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INCH-POUND
MIL-F-24291C(SH)
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MILITARY SPECIFICATION

FLOWMETER, FLUID ELECTROMAGNETIC TYPE

This specification is approved for use by the Naval Sea Systems 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 applies to electromagnetic type fluid flowmeters for use in fresh water, seawater, or any fluid of conductivity at least 0.01 siemens per meter. These flowmeters are not to be used in new construction. Only one classification of flowmeters is covered by this specification.

2. APPLICABLE DOCUMENTS

2.1 Government Documents.

2.1.1 **Specifications, standards, and handbooks.** The following specifications, standards, and handbooks, form a part this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Naval Sea Systems Command, SEA 55Z3, Department of the Navy, Washington, DC 20362-5101, 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 6680

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SPECIFICATIONS

FEDERAL

PPP-F-320	Fiberboard: Corrugated and Solid, Sheet Stock (Container Grade) and Cut Shapes

MILITARY

MIL-S-901	Shock Tests, HI (High-Impact); Shipboard Machinery, Equipment and Systems, Requirements for
MIL-E-2036	Enclosures for Electric and Electronic Equipment
MIL-P-15024	Plates, Tags and Bands for Identification of Equipment
MIL-P-15024/5	Plates, Identification
MIL-E-16400	Electronic, Interior Communication and Navigation Equipment, Naval Ship and Shore: General Specification for
MIL-T-16420	Tube, Copper-Nickel Alloy, Seamless and Welded (Copper Alloy Numbers 715 and 706)
MIL-L-19140	Lumber and Plywood, Fire-Retardant Treated
MIL-R-28803	Readouts, Segmented, General Specification for

STANDARDS

MILITARY

MIL-STD-22	Welded Joint Design
MIL-STD-108	Definitions of and Basic Requirements for Enclosures for Electric and Electronic Equipment
MIL-STD-167-1	Mechanical Vibrations of Shipboard Equipment (Type I Environmental and Type II - Internally Excited)
MIL-STD-278	Welding and Casting Standard
MIL-STD-454	Standard General Requirements for Electronic Equipment

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MIL-STD-461	Electromagnetic Emission and Susceptibility Requirements for the Control of Electromagnetic Interference
MIL-STD-462	Electromagnetic Interference Characteristics, Measurement of
MIL-STD-470	Maintainability Program for Systems and Equipment
MIL-STD-471	Maintainability Verification/Demonstration/Evaluation
MIL-STD-781	Reliability Testing for Engineering Development, Qualification, and Production
MIL-STD-785	Reliability Program for Systems and Equipment Development and Production
MIL-STD-810	Environmental Test Methods and Engineering Guidelines
MIL-STD-1388-1A	Logistic Support Analysis
MIL-STD-1399 Section 300A	Interface Standard for Shipboard Systems Electric Power, Alternating Current (Metric)

HANDBOOK

MILITARY

MIL-HDBK-217	Reliability Prediction of Electronic Equipment

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Naval Publications and Forms Center, (ATTN: NPODS), 5801 Tabor Avenue, Philadelphia, PA 19120-5099.)

2.1.2 Other Government documents, drawings, and publications. The following other Government documents and drawings form a part of this specification to the extent specified herein. Unless otherwise specified, the issues shall be those in effect on the date of the solicitation.

DRAWINGS

NAVAL SEA SYSTEMS COMMAND (NAVSEA)

NAVSHIPS NO.

810-1385861	Flanges, Sea Water 700 PSI Max

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(Application for copies should be addressed to Commander, Portsmouth Naval Shipyard, Code 202.2, Portsmouth, NH 03801.)

PUBLICATIONS

NAVSEA

0981-LP-052-8090 Cable Comparison Guide Pertaining to Electric Shipboard Cable

(Application for copies should be addressed to the Naval Publications and Forms Center, (Attn: NPODS), 5801 Tabor Avenue, Philadelphia PA 19120-5099.)

2.2 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document shall take precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 First article. When specified (see 6.2), a sample shall be subjected to first article inspection (see 6.5) in accordance with 4.4.

3.2 Description. The electromagnetic (EM) flowmeter system (see 6.3) shall sense, measure, and display rate of flow, total flow, and direction of the flow through the flow sensor. An EM flowmeter system shall consist of the following components:

a. *Flow sensor:* Produces an electrical output that represents average flow rate of the liquid (see 3.4)

b. *Indicator transmitter:* The signal conditioner portion of the flowmeter system (see 3.5)

c. *Totalizer indicator:* Provides displays for TOTAL FLOW and FLOW RATE and the operating controls for the systems (see 3.6.3 and 3.6.6.4). When specified (see 6.2) the totalizer indicator shall be combined with the indicator transmitter unit.

3.2.1 **Pipe size.** The flowmeters covered by this specification shall function as specified with nominal pipe sizes (nps) ranging from one inch nps to four inch nps (see 3.4.2 and 6.2).

3.3 General requirements.

3.3.1 Parts, materials, and processes. The selection, usage, and methods of implementation of parts, materials, and processes shall conform to MIL-E-16400.

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3.3.2 Nonmetallic material. Nonmetals, when used for seals, protective finishes, and so forth, shall be moisture and flame resistant, shall not support fungus growth, and shall not be adversely affected by the ambient environments specified.

3.3.3 **Accessibility.** All parts and subassemblies which may require servicing, repair, or replacement during the life of the flowmeter equipment shall be readily accessible for repair or replacement.

3.3.4 **Recovered materials.** Unless otherwise specified herein, all equipment, material, and articles incorporated in the products covered by this specification shall be new and may be fabricated using materials produced from recovered materials to the maximum extent practicable without jeopardizing the intended use. The term "recovered materials" means materials which have been collected or recovered from solid waste and reprocessed to become a source of raw materials, as opposed to virgin raw materials. None of the above shall be interpreted to mean that the use of used or rebuilt products is allowed under this specification unless otherwise specifically specified.

3.3.5 **Interchangeability of removable or separable components.** Parts, subassemblies, and major assemblies of the flowmeter that are removable or separable from the equipment shall be physically and electrically interchangeable with corresponding items from stock or production. Following any such part replacement, the flowmeter equipment shall meet the requirements of this specification upon the accomplishment of the adjustments and calibration procedures that are supplied with the equipment.

3.3.5.1 Interchangeability. In no case shall parts be physically interchangeable or reversible unless such parts are also interchangeable or reversible with regard to function, performance, and strength.

3.3.6 **Safety.** Safety of flowmeter equipment shall be in accordance with requirement 1 of MIL-STD-454.

3.3.7 **Painting and color.** The flowmeter equipment and associated subunits shall be painted in accordance with MIL-E-16400 except for any surfaces or other parts where painting would impair meeting the requirements of this specification. Color shall be in accordance with MIL-E-16400.

