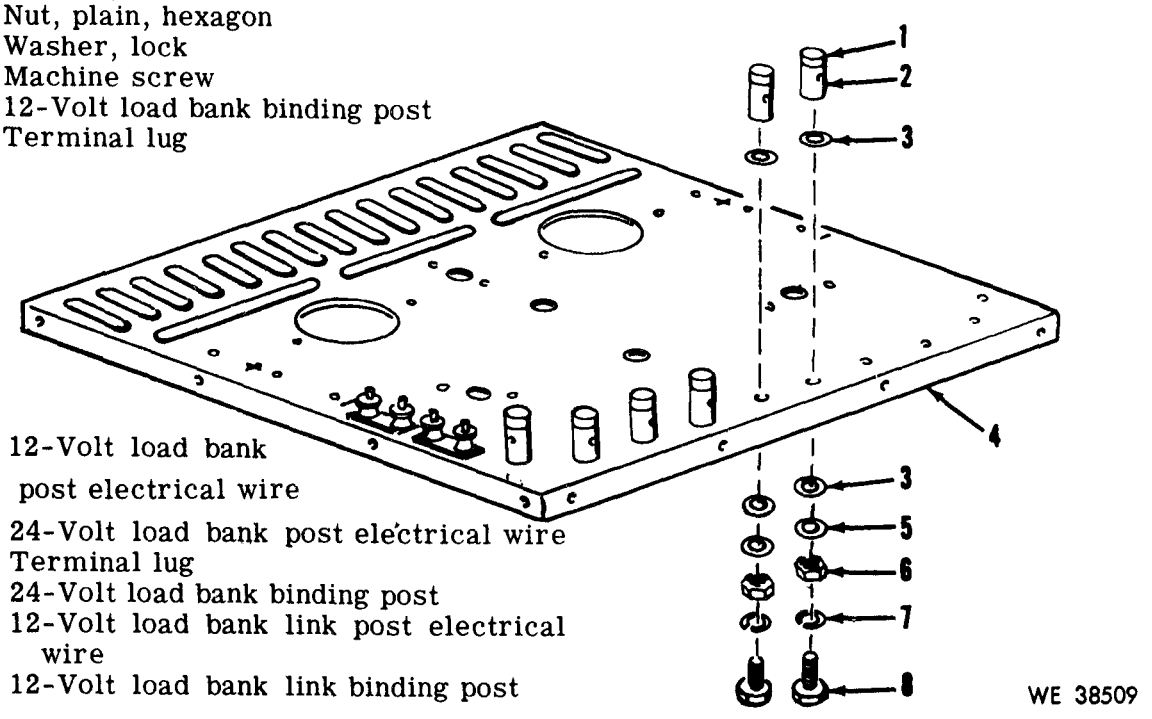
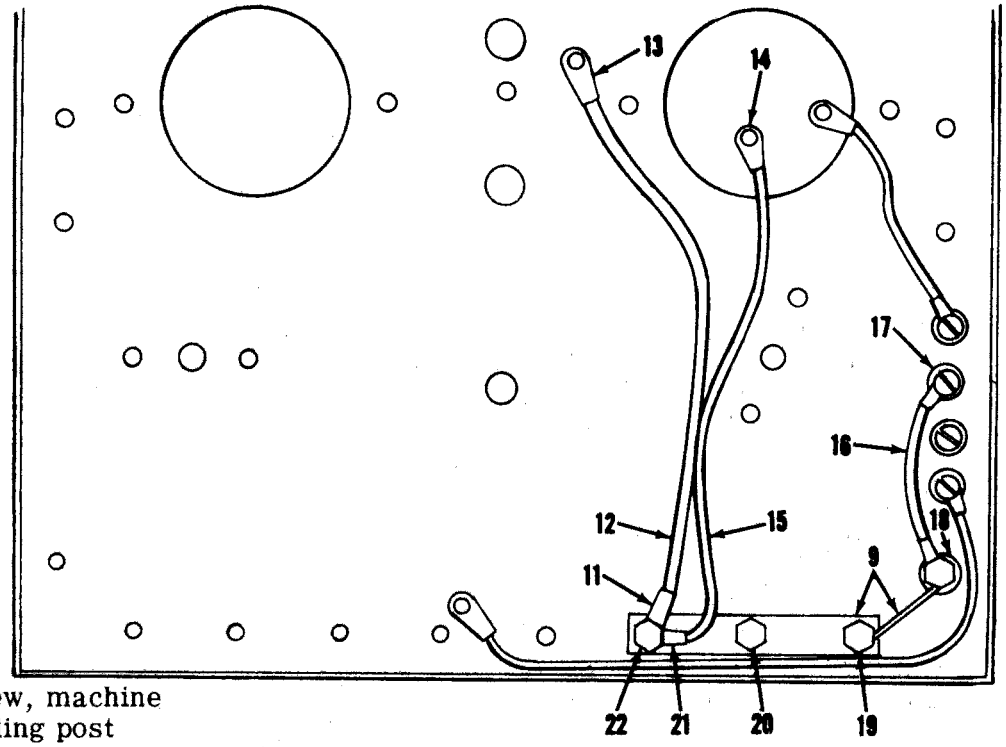
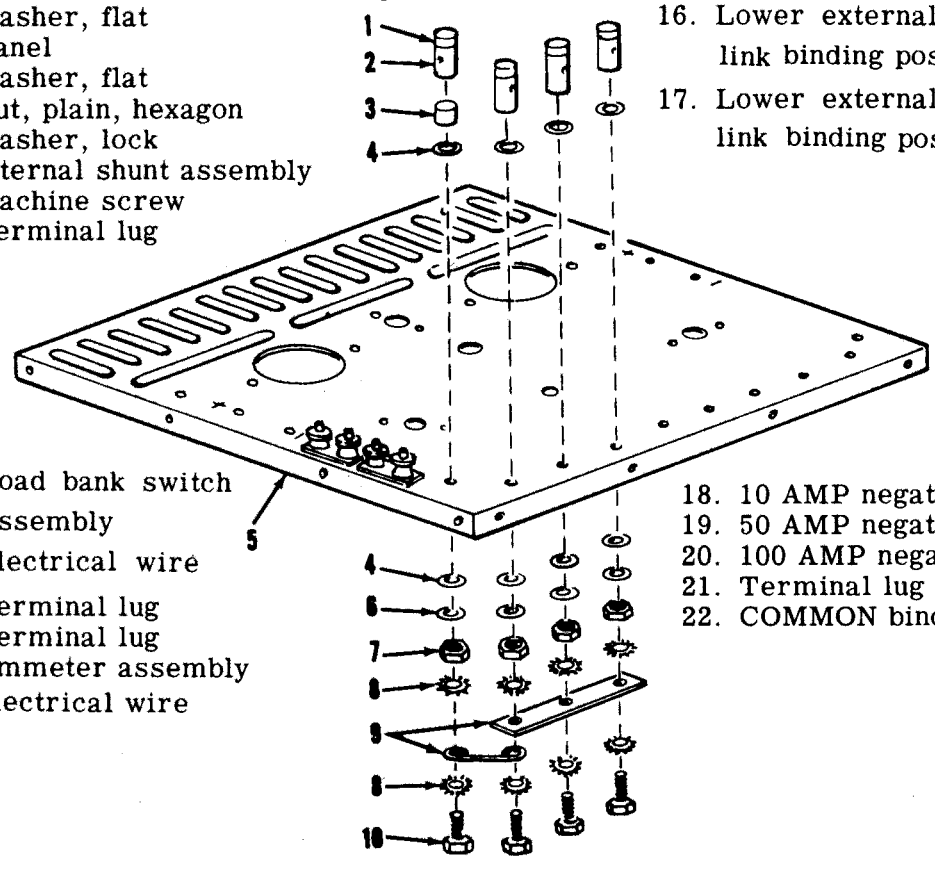


Figure 5-17. 12-, 24-Volt load bank binding posts disassembles. WE 38509



KEY
to fig.
5-18:

1. Screw, machine
2. Binding post
3. Electrical insulation sleeving
4. Washer, flat
5. Panel
6. Washer, flat
7. Nut, plain, hexagon
8. Washer, lock
9. Internal shunt assembly
10. Machine screw
11. Terminal lug
12. Load bank switch assembly electrical wire
13. Terminal lug
14. Terminal lug
15. Ammeter assembly electrical wire
16. Lower external shunt disconnect link binding post electrical wire
17. Lower external shunt disconnect link binding post
18. 10 AMP negative binding post
19. 50 AMP negative binding post
20. 100 AMP negative binding post
21. Terminal lug
22. COMMON binding post



WE 38510

Figure 5-18. 10-, 50-, 100-AMP negative, and COMMON binding post disassemblies. WE 38510

