TM11-6625-3276-14&P

TECHNICAL MANUAL

OPERATOR'S, UNIT, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL (INCLUDING REPAIR PARTS AND SPECIAL TOOLS LISTS) FOR RADIO FREQUENCY POWER TEST SET AN/URM-213 (NSN 6625-01-288-6515) (EIC: N/A)

HEADQUARTERS, DEPARTMENT OF THE ARMY

15 SEPTEMBER 1993

5 SAFETY STEPS TO FOLLOW IF SOMEONE IS THE VICTIM OF ELECTRICAL SHOCK

1. DO NOT TRY TO PULL OR GRAB THE INDIVIDUAL

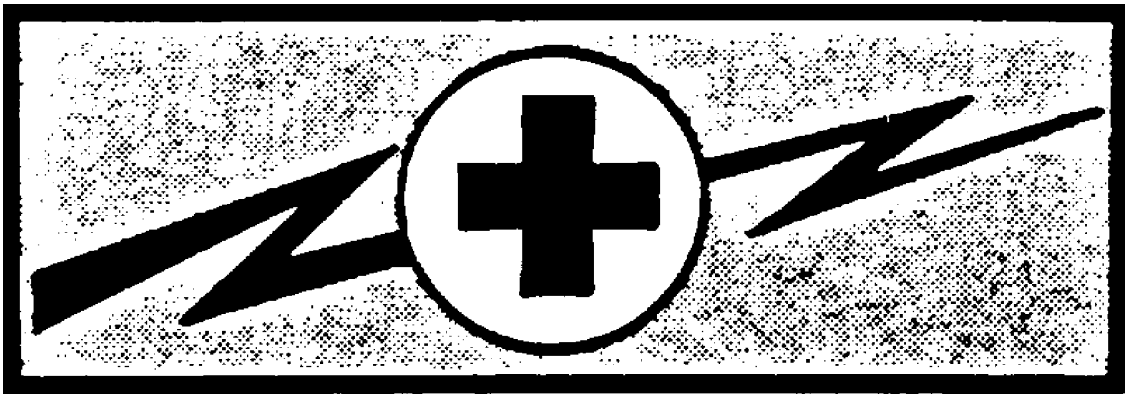
2. IF POSSIBLE, TURN OFF THE ELECTRICAL POWER

3. IF YOU CANNOT TURN OFF THE ELECTRICAL POWER, PULL, PUSH, OR LIFT THE PERSON TO SAFETY USING A DRY WOODEN POLE OR A DRY ROPE OR SOME OTHER INSULATING MATERIAL

4. SEND FOR HELP AS SOON AS POSSIBLE

5. AFTER THE INJURED PERSON IS FREE OF CONTACT WITH THE SOURCE OF ELECTRICAL SHOCK, MOVE THE PERSON A SHORT DISTANCE AWAY AND IMMEDIATELY START ARTIFICIAL RESUSCITATION

WARNING



HIGH VOLTAGE
is used in the operation of this equipment

DEATH ON CONTACT
may result if personnel fail to observe safety precautions

Never work on electronic equipment unless there is another person nearby who is familiar with the operation and hazards of the equipment and who is competent in administering first aid. When the technicians are aided by operators, they must be warned about dangerous areas.

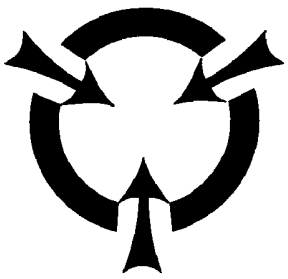
Whenever possible, the power supply to the equipment must be shut off before beginning work on the equipment. Take particular care to ground every capacitor likely to hold a dangerous potential. When working inside the equipment, after the power has been turned off, always ground every part before touching it.

Be careful not to contact high-voltage connections or 115 volt ac input connections when installing or operating this equipment.

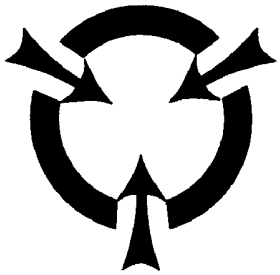
Whenever the nature of the operation permits, keep one hand away from the equipment to reduce the hazard of current flowing through the body.

Warning: Do not be misled by the term "low voltage. Potentials as low as 50 volts may cause death under adverse conditions.

For Artificial Respiration, refer to FM 4-25.11.



CAUTION



THIS EQUIPMENT CONTAINS PARTS AND ASSEMBLIES SENSITIVE TO DAMAGE BY ELECTROSTATIC DISCHARGE (ESD). USE ESD PRECAUTIONARY PROCEDURES WHEN TOUCHING, REMOVING OR INSERTING PRINTED CIRCUIT BOARDS.

ESD
CLASS 1

GENERAL HANDLING PROCEDURES FOR ESDS ITEMS

- USE WRIST GROUND STRAPS OR MANUAL GROUNDING PROCEDURES
- KEEP ESDS ITEMS IN PROTECTIVE COVERING WHEN NOT IN USE
- GROUND ALL ELECTRICAL TOOLS AND TEST EQUIPMENT
- PERIODICALLY CHECK CONTINUITY AND RESISTANCE OF GROUNDING SYSTEM
- USE ONLY METALIZED SOLDER SUCKERS
- HANDLE ESDS ITEMS ONLY IN PROTECTED AREAS

MANUAL GROUNDING PROCEDURES

- MAKE CERTAIN EQUIPMENT IS POWERED DOWN
- TOUCH GROUND PRIOR TO REMOVING ESDS ITEMS
- TOUCH PACKAGE OF REPLACEMENT ESDS ITEM TO GROUND BEFORE OPENING
- TOUCH GROUND PRIOR TO INSERTING REPLACEMENT ESDS ITEMS

ESDS PROTECTIVE PACKAGING AND LABELING

- INTIMATE COVERING OF ANTISTATIC MATERIAL WITH AN OUTER WRAP OF EITHER TYPE 1 ALUMINIZED MATERIAL OR CONDUCTIVE PLASTIC FILM - OR HYBRID LAMINATED BAGS HAVING AN INTERIOR OF ANTISTATIC MATERIAL WITH AN OUTER METALIZED LAYER
- LABEL WITH SENSITIVE ELECTRONIC SYMBOL AND CAUTION NOTE

CAUTION

Devices such as CMOS, NMOS, MNOS, VMOS, HMOS, thin-film resistors PMOS, and MOSFET used in many equipments can be damaged by static-voltages present in most repair facilities. Most of the components contain internal gate protection circuits that are partially effective, but sound maintenance practice and the cost of equipment failure in time and money dictate careful handling of all electrostatic sensitive components.

The following precautions should be observed when handling all electrostatic sensitive components and units containing such components.

CAUTION

Failure to observe all of these precautions can cause permanent damage to the electrostatic sensitive device. This damage can cause the device to fail immediately or at a later date when exposed to an adverse environment.

STEP 1 Turn off and/or disconnect all power and signal sources and loads used with the unit.

STEP 2 Place the unit on grounded conductive work surfaces.

STEP 3 Ground the repair operator using a conductive wrist strap or other device using a 1 -M series resistor to protect the operator

STEP 4 Ground any tools (including soldering equipment) that will contact the unit. Contact with the operator's hand provides a sufficient ground for tools that are otherwise electrically isolated.

STEP 5 All electrostatic sensitive replacement components are shipped in conductive foam or tubes and must be stored in the original shipping container until installed.

STEP 6 When these devices and assemblies are removed from the unit, they should be placed on the conductive work surface or in conductive containers.

STEP 7 When not being worked on, wrap disconnected circuit boards in aluminum foil or in plastic bags that have been coated or impregnated with a conductive material.

STEP 8 Do not handle these devices unnecessarily or remove from their packages until actually used or tested.

CHANGE)
)
No. 1)

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, D.C., 28 April 2006

OPERATOR'S, UNIT, DIRECT SUPPORT AND GENERAL SUPPORT

MAINTENANCE MANUAL
(INCLUDING REPAIR PARTS AND SPECIAL TOOLS LISTS)
FOR
RADIO FREQUENCY POWER TEST SET AN/URM-213

(NSN 6625-01-288-6515) (EIC: N/A)

HAZARDOUS MATERIAL INFORMATION – This document has been reviewed for the presence of solvents containing hazardous materials as defined by the EPCRA 302 and 313 lists by the AMCOM G-4 (Logistics) Environmental Division. As of the base document, dated 15 September 1993, all references to solvents containing hazardous materials have been removed from this document by substitution with non-hazardous or less hazardous materials where possible.

OZONE DEPLETING CHEMICAL INFORMATION – This document has been reviewed for the presence of Class I ozone depleting chemicals by AMCOM G-4 (Logistics) Environmental Division. As of the base document, dated 15 September 1993, all references to Class I ozone depleting chemicals have been removed from this document by substitution with chemicals that do not cause atmospheric ozone depletion.

WARNING – This document contains technical data whose export is restricted by the Arms Export Control Act (Title 22, U. S. C., Sec 2751 et seq) or the Export Administration Act 1979, as amended, Title 50, U.S.C., App. 2401 et seq. Violations of these export laws are subject to severe criminal penalties. Disseminate in accordance with provisions of DOD Directive 5230.25.

DISTRIBUTION STATEMENT D – Distribution authorized to Department of Defense and DOD contractors only to protect critical technical data on systems or hardware. This determination was made OCT 1986. Other requests shall be referred to Program Manager, TMDE, ATTN: SFAE-CS-FT-T-TEMOD, Redstone Arsenal, AL 35898-5000.

DESTRUCTION NOTICE – Destroy by any method that will prevent disclosure of contents or reconstruction of the document.

TM 11-6625-3276-14&P, dated 15 September 1993, is changed as follows:

1. Remove old pages and insert new pages as indicated below. New or changed material is indicated by a vertical bar in the outer margin of the page. Illustration changes are indicated by a pointing hand. New or changed part numbers are indicated by an asterisk (*). Completely revised sections or chapters are indicated by a vertical bar next to the title only.

Removes Pages	Insert Pages
a through d	a through d
NONE	A/(B blank)
i and ii	i and ii
1-1, 1-2	1-1, 1-2
A-1/(A-2 blank)	A-1/(A-2 blank)
COVER	COVER

2. File this change sheet in front of the publication for reference purposes.

By Order of the Secretary of the Army:

PETER J. SCHOOMAKER
General, United States Army
Chief of Staff

Official:

JOYCE E. MORROW
Administrative Assistant to the
Secretary of the Army
0607502

Distribution:

To be distributed in accordance with the initial distribution number (IDN) 369559, requirements for TM 11-6625-3276-14&P.

INSERT LATEST CHANGED PAGES. DESTROY SUPERSEDED PAGES.

LIST OF EFFECTIVE PAGES

NOTE

ON CHANGED PAGES, THE PORTION OF THE TEXT AFFECTED BY THE LATEST CHANGE IS INDICATED BY A VERTICAL LINE OR OTHER CHANGE SYMBOL IN THE OUTER MARGIN OF THE PAGE.

Dates of issue for original and changed pages are:

Original	0	15 September 1993
Change	1	28 April 2006

Total number of pages in this publication is 119 consisting of the following:

Page No.	*Change No.
Cover	1
a through d	1
A	1
B blank	0
i,ii	1
iii	0
0-1	0
1-1, 1-2	1
1-3 through 1-7	0
1-8 blank	0
2-1 through 2-17	0
2-18 blank	0
3-1 through 3-6	0
4-1	0
4-2 blank	0
5-1 through 5-15	0
5-16 through 5-32	0
A-1	1
A-2 blank	0
B-1 through B-5	0
B-6 blank	0
C-1 through C-3	0
C-4 blank	0
D-1	0
D-2 blank	0
E-1	0
E-2 blank	0
F-1 through F-7	0
Fig. F-1	0
Fig. F-2	0
Figure 2-1	0
Figure 3	0
Figure 3-1	0
Figure 4	0
Figure 4-1	0
Index 1	0
Index 2	0
Index 3	0
Index 4 blank	0

* Zero in this column indicates an original page.

Technical Manual
No. 11-6625-3276-14&P

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, DC, 15 September 1993

OPERATOR'S, UNIT, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL (INCLUDING REPAIR PARTS AND SPECIAL TOOLS LISTS) FOR RADIO FREQUENCY POWER TEST SET AN/URM-213

(NSN 6625-01-288-6515) (EIC: N/A)

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter or DA Form 2028 (Recommended Changes to Publications and Blank Forms) directly to: Commander, U.S. Army Aviation and Missile Command, AMSAM-MMC-MA-NP, Redstone Arsenal, AL. 35898-5000. A reply will be furnished to you. You may also provide DA Form 2028 information to AMCOM via email, fax or the World Wide Web. Our fax number is DSN 788-6546 or Commercial 256-842-6546. Our email address is: 2028@redstone.army.mil. Instructions for sending an electronic 2028 may be found at the back of this manual immediately preceding the hardcopy 2028. For the World Wide Web use: https://amcom2028.redstone.army.mil.

HAZARDOUS MATERIAL INFORMATION

This document has been reviewed for the presence of solvents containing hazardous materials as defined by the EPCRA 302 and 313 lists by the AMCOM G-4 (Logistics) Environmental Division. As of the base document, dated 15 September 1993, all references to solvents containing hazardous materials have been removed from this document by substitution with non-hazardous or less hazardous materials where possible.

OZONE DEPLETING CHEMICAL INFORMATION

This document has been reviewed for the presence of Class I ozone depleting chemicals by AMCOM G-4 (Logistics) Environmental Division. As of the base document, dated 15 September 1993, all references to Class I ozone depleting chemicals have been removed from this document by substitution with chemicals that do not cause atmospheric ozone depletion.

WARNING – This document contains technical data whose export is restricted by the Arms Export Control Act (Title 22, U. S. C., Sec 2751 et seq) or the Export Administration Act 1979, as amended, Title 50, U.S.C., App. 2401 et seq. A violation of these export laws are subject to severe criminal penalties. Disseminate in accordance with provisions of DOD Directive 5230.25.

DISTRIBUTION STATEMENT D-Distribution authorized to Department of Defense and DOD contractors only to protect critical technical data on systems or hardware. This determination was made OCT 1986. Other requests shall be referred to Program Manager, TMDE, ATTN: SFAE-CS-FT-T-TEMOD, Redstone Arsenal, AL 35898-5000.

DESTRUCTION NOTICE – Destroy by any method that will prevent disclosure of contents or reconstruction of the document.

TABLE OF CONTENTS- Continued

HOW TO USE THIS MANUAL

This manual tells about the Radio Frequency Power Test Set AN/URM-213 and contains instructions about how to use it during maintenance on other electronic equipment.

The technical manual for the electronic equipment being maintained will tell where to make certain connections and when to use various accessories which are part of the AN/URM-213.

When first receiving the AN/URM-213, start at the front of the manual and go all the way through to the back. Become familiar with every part of the manual and the AN/URM-213.

This manual has an edge index which will help find specific information in a hurry. Simply spread the pages on the right edge of the manual until the printed blocks can be seen. Open the manual where the block on the edge of the page lines up with the selected topic printed on the front cover block.

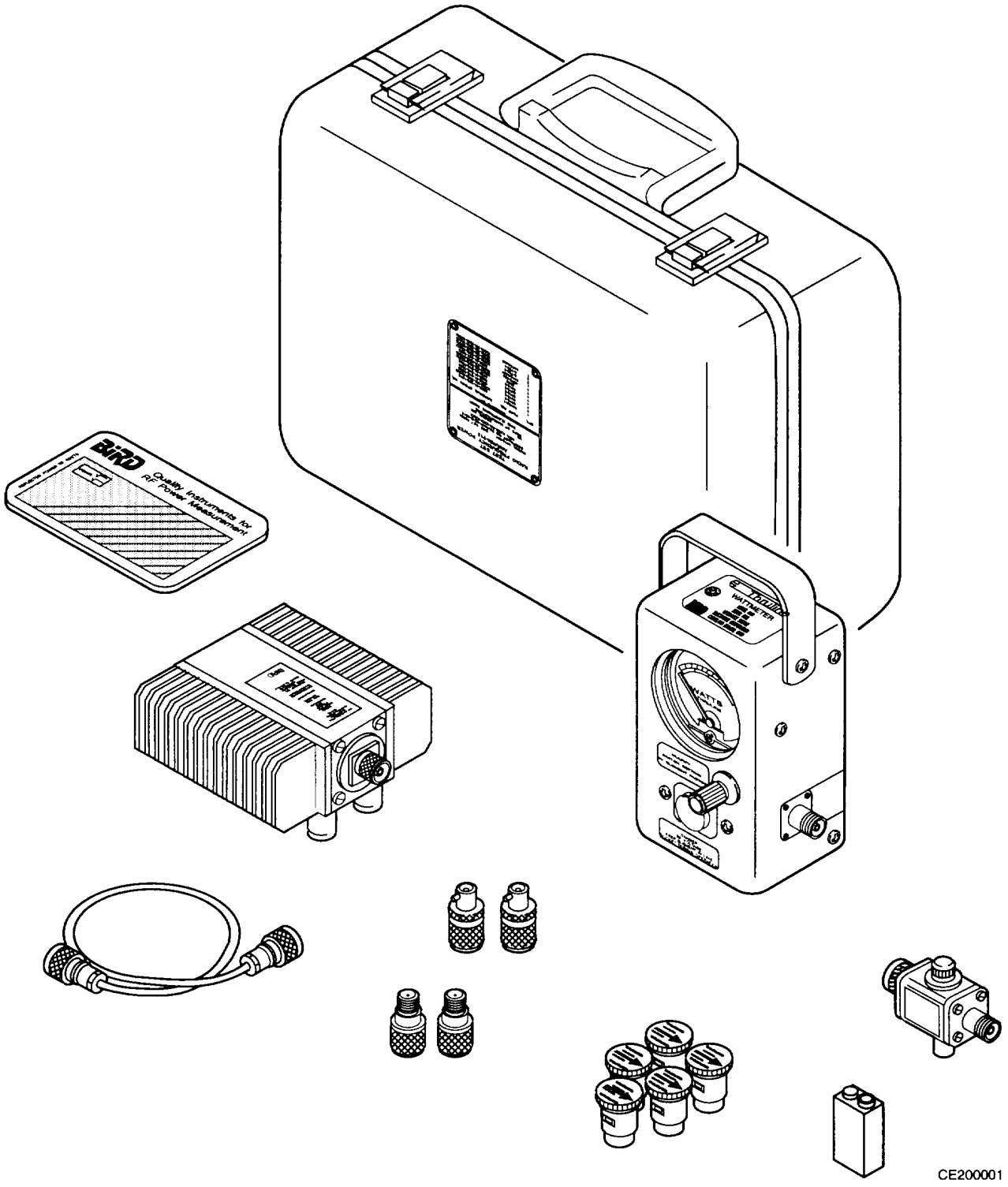


Figure 1-1. Radio Frequency Power Test Set AN/URM-213

CHAPTER 1
INTRODUCTION

Section I. GENERAL INFORMATION

1-1. SCOPE.

Radio Frequency Power Test Set AN/URM-213 (fig. 1-1) is a wattmeter used with a test set for making RF output power measurements, load match measurements, power to load calculations, transmission line loss measurements, and to sample transmission line power. In the rest of this manual, the Radio Frequency Power Test Set AN/URM-213 will be called the RF test set. Use this manual for operation, unit, direct support, and general support maintenance of the RF test set.

1-2. CONSOLIDATED INDEX OF ARMY PUBLICATIONS AND BLANK FORMS.

Refer to the latest issue of DA Pam 25-30 to determine whether there are new editions, changes, or additional publications pertaining to the equipment.

1-3. MAINTENANCE FORMS, RECORDS, AND REPORTS.

a. Reports of Maintenance and Unsatisfactory Equipment. Department of the Army forms and procedures used for equipment maintenance will be those prescribed by DA Pam 750-8.

b. Reporting of Item and Packaging Discrepancies. Fill out and forward SF 364, (Report of Discrepancy (ROD)) as prescribed in AR 735-11-2/DLAR 4140.55/SECNAVINST 4355.18/AFR 400-54/MCO 4430.3J.

c. Transportation Discrepancy Report (TDR)(SF 361). Fill out and forward Transportation Discrepancy Report (TDR)(SF 361) as prescribed in AR 55-38/NAVSUPINST 4610.33C/AFR 75-18/MCO P4610.19D/DLAR 4500.15.

1-4. DESTRUCTION OF ARMY ELECTRONICS MATERIEL.

Destruction of Army electronics materiel to prevent enemy use shall be in accordance with TM 750-244-2.

1-5. ADMINISTRATIVE STORAGE.

Administrative storage of equipment issued to and used by Army activities will have Preventive Maintenance Checks and Services (PMCS) performed before storing. When removing the equipment from administrative storage, the PMCS checks should be performed to assure operational readiness.

1-6. REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR).

If your RF test set needs improvement, let us know. Send us an EIR You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design or performance. Put it on an SF 368 (Product Quality Deficiency Report). Mail it to: Commander, US Army Aviation and Missile Command AMSAM-MMC-MA-NM, Redstone Arsenal, AL. 35858-5000. We'll send you a reply.

1-7. WARRANTY.

The Radio Frequency Power Test Set AN/URM-213 is warranted by Bird Electronic Corporation for a period of 1 year. The warranty expiration date is printed on the label on the front of the test set case. Report all defects in material and workmanship to your supervisor, who will take the appropriate action.

1-8. SAFETY, CARE, AND HANDLING.

Warnings, cautions, and safety procedures are provided in the front of this manual. Operators should become thoroughly familiar with all warnings, safety precautions, and safety procedures before handling or operating the equipment.

1-9. ABBREVIATIONS.

Abbreviations used in the manual are in accordance with requirements of MIL-STD-12.

Section II. EQUIPMENT DESCRIPTION

1-10. EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES.

a. Characteristics.

- · measures forward and reflected RF power
- makes in-line measurements
- makes terminated measurements
- samples RF power

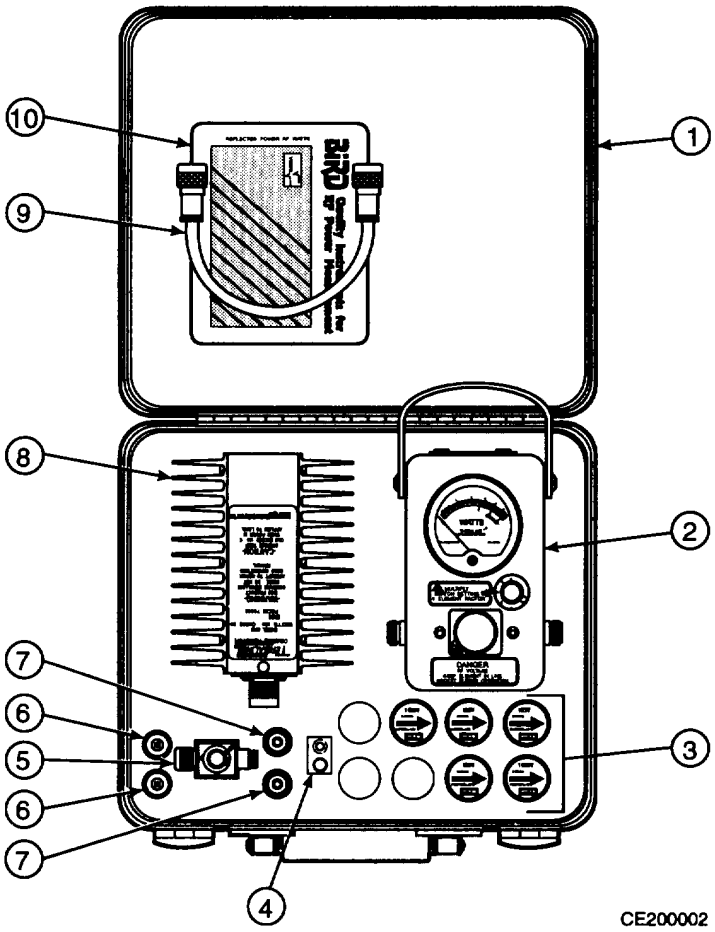
b. Capabilities and Features.

- test set case provides portable operation
- type -N- connectors are replaceable without soldering
- in place battery test feature
- can be used with -N-, BNC, and UHF Type connectors

1-11. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS.

NOTE

Battery (4) will be placed in this position only if RF test set has been stored for more than 30 days, otherwise the battery will be installed in the wattmeter (2).



1 TEST SET CASE. Houses RF test set during storage and shipment.
2 WATTMETER. Provides visual indication of RF Power measured.
3 ELECTRICAL PLUG-IN UNITS. Provides for highly directional capability of RF test set when making RF power measurements.
4 BATTERY. Power source for wattmeter.
5 COUPLER. Provides a sample of RF power for use with a viewing device.
6 ADAPTOR CONNECTORS UG-201A/U. Provides for connection of male type -N- connector to BNC type connector.
7 ADAPTOR CONNECTORS UG-146A/U. Provides for connection of male type -N- connector to UHF type connector.
8 DUMMY LOAD. Used in place of an antenna.
9 RADIO CABLE ASSEMBLY. Used to connect RF test set to a RF power source.
10 VOLTAGE STANDING-WAVE RATIO CHART (VSWR). Used to determine VSWR when used in conjunction with the wattmeter.

1-12. EQUIPMENT DATA.

WEIGHTS AND DIMENSIONS

RF Test Set
- Weight ..... 15 lbs (6.8 kg)
- Length ..... 13 3/4 in (349.3 mm)
- Width ..... 6 in (171.5 mm)
- Height ..... 12 3/4 in (323.9 mm)

Dummy Load
- Weight ..... 4 lbs (1.8 kg)
- Length ..... 7 1/2 in (190 mm)
- Width ..... 5 3/16 in (131.8 mm)
- Height ..... 2 3/4 in (69.9 mm)

Coupler
- Weight ..... 10 oz (0.28 kg)
- Length ..... 2 7/8 in (73 mm)
- Width ..... 1 1/4 in (31.8 mm)
- Height ..... 2 51/64 in (71 mm)

Wattmeter
- Weight ..... 3 lbs (1.4 kg)
- Length ..... 3 5/8 in (92 mm)
- Width ..... 5 1/4 in (133.4 mm)
- Height ..... 6 7/8 in (174.6 mm)

ENVIRONMENTAL CONDITIONS

Ambient Operating Temperatures ..... 32° to 122°F (0° to 50°C)
Storage/Transport
Temperatures ..... 40° to +159°F (-40° to +71°C)
Altitude (max.) ..... 15,000 feet
Relative Humidity (noncondensing) ..... 0% to 95% RH ±5%

OPERATING SPECIFICATIONS

Dummy Load
Frequency Range ..... 450 kHz to 1000 MHz
Continuous Wave Power Rating
Continuous ..... 150 watt
Intermittent (5 minutes "on", 20 minutes "off") ..... 200 watt
Impedance (nominal) ..... 50 ohms
Voltage Standing-Wave Ratio (max) ..... 1.10:1 (ratio)
Connector (type) ..... Male Type -N-
Coupler
Frequency Range ..... 20 MHz to 1000 MHz
Continuous Wave Power Rating (nominal) ..... 1000 watt
Impedance (nominal) ..... 50 ohms
Insertion Voltage Standing-Wave Ratio
- 20 MHz to 512 MHz (max) ..... 1.10:1 (ratio)
- 512 MHz to 1000 MHz (max) ..... 1.25:1 (ratio)

1-12. EQUIPMENT DATA - Continued.

OPERATING SPECIFICATIONS - Continued

Insertion Loss
- 20 MHz to 512 MHz (max) ..... 0.1 dB
- 512 MHz to 1000 MHz (max) ..... 0.2 dB

Connectors
- Input/Output ..... Male Type -N-
- Input/Output ..... Female Type -N-
- Sample ..... Female Type BNC

Wattmeter (with electrical plug-in units)
- Continuous Wave Power and Frequency Range
  - 450 kHz to 25 MHz ..... 0.1 W to 10 kW
  - 25 MHz to 1000 MHz ..... 0.1 W to 1 kW
- Accuracy (CW unmodulated signal) ..... ±5% of full scale
- Directivity (min) ..... 28 dB
- Impedance (nominal) ..... 50 ohms
- Insertion Voltage Standing-Wave Ratio (max) ..... 1.05:1 (ratio)
- Insertion Loss (max) ..... 0.1 dB
- Connectors ..... Female Type -IJ-
- Overload Protection ..... Protected up to 120% full scale of electrical plug-in unit rating
- Power Source ..... One 9 Vdc alkaline battery
  - Battery Life (min) ..... 30 hours

Section III. TECHNICAL PRINCIPLES OF OPERATION

1-13. GENERAL FUNCTIONAL DESCRIPTION.

