

MIL-M-7793F  
15 September 1983  
**SUPERSEDING**  
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## MILITARY SPECIFICATION

### METER, TIME TOTALIZING

This specification is approved for use by all Departments and Agencies of the Department of Defense.

#### 1. SCOPE

1.1 Scope This specification covers the general requirements for hermetically sealed, time totalizing meters.

1.2 Classification. The meters covered by this specification shall be of the types specified in the applicable specification sheets.

#### 2. APPLICABLE DOCUMENTS

##### 2.1 Government documents.

2.1.1 Specifications and standards. The following specifications and standards form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of these documents shall be those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation.

#### SPECIFICATIONS

##### Federal

- |           |  |
|-----------|--|
| QQ-C-320  | - Chromium Plating (Electrodeposited). |
| QQ-N-290  | - Nickel Plating (Electrodeposited).   |
| QQ-S-781  | - Strapping, Steel and Seals.          |
| PPP-B-585 | - Box, Wood, Wirebound.                |

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commanding Officer, Naval Air Engineering Center, Systems Engineering and Standardization Department (Code 53), Lakehurst, NJ 08733-5100 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A

FSC 6645

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- PPP-B-601 - Boxes, Wood, Cleated Plywood.
- PPP-B-621 - Box, Wood, Nailed and Lock-Corner.
- PPP-B-636 - Box, Shipping, Fiberboard.

Military

- MIL-P-116 - Preservation, Methods of.
- DOD-D-1000 - Drawings, Engineering and Associated Lists.
- MIL-C-5541 - Chemical Conversion Coatings on Aluminum Alloys.
- MIL-A-8625 - Anodic Coatings for Aluminum and Aluminum Alloys.
- MIL-T-10727 - Tin Plating, Electrodeposited or Hot Dipped, for Ferrous and Non-ferrous Metals.
- MIL-C-26074 - Coatings, Electroless Nickel, Requirements for.

## STANDARDS

Military

- MIL-STD-129 - Marking for Shipment and Storage.
- MIL-STD-130 - Identification Marking of U.S. Military Property.
- MIL-STD-143 - Standards and Specifications, Order of Precedence for the Selection of.
- MIL-STD-202 - Test Methods for Electronic and Electric Component Parts.
- MIL-STD-461 - Electromagnetic Emission and Susceptibility Requirements for the Control of Electromagnetic Interference.
- MIL-STD-462 - Electromagnetic Interference Characteristics, Measurement of.
- MIL-STD-704 - Aircraft Electric Power Characteristics.
- MIL-STD-794 - Parts and Equipment, Procedures for Packaging and Packing of.
- MIL-STD-889 - Dissimilar Metals.
- MIL-STD-1285 - Marking of Electric and Electronic Parts.
- MIL-STD-2073/1 - Material Procedures for Development and Applications of Packaging Requirements.
- MIL-STD-45662 - Calibration Systems Requirements.

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MS3345 - Flange, Split Mounting, Meter, Time Totalizing.

(Copies of specifications and standards required by manufacturers in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting activity.)

2.2 Other publications. The following document forms a part of this specification to the extent specified herein. Unless otherwise specified, the issues of the documents which are DOD adopted shall be those listed in the issue of the DODISS specified in the solicitation. Unless otherwise specified, the issues of the documents not listed in the DODISS shall be the issue of the nongovernment document which is current on the date of the solicitation.

American Society of Testing and Materials (ASTM)

ASTM-B-633 - Electrodeposited Coatings of Zinc on Iron and Steel.

ASTM-D-3951 - Packaging, Commercial.

(Copies of ASTM-B-633 and ASTM-D-3951 should be obtained from the American Society of Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.)

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein (except for MS standards), the text of this specification shall take precedence. Nothing in this specification, however, shall supersede applicable laws and regulations unless a specific exemption has been obtained.

### 3. REQUIREMENTS

3.1 Qualification. The meters furnished under this specification shall be products which are qualified for listing on the applicable Qualified Products List at the time set for opening of the bids (see 4.4 and 6.4).