3.3.8 **Duty cycle.** The flowmeter equipment shall be constructed for continuous operation.

3.3.9 **Power input.** The flowmeter equipment shall operate with type I, 115 volts, 60 hertz (Hz) electrical ungrounded power in accordance with MIL-STD-1399, section 300. The flowmeter shall operate and meet all the requirements and constraints of MIL-STD-1399, section 300. The equipment shall not be damaged nor require recalibration when power is interrupted and restored.

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3.3.10 Electrostatic discharge caution. When devices, such as complementary metal oxide semiconductors, that are sensitive to electrostatic discharge are used, a note on the printed circuit board or subassembly shall indicate to handle with special care due to the possibility of electrostatic discharge damage.

3.3.11 Electronic circuitry. Electronic components shall not depend on potting or dipping to provide a supporting matrix for the components. If plug-in boards are used, extender boards shall be provided and stowed in the equipment so that the plug-in boards can be made accessible for maintenance or troubleshooting.

3.3.12 Low flow rate exclusion. Flow rates less than the flow rate exclusion point shall be excluded from totalization. The low flow rate exclusion point shall be between 0.5 and 1.0 percent of the full scale flow rate.

3.3.13 Dry sensor indicator. A means shall be provided to detect when the sensor is not filled with water. An indication of this condition shall be provided on the front panel of the totalizer indicator unit (see 3.6.6.6).

3.3.14 Electrode cleaning capability. An electrode cleaning capability shall be incorporated into the flowmeter for cleaning the electrodes without removal of the sensors from the piping systems. After the cleaning test specified in 4.8.18, the flowmeter shall met the accuracy requirement of 3.10.1.

3.3.15 Reverse flow indicator. A single indicator (lamp) or light emitting diode (LED) shall be provided on the front panel of the indicator transmitter and totalizer indicator units to indicate direction of flow. The indicator shall be normally extinguished and shall light when reverse flow is detected.

3.3.16 Liquid. The liquid whose flow is to be measured shall be as specified (see 6.2).

3.3.16.1 Liquid temperature range. The flowmeter shall meet the requirements of this specification for liquid temperatures of 28 to 140 degrees Fahrenheit (°F).

3.3.17 Digital displays. Digital displays shall consist of light emitting diodes (LEDs) conforming to MIL-R-28803.

3.3.18 Display readout units. The desired units for all readouts (pounds, gallons, cubic feet) shall be as specified (see 6.2). All readouts shall display in the same unit.

3.4 Flow sensor. The flow sensor unit shall consist of metal tubing (pipe spool) with flanged ends (see 3.4.1). A watertight and nonconductive housing shall enclose the excitation coils, sensor electrodes, and associated wiring. Unless otherwise specified (see 6.2) a single electrical interface cable, 25 feet in length shall be provided with the sensor. The cable shall enter the sensor through

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a watertight connection positioned on the flow exit end of the sensor, above the sensor pipe spool. The direction of flow through the sensor shall be clearly and permanently indicated by an arrow on the outside of the sensor with the word "FLOW" printed close to the arrow.

3.4.1 Sensor pipe spool. The metal structural part (exclusive of the liner) of the sensor pipe spool shall be made of material specified in 3.4.1.1 or 3.4.1.2 as applicable. The minimum wall thickness of the pipe spool, exclusive of the liner, shall be as specified in table I. Flanges shall be welded to the tubing as specified in 3.4.1.3.1. The pipe spool shall have an electrically insulating liner as specified in 3.4.1.4 securely bonded along the entire length. The inside diameter of the liner shall be as specified in table I.

TABLE I. *Sensor Pipe spool characteristics.*

Flange size nps (inches)	Liner id plus or minus 0.005 (inches)	Minimum wall thickness metal pipe spool (inches)
1	1.125	0.095
1-1/4	1.470	0.120
1-1/2	1.682	0.120
2	2.135	0.134
2-1/2	2.607	0.165
3	3.170	0.180
3-1/2	3.640	0.203
4	4.094	0.203

3.4.1.1 Material (submarine applications). For each lot of material offered for submarine applications the metallic structural part of the sensor pipe spool shall be level 1 Certified Material (see 6.3).

3.4.1.2 Material (surface ship applications). The metallic structural part of the sensor pipe spool shall consist of one integral length of 70-30 copper-nickel tubing conforming to type I, class 700, grade II of MIL-T-16420.

3.4.1.3 Pipe spool flanges. Spool flanges shall be forged 70-30 copper-nickel flat face type in accordance with Drawing 810-1385861.

3.4.1.3.1 **Welding.** The flow sensor tube to flange welding joint shall conform to P10 of MIL-STD-22 and shall be fabricated and welded in accordance with MIL-STD-278.

3.4.1.4 Spool Liner. The spool liner shall provide electrical isolation of the liquid being monitored from the metallic spool.

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3.4.1.5 Sensor electrodes. Sensor electrodes shall not protrude more than 1/8 inch beyond the internal diameter of the liner.

3.4.1.5.1 Material. Sensor electrodes shall be fabricated from 70-30 copper-nickel alloy.

3.4.1.6 Flow range. The sensor flow range shall be equivalent to a velocity range of 1 to 15 feet per second through the liner (see table I for liner internal diameter (id)).

3.4.2 Size of flow sensor unit. The size of the flow sensor shall be as shown in table I. The sensor spool length (face to face distance between the sensor spool flanges) shall be 22 inches unless otherwise specified (see 6.2). The maximum outside width of the housing shall be 16 inches.

3.4.3 Sensor electrical housing. The sensor enclosure shall enable the flowmeter to meet the watertight requirements as specified in MIL-STD-108. When specified (see 6.2), the sensor electrical housing and fittings shall be explosion proof and submersible up to 50 pounds per square inch (lb/in^2) in accordance with MIL-E-2036.

3.4.4 Sensor electrical requirements. The power requirements shall not exceed 200 watts and the input volt-amperes shall not exceed 600. The sensor signal shall transmit a distance of at least 300 feet. Cable type shall be selected from NAVSEA 0981-LP-052-8090. A junction box may be used to facilitate connecting the flow sensor cable specified in 3.4 to the indicator transmitter input cable.

3.5 Indicator transmitter.

3.5.1 Electrical inputs. Electrical inputs shall be as specified in 3.5.1.1 and 3.5.1.2.

3.5.1.1 Sensor select signal. A sensor selecting signal shall be provided for the selection of one of two flow sensors.

3.5.1.2 Sensor interface signal. A flow rate signal from the selected flow sensor shall input to the indicator transmitter unit. The sensor power shall be supplied by the indicator transmitter unit.