RF test set (fig. 1-1) measures, samples, and terminates radio frequency power. Measurement results appear on a meter type display. The following functional descriptions refer to the simplified block diagram of the RF test set (fig. 1-2).

(1) The radio frequency power source is the source of power being measured by the RF test set. The frequency and power rating of this RF source determines selection of the electrical plug-in unit (6) and position of the factor switch (10).

(2) The coupler removes a small portion of RF power through a variable capacitate probe. This provides a sample for use with an oscilloscope, frequency counter, or a spectrum analyzer.

(3) The wattmeter houses all of the components and provides for the connection of the RF power source to instrumentation module (4).

(4) The instrumentation module contains a short piece of RF transmission line that provides a path for the RF power to travel near the electrical plug-in unit (6). It also houses the printed circuit board (5) and provides for connection between the printed circuit board and the electrical plug-in unit.

(5) The printed circuit board detects signals through the electrical plug-in unit (6) and produces an analog output to the meter (13). The printed circuit board includes an analog controller (7), sine-wave generator (8), range attenuator (9), factor switch (10), and provides for calibration adjustment (11).

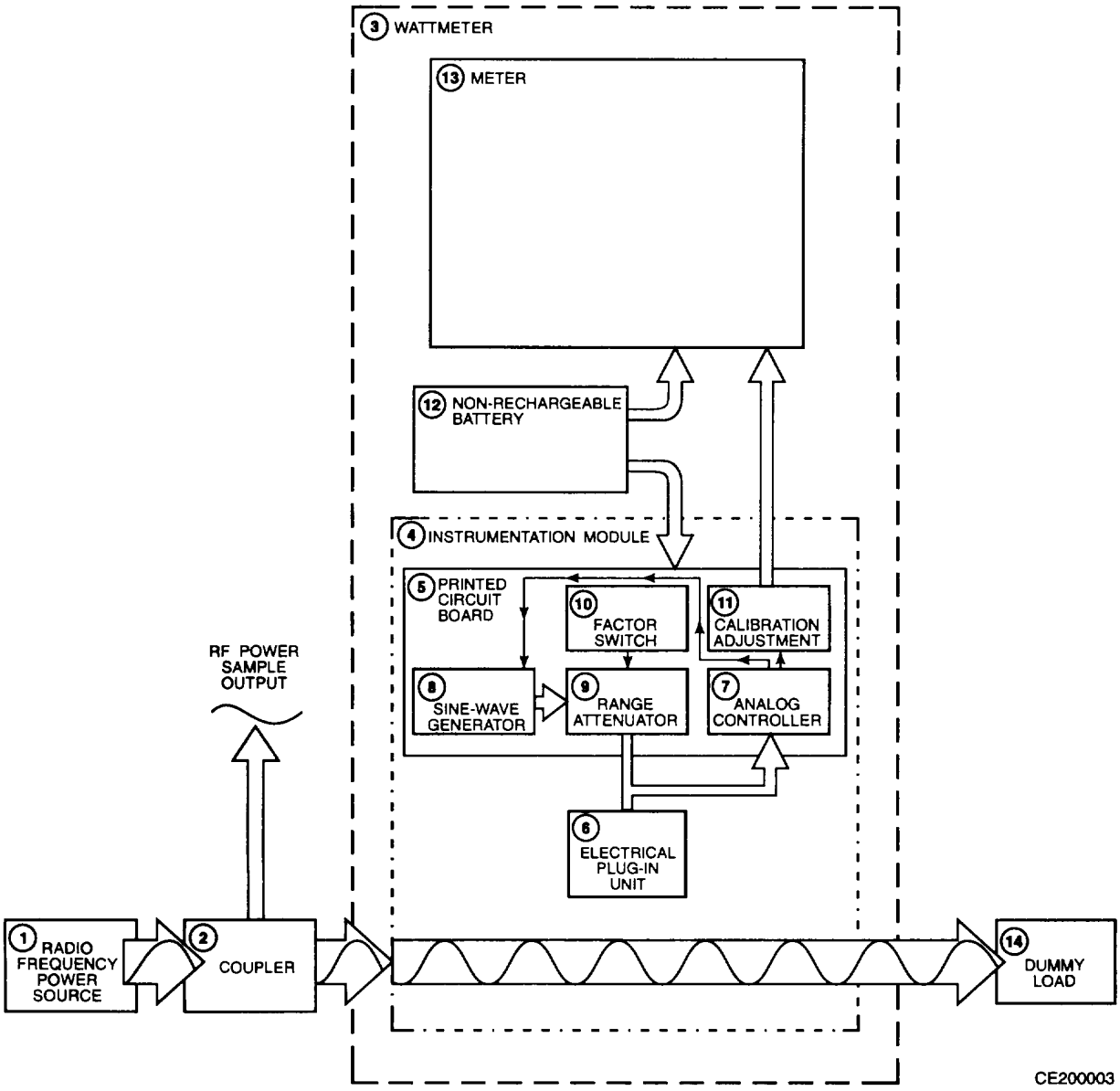


Figure 1-2. Radio Frequency Power Test Set AN/URM-213 Simplified Block Diagram

1-13. GENERAL FUNCTIONAL DESCRIPTION - Continued.

(6) The electrical plug-in units react to traveling RF waves. Energy from traveling RF waves are absorbed by mutual inductance and capacitance. By design, the electrical plug-in unit is highly directional and only detects power level of RF waves traveling in the direction of the arrow imprinted on the top of the electrical plug-in units. These electrical plug-in units can be rotated 180° to measure forward or reflected RF power.

(7) The analog controller sends an analog signal to the sine-wave generator (8), and through the calibration adjustment (11) to the meter (13).

(8) The sine-wave generator responds to a control signal from the analog controller (7), sending a sine wave through range attenuator (9) to the electrical plug-in unit (6) and back to the analog controller (7). The result of this is a self balancing bridge circuit.

(9) The range attenuator diminishes the signal from sine-wave generator (8); the extent the signal is diminished is in direct ratio to the factor switch's (10) position.

(10) The factor switch controls the diminishing quality of the range attenuator (9).

(11) The calibration adjustment regulates the analog output to the meter (13).

(12) The non-rechargeable battery provides all operating voltage needed for the c ircuitry in the wattmeter (3).

(13) The meter provides an accurate indication of RF power that travels through the instrumentation module (4).

(14) The dummy load provides a termination point for the RF power with an impedance of 50w.

CHAPTER 2
OPERATING INSTRUCTIONS

Section I. DESCRIPTION AND USE OF OPERATOR'S CONTROLS, INDICATORS, AND CONNECTORS

2-1. INTRODUCTION.

This section describes all of the operator controls, indicators, and connectors for the RF test set. Figure 2-1 describes the dummy load, Figure 2-2 describes the coupler, and Figure 2-3 describes the wattmeter.

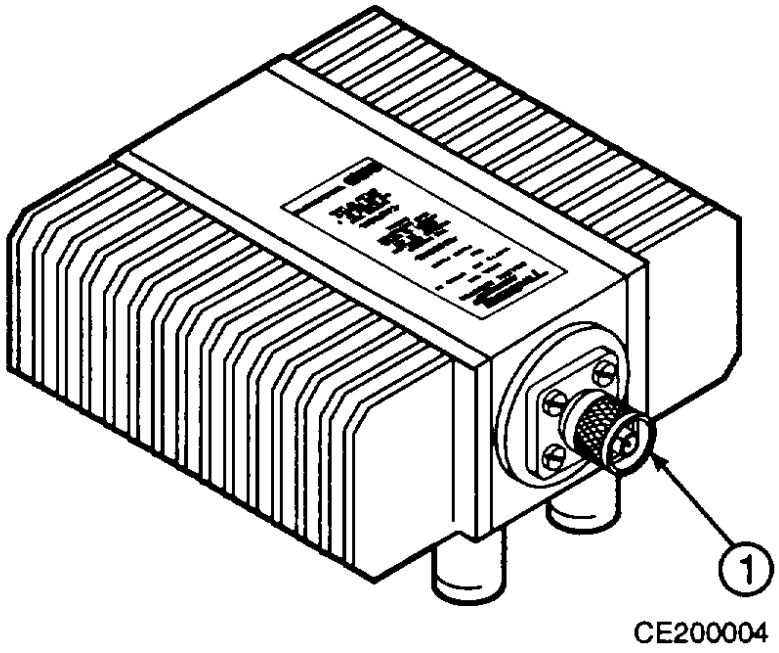


Figure 2-1. Operator's Controls, Indicators, and Connectors - Dummy Load

KEY	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
1	Termination Connector	A male type -N- connector used to maintain a 50Q impedance between the wattmeter and the dummy load.

2-1. INTRODUCTION - Continued.

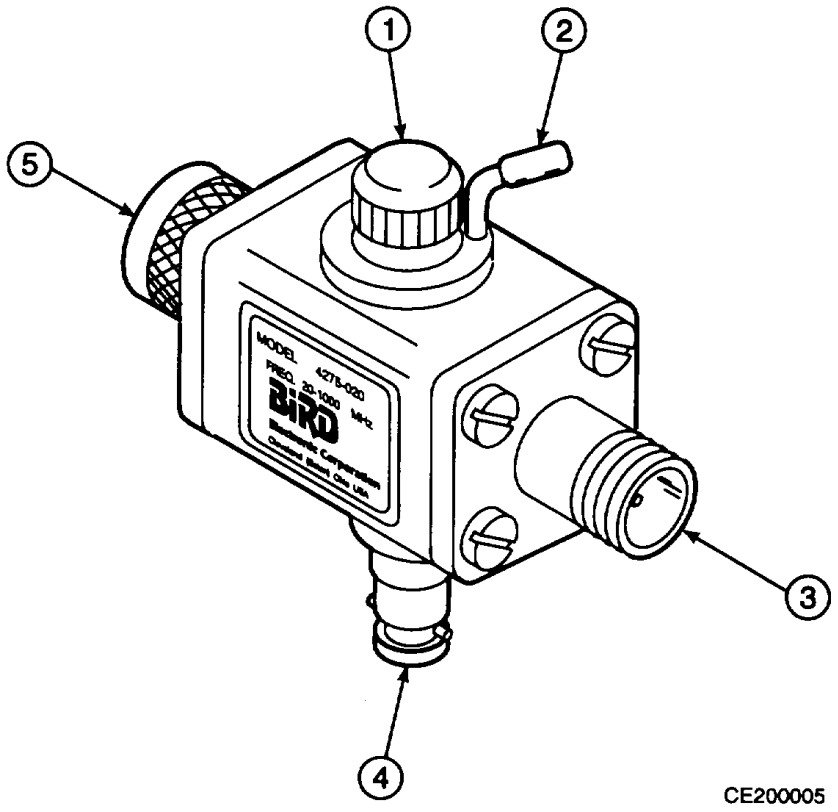


Figure 2-2. Operator's Controls, Indicators, and Connectors - Coupler

KEY	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
1	RF Sample Adjustment	Adjusts the amount of power that is sampled.
2	Adjustment Lock	Secures the RF Adjustment to a specific position.
3	Female Input/ Output Connector	A female type -N- connector used to maintain a 50Ω impedance when sampling RF power.
4	Sample Output Connector	A female BNC type connector used to maintain a 50Ω impedance when sampled output is to be directed to an oscilloscope or a frequency counter.
5	Male Input/ Output Connector	A male type -N- connector used to maintain a 50Ω impedance for the coupler to the RF power source when sampling RF power

2-1. INTRODUCTION - Continued.

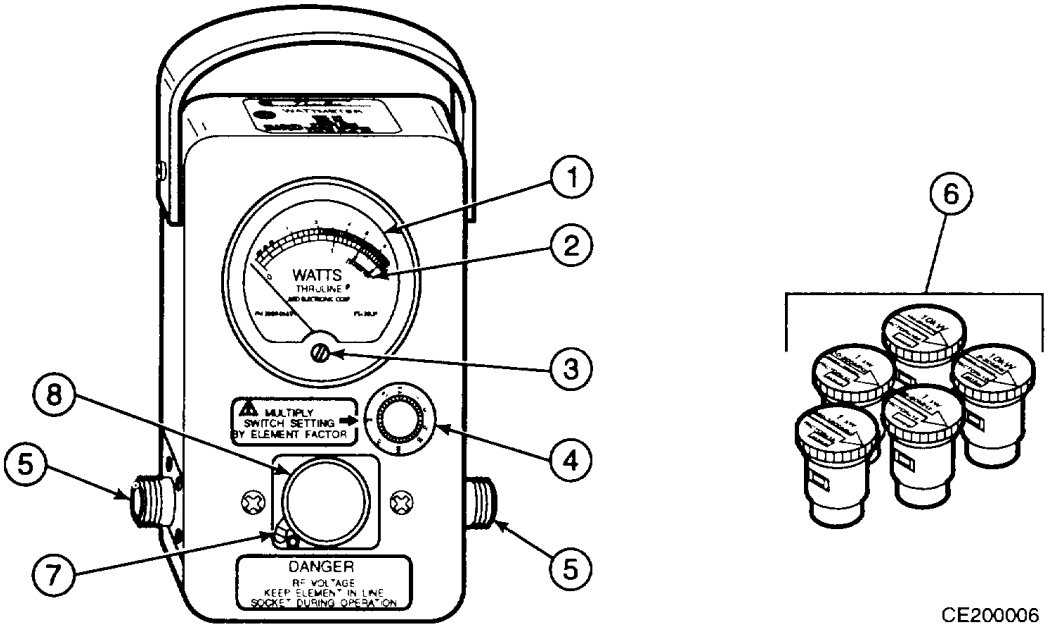


Figure 2-3. Operator's Controls, Indicators, and Connectors - Wattmeter

KEY	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
1	Meter	Displays value of RF power that is flowing through wattmeter.
2	Battery Test Indicator	Displays battery condition when factor switch (4) is placed in the battery test position.
3	Zero Adjustment Screw	Provides for zero adjustment of the meter.
4	Factor Switch	A rotary switch which selects a specific power scale (factors of 0.1, 0.3, 1, 3, 10, 30, 100), battery test, or off.
5	Female Input/ Output Connectors	A pair of female type -N- connectors that maintain a 50Q impedance between RF power and the wattmeter. Either connection will serve as input or output, direction of measurement is determined by the electrical plug-in unit (6).
6	Electrical Plug-in Unit	Provides for selection of frequency band by manual insertion of electrical plug-in unit. Electrical plug-in units are provided in the following ranges: 450 kHz to 2.5 MHz, 2 to 30 MHz, 25 to 80 MHz, 50 to Arrow printed on200 MHz, 200 to 1000 MHz electrical plug-in unit shows the direction of flow Rating printed on
		of RF power being measured electrical plug-in unit is maximum power rating.
7	Latch and Pivot Pin	Secures dust cap or electrical plug-in unit in place.
8 .	Dust Cap	Inserted into electrical plug-in unit socket when wattmeter is not in use to prevent dirt or foreign objects from entering wattmeter

Section II. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

2-2. GENERAL.

To be sure your equipment is always ready for your mission, you must do scheduled preventive maintenance checks and services (PMCS). When doing any PMCS or routine checks, keep in mind the WARNINGS and CAUTIONS about electrical shock and bodily harm.

2-3. PMCS PROCEDURES.

a. Tools, Materials, and Equipment Required for Preventive Maintenance. No tools or equipment are required for operator preventive maintenance. Cleaning materials required are listed in Appendix D, items 1 through 3 and item 5.

b. PMCS for RF test set is limited to routine checks such as shown below.

- cleaning
- dusting
- wiping
- checking for frayed cables
- storing items not in use
- covering unused receptacles
- checking for loose nuts, bolts, and screws

c. Perform these routine checks any time you see they must be done.

Section III. OPERATION UNDER USUAL CONDITIONS

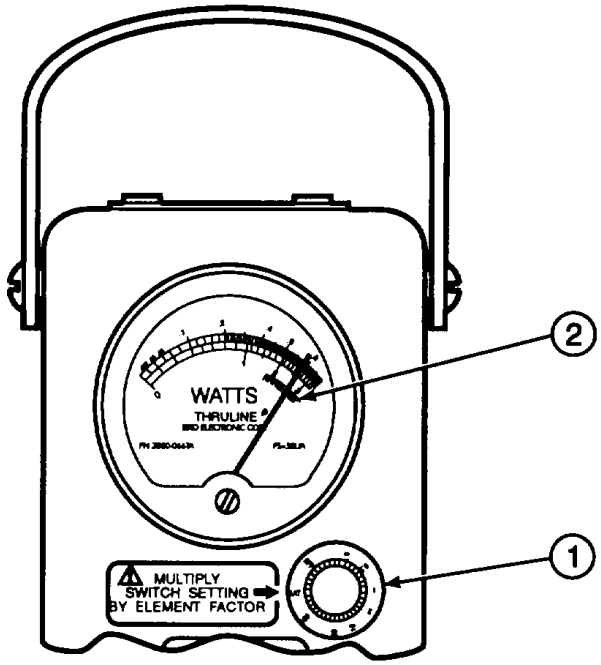
2-4. INITIAL ADJUSTMENTS AND CHECKS.

a. Zero Wattmeter.
- · Turn factor switch (1) to off position.
- Visually check position of meter's indicating needle (2).
- If needle does not come to rest on the zero mark, adjust meter to zero by turning the zero adjustment screw (3).
- Back off adjustment screw (3) slightly in opposite direction of adjustment. If needle moves off of zero, repeat previous step.

2-4. INITIAL ADJUSTMENTS AND CHECKS-Continued.

b. Test Battery.

- Turn factor switch (1) to BAT position (battery test position).
- Visually read meter. Needle should travel up to or over the lowest line on the battery test scale (2). If battery fails test, notify next higher level of maintenance.



BATTERY GOOD CE200012

2-5. OPERATING PROCEDURES.

Operation of the RF test set is described in paragraphs 2-6 through 2-10. Refer to Section I for a further description of the controls and indicators.

2-6. RF OUTPUT POWER MEASUREMENTS.

Perform the following steps to make RF output power measurements. If measurements will be taken at altitudes above 5000 feet MSL (Mean Sea Level), derate dummy load using procedure in high altitude operation (para. 2-11) then measure RF output power.

WARNING

- **Exposure to RF power radiation and the possibility of shock or burns is possible with some operations. Always keep dust cap or an electrical plug-in unit inserted in line section; always be sure to turn off transmitter when connecting or disconnecting wattmeter; be sure transmission line is terminated into a load (dummy load or antenna). Severe personal injury or death may result if transmitter is on while making connections or disconnection.**

- **Dummy load will heat up during operation. Severe burns to exposed skin may result if dummy load is handled while hot.**

CAUTION

- **Do not exceed 120% of the electrical plug-in units power rating. Exceeding 120% of rated power may cause damage to wattmeter and electrical plug-in unit.**

- **Do not use dummy load above rated value (para. 1-12).**

NOTE

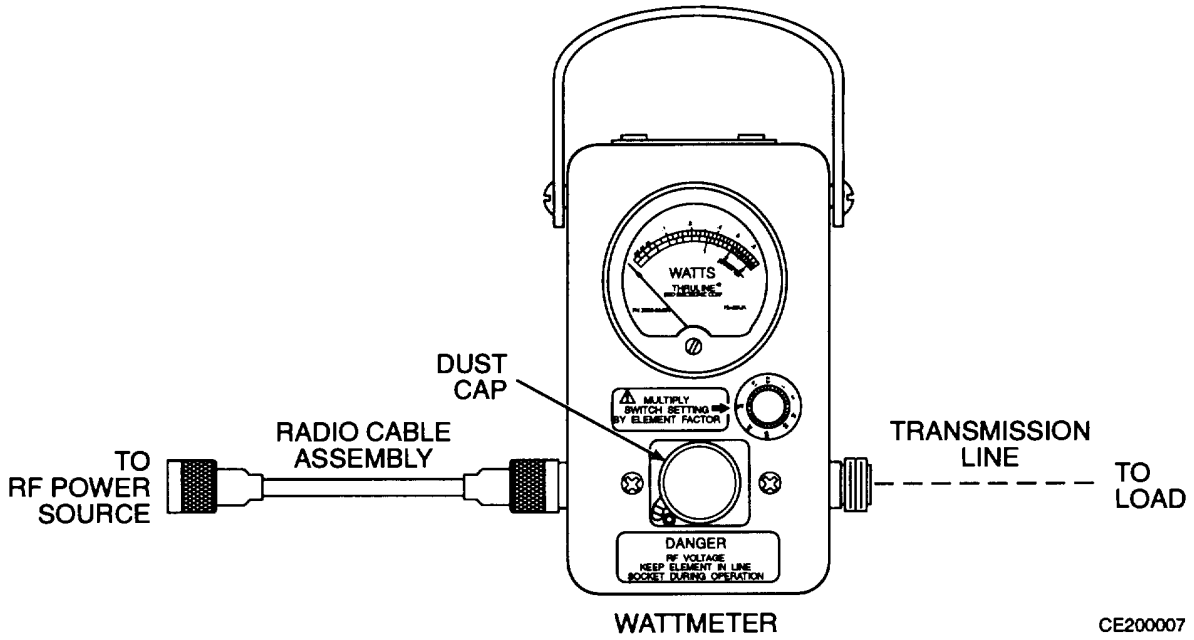
- **This RF test set is designed to measure continuous wave (CW) power and is not recommended for use with AM waves. Inaccurate readings will result if used for measurement of waves that are amplitude modulated.**

- **Dummy load may be used in place of load for non-radiating measurements.**

a. Make sure RF power source to be tested and wattmeter are turned off.

2-6. RF OUTPUT POWER MEASUREMENTS - Continued.

b. Set up RF test set as shown.



c. Select an electrical plug-in unit with a range that includes the frequency and power level of the RF power source being tested.

d. Remove dust cap from wattmeter.

e. Insert electrical plug-in unit into wattmeter receptacle with arrow facing toward load.

f. Lock electrical plug-in unit in place with latch.

g. Set factor switch to 100 multiple.

h. Key RF power source (not to exceed 120% of wattage rating on electrical plug-in unit).

i. Decrease factor switches multiple until meter reads between 0.2 and full scale (1.0) on meter's upper scale.

NOTE

Factor switch setting multiplied by factor printed on cap of electrical plug-in unit is equal to full scale power.

j. Multiply factor switch setting by factor printed on cap of electrical plug-in unit.

k. Determine which scale of meter is appropriate by using FACTOR/SCALE CHART.

FACTOR	SCALE TO BE USED
100	UPPER
30	LOWER
10	UPPER
3	LOWER
1	UPPER
0.3	LOWER
0.1	UPPER

l. Read RF power (watts) from meter.

m. Turn off RF power and wattmeter.

2-7. LOAD MATCH MEASUREMENT.

Perform the following steps to make load match measurements.

WARNING

- **Exposure to RF power radiation and the possibility of shock or burns is possible with some operations. Always keep dust cap or an electrical plug-in unit inserted in line section; always be sure to turn off transmitter when connecting or disconnecting wattmeter; be sure transmission line is terminated into a load (dummy load or antenna). Severe personal injury or death may result if transmitter is on while making connections or disconnection.**

CAUTION

Do not exceed 120% of the electrical plug-in units power rating. Exceeding 120% of rated power may cause damage to wattmeter and electrical plug-in unit.

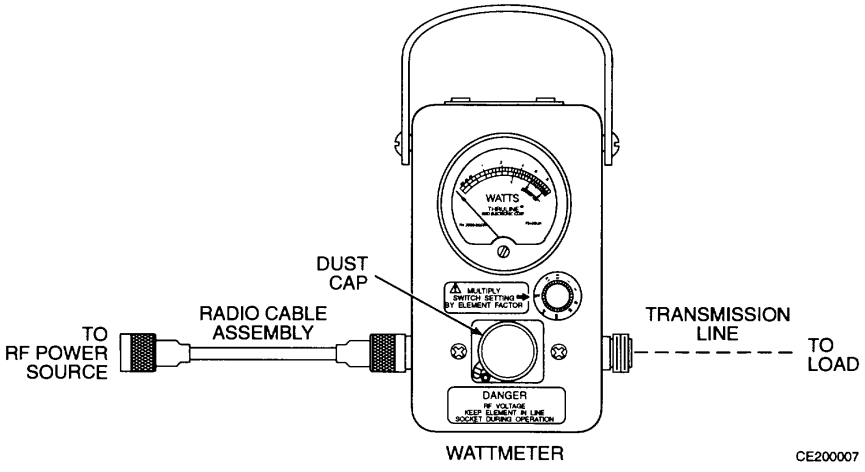
NOTE

- **At higher frequencies, load match measurements are significantly affected by changes in the radio transmission line length. For precision measurement at frequencies above 100 MHz, an exact length of cable must be added between the wattmeter and the antenna. The electrical length of the cable and the wattmeter must equal 1/2 wavelength of the source frequency. Refer to paragraph 2-12.**

- **This RF test set is designed to measure continuous wave (CW) power and is not recommended for use with AM waves. Inaccurate readings will result if used for measurement of waves that are amplitude modulated.**

a. Make sure RF power source to be tested and wattmeter are turned off.

b. Disconnect load from RF power source and connect as shown.



2-7. LOAD MATCH MEASUREMENT - Continued.

c. Select an electrical plug-in unit with a range that includes the frequen cy and power level of the RF power source being tested.

d. Remove dust cap from wattmeter receptacle.

e. Insert electrical plug-in unit into wattmeter receptacle with arrow facing toward load.

f. Lock electrical plug-in unit in place with latch.

g. Set factor switch to 100 multiple.

h. Key RF power source (not to exceed 120% of wattage rating on electrical plug-in unit).

i. Decrease factor switches multiple until meter reads between 0.2 and full scale (1.0) on meter's upper scale.

NOTE

Factor switch setting multiplied by factor printed on cap of electrical plug-in unit is equal to full scale power.

j. Multiply factor switch setting by factor printed on cap of electrical plug-in unit.

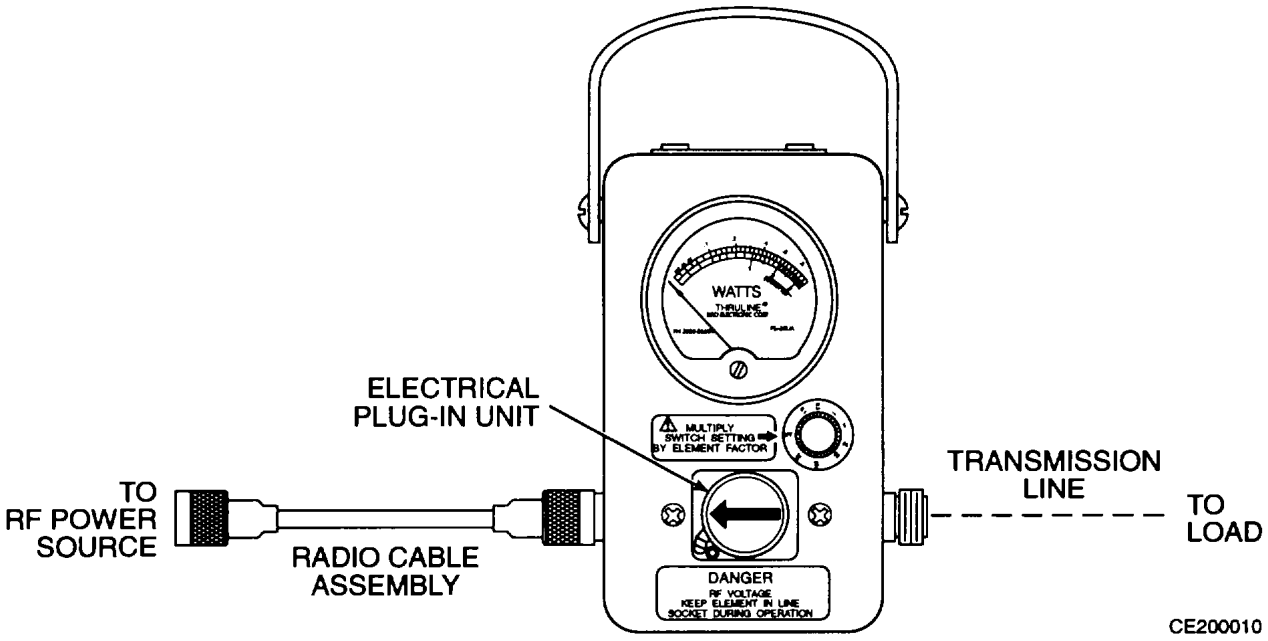
k. Determine which scale of meter is appropriate by using FACTOR/SCALE CHART.