3.2 Selection of Government documents. Specifications and standards for necessary commodities and services not specified herein shall be selected in accordance with MIL-STD-143 except as provided in 3.2.1

3.2.1 Standard parts. Standard parts (AN and MS) shall be used wherever they are suitable for the purpose, and shall be identified on any drawings by their part numbers. Commercial utility parts such as screws, bolts, nuts and cotter pins may be used provided they possess suitable properties, are replaceable by the standard parts (AN and MS) without alteration, and provided the corresponding standard part numbers are referenced in the parts list and, if practicable, on the contractor's drawings. In the event there is no suitable corresponding standard part in effect on the date of invitation for bids, commercial parts may be used provided they conform to all the requirements of this specification.

3.3 Materials. Materials shall conform to applicable specifications and shall be as specified herein. Materials for which there are no applicable specifications, or which are not specifically described herein, shall be of the best quality, of the lightest practicable weight and suitable for the purpose intended.

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3.3.1 Critical materials. Non-critical materials shall be used where practicable. Where the use of a critical material is essential to meet specification requirements, the material used shall be of the least critical of those which are adequate for the purpose.

3.3.2 Non-magnetic materials. Non-magnetic materials shall be used for all parts except where magnetic materials are essential.

3.3.3 Metals. Metals used on the exterior of the meter shall be of the corrosion resistant type or suitably treated to resist corrosion due to fuels, salt spray or atmospheric conditions likely to be met in normal service or storage.

3.3.4 Dissimilar metals. Dissimilar metals as defined in MIL-STD-889 shall not be used in intimate contact with each other, unless suitably protected against electrolytic corrosion by means of protective coatings.

3.3.5 Aluminum alloy parts. Aluminum alloy parts shall be covered with an anodic film conforming to MIL-A-8625, except for internal components contained in a hermetically sealed enclosure or when any of the following conditions prevail:

- a. Small holes and case inserts.
- b. Aluminum alloys which do not anodize satisfactorily shall be coated with a chemical film in accordance with MIL-C-5541.
- c. To provide a paint base, chemical treatments in accordance with MIL-C-5541 may be used in lieu of anodizing.

3.3.6 Iron and steel parts. Iron and steel parts shall be chromium, nickel or zinc plated in accordance with QQ-C-320, QQ-N-290 or ASTM-B-633 respectively. Plating is not required on parts made from corrosion resisting steel or contained in a hermetically sealed enclosure.

3.4 Vacuum impregnation. Coils need not be impregnated when specified performance can be met without impregnation.

3.5 Protective treatment. Finishes and protective coatings which will crack, chip or scale during normal service life, or are affected by extremes of atmospheric or environmental conditions shall not be used.

3.6 Fungus-proof materials. Materials that are nutrients for fungi shall not be used.

3.7 Design and construction. The meter shall be in accordance with the applicable specification sheet and the requirements specified herein. In the event of any conflict between the requirements of this specification and the applicable specification sheet, the latter shall govern. It shall be built to withstand the strains, jars, vibrations and other conditions incident to shipping, storage, installation and service.

3.7.1 Counting mechanism. The indicator counting mechanism shall have a digital readout as specified in the applicable specification sheets and shall be incapable of being reset.

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3.7.2 Meter face plate. The meter face plate shall have a dull black finish. The hours numerals shall be white on a dull black background. Meters with a 1/10th hour readout shall have the tenths place numeral colored red on a white background. The words "HOURS" or "HOURS and TENTHS", as applicable, shall appear on the face plate, as may the manufacturer's name or trademark. The meter shall have an operational indicator visible through the face plate that demonstrates the meter is operating when power is applied.

3.7.3 Enclosure. The case shall be in accordance with the applicable specification sheet and shall provide a hermetically sealed enclosure for the internal mechanism of the instrument. The hermetic sealing shall be so accomplished that the seal will not be dependent upon materials which will be affected by the action of any atmosphere to which the meter may be subjected.

3.7.3.1 Finish. The case shall be finished in a durable, dull black color.

3.7.4 Filling medium. The filling medium shall be at least 98 percent purity and free of dust particles. The filling medium may not contain more than 0.006 milligram of water vapor per liter (dewpoint  $-65^{\circ}\text{C}$  or  $-85^{\circ}\text{F}$  maximum) at the filling pressure. The filling medium shall consist of 100 percent helium (preferred), a mixture of 88 to 92 percent nitrogen and the remainder helium or a mixture of inert noble gasses (such as argon and helium). The absolute pressure of the filling medium in the case shall be a minimum of one atmosphere.

