Designation: F1172 – 88 (Reapproved 2015)ε1

An American National Standard

Standard Specification for Fuel Oil Meters of the Volumetric Positive Displacement Type[1]

This standard is issued under the fixed designation F1172; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

ε[1] NOTE—6.6 and 8.1.1.2 were editorially corrected in May 2015.

1. Scope

1.1 This specification provides the minimum requirements for the design, fabrication, pressure rating, marking, and testing for fuel oil meters (volumetric positive displacement type).

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.3 The following safety hazards caveat pertains only to the test method section of this specification. *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

F722 Specification for Welded Joints for Shipboard Piping Systems

2.2 *ANSI Standards:*[3]

B2.1 Pipe Threads

B16.1 Cast Iron Pipe Flanges and Flanged Fittings

B16.3 Malleable-Iron Screwed Fittings

B16.4 Cast-Iron Screwed Fittings

B16.5 Pipe Flanges and Flanged Fittings

B16.11 Forged Steel Fittings Socket-Welding and Threaded

B16.34 Valves, Flanged and Buttwelding End

B31.1 Power Piping

2.3 *Manufacturers' Standardization Society of the Valve and Fittings Industry:*[4]

MSS SP-25 Standard Marking System for Valves, Fittings, Flanges and Unions

2.4 *API Standard:*[5]

Code No. 1101 Measurement of Petroleum Liquid Hydrocarbons by Positive Displacement Meter

2.5 *American Society of Mechanical Engineers:*[6]

ASME Boiler and Pressure Vessel Code, Section VIII, Div. I, Pressure Vessels; Section IX, Welding and Brazing Qualifications

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *fuel oil meter (volumetric positive displacement type)*—device intended to indicate the volume of liquid fuel oil delivered to a fuel distribution system over a period of time.

3.1.2 *maximum allowable working pressure (MAWP)*—maximum system pressure to which a fuel oil meter may be subjected.

4. Ordering Information

4.1 Orders for products under this specification shall include the following applicable information:

4.1.1 Title, number, and date of this specification.

4.1.2 Operating pressure (psi) and temperature (°F).

4.1.3 End connection and size.

4.1.4 Maximum capacity required.

4.1.5 Type of fuel service.

4.1.6 Materials—external and internal.

4.1.7 Other test requirements.

4.1.8 Qualification test reports as required.

[1] This specification is under the jurisdiction of ASTM Committee F25 on Ships and Marine Technology and is the direct responsibility of Subcommittee F25.11 on Machinery and Piping Systems.

Current edition approved May 1, 2015. Published June 2015. Originally approved in 1988. Last previous edition approved in 2010 as F1172 – 88 (2010). DOI: 10.1520/F1172-88R15.

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.

[4] Available from Manufacturers Standardization Society of the Valve and Fittings Industry (MSS), 127 Park St., NE, Vienna, VA 22180-4602, http://www.mss-hq.com.

[5] Available from American Petroleum Institute (API), 1220 L. St., NW, Washington, DC 20005-4070, http://www.api.org.

[6] Available from American Society of Mechanical Engineers (ASME), ASME International Headquarters, Two Park Ave., New York, NY 10016-5990, http://www.asme.org.

5. Materials and Manufacture

5.1 Fuel oil meter casings, as well as any pressure-retaining parts, shall be constructed of ferrous material as listed in Section VIII, Division 1 of the ASME Boiler and Pressure Vessel Code. All other parts shall be constructed of materials suitable for the service intended. Fasteners in contact with interior fluid shall be of corrosion-resistant steel.

5.2 Seals and associated parts shall be of materials suitable for the service and the fluid to be measured.

5.3 *Manufacture:*

5.3.1 Fuel oil meters with end fittings in compliance with ANSI Standards B2.1, B16.1, B16.3, B16.4, B16.5, B16.11, or B16.34 as appropriate may be used within the pressure-temperature ranges permitted by the applicable standard provided the meter housing is satisfactory for these conditions.

5.3.2 Threaded fittings above two nominal pipe size (NPS) and socket welded flanges above 3 NPS shall not be used in fuel oil meters with a MAWP above 150 psig (1 N/mm^2) and for service above 150°F (65°C).

5.4 Welding procedure qualification, welder performance qualification, and welding materials shall be in accordance with ANSI B31.1 and Section IX of the ASME Code. Brazing or soldering shall not be used.

6. Other Requirements

6.1 *Components:*

6.1.1 The meter shall consist of a housing with measuring mechanism and a register with counter mechanism.

6.1.1.1 *Measuring Chamber*—The measuring chamber for all meters shall be so constructed as not to show distortion under maximum allowable working pressure in any manner, or to affect the sensitivity of the meter.

6.1.1.2 *Adjusting Device*—The meter shall be provided with an adjusting device for changing the registered quantity to attain desired calibration. The adjustment setting shall have provisions for locking and shall not change during the meter life except by manual readjustment. The adjusting device shall be noncyclical and shall permit adjustment without disassembly of the mechanism except for removal of adjusting device cover plate. The plate shall be sealed by means of a lead seal. The meter shall be capable of calibration adjustment over a minimum range of 5 %.

6.1.1.3 *Direction Marking of Meter*—Directions for positive and negative adjustment shall be permanently marked on the meter.

6.1.1.4 *Register*—The register shall be of the direct-reading type. The register shall have a nonsetback total indicator and a setback-type run indicator, so that individual runs can be registered without affecting the total of all runs, as shown on the total indicator. The total indicator shall have a minimum of eight figures, and the setback run indicator shall have a minimum of five figures. Reset digits shall have a minimum height of ½ in. (13 mm) and shall not be coated with fluorescent paint. The indicating register shall read in U.S. gallons of 231 $in.^3$ ($3.785\,41 \times 10^{-3}$ m^3) each. The register shall be isolated from the fluid.

6.1.1.5 *Register Face*—The register shall have a transparent, colorless plastic face of such size that all digits shall be easily read. Glass shall not be used.

6.2 *Rating, Design, and Fabrication:*

6.2.1 The maximum allowable working pressure-temperature rating (MAWP) for fuel oil meters conforming to this standard shall be established by at least one of the following methods:

6.2.1.1 Proof test in accordance with the requirements prescribed in Paragraph UG-101 of Section VIII of the ASME Code. If burst-type tests as outlined in Paragraph UG-101(m) are used, it is not necessary to rupture the component. In this case, the value of *B* to be used in determining the MAWP shall be the maximum pressure to which the component was subjected without rupture. Components that have been subjected to a hydrostatic proof test shall not be offered for sale.

6.2.1.2 The water temperature shall not exceed 125°F (52°C) during the test.

6.2.2 Design calculations are in accordance with the requirements prescribed in Section VIII, Division I of the ASME Code.

6.3 Where welded construction is used for the fabrication of pressure containing parts, welded joint design details shall be in accordance with Section VIII, Division 1 of the ASME Code and Specification F722. Except for fillet welds, all welds shall be full penetration welds extending through the entire thickness of the shell.

6.4 Inlet and outlet connections consisting of welded flanges and fittings shall be in accordance with Specification F722. When radiography is required (see 10.2), all welds shall be butt welds for Class I piping as required by Specification F722, except packing cylinders, drains, and similar ancillary connections may be attached by fillet or socket welds.

6.5 *Capacity*—The maximum capacity of the meter shall be as specified by the manufacturer.

6.6 *Pressure Drop*—The maximum pressure drop between the meter inlet and outlet shall not exceed 5 psi (34 kPa) as certified by testing in accordance with 8.1.1.2.

6.7 *Error, Normal Flow*—For flow rate and calibration setting between 5 and 100 % of maximum capacity, the error of the meter shall not exceed 0.1 % for any one predetermined flow rate and accuracy setting.

6.8 *Maintainability*—The meter shall be so designed as not to require special tools for overhaul and repair.

7. Workmanship, Finish, and Appearance

7.1 Meter shall have all burrs or sharp edges removed and shall be cleaned of all loose metal chips and other foreign substances.

7.2 *Treatment and Painting*—The exterior surface of the meter shall be treated and painted in accordance with best commercial practice.

8. Number of Tests

8.1 *Qualification Tests:*

8.1.1 A representative fuel oil meter of each particular design shall be certified as having undergone the following qualification tests.

8.1.1.1 *Calibration and Adjustment*—The meter shall be tested in accordance with applicable sections of API Code 1101.

8.1.1.2 *Pressure Drop*—Clean fluid at 35 Saybolt seconds Universal (SSU) shall be pumped through the meter at 100 % of manufacturer's rated capacity. After the flow rate has been stabilized, the measured pressure drop between the inlet and outlet of the meter shall not exceed 5 psi (34 kPa).

8.2 *Production Tests:*

8.2.1 The manufacturer shall production test each fuel oil meter by hydrostatic test methods as described in Section 9.

8.2.2 Each meter shall be calibration tested at mid range of flow capacity. The reading error shall not exceed 0.1 % at this flow rate.

9. Test Methods

9.1 *Hydrostatic Test*—Each fuel oil meter shall be given a hydrostatic shell test of at least 1½ times its maximum allowable working pressure.

9.1.1 The fluid temperature shall not exceed 125°F (52°C) during the hydrostatic test, and the fluid used should be nonflammable. Further, it should not cause rusting and should otherwise be compatible with the internal parts of the fuel oil meter.

9.1.2 The test arrangement shall be air free before pressurization.

9.1.3 The minimum duration of the shell test shall be 30 s at required pressure.

9.1.4 No visible leakage or structural damage shall show during the test.

10. Inspection

10.1 Each finished fuel oil meter shall be visually examined and dimensionally checked to ensure that the meter corresponds to this specification and is marked in accordance with Section 12.

10.2 *Nondestructive Examination of Welds:*

10.2.1 All welds shall be visually examined in accordance with ANSI B31.1.

10.2.2 Welded inlet and outlet connections that are equal to or greater than 4 NPS or greater than 0.375-in. nominal wall thickness which are in services greater than 150 psig (1 N/mm^2) and 150°F (65°C) shall be 100 % radiographically examined.

11. Certification

11.1 The pressure ratings established under this specification are based upon materials of high quality produced under regular control of chemical and physical properties by a recognized process. The manufacturer shall be prepared to certify that his product has been so produced and that the physical and chemical properties thereof, as proven by test specimens and nondestructive testing or as documented by certifications from the producer or recognized distributor of these materials, are at least equal to the requirements of the appropriate specifications.

11.2 When specified in the purchase order or contract, the manufacturer certification shall be furnished to the purchaser stating that samples representing each lot have been manufactured, tested, and inspected in accordance with this specification and the requirements have been met. When specified in the purchase order or contract, a report of the test results shall be furnished.

11.3 Certification of the MAWP shall be available to purchasers.

12. Product Marking

12.1 Each fuel oil meter shall be permanently marked with the following:

12.1.1 Manufacturer's name or trademark.

12.1.2 Maximum allowable working pressure—temperature rating (MAWP).

12.1.3 *Flow Direction*—The direction of flow through the meter shall be indicated by the words "inlet" and "outlet," a directional arrow, or both, stamped or embossed on the meter.

12.1.4 End fittings complying with a standard listed in 5.3.1 may be marked in accordance with the applicable requirements of MSS SP-25 for dimensional identification purposes if desired.

12.1.5 Size (end connection size), may be included at the option of the manufacturer.

12.1.6 ASTM designation of this specification.

13. Quality Assurance Provisions

13.1 The manufacturer of the fuel oil meter shall maintain the quality of the meters that are designed, tested, and marked in accordance with this specification. At no time shall a meter be sold that is marked with this standard designation that does not meet the requirements herein.

14. Keywords

14.1 fuel oil; fuel oil meters; meters; volumetric positive displacement meters