FACTOR	SCALE TO BE USED
100	UPPER
30	LOWER
10	UPPER
3	LOWER
1	UPPER
0.3	LOWER
0.1	UPPER

2-7. LOAD MATCH MEASUREMENT - Continued.

l. Read forward RF power (watts) from meter.

m. Turn electrical plug-in unit 180' so arrow printed on top is pointed away from load.



n. Decrease factor switches multiple until meter reads between 0.2 and full scale (1.0) on meter's upper scale.

o. Multiply factor switch setting by factor printed on cap of electrical plug-in unit.

p. Determine which scale of meter is appropriate by using FACTOR/SCALE CHART.

q. Read reflected RF power (watts) from meter.

r. Determine VSWR (if needed).

- Select side of VSWR Chart that matches the reflected power reading in watts.
- Project the reflected RF power reading horizontally from the left side (Reflected Power - RF Watts) of the chart. Project the forward RF power reading vertically from the base line (Forward Power - RF Watts) of the chart.
- Read approximate VSWR from closest diagonal line on chart at point where the two lines intersect.

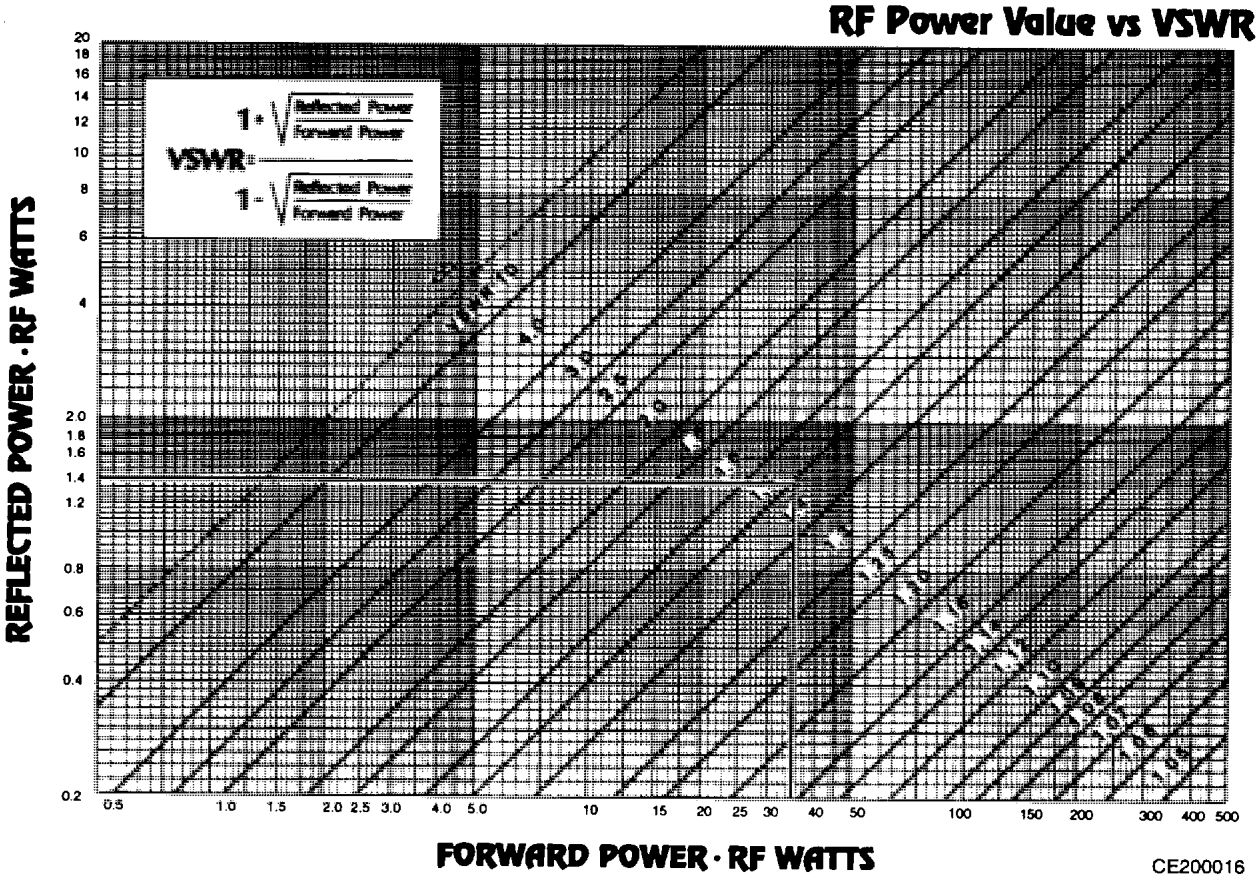
s. Turn off RF power and wattmeter.

2-7. LOAD MATCH MEASUREMENT - Continued.

EXAMPLE

With a forward RF power reading of 35 watts and a reflected RF power reading of 1.4 watts, the diagonal line that is closest to the intersection shows the approximate VSWR of 1.5:1.

From 0.45 to 4000 MHz and from 25 mW to 250 kW In 50 ohm coaxial line systems.



2-8. POWER TO LOAD CALCULATION.

Perform the following steps to determine power to load.

NOTE

At higher frequencies, load match measurements are significantly affected by changes in the radio transmission line length. For precision measurement at frequencies above 100 MHz, an exact length of cable must be added between the wattmeter and the antenna. The electrical length of the cable and the wattmeter must equal 1/2 of a wavelength. Refer to paragraph 2-12.

a. Make a load match measurement using paragraph 2-7.

b. Subtract value of reflected power from the value of forward power. Result is maximum power to load.

2-9. TRANSMISSION LINE LOSS MEASUREMENT.

Perform the following steps to make transmission line loss measurements. If measurements will be taken at altitudes above 5000 feet MSL (Mean Sea Level), derate dummy load using procedure in high altitude operation (para. 2-11), then measure transmission line loss.

a. Measure in Watts.

WARNING

- **Exposure to RF power radiation and the possibility of shock or burns is possible with some operations. Always keep dust cap or an electrical plug-in unit inserted in line section; always be sure to turn off transmitter when connecting or disconnecting wattmeter; be sure transmission line is terminated into a load (dummy load or antenna). Severe personal injury or death may result if transmitter is on while making connections or disconnection.**

- **Dummy load will heat up during operation. Severe burns to exposed skin may result if dummy load is handled while hot.**

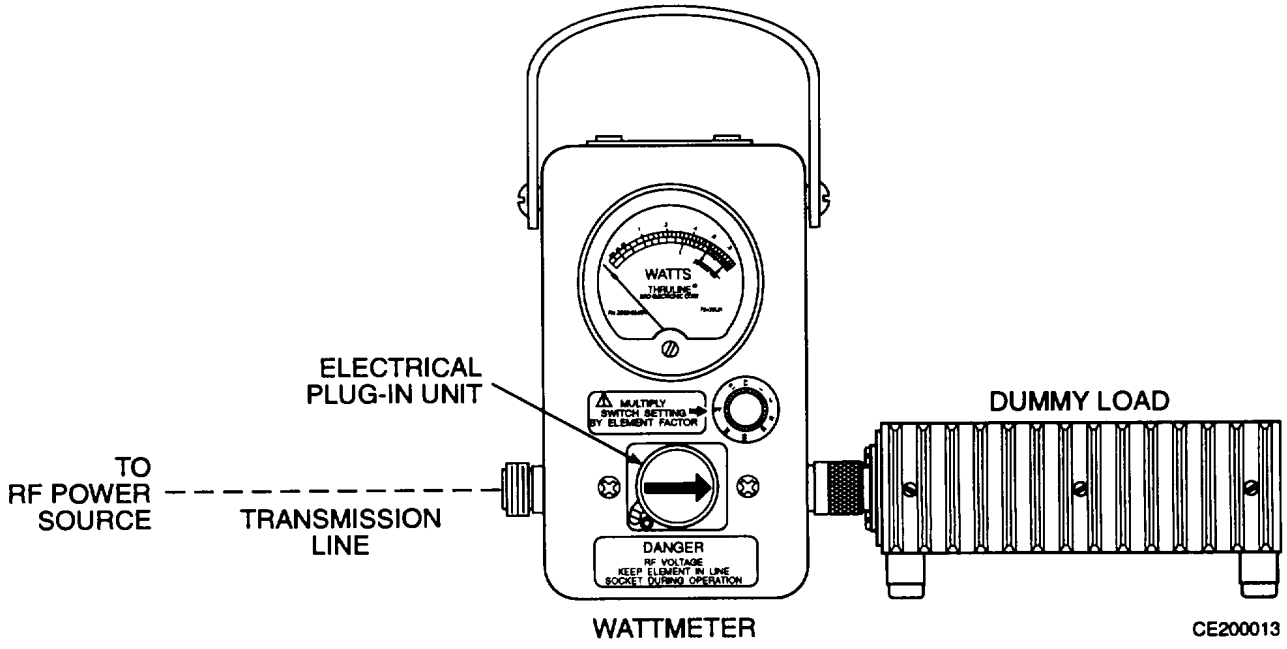
CAUTION

Do not use dummy load above rated value (para. 1-12).

NOTE

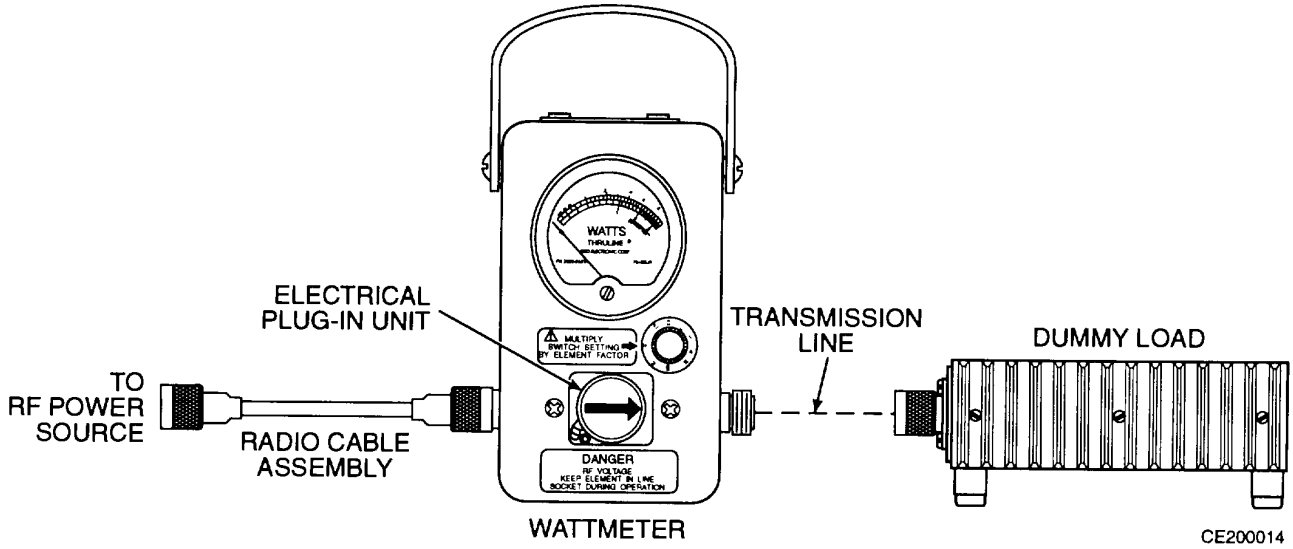
This RF test set is designed to measure continuous wave (CW) power and is not recommended for use with AM waves. Inaccurate readings will result if used for measurement of waves that are amplitude modulated.

• Assemble RF test set as shown.



2-9. TRANSMISSION LINE LOSS MEASUREMENT - Continued.

- Measure forward RF output power using procedure in paragraph 2-6, steps c. through m. Record this reading as *a.*
- Turn off RF power source and wattmeter.
- Connect RF power source to wattmeter as shown.



- Measure forward RF power. Use procedure in paragraph 2-6, steps c. through m. Record this reading as *b.*
- Subtract a from b. Record this value as amount of power lost through the transmission line.

b. Convert to dB using the following formula:

$$10 \log_{10} \frac{a}{(b)} \text{ - Transmission Line Loss in dB}$$

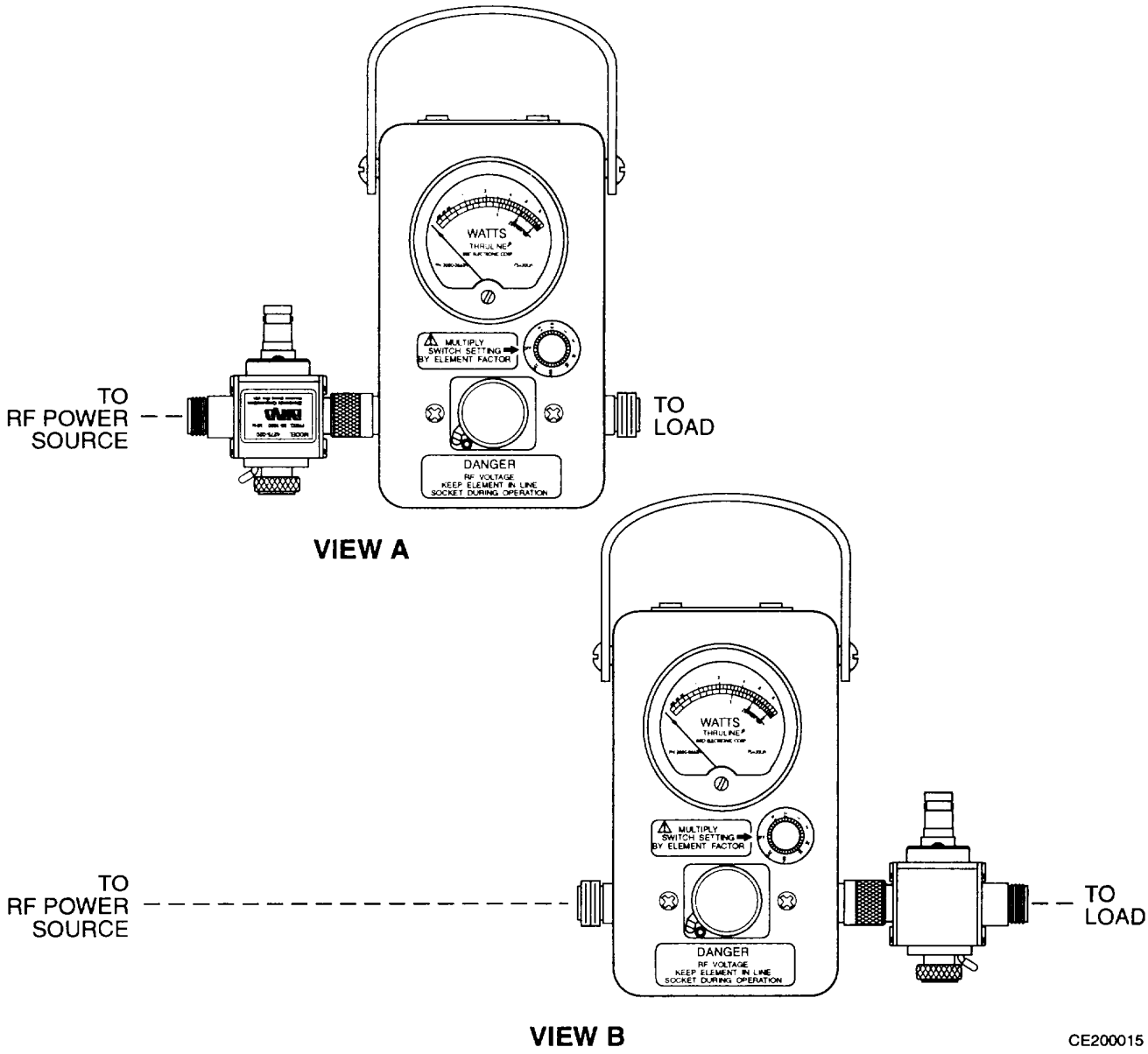
EXAMPLE FOR CONVERTING WATTS TO dB

- Using a calculator with a $\log_{10}$ key, clear calculator.
- Enter value of *a* from above (RF power in watts measured with wattmeter at load end).
- Press the divide key (+*).
- Enter value of b from above (RF power in watts measured with wattmeter at RF source end).
- Press equal key (=).
- Press $\log_{10}$ key ($\log_{10}$).
- Press multiplication key (x).
- Enter a value of 10.
- Press equal key (=). This value is transmission line loss in dB.

2-10. SAMPLING TRANSMISSION LINE POWER.

Use the following procedure when sample of RF power is needed.

a. Assemble RF test set as shown.



- If a load match measurement is to be taken, connect RF test set as shown in View A.
- If a power to load calculation is to be made, connect RF test set as shown in View B.

2-10. SAMPLING TRANSMISSION LINE POWER - Continued.

NOTE

Turning couplers sample adjustment clockwise increases RF power sample.

b. Unlock couplers adjustment lock. Turn sample adjustment counterclockwise at least four turns.

c. Connect input end of oscilloscope, spectrum analyzer, or frequency counter cable to BNC connector of coupler.

d. Increase amount of RF power sampled by turning coupler adjustment knob clockwise.

e. Use adjustment lock to keep sampler adjustment in a set position (if needed).

2-11. DUMMY LOAD OPERATION ABOVE 5000 FEET.

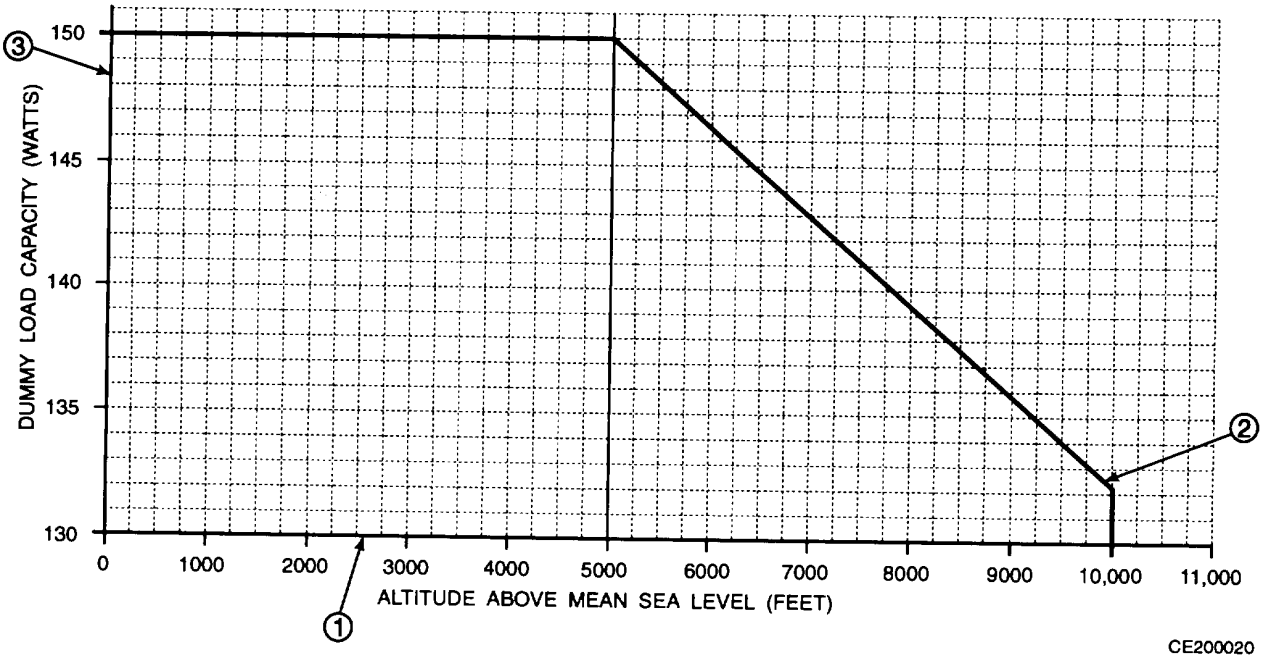
Below 5000 feet MSL (mean sea level), the dummy load is rated at 150 watts. For operation in high altitudes (above 5000 feet MSL), the power the dummy load is able to handle declines 2-1/2% for every 1000 foot increase. This does not apply to a pressurized vessel such as a jet airplane, but would apply in a heated but not pressurized airplane. Use the following procedure to determine dummy load power rating at increased altitude.

a. Determine maximum altitude in feet where dummy load will be used.

b. Match maximum altitude with altitude scale (1) on baseline of chart.

c. Project a line vertically from this point to the intersection of the high altitude operation curve (2).

d. Project a line horizontally and to the left from this intersection to the dummy load capacity scale (3). This point on the dummy load capacity scale represents the rated capacity of the dummy load at the specific altitude.



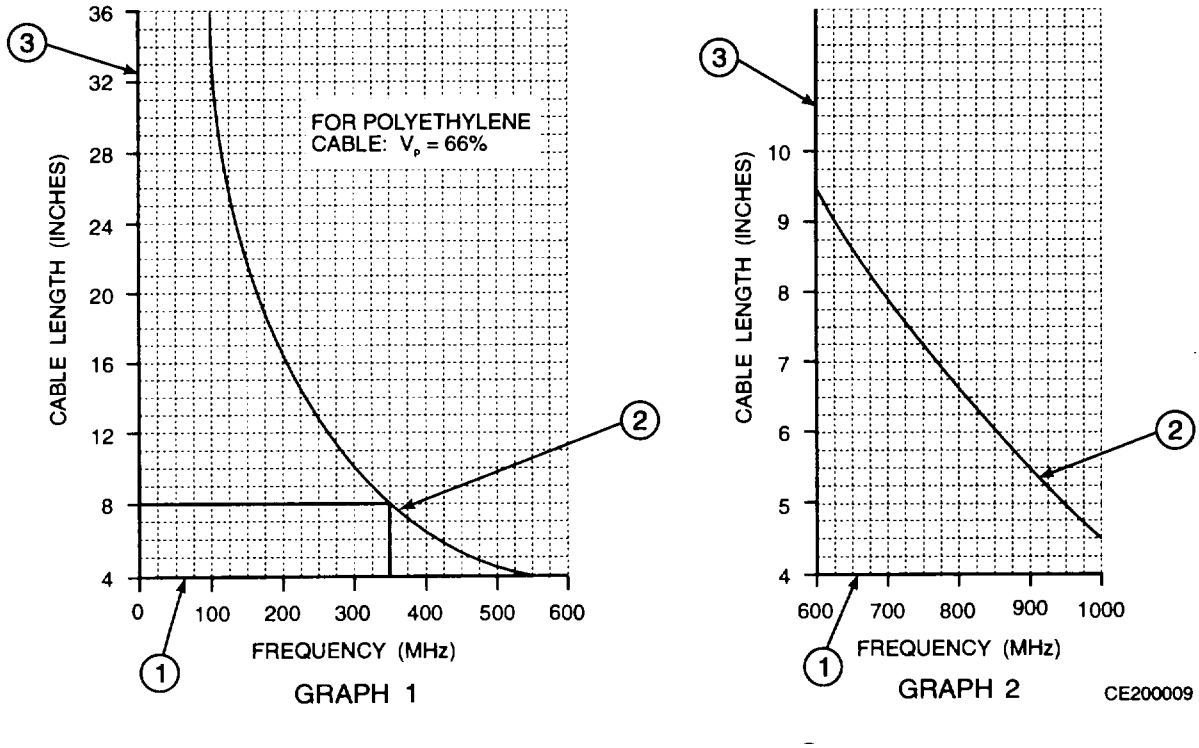
2-12. OPTIONAL IN-LINE SET-UP FOR PRECISION MEASUREMENTS.

For precision measurements above 100 MHz, use the following procedure to determine the exact length of cable needed between the wattmeter and the load.

NOTE

- **Using optional assembly for precision measurements does not increase accuracy of RF test set. It does provide a better indication of true line conditions by accounting for the change in high frequency measurements caused by the addition of the RF test set.**
- **For frequencies from 100 MHz to 600 MHz, use Graph 1, for frequencies from 600 to 1000 MHz, use Graph 2.**

a. Match frequency of transmitter to point on frequency scale (1) of the proper graph.



NOTE

- **Physical cable length is shown in inches on graphs 1 and 2. It is measured from end to end of outer conductor of male type -N- connectors. Cable with UHF plugs are measured from tip to tip of the center pins.**
- **When cable length is too short to be practically made, multiply physical cable length by 2.**

b. Project a line from graph frequency scale vertically to the point of intersection with the cable length curve (2).

c. Project a line from this intersection horizontally to the cable length inches scale (3). The point at which this line intersects the cable length inches scale is the length of the cable required.

2-12. OPTIONAL IN-LINE SET-UP FOR PRECISION MEASUREMENTS - Continued.

d. If cables other than solid polyethylene are used, divide relative velocity of type of cable used (%) (see table below) by 66%. Multiply the solid polyethylene cable length in inches by this factor. This is the cable length in inches for cables other than solid polyethylene.

DIELECTRIC MATERIAL	CABLE TYPE	RELATIVE VELOCITY
Polyethylene	RG-8/U RG-58 RG-58C/U RG- 122/U RG- 174/U RG-213/U RG-214/U RG-217/U RG-223/U	66%
Cellular Polyethylene	RG-58/U	78%
Tetrafluoroethylene (TeflonTM)	RG-141A/U RG- 142B/U RG- 178B/U RG- 188A/U RG-316/U RG-303	69.5%

NOTE

If coupler is installed, subtract 3.3 from value of cable length determined in step c. The result is the length of cable needed when a coupler is installed along with the wattmeter.

e. Add correct cable length between wattmeter and antenna feed line. Tighten connections hand-tight.

EXAMPLE FOR DETERMINING CABLE LENGTH FOR PRECISION MEASUREMENTS

An RF power source of 350 MHz is being measured. An RG-58/U type cable (with relative velocity of 78%) along with a coupler is used. What cable length should be used to connect the wattmeter output and the antenna feed line input?

- **The RF power source is 350 MHz, which is located on Graph 1.**
- **Projecting a line from the 350 MHz point on the baseline scale, upwards vertically to the cable length curve, then horizontally left to the cable length inches scale, a point of 8 inches is reached. This is the solid polyethylene cable length.**
- **Dividing the RG-58/U cable's relative velocity (78%) by 66%, a factor of 1.1818 is reached. Multiplying the 8 inch cable length by 1.1818, it is determined that the length of the RG-58/U cable should be 9.45 inches without a coupler.**
- **Subtract 3.3 from 9.45 inches. This accounts for the electrical length of the coupler. The cable length connecting wattmeter output and antenna input should be 6.15 inches for a RG-58/U cable with a coupler in line.**

CHAPTER 3
UNIT MAINTENANCE

Section I. REPAIR PARTS, SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT

3-1. COMMON TOOLS AND EQUIPMENT.

Common tools and equipment required for unit maintenance of Radio Frequency Power Test Set AN/URM-213 are listed in the Maintenance Allocation Chart (MAC) (Appendix B).

3-2. SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT.

There are no special tools, TMDE, or support equipment required.

3-3. REPAIR PARTS.

Repair parts are listed and illustrated in the Repair Parts and Special Tools List (Appendix F).

Section II. SERVICE UPON RECEIPT

3-4. SERVICE UPON RECEIPT OF MATERIEL.

a. Unpacking. Special material in this shipping carton provides maximum protection for the RF test set. Avoid damaging carton and packing material during equipment unpacking. Use the following steps for unpacking the RF test set:

- **Cut and remove paper sealing tape on carton top and open carton.**
- **Each carton will contain one RF test set. Grasp RF test set firmly while restraining shipping carton and lift equipment vertically.**
- **Place each RF test set on a suitable, flat, clean, and dry surface.**

3-4. SERVICE UPON RECEIPT OF MATERIEL- Continued.

b. Checking Unpacked Equipment.