3.7.5 Coils. The coils shall be properly insulated from the case and other grounded parts.

3.7.5.1 Coil temperature. The coil temperature rise shall be left to the discretion of the manufacturer, but shall be considered additive to the maximum operating temperature specified herein

3.7.6 Terminals. All terminals used for soldered connections shall be of the "hook-type," and shall be hot-tin dipped or tin plated in accordance with MIL-T-10727, or electroless nickel plated in accordance with MIL-C-26074. The terminals shall meet the solderability requirements of MIL-STD-202, Method 208. Each terminal shall accommodate one wire sized 22 AWG or smaller.

3.7.7 Operating position. The indicator shall be designed to operate in any position.

3.7.8 Interchangeability. All parts having the same manufacturer's part number shall be directly and completely interchangeable with each other with respect to installation and performance. Changes in manufacturer's part numbers shall be governed by the drawing number requirements of DOD-D-1000.

3.7.9 Identification of product. Meters and assemblies and parts thereof shall be marked for identification in accordance with MIL-STD-130.

3.7.9.1 Nameplate. The following nameplate data shall appear on the outer surface of the enclosure:

Manufacturer's name or trademark  
Manufacturer's model number  
Nominal voltage and frequency (if applicable)  
Nominal power (watts)

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Military part number

Coded date (Week and Year) in accordance with MIL-STD-1285

3.7.9.2 Use of AN or MIL designations. AN or MIL designations shall not be applied to a product, except for qualification test samples, nor referenced to in correspondence, until notice of approval has been received from the activity responsible for qualification.

3.7.10 Mounting flange. Meter flanges shall be in accordance with the applicable specification sheet. Fixed flanges shall be tin-plated on the specified mount surface to provide a case ground for the meter. Tin-plate shall be .0002 inch minimum thickness and shall be in accordance with MIL-T-10727.

3.8 Performance. The meter shall perform as specified in this section when tested in accordance with 4.6.

3.8.1 Examination of product. The meter shall conform to the dimensions, workmanship, marking and configuration requirements of this specification (see 4.6.1).

3.8.2 Operation. As evidenced by the operational indicator, the meter shall start and operate normally within 40 seconds after applying the specified voltage (see 4.6.2). (Note: This test verifies normal meter operation under short-term conditions. It is not a practical medium to measure the meter's compliance with accuracy requirements.)

3.8.3 Power consumption. Power consumption at rated voltage shall be as specified on the applicable specification sheets (see 4.6.3).

3.8.4 Power supply tolerance. The meter shall be capable of withstanding the voltage and frequencies specified in 4.6.3 or the individual specification sheet. The meter shall meet the operational requirements of 3.8.2 after the test (see 4.6.4).

3.8.5 Insulation resistance. The insulation resistance between terminals and case shall exceed 100 megohms. The meter shall not be damaged by the test potential (see 4.6.5).

3.8.6 Dielectric strength. There shall be no damage, arcing or current leakage in excess of 1.0 milliamperes. (see 4.6.6).

3.8.7 Altitude. The meter shall operate normally at specified voltages and barometric pressure, with no evidence of damage after the test (see 4.6.7).

3.8.8 Thermal shock. The meter shall operate through a range of  $-65^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$  ambient unless otherwise specified in the applicable specification sheet. The meter shall not show any signs of electrical or mechanical damage after the test (see 4.6.8).

3.8.9 Moisture resistance. The meter shall meet the requirements of 3.8.2 after the test. There shall be no signs of moisture in the face of the meter, nor signs of corrosion (see 4.6.9).

3.8.10 Salt spray. The meter with mounting flange or removable face plate attached, shall meet the requirements of 3.8.2 after being subjected to the

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test of 4.6.10. There shall be no signs of corrosion of the metal parts or signs of moisture inside the face of the meter after the test.

3.8.11 Vibration. The meter shall meet the requirements of 3.8.2 and shall show no evidence of mechanical damage and operate correctly during and after subjection to the vibration test as specified in 4.6.11. Application of the vibration shall be in each of the three principal axes.

3.8.11.1 Random vibration. When required by the applicable specification sheet, the meter shall meet the requirements of 3.8.2 and shall show no evidence of mechanical damage and operate correctly during and after subjection to the random vibration test as specified in 4.6.11.1. Application of the vibration shall be in each of the three principal axes

3.8.12 Shock. The meter shall meet the requirements of 3.8.2 and shall show no evidence of mechanical damage and operate correctly after subjection to the shock tests (see 4.6.12).