3.5.2 Outputs. Outputs shall be as specified in 3.5.2.1 through 3.5.2.3.

3.5.2.1 Flow rate. A flow rate signal shall be provided to the totalizer indicator.

3.5.2.2 Flow total. A total flow signal shall be provided to the totalizer indicator units. If the totalizer indicator unit contains an integrator for the flow rate signal, this signal is not required.

3.5.2.3 Test jacks. Key test points shall be brought to one convenient location for rapid signal tracing for test, maintenance, or calibration.

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3.5.3 Enclosure. The enclosure shall be dripproof (45 degrees) as specified in MIL-STD-108. The maximum volume shall be 810 cubic inches.

Maximum dimensions shall be as follows:

a. Height: 10 inches
b. Width: 9 inches
c. Depth: 9 inches

3.5.3.1 Mounting. Unless otherwise specified (see 6.2), the indicator transmitter shall have provision for both bulk head mounting and panel mounting, in accordance with MIL-E-16400.

3.5.4 Indicator transmitter controls.

3.5.4.1 Front panel controls.

3.5.4.1.1 Zero-operate-test switch. The zero-operate-test switch shall provide test positions in "zero" and "test" and normal flowmeter operation in "operate" position. An associated red lamp or light emitting diode indicator shall indicate when this switch is not in the "operate" position.

3.5.4.1.2 Clean switch. The clean switch shall cause a cleaning current to be applied to the sensor electrodes in the "clean" position.

3.5.5 Indicator transmitter readouts.

3.5.5.1 Flow rate indicator. Unless otherwise specified (see 6.2), a flow rate indicator utilizing light emitting diode readouts shall be provided.

3.6 Totalizer indicator unit. The totalizer indicator unit shall provide separate readouts for flow rate in units per minute and total flow.

3.6.1 Inputs. Inputs to the totalizer indicator unit shall include, as a minimum:

a. Flow total (if required see 3.5.2.2) and flow rate signals from the indicator transmitter unit

b. Electrical power as specified (see 3.3.9)

c. Externally controlled, variable (0 to 5V) voltage for illumination devices.

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3.6.2 Outputs. Outputs of the totalizer indicator unit shall be as follows:

a. When specified (see 6.2), provision for another remote indicator for flow rate and flow total

b. Relay contacts, which actuate when the preset total has been completed, via an external connector for remote indication

c. A sensor select signal which causes either one of two sensors to be selected

d. Energizing power to other units as required.

3.6.3 Enclosure. The totalizer indicator unit enclosure shall be dripproof, (45 degrees) in accordance with MIL-STD-108. The maximum volume shall be 450 cubic inches.

Maximum dimensions shall be as follows:

a. Height: 5 inches
b. Width: 9 inches
c. Depth: 10 inches

3.6.4 Mounting. Unless otherwise specified (see 6.2), the totalizer indicator shall have provision for both bulkhead mounting and panel mounting, in accordance with MIL-E-16400.

3.6.5 Controls.

3.6.5.1 Front panel controls. Front panel controls shall include:

a. *Power switch* - Energizes and de-energizes the entire system

b. *Sensor select switch* - Selects or causes to be selected one of two flowmeter sensors

c. *Preset total switches* - Selects the preset total for a liquid transfer. This switch shall be a thumbwheel switch with at least four decimal digit capability.

d *Counter reset/preset controls* - a totalization counter reset control shall be provided to reset the flow total counter (see 3.6.6.1). Another preset-enter control shall be provided to enter the preset flow amount into the preset counter. These controls shall have means to prevent accidental actuation. When specified (see 6.2) a single reset/preset control may be used to perform both functions.

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3.6.6 Readouts and indicators.

3.6.6.1 Total flow indicator. A digital display consisting of four or more decimal digits for total flow shall be furnished.

3.6.6.2 Preset total flow indicator. A four or more place decimal digital display of the preset total flow for a liquid transfer shall be provided. This display shall be preset (see 3.6.5.1(c)) to the desired quantity of liquid to be transferred and then shall countdown toward zero as the liquid is transferred. When the count reaches zero an indicator shall be activated (see 3.6.6.3).

3.6.6.3 Preset total flow complete indicator. This indicator shall be activated when the preset total flow counter reaches zero (completion of preset liquid transfer) (see 3.6.6.2). This indicator shall be deactivated when a new preset flow amount is entered into the preset flow counter (see 3.6.5.1(d)).

3.6.6.4 Flow rate. A light emitting diode (LED) digital display with a minimum of three decimal digits shall be provided for liquid flow rate.

3.6.6.5 Indicator labeling. Indicator labels shall be provided to indicate the units (pounds, gallons, pounds X10, and so forth) which each indicator (flow total and rate) represents (see 3.3.18).

3.6.6.6 Dry sensor indicator. A red lamp or red light emitting diode indicator shall be provided on the front panel to indicate an unfilled flow sensor.

3.6.6.7 Reverse flow indicator. A red lamp or red light emitting diode indicator shall be provided on the front panel to indicate reverse flow of the liquid being measured.

3.7 Reliability. The flowmeter equipment minimum mean time between failure (MTBF) shall be 2000 hours. Reliability demonstration/prediction shall be as specified in 4.8.17.

3.8 Maintenance. The flowmeter equipment shall facilitate disassembly, assembly, location of trouble sources, and calibration and maintenance without the aid of special tools. Special tools are defined as those tools not listed in GSA Supply Catalog. All functional parts shall be readily identifiable, accessible, and removable for replacement. Functional parts are defined as individual component parts (such as discrete resistors, capacitors, and semi conductor devices) or replaceable functional assemblies (such as integrated or hybrid circuits, and power supplies). For purposes of maintenance and calibration, no mechanical or electrical disassembly shall be required except for the opening of a door or the removal of a coverplate.

3.8.1 Program. When specified (see 6.2), the contractor shall perform the maintainability tasks derived from MIL-STD-470. Logistic support analysis where required, shall be in accordance with MIL-STD-1388.

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3.8.2 Repair time. Various repair times may apply to the failure modes, but the total repair time for a maintenance event shall not exceed 2.0 hours and the mean time to repair (MTTR) shall not exceed 1.5 hours. Time to repair includes preparation, fault location, fault correction, and check out as required but does not include logistic time or administrative time.

3.8.3 Level of repair (LOR). All maintenance actions shall be accomplishable by no more than one repair technician of a grade no higher than E-4, or equivalent.

3.8.4 Maintainability Demonstration. The contractor shall demonstrate a viable (to an E-4 grade technician level) means for troubleshooting each of 10 parts of the equipment which shall be considered to have failed. The mean time required to remove and replace six parts shall be measured by actual removal and replacement of these parts, one at a time, by an E-4 grade technician level or equivalent person who has been instructed by the contractor (previous to the removal and replacement time). In lieu of months of experience with the equipment, the E-4 grade or equivalent person may be instructed just prior to the removal or replacement effort for each part, but not during the actual removal and replacement. The mean time to remove or replace the failed part shall not exceed 0.8 of the MTTR specified in 3.8.2. The equipment shall operate properly after each removal or replacement. The time required to prove the equipment operates properly shall not be included in the remove and replace time measurements.

3.8.4.1 Optional maintainability demonstration. When specified (see 6.2), a maintainability demonstration in accordance with MIL-STD-471 or parts thereof shall be required. In this case, the minimum requirements of 3.8.4 may be waived.

3.8.5 Preventive maintenance. The manufacturer of the equipment shall suggest the periodic interval between preventive maintenance actions and what these action should be.

3.8.6 Built in test equipment. Unless otherwise specified (see 6.2), built in test equipment (BITE) shall be provided in the flowmeter.

3.9 Identification plates. Flowmeter unit major assemblies shall have identification plates in accordance with type C of MIL-P-15024 and MIL-P-15024/5. Identification plates shall be brass, black, and size 5 to 9 (larger sizes preferred). No abbreviated classification code shall be assigned. An example of a unit identification plate follows for the liquid flow sensing unit:

Electromagnetic flow sensing unit in accordance with MIL-F-24291C

LIQUID _____
FLOW RANGE/UNITS _____
TECH.MAN.NAVSEA _____
NSN _____ CONTRACT _____
MFG. _____ MODEL NO. _____
SER. _____ INSP. _____

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Line 1 in the above example shall reflect the name of each major assembly unit to which the identification plate applies. The information on the other lines shall convey the characteristics (if different than that shown in the example) of the equipment subunit for which the identification plate applies. The form of the identification plate may be varied to best fit the mounting area available.

3.10 Performance requirements.

3.10.1 Flow rate range and accuracy. Unless otherwise specified (see 6.2) the minimum flow rate range shall be equivalent to zero to 15 feet per second average velocity. Fifteen feet per second (3171 pounds per minute and 369 gallons per minute for three inch pipe) shall be considered the full scale flow rate of the flowmeter. The overall system accuracy of the flow rate readouts of the flowmeter shall be as specified in table II.

TABLE II. *Flow rate range and accuracy.*

Flow rate	Flow rate readouts maximum error inaccuracy
5 to 20 percent of full scale	Plus or minus 0.7 percent of full scale
20 to 100 percent of full scale	Plus or minus 0.5 percent of full scale

3.10.1.1 Flow total accuracy. The accuracy of the total flow readouts shall be the same as for the flow rate accuracy (see 3.10.1) plus an additional error of plus or minus one least significant digit or plus or minus 0.05 percent of the total readout, whichever is greater, for the integration process.

3.10.2 Repeatability. The flowmeter shall have a repeatability of plus or minus 0.2 percent (plus or minus one least significant digit) of the actual flow rate, total, and preset total as applicable (see 4.8.2).

3.10.3 Warm-up-time. The flowmeter shall meet the accuracy requirement of 3.10.1 within five minutes after power is turned on (see 4.8.8).

3.10.4 Inclination. The flowmeter shall meet the accuracy requirement (see 3.10.1) when the indicator transmitter and totalizer indicator units are subjected to an inclination of 60 degrees in accordance with the submarine requirement of MIL-E-16400 (see 4.8.5).

3.10.4.1 Sensor orientation. The accuracy requirement of 3.10.1 shall be met with the sensors mounted in any orientation (see 4.8.5.1).

3.10.5 Supply voltage and frequency (steady state). Readout errors during the accuracy tests specified in 4.8.11 shall not exceed the limits of table II and 3.10.1.

5.2 Marking. The interior and exterior containers shall be marked

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3.10.6 Supply voltage and frequency transients.

3.10.6.1 Voltage. The total flow readout obtained in the voltage transient tests specified in 4.8.12 shall not differ from a reference test by more than one percent.

3.10.6.2 Frequency. The total flow readout obtained by the frequency transient tests specified in 4.8.12 shall not differ from a reference test by more than 0.5 percent.

3.10.6.3 Spike voltage. After the spike voltage test specified in 4.8.12.3, the flowmeter shall meet the accuracy requirement of 3.10.1.

3.10.7 Ambient temperature. The equipment shall meet the accuracy requirement of 3.10.1 at all operating temperatures (see 4.8.10.1).

3.10.8 Humidity. The flowmeter shall meet the accuracy requirement specified in 3.10.1 for all operational checks that are specified during the humidity test (see 4.8.13).

3.10.9 Salt fog. The flowmeter shall withstand the effects of the salt fog test specified in 4.8.9. After completion of the test and cleaning, no appreciable corrosion or other damage shall be evident. The flowmeter shall meet the accuracy test specified in 4.8.1 after the test.

3.10.10 Insulation resistance. The insulation resistance between electrical circuits and chassis ground, as determined in accordance with 4.8.3, shall be not less than 10 megohms.

3.10.11 Vibration. The complete system shall withstand the test specified in 4.8.14. Operating and maintenance controls shall not change settings as a result of the vibration test. There shall be no evidence of damage or loosening of parts which would interfere with the functioning of the system. After vibration, the flowmeter shall pass the accuracy test specified in 4.8.1 without adjustment of controls.

3.10.12 Shock. The complete flowmeter system shall conform to the grade A, class I, type A requirements specified in MIL-S-901. After the shock test specified in 4.8.15, but prior to any adjustments, the flow meter shall show no deviation greater than plus or minus 10 percent between the flow accuracy measurements made after the shock test compared to an accuracy test made before shock. After the shock test, the flowmeter shall adjust into the accuracy required by 3.10.1 and shall be recalibrated if necessary. There shall be no damage to any part of the flowmeter which would interfere with the functioning of the system as a result of the shock test.

3.10.13 Electromagnetic susceptibility and emission control. Flowmeter equipment shall meet the following requirements in accordance with MIL-STD-461 (see 4.8.16): CE01, CE03, CS01, CS02, CS06, CS09, RE01, RE02, RS01, RS02, RS03, except as modified below:

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a. Requirement CS02 shall be met as specified except as follows:

(1) At frequencies between two megahertz (MHz) and 30 MHz, the full output of the generator (source impedance of 50 ohms, and an output capability of 12.25 volts root mean square (rms), or three watts, when connected to a 50 ohm load) shall be applied to all power and signal leads of the test sample.