- **Inspect equipment for damage incurred during shipment. If the equipment has been damaged, report the damage on SF 364, Report of Discrepancy (ROD).**
- **Check the equipment against the packing slip to see if shipment is complete. Report all discrepancies in accordance with the instructions of DA Pam 738-750.**
- **Check to see if equipment has been modified.**

3-5. PRELIMINARY SERVICING AND ADJUSTMENT OF EQUIPMENT.

a. Install battery (para. 3-7).

b. Perform PMCS (para. 2-3).

c. Perform initial adjustments and checks (para. 2-4).

Section III. TROUBLESHOOTING

SYMPTOM INDEX

3-6. TROUBLESHOOTING TABLE.

Table 3-1 lists common malfunctions found during operation or maintenance of the RF test set. You should perform the tests/inspections and corrective actions for a particular malfunction in the order given.

NOTE

Table 3-1 does not list all malfunctions that may occur or all tests or inspections and corrective actions. If a malfunction is not listed or is not corrected by listed corrective actions, notify next higher level of maintenance.

Table 3-1. Troubleshooting.

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

1. WATTMETER NOT OPERATING, NO METER INDICATION.

Step 1. Check battery using procedure in paragraph 2-4b.

- If battery fails check, replace battery (para. 3-7).
- If still not operating, notify next higher level of maintenance.

Step 2. Check the alignment of electrical plug-in unit arrow.

- Align arrow on electrical plug-in unit so arrow is pointed in direction of power being measured (forward or reflected).

Step 3. Check position of wattmeter factor switch.

- Select proper factor for wattage of RF power being measured (para. 2-6, RF Output Power Measurements).

Step 4. Check to see if DC contact in wattmeter receptacle is dirty.

- Clean DC contact, Appendix D items I and 5.

Step 5. Check electrical plug-in unit by replacement.

- Replace electrical plug-in unit.

Step 6. Check connections, radio cable assembly, and coupler.

- Check cable connections and set up.
- If cable is defective, see Appendix E for fabrication instructions.
- If wattmeter fails to operate, notify next higher level of maintenance.

2. INTERMITTENT OR INCONSISTENT READINGS.

Step 1. Check for shorts in radio cable assembly.

- If cable is defective, see Appendix E for fabrication instructions.

Step 2. Inspect connections between load and wattmeter.

- If either connector is damaged, notify next higher level of maintenance.

3. DUMMY LOAD OVERHEATS.

Check for minimum 6 inch clearance around dummy load.

- Provide at least a six inch clearance between the dummy load and the nearest object.

Section IV. MAINTENANCE PROCEDURES

3-7. BATTERY REPLACEMENT.

DESCRIPTION

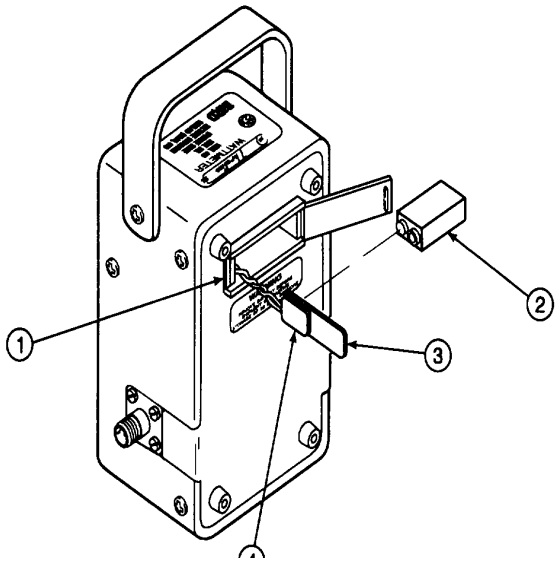
This procedure covers: Removal and installation of battery.

REMOVE

1. Make sure wattmeter is turned off.
2. Pry cover of battery compartment (1) open.
3. Remove battery (2) from battery compartment using battery removal tab (3).
4. Free battery from battery clip (4).

INSTALL

1. Push terminals of new battery on to respective terminals on battery clip (4).
2. Install battery in compartment.
3. Close cover of battery compartment (1).



CE200024

END OF TASK

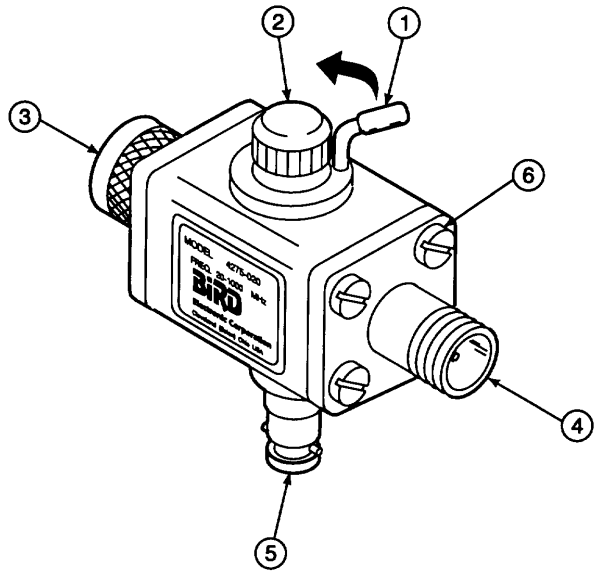
3-8. COUPLER INSPECTION.

DESCRIPTION

This procedure covers: Inspection of coupler.

INSPECT

1. Unlock adjustment lock (I) by turning counterclockwise.
2. Check adjustment knob (2) for sticking or binding.
3. Visually inspect male type -N- (3), female type -N- (4), and sample BNC (5) connectors for bent or missing pins or contacts, and stripped threads.
4. Make sure all screws (6) securing connectors to coupler are tight.



CE200026

END OF TASK

Section V. PREPARATION FOR STORAGE OR SHIPMENT

3-9. PACKAGING.

Package the RF test set in the original shipping container. When using packing materials other than the original, use the following guidelines:

a. Remove battery (para. 3-7).

b. Use a double-wall cardboard shipping container.

c. Protect all sides with shock-absorbing material to prevent the RF test set from movement within the container.

d. Seal the shipping container with approved sealing tape.

e. Mark "FRAGILE" on all sides, top, and bottom of the shipping container.

3-10. TYPES OF STORAGE.

NOTE

If RF test set is to be stored for more than 30 days, remove battery from wattmeter and place in RF test set case. Refer to paragraph 3-7.

a. Short Term Storage = 1 to 45 days.

b. Intermediate = 46 to 180 days.

c. Long Term = over 180 days.

3-11. ENVIRONMENT.

The RF test set should be stored in a clean, dry environment. In high humidity environments, protect the RF test set from temperature variations that could cause internal condensation. The following environmental conditions apply for both shipping and storage:

Temperature	-40° to +159°F (-40° to +71°C)
Relative Humidity (noncondensing)	95% RH (±5%)
Altitude	15,000 feet maximum

CHAPTER 4
DIRECT SUPPORT MAINTENANCE

4-1. DIRECT SUPPORT MAINTENANCE.

There is no direct support maintenance for the Radio Frequency Power Test Set AN/URM-213.

CHAPTER 5
GENERAL SUPPORT MAINTENANCE

Section I. REPAIR PARTS, SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT

5-1. COMMON TOOLS AND EQUIPMENT.

Common tools and equipment required for unit maintenance of Radio Frequency Power Test Set AN/URM-213 are listed in the Maintenance Allocation Chart (MAC) (Appendix B).

5-2. SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT.

There are no special tools, TMDE, or support equipment required.

5-3. REPAIR PARTS.

Repair parts are listed and illustrated in the Repair Parts and Special Tools List (Appendix F).

Section II. SERVICE UPON RECEIPT

5-4. SERVICE UPON RECEIPT OF MATERIEL.

For service upon receipt information, refer to Chapter 3, Section II.

5-5. PRELIMINARY SERVICING AND ADJUSTMENT OF EQUIPMENT.

a. Install battery (para. 3-7).

b. Zero wattmeter (para. 2-4a).

c. Test battery (para. 2-4b).

Section III. THEORY OF OPERATION

This section provides additional theory of operation needed by general support maintenance personnel to repair the RF test set. This information is in addition to the information provided in Chapter 1, Section III.

5-6. GENERAL THEORY OF OPERATION.

A functional block diagram of the RF test set is shown in Figure 5-1. There are four basic paths of signal flow. The first is the RF source (1) to dummy load (7) path which is the RF power to be measured. The second is the RF sample path which uses the coupler (2) to produce a sample of the RF power to a viewing device (3). The third path contains the capacitive voltage and inductive current samplers (4) which produces a voltage induced from the RF power. The fourth is a self-balancing bridge circuit (5) that measures voltage generated by the coupler and produces the readable output.

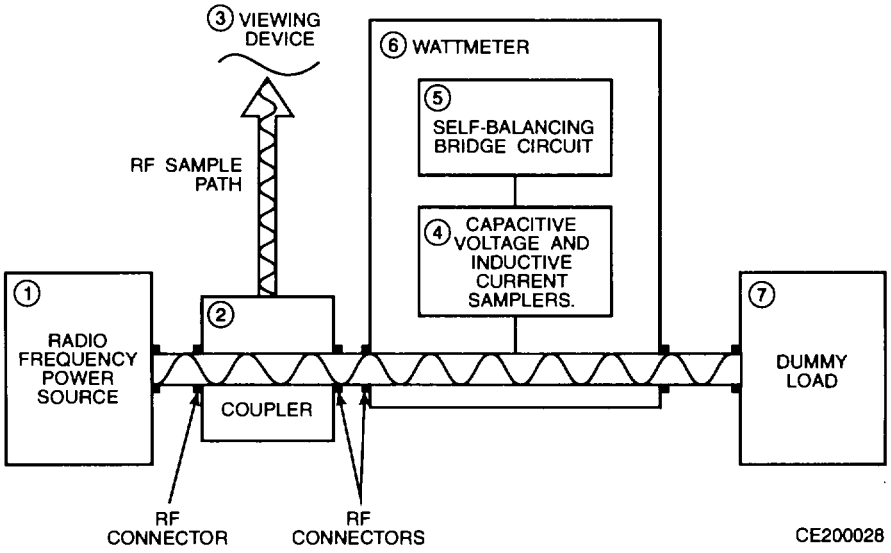


Figure 5-1. RF Test Set Functional Block Diagram

The RF connectors provide for connection between the various cables, wattmeter, coupler, and dummy load. The RF connectors on all of the RF test set components are designed not to reflect RF power. A failed connector will reflect an amount of RF power that will result in inaccurate readings. If RF power passes through a failed connector before it reaches the wattmeter, a lower than actual power reading will result. If the RF power passes through the wattmeter before it reaches a failed connector, a high reflected power measurement may result.

5-7. DUMMY LOAD OPERATION.

The RF power source (1) to dummy load (7) path begins with the generation of the RF power to be tested. The power will flow through the wattmeter's line section and terminate at the dummy load. RF power is converted to heat and will be dissipated through the fins on the dummy load. Most of the RF power should be absorbed by the dummy load with only a very small amount (less than 0.2%) of RF power reflected.

The dummy load can affect the VSWR reading if it has a defective connector. A defective dummy load connector, in position after the wattmeter, will produce a high VSWR. This is due to the defective connector reflecting a portion of the RF waves back to the wattmeter, causing a higher reflected wave power indication.

A defective dummy load having an impedance other than 502 will also produce high VSWR. This is due to the mismatch caused by differences in impedance values of a defective dummy load and the 500 transmission system.

5-8. COUPLER OPERATION.

The purpose of the coupler (2) is to remove a small portion of RF power with minimal disruption of the RF power in the transmission line. This sampled output can then be used to drive an oscilloscope, a frequency counter, or a spectrum analyzer for viewing. The coupler will be placed in the transmission line either before or after the wattmeter. The position will depend on what measurements will be taken with the wattmeter.

The coupler can affect the RF power and VSWR readings if it has a defective connector. The location of the connector determines what type of effect it has on the readings. With the coupler located between RF power source and wattmeter (para. 2-10, Sampling Transmission Line Power, View A), a defective connector will cause a lower than actual load power reading. This is because the defective connector will reflect some of the RF waves before they reach the wattmeter. When the coupler is located between the wattmeter and the load (para. 2-10, Sampling Transmission Line Power, View B), a defective connector can produce a high reflected power measurement. This is because the defective connector will reflect additional RF waves back to the wattmeter causing a higher reflected RF wave power indication.

5-9. WATTMETER OPERATION.

A functional block diagram of the wattmeter is shown in Figure 5-2. The electrical plug-in unit (1) samples the RF voltage and current signals traveling through the coaxial line. The capacitive voltage sampler (2) produces a voltage (V_{Cf}) from the flow in the forward RF voltage (from source to load) and also a voltage (V_{Cr}) from the flow of any reflected RF voltage (from load to source). The forward and reflected samples add together to form the total capacitive voltage signal ($V_{Cf} + V_{Cr} = V_{Ctotal}$). In the illustration, signals sampled from the forward RF power are represented by solid arrows while signals sampled from the reflected RF power are represented by dashed arrows. The inductive current sampler (3) produces a voltage (V_{Lf}) from forward flow of RF current and a voltage (V_{L},) from any reflected RF current. The voltage generated from the reflected RF current is 180 ° out of phase with the voltage generated from the forward RF current and will subtract to form the total inductive voltage signal (V_{Lf} $V_{Lr} = V_{Ltotal}$). The element is designed so that the voltages generated by the capacitive voltage sampler are the same amplitude as the voltages generated from the inductive current sampler ($V_{cf} = V_{Lf}$ and $V_{Cr} = V_{Lr}$). Combining the output of both samplers causes the signals from power flow to add in one direction and the opposite signals to subtract. For example, during forward power measurements the samples add in the following way; $V_{Cf} + V_{Cr} + V_{Lf}$ V_{Lf} which is equal to ($V_{Cf} + V_{Lf}$). If the electrical plug-in unit is turned in the reflected direction, forward signals from the capacitive voltage sampler and the inductive current sampler will cancel while the reflected signals will be combined. This is how the electrical plug-in unit obtains it's highly directional characteristics.

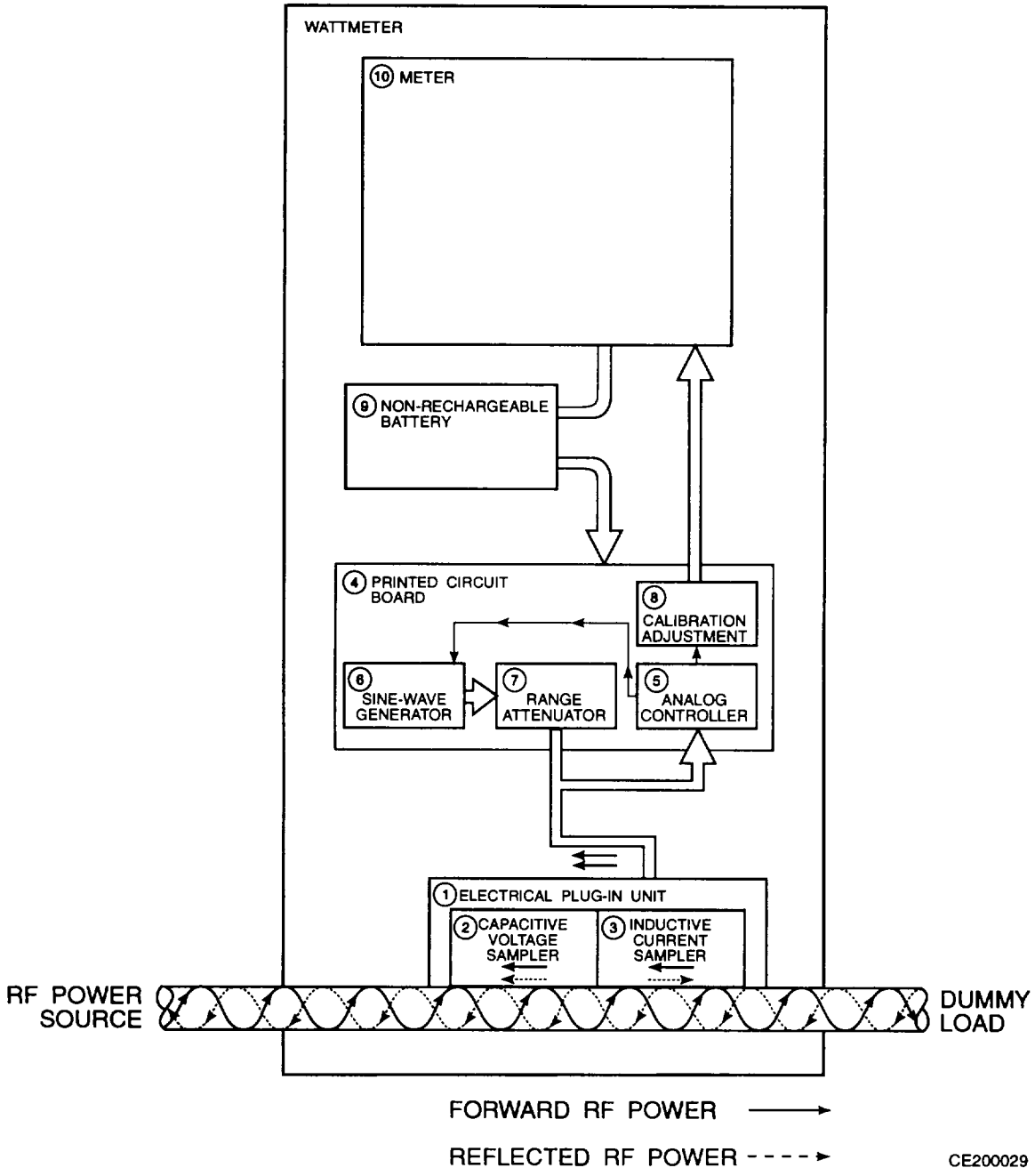


Figure 5-2. Wattmeter Functional Block Diagram

5-9. WATTMETER OPERATION - Continued.

Diode detectors mounted in the electrical plug-in unit are part of a self-balancing bridge circuit. The rest of the bridge circuit is located on the printed circuit board (4) and include; an analog controller (5), a range attenuator (7), and a calibration adjustment (8). The output of the printed circuit board is a low frequency sine wave. The amplitude of this sine wave is automatically adjusted until it is equal to the amplitude of the voltage produced by the electrical plug-in unit. Voltage produced by the electrical plug-in unit and therefore the low frequency sine wave voltage, are proportional to the RF power traveling through the line section. The amplitude of the low frequency sine wave is used to display the value of RF power flowing through the coaxial line. This type of detector provides increased dynamic range and relative immunity to variations in temperature. All power required to operate the detector comes from a single non-rechargeable battery (9).

The wattmeter produces a reading of RF power. A defective RF input connector will cause a lower than actual power reading. This is due to RF power being reflected from the defective connector before reaching the wattmeter. A defective output connector can produce a higher than actual reflected power measurement due to the additional reflected wave from the defective connector. Erroneous or inaccurate readings may result from a failed meter, instrumentation module, or electrical plug-in unit.

Section IV. TROUBLESHOOTING

SYMPTOM INDEX

NOTE

- **Before using this troubleshooting section, check the equipment work order and, if possible, talk to the unit maintenance personnel for a description of the symptoms and steps taken to correct them.**
- **Check all forms or tags attached to and accompanying the RF test set to determine the reason for removal from service.**

5-10. TROUBLESHOOTING GUIDELINES.

The following is a list of aids that you can use when troubleshooting the RF test set.

a. Refer to Theory of Operation (Chapter 5, Section III) as required. The theory of operation provides the circuit theory of each section of the RF test set. Block diagrams of the circuits are provided in the theory of operation sections.

b. Problems with instruments that have been in service for a long period of time, or in a harsh environment, may be caused by corrosion. Sometimes removing and reseating the affected assembly connectors will correct a malfunction.

5-11. EQUIPMENT INSPECTION.

The following internal inspection procedure shall be used to locate obvious malfunctions with the RF test set.

WARNING

Make sure RF power source and load are disconnected from wattmeter when wattmeter cover assembly is removed. Several dangerous voltage points may be exposed. Contact with these points could cause serious injury or death.

CAUTION

- **Do not disconnect or remove any connectors, components, or printed circuit boards from the wattmeter unless the battery is removed and RF power to wattmeter is off.**
- **The wattmeter has several components that can be damaged by electrostatic discharge. Use conductive foam and grounding straps when servicing in the area of static-sensitive devices. Use care when removing and inserting modules that contain integrated circuits.**

a. Remove access door (para. 5-19).

b. Inspect all components for physical damage or breakage.

- Inspect all assemblies for burnt or loose components.

5-12. TROUBLESHOOTING TABLE.

Troubleshooting table (Table 5-1) lists common malfunctions that you may find during operation or maintenance of the RF test set. You should perform the tests, inspections and corrective actions for a particular malfunction in the order given.

Table 5-1. Troubleshooting.

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
1. WATTMETER NOT OPERATING, NO METER INDICATION.
Step 1. Test battery (para. 2-4b).
• If no meter indication, measure battery voltage using dc voltmeter. If dc voltage is less than 6.2 volts, replace battery (para. 3-7). If dc voltage is greater than 6.2 volts, go to step 7.
Step 2. Check the alignment of electrical plug-in unit arrow.
• Align arrow on electrical plug-in unit so arrow is pointed in direction of power being measured (forward or reflected).

Table 5-1. Troubleshooting - Continued.

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

1. WATTMETER NOT OPERATING, NO METER INDICATION Continued.

Step 3. Check position of wattmeter factor switch.

- Select proper factor for wattage of RF power being measured (para. 2-6, RF Output Power Measurements).

Step 4. Check adjustment of dc contact.

- Adjust dc contact (para. 5-25).

Step 5. Check connections and radio cable assembly.

- Tighten cable connections.
- If cable is defective, see Appendix E for fabrication instructions.

Step 6. Check electrical plug-in unit by replacement.

- Replace electrical plug-in unit.

Step 7. Perform wattmeter fault isolation test (para. 5-13).

- If dc voltmeter reads greater than 20 mV, replace meter and gasket (para. 5-22).
- If dc voltmeter reads less than 20 mV, replace instrumentation module (para. 5-23).

2. CONSISTENTLY LOW RF POWER READINGS.

Step 1. Check that all connections are hand-tight.

- Tighten loose connections hand-tight.

Step 2. Inspect wattmeter input connector (para. 5-14).

- If connector fails inspection, replace watt meter input connector (para. 5-20).

Step 3. If coupler is used and installed between wattmeter and load, inspect coupler female connector (para. 5-14) and male connector (para. 5-15).

- If a connector fails inspection, replace connector (para. 5-18).

Step 4. Check if consistently low RF power readings are due to erroneous or inaccurate readings.

- Go to MALFUNCTION 4, ERRONEOUS OR INACCURATE READINGS.

Table 5-1. Troubleshooting - Continued.

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

3. WATTMETER NOT LINEAR.

Step 1. Check for shorted radio cable assembly.

- If cable is defective, see Appendix E for fabrication instructions.

Step 2. Check coupler.

- If coupler is used, check to make sure it is installed correctly and is working properly (para. 2-10).

Step 3. Check electrical plug-in unit by replacement.

- Replace electrical plug-in unit.

Step 4. Perform wattmeter fault isolation test (para. 5-13).

- If factor switch is in the 100 multiple, and dc voltmeter indicates 42 mV $\pm$2 mV, replace meter and gasket (para. 5-22).
- If dc voltmeter indicates above or below 42 mV ±2 mV, replace instrumentation module (para. 5-23).

4. ERRONEOUS OR INACCURATE READINGS.

Step 1. Check for shorted radio cable assembly.

- If cable is defective, see Appendix E for fabrication instructions.

Step 2. Check electrical plug-in unit by replacement.

- Replace electrical plug-in unit.

Step 3. Perform wattmeter fault isolation test (para. 5-13).

- If factor switch is in the 100 multiple and dc voltmeter indicates 42 mV $\pm$ 2 mV, replace meter and gasket (para. 5-22).
- If the dc voltmeter indicates above or below 42 mV $\pm$ 2 mV, replace instrumentation module (para. 5-23).

Table 5-1. Troubleshooting - Continued.

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

5. INTERMITTENT OR INCONSISTENT READINGS.

Step 1. Inspect dummy load connector (para. 5-15).

- If connector fails inspection, replace connector (para. 5-17).

Step 2. Check electrical plug-in unit by replacement.

- Replace electrical plug-in unit.

Step 3. Perform wattmeter fault isolation test (para. 5-13).

- If factor switch is in the 100 multiple, and dc voltmeter reads 42 mV $\pm$2 mV, replace meter and gasket (para. 5-22).
- If factor switch is in the 100 multiple and dc voltmeter reads above or below 42 mV $\pm$2 mV, replace instrumentation module (para. 5-23).

6. DUMMY LOAD OVERHEATS.

Check dummy load position.

- Provide at least a six inch clearance between the dummy load and nearest object.

7. DUMMY LOAD FAILS PERFORMANCE TEST.

WARNING

The dummy load contains 0.9 ounces of Beryllium Oxide (B_eO) in a solid form. Beryllium Oxide dust is considered a hazardous waste. Dispose of the dummy load in accordance with the governing Federal regulations. Inspect dummy load connector (para. 5-15).

- Replace dummy load connector if damaged (para. 5-17).
- If connector is not damaged, replace dummy load.

8. COUPLER HAS INSUFFICIENT RANGE OF ADJUSTMENT.

Inspect female type -N- connector (para. 5-14) and male type -N- connector (para. 5-15).

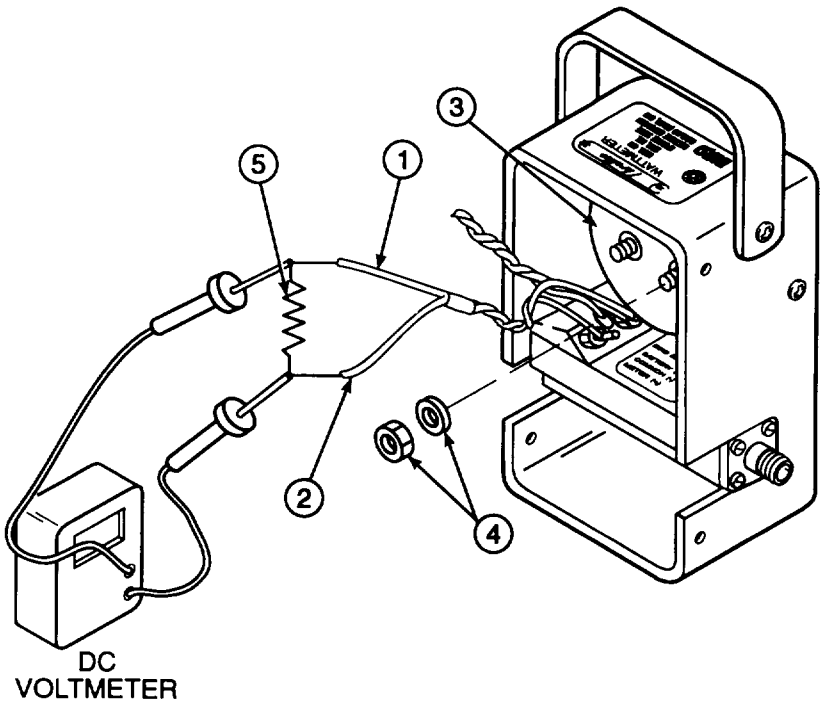
- Replace defective connector(s) (para. 5-18).

5-13. WATTMETER FAULT ISOLATION TEST.