3.8.13 Hermetic seal. The meter shall operate satisfactorily after being subjected to the gross leak or fine leak test. The meter face shall show no evidence of the presence of moisture intrusion. Any leakage, as evidenced by bubbles, is considered a failure of the MIL-STD-202, Method 104 gross leak test. The leak rate shall be not greater than .01 micron ft<sup>3</sup>/hr for the fine leak test (see 4.6.13).

3.8.14 Life accuracy. Unless otherwise specified, when tested in accordance with 4.6.14 the meters shall have the following minimum accuracy:

- a. 28 V DC meters     +1 0%
- b. 60 Hz AC meters   +0 1%
- c. 400 Hz AC meters  +0 1%

3.8.15 Electromagnetic compatibility. Meters shall conform to the electromagnetic compatibility requirements CE03 and RE02 of MIL-STD-461 (see 4.6.15).

3.8.16 Terminal stress. Each terminal shall withstand a 4.5 pound (20 0 Newton) axial force without loosening or being damaged (see 4.6.16).

3.8.17 Low temperature storage. The meter shall meet the operational requirements of 3.8.2 during the last -50°C step of the test (see 4.6.17).

3.9 Workmanship. The meter, including all parts and accessories shall be fabricated and finished in a thoroughly workmanlike manner. Particular attention shall be given to freedom from blemishes, defects, burrs and sharp edges; accuracy of dimensions, radii of fillets and marking of parts and assemblies; thoroughness of soldering, welding, brazing, painting, wiring, riveting and alignment of parts and tightness of assembly screws and bolts.

3.9.1 Cleaning. The meter supplied shall be thoroughly cleaned by the supplier. Loose, spattered or excess solder, metal chips and other foreign material shall be removed during and after final assembly.

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3.9.2 Riveting. Riveting operations shall be carefully performed to insure that the rivets are tight and satisfactorily headed.

#### 4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his or any other facilities suitable for performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items must meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of assuring all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to acceptance of defective material.

4.1.2 Test equipment and inspection facilities. Test equipment and inspection facilities shall be of sufficient accuracy, quality and quantity to permit performance of the required inspection. The manufacturer shall establish calibration of inspection equipment to the satisfaction of the Government. Calibration of the standards which control the accuracy of inspection equipment shall be in accordance with MIL-STD-45662.

#### 4.2 Classification of inspection.

- a. Materials and design inspection (see 4.3)
- b. Qualification inspection (see 4.4)
- c. Retention of qualification (see 4.4.2)
- d. Quality assurance inspection (see 4.5)

4.3 Materials and design inspection. Materials and design inspection shall consist of certification that the materials used in fabricating the meters as listed in 3.3 through 3.7.10 are in accordance with the applicable referenced standards, specifications or requirements prior to such fabrication. This certification shall be supported by verifying data and shall be furnished with the report of qualification testing.

4.4 Qualification inspection. Qualification inspection shall consist of the examination and tests, specified in Table I and the applicable specification sheets, to be performed on the specified test samples. The test sample size shall consist of three meters for Group I of Table I and any additional meters as required for Group II and the applicable specification sheet. Tests shall be performed in the order specified for all tests within Group I of Table I. Failure of any meter to pass all the tests is considered

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a failure of the qualification sample. The cause of failure of the meter shall be determined and corrected by the supplier. Failure mode and corrective action must be documented in the qualification test report before the qualifying activity can consider the products for listing on the QPL.

Table I. Qualification inspection.

<u>Group</u>	<u>Test</u>	<u>Requirement</u>	<u>Method</u>
I	Examination of product	3.7.1 3.7.2 3.7.3 3.7.6 3.9 3.9.1	Visual examinations (4.6.1)  4.6.2 4.6.3 4.6.4 4.6.5 4.6.6.1 4.6.7 4.6.8 4.6.9 4.6.10 4.6.11 4.6.12 4.6.13.2 4.6.14
	Operation	3.8.2	
	Power consumption	3.8.3	
	Power supply tolerance	3.8.4	
	Insulation resistance	3.8.5	
	Dielectric strength (altitude)	3.8.6	
	Altitude	3.8.7	
	Thermal shock	3.8.8	
	Moisture resistance	3.8.9	
	Salt spray	3.8.10	
	Vibration	3.8.11	
	Shock	3.8.12	
	Hermetic seal (fine leak test)	3.8.13	
	Life Accuracy	Spec. Sheet	
II	Random vibration (when req'd)	3.8.11.1	4.6.11.1
	Electromagnetic compatibility	3.8.15	4.6.15
	Terminal stress	3.8.16	4.6.16
	Low temperature storage	3.8.17	4.6.17
	Transient protection (when req'd)	Spec. Sheet	Spec. Sheet
	Transient generation (when req'd)	Spec. Sheet	Spec. Sheet

4.4.1 Qualification test samples. Samples for qualification tests shall be manufactured by the contractor's routine production process. Qualification samples for the contractor's tests and untested samples required by the qualifying activity shall be verified as production samples by the Government inspector.

4.4.2 Periodic qualification inspection. It shall be the responsibility of the qualified supplier to provide to the Government periodic verification of ability of qualified products to meet the requirements of this specification. Periodic verification shall be performed at two year intervals and shall consist of all tests listed in Table II performed in order, unless otherwise designated by the qualifying activity. The test sample shall be three meters for each meter type the supplier is qualified to.

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Table II. Periodic qualification test plan.

<u>Test</u>	<u>Requirement</u>	<u>Method</u>
Examination of Product	3.7.1	4.6.1
Operation	3.8.2	4.6.2
Power supply tolerance	3.8.4	4.6.4
Dielectric strength (alt)	3.8.6	4.6.6.1
Thermal shock	3.8.8	4.6.8
Salt spray	3.8.10	4.6.10
Vibration	3.8.11	4.6.11
Shock	3.8.12	4.6.12
Hermetic seal (fine leak)	3.8.13	4.6.13.2
Life accuracy	3.8.14	4.6.14

4.5 Quality assurance inspection. Quality conformance inspection shall consist of the following tests:

- a. Individual tests (see 4.5.1)
- b. Sampling plan tests (see 4.5.2.1)

4.5.1. Individual tests. All meters delivered under this specification shall comply with the following tests performed in the order shown. Meters shall show  $0 \pm 1$  hour at the time of delivery.

- a. Examination of product (see 4.6.1)
- b. Operation (see 4.6.2)
- c. Insulation resistance (see 4.6.5)
- d. Dielectric strength (see 4.6.6.2)
- e. Hermetic seal (see 4.6.13.1) (gross leak only).

4.5.2 Sampling plan. Sampling plan tests shall be performed on each lot of meters supplied under this specification. The meters selected for a sampling test shall first have passed the individual tests. The test samples (meters) which have passed sampling plan tests shall not be delivered on contract unless refurbished and reverified to comply with all the individual tests of 4.5.1.

<u>Production Quantity</u>	<u>Sampling Plan Quantity</u>
1 - 15	1
16 - 50	2
51 - 120	3
121 - 200	4
Each additional 100	Add one meter for each 100 produced

4.5.2.1 Sampling plan tests. Meters selected in accordance with the 4.5.2 sampling plan shall comply with the following tests performed in the order shown:

- a. Thermal shock (see 4.6.8)
- b. Power supply tolerance (see 4.6.4)
- c. Hermetic seal (see 4.6.13.2) (fine leak only)

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4.5.2.2 Rejection and retest. When one item selected from a production run fails to meet specification requirements, items still on hand or produced later will not be accepted until the extent and cause of failure is determined. After corrections have been made, all necessary tests shall be repeated. Individual tests may continue for operational and production reasons, pending the results of the investigation of a sampling test failure. Final acceptance of items on hand or later produced shall not be made until it has been determined that the items meet all the requirements of this specification.

4.5.3 Defects in items already accepted. The investigation of a test failure could indicate that defects may exist in items already accepted. If so, the contractor shall fully advise the acquiring activity of all defects likely to be found, and methods for correcting them.

4.6 Test methods and conditions. Unless otherwise specified, all inspections shall be performed in accordance with the test conditions of MIL-STD-202 and at the rated voltage (and frequency, if applicable) from the applicable specification sheet.

4.6.1 Examination of product. The meter shall be examined visually for conformance to dimensions, markings, workmanship and other requirements not verified by specific performance tests (see 3.8.1).