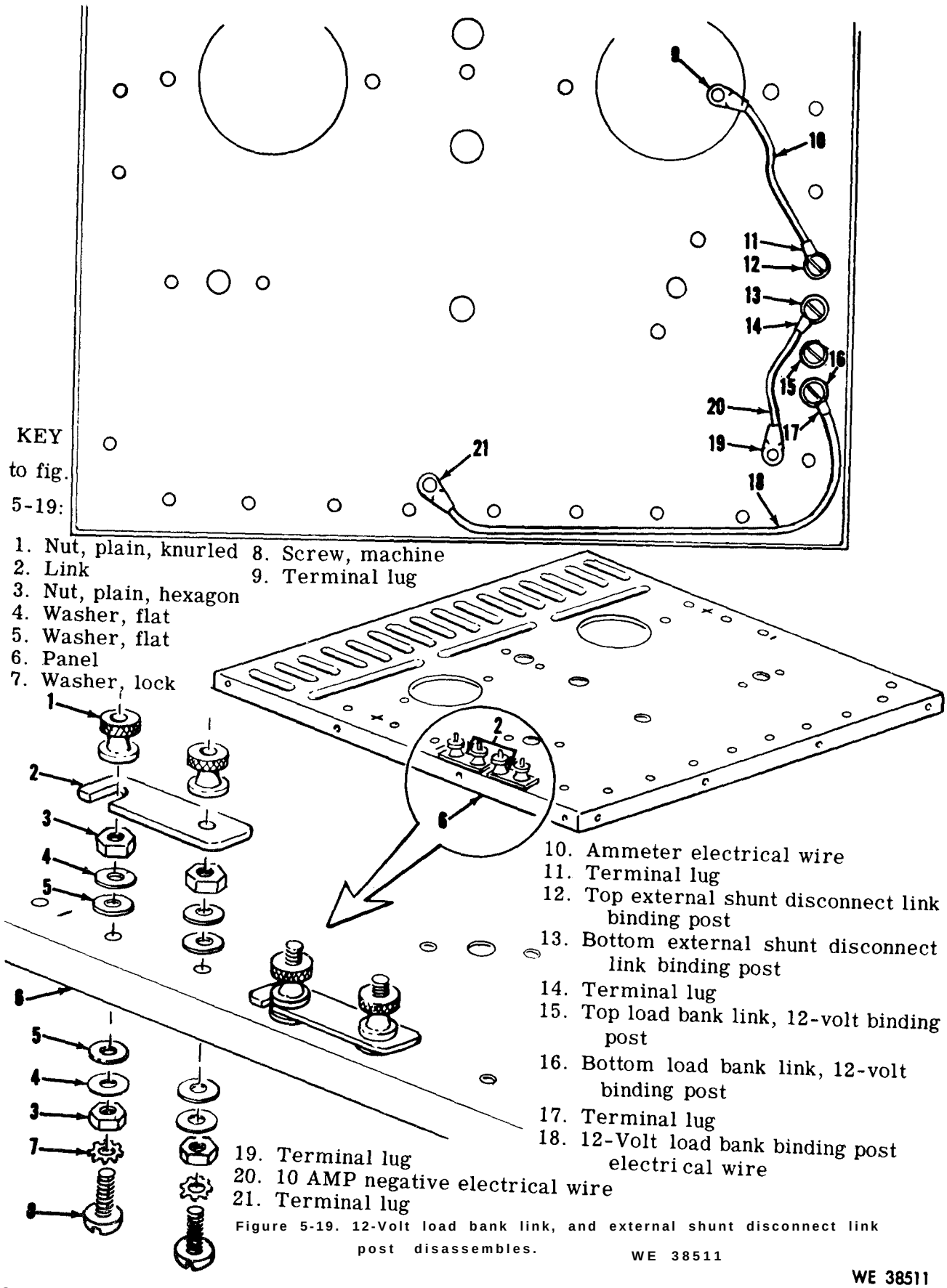


Figure 5-19. 12-Volt load bank link, and external shunt disconnect link post disassembles.

WE 38511

WE 38511

CHAPTER 6

REPAIR OF CONTROL PLATE, LOAD BANK SELECTOR SWITCH

Section I. GENERAL

6-1. Scope. This section describes procedures performed prior to repair of control plate (Fig. 6-l). The control plate slides into the mount (8, Fig. 5-13) of the load bank selector switch assembly (6, Fig. 5-13). The control plate is engaged by the control shaft (7, Fig. 5-13) as described in paragraph 5-32. First indication of malfunction will be the detection of smoke from inside of test set. The smoke will smell like fiber or insulation burning. Repair of control plate will be made at this time to prevent further damage.

6-2. Maintenance. This repair is the responsibility of direct support and general support maintenance as authorized by the Maintenance Allocation Chart.

6-3. Removal. Remove panel from case as described in paragraph 5-19.

6-4. Inspection. Inspect control plate (Fig. 6-1) for evidence of burning.

6-5. Disassembly.

Note: The key numbers shown below in parentheses refer to figure 6-1.

Disassemble as described in paragraph 5-32 with the following exception. The wires (2 and 4) will be disconnected at the binding post (1 and 3) end as described in paragraph 5-36 instead of copper plate (5) end.

Section II. RECLAMATION TECHNIQUES

6-6. Repair Procedures.

Note: The key numbers shown below in parentheses refer to figure 6-1. except where otherwise noted.

a. Clean all burned material (6) from control plate.

b. Fill cleaned depression with adhesive (epoxy base) (FSN 8040-753-4800) (7) till the filled area is slightly higher than the surrounding surface (8).

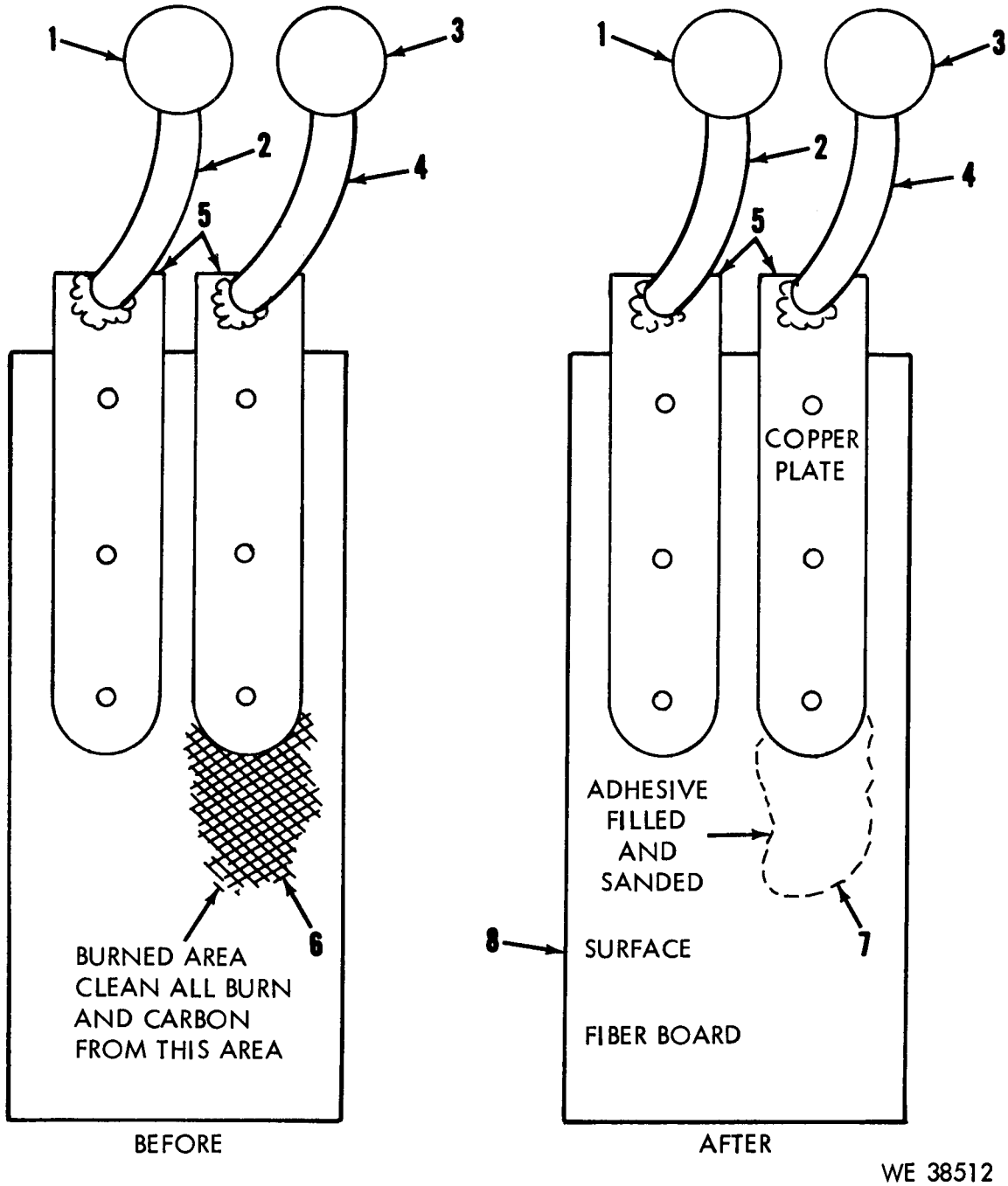
c. When adhesive is dry, file and sand smooth to the level of surrounding surface.

d. Clean sanding and filing residue from area.

e. Lubricate the inside ends of control leads (11, Fig. 5-13) with an electrical lubricant (FSN 9150-273-2389).

6-7. Reassembly. Reassemble in reverse order described in paragraph 6-5. Do not bend control lead (11, Fig. 5-13) ends when sliding control plate (9, Fig. 5-13) back into mount (8, Fig. 5-13).

6-8. Installation. Reinstall panel into case in reverse order described in paragraph 5-19.



KEY to fig. 6-1:
1. 12-V load bank binding post
2. 12-V load bank binding post wire
3. 24-V load bank binding post
4. 24-V load bank binding post wire
5. Copper plate
6. Burned material
7. Adhesive
8. Surface

Figure 6-1. Control plate. WE 38512

CHAPTER 7

ADMINISTRATIVE STORAGE

Refer to TM 740-90-1 for administrative storage of equipment.

APPENDIX A

REFERENCES

A-1. Supply Catalog

Adapter Set, Engine Electrical Test: Sealed for - SC 4910-95-CL-A55 Wheeled Tactical Vehicles, 54 V, 5 Adapters in Metal Box (4910-348-7600)

A-2. Forms

DA Form 2028, Recommended Changes to Publications
DA Form 2404, Equipment Inspection and Maintenance Worksheet

A-3. Other Publications

a. *General.*

Control of COMSEC Material . . . . . .AR 380-41
Defense Demilitarization Manual . . . . . DOD 4160.21-M-1
Electrical Equipment (Auto-Lite) . . . . . TM 9-1825B
Electrical Equipment (Delco-Remy) . . . . . TM 9-8627
Federal Supply Code for Manufacturers . . . . . SB 708-42
United States and Canada-Code to Name (Cataloging Handbook H4-2)
Intensive Management of Secondary Items . . . . . AR 710-50
The Army Maintenance Management Systems (TAMMS) . . . . . TM 38-750

b. *Maintenance and Repair.*

Calibration Procedure for Automotive Generator and Voltage Regulator Test Set 4910-092-9136 . . . . . TB 9-4910-521-50
Classification, Reclassification, Maintenance, Issuance and Reporting of Maintenance Training Aircaft . . . . . AR 700-42
Operation and organizational, Field, and Depot Maintenance: Storage Batteries, Lead-Acid Type . . . . . TM 9-6140-200-15
Operator's Manual: Welding Theory and Application . . . . . TM 9-237
Organization, Policies, and Responsibilities for Maintenance Operation . . . . . AR 750-5
Painting Instructions for Field Use . . . . . .TM 9-213
Solder and Soldering . . . . TB Sig 222

c. *storage.*

Administrative Storage of Equipment . . . . . TM 740-90-1
Storage Serviceability Standard for USA WECOM Materiel: Tools and Equipment . . . . . SB 740-95-501

APPENDIX B

MAINTENANCE ALLOCATION CHART

Section I. INTRODUCTION

B-1. General. The Maintenance Allocation Chart allocates maintenance operations to the proper category of maintenance. Allocations of maintenance operations are made on the basis of time, tools, and skills normally available to the various categories of maintenance to combat situation and influenced by maintenance policy and sound maintenance practices, as outlined in AR 750-5.