DESCRIPTION

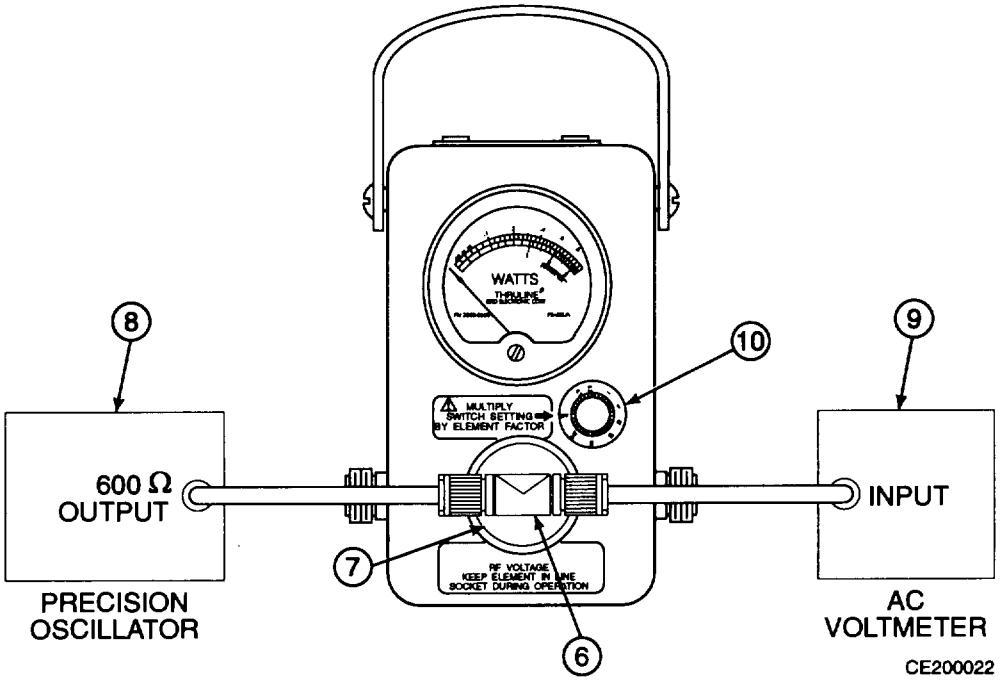
This procedure isolates wattmeter fault to meter movement or instrumentation module.

1. Remove access door from wattmeter (para. 5-19).
2. Reconnect battery to battery clip.
3. Remove instrumentation module leads (1) and (2) from meter (3) by removing attaching hardware (4).
4. Connect decade resistor (5) as shown. Set to 1400 Ω ±1%.
5. Connect positive lead of dc voltmeter to orange lead of instrumentation module and negative lead to black lead of instrumentation module.
6. Adjust dc voltmeter to read dc mV.



CE200021

5-13. WATTMETER FAULT ISOLATION TEST - Continued.



7. Connect BNC adaptor tee (6) to model 4410-070 calibration plug-in unit (7).

8. Remove dust cap from wattmeter and insert calibration plug-in unit in wattmeter receptacle.

9. Rotate calibration plug-in unit clockwise until it stops.

10. Connect precision oscillator (8) main 6004 output to BNC tee adapter using 50 Ω coaxial cable.

11. Adjust ac voltmeter to measure ac volts.

12. Connect output of BNC tee adaptor to voltag e input of ac voltmeter (9) using 50 Ωcoaxial cable.

13. Set up precision oscillator to provide a 1000 Hz ±100 Hz, symmetrical sine wave with 0 Volts dc offset.

14. Adjust amplitude of the precision oscillator until the multimeter reads 1.591 ±0.0005 Volts RMS at 1000 Hz ±100 Hz.

15. Turn factor switch (10) to the 100 multiple.

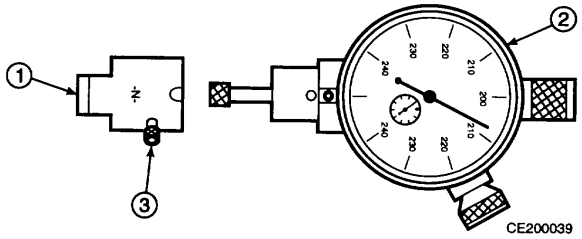
16. Measure dc voltage across the 1400 Ω resistance. Use measurement in conjunction with troubleshooting chart (table 5-1) for voltages and corrective actions.

5-14. FEMALE TYPE -N- CONNECTOR FAULT INSPECTION.

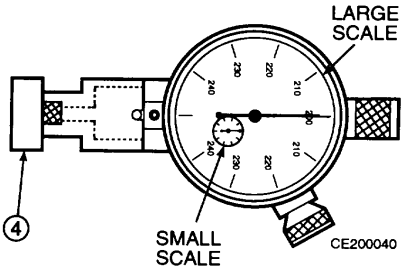
DESCRIPTION

This inspection determines faults in female type -N- connectors by measurement of the female center conductor depth.

1. Attach type -N- bushing (1) to dial indicator (2) securing with bushing screw (3).

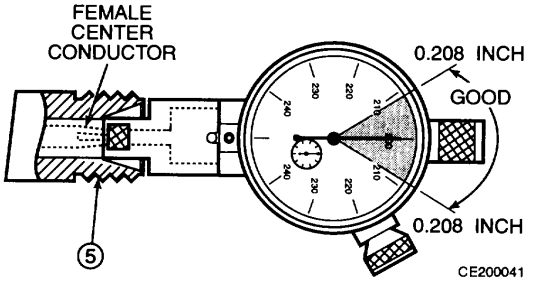


2. Zero dial indicator (2) using calibration block (4) (small scale will read zero and large scale will read 0.200).



3. Take reading of connector by inserting dial indicator into female type -N- connector (5).

   - If dial indicator reading of female center conductor depth is not within 0.008 inch of zero set in step 2, connector is defective.

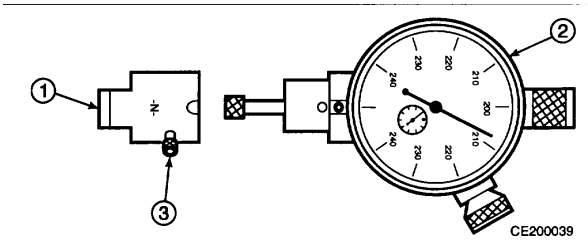


5-15. MALE TYPE -N- CONNECTOR FAULT INSPECTION.

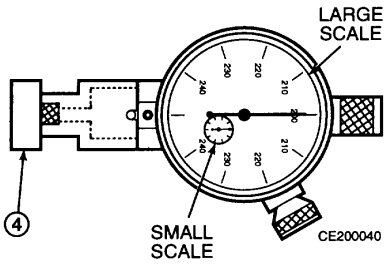
DESCRIPTION

This procedure determines faults in male type -N- connectors by measurement of the male center conductor depth.

1. Attach type -N- bushing (1) to dial indicator (2) securing with bushing screw (3).

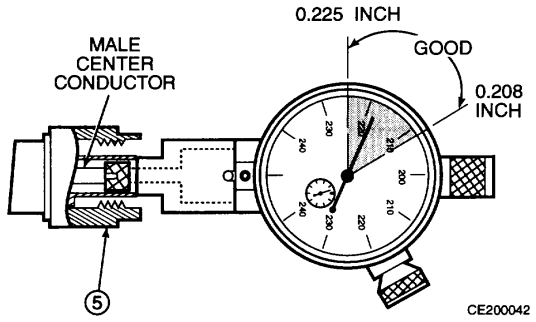


2. Zero dial indicator (2) using calibration block (4) (small scale will read zero and large scale will read 0.200).



3. Take reading of connector by inserting dial indicator into male type -N- connector (5).

   - If dial indicator reading of male center conductor depth is not between 0.208 and 0.225 inch (counterclockwise) of zero set in step 2, connector is defective.



Section V. MAINTENANCE PROCEDURES

5-16. INTRODUCTION TO MAINTENANCE PROCEDURES.

The following maintenance procedures are authorized at the general support maintenance level in accordance with the Maintenance Allocation Chart (Appendix B).

5-17. DUMMY LOAD CONNECTOR REPLACEMENT.

DESCRIPTION

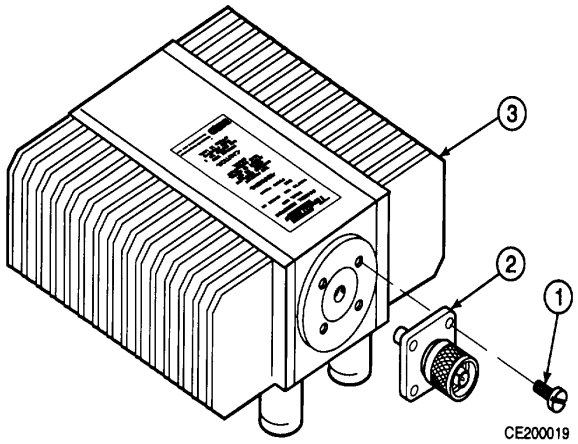
This procedure covers: Removal and installation of dummy load input connector.

REMOVE

1. Remove screws (1) securing defective male type -N- connector (2) to dummy load (3).
2. Remove connector from dummy load by pulling straight out.

INSTALL

1. Align pin on new male type -N-connector (2) with receptacle in dummy load (3), push connector into dummy load.
2. Secure connector to dummy load with screws (1).



END OF TASK

5-18. COUPLER CONNECTOR REPLACEMENT.

DESCRIPTION

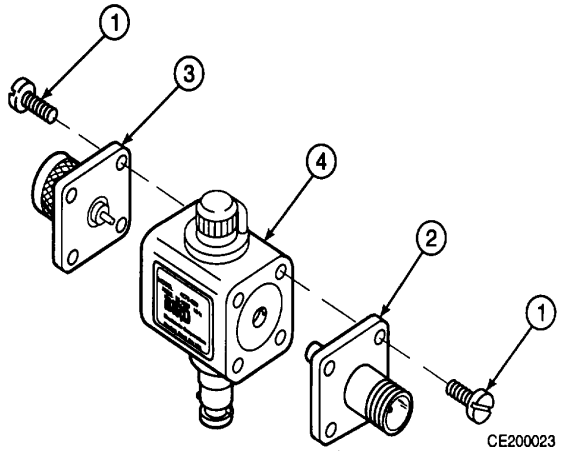
This procedure covers: Removal and installation of coupler input/output connectors.

REMOVE

1. Remove screws (1) securing defective connector (2) or (3) to coupler (4).
2. Remove defective connector from coupler by pulling straight out.

INSTALL

1. Align pin on new connector (2) or (3) with receptacle in coupler (4), push connector into coupler.
2. Secure connector to coupler with screws (1).



END OF TASK

5-19. WATTMETER ACCESS DOOR REMOVAL.

DESCRIPTION

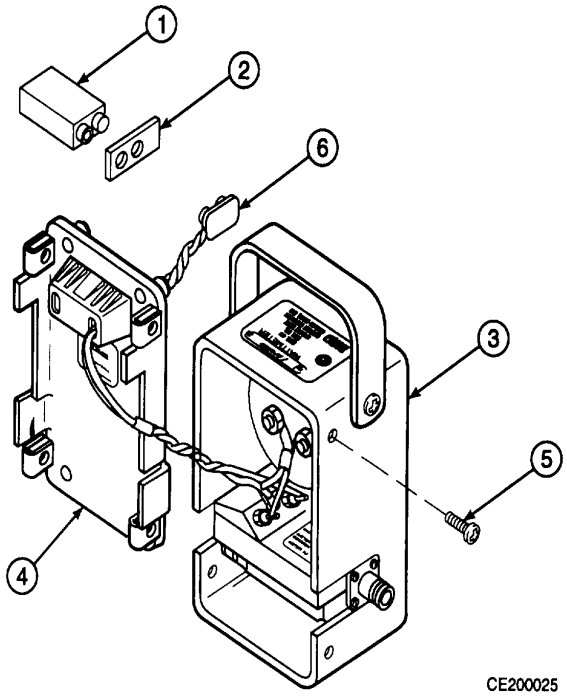
This procedure covers: Removal and installation of wattmeter access door.

REMOVE

1. Remove battery (1) and removal tab (2) from wattmeter (3).
2. Remove access door (4) from wattmeter by removing screws (5).
3. Slide battery clip (6) through installation and removal hole.

INSTALL

1. Slide battery clip (6) through installation and removal hole.
2. Place access door (4) on wattmeter.
3. Secure access door to wattmeter with screws (5).
4. Install removal tab (2) and battery (1) in wattmeter.



END OF TASK

5-20. WATTMETER CONNECTOR REPLACEMENT.

DESCRIPTION

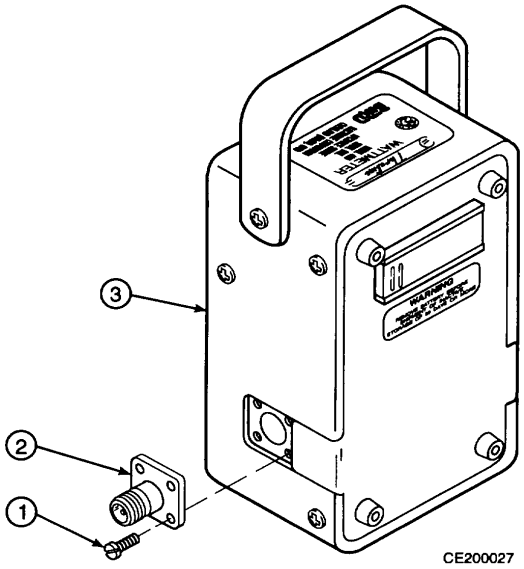
This procedure covers: Removal and installation of wattmeter input/output connectors.

REMOVE

1. Remove screws (1) securing defective female type -N- connector (2) to wattmeter (3).
2. Remove connector from wattmeter by pulling straight out.

INSTALL

1. Align pin on new female type -N- connector (2) with receptacle in wattmeter (3), push connector into wattmeter.
2. Secure connector to wattmeter with screws (1).



END OF TASK

5-21. WATTMETER STRAP REPLACEMENT.

DESCRIPTION

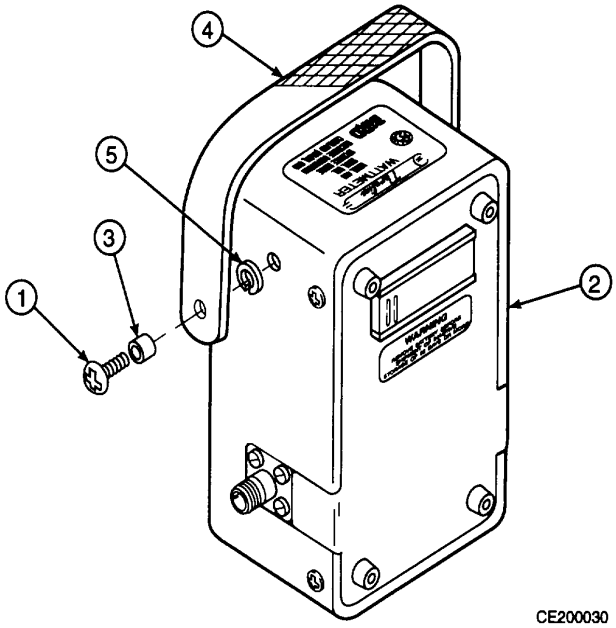
This procedure covers: Removal and installation of wattmeter strap.

REMOVE

1. Remove strap screw (1) from - wattmeter (2).
2. Remove spacer (3), strap (4), and lock washer (5) from wattmeter.
3. Repeat REMOVE procedure for other end of strap.

INSTALL

1. Install spacer (3) onto strap screw (1).
2. With textured side of strap (4) out, fasten strap to wattmeter (2) with lock washer (5) and strap screw.
3. Repeat INSTALL procedure for other end of strap.



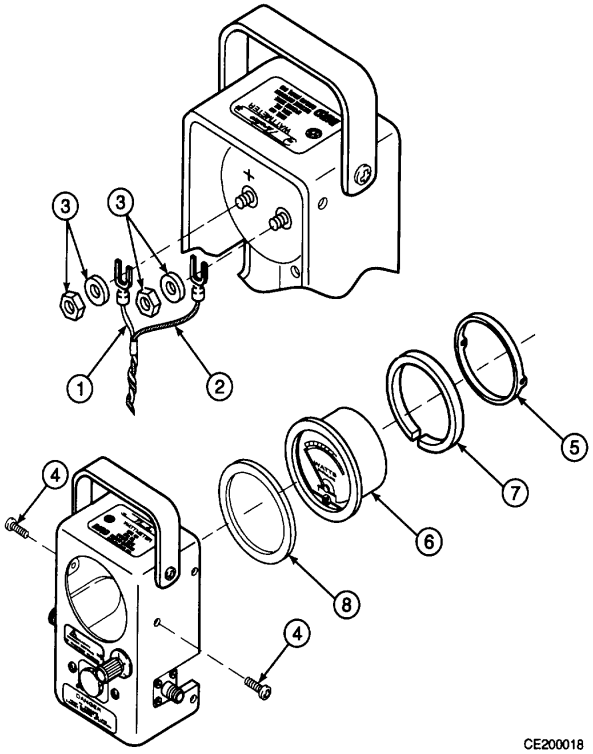
END OF TASK

5-22. WATTMETER METER AND GASKET REPLACEMENT.

DESCRIPTION

This procedure covers: Removal and installation of wattmeter meter and gasket.

REMOVE



1. Remove wattmeter access door (para. 5-19).
2. Detach orange lead (1) from positive meter terminal and black lead (2) from negative meter terminal by removing attaching hardware (3).
3. Remove screws (4) securing shock mount (5) and meter (6).
4. Remove assembled meter and shock mount from wattmeter housing.
5. Remove shock mount (5) and shock strip (7) off of defective meter (6).

INSTALL

1. Attach new gasket (8) to new meter.
2. Place shock strip (7) onto back of meter (6) and then place shock mount (5) onto shock strip.
3. Place meter and shock mount as an assembly into wattmeter housing.
4. Align meter face so zero adjustment screw is at the bottom of the meter.
5. Align shock mount holes with holes in wattmeter housing.
6. Place a drop of locktite (item 4, Appendix D) on screw (4), secure shock mount to housing with screw.
7. Secure orange lead (1) to positive meter terminal and black lead (2) to negative meter terminal with attaching hardware (3).
8. Install battery on battery clip.
9. Adjust wattmeter (para. 5-26).
10. Install access door (para. 5-19)

END OF TASK

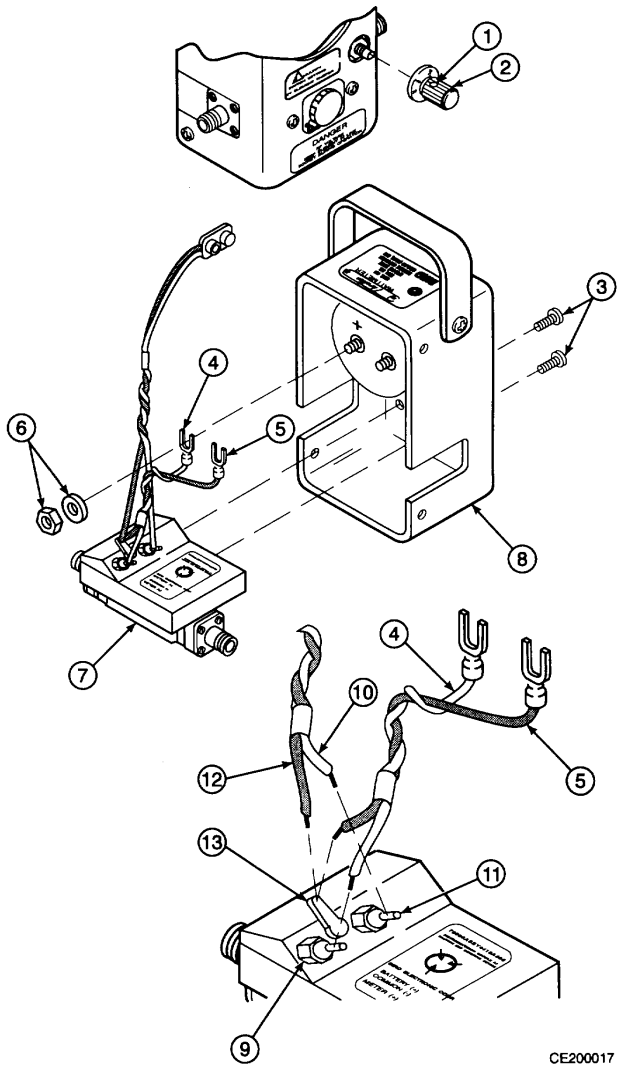
5-23. WATTMETER INSTRUMENTATION MODULE REPLACEMENT.

DESCRIPTION

This procedure covers: Removal and installation of instrumentation module.

REMOVE

1. Remove access door (para. 5-19).
2. Using an allen wrench, loosen allen screw (1) and remove factor switch knob (2).
3. Remove instrumentation module screws (3).
4. Detach orange lead (4) from positive meter terminal and black lead (5) from negative meter terminal by removing attaching hardware (6).
5. Remove instrumentation module (7) from wattmeter housing (8).
6. Unsolder orange lead (4) from capacitor (9) and red lead (10) from capacitor (11).
7. Unsolder black leads (5) and (12) from lug (13) located between capacitors.



5-23. WATTMETER INSTRUMENTATION MODULE REPLACEMENT- Continued.

INSTALL

1. Solder black leads (5) and (12) to lug (13) located between capacitors.
2. Solder orange lead (4) to capacitor (9) and red lead (10) to capacitor (11).
3. Insert new instrumentation module (7) into wattmeter housing.
4. Secure instrumentation module with screws (3).
5. Attach orange lead to positive meter terminal. Secure with attaching hardware (6).
6. Attach black lead to negative meter terminal. Secure with attaching hardware (6).
7. Align the factor switch knob (2) to the off position, press knob onto shaft and secure with alien screw (1).
8. Install battery on battery clip.
9. Adjust wattmeter (para. 5-26).
10. Install wattmeter access door (para. 5-19).

END OF TASK

5-24. PERFORMANCE TESTS.

DESCRIPTION

This procedure covers:

- Wattmeter Linearity Test
- Electrical Plug-in Unit Accuracy Test
- Coupler Range Test
- Dummy Load RF Impedance Verification

NOTE

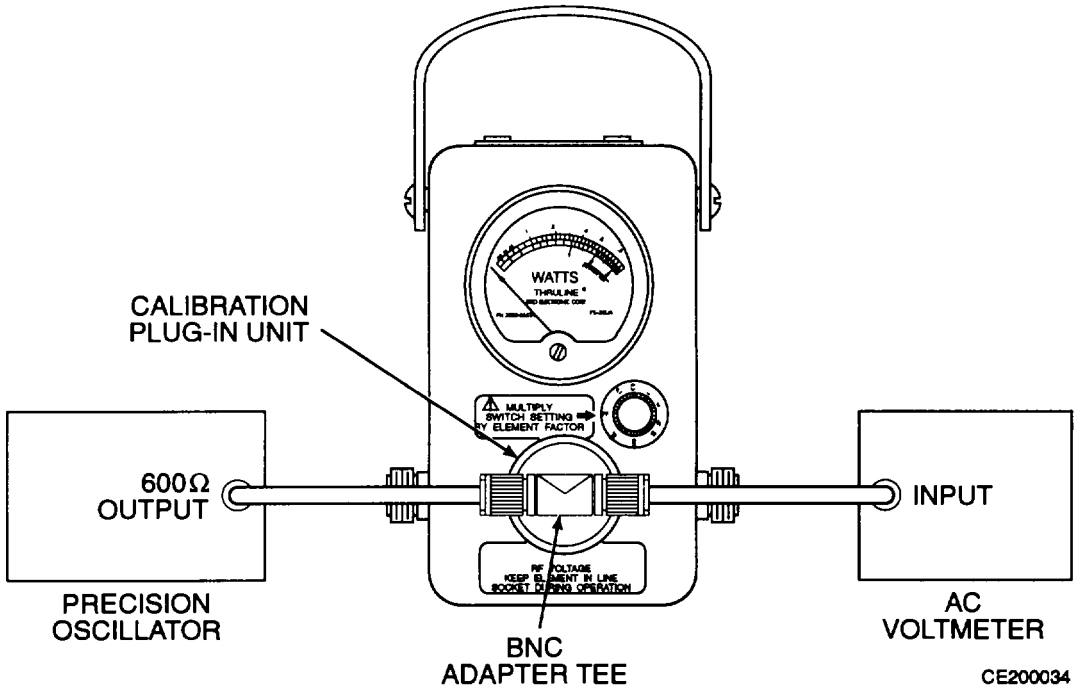
It is necessary to perform the wattmeter linearity test before performing the electrical plug-in unit accuracy test.

INITIALIZED SETUP.

1. Make sure work space has a uniform ambient temperature of between 68 ° and 77°F (20° to 25ΩC).
2. Make sure that test set has temperature stabilized to the environmental conditions in the test room.
3. Check wattmeter's zero (para. 2-4a).

WATTMETER LINEARITY TEST.

1. Connect equipment as shown.



5-24. PERFORMANCE TESTS - Continued.

WATTMETER LINEARITY TEST- Continued.

2. Turn ac voltmeter and precision oscillator on.

3. Set precision oscillator to provide a symmetrical sine wave with zero dc offset.

4. Adjust precision oscillator until ac voltmeter indicates 0.1591 ±0.00005 Volts RMS at 1000 ±100 Hz.

5. Turn wattmeter factor switch to the "1" multiple. Allow the equipment to warm up in this position for 5 minutes.

6. Test battery (para. 2-4b). If battery fails test, replace battery (para. 3-7).

7. Place wattmeter factor switch to the "1" multiple.

8. Adjust amplitude of the precision oscillator until the wattmeter's meter indicates exactly 1.0 on upper scale.

9. If RMS voltage indicated by the ac voltmeter is outside of 0.1575 to 0.1607 volts, perform wattmeter adjustment (para. 5-26).

10. Repeat step 8 using the "100" and "0.1" multiple settings of the factor switch. Compare RMS voltage indicated by the ac voltmeter with the following table. If voltages indicated by ac voltmeter are not within the tolerances listed below, repair wattmeter using troubleshooting table (table 5-1).

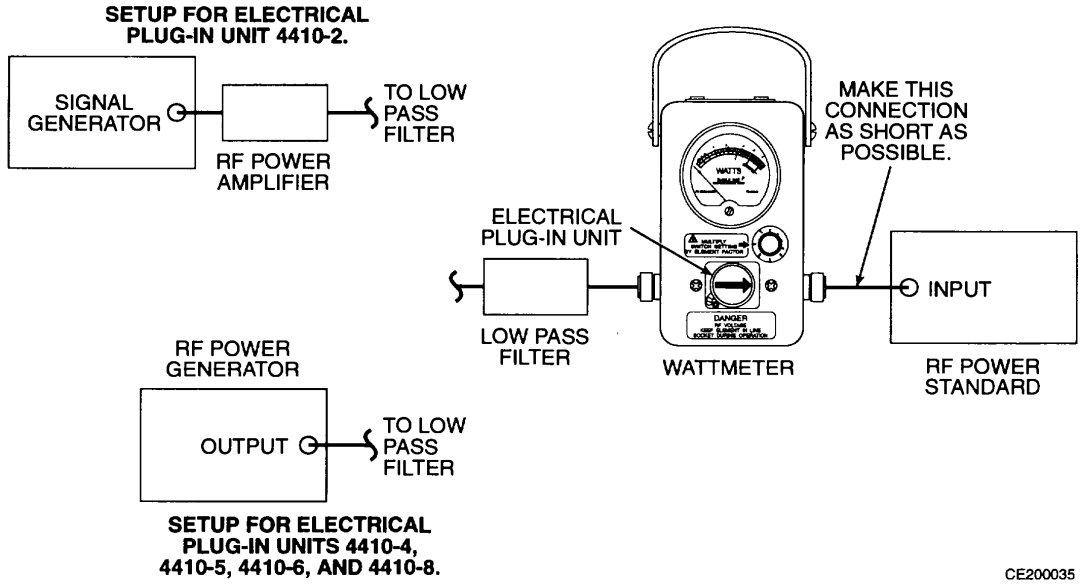
WATTMETER FACTOR SWITCH SETTING	WATTMETER READING (UPPER SCALE)	ALLOWABLE READINGS (Volts RMS)	
		Minimum	Maximum
100	1.0	1.575	1.607
0.1	1.0	0.0495	0.0511

11. Turn off all power.
12. Disconnect the test equipment.

5-24. PERFORMANCE TESTS - Continued.

ELECTRICAL PLUG-IN UNIT ACCURACY TEST.

1. Connect equipment as shown. Use the following table to select low pass filter and power source plug-in according to which electrical plug-in unit part is being tested.



