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30 September 1975
SUPERSEDING
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MILITARY SPECIFICATION

MANOMETERS, U-TUBE AND CURVED-TUBE

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

1. SCOPE

1.1 Scope. This specification covers manometers for determining positive pressure, vacuum, and pressure differentials in linear inches.

* 1.2 Classification. Manometers shall be of the following types, sizes, and styles, as specified (see 6.2.1):

Type I - U-tube.
Size 1 - Range 15-0-15 inches.
Size 2 - Range 5-0-5 inches.
Type II - Curved-tube.
Style A - Smooth bend, with logarithmic graduated scale.
Size 3 - Range 0-3 inches.
Size 4 - Range 0-7 inches.
Style B - Abrupt bend, with two straight portions, each having arithmetic graduated scale.
Size 5 - Range as specified.

2. APPLICABLE DOCUMENTS

2.1 The following documents, of the issue in effect on date of invitation for bids or request for proposal, form a part of the specification to the extent specified herein.

SPECIFICATIONS

FEDERAL

PPP-B-601 - Boxes, Wood, Cleated-Plywood.
PPP-B-636 - Boxes, Shipping, Fiberboard.

FSC 6685

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MILITARY

MIL-P-116 - Preservation-Packaging, Methods of.
MIL-T-704 - Treatment and Painting of Materiel.

STANDARDS

MILITARY

MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes.
MIL-STD-129 - Marking for Shipment and Storage.
MIL-STD-130 - Identification Marking of U. S. Military Property.

(Copies of specifications, standards, and publications required by suppliers in connection with specific procurement functions, should be obtained from the procuring activity or as directed by the contracting officer.)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

NATIONAL BUREAU OF STANDARDS (NBS)

Handbook H28 - Screw-Thread Standards for Federal Services.

(Application for copies should be addressed to the Superintendent of Documents, Government Printing Office, Washington, DC 20402.)

NATIONAL MOTOR FREIGHT TRAFFIC ASSOCIATIONS, INC., AGENT

National Motor Freight Classification.

(Application for copies should be addressed to the American Trucking Association, Inc., Tariff Order Section, 1616 P Street, N.W., Washington, DC 20036.)

UNIFORM CLASSIFICATION COMMITTEE, AGENT

Uniform Freight Classification.

(Application for copies should be addressed to the Uniform Classification Committee, Tariff Publishing Officer, Room 1106, 222 South Riverside Plaza, Chicago, IL 60606.)

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Technical society and technical association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.

3. REQUIREMENTS

* 3.1 Description. The manometers shall be designed to be used with any of the commercial indicator fluids for determining positive pressure, vacuum, and pressure differentials. All parts subject to wear, breakage, or distortion shall be accessible for adjustment, replacement, and repair.

3.1.1 Type I. Type I shall be of the vertical type, with straight indicating tubes. Size 1 shall be adaptable for mounting on a wall or table stand; size 2, for wall-mounting only.

3.1.2 Type II. Type II shall be of the inclined-vertical type, with a curved tube. The lower portion of the tube has a slight inclination from horizontal to provide low-range accuracy. The upper portion of the tube has a slight inclination from vertical to provide high capacity.

* 3.1.2.1 Style A. Style A shall consist of an indicating tube curved in a smooth bend throughout its entire length, and calibrated logarithmically with uneven graduations. Style A shall be for wall-mounting only.

* 3.1.2.2 Style B. Style B shall be similar to style A, except that the curve shall be an abrupt bend, thus forming two straight-tube portions at an angle to each other. Each straight portion shall be independently arithmetically calibrated with even graduations. Style B shall be adaptable for wall-mounting. When specified (see 6.2.1), table-stand mounting shall be provided.

* 3.2 First article. When specified (see 6.2.1), the contractor shall furnish a manometer for first article inspection and approval (see 4.3 and 6.3).

3.3 Standard commercial product. The manometers shall, as a minimum, be in accordance with the requirements of this specification and shall be the manufacturer's standard commercial product. Additional or better features which are not specifically prohibited by this specification, but which are a part of the manufacturer's standard commercial product shall be included in the manometers being furnished. A standard commercial product is a product which has been or will be sold on the commercial market through advertisements or manufacturer's catalogs or brochures, and represents the latest production model(s).

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3.4 Material. All material shall be new and unused. All material shall be as specified herein. Material not specified shall be of the same quality used for the intended purpose in commerical practice. Materials shall be free from defects which would adversely affect the performance or maintainability of individual components or the overall assembly.