B-2. Maintenance Functions. Maintenance functions will be limited to and defined as follows:

a. *INSPECT*. To determine serviceability of an item by comparing its physical, mechanical, and electrical characteristics with established standards.

b. *TEST*. To verify serviceability and to detect electrical or mechanical failure by use of test equipment.

c. *SERVICE*. To clean, to preserve, to charge, and to add fuel, lubricants, cooling agents, and air.

d. *ADJUST*. To rectify to the extent necessary to bring into proper operating range.

e. *ALIGN*. To adjust specified variable elements of an item to bring to optimum performance.

f. *CALIBRATE*. To determine the corrections to be made in the readings of instruments or test equipment used in precise measurement. Consists of the comparison of two instruments, one of which is certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared with the certified standard.

g. *INSTALL*. To set up for use in an operational environment such as an emplacement, site, or vehicle.

h. *REPLACE*. To replace unserviceable items with serviceable like items.

i. *REPAIR*. Those maintenance operations necessary to restore an item to serviceable condition through correction of material damage or a specific failure. Repair may be accomplished at each category of maintenance.

j. *OVERHAUL*. Normally, the highest degree of maintenance performed by the Army in order to minimize time work in process is consistent with quality and economy of operation. It consists of that maintenance necessary to restore an item to completely serviceable condition as prescribed by maintenance standards in technical publications for each item of equipment. Overhaul normally does not return an item to like new, zero mileage, or zero hour condition.

k. *REBUILD*. The highest degree of materiel maintenance. It consists of restoring equipment as nearly as possible to new condition in accordance with original manufacturing standards. Rebuild is performed only when required by operational considerations or other paramount factors and then only at the depot maintenance category. Rebuild reduces to zero the hours or miles the equipment, or component thereof, has been in use.

1. *SYMBOLS*. The uppercase letter placed in the appropriate column indicates the lowest level at which that particular maintenance function is to be performed.

B-3. Explanation of Format. Purpose and use of the Maintenance Allocation Chart format are as follows:

a. *Column 1, Group Number*. Column 1 lists group numbers, the purpose of which is to identify components, assemblies, subassemblies and modules with the next higher assembly.

b. *Column 2, Functional Group*. Column 2 lists the noun names of components, assemblies, subassemblies and modules on which maintenance is authorized.

c. *Column 3, Maintenance Functions*. Column 3 lists the category of maintenance.

d. *Use of Symbols*. See legend at bottom of Maintenance Allocation Chart.

e. *Column 4, Tools and Equipment*. This column shall be used to specify, by code, those tools and test equipment required to perform the designated function.

f. *Column 5, Remarks*. Self-explanatory.

Section II. MAINTENANCE ALLOCATION CHART
FOR

TEST SET, GENERATOR AND VOLTAGE REGULATOR AUTOMOTIVE

(1) GROUP NO.	(2) FUNCTIONAL GROUP	(3) MAINTENANCE FUNCTION											(4) TOOLS & EQUIP	(5) REMARKS
		Inspect	Test	Service	Adjust	Align	Calibrate	Install	Replace	Repair	Overhaul	Rebuild		
1	CIRCUIT TESTER	C	O	C	C		H			F	H			
2	PANEL GROUP	C	F	C	C			F	F	F				
	SWITCHES		F	F				F	F	F				
	METERS	C	F	C	C			F	F					
	RESISTORS	F	F					F	F					
	RHEOSTAT ASSEMBLIES	F	F	F				F	F					
	POST, BINDING	C		O				F	F	F				
	SHUNTS	F	F					F	F					
3	LOAD BANK GROUP	F	F	F				F	F	F				
	RESISTOR PANEL ASSEMBLY	F	F					F	F					
		F	F					F	F					
4	EQUIPMENT GROUP	C	O	C				C	O	O				
	LEAD ASSEMBLIES	C	O	C				C	C	O				

LEGEND: C-Operator/ Crew
O-Organizational Maintenance
F-Direct Support Maintenance
H-General Support Maintenance
D-Depot Maintenance

APPENDIX C
BASIC ISSUE ITEMS LIST AND ITEMS TROOP INSTALLED OR AUTHORIZED LIST AND OPERATOR'S, ORGANIZATIONAL, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE REPAIR PARTS AND SPECIAL TOOLS LIST (INCLUDING DEPOT MAINTENANCE REPAIR PARTS AND SPECIAL TOOLS)

Section I. INTRODUCTION

C-1. Scope.

This appendix lists repair parts and special tools required by the crew/operator for operation and required for the performance of organizational, direct support, and general support maintenance of the automotive generator and voltage regulator test set.

C-2. General.

This Repair Parts, and Special Tools List is divided into the following sections

a. Basic Issue Items List. Not applicable.

b. Items Troop Installed or Authorized List. Not applicable.

c. Repair Parts List - Section II. A list of repair parts authorized at the organizational level for the performance of maintenance in figure and item number sequence.

d. Tools and Support Equipment-Section III. A list of operating tools and support equipment authorized at the organizational level for use by test set operator and crew.

e. Repair Parts List - Section IV. A list of repair parts authorized for the performance of maintenance at the direct support and general support levels in figure and item number sequence.

f. Special Tools List. Not applicable.

g. Federal Stock Number and Reference Number Index-Section V. A list, in ascending numerical sequence, of all Federal stock numbers appearing in the listings, followed by a list, in alpha-meric sequence, of all reference numbers appearing in the listings. Federal stock number and reference numbers are cross-referenced to each illustration figure and item number appearance.

C-3. Explanation of Columns.

The following provides an explanation of columns found in the tabular listings.

a. Source, Maintenance, and Recoverability Codes (SMR).

(1) *Source code.* Indicates the source for the listed items. Source codes are:

code	*Explanation*
P	Repair parts, special tools and test equipment supplied from the GSA/DSA or Army supply system, and authorized for use at indicated maintenance categories.
P 2	Repair parts, special tools and test equipment which Repair Parts, Special Tools and Test Equipment which are procured and stocked for insurance purposes because the combat or military essentiality of the end item dictates that a minimum quantity be available in the supply system.
P 9	Assigned to items which are NSA design controlled: unique repair parts, special tools, test, measuring, and diagnostic equipment, which are stocked and supplied by the Army COMSEC Logistic System and which are not subject to the provisions of AR 380-41.
P 10	Assigned to items which are NSA design controlled: special tools, test, measuring, and diagnostic equipment for COMSEC support, which are accountable under the provisions of AR 380-41 and which are stocked and supplied by the Army COMSEC Logistic System.
M	Repair parts, special tools and test equipment which are not procured or stocked as such in the supply system but are to be manufactured at indicated maintenance levels.
A	Assemblies which are not procured or stocked as such but are made up of two or more units. Such component units carry individual stock numbers and descriptions, are procured and stocked separately and can be assembled to form the required assembly at indicated maintenance categories.
X	Parts and assemblies that are not procured or stocked because the failure rate is normally below that of the

Code	Explanation
	applicable end item or component. The failure of such part or assembly should result in retirement of the end item from the supply system.
X1	Repair parts which are not procured or stocked. The requirement for such items will be filled by the next higher assembly or component.
X2	Repair parts, special tools, and test equipment which are not stocked and have no foreseen mortality. The indicated maintenance category requiring such repair parts will attempt to obtain the parts through cannibalization or salvage. The item may be requisitioned with exception data, from the end item manager, for immediate use.
G	Major assemblies that are procured with PEMA funds for initial issue only as exchange assemblies at DS and GS level. These assemblies will not be stocked above the DS and GS level or returned to depot supply level.

NOTE

Cannibalization or salvage may be used as a source of supply for any items source coded above except those coded Xl and aircraft support items as restricted by AR 700-42.

(2) *Maintenance* ***code.*** Indicates the lowest category of maintenance authorized to install the repair part and/or use the special tool or test equipment for each application. Capabilities of higher maintenance categories are considered equal or better. Maintenance codes are:

Code	Explanation
C	Crew/operator
O	Organizational maintenance
F	Direct support maintenance
H	General support maintenance
D	Depot maintenance

(3) *Recoverability code.* Indicates whether unserviceable items should be returned for recoverv or salvrage. Items not coded are nonrecoverable. Recoverability coees are:

Code	Explanation
R	Repair parts (assemblies and components) special tools and test equipment which are considered economically reparable at direct and general support maintenance levels. When the item is no longer economically reparable, it is normally disposed of at the GS level. When supply considerations dictate, some of these repair parts may be listed for automatic return to supply for depot level repair as set forth in AR 710-50. When so listed, they will be replaced by supply on an exchange basis.
S	Repair parts, special tools, test equipment and assemblies which are economically reparable at DS and GS activities and which normally are furnished by supply on an exchange basis. When items are determined by a GSU to be uneconomically reparable, they will be evacuated to a depot for evaluation and analysis before final disposition.
T	Higher dollar value recoverable repair parts, special tools and test equipment which are subject to special handling and are issued on an exchange basis. Such items will be repaired or overhauled at depot maintenance activities only. No repair may be accomplished at lower levels.
U	Repair parts, special tools and test equipment specifically selected for salvage by reclamation units because of precious metal content, critical materials, high dollar value, or reusable casings or castings.

b. *Federal Stock Number.* Indicates the Federal stock number assigned to the item and will be used for requisitioning purposes.

c. *Description.* Indicates the Federal item name and a minimum description required to identify the item. The last line indicates the reference number followed by the applicable Federal Supply Code for Manufacturer (FSCM) in parentheses. The FSCM is used as an element in item identification to designate manufacturer or distributor or Government agency, etc., and is identified in SB 708-42. Items that are included in kits and sets are listed below the name of the kit or set with quantity of each item in the kit or set indicated in front of the item name.

d. *Unit of Measure (U/M).* Indicates the standard or basic quantity by which the listed item is used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation, e.g., ea, in., pr, etc., and is the basis used to indicate quantities and allowances in subsequent columns. When the unit of measure differs from the unit of issue, the lowest unit of issue that will satisfy the required units of measure will be requisitioned.

e. *Quantity Incorporated in Unit.* Indicates the quantity of the item used in the breakout shown on the illustration figure, which is prepared for a functional group, subfunctional group, or an assembly. A "V" appearing in this column in lieu of a quantity indicates that no specific quantity is applicable, e.g., shims, spacers, etc.

f. *Maintenance Allowances.* All items are authorized for use as required.

g. *Illustration.* This column is divided as follows:

(1) *Figure number.* Indicates the figure number of the illustration on which the item is shown.

(2) *Item number.* Indicates the callout number used to reference the item on the illustration.

C-4. Special Information. Not applicable.

C-5. How to Locate Repair Parts.

a. *When Federal Stock Number or Reference Number Is Unknown:*

(1) *First.* Find the illustration of the assembly or subassembly to which the repair part belongs.

(2) *Second.* Identify the repair part on the illustration and note the illustration figure and item number of the repair part.

(3) *Third.* Using the Repair Parts Listing, find the figure and item number listed in the illustration column.

b. *When Federal Stock Number or Reference Number Is Known:*

(1) *First.* Using the Index of Federal Stock Numbers and Reference Numbers, find the pertinent Federal stock number or reference number. This index is in ascending FSN sequence followed by a list of reference numbers in ascending alphanumeric sequence, cross-referenced to the illustration figure and item number.

(2) *Second.* Using the Repair Parts Listing, find the illustration figure number and item number referenced in the Index of Federal Stock Numbers and Reference Numbers.

C-6. Abbreviations.

al	aluminum
amp	ampere(s)
AWG	American Wire Gage
br	brass
btry	battery
bz	bronze
cop.	copper
exter	external
fbr	fiber
fin	finish(ing)
flex.	flexible
h	high, height
NC	American National Coarse Thread
NEF	American National Extra Fine Thread
NF	American National Fine Thread
pos	positive
ref	reference(s)
reqd	required
ru	rubber
sm	smooth
sp	special
spg-S	spring steel
stght	straight
UNC	Unified Coarse Thread
UNF	Unified Fine Thread
W	wide, width

Section II. REPAIR PARTS LIST

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION REF. NUMBER & MFR. CODE	USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 15-DAY ORG. MAINT ALW (a) 1-5	(b) 6-20	(c) 21-50	(d) 51-100	(7) ILLUSTRATION (A) FIG. NO.	(B) ITEM NO.
		REPAIR PARTS FOR: AMMETER NEGATIVE TEST LEAD (6625-885-5757)									
P O --	6145-705-6676	WIRE, ELECTRICAL (9 FT REQD) MLC 13486-1 (81349)		FT	9	*	*	*	*	4-1	1
P O --	5940-050-6221	TERMINAL, LUG COP. OR AL BZ 30635 (00779)		EA	1	*	*	*	*	4-1	2
P O --	5935-258-4565	COVER, ELECTRICAL CONNECTOR NONMETALLIC MATERIAL 143 (76545)		EA	1	*	*	*	*	4-1	3
P O --	5940-204-5777	CLIP, ELECTRICAL BTRY TYPE, COP. 210 (76545)		EA	1	*	*	*	*	4-1	5
K2 O --		PLUG, TIP STGHT TYPE 600828 (01216)		EA	1					4-1	7
		AMMETER POSITIVE TEST LEAD (6625-885-5759)									
P O --	6145-705-6676	WIRE, ELECTRICAL (9 FT REQD) MLC 13486-1 (81349)		FT	9	*	*	*	*	4-1	1
P O --	5940-050-6221	TERMINAL, LUG COP. OR AL BZ 30635 (00779)		EA	1	*	*	*	*	4-1	2
P O --	5940-204-5777	CLIP, ELECTRICAL BTRY TYPE, COP. 210 (76545)		EA	1	*	*	*	*	4-1	5
P O --	5975-281-0024	CABLE NIPPLE, ELECTRICAL FLEX., PLASTIC FSM 32691-1P (28527)		EA	1	*	*	*	*	4-1	6
K2 O --		PLUG, TIP STGHT TYPE 600828 (01216)		EA	1					4-1	7
		FIELD TEST LEAD (6625-885-5755)									
P O --	5940-230-1212	CLIP, ELECTRICAL BTRY TYPE, COP. 3169 (86796)		EA	1	*	*	*	*	4-2	1
P O --	5975-383-1318	CABLE NIPPLE, ELECTRICAL FLEX., PLASTIC LA410544-2 (35225)		EA	1	*	*	*	*	4-2	3
P O --	6145-772-2204	WIRE, ELECTRICAL (9 FT REQD) 812363 (18876)		FT	9	*	*	*	*	4-2	4
K2 O --		PLUG, TIP STEP TYPE 600800 (01216)		EA	1					4-2	5
		JUMPER TEST LEAD (6625-885-5756)									
P O --	5975-383-1318	CABLE NIPPLE, ELECTRICAL FLEX., PLASTIC LA410544-2 (35225)		EA	2	*	*	*	*	4-3	2
P O --	6145-772-2204	WIRE, ELECTRICAL (1 FT REQD) 812363 (18876)		FT	1	*	*	*	*	4-3	3
P O --	5940-230-1212	CLIP, ELECTRICAL BTRY TYPE, COP. 3169 (86796)		EA	2	*	*	*	*	4-3	4
		VOLTMETER NEGATIVE TEST LEAD (6625-885-5758)									
P O --	5940-230-1212	CLIP, ELECTRICAL BTRY TYPE, COP. 3169 (86796)		EA	1	*	*	*	*	4-2	1
P O --	5975-383-1318	CABLE NIPPLE, ELECTRICAL FLEX., PLASTIC LA410544-2 (35225)		EA	1	*	*	*	*	4-2	3

Section II. REPAIR PARTS LIST – Continued

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	DESCRIPTION REF. NUMBER & MFR. CODE	USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 15-DAY ORG. MAINT ALW (a) 1-5	(b) 6-20	(c) 21-50	(d) 51-100	(7) ILLUSTRATION (A) FIG. NO.	(B) ITEM NO.
		VOLTMETER NEGATIVE TEST LEAD - Continued									
P O --	6145-772-2204	WIRE, ELECTRICAL (9 FT REQD) 812363 (18876)		FT	9	*	*	*	*	4-2	4
X2 O --		PLUG, TIP STEP TYPE 600800 (01216)		EA	1					4-2	5
		VOLTMETER POSITIVE TEST LEAD (6625-885-5760)									
P O --	5940-230-1212	CLIP, ELECTRICAL BTRY TYPE, COP. 3169 (86796)		EA	1	*	*	*	*	4-2	1
P O --	6145-772-2204	WIRE, ELECTRICAL (9 FT REQD) 812363 (18876)		FT	9	*	*	*	*	4-2	4
X2 O --		PLUG, TIP STEP TYPE 600800 (01216)		EA	1					4-2	5
P O --	5975-281-0046	CABLE NIPPLE, ELECTRICAL FLEX. , PLASTIC 4030T250-251 (89482)		EA	1	*	*	*	*	4-2	6

Section III. TOOLS AND SUPPORT EQUIPMENT

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION REF. NUMBER & MFR. CODE	USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 15-DAY ORG. MAINT ALW (a) 1-5	(b) 6-20	(c) 21-50	(d) 51-100	(7) ILLUSTRATION (A) FIG. NO.	(B) ITEM NO.
		VOLTMETER POSITIVE TEST LEAD (6625-885-5760)									
P C --	6625-885-5757	LEAD, TEST NEGATIVE, AMMETER TV 186B (02805)		EA	1	*	*	*	*	2-2	1
P C --	6625-885-5759	LEAD, TEST POS, AMMETER TV 186R (02805)		EA	1	*	*	*	*	2-2	2
P C --	6625-885-5760	LEAD, TEST POS, VOLTMETER TV 188R (02805)		EA	1	*	*	*	*	2-2	3
P C --	6625-885-5758	LEAD, TEST NEGATIVE, VOLTMETER TV 188B (02805)		EA	1	*	*	*	*	2-2	4
P C --	6625-885-5755	LEAD, TEST FIELD TV 167 (02805)		EA	2	*	*	*	*	2-2	5
P C --	6625-885-5761	SHUNT ASSEMBLY, INSTRUMENT EXTER, 500 AMP TV 102 (02805)		EA	1	*	*	*	*	2-2	6
P C --	6625-885-5756	LEAD, TEST JUMPER TV 189 (02805)		EA	1	*	*	*	*	2-2	7

Section IV. REPAIR PARTS LIST

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION REF. NUMBER & MFR. CODE / USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (A) 1-20	(B) 21-50	(C) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (A) 1-20	(B) 21-50	(C) 51-100	(8) 1-YR ALW PER 100 EQUIP CNTGY	(9) ILLUSTRATION (A) FIG. NO.	(B) ITEM NO.
		REMOVE COVER											
X2 F --		COVER 17-1/4 LG, 14-7/8 W, 3/4 DEPTH A600810 (01216)	EA	1								5-1	1
X2 F --		CASE 17 LG, 14-5/8 W, 10-1/8 DEPTH A600906 (01216)	EA	1								5-1	4
X2 F --		FOOT RU, 0.156 ID, 1 OD, 1 LG 10054 (01216)	EA	4								5-1	--
		REMOVE PANEL											
P F --	5305-391-1925	SCREW, MACHINE 10-24NC-2A, 7/16 LG 1768-14 (60703)	EA	15	*	*	*	*	*	*	*	5-2	1
P F --	5310-193-7571	WASHER, LOCK 0.221 ID, 0.462 OD, 0.025 THK 1612 (78189)	EA	15	*	*	*	*	*	*	*	5-2	2
		REMOVE PANEL —ASSEMBLY FROM LOAD BANK RESISTOR BOARD ASSEMBLY											
P F --	5305-391-1925	SCREW, MACHINE 10-24NC-2A, 7/16 LG 1768-14 (60703)	EA	2	*	*	*	*	*	*	*	5-3	3
P F --	5310-193-7571	WASHER, LOCK 0.221 ID, 0.462 OD, 0.025 THK 1612 (78189)	EA	2	*	*	*	*	*	*	*	5-3	4
		VIEW OF WIRING BEFORE DISASSEMBLY											
P F --	5940-143-4780	TERMINAL, LUG FOR 16 AWG WIRE RB 873 (59730)	EA	16	*	*	*	*	*	*	*	5-4	1 1B 2B 3B 4B 5B 6B 7B 1R 2R 3R 4R 5R 6R 7R 8R

Section V. FEDERAL STOCK NUMBER AND REFERENCE NUMBER INDEX – Continued

(1) SMR	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION REF. NUMBER & MFR. CODE	USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (A) 1-20	(B) 21-50	(C) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (A) 1-20	(B) 21-50	(C) 51-100	(8) 1-YR ALW PER 100 EQUIP CNTGY	(9) ILLUSTRATION (A) FIG. NO.	(B) ITEM NO.
		VIEW OF WIRING BEFORE DISASSEMBLY – Continued												
P F --	6145-060-0387	WIRE, ELECTRICAL 16 AWG, 7 STRANDS, 24 AWG J-C-30 (81348)		FT	8	*	*	*	*	*	*	*	5-4	1B 2B 3B 4B 5B 6B 7B
P F --	6145-263-6987	WIRE, ELECTRICAL 16 AWG, RED, 26 STRANDS, 30 AWG FED-S-J-C-90		FT	8	*	*	*	*	*	*	*	5-4	1R 2R 3R 4R 5R 6R 7R 8R
P F --	5940-143-4794	TERMINAL, LUG FOR 10 AWG WIRE RC 363 (59730)		EA	1	*	*	*	*	*	*	*	5-4	2
P F --	6145-283-9471	WIRE, ELECTRICAL 10 AWG, BLACK, 65 STRANDS, 28 AWG NO REF (33333)		FT	1	*	*	*	*	*	*	*	5-4	2
P F --	6145-164-6865	WIRE, ELECTRICAL 6 AWG, BLACK, 665 STRANDS, 34 AWG MIL-W-76 (96906)		FT	2	*	*	*	*	*	*	*	5-4	3
		DISASSEMBLY OF LOAD BANK RESISTOR BOARD ASSEMBLY												
P F --	5305-366-9190	SCREW, MACHINE 6-32NC-2A, BR M1575 (01121)		EA	4	*	*	*	*	*	*	*	5-5	1
P F --	5310-209-6051	WASHER, LOCK 0.164 ID, 0.271 OD, 0.032 THK 10426 (82423)		EA	4	*	*	*	*	*	*	*	5-5	2