ELECTRICAL PLUG-IN UNIT PART NUMBER	WATTMETER FACTOR SWITCH POSITION	POWER LEVEL	POWER SOURCE PLUG-IN	LOW PASS FILTER	TEST FREQUENCY	TOLERANCE
4410-2	1	80.0 W	100 kHz - 10 MHz	600 kHz	450 kHz	±5 W
			100 kHz - 10 MHz	1.8 MHz	1.0 MHz	
			100 kHz - 10 MHz	3.0 MHz	2.5 MHz	
4410-4	0.3	25.0 W	100 kHz - 10 MHz	3.0 MHz	2.0 MHz	±1.5 W
			100 kHz - 10 MHz	14 MHz	10 MHz	
			10 MHz - 50 MHz	45 MHz	30 MHz	
4410-5	1	8.00 W	10 MHz - 50 MHz	30 MHz	25 MHz	±0.5 W
			50 MHz - 200 MHz	75 MHz	60 MHz	
			50 MHz - 200 MHz	125 MHz	80 MHz	
4410-6	1	8.00 W	50 MHz - 200 MHz	75 MHz	50 MHz	±0.5 W
			50 MHz - 200 MHz	125 MHz	100 MHz	
			50 MHz - 200 MHz	316 MHz	200 MHz	
4410-8	1	8.00 W	200 MHz - 500 MHz	316 MHz	200 MHz	±0.5 W
			200 MHz - 500 MHz	450 MHz	400 MHz	
			500 MHz - 1000 MHz	1225 MHz	750 MHz	
			500 MHz - 1000 MHz	1225 MHz	1000 MHz	

5-24. PERFORMANCE TESTS - Continued.

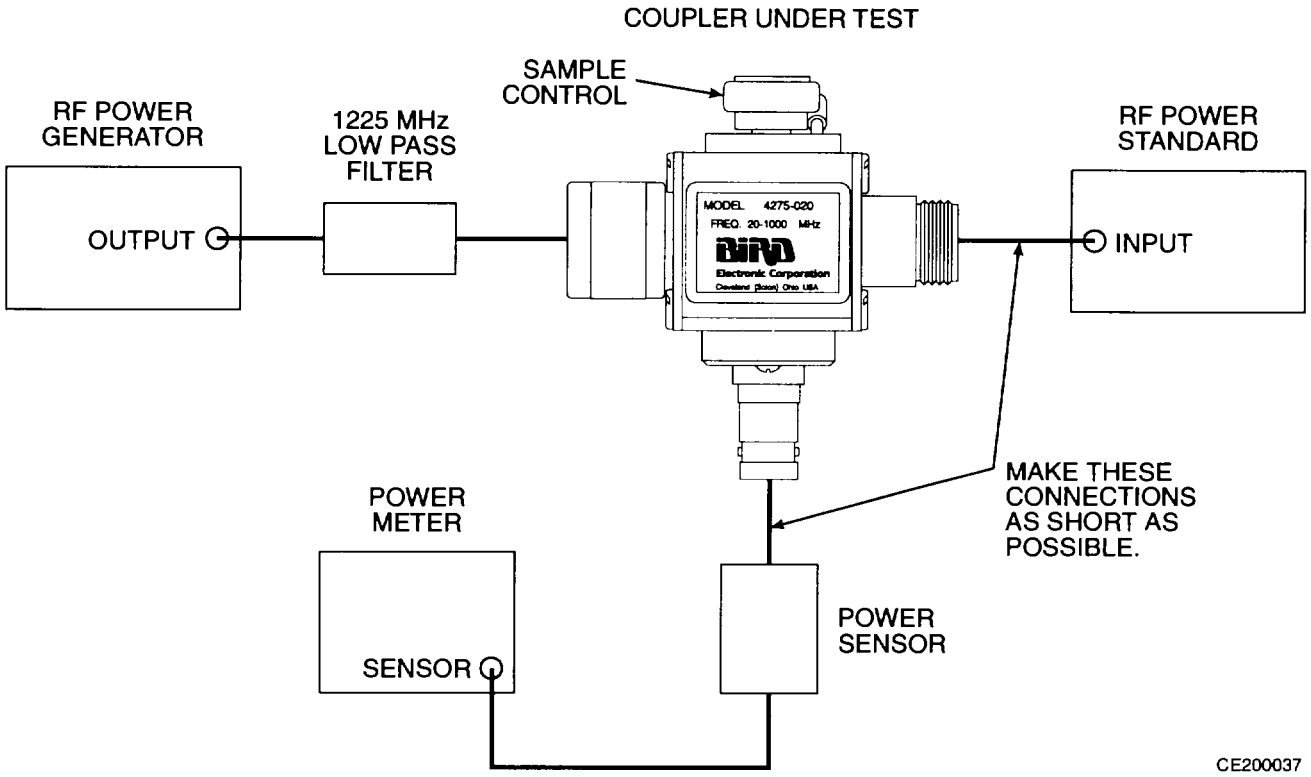
ELECTRICAL PLUG-IN UNIT ACCURACY TEST- Continues

2. Insert electrical plug-in unit into wattmeter as shown.
3. Turn wattmeter factor switch to position listed in table for particular electrical plug-in unit under test.
4. Tune RF power source to lowest test frequency listed in table.
5. Adjust the RF power source so that RF power standard displays the exact level shown in table.
6. Compare the power level displayed on wattmeter with power level displayed by RF power standard. If power level is not within tolerance, reject electrical plug-in unit.
7. Repeat 3 through 6 for middle test frequency and high test frequency for the electrical plug-in unit under test.
8. Repeat procedure for each electrical plug-in unit in the RF Test Set.
9. Turn off all power.
10. Disconnect the test equipment.

5-24. PERFORMANCE TESTS - Continued.

COUPLER RANGE TEST

1. Connect equipment as shown and allow at least one hour for equipment to warm-up.



2. Zero power meter and set calibration factor for 1000 MHz.
3. Connect power sensor mount to the BNC sample port on coupler.
4. Adjust RF power generator until RF power standard indicates exactly 25.0 watts at 1000 MHz.
5. Turn coupler's RF sample adjustment fully clockwise.
6. Read value displayed on power meter. If value is not be tween 4.0 and 15.8 mW, repair coupler using troubleshooting table (table 5-1).
7. Turn coupler's RF sample adjustment fully counterclockwise.
8. Read value displayed on power meter. If value is not between 125 and 499 µW, repair wattmeter using troubleshooting table (table 5-1).
9. Turn off all power.
10. Disconnect the test equipment.

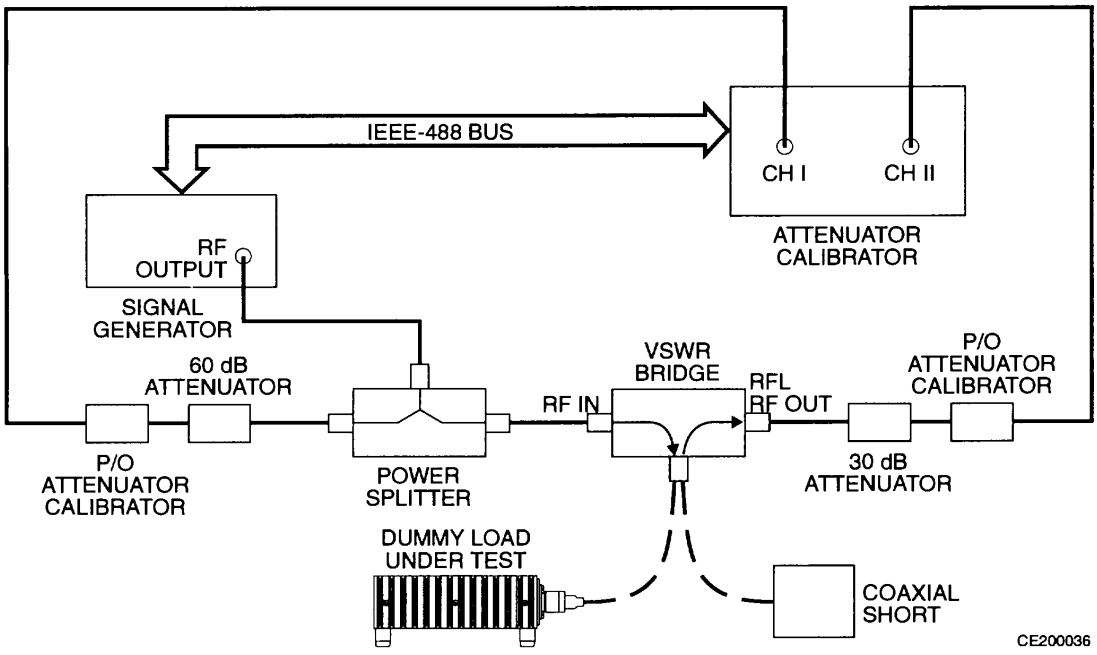
5-24. PERFORMANCE TESTS - Continued.

DUMMY LOAD RF IMPEDANCE VERIFICATION.

WARNING

The dummy load contains 0.9 ounces of Beryllium Oxide (B_eO) in a solid form. Beryllium Oxide dust is considered a hazardous waste. Dispose of the dummy load in accordance with the governing Federal regulations.

1. Connect equipment as shown.



2. Configure the attenuator calibrator to the following parameters:

   - mode: Automatic Local Program
   - band: A
   - start frequency: 100 MHz
   - stop frequency: 1000 MHz
   - lower limit attenuation: 30 dB
   - upper limit attenuation: 80 dB
   - percentage search: 5%
   - channel: II-I
   - resolution: 0.1 dB
   - averaging mode: 3
   - distribution: Linear
   - spacing: 10

3. Set signal generator output to +5 dBm.

4. Connect coaxial short to reflected RF output port on the VSWR bridge.

5-24. PERFORMANCE TESTS - Continued.

DUMMY LOAD RF IMPEDANCE VERIFICATION- Continued.

5. Perform a measurement sweep and record results for each frequency.

6. Remove coaxial short from VSWR bridge.

7. Perform a measurement sweep and record results (including sign) for each frequency.

8. Connect dummy load under test to the reflected RF output port on the VSWR bridge.

9. Perform a measurement sweep with the attenuator calibrator and record results.

10. Determine the return loss of the dummy load at each frequency by using the following formula. Use the results recorded in step 7 as REF (open/short reference) and the results recorded in step 9 as MEAS (dummy load measurement).

$$\textit{Return Loss of Dummy Load} = \textit{MEAS} - \frac{\textit{REF}}{2}$$

11. If return loss is less than 26.4 dB (1.10 VSWR), repair dummy load using troubleshooting table (table 5-1).

12. Turn off all power.

13. Disconnect the test equipment.

5-25. WATTMETER DC CONTACT INSPECTION AND ADJUSTMENT.

DESCRIPTION

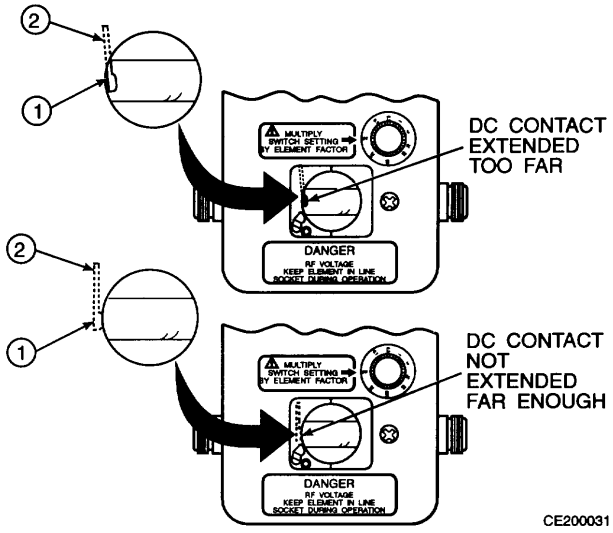
This procedure covers: Inspection and adjustment of the wattmeter dc contact.

INSPECT

WARNING

Do not touch RF line section or remove dust cap while wattmeter is connected to an RF power source. Severe injury or death may result if RF line section is touched or dust cap removed.

1. Make sure wattmeter is removed from all power.
2. Remove dust cap from wattmeter.
3. Visually inspect dc contact button (1) position relative to the surface of the wattmeter's receptacle.



- If any portion of contact strip (2) can be seen from a vertical view point, dc contact is extended too far.
- If none or only a small portion of the dc contact button (1) extends past the surface of the wattmeter's receptacle, dc contact is not extended enough.

ADJUST

1. Adjust dc contact button (1) to proper extension.
   - To increase extension of dc contact button, pry dc contact out slightly.
   - To decrease extension of dc contact button, press on mid point of contact strip (2) and push dc contact in slightly.
2. Inspect dc contact button to determine if correct adjustment was made.

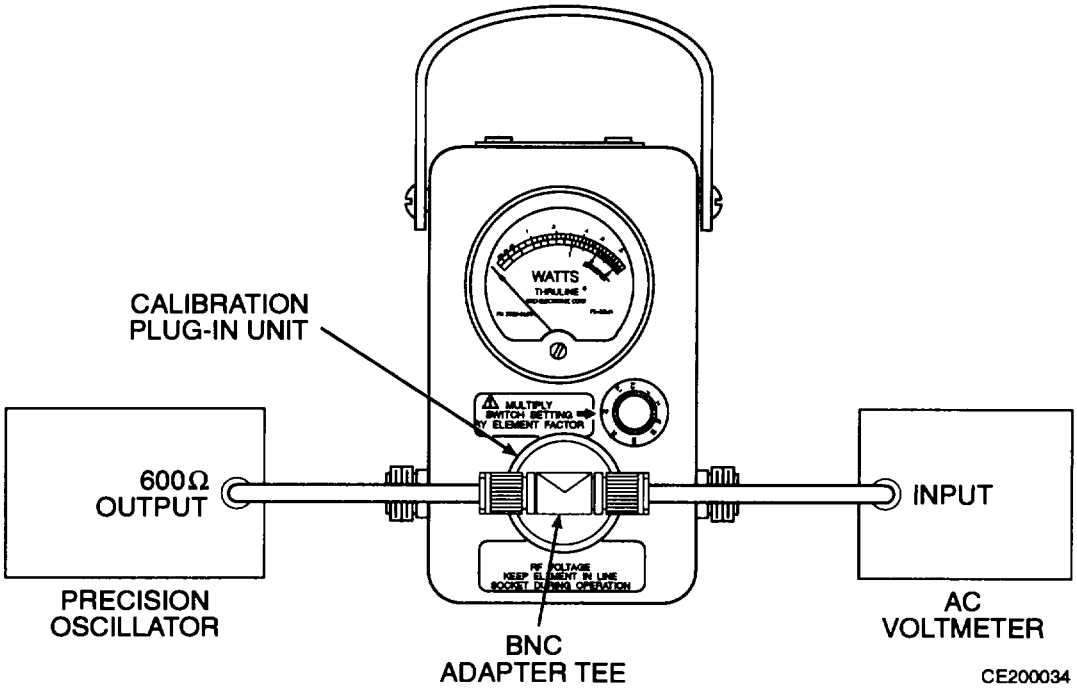
5-26. WATTMETER ADJUSTMENT.

DESCRIPTION

This procedure covers: Adjustment of the wattmeter.

SETUP

1. Make sure work space has a uniform ambient temperature of between 68° and 77°F (20° to 25°C).
2. Make sure that test set has temperature stabilized to the environmental conditions in the test room.
3. Check wattmeter's zero (para. 2-4a).
4. Connect equipment as shown.
5. Turn ac voltmeter and precision oscillator on.
6. Set precision oscillator to provide a symmetrical sine wave with zero dc offset.
7. Adjust precision oscillator until ac voltmeter indicates 0.1591 ±0.00005 Volts RMS at 1000 ±100 Hz.
8. Turn wattmeter factor switch to the "1" multiple. Allow the equipment to warm up in this position for 5 minutes.



5-26. WATTMETER ADJUSTMENT - Continued.

ADJUST

1. Test battery (para. 2-4b). If battery fails test, replace battery (para. 3-7).

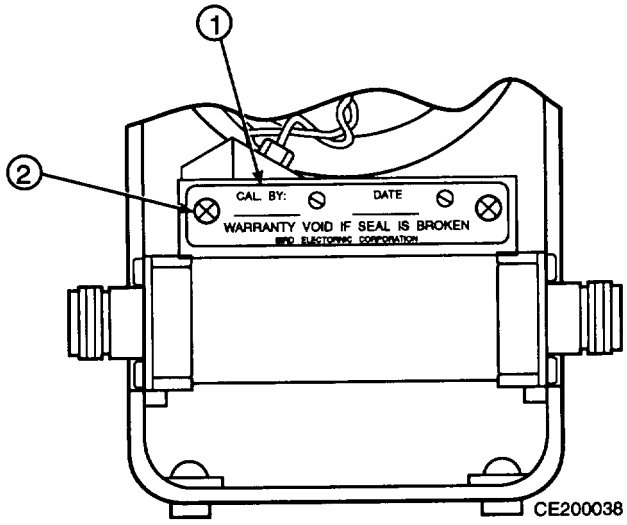
2. Adjust amplitude of the precision oscillator until the ac voltmeter indicates exactly t he same as the cal label on back panel of wattmeter.

3. Turn the wattmeter factor switch to the "1" multiple. The wattmeter's needle should come to rest on full scale (1.0) within ±1/2 division.

NOTE

This is not the calibration done in accordance with the technical bulletin listed in TB 43-180.

- If needle does not come to rest exactly on full scale, pierce adjustment label (1) and turn calibration adjustment (2) until needle rests on full scale value.



4. Turn off all power.

5. Disconnect the test equipment.

SECTION VI. PREPARATION FOR STORAGE OR SHIPMENT

5-27. PACKAGING.

Package the RF test set in the original shipping container. When using packing materials other than the original, use the following guidelines:

a. Remove battery (para. 3-7).

b. Use a double-wall cardboard shipping container.

c. Protect all sides with shock-absorbing material to prevent the RF test set fro m movement within the container.

d. Seal the shipping container with approved sealing tape.

e. Mark "FRAGILE" on all sides, top, and bottom of the shipping container.

5-28. TYPES OF STORAGE.

NOTE

If RF test set is to be stored for more than 30 days, remove battery from wattmeter and place in test set case.

a. Short Term Storage = 1 to 45 days.

b. Intermediate = 46 to 180 days.

c. Long Term = over 180 days. After long term storage, perform initial adjustments and checks (para. 2-4). If procedures fail, perform troubleshooting procedures (table 5-1).

5-29. ENVIRONMENT.

The RF test set should be stored in a clean, dry environment. In high humidity environments, protect the RF test set from temperature variations that could cause internal condensation. The following environmental conditions apply for both shipping and storage:

Temperature	-40° to +159°F (-40° to +71°C)
Relative Humidity (noncondensing)	95% RH (±5%)
Altitude	15,000 Feet maximum

APPENDIX A

REFERENCES

A-1. SCOPE.

This appendix lists all forms, field manuals, technical manuals, and miscellaneous publications referenced in this manual.

A-2. FORMS.

Product Quality Deficiency Report……Form SF 368
Recommended Changes to Publications and Blank Forms……DA Form 2028
Report of Discrepancy (ROD)……Form SF 364
Transportation Discrepancy Report (TDR)……Form SF 361

A-3. TECHNICAL MANUALS.

Procedures for Destruction of Electronics Materiel to Prevent Enemy Use (Electronics Command).TM 750-244-2
The Army Maintenance Management System (TAMMS)…….....DA Pam 750-8

A-4. MISCELLANEOUS.

Abbreviations for Use on Drawings, Specifications Standards and in Technical Documents……....MIL-STD-12
Interactive Electronic Technical Manual for Calibration and Repair Requirements
for the Maintenance of Army Materiel……EM 0022
Common Table of Allowances……CTA 50-970
Consolidated Index of Army Publications and Blank Forms……..DA Pam 25-30
First Aid ……FM 4-25.11
Safety Precautions for Maintenance of Electrical/Electronic Equipment.……TB 385-4

APPENDIX B
MAINTENANCE ALLOCATION CHART

Section I. INTRODUCTION

B-1. GENERAL.

a. This appendix provides a general explanation of all maintenance and repair functions authorized at various maintenance levels for the Radio Frequency Test Set AN/URM-213.

b. The Maintenance Allocation Chart (MAC) in Section II designates overall authority and responsibility for the performance of maintenance functions on the identified end item or component. The application of the maintenance functions to the end item or component will be consistent with the capacities and capabilities of the designated maintenance levels.

c. Section III lists the tools and test equipment (both special tools and common tool sets) required for each maintenance function as referenced in Section II.

d. Section IV contains supplemental instructions and explanatory notes for a particular maintenance function.

B-2. MAINTENANCE FUNCTIONS.

Maintenance functions will be limited to and defined as follows:

a. Inspect. To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination.

b. Test. To verify serviceability and to detect incipient failure by measuring the mechanical or electrical characteristics of an item and comparing those characteristics with prescribed standards.

c. Service. Operations required periodically to keep an item in proper operating condition, i.e., to clean (includes decontaminate, when required), preserve, drain, paint, or to replenish fuel, lubricants, chemical fluids, or gases.

d. Adjust. Maintain or regulate, within prescribed limits, by bringing into proper or exact position, or by setting the operating characteristics to specified parameters.

e. Align. To adjust specified variable elements of an item to bring about optimum or desired performance.

f. Calibrate. To determine the cause and corrections to be made or adjusted on instruments or test measuring and diagnostic equipment used in precision measurement. This consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

g. Remove/Install. To remove and install the same item when required to perform service on other maintenance functions. Install may be the act of emplacing, seating, or fixing into position an item, part, module (component or assembly) in a manner to allow the proper functioning of the equipment or system.

h. Replace. To remove an unserviceable item and install a serviceable counterpart in its place. Replace is authorized by the MAC and is shown as the third position code of the SMR code.

i. Repair. The application of maintenance services (inspect, test, service, adjust, align, calibrate, and/or replace), including fault location/troubleshooting, removal/installation, and disassembly/assembly procedures, and maintenance actions (welding, grinding, riveting, straightening, facing, remachining, or resurfacing) to identify troubles, and restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module (component or assembly), and item or system.

B-2. MAINTENANCE FUNCTIONS - Continued.

j. Overhaul. That periodic maintenance effort (service/action) prescribed to restore an item to a completely serviceable/operational condition as required by maintenance standards in appropriate technical publications (i.e., DMWR). Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like new condition.

k. Rebuild. Consists of those services/actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards. Rebuild is the highest degree of material maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (hours, miles, etc.) considered in classifying Army equipment/components.

B-3. EXPLANATION OF COLUMNS IN THE MAC, SECTION II.

a. Column 1, Group Number. Column 1 lists functional group code numbers, the purpose of which is to identify maintenance significant components, assemblies, subassemblies, and modules with the next higher assembly. End item group number shall be "00".

b. Column 2, Component/Assembly. Column 2 contains the noun names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

c. Column 3, Maintenance Functions. Column 3 lists the functions to be performed on the items listed in column 2.

d. Column 4, Maintenance Level. Column 4 specifies, by the listing of a work time figure in the appropriate subcolumn(s), the level of maintenance authorized to perform the function listed in column 3. This figure represents the active time required to perform that maintenance function at the indicated level of maintenance. If the number or complexity of the tasks within the listed maintenance function vary at different levels, appropriate work time figures will be shown for each level. The work time figure represents the average time required to restore an item (assembly, subassembly, component, module, end item, or system) to a serviceable condition under typical field operating conditions. This time includes preparation time (including any necessary disassembly/assembly time), troubleshooting/fault location time, and quality assurance/quality control time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the maintenance allocation chart. The symbol designations for the various maintenance levels are as follows:

C -- Operator/crew maintenance
O -- Unit maintenance
F -- Direct support maintenance
H -- General support maintenance
L -- Specialized Repair Activity
D -- Depot maintenance

e. Column 5, Tools and Equipment. Column 5 specifies by code, those common tool sets (not individual tools) and special tools, TMDE, and support equipment required to perform the designated function.

f. Column 6, Remarks. This column shall, when applicable, contain a letter code, in alphabetic order, which shall be keyed to the remarks contained in Section IV.

B-4. EXPLANATION OF COLUMNS IN THE TEST EQUIPMENT REQUIREMENTS, SECTION III.

a. Column 1, Reference Code. The tool and test equipment code correlates with a code used in the MAC, Section II, Column 5.

b. Column 2, Maintenance Level. The lowest level of maintenance authorized to use the tool or test equipment.

c. Column 3, Nomenclature. Name or identification of the tool or test equipment.

d. Column 4, National Stock Number. The National Stock Number of the tool or test equipment.

e. Column 5, Tool Number. The manufacturer's part number.

B-5. EXPLANATION OF COLUMNS IN REMARKS, SECTION IV.

a. Column 1, Reference Code. The code recorded in column 6, Section II.

b. Column 2, Remarks. This column lists information pertinent to the maintenance function being performed as indicated in the MAC, Section II.

Section II. MAINTENANCE ALLOCATION CHART FOR RADIO FREQUENCY TEST SET AN/URM-213

(1)	(2)	(3)	(4) MAINTENANCE LEVEL					(5)	(6)
			Unit		Direct Support	General Support	Depot		
GROUP NUMBER	COMPONENT/ ASSEMBLY	MAINTENANCE FUNCTION	C	O	F	H	D	TOOLS AND EQUIPMENT Ref Code	REMARKS Code
00	RADIO FREQUENCY	INSPECT		0.4					A
	POWER TEST SET	SERVICE		0.1				1	B
	AN/URM-213	TEST				1.5		2 thru 30	J
		REPAIR		0.6				1	C
		CALIBRATE				1.3		2 thru 20	D
01	DUMMY LOAD	INSPECT		0.1					E
		REPLACE		0.1				1	
		REPAIR				0.2		2	F
02	COUPLER	INSPECT		0.1					E
		REPLACE		0.1				1	
		REPAIR				0.2		2	G
03	WATTMETER	INSPECT		0.1					H
		REPLACE		0.1				1	
		REPAIR				0.4		2 thru 7, 31 & 32	I

SECTION III. TOOL AND TEST EQUIPMENT REQUIREMENTS FOR RAIDO FREQUENCY POWER TEST SET AN/URM-213

(1) TOOL/ TEST EQUIPMENT REF CODE	(2) MAINT LEVEL	(3) NOMENCLATURE	(4) NATIONAL STOCK NUMBER	(5) TOOL NUMBER
1	O	Tool Kit, Electronic Equipment	5180-00-064-5178	TK-101/G
2	H	Tool Kit, Electronic Equipment	4931-01-073-3845	JTK-17AL
3	H	Precision Oscillator	6695-01-080-6547	
4	H	AC Voltmeter	6625-01-332-6985	8506A/CT
5	H	DC Voltmeter	6625-01-221-9367	8840A/AF-05
6	H	Calibration Plug-in Unit	6625-01-218-7794	4410-097
7	H	BNC Adapter Tee	5935-00-666-4876	UG274 A/U
8	H	Generator, RF Power	4931-01-181-8368	
9	H	600 kHz Low Pass Filter		9220-1A
10	H	1.8 kHz Low Pass Filter		9220-1B
11	H	3 MHz Low Pass Filter		9220-1C
12	H	14 MHz Low Pass Filter	5915-01-012-9002	
13	H	30 MHz Low Pass Filter	5915-00-408-5467	
14	H	45 MHz Low Pass Filter	5915-01-015-8317	
15	H	75 MHz Low Pass Filter	5915-00-478-5496	
16	H	125 MHz Low Pass Filter	5915-00-481-1902	
17	H	316 MHz Low Pass Filter	5915-00-410-1719	
18	H	450 MHz Low Pass Filter	5915-01-010-1141	
19	H	1225 MHz Low Pass Filter	5915-00-462-2878	
20	H	RF Power Standard		13335537*
21	H	Attenuator Calibrator	4931-01-041-1564	VM4-A
22	H	Attenuator, Coaxial 30 dB	6695-01-109-9115	
23	H	Attenuator, Coaxial 60 dB	6695-01-109-9038	
24	H	VSWR Bridge, 10 MHz-2 GHz	6695-01-138-6977	60NF50
25	H	Generator, Signal	6625-01-233-8615	SG-1207/U
26	H	Power Splitter, Broadband	6695-01-108-9833	1870A
27	H	Short, Coaxial	5935-00-937-6255	11511A
28	H	Power Meter	6625-01-316-6448	HP437B
29	H	Power Sensor	6625-01-015-4412	HP8482A
30	H	RF Power Amplifier		9220
31	H	Type -N- Connector Gauge	6695-00-152-1844	
32	H	Decade Resistor	6625-00-585-4915	WINSLOW #336

*SCD - Specification Control Drawing

Section IV. REMARKS FOR RADIO FREQUENCY TEST SET AN/URM-213

(1) REMARKS CODE	(2) REMARKS
A	Check for missing components of test set and for visible external damaged or broken connectors, and damage to case assembly.
B	Service is limited to cleaning of external surfaces including element bore and RF connectors.
C	Repair is limited to replacing the electrical plug-in units, case assembly, connector adapters, VSWR chart, battery and fabrication of radio cable assembly.
D	Calibration is performed in accordance with TB 43-180.
E	Inspect for damage to QC (Quick Change) type RF connector(s).
F	Repair is limited to replacement of input RF connector.
G	Repair is limited to replacement of input and output RF connectors.
H	Inspect externally for signs of damaged or broken connectors, loose parts, broken strap, missing items, etc.
I	Repair is limited to replacement input and output RF connectors, strap, battery, instrumentation module, and meter/gasket.
J	Performance Test

APPENDIX C
COMPONENTS OF END ITEM AND BASIC ISSUE ITEMS LISTS

Section I. INTRODUCTION

C-1. SCOPE.