* 3.5 Interchangeability. All manometers of the same classification furnished with similar options under a specific contract shall be identical to the extent necessary to insure interchangeability of component parts, assemblies, accessories, and spare parts. All threaded parts shall comply with Handbook H28.

* 3.6 Performance. The manometer shall indicate positive pressure, vacuum, and pressure differentials in linear inches of indicator fluid. The manometer shall measure differential pressure within the minimum range indicated in table I. The manometer shall withstand, without damage or leakage, an internal pressure not less that 100 pounds per square inch gage (psig).

Table I. Minimum differential pressure range

Size	Linear inches of indicating fluid (psig)
1	0 to 30
2	0 to 10
3	0 to 3
4	0 to 7
5	as specified

* 3.7 Construction. The manometer shall be complete and usable for operation. Type I shall consist of frame, clean-out head or tube, graduated scale, and U-tube. The mounting stand shall be furnished with size 1 manometers. Type II manometers shall include housing, reservoir, curved-tube, and applicable components of type I manometers.

* 3.7.1 Frame. The frame shall be metal or plastic. Metal frames shall be corrosion resistant or have a corrosion-resistant finish. All frames shall have provisions for wall-mounting. The frame for the size 1 manometer shall permit mounting in the table stand. When a table stand is required for the style B manometer, the frame shall include provision for mounting in the stand.

* 3.7.2 Cleanout head or tube connector. The cleanout head or tube connector shall be corrosion-resistant steel, and shall be removable

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without the use of special tools to permit cleaning and replacing the tube. The head shall have a female pressure connection. The pressure connection shall be connected to the inlet for tube ends. The cleanout head shall be secured to the frame by clamp or screw providing an air-tight connection between the head inlet and the tube end. Tube connectors, if furnished, shall provide an air-tight connection between indicating tube and connecting tubing.

* 3.7.3 Tube. The U-tube shall be borosilicate glass or plastic. Unless otherwise specified (see 6.2.1), the curved tube shall be cellulose acetate butyrate. The tube shall be clear, free of scratches, bubbles, and fog to permit an unobstructed view of the indicating fluid level, and shall withstand a minimum internal pressure of 100 psig. The tube shall be removable without the use of special tools to permit cleaning and replacement. A brush shall be provided for cleaning the tube.

* 3.7.4 Scale. The scale shall be graduated in linear inches and millimeters, and constructed of corrosion-resistant material. The scale shall be adjustable to aline the zero mark with the fluid level. The scale marking and background shall be nonglare contrast colors. The minimum range of the graduated scale for the type, size, and style manometer shall be as indicated in table II.

Table II. Minimum graduated scale range

Type	Style	Size	Range (inches)	Increments (inches)	Graduation
I	-	1	15-0-15	0.1(1)	arithmetic
I	-	2	5-0-5	0.1(1)	arithmetic
II	A	3	0-3	(2)	logarithmic
II	A	4	0-7	(2)	logarithmic
II	B	5	(3)	(3)	arithmetic

Notes: (1) Even graduations. Numerical markings at 1 inch interval. The distance from the zero index to each 1-inch graduation on the scale shall have a maximum tolerance of 0.025 inch. Each 0.1-inch graduation within each inch shall be accurate within 0.010 inch. The accuracy of the graduations shall be determined at a temperature of 80° Fahrenheit (F) ±5° F.

(2) Logarithmic graduations in increments of 0.01 inch up to 0.10 inch, and 0.1 inch above 1 inch.

(3) Range and graduations in even increments as specified (see 6.2.1).

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* 3.7.5 Table mounting stand. The table mounting stand shall be constructed of corrosion-resistant metal or metal treated to resist corrosion. Without means for fastening or attachment to the table, the stand shall rigidly hold the manometer in a stable vertical position. The base shall encompass a minimum area of 35 square inches.

* 3.7.6 Housing for type II manometers. Unless otherwise specified (see 6.2.1), the housing shall be plastic.

* 3.7.7 Reservoir for type II manometers. Unless otherwise specified (see 6.2.1), the reservoir for holding indicator fluid shall be brass plated to resist corrosion. Reservoir connections shall be provided with O-ring seals to prevent fluid leakage. Adequate means shall be provided to permit tight external connections when plastic tubing is used. Fittings shall be furnished for 1/8-inch nominal pipe size connections.