Section IV. REPAIR PARTS LIST - Continued

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION REF. NUMBER & MFR. CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT (A) 1-20	(B) 21-50	(C) 51-100	(7) 30-DAY GS MAINT NAN (A) 1-20	(B) 21-50	(C) 51-100	(8) 1-YR ALW PER 100 QUIP NTGY	(9) ILLUSTRATION (A) FIG. NO.	(I) ITEM NO.
P F --	5325-290-4344	GROMMET, RUBBER 7/16 ID, 3/4 OD, 1/16 W GROOVE 2177 (83330)	EA	2	*	*	*	*	*	*	*	5-5	6
P F --	5940-557-4344	TERMINAL, LUG FOR 6 AWG WIRE RE 9711 (59730)	EA	4	*	*	*	*	*	*	*	5-5	8
P F --	5940-143-4774	TERMINAL, LUG FOR 16 AWG WIRE MS25036-153 (96906)	EA	1	*	*	*	*	*	*	*	5-5	9
P F --	5325-089-6159	GROMMET, RUBBER 5/16 ID, 5/8 OD, 1/16 W GROOVE 2174 (83330)	EA	1	*	*	*	*	*	*	*	5-5	14
X2 F --		TAPE, ADHESIVE, RUBBER 200 LG, 7/8 W, 1/32 THK, BLACK EC1202 (76381)	FT	1								5-5	16
		LOAD BANK RESISTOR HEAT BOARD											
X2 F --		HEAT BOARD 600786 (01216)	EA	1								5-6	1
M F --		PLATE, COPPER 9 LG, 5/8 W, 0.032 THK SPEC QQ-B-825 FOR REPLACEMENT USE:	EA	2								5-6	2
P F --	9535-232-2293	COPPER STRIP 36 LG, 12 W, 0.032 THK SPEC QQ-B-825	EA	1	*	*	*	*	*	*	*	5-6	2
P F --	5305-208-0316	SCREW, MACHINE 8-32 NC-2A, BR 1284 (59433)	EA	32	*	*	*	*	*	*	*	5-6	5
P F --	5310-190-2924	WASHER, FLAT 0.187 ID, 0.312 OD, 0.031 THK, BR 100704 (64560)	EA	40	*	*	*	*	*	*	*	5-6	6
P F --	5310-837-7396	WASHER, LOCK 0.187 ID, 0.328 OD, 0.056 THK T155-10 (12584)	EA	32	*	*	*	*	*	*	*	5-6	7
P F --	5310-754-3384	NUT, PLAIN, HEXAGON 8-32 NC-2B, BR 9024483 (18876)	EA	40	*	*	*	*	*	*	*	5-6	8
P F --	5305-954-8997	SCREW, MACHINE 10-24 NC-2A, 1-1/4 LG MS35214-60 (96906)	EA	8	*	*	*	*	*	*	*	5-6	10
P F --	5310-546-8204	WASHER, LOCK 0.218 ID, 0.437 OD, 0.040 THK, BR 8520331 (18876)	EA	16	*	*	*	*	*	*	*	5-6	11
M F --		TUBE, COPPER 7/32 ID, 1/2 LG WW-T-775 FOR REPLACEMENT USE:	EA	8								5-6	12
P F --	4710-277-5526	TUBE, COPPER 25 FT LG, 0.312 OD, 0.032 THK WALL WW-T-775	FT	1	*	*	*	*	*	*	*	5-6	12
P F --	5310-826-5137	NUT, PLAIN, HEXAGON 10-24NC-2B, BR 9024484 (18876)	EA	16	*	*	*	*	*	*	*	5-6	13
P F --	5310-546-8204	WASHER, LOCK 0.221 ID, 0.380 OD, 0.056 THK 8520331 (18876)	EA	8	*	*	*	*	*	*	*	5-6	14

Section IV. REPAIR PARTS LIST - Continued

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION EF. NUMBER & MFR. CODE / USABLE ON CODE	(4) UNIT OF MEAS	(5) TYPICAL ITEM QTY	(6) 30-DAY DS MAINT ALLOWANCE (A) 1-20	(B) 1-50	(C) 1-100	(7) 30-DAY GS MAINT ALLOWANCE (A) 1-20	(B) 1-50	(C) 1-100	(8) 1-YR ALW PER 100 EQUIP QTY	(9) ILLUSTRATION (A) FIG. NO.	(B) ITEM NO.
X2 F --		RESISTOR 2.1 OHM 600738 (01216)	EA	7								5-6	16
X2 F --		RESISTOR 1.8 OHM 600747 (01216)	EA	1								5-6	17
P F --	5305-800-6319	SCREW, MACHINE 1/4-20UNC, 1/2 LG N64P21008 (24446)	EA	2	*	*	*	*	*	*	*	5-6	19
P F --	5310-527-3634	WASHER, LOCK 0.250 ID, 0.494 OD, 0.028 THK MS35335-61 (96906)	EA	2	*	*	*	*	*	*	*	5-6	20
P F --	5310-014-7656	WASHER, FLAT 0.281 ID, 0.625 OD, 0.065 THK, BR CPC 657 (79172)	EA	4	*	*	*	*	*	*	*	5-6	21
P F --	5310-208-2716	NUT, PLAIN, HEXAGON 1/4-28UNF-2B, BR X 1051 (80719)	EA	2	*	*	*	*	*	*	*	5-6	22
		LOAD BANK SWITCH DISASSEMBLY											
P F --	5305-015-4982	SCREW, MACHINE 6-32NC-2A, 7/16 LG FF-S-92 (81348)	EA	2	*	*	*	*	*	*	*	5-8	1
P F --	5310-685-7625	WASHER, LOCK 0.141 ID, 0.250 OD, 0.030 THK SCC 614418 (80063)	EA	2	*	*	*	*	*	*	*	5-8	2
P F --	5930-685-9657	SWITCH, TOGGLE 2.156 LG, 1.516 W, 1.375 H MIL-S-21195A SHIPS (81349)	EA	1	*	*	*	*	*	*	*	5-8	5
M F --		PLATE, COPPER 2-1/4 LG, 5/8 W, 0.032 THK SPEC QQ-B-825 FOR REPLACEMENT USE:	EA	1								5-8	6
P F --	9535-232-2293	COPPER STRIP 36 LG, 12 W, 0.032 THK SPEC QQ-B-825	EA	1	*	*	*	*	*	*	*	5-8	6
P F --	5310-208-2716	NUT, PLAIN, HEXAGON 1/4-28 UNF-2B, BR X 1051 (80719)	EA	1	*	*	*	*	*	*	*	5-8	7
P F --	5310-014-7656	WASHER, FLAT 0.281 ID, 0.625 OD, 0.065 THK, BR CPC 657 (79172)	EA	1	*	*	*	*	*	*	*	5-8	8
P F --	5310-826-8266	WASHER, LOCK 0.250 ID, 0.500 OD, 0.020 THK 9024316 (18876)	EA	1	*	*	*	*	*	*	*	5-8	9
P F --	5305-800-6319	SCREW, MACHINE 1/4-20UNC, 1/2 LG N64P21008 (24446)	EA	1	*	*	*	*	*	*	*	5-8	10
P F --	5305-182-1333	SCREW, MACHINE 8-32 NC-2A, BR AN 508-8-4 (88044)	EA	4	*	*	*	*	*	*	*	5-8	11
P F --	5310-837-7396	WASHER, LOCK 0.187 ID, 0.328 OD, 0.056 THK T 155-10 (12584)	EA	4	*	*	*	*	*	*	*	5-8	12

Section IV. REPAIR PARTS LIST - Continued

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION REF. NUMBER & MFR. CODE / USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT (A) 1-20	(B) 1-50	(C) 1-100	30-DAY GS MAINT (A) 1-20	(B) 1-50	(C) 1-100	(8) 1-YR ALW PER 100 EQUIP QTY	(10) ILLUSTRATION (A) FIG. NO.	(B) ITEM NO.
		AMMETER AND VOLTMETER DISASSEMBLIES											
P F --	6625-928-3399	METER, AMPERE-HOUR 600604 (01216)	EA	1	*	*	*	*	*	*	*	5-9	1
M F --		RUBBER SHEET, CELLULAR 5 LG, 3-3/4 W, 1/8 THK RU, SM SURFACE MIL-R-6130 FOR REPLACEMENT USE:	EA	2								5-9	2
P F --	9320-141-7167	RUBBER SHEET, CELLULAR 24 LG, 24 W, 0.125 THK, RU, SM SURFACE MIL-R-6130	EA	1	*	*	*	*	*	*	*	5-9	2
P F --	6625-928-3398	VOLTMETER 600603 (01216)	EA	1	*	*	*	*	*	*	*	5-9	3
P F --	5310-727-8118	WASHER, LOCK 0.190 ID, 0.395 OD, 0.025 THK N413P19Q7 (24446)	EA	4	*	*	*	*	*	*	*	5-9	5
P F --	5310-815-9841	NUT, PLAIN, HEXAGON 8-32 NC-2B, CHROMATE FIN. 10034399-19 (18876)	EA	4	*	*	*	*	*	*	*	5-9	6
P F --	5310-754-3384	NUT, PLAIN, HEXAGON 8-32 NC-2B, BR 9024483 (18876)	EA	4	*	*	*	*	*	*	*	5-9	8
P F --	5310-837-7396	WASHER, LOCK 0.187 ID, 0.328 OD, 0.056 THK T 155-10 (12584)	EA	4	*	*	*	*	*	*	*	5-9	9
		VOLTMETER RANGE SELECTOR SWITCH DISASSEMBLY											
X2 F --		KNOB FLUSHTYPE BR INSERT 2379-4 (01216)	EA	1								5-10	
P F --	5305-638-2260	SETSCREW 8-32 NC-3A, 3/8 LG MS51021-34 (96906)	EA	1	*	*	*	*	*	*	*	5-10	2
P F --	5310-558-3175	NUT, PLAIN, HEXAGON 3/8-32 NEF-2B, BR NT 10011A (80249)	EA	1	*	*	*	*	*	*	*	5-10	3
P F --	5310-209-0737	WASHER, LOCK 0.405 ID, 0.678 OD, 0.022 THK 1920-04 (78189)	EA	1	*	*	*	*	*	*	*	5-10	4
X2 F --		RESISTOR 49.95 K 600734 (01216)	EA	1								5-10	7
X2 F --		RESISTOR 19.95 K 600733 (01216)	EA	1								5-10	8
X2 F --		RESISTOR 9950 OHM 600732 (01216)	EA	1								5-10	9
X2 F --		RESISTOR 950 OHM 600731 (01216)	EA	1								5-10	10
P F --	4910-421-1693	SWITCH, VOLTMETER 600730 (01216)	EA	1	*	*	*	*	*	*	*	5-10	11
P F --	5940-143-4780	TERMINAL, LUG FOR 16 AWG WIRE RB 873 (59730)	EA	1	*	*	*	*	*	*	*	5-10	12
P F --	6145-170-6869	WIRE, ELECTRICAL 16 AWG, BLACK, 16 STRANDS, 28 AWG 71-1677 COND 16 AWG (80063)	FT	1	*	*	*	*	*	*	*	5-10	13

Section IV. REPAIR PARTS LIST - Continued

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION REF. NUMBER & MFR. CODE / USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (A) 1-20	(B) 21-50	(C) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (A) 1-20	(B) 21-50	(C) 51-100	(8) 1-YR ALW PER 100 EQUIP CNTGY	(9) ILLUSTRATION (A) FIG. NO.	(B) ITEM NO.
		FINE LOAD BANK CONTROL RHEOSTAT DISASSEMBLY											
P F --	5305-281-3118	SETSCREW 8-32 NC-2A, 1/4 LG MS51021-32 (96906)	EA	1	*	*	*	*	*	*	*	5-11	1
X2 F --		KNOB FLUSHTYPE BR INSERT 17669 (01216)	EA	1								5-11	2
P F --	5310-558-3175	NUT, PLAIN, HEXAGON 3/8-32 NEF-2B, BR NT 10011A (80249)	EA	1	*	*	*	*	*	*	*	5-11	3
P F --	5310-209-0737	WASHER, LOCK 0.405 ID, 0.678 OD, 0.022 THK 1920-04 (78189)	EA	1	*	*	*	*	*	*	*	5-11	4
P F --	5310-531-8777	WASHER, FLAT 0.406 ID, 0.750 OD, 0.032 THK 236-1062P1 (94144)	EA	4	*	*	*	*	*	*	*	5-11	6
X2 F --		RHEOSTAT ASSEMBLY 10.2 OHM 600773 (01216)	EA	1								5-11	7
M F --		INSULATION SLEEVING, ELECTRICAL: FLEX., PLASTIC, 0.208 ID MIL-I-631 FOR REPLACEMENT USE:	FT	1								5-11	9
P F --	5970-841-6606	INSULATION SLEEVING, ELECTRICAL: FLEX., PLASTIC, 0.208 ID MIL-I-631	FT	1	*	*	*	*	*	*	*	5-11	9
P F --	6145-283-9471	WIRE, ELECTRICAL 10 AWG, BLACK, 65 STRANDS, 28 AWG NO REF (33333)	FT	1	*	*	*	*	*	*	*	5-11	1(
P F --	5940-143-4794	TERMINAL, LUG FOR 10 AWG WIRE RC 363 (59730)	EA	1	*	*	*	*	*	*	*	5-11	11
		FIELD RHEOSTAT CONTROL DISASSEMBLY											
P F --	5305-531-8340	SETSCREW, 10-36NF-3A, BR MS51021-43 (96906)	EA	1	*	*	*	*	*	*	*	5-12	1
X2 F --		KNOB FINGER SPINNER, BR SHAFT 1798-11 (01216)	EA	1								5-12	2
P F --	5305-811-6711	SCREW, MACHINE 1/4-20 UNC-2A, 1 LG 59647 (30874)	EA	2	*	*	*	*	*	*	*	5-12	3
P F --	5310-952-6876	WASHER, SPRING TENSION 0.281 ID, 0.427 OD, BERYLLIUM COP. 6285 B (93232)	EA	2	*	*	*	*	*	*	*	5-12	4
P F --	5310-339-4795	WASHER, FLAT 0.281 ID, 0.625 OD, 0.063 THK AU02TA171 (10855)	EA	4	*	*	*	*	*	*	*	5-12	6
X2 F --		FIELD RHEOSTAT CONTROL ASSEMBLY 70 OHM 600772 (01216)	EA	1								5-12	7
P F --	5310-754-3384	NUT, PLAIN, HEXAGON 8-32 NC-2B, BR 9024483 (18876)	EA	2	*	*	*	*	*	*	*	5-12	8

Section IV. REPAIR PARTS LIST - Continued

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION REF. NUMBER & MFR. CODE	USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY OS MAINT ALLOWANCE (A) 1-20	(B) 21-50	(C) 51-100	(7) 30-DAY OS MAINT ALLOWANCE (A) 1-20	(B) 21-50	(C) 51-100	(8) 1-YR ALW PER 100 EQUIP CNTGY	(9) ILLUSTRATION (A) FIG. NO.	(B) ITEM NO.
P F --	5310-190-2924	WASHER, FLAT 0.187 ID, 0.312 OD, 0.031 THK, BR 100704 (64560)		EA	2	*	*	*	*	*	*	*	5-12	9
P F --	5305-208-0316	SCREW, MACHINE 8-32NC-2A, BR 1284 (59433)		EA	2	*	*	*	*	*	*	*	5-12	10
		COARSE LOAD BANK CONTROL DISASSEMBLY												
P F --	5305-531-8340	SETSCREW 10-36NF-3A, BR MS51021-43 (96906)		EA	1	*	*	*	*	*	*	*	5-13	1
X2 F --		KNOB FINGER SPINNER, BR SHAFT 1798-11 (01216)		EA	1								5-13	2
P F --	5305-391-1925	SCREW, MACHINE 10-24NC-2A, 7/16 LG 1768-14 (60703)		EA	2	*	*	*	*	*	*	*	5-13	3
P F --	5310-197-4502	WASHER, LOCK 0.250 ID, 0.365 OD, 0.022 THK 1114-05-00 (78189)		EA	2	*	*	*	*	*	*	*	5-13	4
X2 F --		LOAD BANK SELECTOR SWITCH ASSEMBLY 600737 (01216)		EA	1								5-13	6
X2 F --		CLAMP, PLASTIC, LOOP TYPE 1/4 DIA 3063T (39428)		EA	1								5-13	12
X2 F --		RETAINING RING, E-TYPE 1/4 OPENING, 17/32 OD, 0.025 THK SPG-S 98407D (39428)		EA	1								5-13	13
		POSITIVE AND NEGATIVE BINDING POSTS FOR EXTERNAL SHUNT AND VOLTMETER DISASSEMBLIES												
X2 F --		BINDING POST 600727 (01216)		EA	4								5-14	2
P F --	5310-339-4795	WASHER, FLAT 0.281 ID, 0.625 OD, 0.063 THK AU02TA171 (10855) (SP WASHER - TURNED TO PREVENT TOUCHING PANEL AND SHORTING - MADE FROM FBR WASHER) 9/32 ID, 5/8 OD, 1/16 THK - TURN DOWN TO 3/8 DIA - 1/32 SHOULDER RECESSED		EA	8	*	*	*	*	*	*	*	5-14	3
P F --	5310-579-3435	WASHER, FLAT 0.312 ID, 0.750 OD, 0.051 THK, BR FF-W-92 (81348)		EA	4	*	*	*	*	*	*	*	5-14	5
P F --	5310-826-8266	WASHER, LOCK 0.250 ID, 0.500 OD, 0.020 THK 9024316 (18876)		EA	4	*	*	*	*	*	*	*	5-14	6
P F --	5305-740-2558	SCREW, MACHINE 1/4-28 UNF-2A, 5/8 LG, BR 5516898 (72560)		EA	4	*	*	*	*	*	*	*	5-14	7

Section IV. REPAIR PARTS LIST - Continued

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION REF. NUMBER & MFR. CODE / USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (A) 1-20	(B) 21-50	(C) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (A) 1-20	(B) 21-50	(C) 51-100	(8) 1-YR ALW PER 100 EQUIP CNTGY	(9) ILLUSTRATION (A) FIG NO	(B) ITEM NO.
P F --	5940-230-0515	TERMINAL, LUG FOR 16 AWG WIRE RB 713 (59730)	EA	1	*	*	*	*	*	*	*	5-14	9
P F --	5940-230-0515	TERMINAL, LUG FOR 16 AWG WIRE RB 713 (59730)	EA	1	*	*	*	*	*	*	*	5-14	11
P F --	6145-170-6869	WIRE, ELECTRICAL 16 AWG, BLACK, 16 STRANDS, 28 AWG 71-1677COND16AWG (80063)	FT	1	*	*	*	*	*	*	*	5-14	12
P F --	5940-143-4780	TERMINAL, LUG FOR 16 AWG WIRE RB 873 (59730)	EA	1	*	*	*	*	*	*	*	5-14	13
P F --	6145-170-6869	WIRE, ELECTRICAL 16 AWG, BLACK, 16 STRANDS, 28 AWG 71-1677COND16AWG (80063)	FT	1	*	*	*	*	*	*	*	5-14	14
P F --	5940-143-4780	TERMINAL, LUG FOR 16 AWG WIRE RB 873 (59730)	EA	1	*	*	*	*	*	*	*	5-14	15
P F --	5940-143-4780	TERMINAL, LUG FOR 16 AWG WIRE RB 873 (59730)	EA	1	*	*	*	*	*	*	*	5-14	16
P F --	6145-170-6869	WIRE, ELECTRICAL 16 AWG, BLACK, 16 STRANDS, 28 AWG 71-1677COND16AWG (80063)	FT	1	*	*	*	*	*	*	*	5-14	17
P F --	6145-170-6869	WIRE, ELECTRICAL 16 AWG, BLACK, 16 STRANDS, 28 AWG 71-1677COND16AWG (80063)	FT	1	*	*	*	*	*	*	*	5-14	18
P F --	5940-230-0515	TERMINAL, LUG FOR 16 AWG WIRE RB 713 (59730)	EA	1	*	*	*	*	*	*	*	5-14	19
P F --	5940-230-0515	TERMINAL, LUG FOR 16 AWG WIRE RB 713 (59730)	EA	1	*	*	*	*	*	*	*	5-14	21
		FIELD RHEOSTAT BINDING POSTS DISASSEMBLIES											
X2 F --		BINDING POST 600727 (01216)	EA	2								5-15	2
P F --	5310-339-4795	WASHER, FLAT 0.281 ID, 0.625 OD, 0.063 THK AU02TA171 (10855) (SP WASHER - TURNED TO PREVENT TOUCHING PANEL AND SHORTING - MADE FROM FBR WASHER) 9/32 ID, 5/8 OD, 1/16 THK - TURN DOWN TO 3/8 DIA - 1/32 SHOULDER RECESSED	EA	4	*	*	*	*	*	*	*	5-15	3

Section IV. REPAIR PARTS LIST - Continued

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION REF. NUMBER & MFR. CODE / USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (A) 1-20	(B) 21-50	(C) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (A) 1-20	(B) 21-50	(C) 51-100	(8) 1-YR ALW PER 100 EQUIP CNTGY	(9) ILLUSTRATION (A) FIG. NO.	(B) ITEM NO.
P F --	5310-579-3435	WASHER, FLAT 0.312 ID, 0.750 OD, 0.051 THK, BR FF-W-92 (81348)	EA	2	*	*	*	*	*	*	*	5-15	5
P F --	5310-826-8266	WASHER, LOCK 0.250 ID, 0.500 OD, 0.020 THK 9024316 (18876)	EA	2	*	*	*	*	*	*	*	5-15	6
P F --	5305-740-2558	SCREW, MACHINE 1/4-28UNF-2A, 5/8 LG, BR 5516898 (72560)	EA	2	*	*	*	*	*	*	*	5-15	7
P F --	6145-170-6869	WIRE, ELECTRICAL 16 AWG, BLACK, 16 STRANDS, 28 AWG 71-1677COND16AWG (80063)	FT	2	*	*	*	*	*	*	*	5-15	8
P F --	5940-143-4780	TERMINAL, LUG FOR 16 AWG WIRE RB 873 (59730)	EA	2	*	*	*	*	*	*	*	5-15	9
P F --	5940-230-0515	TERMINAL, LUG FOR 16 AWG WIRE RB 713 (59730)	EA	2	*	*	*	*	*	*	*	5-15	10
		1/4-OHM FIXED RESISTOR BINDING POSTS DISASSEMBLIES											
X2 F --		BINDING POST 600728 (01216)	EA	2								5-16	2
P F --	5310-339-4795	WASHER, FLAT 0.281 ID, 0.625 OD, 0.063 THK AU02TA171 (10855) (SP WASHER - TURNED TO PREVENT TOUCHING PANEL AND SHORTING - MADE FROM FBR WASHER) 9/32 ID, 5/8 OD, 1/16 THK - TURN DOWN TO 3/8 DIA - 1/32 SHOULDER RECESSED	EA	4	*	*	*	*	*	*	*	5-16	3
P F --	5310-579-3435	WASHER, FLAT 0.312 ID, 0.750 OD, 0.051 THK, BR FF-W-92 (81348)	EA	4	*	*	*	*	*	*	*	5-16	5
P F --	5310-208-2716	NUT, PLAIN, HEXAGON 1/4-28UNF-2B, BR X 1051 (80719)	EA	2	*	*	*	*	*	*	*	5-16	6
X2 F --		RESISTOR ASSEMBLY 1/4-OHM 600885 (01216)	EA	1								5-16	7
P F --	5310-826-8266	WASHER, LOCK 0.250 ID, 0.500 OD, 0.020 THK 9024316 (18876)	EA	2	*	*	*	*	*	*	*	5-16	8
P F --	5305-740-2558	SCREW, MACHINE 1/4-28UNF-2A, 5/8 LG, BR 5516898 (72560)	EA	2	*	*	*	*	*	*	*	5-16	9
		12-, 24-VOLT LOAD BANK BINDING POSTS DISASSEMBLIES											
X2 F --		BINDING POST 600728 (01216)	EA	2								5-17	2

Section IV. ***REPAIR PARTS LIST*** *– Continued*

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION / REF. NUMBER & MFR. CODE / USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (A) 1-20	(B) 21-50	(C) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (A) 1-20	(B) 21-50	(C) 51-100	(8) 1-YR ALW PER 100 EQUIP CNTGY	(9) ILLUSTRATION (A) FIG. NO.	(B) ITEM NO.
P F --	5310-339-4795	WASHER, FLAT 0.281 ID, 0.625 OD, 0.063 THK AU02TA171 (10855) (SP WASHER – TURNED TO PREVENT TOUCHING PANEL AND SHORTING – MADE FROM FBR WASHER) 9/32 ID, 5/8 OD, 1/16 THK – TURN DOWN TO 3/8 DIA – 1/32 SHOULDER RECESSED	EA	4	*	*	*	*	*	*	*	5-17	3
P F --	5310-579-3435	WASHER, FLAT 0.312 ID, 0.750 OD, 0.051 THK, BR FF-W-92 (81348)	EA	2	*	*	*	*	*	*	*	5-17	5
P F --	5310-208-2716	NUT, PLAIN, HEXAGON 1/4-28 UNF-2B, BR X 1051 (80719)	EA	2	*	*	*	*	*	*	*	5-17	6
P F --	5310-826-8266	WASHER, LOCK 0.250 ID, 0.500 OD, 0.020 THK 9024316 (18876)	EA	2	*	*	*	*	*	*	*	5-17	7
P F --	5305-740-2558	SCREW, MACHINE 1/4-28 UNF-2A, 5/8 LG, BR 5516898 (72560)	EA	2	*	*	*	*	*	*	*	5-17	8
P F --	5940-557-4344	TERMINAL LUG FOR 6 AWG WIRE RE 9711 (59730)	EA	1	*	*	*	*	*	*	*	5-17	10
P F --	6145-164-6865	WIRE, ELECTRICAL 6 AWG, BLACK, 665 STRANDS, 34 AWG MIL-W-76 (96906)	FT	1	*	*	*	*	*	*	*	5-17	11
P F --	6145-164-6865	WIRE, ELECTRICAL 6 AWG, BLACK, 665 STRANDS, 34 AWG MIL-W-76 (96906)	FT	1	*	*	*	*	*	*	*	5-17	12
P F --	5940-557-4344	TERMINAL LUG FOR 6 AWG WIRE RE 9711 (59730)	EA	1	*	*	*	*	*	*	*	5-17	13
		10-, 50-, 100-AMP NEGATIVE, AND COMMON BINDING POSTS DISASSEMBLIES											
X2 F --		BINDING POST 600728 (01216)	EA	4								5-18	2
M F --		INSULATION SLEEVING, ELECTRICAL: FLEX., PLASTIC, BLACK, 0.625 ID MIL-I-7444	FT	1								5-18	3
P F --	5970-754-9716	FOR REPLACEMENT USE: INSULATION SLEEVING, ELECTRICAL: FLEX., PLASTIC, BLACK, 0.625 ID MIL-I-7444	FT	1	*	*	*	*	*	*	*	5-18	3

Section IV. REPAIR PARTS LIST - Continued

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION REF. NUMBER & MFR. CODE / USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DG MAINT ALLOWANCE (A) 1-20	(B) 21-50	(C) 51-100	(7) 30-DAY GS MAINT (A) 1-20	(B) 21-50	(C) 51-100	(8) 1-YR ALW PER 100 EQUIP CNTGY	(9) ILLUS-TRATION (A) FIG. NO.	(B) ITEM NO.
P F --	5310-339-4795	WASHER, FLAT 0.281 ID, 0.625 OD, 0.063 THK AU02TA171 (10855) (SP WASHER- TURNED TO PREVENT TOUCHING PANEL AND SHORTING - MADE FROM FBR WASHER) 9/32 ID, 5/8 OD, 1/16 THK - TURN DOWN TO 3/8 DIA - 1/32 SHOULDER RECESSED	EA	8	*	*	*	*	*	*	*	5-18	4
P F --	5310-579-3435	WASHER, FLAT 0.312 ID, 0.750 OD, 0.051 THK, BR FF-W-92 (81348)	EA	4	*	*	*	*	*	*	*	5-18	6
P F --	5310-208-2716	NUT, PLAIN, HEXAGON 1/4-28UNF-2B, BR X 1051 (80719)	EA	4	*	*	*	*	*	*	*	5-18	7
P F --	5310-826-8266	WASHER, LOCK 0.250 ID, 0.500 OD, 0.020 THK 9024316 (18876)	EA	8	*	*	*	*	*	*	*	5-18	8
X2 F --		INTERNAL SHUNT ASSEMBLY A600803 (01216)	EA	1								5-18	9
P F --	5305-740-2558	SCREW, MACHINE 1/4-28UNF-2A, 5/8 LG, BR 5516898 (72560)	EA	4	*	*	*	*	*	*	*	5-18	10
P F --	5940-557-4344	TERMINAL, LUG FOR 6 AWG WIRE RE 9711 (59730)	EA	1	*	*	*	*	*	*	*	5-18	11
P F --	6145-164-6865	WIRE, ELECTRICAL 6 AWG, BLACK, 665 STRANDS, 34 AWG MIL-W-76 (96906)	FT	1	*	*	*	*	*	*	*	5-18	12
P F --	5940-557-4344	TERMINAL, LUG FOR 6 AWG WIRE RE 9711 (59730)	EA	1	*	*	*	*	*	*	*	5-18	13
P F --	5940-143-4780	TERMINAL, LUG FOR 16 AWG WIRE RB 873 (59730)	EA	1	*	*	*	*	*	*	*	5-18	14
P F --	6145-170-6869	WIRE, ELECTRICAL 16 AWG, BLACK, 16 STRANDS, 28 AWG 71-1677COND16AWG (80063)	FT	1	*	*	*	*	*	*	*	5-18	15
P F --	5940-230-0515	TERMINAL, LUG FOR 16 AWG WIRE RB 713 (59730) 12-VOLT LOAD BANK LINK, AND EXTERNAL SHUNT DISCONNECT LINK BINDING POSTS DISASSEMBLES	EA	1	*	*	*	*	*	*	*	5-18	21
P F --	5310-558-5062	NUT, PLAIN, KNURLED 6-32NC-2B, BR (33333)	EA	4	*	*	*	*	*	*	*	5-19	1
X2 F --		LINK 1-1/4 LG, 3/8 W, 0.041 THK 600825 (01216)	EA	2								5-19	2
P F --	5310-721-4712	NUT, PLAIN, HEXAGON 6-32NC-2B, BR MIL-B-994C (96906)	EA	8	*	*	*	*	*	*	*	5-19	3
P F --	5310-187-3441	WASHER, FLAT 0.140 ID, 0.500 OD, 0.031 THK, BR S 2034 (41330)	EA	8	*	*	*	*	*	*	*	5-19	4

Section IV. REPAIR PARTS LIST- Continued

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION REF. NUMBER & MFR. CODE	USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (A) 1-20	(B) 1-20	(C) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (A) 1-20	(B) 21-50	(C) 51-100	(8) 1-YR ALW PER 100 EQUIP CNTGY	(9) ILLUSTRATION (A) FIG. NO.	(B) ITEM NO.
P F --	5310-239-3536	WASHER, FLAT 0.140 ID, 0.375 OD, 0.047 THK, FBR (TURNED DOWN TO 1/4 DIA - 1/64 SHOULDER RECESSED) 22986 (31435)		EA	8	*	*	*	*	*	*	*	5-19	5
P F --	5310-939-0903	WASHER, LOCK 0.141 ID, 0.305 OD, 0.035 THK MS35335-86 (96906)		EA	4	*	*	*	*	*	*	*	5-19	7
P F --	5305-054-6657	SCREW, MACHINE 6-32NC-2A, 7/8 LG MS51957-33 (96906)		EA	4	*	*	*	*	*	*	*	5-19	8
P F --	5940-143-4780	TERMINAL, LUG FOR 16 AWG WIRE RB 873 (59730)		EA	1	*	*	*	*	*	*	*	5-19	9
P F --	6145-170-6869	WIRE, ELECTRICAL 16 AWG, BLACK, 16 STRANDS, 28 AWG 71-1677COND16AWG (80063)		FT	1	*	*	*	*	*	*	*	5-19	10
P F --	5940-143-4774	TERMINAL, LUG FOR 16 AWG WIRE MS25036-153 (96906)		EA	1	*	*	*	*	*	*	*	5-19	11
P F --	5940-143-4774	TERMINAL, LUG FOR 16 AWG WIRE MS25036-153 (96906)		EA	1	*	*	*	*	*	*	*	5-19	14
P F --	5940-143-4774	TERMINAL, LUG FOR 16 AWG WIRE MS25036-153 (96906)		EA	1	*	*	*	*	*	*	*	5-19	17
P F --	6145-170-6869	WIRE, ELECTRICAL 16 AWG, BLACK, 16 STRANDS, 28 AWG 71-1677COND16AWG (80063)		FT	1	*	*	*	*	*	*	*	5-19	18
P F --	5940-230-0515	TERMINAL, LUG FOR 16 AWG WIRE RB 713 (59730)		EA	1	*	*	*	*	*	*	*	5-19	19
P F --	6145-170-6869	WIRE, ELECTRICAL 16 AWG, BLACK, 16 STRANDS, 28 AWG 71-1677COND16AWG (80063)		FT	1	*	*	*	*	*	*	*	5-19	20
P F --	5940-230-0515	TERMINAL, LUG FOR 16 AWG WIRE RB 713 (59730)		EA	1	*	*	*	*	*	*	*	5-19	21

Section V. FEDERAL STOCK NUMBER AND REFERENCE NUMBER INDEX

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4710-277-5526	5-6	12
4910-421-1693	5-10	11
5305-015-4982	5-8	1
5305-054-6657	5-19	8
5305-182-1333	5-8	11
5305-208-0316	5-6	5
	5-12	10
5305-281-3118	5-11	1
5305-366-9190	5-5	1
5305-391-1925	5-2	1
	5-3	3
	5-13	3
5305-531-8340	5-12	1
	5-13	1
5305-638-2260	5-10	2
5305-740-2558	5-14	7
	5-15	7
	5-16	9
	5-17	8
	5-18	10
5305-800-6319	5-6	19
	5-8	10
5305-811-6711	5-12	3
5305-954-8997	5-6	10
5310-014-7656	5-6	21
	5-8	8
5310-187-3441	5-19	4
5310-190-2924	5-6	6
	5-12	9
5310-193-7571	5-2	2
	5-3	4
5310-197-4502	5-13	4
5310-208-2716	5-6	22
	5-8	7
	5-16	6
	5-17	6
	5-18	7
5310-209-0737	5-10	4
	5-11	4
5310-209-6051	5-5	2
5310-239-3536	5-19	5
5310-339-4795	5-12	6
	5-14	3
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	5-16	3
	5-17	3
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5310-527-3634	5-6	20
5310-531-8777	5-11	6
5310-546-8204	5-6	11
	5-6	14
5310-558-3175	5-10	3
	5-11	3
5310-558-5062	5-19	1
5310-579-3435	5-14	5
	5-15	5
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	5-17	5
	5-18	6
5310-685-7625	5-8	2
5310-721-4712	5-19	3
5310-727-8118	5-9	5
5310-754-3384	5-6	8
	5-9	18
	5-12	8
5310-815-9841	5-9	6
5310-826-5137	5-6	13
5310-826-8266	5-8	9
	5-14	6
	5-15	6
	5-16	8
	5-17	7
	5-18	8
5310-837-7396	5-6	7
	5-8	12
	5-9	19
5310-939-0903	5-19	7
5310-952-6876	5-12	4
5325-089-6159	5-5	14
5325-290-4344	5-5	6
5930-685-9657	5-8	5
5935-258-4565	4-1	3
5940-050-6221	4-1	2
	4-1	2
5940-143-4774	5-5	9
	5-19	11
	5-19	14
	5-19	17
5940-143-4780	5-4	1, 1B-7B, 1R-8R
	5-10	12
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	5-14	15
	5-14	16
	5-15	9
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	5-19	9
5940-143-4794	5-4	2
	5-11	11
5940-204-5777	4-1	5
	4-1	5
5940-230-0515	5-14	9
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	5-19	19
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5940-230-1212	4-2	1
	4-2	1
	4-2	1
	4-3	4
5940-557-4344	5-5	8
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	5-18	11
	5-18	13
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5970-841-6606	5-11	9
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6145-164-6865	5-4	3
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	5-18	12
6145-170-6869	5-10	13
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	5-14	14
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	5-15	8
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	5-19	20
6145-263-6987	5-4	1R-8R
6145-283-9471	5-4	2
	5-11	10
6145-705-6676	4-1	1
	4-1	1
5145-772-2204	4-2	4
	4-2	4
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	4-3	3
6625-885-5755	2-2	5
5625-885-5756	2-2	7
6625-885-5757	2-2	1
6625-885-5758	2-2	4
6625-885-5759	2-2	2
6625-885-5760	2-2	3
6625-885-5761	2-2	6
6625-928-3398	5-9	3
6625-928-3399	5-9	1
9320-141-7167	5-9	2
9535-232-2293	5-6	2
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Reference No.	*Mfg Code*	*Fig. No*	*Item No*
AN 508-8-4	88044	5-8	11
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		5-16	3
		5-17	3
		5-18	4
A600803	01216	5-18	9
A600810	01216	5-1	1
A600906	01216	5-1	4
CPC 657	79172	5-6	21
		5-8	8
EC 1202	76381	5-5	16
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FF-S-92	81348	5-8	1
FF-W-92	81348	5-14	5
		5-15	5
		5-16	5
		5-17	5
		5-18	6
FSM32691-1P	28527	4-1	6
J-C-30	81348	5-4	1, 1B-7B
LA410544-2	35225	4-2	3
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		4-3	2
MIL-B-994C	96906	5-19	3
MIL-I-631	-----	5-11	9
MIL-I-7444	-----	5-18	3
MIL-R-6130	-----	5-9	2
MIL-S-21195A SHIPS	81349	5-8	5
MIL-W-76	96906	5-4	3
		5-17	11
		5-17	12
		5-18	12
MLC13486-1	81349	4-1	1
		4-1	1
MS25036-153	96906	5-5	9
		5-19	11
		5-19	14
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MS35214-60	96906	5-6	10
MS35335-61	96906	5-6	20
MS35335-86	96906	5-19	7
MS51021-32	96906	5-11	1
MS51021-34	96906	5-10	2
MS51021-43	96906	5-12	1
		5-13	1
MS51957-33	96906	5-19	8
M 1575	01121	5-5	1
NT 10011A	80249	5-10	3
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N413P19Q7	24446	5-9	5
N64P21008	24446	5-6	19
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RB 713	59730	5-14	9
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RB 873	59730	5-4	1, 1B-7B, 1R-8R
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TV 186R	02805	2-2	2
TV 188B	02805	2-2	4
TV 188R	02805	2-2	3
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		5-17	6
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10034399-19	18876	5-9	6
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100704	64560	5-6	6
		5-12	9
10426	82423	5-5	2
1114-05-00	78189	5-13	4
1284	59433	5-6	5
		5-12	10
143	76545	4-1	3
1612	78189	5-2	2
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17669	01216	5-11	2
1768-14	60703	5-2	1
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1798-11	01216	5-12	2
		5-13	2
1920-04	78189	5-10	4
		5-11	4
210	76545	4-1	5
		4-1	5
2174	83330	5-5	14
2177	83330	5-5	6
22986	31435	5-19	5
236-1062P1	94144	5-11	6
2379-4	01216	5-10	1
3063T	39428	5-13	12
30635	00779	4-1	2
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3169	86796	4-2	1
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		4-2	1
		4-3	4
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59647	30874	5-12	3
600603	01216	5-9	3
600604	01216	5-9	1
600727	01216	5-14	2
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600728	01216	5-16	2
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600730	01216	5-10	11
600731	01216	5-10	10
600732	01216	5-10	9
600733	01216	5-10	8
600734	01216	5-10	7
600737	01216	5-13	6
600738	01216	5-6	16
600747	01216	5-6	17
600772	01216	5-12	7
600773	01216	5-11	7
600786	01216	5-6	1
600800	01216	4-2	5
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		4-2	5
600825	01216	5-19	2
600828	01216	4-1	7
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8520331	18876	5-6	11
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9024316	18876	5-8	9
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USDB (1)
USABRL (1)
USATOPOCOM (1)
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US Mil Gp Ecuador (1)
JUSMAG Philippines (1)
Corps (2)
Div (2)
Brig (2)
Regt/Gp (2)
Bn (2)
Co/Btry (2)

NG: None
USAR: None
For explanation of abbreviations used, see AR 310-50.

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The Metric System and Equivalents

Linear Measure

1 centimeter = 10 millimeters = .39 inch
1 decimeter = 10 centimeters = 3.94 inches
1 meter = 10 decimeters = 39.37 inches
1 dekameter = 10 meters = 32.8 feet
1 hectometer = 10 dekameters = 328.08 feet
1 kilometer = 10 hectometers = 3,280.8 feet

Weights

1 centigram = 10 milligrams = .15 grain
1 decigram = 10 centigrams = 1.54 grains
1 gram = 10 decigram = .035 ounce
1 dekagram = 10 grams = .35 ounce
1 hectogram = 10 dekagrams = 3.52 ounces
1 kilogram = 10 hectograms = 2.2 pounds
1 quintal = 100 kilograms = 220.46 pounds
1 metric ton = 10 quintals = 1.1 short tons

Liquid Measure

1 centiliter = 10 milliliters = .34 fl. ounce
1 deciliter = 10 centiliters = 3.38 fl. ounces
1 liter = 10 deciliters = 33.81 fl. ounces
1 dekaliter = 10 liters = 2.64 gallons
1 hectoliter = 10 dekaliters = 26.42 gallons
1 kiloliter = 10 hectoliters = 264.18 gallons

Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch
1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches
1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet
1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch
1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

Approximate Conversion Factors

To change	*To*	*Multiply by*	*To change*	*To*	*Multiply by*
inches	centimeters	2.540	ounce-inches	newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29,573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	newton-meters	1.356	metric tons	short tons	1.102
pound-inches	newton-meters	.11296			

Temperature (Exact)

°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

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