This appendix lists the components of end item and basic issue items for the RF test set to help you inventory items required for safe and efficient operation.

C-2. GENERAL.

The Components of End Item and Basic Issue Items Lists are divided into the following sections:

a. Section II. Components of End Item. This listing is for informational purposes only, and is not authority to requisition replacements. These items are part of the end item, but are removed and separately packaged for transportation or shipment. As part of the end item, these items must be with the end item whenever it is issued or transferred between property accounts. Illustrations are furnished to assist you in identifying the items.

b. Section III. Basic Issue Items (BII). There are no basic issue items required.

C-3. EXPLANATION OF COLUMNS.

The following provides an explanation of columns found in the tabular listings.

a. Column (1) Illustration Number. This column indicates the number of the illustration in which the item is shown.

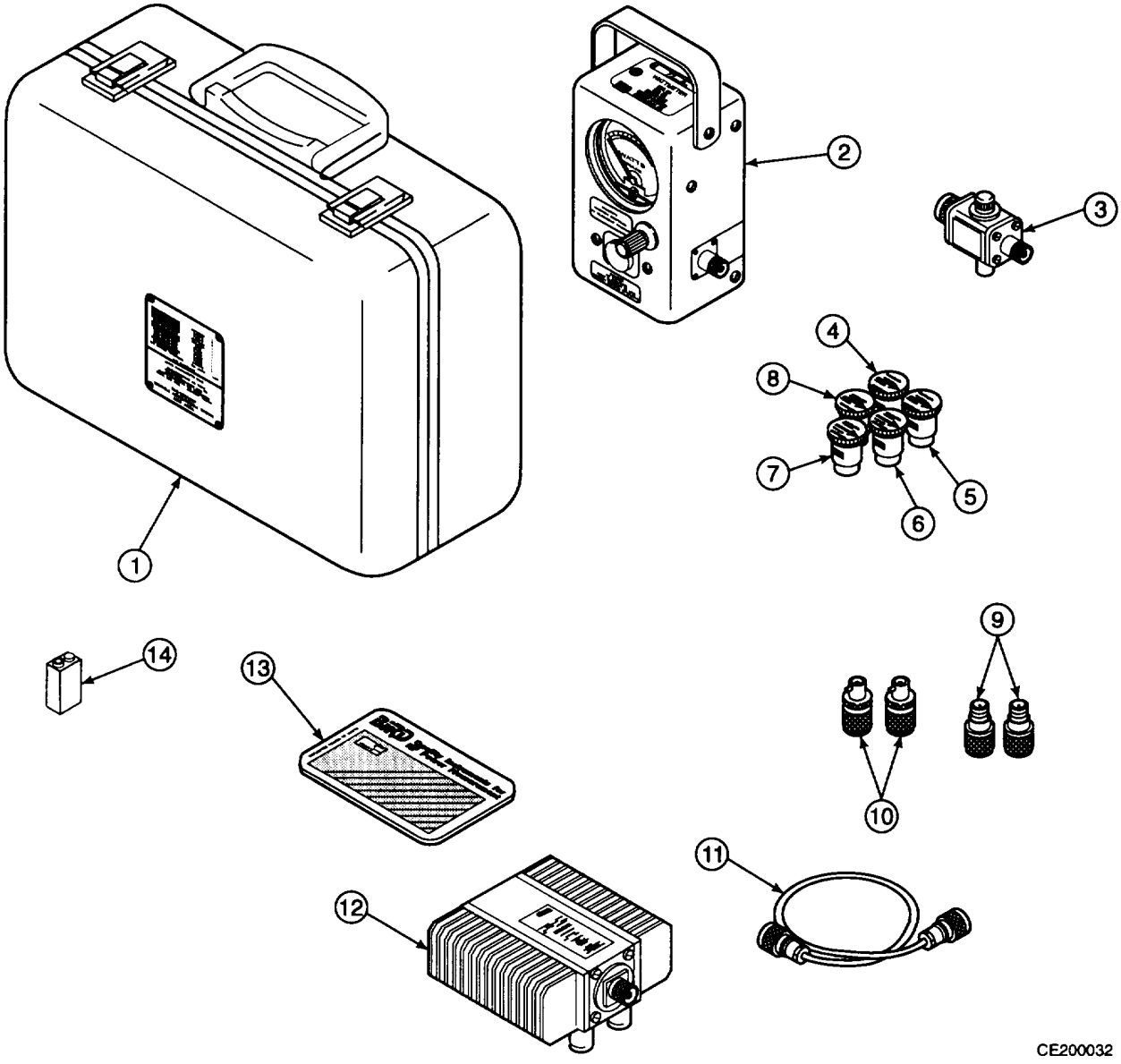
b. Column (2) National Stock Number. Indicates the national stock number assigned to the item and will be used for requisitioning purposes.

c. Column (3) Description. Indicates the Federal item name and, if required, a minimum description to identify and locate the item. The last line for each item indicates the CAGEC (in parentheses) followed by the part number.

d. Column (4) Unit of Issue (U/I). Indicates how the item is issued for the National Stock Number shown in column (2).

e. Column (5) Quantity Required (Qty Reqd). Indicates the quantity of the item authorized to be used on/with the equipment.

Section II. COMPONENTS OF END ITEM.



Section II. COMPONENTS OF END ITEM - Continued.

(1) ILLUSTRATION NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION, CAGEC and Part Number		(4) UNIT OF ISSUE	(5) QTY REQD
1		TEST SET CASE (70998) 4410A405	JXN	EA	1
2		WATTMETER (70998) 4410A	JXN	EA	1
3	5985-01-091-8952	COUPLER (70998) 4275-020	JXN	EA	1
4	6625-01-260-7421	ELECTRICAL PLUG-IN UNIT, 450 kHz - 2.5 MHz (70998) 4410-2	JXN	EA	1
5	6625-01-218-7450	ELECTRICAL PLUG-IN UNIT, 2-30 MHz (70998) 4410-4	JXN	EA	1
6	6625-01-218-7851	ELECTRICAL PLUG-IN UNIT, 25-80 MHz (70998) 4410-5	JXN	EA	1
7	6625-01-218-7852	ELECTRICAL PLUG-IN UNIT, 50-200 MHz (70998) 4410-6	JXN	EA	1
8	6625-01-284-6828	ELECTRICAL PLUG-IN UNIT, 200-1000 MHz (70998) 4410-8	JXN	EA	1
9		ADAPTOR CONNECTOR (91836) UG-146A/U	JXN	EA	2
10		ADAPTOR CONNECTOR (74868) UG-201A/U	JXN	EA	2
11		RADIO CABLE ASSEMBLY (70998) 4410A407	JXN	EA	1
12		DUMMY LOAD (70998) 8065	JXN	EA	1
13		VSWR CHART (70998) 4400-012	JXN	EA	1
14		BATTERY (90303) MN1604	JXN	EA	1

APPENDIX D
EXPENDABLE SUPPLIES AND MATERIALS LIST

Section I. INTRODUCTION

D-1. SCOPE.

This appendix lists expendable items that you will need for RF test set operation, unit, direct support and general support maintenance. This listing is for information only and is not authority to requisition the listed items. These items are authorized to you by CTA 50-970, Expendable/Durable Items (except medical, class V, repair parts, and heraldic items).

D-2. EXPLANATION OF COLUMNS.

a. Column (1) Item Number. This number is assigned to the entry in the listing and is referenced in the narrative instructions to identify the item (for example, "Use cleaning compound, item 5, Appendix D").

b. Column (2) Level. This column identifies the lowest level of mainte nance that requires the listed item.

c. Column (3) National Stock Number. This column indicates the national stock number assigned to the item and will be used for requisitioning purposes.

d. Column (4) Description. This column indicates the federal item name and, if required, a minimum description to identify the item. The last line for each item indicates the CAGEC (in parentheses) followed by the part number.

e. Column (5) Unit of Measure (U/M). This column indicates the measure used in perform ing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation (for example, EA, IN, PR). If the unit of measure differs from the unit of issue, requisition the lowest unit of issue that will satisfy your requirements.

Section II. EXPENDABLE AND DURABLE ITEMS LIST

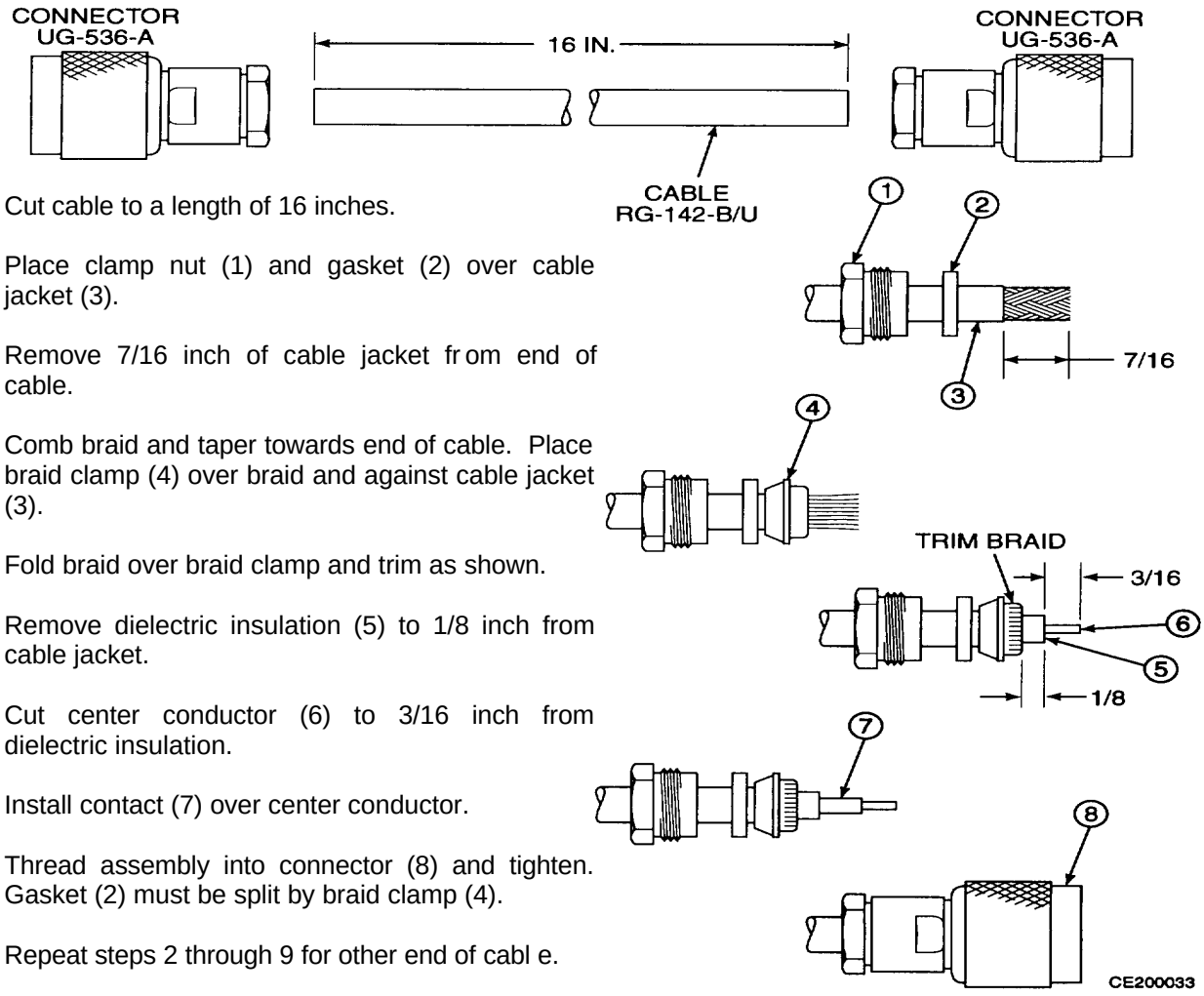
(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION, MIL-SPEC, (CAGEC)	(5) U/M
1	C	6810-00-983-8551	Alcohol, Isopropyl, TT-I-735 (Commercial)	OZ
2	C	8305-00-267-3015	Cloth, Cheesecloth, Cotton Lintless, CCC-C-440, Type II, Class 2 (81349)	YD
3	C	7930-00-068-1669	Detergent, General Purpose	OZ
4	H		Locktite,#222	OZ
5	C		Swabs, Cotton	PK

APPENDIX E
ILLUSTRATED LIST OF MANUFACTURED ITEMS
Section I. INTRODUCTION

E-1. ORGANIZATION AND SCOPE.

This appendix includes complete instructions for making items to be manufactured or fabricated at unit and general support maintenance level for the Radio Frequency Power Test Set AN/URM-213.

All bulk materials needed for manufacture of an item are listed by part number.



1. Cut cable to a length of 16 inches.
2. Place clamp nut (1) and gasket (2) over cable jacket (3).
3. Remove 7/16 inch of cable jacket from end of cable.
4. Comb braid and taper towards end of cable. Place braid clamp (4) over braid and against cable jacket (3).
5. Fold braid over braid clamp and trim as shown.
6. Remove dielectric insulation (5) to 1/8 inch from cable jacket.
7. Cut center conductor (6) to 3/16 inch from dielectric insulation.
8. Install contact (7) over center conductor.
9. Thread assembly into connector (8) and tighten. Gasket (2) must be split by braid clamp (4).
10. Repeat steps 2 through 9 for other end of cable.

APPENDIX F

OPERATOR'S, UNIT, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE REPAIR PARTS AND SPECIAL TOOLS LIST

SECTION I. INTRODUCTION

F-1. SCOPE.

This Repair Parts and Special Tools List (RPSTL) lists and authorizes spares and repair parts; special tools; special Test, Measurement, and Diagnostic Equipment (TMDE); and other special support equipment required for performance of operator's, unit, direct support, and general support maintenance of the Radio Frequency Power Test Set AN/URM-213. It authorizes the requisitioning, issue, and disposition of spares, repair parts and special tools as indicated by the Source, Maintenance and Recoverability (SMR) codes.

F-2. GENERAL.

This Repair Parts and Special Tools List is divided into the following sections:

a. Section II. Repair Parts List. A list of spares and repair parts authorized by this RPSTL for use in the performance of maintenance. The list also includes parts which must be removed for replacement of the authorized parts. Parts lists are composed of functional groups in ascending item number sequence, with the parts in each group listed in ascending item number sequence. Figure numbers are listed directly beneath the group header. Items listed are shown on the associated illustration.

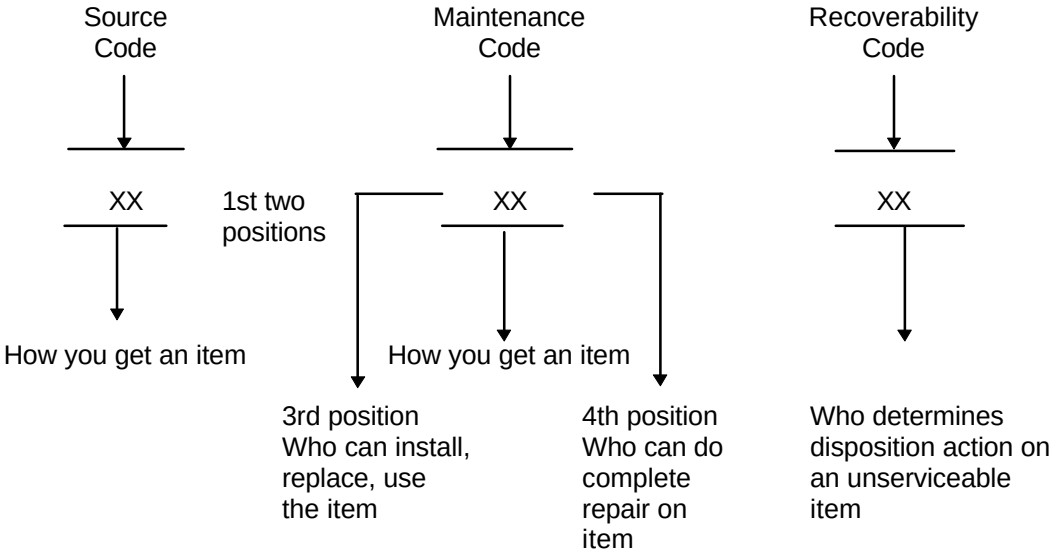
b. Section III. Special Tools List. Not applicable.

c. Section IV. Cross-reference Index. A list, in National Item Identification Number (NIIN) sequence, of all National stock numbered items appearing in the listing, followed by a list in alphanumeric sequence of all part numbers appearing in the listings. National stock numbers and part numbers are cross-referenced to each illustration figure and item number appearance. The figure number and item number index lists figure and item numbers in numeric sequence and cross-references National stock number, Commercial and Government Entity Code, and part numbers.

F-3. EXPLANATION OF COLUMNS (SECTIONS II AND III).

a. Item No. (Column (1)). Indicates the number used to identify items called out in the illustration.

b. SMR Code (Column (2)). The Source, Maintenance, and Recoverability (SMR) code is a 5-position code containing supply/requisitioning information, maintenance category authorization criteria, and disposition instruction, as shown in the following breakout:



NOTE

Complete Repair: Maintenance capacity, capability, and authority to perform all corrective maintenance tasks of the "Repair" function in a use/user environment in order to restore serviceability to a failed item.

(1) Source Code. The source code tells you how to get an item needed for maintenance, repair, or overhaul of an end item/equipment. Explanations of source codes follows:

Code	Explanation
PA PB PC** PD PE PF PG	Stocked items; use the applicable NSN to request/requisition items with these source codes. They are authorized to the category indicated by the code entered in the 3rd position of the SMR code. **NOTE** **Items coded PC are subject to deterioration.**
KD KF KB	Items with these codes are not to be requested/requisitioned individually. They are part of a kit which is authorized to the maintenance category indicated in the 3rd position of the SMR code. The complete kit must be requisitioned and applied.
MO (Made at org/AVUM Level) MF (Made at DS/AVUM Level) MH (Made at GS Level) ML (Made at Specialized Repair Act (SRA)) MD (Made at Depot)	Items with these codes are not to be requested/requisitioned individually. They must be made from bulk material which is identified by the part number in the DESCRIPTION AND USABLE ON CODE (UOC) column and listed in the Bulk Material group of the repair parts list in this RPSTL. If the item is authorized to you by the 3rd position code of the SMR code, but the source code indicates it is made at a higher level, order the item from the higher level of maintenance.
AO (Assembled by org/AVUM Level) AF (Assembled by DS/AVIM Level) AH (Assembled by GS Category) AL (Assembled by SRA) AD (Assembled by Depot)	Items with these codes are not to be requested/requisitioned individually. The parts that make up the assembled item must be requisitioned or fabricated and assembled at the level of maintenance indicated by the source code. If the 3rd position code of the SMR code authorizes you to replace the item, but the source code indicates the item is assembled at a higher level, order the item from the higher level of maintenance.
XA	Do not requisition an "XA" coded item. Order its next higher assembly.
XB	If an "XB" item is not available from salvage, order it using the FSCM and part number given.

Code	Explanation
XC	Installation drawing, diagram, instruction sheet, field service drawing, that is identified by manufacturer's part number.
XD	Item is not stocked. Order an "XD" coded item through normal supply channels using the FSCM and part number given, if no NSN is available.

NOTE

Cannibalization or controlled exchange, when authorized, may be used as a source of supply for items with the above source codes, except for those source coded "XA" or those aircraft support items restricted by requirements of AR 700-42.

(2) Maintenance Code. Maintenance codes tells you the level(s) of maintenance authorized to USE and REPAIR support items. The maintenance codes are entered in the third and fourth positions of the SMR Code as follows:

(a) The maintenance code entered in the third position tells you the lowest maintenance level authorized to remove, replace, and use an item. The maintenance code entered in the third position will indicate authorization to one of the following levels of maintenance.

Code	Application/Explanation
C	Crew or operator maintenance done within organizational or aviation unit maintenance.
O	Organizational or aviation unit category can remove, replace, and use the item.
F	Direct support or aviation intermediate level can remove, replace, and use the item.
H	General support level can remove, replace, and use the item.
L	Specialized repair activity can remove, replace, and use the item.
D	Depot level can remove, replace, and use the item.

(b) The maintenance code entered in the fourth position tells whether or not the item is to be repaired and identifies the lowest maintenance level with the capability to do complete repair (i.e., perform all authorized repair functions.)

NOTE

Some limited repair may be done on the item at a lower level of maintenance, if authorized by the Maintenance Allocation Chart (MAC) and SMR codes. This position will contain one of the following maintenance codes.

Code	Application/Explanation
O	Organizational or aviation unit is the lowest level that can do complete repair of the item.

Code	Application/Explanation
F	Direct support or aviation intermediate is the lowest level that can do complete repair of the item.
H	General support is the lowest level that can do complete repair of the item.
L	Specialized repair activity (designate the specialized repair activity) is the lowest level that can do complete repair of the item.
D	Depot is the lowest level that can do complete repair of the item.
Z	Nonrepairable. No repair is authorized.
B	No repair is authorized. (No parts or special tools are authorized for the maintenance of a "B" coded item). However, the item may be reconditioned by adjusting, lubricating, etc., at the user level.

(3) Recoverability Code. Recoverability codes are assigned to items to indicate the disposition action on unserviceable items. The recoverability code is entered in the fifth position of the SMR Code as follows:

Code	Application/Explanation
Z	Nonrepairable item. When unserviceable, condemn and dispose of the item at the level of maintenance shown in 3rd position of SMR Code.
O	Repairable item. When uneconomically repairable, condemn and dispose of the item at organizational or aviation unit level.
F	Repairable item. When uneconomically repairable, condemn and dispose of the item at the direct support or aviation intermediate level.
H	Repairable item. When uneconomically repairable, condemn and dispose of the item at the general support level.
D	Repairable item. When beyond lower level repair capability, return to depot. Condemnation and disposal of item not authorized below depot level.
L	Repairable item. Condemnation and disposal not authorized below specialized repair activity (SRA).
A	Item requires special handling or condemnation procedures because of specific reasons (e.g., precious metal content, high dollar value, critical material, or hazardous material). Refer to appropriate manuals/directives for specific instructions.

c. CAGEC (Column (3)). The Federal Supply Code for Manufacturer (FSCM) is a 5-digit numeric code which is used to identify the manufacturer, distributor, or Government agency, etc., that supplies the item.

d. Part Number (Column (4)). Indicates the primary number used by the manufacturer (individual, company, firm, corporation, or Government activity), which controls the design and characteristics of the item by means of its engineering drawings, specifications standards, and inspection requirements to identify an item or range of items.

NOTE

When you use a NSN to requisition an item, the item you receive may have a different part number from the part ordered.

e. Description and Usable On Code (UOC) (Column (5)). This column includes the following information:

(1) The Federal item name and, when required, a minimum description to identify the item.

(2) The physical security classification of the item.

(3) The statement "END OF FIGURE" appears just below the last item description in Column 5 for a given figure in both Section II and Section III.

f. QTY (Column (6)). 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 the quantity is variable and the quantity may vary from application to application.

F-4. EXPLANATION OF COLUMNS (SECTION IV).

a. National Stock Number (NSN) Index.

(1) STOCK NUMBER Column. This column lists the NSN by National Item Identification Number (NIIN) sequence. The NIIN consists of the last nine digits of the NSN. When using this column to locate an item, ignore the first 4 digits of the NSN. When requisitioning items use the complete NSN (13 digits) sequence.

(2) FIG. Column. This column lists the number of the figure where the item is identified/located. The figures are in numerical order in Section II and Section III.

(3) ITEM column. The item number identifies the item associated with the figure listed in the adjacent FIG. column. This item is also identified by the NSN listed on the same line.

b. Part Number Index. Part numbers in this index are listed by part number in ascending alphanumeric sequence.

(1) CAGEC Column. This column list the Commercial and Government Entity Code (CAGEC).

(2) Part Number Column. This column indicates the part number assigned to the item.

(3) Stock Number Column. This column lists the National stock number for the associated part number and manufacturer identified in the part number and CAGEC columns to the left.

(4) FIG. Column. This column lists the number of the figure where the item is identified/located in Section II and III.

(5) ITEM Column. The item number is that number assigned to the item as it appears in the figure referenced in the adjacent figure number column.

c. Figure and Item Number Index.

(1) FIG. Column. This column list the number of the figure where the item is identified/located in Section II and III.

(2) ITEM Column. The item number is that number assigned to the item as it appears in the figure referenced in the adjacent figure number column.

(3) STOCK NUMBER Column. This column lists the National stock number for the item.

(4) CAGEC Column. The Commercial and Government Entity Code (CAGEC) is a 5-digit numeric code used to identify the manufacturer, distributor, or Government agency, etc., that supplies the item.

(5) PART NUMBER Column. Indicates the primary number used by the manufacturer (individual, firm, corporation, or Government activity), which controls the design and characteristics of the item by means of its engineering drawings, specifications, standards, and inspection requirements to identify an item or range of items.

F-5. SPECIAL INFORMATION.

a. Usable On Code. Not applicable.

b. Associated Publications. Not applicable.

F-6. HOW TO LOCATE REPAIR PARTS.

a. When National stock number or part number is not known.

(1) *First*. Using the table of contents, determine the assembly group or subassembly group to which the item belongs. This is necessary since figures are prepared for assembly groups and subassembly groups, and listings are divided into the same groups.

(2) *Second.* Find the figure covering the assembly group or subassembly group to which the item belongs.

(3) *Third*. Identify the item on the figure and note the item number.

(4) *Fourth*. Refer to the Repair Parts List for the figure to find the part number for the item number noted on the figure.

(5) *Fifth.* Refer to the Part Number Index to find the NSN, if assigned.