* 3.8 Indicator fluid. The type and quantity of indicator fluid to be furnished with each manometer shall be as specified (see 6.2.1).

* 3.9 Painting. All surfaces to be painted shall be free of grease, oil, scale, rust, dirt, other extraneous material, and shall be dry. Painting shall be in accordance with MIL-T-704 except as specified herein. Unless otherwise specified for Navy use (see 6.2.1), the equipment shall be treated and painted in accordance with the manufacturer's standard commercial practice.

* 3.10 Identification marking. Equipment, assemblies, and component parts shall be marked for identification in accordance with MIL-STD-130.

* 3.11 Instructions handbook. When specified (see 6.2.1 and 6.4), the supplier shall furnish the quantity of handbooks specified in the contract. The handbook shall contain operating instructions, drawings, illustrations, parts list, and safety precautions to insure proper operation and maintenance of the manometer. A list of indicating fluids shall be included for use with the manometer, with the specific gravity and the freezing or congealing point of each fluid, and factors for converting scale readings in inches to pressure in psig.

* 3.11.1 Conversion-factor table. A conversion-factor table, independent of the instructions handbook, shall be furnished with each manometer. The table shall comprise the conversion factors of 3.11 and shall be imprinted or otherwise indelibly inscribed on a plate or card, suitable for attaching to a surface in the proximity of the manometer.

* 3.12 Workmanship. Workmanship shall be of the highest grade in accordance with good commercial practice for this type of equipment.

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4. QUALITY ASSURANCE PROVISIONS

* 4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier may use his own or any other facilities suitable for the 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.

* 4.2 Classification of inspection. The inspection requirements specified herein are classified as follows:

(a) First article inspection.
(b) Quality conformance inspection.
(c) Preparation for delivery inspection.

* 4.3 First article inspection. First article inspection shall be performed on one of each type, size, and style manometer when a first article sample is required (see 3.2). This inspection shall include the examination of 4.5 and tests of 4.6. The first article may be a standard production item from the supplier's current inventory provided the manometer meets the requirements of this specification and is representative of the design, construction, and manufacturing technique applicable to the remaining manometers to be furnished under the contract.

* 4.4 Quality conformance inspection. Quality conformance inspection shall include the examination of 4.5 and the test of 4.6.

* 4.4.1 Inspection lot. A lot shall consist of all manometers of the same type, size, and style offered for delivery to the Government at one time under a specific contract.

* 4.4.2 Sampling for examination. A random sample of manometers shall be selected from each lot in accordance with inspection level II of MIL-STD-105. The Acceptable Quality Level (AQL) shall be 1.5 percent defective.

* 4.4.3 Sampling for tests. A random sample of manometers shall be selected from each lot in accordance with MIL-STD-105 at inspection level S-2. The AQL shall be 4.0 percent defective.

* 4.5 Examination. Each sample selected in accordance with 4.4.2 shall be examined for compliance with the requirements specified in

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section 3 of this specification. This element of inspection shall encompass all visual examinations and dimensional measurements.

4.6 Tests. Each sample shall be tested as specified in 4.6.1 and 4.6.2.

4.6.1 Scale accuracy. The manometer shall be tested in a room having a temperature of 80° ±5° F. The graduated scale of type I manometers shall be checked against a standard measuring device having an accuracy of 0.001 inch at any reading. The distances from the zero index to each 1-inch scale graduation, and the 1/10-inch graduations within each 1-inch increment shall be checked to determine compliance with 3.7.4. The type II manometers shall be given a comparable test.

4.6.2 Pressure test. The manometer tube shall be filled with water, and one pressure connection shall be plugged. The other pressure connection shall be attached to a source of air pressure by means of 5/16-inch inside diameter air hose 10 feet in length. A pressure gage having an accuracy 0.25 percent shall be inserted in the air hose. A pressure of 100 psig shall be applied for 10 minutes. During this period no pressure drop shall be indicated on the gage. After the test the manometer shall be examined to determine compliance with 3.6.

4.7 Preparation for delivery inspection. The packaging, packing, and marking of the manometers shall be inspected to verify conformance to the requirements of section 5.

5. PREPARATION FOR DELIVERY

5.1 Packaging. The packaging shall be level A, or C, as specified (see 6.2.1).

5.1.1 Level A.

* 5.1.1.1 Manometers. Each manometer shall be packaged in accordance with MIL-P-116, method III, in a fiberboard box conforming to PPP-B-636, W5c or W6c. The box shall be waterproof sealed with tape in accordance with the appendix to the box specification, method V closure.