4.6.2 Operation Operating power shall be applied to the meter to check for normal operation under each of the following conditions from the meters' individual specification sheets (see 3.8.2):

28 V DC MeterAC Meters

Maximum rated voltage  
Minimum rated voltage

Minimum rated voltage, minimum Hz  
Minimum rated voltage, maximum Hz  
Maximum rated voltage, minimum Hz  
Maximum rated voltage, maximum Hz

4.6.3 Power consumption. Meters shall be checked for power consumption at the rated voltage shown on the applicable specification sheet (see 3.8.3).

4.6.4 Power supply tolerance. The meter shall be subjected to steady energization for 30  $\pm$ 1 minutes as specified on the applicable specification sheets for each of the following conditions:

DC meter400 Hz meter60 Hz meter

Minimum voltage  
Maximum voltage

Rated voltage, 300 Hz  
Maximum voltage, 500 HZ

Rated voltage, 50 Hz  
Maximum voltage, 70 Hz

Upon completion of the power supply tolerance test, the meters shall be subjected to the operational check test specified in 4.6.2 (See 3.8.4).

4.6.5 Insulation resistance. The insulation resistance shall be measured between the terminals connected together and the meter case. The test method shall be in accordance with Method 302, Test Condition B of MIL-STD-202 (See 3.8.5).

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4.6.6 Dielectric strength. The meters shall be subjected to Method 301 of MIL-STD-202 under conditions specified in 4.6.6.1 and 4.6.6.2. Test voltage shall be applied between the terminals connected together and the case (see 3.8.6).

4.6.6.1 Dielectric at altitude. Apply the applicable specification sheet's test voltage (altitude) for 60  $\pm$ 5 seconds to the meter under barometric pressure conditions required as follows for for the meter under test:

- a. DC and 400 Hz - 0.82 inch Hg (80,000 feet)
- b. 60 Hz - 20.58 inch Hg (10,000 feet)

4.6.6.2 Dielectric at room ambient. For quality conformance testing only, apply the applicable specification sheet's test voltage (room) for two to five seconds to the meter at room ambient altitude and temperature.

4.6.7 Altitude. The meter shall be subjected to Method 105 of MIL-STD-202, except that the absolute pressure shall be .82 inch of mercury (80,000 feet altitude) for the 400 Hz and 28 V DC types and 20.58 inches of mercury (10,000 feet altitude) for 60 Hz types. The meter shall be energized for 10  $\pm$ 1 minutes under these conditions, with the maximum voltage and frequency specified on the applicable specification sheet (see 3.8.7).

4.6.8 Thermal shock. The meter shall be subjected to Method 107, Condition B of MIL-STD-202. The meter shall be energized as follows for each step of the test cycle (see 3.8.8):

- Step 1 - Maximum rated voltage (and minimum frequency for AC meters)
- Step 2 - Rated voltage (and rated frequency for AC meters)
- Step 3 - Minimum rated voltage (and maximum frequency for AC meters)
- Step 4 - Rated voltage (and rated frequency for AC meters)

NOTE: Energization of the meters is optional during steps 2 and 4 at room ambient temperature.

4.6.9 Moisture resistance. The unenergized meter shall be subjected to Method 106 of MIL-STD-202. The meter shall be mounted with the digital display in the vertical position. The meter shall be subjected to the operational check (see 4.6.2) after completion of the moisture resistance test (see 3.8.9).

4.6.10 Salt spray. The unenergized meter, with mounting flange or removable face plate attached, shall be tested in accordance with Method 101, Condition B of MIL-STD-202. The meter shall be subjected to the operational check (see 4.6.2) after completion of the test (see 3.8.10).

4.6.11 Vibration. The 400 Hz and 28 V DC meters shall be tested in accordance with Method 204, Condition D of MIL-STD-202. The 60 Hz meters shall be tested in accordance with Method 201 of MIL-STD-202. The meter shall be energized with the rated voltage and frequency, if applicable. The meter shall be rigidly mounted to the vibration table. The meter shall be subjected to the operational check (see 4.6.2) after the vibration test (see 3.8.11).

4.6.11.1 Random vibration. When required by the applicable specification sheet, meters shall be tested in accordance with MIL-STD-202, Method 214,

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Condition I, letter D Test duration shall be 30 min/axis. The meter shall be energized with the rated voltage and frequency, if applicable. The meter shall be rigidly mounted to the vibration table. The meter shall be subjected to the operational check (see 4.6.2) after the vibration test (see 3.8.11.1).

4.6.12 Shock. The unenergized meter shall be tested in accordance with MIL-STD-202, Method 213, Test Condition I, to an acceleration of 100 g's, sawtooth wave, for 6 ±1 milliseconds (see 3.8.12) The meter shall be subjected to the operational check (see 4.6.2) after completion of the shock test.

4.6.13 Hermetic seal. The gross leak or fine leak test shall be performed as specified below. Upon completion, the meter shall be visually checked for internal moisture inside of the face plate. The operation test (see 3.8.13) shall then be performed

4.6.13.1 Gross leak. The test shall be performed in accordance with MIL-STD-202, Method 104, Condition A. The meter shall be checked for bubble leaks. (Note. Leaks will normally be from the face plate area or on the rear end)

4.6.13.2 Fine leak. The meter shall be checked for fine leaks with a mass spectrometer-type helium leak detector which can measure leak rates up to 0.01 micron ft<sup>3</sup>/hr

4.6.14 Life accuracy. The test shall be performed at the applicable specification sheet's temperature and voltage for each step in the sequence listed below. Test A is to be performed for initial qualification and Test B is to be performed for periodic qualification. The nominal rated frequency shall be used during all steps for the AC meters (see 3.8.14):

Step	Temperature	Voltage	Test A (hr)	Test B (hr)
1	maximum	maximum	200 ±8	100 ±4
2	maximum	minimum	200 ±8	100 ±4
3	minimum	maximum	200 ±8	100 ±4
4	minimum	minimum	200 ±8	100 ±4
5	room ambient	rated	200 ±8	100 ±4
			<u>1000±40</u>	<u>500 ±20</u>

The maximum and minimum temperatures and voltages, and the rated voltages and temperatures are listed on the individual specification sheet. At the end of the specified time, the meters shall be checked for accuracy in accordance with the requirements of 3.8.14 or the applicable specification sheet. Accuracy is calculated as follows.

$$\text{Accuracy (\%)} = \frac{(\text{Measured Elapsed Time} - \text{Actual Elapsed Time}) \times 100}{(\text{Actual Elapsed Time})}$$

4.6.15 Electromagnetic compatibility. Radiated and conducted interference control tests shall be conducted in accordance with MIL-STD-462, Test Method CE03 and RE02 (see 3.8.15).

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4.6.16 Terminal stress. Each terminal shall be tested in accordance with MIL-STD-202, Method 211, Test Condition A (see 3.8.16).

4.6.17 Low temperature storage. The meter shall be placed in a chamber maintained at  $-80^{\circ}\text{C}$  for  $30 \pm 2$  minutes. The temperature of the meter shall be raised to  $-50 \pm 5^{\circ}\text{C}$ . This test procedure shall be repeated three times. At the completion of this test the meter shall be subjected to the operational test of 4.6.2 while at  $-50^{\circ}\text{C}$  (see 3.8.17).

4.6.18 Packaging inspection. The preservation, packaging and marking of the meter shall be examined to determine conformance to the requirements of section 5.

## 5. PACKAGING

5.1 Preservation. The time totalizing meter shall be packaged in accordance with MIL-STD-794, Level A or commercial, as specified in the contract or purchase order. For Level A packaging, the method of preservation shall be in accordance with MIL-P-116, Method 1A-8 without preservation compound, and cushioned to meet the drop test of MIL-P-116 (see 6.2.1).

5.2 Packing. The time totalizing meter shall be packed in accordance with MIL-STD-794, Level A or C, as specified in contract or purchase order (see 6.2.1).

5.3 Preservation - packaging (for Air Force use only). The requirements for packaging shall be in accordance with MIL-STD-2073/1. Preservation shall be level A, C or commercial as specified (see 6.2.1).

5.3.1 Level A. The time totalizing meter shall be preserved and packaged in accordance with MIL-P-116, Method 1A-8 without preservation compound and cushioning to meet the drop test of MIL-P-116.

5.3.2 Level C. The time totalizing meter shall be preserved and packaged in accordance with the applicable requirements of MIL-STD-2073/1.

5.3.3 Commercial. The time totalizing meter shall be preserved and packaged in accordance with the requirements of ASTM-D-3951.