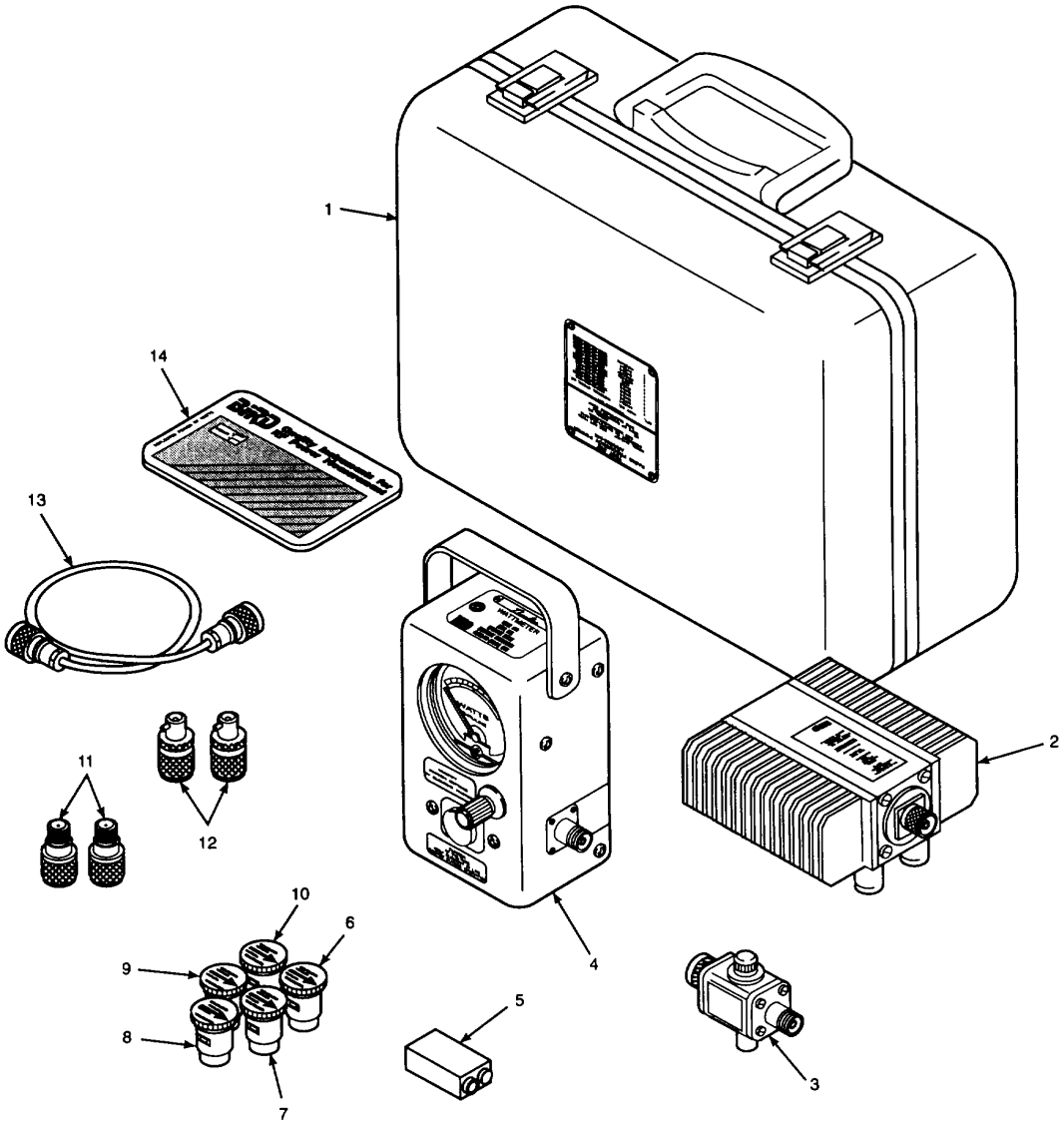
b. When National stock number or part number is known.

(1) *First.* Using the Index of National stock numbers and part numbers, find the pertinent National stock number or part number. The NSN index is in National Item Identification Number (NIIN) sequence (para. 4a(1)). The part numbers in the part number index are listed in ascending alphanumeric sequence (para. 4b). Both indexes cross-reference you to the illustration figure and item number of the item you are looking for.

(2) *Second.* After finding the figure and item number, verify that the item is the one you are looking for, then locate the item number in the repair parts list for the figure.

F-7. ABBREVIATIONS.

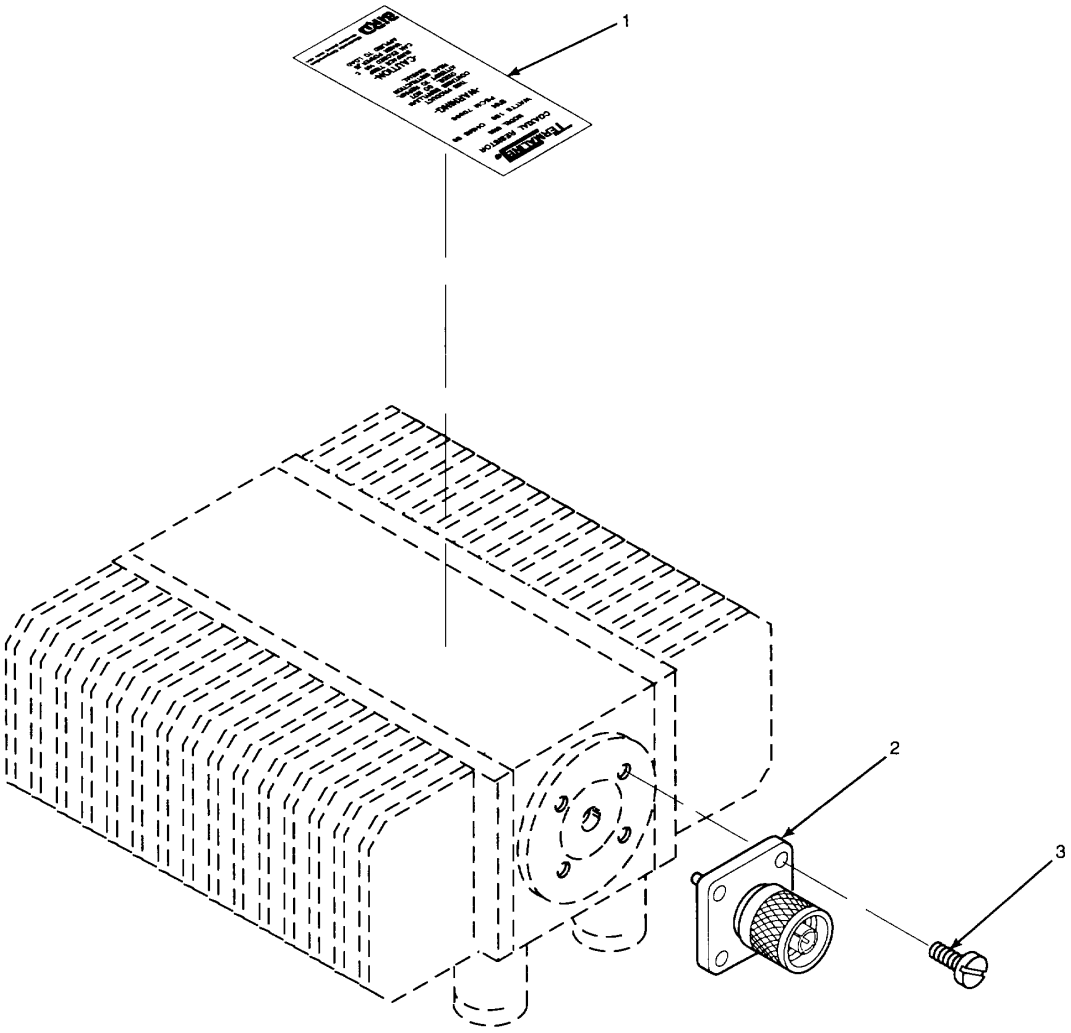
Not applicable.



CE200043

Figure F-1. Radio Frequency Power Test Set AN/URM-213

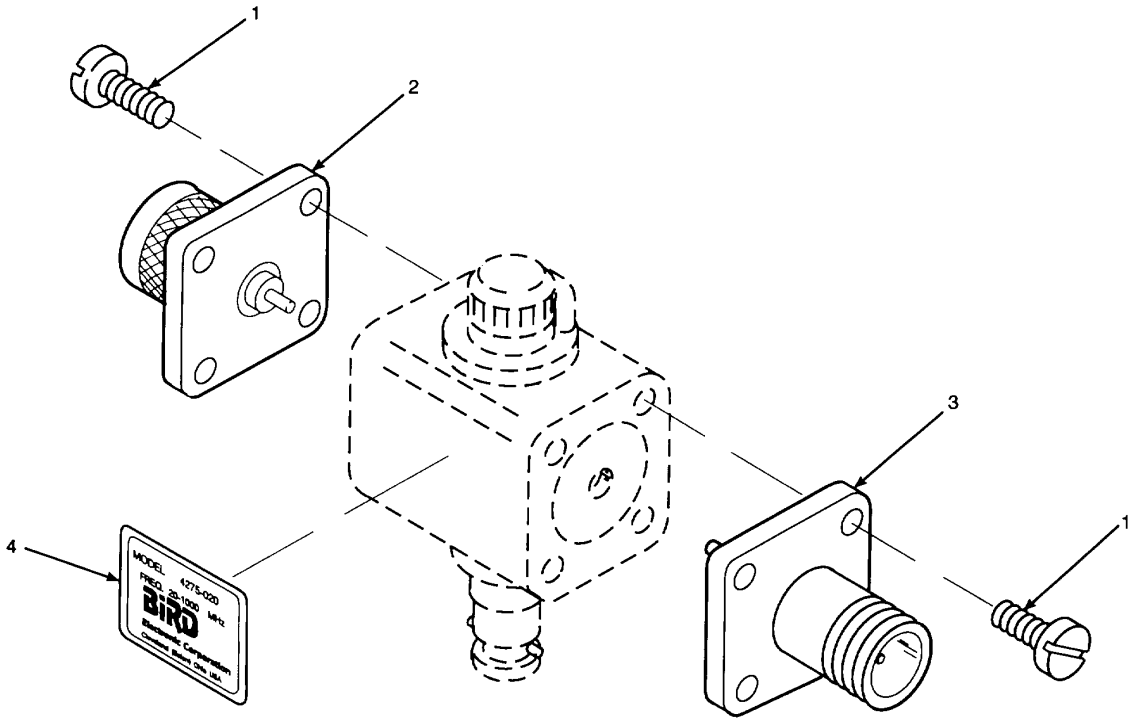
(1) ITEM NO	(2) SMR CODE	(3) CAGEC	(4) PART NUMBER	(5) DESCRIPTION AND USABLE ON CODES (UOC)	(6) QTY
				GROUP 00 RADIO FREQUENCY POWER TEST SET AN /URM-213 FIGURE F-1	
1	PAOZZ	70998	4410A405	CASE, TEST SET	1
2	PAOHH	70998	8065A001	DUMMY LOAD, ELECTRIC	1
3	PAOHH	70998	4275-020	COUPLER, DIRECTIONAL	1
4	PAOHH	70998	4410-201	WATTMETER	1
5	PCOZZ	80058	BA-3090/U	BATTERY, NONRECHARG	1
6	PAOZZ	70998	4410-2	PLUG-IN UNIT, ELECTR	1
7	PAOZA	70998	4410-4	PLUG-IN UNIT, ELECTR	1
8	PAOZZ	70998	4410-5	PLUG-IN UNIT, ELECTR	1
9	PAOZZ	70998	4410-6	PLUG-IN UNIT, ELECTR	1
10	PAOZZ	70998	4410-8	PLUG-IN UNIT, ELECTR	1
11	PAOZZ	91836	UG146A/U	ADAPTOR, CONNECTOR	2
12	PAOZZ	74868	UG201A/U	ADAPTOR, CONNECTOR	2
13	AOOZZ	70998	4410A407	CABLE ASSEMBLY, RADI SEE APPENDIX E	1
14	XBOZZ	70998	4400-012	CHART	1
				END OF FIGURE	



CE200044

Figure F-2. Dummy Load

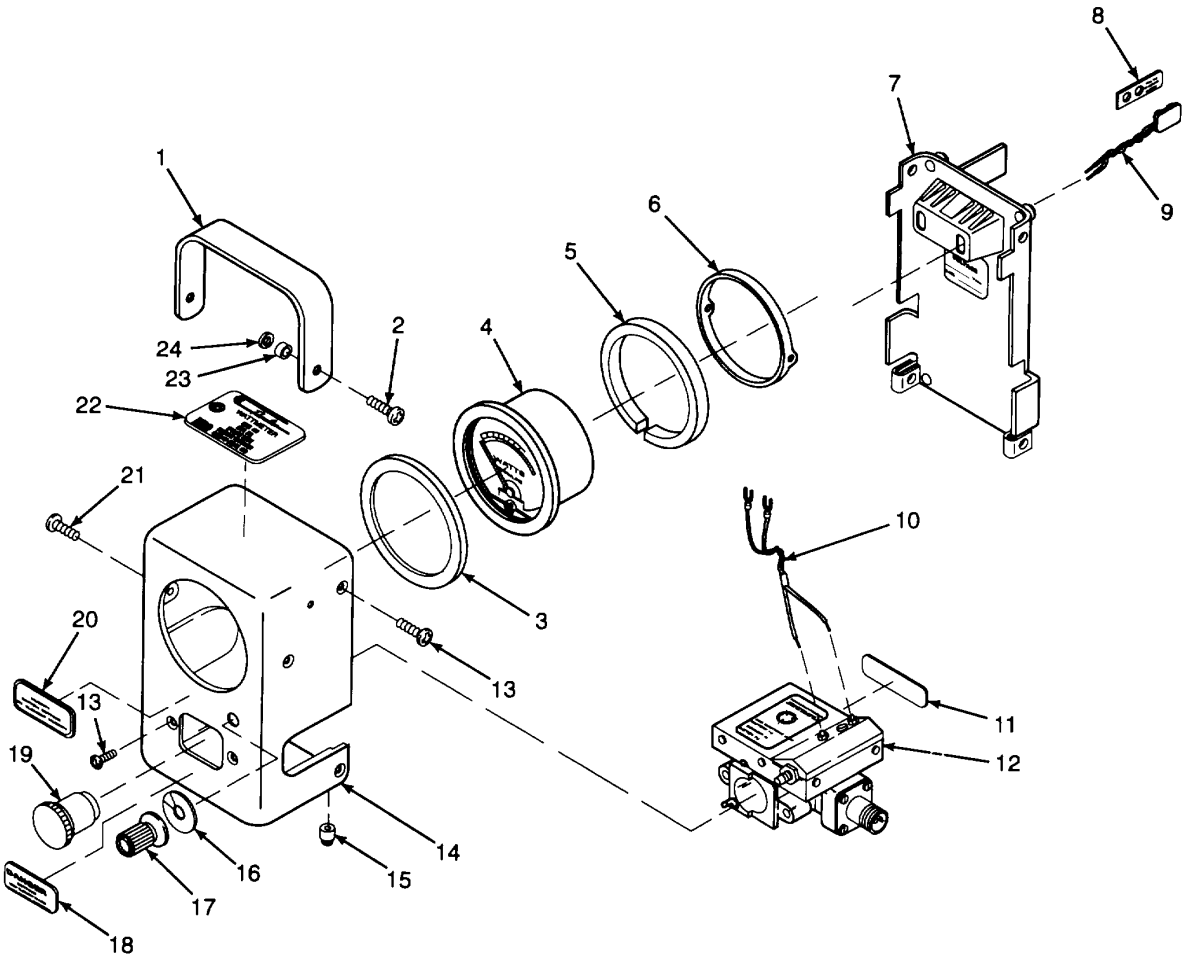
(1) ITEM NO	(2) SMR CODE	(3) CAGEC	(4) PART NUMBER	(5) DESCRIPTION AND USABLE ON CODES (UOC)	(6) QTY
				GROUP 01 DUMMY LOAD	
				FIGURE F-2	
1	XBHZZ	70998	8065-006	PLATE, INSTRUCTION.....	1
2	PAHZZ	70998	424063	CONNECTOR, RECEPTACL	1
3	PAHZZ	96906	MS51957-26	SCREW, MACHINE	4
				END OF FIGURE	



CE200045

Figure F-3. Directional Coupler

(1) ITEM NO	(2) SMR CODE	(3) CAGEC	(4) PART NUMBER	(5) DESCRIPTION AND USABLE ON CODES (UOC)	(6) QTY
				GROUP 02 DIRECTIONAL COUPLER	
				FIGURE F-3	
1	PAHZZ	96906	MS51957-41	SCREW, MACHINE	8
2	PAHZZ	70998	424063	CONNECTOR, RECEPTACL	1
3	PAHZA	70998	4240-062	CONNECTOR, RECEPTACL	1
4	XBHZZ	70998	4275-019	PLATE, IDENTIFICATIO	1
				END OF FIGURE	



CE200046

Figure F-4. Wattmeter

(1) ITEM NO	(2) SMR CODE	(3) CAGEC	(4) PART NUMBER	(5) DESCRIPTION AND USABLE ON CODES (UOC)	(6) QTY
				GROUP 03 WATTMETER	
				FIGURE F-4	
1	XBHZZ	70998	8580A003	STRAP, WEBBING	1
2	PAHZZ	34295	10F50NT0S	SCREW, MACHINE	2
3	PAHZZ	70998	4410A261	PAD, SHOCK MOUNT	1
4	PAHZZ	70998	2080-066	WATTMETER	1
5	PAHZZ	70998	5-1066	SHOCKSTRIP, RUBBER	1
6	PAHZZ	70998	4220-087	HOLDER, METER	1
7	PAHZZ	70998	4410-039	DOOR, ACCESS	1
8	XBHZZ	70998	4410A264	PLATE, INSTRUCTION	1
9	PAHZZ	70998	4410-007	RETAINER, BATTERY	1
10	PAHZZ	70998	4410-006	CABLE ASSEMBLY, SPEC	1
11	XBHZZ	70998	4410-023	LABEL	1
12	PAHZZ	70998	4410A205-1	LINE SECTION, RADIO	1
13	PAHZZ	34295	10F50NX0S	SCREW, MACHINE	2
14	PAHZZ	70998	4410A009	HOUSING	1
15	XBHZZ	3M927	9600-305	BUMPER, RUBBER	4
16	XBHZZ	70998	4410-029	LABEL	1
17	PAHZZ	70998	4410-028	KNOB	1
18	XBHZZ	70998	4410A403	PLATE, INSTRUCTION	1
19	PAHZZ	70998	3610-031-1	CAP, PROTECTIVE, DUST	1
20	PAHZZ	34295	10F50NX0S	SCREW, MACHINE	2
21	XBHZZ	70998	4410-013	LABEL	1
22	XBHZZ	70998	4410-214	PLATE, IDENTIFICATIO	1
23	PAHZZ	70998	8240-054	SPACER, SLEEVE	1
24	PAHZZ	96906	MS35338-138	WASHER, LOCK	2
				END OF FIGURE	

CROSS- REFERENCE-INDEXES

NATIONAL STOCK NUMBER INDEX

STOCK NUMBER	FIG.	ITEM	STOCK NUMBER	FIG.	ITEM
5935-00-027-9732	F-2	2			
	F-3	2			
5305-00-054-6650	F-2	3			
5305-00-054-6666	F-3	1			
5365-00-252-8668	F-4	23			
5935-00-404-2386	F-3	3			
6625-00-531-4273	F-4	6			
5310-00-933-8120	F-4	24			
6135-01-063-1978	F-1	5			
5985-01-091-8952	F-1	3			
5340-01-141-6404	F-4	5			
6625-01-218-7850	F-1	7			
6625-01-218-7851	F-1	8			
6625-01-218-7852	F-1	9			
5340-01-219-2687	F-4	7			
6150-01-252-9306	F-4	10			
6625-01-260-7421	F-1	6			
6140-01-267-0092	F-4	9			
6625-01-267-2289	F-4	4			
5355-01-279-6214	F-4	17			
6625-01-284-6828	F-1	10			

CROSS-REFERENCE INDEXES
PART NUMBER INDEX

CAGEC	PART NUMBER	STOCK NUMBER	FIG.	ITEM
80058	BA-3090/U	6135-01-063-1978	F-1	5
96906	MS35338-138	5310-00-933-8120	F-4	24
96906	MS51957-26	5305-00-054-6650	F-2	3
96906	MS51957-41	5305-00-054-6666	F-3	1
91836	UG146A/U		F-1	11
74868	UG201A/U		F-1	12
34295	10F50NT0S		F-4	2
34295	10F50NX0S		F-4	13
			F-4	20
70998	2080-066	6625-01-267-2289	F-4	4
70998	3610-031-1		F-4	19
70998	4220-087	6625-00-531-4273	F-4	6
70998	4240-062	5935-00-404-2386	F-3	3
70998	424063	5935-00-027-9732	F-2	2
			F-3	2
70998	4275-019		F-3	4
70998	4275-020	5985-01-091-8952	F-1	3
70998	4400-012		F-1	14
70998	4410-006	6150-01-252-9306	F-4	10
70998	4410-007	6140-01-267-0092	F-4	9
70998	4410-013		F-4	21
70998	4410-023		F-4	11
70998	4410-028	5355-01-279-6214	F-4	17
70998	4410-029		F-4	16
70998	4410-039	5340-01-219-2687	F-4	7
70998	4410-2	6625-01-260-7421	F-1	6
70998	4410-201		F-1	4
70998	4410-214		F-4	22
70998	4410-4	6625-01-218-7850	F-1	7
70998	4410-5	6625-01-218-7851	F-1	8
70998	4410-6	6625-01-218-7852	F-1	9
70998	4410-8	6625-01-284-6828	F-1	10
70998	4410A009		F-4	14
70998	4410A205-1		F-4	12
70998	4410A261		F-4	3
70998	4410A264		F-4	8
70998	4410A403		F-4	18
70998	4410A405		F-1	1
70998	4410A407		F-1	13
70998	5-1066	5340-01-141-6404	F-4	5
70998	8065-006		F-2	1
70998	8065A001		F-1	2
70998	8240-054	5365-00-252-8668	F-4	23
70998	8580A003		F-4	1
3M927	9600-305		F-4	15

CROSS REFERENCE INDEXES

FIGURE AND ITEM NUMBER INDEX

FIG.	ITEM	STOCK NUMBER	CAGEC	PART NUMBER
F-1	1		70998	4410A405
F-1	2		70998	8065A001
F-1	3	5985-01-091-8952	70998	4275-020
F-1	4		70998	4410-201
F-1	5	6135-01-063-1978	80058	BA-3090/U
F-1	6	6625-01-260-7421	70998	4410-2
F-1	7	6625-01-218-7850	70998	4410-4
F-1	8	6625-01-218-7851	70998	4410-5
F-1	9	6625-01-218-7852	70998	4410-6
F-1	10	6625-01-284-6828	70998	4410-8
F-1	11		91836	UG146A/U
F-1	12		74868	UG201A/U
F-1	13		70998	4410A407
F-1	14		70998	4400-012
F-2	1		70998	8065-006
F-2	2	5935-00-027-9732	70998	424063
F-2	3	5305-00-054-6650	96906	MS51957-26
F-3	1	5305-00-054-6666	96906	MS51957-41
F-3	2	5935-00-027-9732	70998	424063
F-3	3	5935-00-404-2386	70998	4240-062
F-3	4		70998	4275-019
F-4	1		70998	8580A003
F-4	2		34295	10F50NT0S
F-4	3		70998	4410A261
F-4	4	6625-01-267-2289	70998	2080-066
F-4	5	5340-01-141-6404	70998	5-1066
F-4	6	6625-00-531-4273	70998	4220-087
F-4	7	5340-01-219-2687	70998	4410-039
F-4	8		70998	4410A264
F-4	9	6140-01-267-0092	70998	4410-007
F-4	10	6150-01-252-9306	70998	4410-006
F-4	11		70998	4410-023
F-4	12		70998	4410A205-1
F-4	13		34295	10F50NX0S
F-4	14		70998	4410A009
F-4	15		3M927	9600-305
F-4	16		70998	4410-029
F-4	17	5355-01-279-6214	70998	4410-028
F-4	18		70998	4410A403
F-4	19		70998	3610-031-1
F-4	20		34295	10F50NX0S
F-4	21		70998	4410-013
F-4	22		70998	4410-214
F-4	23	5365-00-252-8668	70998	8240-054
F-4	24	5310-00-933-8120	96906	MS35338-138

SUBJECT INDEX

SUBJECT INDEX - Continued

SUBJECT INDEX - Continued

By Order of the Secretary of the Army:

GORDON R. SULLIVAN
General, United States Army
Chief of Staff

Official:

MILTON H. HAMILTON
Administrative Assistant to the
Secretary of the Army
05265

DISTRIBUTION:

To be distributed in accordance with DA Form 12-36-E, block 9559, requirements for TM 11-6625-3276-14&P.

***US. GOVERNMENT PRINTING OFFICE**: 1993-710-084/803-38

These are the instructions for sending an electronic 2028

The following format must be used if submitting an electronic 2028. The subject line must be exactly the same and all fields must be included; however only the following fields are mandatory: 1, 3, 4, 5, 6, 7, 8, 9, 10, 13, 15, 16, 17, and 27.

From: "Whomever" <whomever@wherever.army.mil>
To: 2028@redstone.army.mil

Subject: DA Form 2028

1. ***From:*** Joe Smith
2. *Unit:* home
3. ***Address:*** 4300 Park
4. ***City:*** Hometown
5. ***St:*** MO
6. ***Zip:*** 77777
7. ***Date Sent:*** 19−OCT−93
8. ***Pub no:*** 55−2840−229−23
9. ***Pub Title:*** TM
10. ***Publication Date:*** 04−JUL−85
11. *Change Number:* 7
12. *Submitter Rank:* MSG
13. ***Submitter FName:*** Joe
14. *Submitter MName:* T
15. ***Submitter LName:*** Smith
16. ***Submitter Phone:*** 123−123−1234
17. ***Problem:*** **1**
18. *Page:* 2
19. *Paragraph:* 3
20. *Line:* 4
21. *NSN:* 5
22. *Reference:* 6
23. *Figure:* 7
24. *Table:* 8
25. *Item:* 9
26. *Total:* 123
27. ***Text:***

This is the text for the problem below line 27.

RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS For use of this form, see AR 25–30; the proponent agency is ODISC4.	Use Part II (*reverse)* for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/ Supply Manuals (SC/SM)	DATE 8/30/02
TO: (*Forward to proponent of publication or form)(Include ZIP Code)* Commander, U.S. Army Aviation and Missile Command ATTN: AMSAM–MMC–MA–NP Redstone Arsenal, 35898	FROM: (*Activity and location)(Include ZIP Code)* MSG, Jane Q. Doe 1234 Any Street Nowhere Town, AL 34565	

PART 1 – ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS

PUBLICATION/FORM NUMBER	DATE	TITLE
TM 9–1005–433–24	16 Sep 2002	Organizational, Direct Support, And General Support Maintenance Manual for Machine Gun, .50 Caliber M3P and M3P Machine Gun Electrical Test Set Used On Avenger Air Defense Weapon System

ITEM NO.	PAGE NO.	PARA–GRAPH	LINE NO. *	FIGURE NO.	TABLE NO.	RECOMMENDED CHANGES AND REASON
1	WP0005 PG 3		2			Test or Corrective Action column should identify a different WP number.

** Reference to line numbers within the paragraph or subparagraph.*

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/ AUTOVON, PLUS EXTENSION	SIGNATURE
MSG, Jane Q. Doe, SFC	788–1234	

TO: (*Forward direct to addressee listed in publication)*	**FROM:** (*Activity and location) (Include ZIP Code)*	**DATE**
Commander, U.S. Army Aviation and Missile Command ATTN: AMSAM–MMC–MA–NP Redstone Arsenal, 35898	MSG, Jane Q. Doe 1234 Any Street Nowhere Town, AL 34565	8/30/02

PART II – REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS

PUBLICATION NUMBER	DATE	TITLE

PAGE NO.	COLM NO.	LINE NO.	NATIONAL STOCK NUMBER	REFERENCE NO.	FIGURE NO.	ITEM NO.	TOTAL NO. OF MAJOR ITEMS SUPPORTED	RECOMMENDED ACTION

PART III – REMARKS (*Any general remarks or recommendations, or suggestions for improvement of publications and blank forms. Additional blank sheets may be used if more space is needed.)*

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE
MSG, Jane Q. Doe, SFC	788–1234	

RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS For use of this form, see AR 25–30; the proponent agency is ODISC4.	Use Part II (*reverse)* for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/ Supply Manuals (SC/SM)	DATE
TO: (*Forward to proponent of publication or form)(Include ZIP Code)* Commander, U.S. Army Aviation and Missile Command ATTN: AMSAM-MMC-MA-NP Redstone Arsenal, AL 35898	FROM: (*Activity and location)(Include ZIP Code)*	

PART 1 – ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS

PUBLICATION/FORM NUMBER	DATE	TITLE

ITEM NO.	PAGE NO.	PARA–GRAPH	LINE NO. *	FIGURE NO.	TABLE NO.	RECOMMENDED CHANGES AND REASON

** Reference to line numbers within the paragraph or subparagraph.*

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/ AUTOVON, PLUS EXTENSION	SIGNATURE

TO: (*Forward direct to addressee listed in publication)* Commander, U.S. Army Aviation and Missile Command ATTN: AMSAM-MMC-MA-NP Redstone Arsenal, AL 35898	**FROM:** (*Activity and location) (Include ZIP Code)*	**DATE**

PART II – REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS

PUBLICATION NUMBER	DATE	TITLE

PAGE NO.	COLM NO.	LINE NO.	NATIONAL STOCK NUMBER	REFERENCE NO.	FIGURE NO.	ITEM NO.	TOTAL NO. OF MAJOR ITEMS SUPPORTED	RECOMMENDED ACTION

PART III – REMARKS (*Any general remarks or recommendations, or suggestions for improvement of publications and blank forms. Additional blank sheets may be used if more space is needed.)*

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE