

NOTICE OF
CANCELLATION

INCH-POUND

MIL-G-17713D(YD)
NOTICE 1
17 January 1997

MILITARY SPECIFICATION

GAGES, LIQUID LEVEL MEASURING, TANK

Military Specification MIL-G-17713D(YD), dated 26 July 1988, is hereby canceled. Future acquisition of this material should refer to Commercial Item Description A-A-50568.

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

Custodian:
Navy - YD1

Preparing Activity:
Navy - YD1

(Project 6680-N241)

AMSC N/A

FSC 6680

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

INCH-POUND

MIL-G-17713D(YD)

26 July 1988

SUPERSEDING

MIL-G-17713C(YD)

29 March 1982

MILITARY SPECIFICATION

GAGES, LIQUID LEVEL MEASURING, TANK

This specification is approved for use by the Naval Facilities Engineering Command, Department of the Navy, and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers gages for measuring, transmitting, and indicating liquid levels of tanks.

1.2 Classification. Gages shall be of the following types as specified (see 6.2):

- Type I - Buoyant force.
- Type II - Diaphragm.
- Type III - Purge.
- Type IV - Differential pressure.
- Type V - Magnetic Float Type Indicating System.
- Type VI - Direct Reading Magnetic Flag Level Indicator.

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 (see 6.2). 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.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commanding Officer (Code 156), Naval Construction Battalion Center, Port Hueneme, CA 93043-5000, 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

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DISTRIBUTION STATEMENT A. Approved for public release; distribution is

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SPECIFICATIONS

MILITARY

- MIL-P-116 - Preservation, Methods of.
- MIL-V-173 - Varnish, Moisture- and Fungus-Resistant (for the Treatment of Communications, Electronic, and Associated Electrical Equipment).

STANDARDS

FEDERAL

- FED-STD-H28 - Screw-Thread Standard for Federal Services.

MILITARY

- MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes.
- MIL-STD-129 - Marking for Shipment and Storage.
- MIL-STD-147 - Palletized Unit Loads.
- MIL-STD-794 - Parts and Equipment, Procedures for Packaging and Packing of.

(Copies of specifications, standards, handbooks, drawings, publications, and other Government documents required by contractors 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(s) form 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 non-Government documents which is current on the date of the solicitation.

AMERICAN GEAR MANUFACTURER'S ASSOCIATION (AGMA)

- AGMA - 390.03 - Gear Handbook - Volume 1 - Gear Classification, Materials, and Measuring Methods for Unassembled Gears.
- AGMA - 201.02 - Tooth Proportions for Coarse-Pitch Involute Gears.

(Application for copies should be addresssed to the American Gear Manufacturer's Association, 1330 Massachusetts Avenue, N.W., Washington, DC 20005.)

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AMERICAN NATIONAL STANDARDS INSTITUTE, INC. (ANSI)

B31.1 - Power Piping.

(Application for copies should be addressed to the American National Standards Institute, Inc., 1430 Broadway, New York, NY 10018.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

D3951 - Packaging, Commercial.

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

70 - National Electrical Code.

(Application for copies should be addressed to the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.)

* (Non-Government standards and other publications are normally available from the organizations which prepare or which distribute the documents. These documents also may be available in or through libraries or other informational services.)

* 2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein (except for associated detail specifications, specification sheets or 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 Description. The gages shall consist of a liquid level measuring element, a means of transmitting the measurement, and an indicator. The measuring element shall be composed of materials that will not chemically react with the operating fluid. When the liquid is corrosive, or contaminated by solids that may obstruct or interfere with the normal operation of the indicator, provisions shall be made to seal the indicator from the system. The indicating element shall receive and indicate the signal from the measuring element either indirectly or directly, as specified (see 6.2). The gages shall be designed so that the tank's liquid level may be easily read. The use of compressed air or a hand pump as specified (see 6.2), may be used with type III gages.

3.2 Standard commercial product. The gage unit shall, as a minimum, be in accordance with the requirements of this specification and shall be the manufacturer's standard commercial product with any added features needed to

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comply with the requirements. 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 gage unit being furnished. A standard commercial product is a product which has been sold or is being currently offered for sale on the commercial market through advertisements or manufacturer's catalogs, or brochures, and represents the latest production model.

3.2.1 Repair parts and services. Replacement or repair parts, and service for the standard commercial product provided under this specification shall be available from the manufacturer's regular, or through commercial, parts distribution or service organizations.

3.2.2 Identification or model numbers. The standard commercial product provided under this specification shall be identifiable by the manufacturer's regular, or by commercial parts distribution or service organizations.

3.3 First article. When specified (see 6.2), the contractor shall furnish a gage of each type ordered for first article inspection and approval.

3.4 Interchangeability. All gages of the same type, 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.

3.5 Dissimilar metals. Metals dissimilar with respect to the galvanic scale shall not be used unless separated by an insulating material which will avoid electrolytic corrosion.

3.6 Design. The gages shall be capable of indicating levels of still or turbulent liquids over the entire indicating range. The gage design shall prevent conditions hazardous to personnel or deleterious to equipment and shall facilitate installation and service in the field. Screw-threads shall conform to FED-STD-H28. Instrument piping shall conform to ANSI B31.1. The gages shall be designed for the fluid properties and system conditions specified (see 6.2).

3.7 Construction. The gages shall be constructed to maintain accuracy of indication and to resist wear and corrosion. Materials for the construction of pressure-containing parts shall be selected in accordance with the operating fluid, the system operating pressure, and the system temperature. Moving parts shall be properly aligned and adequately lubricated, as applicable. Interior parts, seals, and packing shall be accessible for service. Mounting shall be either at the source or at a remote location (panel or wall type) as specified (see 6.2). When specified (see 6.2), protection from gage overrange shall be furnished. A single measuring device shall be capable of covering the entire operating range. Means shall be provided to permit filling and drainage of fluid-containing components without

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the need for disassembly of the gage unit. At the option of the manufacturer, unless definitely specified (see 6.2), type III gages shall be equipped with means of constant bleed (with or without rapid blow-down) for continuous indication, or intermittent purge to check reading.

3.8 Performance. The gage characteristics for each type shall be as specified in table I and shall operate in accordance with the requirements specified herein.

3.8.1 Accuracy. The accuracy of the measurements beyond the first major graduation on the indicator shall be within the limits specified in table I. When specified (see 6.2), the accuracy shall be within plus or minus one percent.

3.9 Components.

3.9.1 Measuring element. The measuring element shall be inherently resistant to corrosion and of the type specified in table I. This element shall accurately and instantaneously measure the liquid level by means of the static pressure, buoyant force, magnetically actuated reed switch, or displacement principle and shall include, when applicable, compensation for variations in pressure and temperature. The element shall be furnished for indoor or outdoor service (see 6.2) and shall not result in failure due to normal system variations. The cable for the type I gage shall be taut, non-twisting, and non-stretching. Capillary tubes for type II gages shall have a maximum inside diameter of 0.80 inches. The bubble pipe for the type III gage shall be positioned so that the maximum liquid rise in the pipe will be at least one inch below the air connection to the pipe. Depending on tank conditions, the type IV gage may be designed to indicate the liquid level by means of a suitable datum pressure and either the total tank pressure, the vapor pressure above the liquid, or the liquid pressure. When the vapor pressure above the liquid is selected to provide a differential pressure with a datum pressure, an equalizing tube shall be provided. Condensing, seal, or surge chambers shall be furnished when necessary to meet the specified requirements. Type V shall be flanged or bracket mounted rigid pipe mounted in such a way as to provide free movement of the float within the tank or vessel. Type VI shall be rigidly mounted pipe external from the tank and mounted in such a way as to provide visual access to the indicating element.

* **3.9.2 Measuring transmitter.** The measured level shall be transmitted from the measuring element to the indicator either directly or indirectly by mechanical, electrical, hydraulic, or pneumatic means. When transmission is electrical, the transmission shall conform to the applicable portions of NFPA 70. Transmission shall be accomplished with minimum resistance, pressure drop, or lost motion, in accordance with the accuracy requirements specified. The transmitter shall be designed to operate over the entire range of measurements indicated, and shall not be adversely affected by normal system variations.

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*TABLE I. Gage types and characteristics.

Character- istics	Type I	Type II	Type III	Type IV	Type V	Type VI
Operating fluid	Corrosive, viscous & solids bearing	Corrosive, viscous & solids bearing	Corrosive, viscous & solids bearing	Non-viscous liquids	Corrosive, viscous	Corrosive non viscous
Static pressure range	0-3,000 psi	0-150 psi	0-75 psi	0-3,000 psi	0-3,000 psi	0-750 psi
Maximum temperature	180°F	275°F	180°F	150°F	225°F	750°F
Measuring element	Float & float arm, cable	Diaphragm	Bubble pipe	Manometric device	Magnetic float	Float/rig pipe
Direct trans- mission	Mechanical linkage	Fluid pressure	Inert gas, compressed air	Magnetic, mechanical	Electro- mechanical/ reed switch	Magnetic visual
Tank condition	Vented or under pressure	Vented or under pressure	Vented or under pressure	Vented or under pressure	Vented or under pressure	Vented or under pressure
Level change limits*	0-100 ft H ₂ O	0-200 ft H ₂ O	0-100 ft H ₂ O	10 inch to 40 ft H ₂ O	0-500 ft H ₂ O	0-100 ft H ₂ O
Temperature compensa- tion	Above 120°F or as required	Above 120°F	Above 160°F	Above 700 psi	N/A	N/A
Pressure compensation	N/A	N/A	N/A	Above 1,500 psi	N/A	N/A
Accuracy	± 3%	± 3%	± 3%	± 3%	± 1%	± 3/8 in
Remote transmission limit	250 ft (10,000 ft for electric)	1,000 ft	1,000 ft	5,000 ft for electric	10,000 ft	10,000 ft

*Gage types are operable under conditions within the limits indicated. Operation for purpose of this specification is not necessarily intended to extend over the entire range indicated. Typical requirements for level measuring applications within the above limits are noted in section 6. Actual range of operating conditions shall be as specified (see 6.2).

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* 3.9.3 Indicator. The indicator shall clearly indicate the liquid level measured, be adjustable, balanced and aligned, enclosed in a dust-proof housing, and designed for minimum friction, lost motion, and moisture contamination. Length and graduation shall be as specified (see 6.2). Unless otherwise specified (see 6.2), calibration shall be made at midscale. When the indicator is of the liquid-containing type, it shall be leak-tight, equipped with a drain, and constructed of materials that avoid deterioration due to corrosion. Provisions shall be made to enable the indicator to retain the liquid when the indicator range has been exceeded. Operation of the indicator shall be by the same means that are employed in operation of the transmitter. Indicator performance shall not be affected by system variations or slight distortion of the housing.

3.9.4 Bearings. Bearings provided in any of the gage components shall be the sealed-for-life anti-friction type, designed for long life and resistance to wear.

3.10 Fastening devices. All screws, pins, bolts, and similar parts shall be installed with means for preventing loss of tightness. When subject to removal or adjustment, such parts shall not be swaged, peened, staked, or otherwise permanently deformed.

* 3.11 Treatment and painting. Unless otherwise specified (see 6.2), the gages shall be treated and painted in accordance with the manufacturer's standard practice. All surfaces of the gages other than corrosion-resisting steel shall be protected against corrosion and present a neat appearance.

3.12 Electrical equipment. When electrical operation is required, input characteristics and connections shall be as specified (see 6.2).

3.13 Pneumatic and hydraulic equipment. Unless otherwise specified (see 6.2), each instrument located at measuring source, shall be furnished with integral piping for installation into an existing system. Unless otherwise specified (see 6.2), continuous length tubing shall be provided. When specified (see 6.2), tubing shall be encased in a sheath. Fluid characteristics and connections shall be as specified (see 6.2). Piping connections shall be as specified (see 6.2).

3.14 Gearing. Spur gears and pinions used in any of the meter components shall be machined in the "inch" system and shall conform to the dimensions and tolerances of AGMA 201.02. Where helical, herringbone, bevel, or worm gearing is used, the dimensions and tolerances shall conform to AGMA 390.03. Operation of gears shall be smooth and free of vibration.

3.15 Frost protection. When specified (see 6.2), gages shall be furnished with a frost-protection device to yield under normal freezing conditions and reduce damage to the other gage parts.

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3.16 Fungus resistance. When specified (see 6.2), electrical components and circuit elements, including terminal and circuit connections shall be coated with varnish conforming to MIL-V-173, except that:

- a. Components and elements inherently inert to fungi or in hermetically sealed enclosures need not be coated.
- b. Current-carrying contact surfaces, such as relay contact points, shall not be coated.

3.17 Workmanship. The quality of workmanship shall be such as to produce gages that are in accordance with the requirements of this specification and so constructed as to insure the proper functioning of all parts of the unit.

3.17.1 Machine work. Tolerances for contact and bearing surfaces shall conform to standard prevailing among manufacturers normally producing units of this type.

3.17.2 Castings and forgings. Castings and forgings shall be sound and free from patching, misplaced coring, warping, or other defects that may render the castings or forgings unsound for use. Repair processes, such as welding, peening, plugging, or filling with cold solder or metallic paste, shall not be attempted without authorization from the contracting officer.

3.17.3 Surface finish. All surfaces of castings, forgings, molded parts, stamping, and welded parts shall be cleaned and made free of sand, dirt, fins, sprues, scale, flux, or other extraneous materials. External surfaces shall be smooth and all edges shall be either rounded or beveled.

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 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.

* 4.1.1 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 that 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.

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4.1.2 Component and material inspection. Components and materials shall be inspected in accordance with all the requirements specified herein and in applicable referenced documents.

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

- a. First article inspection (see 4.2.1).
- b. Quality conformance inspection (see 4.2.2).

* 4.2.1 First article inspection. The first article inspection shall be performed on one gage of each type ordered when a first article sample is required (see 3.3). This inspection shall include the examination of 4.5 and the tests of 4.6. The first article may be either a first production item or a standard production item from the supplier's current inventory provided the item meets the requirements of the specification and is representative of the design, construction, and manufacturing technique applicable to the remaining items to be furnished under the contract.

4.2.2 Quality conformance inspection. The quality conformance inspection shall be performed on the sample gages selected in accordance with 4.4. This inspection shall include the examination of 4.5, the tests of 4.6, and the packaging inspection of 4.7.

4.3 Inspection lot. All units of the same type, offered to the Government at one time, shall be considered a lot, for purposes of inspection. The sample unit shall be one complete gage.

4.4 Sampling.

4.4.1 Sampling for examination. A random sample of gages shall be selected from each lot offered to the Government in accordance with MIL-STD-105 at inspection level II. The acceptable quality level shall be 2.5 percent defective for major defects and 4.0 percent defective for minor defects.

4.4.2 Sampling for tests. A random sample of gages shall be selected from each lot offered to the Government in accordance with MIL-STD-105 at inspection level S2. The acceptable quality level shall be 2.5 percent defective.

* 4.5 Examination. Each unit shall be examined for defects listed in table II. Each attribute within each classification of multiple defects shall constitute one defect.

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TABLE II. Classification of defects.

Classification	Defects
Critical	
Major:	
101	Missing, broken or improper parts.
102	Gage not rated in accordance with system requirements.
103	Screw-threads and piping not as specified.
104	Like parts not interchangeable.
105	Materials not as specified.
106	Wearing parts not accessible for service.
107	No drain or means for filling in fluid-containing components.
108	Failure to maintain accurate indication.
109	Components not as specified.
110	Improper electrical end piping connections.
Minor:	
201	Bearing selection not as specified.
201	Improper castings or forgings.
201	Improper fastening devices.
201	surface finish not as specified.
205	Painted surfaces scratched or not completely covered.

4.6 Tests. Each unit selected in accordance with 4.4.2 shall be tested, and any unit failing to pass the following tests, as applicable, shall be rejected.

4.6.1 Indication test. The gage shall be operated over its entire range for three complete cycles. For each cycle, the gage shall be checked for accuracy at the low-, mid- and high-point of the operating range. When facilities are not available to test the gage under the system operating conditions, simulations of these conditions may be accomplished, providing the test results are corrected to reflect the specified fluid properties, the tank static pressure, and the environmental conditions existing at the measurement tank.

4.6.2 Component test. Instrument piping shall be tested in accordance with ANSI B31.1.

4.7 Packaging inspection. The preservation, packing, unitization, and marking of the item shall be inspected to verify conformance to the requirements of section 5.

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5. PACKAGING

5.1 Preservation. Preservation shall be level A, B, or commercial as specified (see 6.2).

5.1.1 Level A.

5.1.1.1 Methods of preservation. Method of preservation and application of preservatives shall conform to the general requirements of MIL-P-116 and any applicable specifications.

5.1.1.2 Cleaning and drying. Prior to the application of preservative compounds or paint, surfaces shall be cleaned by process C-1 and dried by any applicable procedure of MIL-P-116.

5.1.1.3 Unit pack. Each gage shall be preserved method IC-2.

5.1.2 Level B.

5.1.2.1 Unit pack. Each gage shall be preserved same as level A except that the unit pack shall be method III.

* 5.1.3 Commercial. Material shall be packaged in accordance with ASTM D3951.

5.2 Packing. Packing shall be level A, B, or Commercial as specified (see 6.2)

5.2.1 Levels A and B. Packing shall be in accordance with MIL-STD-794. Containers shall be selected from table II for the appropriate level.

* 5.2.2 Commercial. Material shall be packed in accordance with ASTM D3951.

5.3 Palletization. Material shall be palletized in accordance with MIL-STD-147 when the following criteria is met:

- a. Load to consist of four or more unskidded containers; and,
- b. Load shall utilize a minimum of 80 percent of the pallet base.

5.4 Marking. Marking shall be in accordance with MIL-STD-129.

6. NOTES

6.1 Intended use. The gages specified herein are used primarily to indicate levels in de-aerating tanks, condensate storage and return tanks, hot water expansion tanks, lubricating oil and fuel oil tanks, acid storage tanks, and caustic storage tanks. Typical condensate tank operating conditions are 2 pounds per square inch (psi) at 220 degrees Fahrenheit (°F). Operating capability shall be at a range that extends to 30 psi at 275°F.

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6.2 Ordering data. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. Type gage required (see 1.2 and table I).
- c. When specifications and standards shall be other than as specified (see 2.1.1).
- d. Whether measurement is direct or indirect, and whether compressed air or a hand pump is available for type III gages (see 3.1).
- e. When a first article is required for inspection and approval (see 3.3).
- f. Fluid density, pressure, and temperature; static pressure, tank height, range of level measurement, and tank pressure specified (see 3.6 and table I).
- g. Whether gage is to be remotely mounted or mounted at the measurement source; whether wall or panel mounting is required; whether protection from gage overrange is to be furnished, and whether continuous indication (with or without rapid blow-down) or intermittent purge is required (see 3.7).
- h. When gage accuracy is plus or minus one percent is required (see 3.8.1).
- i. Whether measuring element shall be for indoor or outdoor service (see 3.9.1).
- j. Length and graduation required and indicator calibration if other than specified (see 3.9.3).
- k. Treatment and painting, if different than specified (see 3.11).
- l. If electrical operation is required; electrical input characteristics and connections required (see 3.12).
- m. When integral piping is not required, and whether continuous length tubing need not be furnished; whether tubing shall be encased in sheath; fluid characteristics and connections required; and piping connections required (see 3.13).
- n. Frost protection, if required (see 3.15).
- o. Fungus-proofing requirements, if required (see 3.16).
- p. Level of preservation and level of packing required (see 5.1 and 5.2).

6.3 Options. Since overall accuracy of the gages specified are governed by the type measurement, method of transmission, and indicator location, a complete gage unit arranged as recommended by the manufacturer should be provided for the intended system application. Type I gages are essentially unaffected by changes in the fluid specific gravity, and may be used on tanks where there is sufficient installation clearance. Type II gages are suitable for use when purge air, gas, or liquid is not available, or where its use is undesirable. For type III gages, a hand pump is recommended for open or vented tanks or non-vented tanks when the over the liquid pressure does not exceed 5 psi, or when the head of the fluid does not exceed 20 psi, or when the indicator is not more than 250 feet from the tank. Type IV gages are normally furnished when it is convenient to make use of the liquid static pressure acting on various type indicating elements such as spiral, diaphragm, or bellows. Type V gages are unaffected by depth, density, operating

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temperatures and pressures and may be used on tanks where there is sufficient installation clearance. Type VI gages are used when direct tank penetration is not possible and when a remote electrical output is not required.

6.4 Contract data requirements. When this specification is used in an acquisition which incorporates a DD Form 1423 and invokes the provisions of paragraph 7-104.9(n) of the Defense Acquisition Regulations (DAR), the data requirements will be developed as specified by an approved Data Item Description (DD Form 1664) and developed in accordance with Contract Data Requirements List (DD Form 1423) incorporated into the contract. When the provisions of the DAR 7-104.9(n) are not invoked, the data shall be delivered in accordance with the contract requirements.

6.5 First article. When the first article is required, it shall be tested and approved under the appropriate provisions of paragraph 7-104.55 of the DAR. The first article should be a first production item consisting of one complete gage or it may be a standard production item from the contractor's current inventory as specified in 4.2.1. The contracting officer should include specific instructions in all acquisition instruments regarding arrangement for examinations, tests, and approval of the first article.

* 6.6 Subject key word listing.

Buoyant force.
Diaphragm.
Purge.
Magnetic float.
Differential pressure.

6.7 Changes from previous issue. The margins of this specification are marked with an asterisk to indicate where changes (additions, modifications, corrections, deletions) 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.

Custodian:
Navy - YD

Preparing activity:
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