* 5.1.1.2 Indicator fluid. Indicator fluid furnished in commerical containers shall be packaged in accordance with MIL-P-116, method III.

* 5.1.1.3 Technical publications. Technical publications, when furnished, shall be packaged in accordance with MIL-P-116, method IC-1.

5.1.1.4 Consolidated packaging. The manometer, indicator fluid, and technical manuals shall be packaged in a fiberboard box conforming

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to PPP-B-636, class weather-resistant. Cushion shall be provided to prevent movement. The box shall be closed in accordance with the appendix to the box specification, method V.

* 5.1.2 Level C. The manometers and technical publications, when furnished, shall be packaged in a manner that will insure adequate protection against deterioration and damage during shipment. This level may conform to the supplier's commercial practice when such meets the requirements of this level.

5.2 Packing. Packing shall be level A, B, or C, as specified (see 6.2.1).

* 5.2.1 Level A. Manometers shall be packed in close-fitting boxes conforming to PPP-B-601, overseas type; or PPP-B-636, grade V2s or V3s. The contents shall be cushioned, blocked, and braced to prevent movement inside the containers or damaging of the contents.

* 5.2.2 Level B. Manometers shall be packed as specified for level A, except boxes shall conform to PPP-B-601, domestic type; or PPP-B-636, grade V3c.

* 5.2.3 Level C. The manometers shall be packed in a manner which will insure arrival at destination in a satisfactory condition and which will be acceptable to the carrier at lowest rates. Packing shall comply with Uniform Freight Classification rules or National Motor Freight Classification rules.

* 5.3 Marking. Interior packages and shipping containers shall be marked in accordance with MIL-STD-129.

6. NOTES

6.1 Intended use. The manometers covered by this specification are intended for use in determining positive pressure, vacuum, pressure differential or, when used with a pitot tube, rate of flow. The manometers may be used as liquid level gages and for calibration of pressure gages.

6.2 Ordering data. Procurement documents should specify:

6.2.1 Procurement requirements.

(a) Title, number, and date of this specification.
(b) Types, sizes, and styles of manometers required (see 1.2).
(c) When table-stand mounting is required for style B manometers (see 3.1.2.2).

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(d) When a first article is required for inspection and approval (see 3.2, 4.3, and 6.3).
(e) When the curved-tube is constructed of different material (see 3.7.3).
(f) Scale ranges, graduations, and increments for style B manometers (see 3.7.4).
(g) When the housing for type II manometers is different (see 3.7.6).
(h) When the reservoir of type II manometers is different (see 3.7.7).
(i) The type and quantity of indicator fluid required (see 3.8).
(j) When treatment and painting of equipment is different for Navy use (see 3.9).
(k) When instruction handbooks are required and the number to be furnished (see 3.11).
(l) Level of packaging and level of packing required (see 5.1 and 5.2).

* 6.3 First article. When a first article is required, it shall be tested and approved under the appropriate provisions of paragraph 7-104.55 of the Armed Services Procurement Regulation (ASPR). The first article should be the first production unit or a sample selected from the supplier's current inventory. The first article should consist of one unit. The contracting officer should include specific instructions in all procurement instruments, regarding arrangements for examination, tests, and approval of the first article.

* 6.4 Contract data requirements. When this specification is used in a procurement which incorporates a DD Form 1423 and invokes the provisions of paragraph 7-104.9(n) of the ASPR, the data requirements identified below will be developed as specified by an approved Data Item Description (DD Form 1664) and delivered in accordance with the Contract Data Requirements List (DD Form 1423) incorporated into the contract. When the provisions of ASPR 7-104.9(n) are not invoked, the data specified below shall be delivered in accordance with the contract requirements. Deliverable data required by this specification is cited in the following paragraph:

Paragraph	Data Requirements	Applicable DD 1664
3.11	Handbook, Operator's	UDI-M-24031

(Copies of Data Item Descriptions required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

* 6.5 The margin of this specification is marked with asterisks to indicate where changes (additions, modifications, corrections, deletions)

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from the previous issue were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content, irrespective of the marginal notations and relationship to the last previous issue.

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6685-0370

DOCUMENT IDENTIFIER AND TITLE
MIL-M-55023C - MANOMETERS, U-TUBE AND CURVED-TUBE

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