5.4 Packing (for Air Force use only). Packing shall be level A, B, C or commercial as specified (see 6.2.1).

5.4.1 Level A. The packaged time totalizing meter shall be packed in containers in accordance with PPP-B-601, overseas type; PPP-B-621, Class 2, Style 4 or PPP-B-585, Class 3, Style 2 or 3. Closure and strapping shall be in accordance with applicable container specifications except that strapping shall conform to QQ-S-781, Type I or IV, finish A. When the gross weight is greater than 200 pounds or the container length and width is 48" x 24" or greater and the weight is greater than 100 pounds, 3" x 4" skids (laid flat) shall be applied in accordance with the requirements of the container specification.

5.4.2 Level B. The packaged time totalizing meter shall be packed in fiberboard containers in accordance with PPP-B-636 class-weather resistant, style optional, special requirements. In lieu of the closure and waterproofing requirements in the appendix of PPP-B-636, closure waterproofing

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shall be accomplished by sealing all seams, corners and manufacturer's joints with waterproof packaging tape or box closure and sealing tape, two inches minimum width.

5.4.3 Level C. The level C packing for time totalizing meters shall be in accordance with the MIL-STD-2073/1 requirements for this level.

5.4.4 Commercial. The preserved time totalizing meter shall be packed in accordance with the requirements of ASTM-D-3951.

5.5 General (for Air Force use only).

5.5.1 Exterior containers. Exterior containers (see 5.4.1, 5.4.2, 5.4.3 and 5.4.4) shall be of minimum tare and cube consistent with the protection required and shall contain equal quantities of identical stock numbered items to the greatest extent practicable

5.6 Marking. In addition to any special markings required by the contract or purchase order, interior packages and shipping containers shall be marked in accordance with MIL-STD-129.

5.6.1 Reinspection dates. Reinspection marking shall be as specified by the acquiring activity. Unpacked items not in a shipping container, shall have firmly affixed thereto a tag or label with essentially the same legend (see 6.2.1).

6 NOTES

6.1 Intended use. The time totalizing meters covered by this specification are intended for use in equipment where there is a requirement for accurately recording the number of hours which the equipment has operated. These meters are suitable for use in aircraft

6.2 Ordering data.

6.2.1 Acquisition requirements Procurement documents should specify the following.

- a. Title, number and date of this specification.
- b. Number of applicable specification sheet
- c. Level of preservation, packing and marking required (see section 5).
- d. Reinspection dates (see 5.3.1).
- e. Selection of applicable levels of preservation, packaging, packing, marking and commercial or industrial (for Air Force use only) (see section 5).

6.3 Data. For information of contractors and contracting officers, any of the data specified in applicable documents listed in section 2 of this specification or referenced lower tier documents, need not be prepared for the Government and shall not be furnished to the Government unless specified in the contract or order. The data to be furnished should be listed on DD Form 1423 (Contractor Data Requirements List) which should be attached to and made part of the contract or purchase order. For Navy contracts, NAVAIR Form 4200/15 Drawings, Lists and Specifications Required should be attached where applicable.

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6.4 Qualification. With respect to products requiring qualification, awards will be made only for products which are at the time set for opening of bids, qualified for inclusion in the applicable Qualified Products List, whether or not such products have actually been listed by that date. The attention of suppliers is called to this requirement and manufacturers are urged to arrange to have the products that they propose to offer to the Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. The activity responsible for the Qualified Products List is the Commanding Officer, Naval Avionics Center, Attention: Code B/714, 6000 East 21st Street, Indianapolis, IN 46219-2189, and information pertaining to qualification of products may be obtained from that activity.

6.5 Changes from previous issue. Asterisks are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

6.6 Definitions.

6.6.1 Voltage. All alternating current voltages as used in this specification will be considered to be root mean square (rms) values.

6.6.2 Hermetic seal. A hermetic seal is defined as a perfectly closed and airtight seal made between either vitric or metallic, or both materials. A hermetic seal is not intended to include seals accomplished by gaskets. Other materials may be used to effect a hermetic seal, provided the criteria of 3.8.13 and 4.6.13 are met.

6.7 Mounting. Meters are designed to be visibly mounted in equipment so that the readout is parallel to the bottom surface of the equipment.

6.8 Subject term (key word) listing.

Aircraft  
Hermetic seal  
Meter, time totalizing

Custodians:  
Army - AR  
Navy - AS  
Air Force - 99

Preparing activity:  
Navy - AS  
(Project No. 6645-0385)

Review activities:  
Army - ER, MI, ME