(2) The calibrating resistor, or 50 ohm load shown in the CS02 test block diagram as specified in MIL-STD-462, shall not be connected during the test.

b. Requirement RS03 shall be met as specified except that between the frequencies of 14 kilohertz (kHz) and 18 gigahertz (GHz), the electrical field strength test level shall be 10 volts per meter (V/m).

3.10.13.1 Susceptibility tests. During the susceptibility tests specified in 4.8.16.1, there shall be no deviation greater than one percent in readouts of the equipment under test between when the electromagnetic interference (EMI) generator is on, and when it is off.

3.10.13.2 Emission tests. Emissions from the flowmeter equipment under test shall be within the requirements specified MIL-STD-461 for the test specified in 4.8.16.2.

3.10.13.3 Electromagnetic interference control. Flowmeter equipment that has yet to be constructed or is to receive extensive reconstruction shall meet the requirements of 3.10.13 (see 6.3).

3.10.14 Digital readout toggling. Toggling between any two digits which renders the display unreadable shall not occur at any steady state flow input (see 4.8.6).

3.10.15 Leakage current. The flowmeter equipment shall meet the leakage current requirements of MIL-E-16400 as specified in 4.8.4.

3.10.16 Burn-in. After burn-in as specified in 4.8.20, the flowmeter shall meet the accuracy requirement of 3.10.1. The flowmeter shall be considered to have failed the test if:

a. It does not meet the accuracy requirements of 3.10.1

b. Any part, unit subassembly or plug-in circuit board requires replacement, adjustment, or calibration

c. It fails to operate continuously for the specified time.

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3.11 Workmanship. Workmanship shall be in accordance with requirement 9 of MIL-STD-454.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order (see 6.2), the contractor is responsible for the performance of all inspection requirements (examinations and tests) 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 ensure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items shall meet all requirements of section 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system (see 6.3) or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of the manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of know defective material, either indicated or actual, nor does it commit the Government to accept defective material.

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

a. First article inspection (see 4.4)
b. Quality conformance inspection (see 4.5).

4.3 Equipment configuration. The worst case equipment configuration shall be used for all tests. For example, if flowmeter equipment is to work with up to 300 feet of interconnecting cable between flow sensor and indicator transmitter unit, then 300 feet of cable shall be used.

4.4 First article inspection. First article inspection shall be performed on sample units produced with equipment and procedures normally used in production. The sample shall be subjected to the inspections specified in table III (see 6.3). The inspections shall be performed in the sequence shown except for the reliability demonstration, which may be performed on other flowmeter equipments prior to, concurrent with, or after the other first article inspections. The manufacturer may perform any test at any time as a construction check.

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4.4.1 Sample size. One flowmeter equipment of each type shall be subjected to the first article inspection.

TABLE III. *First article inspection.*

Inspection	Requirement	Inspection
Group A quality conformance inspection	See table IV	See table IV
Sensor electrode cleaning	3.3.14	4.8.18
Inclination	3.10.4	4.8.5
Digital readout toggling	3.10.14	4.8.6
Enclosure	3.4.3, 3.5.3, and 3.6.3	4.8.7
Salt Fog	3.10.9	4.8.9
Warm up time	3.10.3	4.8.8
Temperature, air	3.10.7	4.8.10.1
Temperature, liquid	3.3.16.1	4.8.10.2
Supply voltage and frequency, steady state	3.10.5	4.8.11
Supply voltage and frequency, transients	3.10.6	4.8.12
Humidity	3.10.8	4.8.13
Insulation resistance	3.10.10	4.8.3
Leakage current	3.10.15	4.8.4
Vibration	3.10.11	4.8.14
Shock	3.10.12	4.8.15
EMI	3.10.13	4.8.16
Reliability	3.7	4.8.17

TABLE IV. *Quality conformance inspection.*

Inspection	Requirement	Inspection
Group A		
General examination and operation	3.2 through 3.6.6.7 3.8 through 3.10.16	4.6
Welding inspection	3.4.1.3.1	
Hydrostatic pressure	3.4.3	4.8.19
Insulation resistance	3.10.10	4.8.3
Leakage current	3.10.15	4.8.4
Burn in	3.10.16	4.8.20
Accuracy	3.10.1	4.8.1
Repeatability	3.10.2	4.8.2
Group B Those inspections, as determined by NAVSEA, chosen from the first article inspections specified in table III whose outcome may be affected by changes to the equipment shall be repeated for group B inspections.		

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4.5 Quality conformance inspection. Quality conformance inspection shall be as specified in table IV in the sequence shown (see 6.3).

4.5.1 Inspection lot. An inspection lot shall consist of all flowmeter equipment of each type (type of construction) produced under essentially the same conditions and offered for inspection at the same time.

4.5.1.1 Group A inspections. All equipment in a lot shall be subjected to group A inspections specified in table IV. Equipment that fails may be corrected and retested except that no special selection of components may be used. Any equipment or parts of equipment so corrected or reworked must be submitted to the contracting activity or its representative for quality approval before being reinstalled in the equipment. Equipment so corrected must be retested for group A quality conformance tests.

4.5.1.2 Group B inspections. Group B inspections specified in table IV shall be conducted when the basic construction of the equipment or the material of a vital part has been changed. One complete flowmeter equipment shall be randomly selected and subjected to the group B inspections specified in table IV. Group B inspections shall be made on a sample unit which has passed the group A inspections. The sample unit which has been subjected to group B inspections shall not be delivered on the contract. If the sample unit fails any of the group B inspections, the sample shall be rejected until corrective action is taken. The contractor shall notify NAVSEA and the contracting activity of such failure and take corrective action on the materials or processes, or both, as warranted and on all units of the lot which can be corrected. Acceptance and shipment of the product shall be discontinued until corrective action, acceptable to NAVSEA, has been taken. After corrective action has been taken, tests selected by NAVSEA shall be re-performed. In the event of failure after re-inspection, information concerning the failure shall be furnished to NAVSEA and the contracting activity.

4.6 General examination and operation. The unpowered flowmeter equipment shall be given a thorough examination to determine conformance to the requirements of this specification with respect to material, color, finish, workmanship, safety, construction, assembly, dimensions, weight, and marking of identification plates. Examination shall be limited to the examinations that may be performed without disassembling the unit in such a manner that its performance, durability, or appearance would be affected. Examination shall also include an operational check of all features and capabilities (such as self test, operating controls, and maintenance adjustments). The operational check shall be performed at room temperature. The accuracy requirement of 3.10.1 shall also be met.

4.7 Test conditions and test apparatus accuracy.

4.7.1 Test conditions. Except where the following factors are the variables, the tests specified in 4.7 shall be conducted with the equipment operating under the following conditions:

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a. Ambient temperature shall be 75 ± 20 °F
b. Relative humidity shall be 60 ± 30 percent
c. Supply voltage shall be nominal
d. Supply frequency shall be nominal
e. Controls shall be in the neutral or normal position
f. Flow liquid shall be fresh water (conductivity between 0.0001 and 0.001 siemens per centimeter).

4.7.2 Test apparatus accuracy. The accuracy of instruments and test equipment used to control and monitor the test parameters shall be in accordance with MIL-E-16400.

4.8 Accuracy. The accuracy of the flowmeter under test shall be tested at each of the following flow rates in percent of the full scale value specified in 3.10.1, first in ascending flow rate and then in descending flow rate:

0 percent
5 ± 1 percent
10 ± 1 percent
20 ± 5 percent
40 ± 5 percent
60 ± 5 percent
80 ± 5 percent
100 (+ 0, −5 percent).

The flow test standard shall have an accuracy at least four times better than the accuracy specified (see 3.10.1). The accuracy requirement of 3.10.1 shall be met.

4.8.1 Accuracy check. As an operational check, the accuracy of the flowmeter shall be checked at the following percentages of full scale.

0 percent
20 ± 5 percent
60 ± 5 percent
95 ± 5 percent

The flowmeter shall meet the requirement of 3.10.1.

4.8.2 Repeatability. The accuracy measurements of 4.8.1 shall be performed at least twice, with the actual flow rate and flow total determined to an accuracy at least four times better than the allowed error in 3.10.1. The repeatability shall meet the requirements of 3.10.2.

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4.8.3 Insulation resistance. The insulation resistance of the unpowered flowmeter shall be determined by applying 50 volts direct current (Vdc) between electrical inputs and cabinet ground and measuring current flow. Low level inputs or outputs that may be damaged by 50 Vdc shall not be tested. Insulation resistance shall conform to the requirements of 3.10.10.

4.8.4 Leakage current. The leakage current between each side of the power line and the equipment enclosure, when measured in accordance with the applicable provision of MIL-E-16400, shall meet the requirements of 3.10.15.

4.8.5 Inclination. The indicator transmitter and totalizer indicator under test shall be tested for accuracy (see 4.8) in each of the following inclinations:

a. Sixty degrees from vertical forward
b. Sixty degrees from vertical backward
c. Sixty degrees from vertical to the left
d. Sixty degrees from vertical to the right
e. Normal, horizontal position.

4.8.5.1 Sensor orientation. The accuracy check (see 4.8.1) shall be performed with the flow sensor oriented in the horizontal and the vertical positions. The requirement of 3.10.4.1 shall be met.

4.8.6 Digital readout toggling. The accuracy test of 4.8 shall be performed except that at each flow rate specified, flow shall be stopped and then increased (and decreased if necessary) very slowly so as to spend at least one minute at flow readouts between least significant digits on digital electronic readouts. The toggling back and forth between the adjacent two least significant digits, if any, shall meet the requirements of 3.10.14.

4.8.7 Enclosure. The indicator transmitter and the totalizer indicator units of the flowmeter shall be subjected to the dripproof test specified in MIL-STD-108. Performance shall conform to the requirements of 3.5.3 and 3.6.3.

4.8.7.1 Flow sensor. The flow sensor unit of the flowmeter shall be subjected to the watertight test specified in MIL-STD-108. Performance shall conform to the requirements of 3.4.3.

4.8.8 Warm up time. The unpowered flowmeter equipment under test shall be held at 32 ± 2 °F for a period of at least two hours. A fluid flow of 65 ± 10 percent of range shall be maintained and the power turned on. The warm up time requirements of 3.10.3 shall be met.

4.8.9 Salt fog. The flowmeter equipment shall be subjected to the salt fog test specified in MIL-STD-810, procedure I. Performance shall conform to 3.10.9.

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4.8.10 Temperature. The flowmeter equipment under test shall be subjected to the environmental temperature tests of 4.8.10.1 and 4.8.10.2. Performance shall conform to 3.10.7 and 3.3.16.1 respectively.

4.8.10.1 Ambient environmental temperature tests. The flowmeter under test shall be subjected to the operating and non-operating environmental temperature test sequence specified by MIL-E-16400 for temperature range 4 (sheltered controlled environment, ship or shore) equipment, except that the upper limit of the operating temperature range shall be 140 °F. The accuracy test of 4.8 shall be performed where an operational test is specified by the test procedures.

4.8.10.2 Liquid temperature tests. With the flow sensor mounted in a flow test stand, the flowmeter shall be tested for accuracy in accordance with 4.8.1 at the minimum and maximum liquid temperatures specified in 3.3.16.1 after a minimum stabilization period of 30 minutes at each fluid temperature extreme.

4.8.11 Supply voltage and frequency (steady state). The accuracy check of 4.8.1 shall be performed at an average flow rate of 65 ± 10 percent of full scale at each of the following conditions:

Voltage	Frequency (Hz)
115	60
123	62
107	62
107	58
123	58

The requirement of 3.10.5 shall be met.

4.8.12 Supply voltage and frequency (transients). The voltage and frequency transient tests shall be conducted with the flowmeter under test configured in the normal flow measurement mode and with the flow velocity adjusted to 60 ± 10 percent of range. A reference total flow measurement with a 5 ± 0.5 minutes integration period shall be made at nominal voltage and frequency.

4.8.12.1 Voltage transient (type I power). Performance shall conform to 3.10.6.1.

4.8.12.1.1 Voltage high. The reference measurement of 4.8.12 shall be repeated with an actual flow within plus or minus 0.2 percent of the actual total flow of the reference measurement except that the supply voltage shall be four percent above the nominal steady state voltage through the

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integration period and a transient voltage of plus 16 ± 3 percent of nominal shall be superimposed recovering to the initial voltage within two seconds. The transient shall be applied at the halfway point (2.5 ± 0.5 minutes) of the integration period.

4.8.12.1.2 Voltage low. The reference measurement of 4.8.12 shall be repeated (see 4.8.12.1.1) except that the supply voltage shall be four percent below nominal throughout the integration period and a transient voltage of minus 16 ± 3 percent of nominal shall be superimposed recovering to the initial voltage within two seconds. The transient shall be applied at the halfway point (2.5 ± 0.5 minutes) of the integration period.

4.8.12.2 Frequency transients. Performance shall conform to 3.10.6.2 for each test.

4.8.12.2.1 Frequency high. The reference measurement of 4.8.12 shall be repeated with an actual flow within 0.2 percent of the actual total flow of the reference measurement except that the supply frequency shall be 1.5 percent above the nominal steady state frequency (60 Hz) and a transient frequency increase of plus four percent of a nominal shall be superimposed recovering to the initial frequency within two seconds. The transient shall be applied at the halfway point (2.5 ± 0.5 minutes) of the integration period.

4.8.12.2.2 Frequency low. The reference measurement of 4.8.12 shall be repeated (see 4.8.12.2.1) except that the supply frequency shall be 1.5 percent below the nominal steady state frequency (60 Hz) and a transient frequency change of a minus four percent of nominal shall be superimposed recovering to the initial frequency within two seconds. The transient shall be applied at the halfway point (2.5 ± 0.5 minutes) of the integration period.

4.8.12.3 Spike voltage. The flowmeter equipment under test shall be subjected to the spike voltage test of MIL-STD-1399 section 300. Performance shall conform to 3.10.6.3.

4.8.13 Humidity. The flowmeter equipment under test shall be subjected to the humidity test as specified in MIL-STD-810, method 507.2, procedure III, except that step 6 shall be changed from 10 cycles to five cycles. Whenever MIL-STD-810, method 507.2 calls for an operational check, the accuracy test of 4.8 shall be performed.

4.8.14 Vibration. The flowmeter equipment under test shall be tested in accordance with type I (environmental vibration) of MIL-STD-167-1. If no resonances are observed, the two hour endurance test shall be conducted at 50 Hz. During the vibration test, the flowmeter shall be operating (power on) and a zero flow condition shall be maintained. Flowmeter readouts shall be monitored periodically during the test to determine that the readouts do not change by more than one least significant digit during the test. After the test, an accuracy measurement in accordance with 4.8.1 shall be conducted. The requirements of 3.10.11 shall be met.

4.8.15 Shock. Prior to the shock test, the accuracy measurement of 4.8 shall be conducted and the results recorded. An accuracy measurement made at the end of a previous test may be used. The flowmeter shall then be subjected to a shock test in accordance with grade A, class I, type A

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of MIL-S-901. For feasibility of the test, a zero flow condition shall be maintained. After the shock tests are completed, and prior to any adjustments, the accuracy test shall be repeated. The performance of the flowmeter shall conform to 3.10.2.

4.8.16 Electromagnetic interference tests. The flowmeter equipment shall meet the requirements of 3.10.13, when tested in accordance with MIL-STD-462.

4.8.16.1 Susceptibility testing criteria. The flowmeter shall measure actual flow of 60 ± 10 percent of range in a test stand. The flow (rate or total as applicable) readout shall be monitored to identify any deviation when EMI generator is turned on as compared to the same flow measurement when the EMI generator is off.

4.8.16.2 Emission testing. Emission tests shall be conducted with the flowmeter under test operating and the flow sensor installed on a test section of pipe. Actual flow through the pipe shall be utilized in order to produce changes in the digital readouts.

4.8.17 Reliability verification. The reliability of the equipment shall be verified by the method of 4.8.17.1 or 4.8.17.2 as specified (see 6.2). If unspecified in the acquisition document, the contractor may choose either method. Performance shall be as specified (see 3.7).

4.8.17.1 Reliability demonstration. MTBF shall be demonstrated in a test program of statistically valid length in accordance with test plan IVC or XIVC of MIL-STD-781. The lower test MTBF ( ) shall be as specified in 3.7 and the upper test MTBF ( ) shall be twice the lower test MTBF for consumer's risk (B) and producer's risk (a) of 0.2, . . B and (a) are as specified in MIL-STD-781.

4.8.17.2 Reliability prediction. Total equipment MTBF shall be verified by a reliability prediction in accordance with MIL-HDBK-217 "part stress analysis prediction" MIL-STD-785 Task 203 "Reliability Predictions" or combinations of the above. In accordance with the predicted MTBF, provision of MIL-STD-781, the predicted MTBF shall be at least twice the MTBF specified in 3.7.

4.8.18 Sensor electrode cleaning. The interior of the flow sensor shall be completely exposed to 100 percent oil. The sensor shall then be filled with fresh water (see 4.7.1 (f)). With a zero flow condition, activate the electrode cleaning system shall be activated for a period of two minutes. Immediately thereafter the accuracy check of 4.8.1 shall be performed. The requirement of 3.3.14 shall be met.

4.8.19 Hydrostatic pressure. The sensor pipe spool shall be subjected, at room temperature, to an internal pressure of not less than 150 percent of the working pressure specified in table I. The hydrostatic test shall use clean fresh water. Pressure shall be maintained for a period of not less than 1/2 hour. The requirement of 3.4.3 shall be met.

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4.8.20 Burn-in test. The equipment shall be subjected to a continuous 32 hour burn-in test. This 32 hour test shall consist of four eight-hour consecutive phases as follows:

a. at 149 °F
b. at room temperature
c. at 149 °F
d. at room temperature.

During each of these test phases, the equipment shall be energized and continuously operated (performing its normal function) for the prescribed time and at the indicated temperature. Zero flow condition may be used to facilitate placing the flow sensor in the environmental chamber. No calibration, alignment, adjustment, modification, or replacement of any plug-in circuit board subassembly, unit or part is permitted during this test, except replacement of lightbulbs used for instrument illumination. After the burn-in, the equipment shall be tested for accuracy in accordance with 4.8. The requirement of 3.10.16 shall be met.

4.9 Inspection of packaging. Sample packages and packs, and the inspection of the preservation, packing, and marking for shipment and storage shall be in accordance with the requirements of section 5 and the documents specified therein.

5. PACKAGING

(The packaging requirements specified herein apply only for direct Government acquisition. For the extent of applicability of the packaging requirements of referenced documents listed in section 2 (see 6.7).)

5.1 General.

5.1.1 Navy fire-retardant requirements.

a. *Treated lumber and plywood.* When specified (see 6.2), all lumber and plywood including laminated veneer material used in shipping container and pallet construction, members, blocking, bracing, and reinforcing shall be fire-retardant treated material conforming to MIL-L-19140 as follows:

Levels A and B	-	Type II - weather resistant Category 1 - general use
Level C	-	Type I - non-weather resistant Category 1 - general use.

in the contract or purchase order; the supplier is responsible for the performance

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b. *Fiberboard.* Unless otherwise specified (see 6.2), fiberboard used in the construction of class-domestic, non-weather resistant fiberboard and cleated fiberboard boxes including interior packing forms shall meet the flamespread index and the specific optic density requirements of PPP-F-320 and amendment thereto.

5.2 Packaging requirements. The packaging (preservation, packing, and marking) requirements shall be in accordance with MIL-E-17555 for the level of preservation (A, B, C, or commercial), level of packing (A, B, C, or commercial), and marking including bar coding and other packaging acquisitioning options therein as specified (see 6.2).

6. Notes

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. Flowmeters described in this specification are intended to measure the flow rates of various liquids.

6.2 Acquisition requirements. Acquisition documents must specify the following:

a. Title, number, and date of this specification

b. Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1.1 and 2.2)

c. When first article inspection is required (see 3.1)

d. Quantity of flowmeters required

e. Number of subunits of the flowmeter (see 3.2)

f. Pipe size (3.2.1)

g. The liquid whose flow is to be measured and its applicable characteristics (see 3.3.16)

h. Readout units: pounds, gallons, and so forth (see 3.3.18)

i. Length of flow sensor cable if other than specified (see 3.4)

j. Sensor spool flange face to face distance if other than specified (see 3.4.2)

k. If the flow sensor is required to be explosion proof or submersible (see 3.4.3)

l. If mounting shall be bulkhead or panel (see 3.5.3.1 and 3.6.4)

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m. If a flow rate indicator is not required (see 3.5.5.1)

n. If a second remote indicator is required for flow total or rate (see 3.6.2(a))

o. If a single control may be utilized for both the reset of the flow total counter and the preset of the flow preset counter (see 3.6.5.1 (d))

p. If a maintainability program is required (see 3.8.1)

q. If a MIL-STD-471 maintainability demonstration is required (see 3.8.4.1)

r. If built in test equipment (BITE) is not required (see 3.8.6)

s. The flow rate range (if other than 0 to 20 feet per second) (see 3.10.1) and if full accuracy in either direction of fluid flow is not required

t. If the reliability verification shall consist of an actual demonstration or prediction (see 4.8.17)

u. When fire-retardant treated lumber and plywood is required (see 5.1.1. (a))

v. When fire-retardant fiberboard is not required (see 5.1.1 (b))

w. Level of preservation and level of packing required including other packaging acquisitioning options (see 5.2).

6.3 **Consideration of data requirements.** The following data requirements shall be considered when this specification is applied on a contract. The applicable Data Item Descriptions (DIDs) should be reviewed in conjunction with the specific acquisition to ensure that only essential data are requested/provided and that the DIDs are tailored to reflect the requirements of the specific acquisition. To ensure correct contractual application of the data requirements, a Contract Data Requirements List (DD Form 1423) must be prepared to obtain the data, except where DOD FAR Supplement 27.475-1 exempts the requirement for a DD Form 1423.

Reference Paragraph	DID Number	DID Title	Suggested Tailoring
3.2	DI-E-7031	Drawings, engineering and associated lists	–
3.4.1.1	UDI-T-23191B	Certification data for level I material	–

Rubber material not conforming to

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Reference Paragraph	DID Number	DID Title	Suggested Tailoring
3.10.13.3	DI-EMCS-80199	Electromagnetic interference control plan	–
4.1.1	DI-R-4803	Inspection system program plan	–
4.5	DI-T-2072	Reports, Tests	–

The above DIDs were those cleared as of the date of this specification. The current issue of DOD 5010.12-L, Acquisition Management Systems and Data Requirements Control List (AMSDL), must be researched to ensure that only current, cleared DIDs are cited on the DD Form 1423.

6.3.1 **Electromagnetic interference control plan.** For flowmeter equipment that has yet to be constructed or is to receive extensive reconstruction, the contractor should prepare an electromagnetic interference control plan (see 6.3). For flowmeter equipment that has already met the requirements of 3.10.13 or has already been constructed or built, the control plan is not required.

6.4 **Technical manuals.** The requirement for technical manuals should be considered when this specification is applied on a contract. If technical manuals are required, military specifications and standards that have been cleared and listed in DOD 5010.12-L, Acquisition Management Systems and Data Requirements Control List (AMSDL) must be listed on a separate Contract Data Requirements List (DD Form 1423), which is included as an exhibit to the contract. The technical manuals must be acquired under separate contract line item in the contract.

6.5 **First article.** When first article inspection is required, the contracting officer should provide specific guidance to offerors whether the item(s) should be a preproduction sample, a first article sample, a first production item, a sample selected from the first production items, a standard production item from the contractor's current inventory (see 3.1), and the number of items to be tested as specified in 4.4. The contracting officer should also include specific instructions in acquisitions documents regarding arrangements for examinations, approval of first article test results, and disposition of first articles. Invitations for bids should provide that the Government reserves the right to waive the requirement for samples for first article inspection to those bidders offering a product which has been previously acquired or tested by the Government, and that bidders offering such products, who wish to rely on such production or test, must furnish evidence with the bid that prior Government approval is presently appropriate for the pending contract. Bidders should not submit alternate bids unless specifically requested to do so in the solicitation.

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6.5.1 **Pass samples.** First article samples that have passed the first article inspection specified in table III are not to be considered for shipboard installation regardless of the degree of refurbishment required. Unless otherwise directed by NAVSEA, the passed first article samples are to be retained by the first article test facility for future reference.

6.6 **Provisioning.** Provisioning Technical Documentation (PTD), spare parts, and repair parts should be furnished as specified in the contract.

6.6.1 When ordering spare parts or repair parts for the equipment covered by this specification, the contract should state that such spare parts and repair parts should meet the same requirements and quality assurance provisions as the parts used in the manufacture of the equipment. Packaging for such parts should also be specified.

6.7 **Sub-contracted material and parts.** The packaging requirements of referenced documents listed in section 2 do not apply when material and parts are acquired by the contractor for incorporation into the equipment and lose their separate identity when the equipment is shipped.

6.8 **Subject term (key-word) listing.**

Meter, flow

6.9 **Changes from previous issues.** Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

Preparing activity:
Navy - SH
(Project 6680-N223)

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STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions - Reverse Side)

1. DOCUMENT NUMBER	2. DOCUMENT TITLE
MIL-F-24291C(SH)	FLOWMETER, FLUID ELECTROMAGNETIC TYPE

3a. NAME OF SUBMITTING ORGANIZATION	4. TYPE OF ORGANIZATION *(Mark one)*
	☐ VENDOR
b. ADDRESS *(Street, City, State, ZIP Code)*	☐ USER
	☐ MANUFACTURER
	☐ OTHER *(Specify)*: _____

5. PROBLEM AREAS

a. Paragraph Number and Wording:

b. Recommended Wording

c. Reason/Rationale for Recommendation

6. REMARKS

7a. NAME OF SUBMITTER *(Last, First, MI)* – Optional	b. WORK TELEPHONE NUMBER *(Include Area Code)* – Optional
c. MAILING ADDRESS *(Street, City, State, ZIP Code)* – Optional	8. DATE OF SUBMISSION *(YYMMDD)*

DD FORM 82 MAR 1426

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NOTE: This form may not be used to request copies of documents, nor to request waivers, deviations, or clarification of specification requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

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