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An American National Standard

Standard Specification for Entrainment Separators for Use in Marine Piping Applications[1]

This standard is issued under the fixed designation F1006; 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.

1. Scope

1.1 This specification covers the minimum requirements for the pressure-temperature rating, testing, and making of pressure-containing vessels for entrainment separators.

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 methods portion, Section 6, 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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ANSI Standards:*[2]
B2.1 Pipe Threads (Except Dryseal)
B16.31 Non-Ferrous Pipe Flanges

2.2 *ASME Standards:*[3]
B16.1 Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250
B16.3 Malleable Iron Threaded Fittings: Classes 150 and 300
B16.4 Gray Iron Threaded Fittings: Classes 125 and 250
B16.5 Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard
B16.11 Forged Fittings, Socket-Welding and Threaded
B16.15 Cast Copper Alloy Threaded Fittings: Classes 125 and 250
B16.24 Cast Copper Alloy Pipe Flanges, Flanged Fittings, and Valves: Classes 150, 300, 600, 900, 1500, and 2500
B16.25 Buttwelding Ends
SA-278 Cast Gray Iron Pressure Vessels
SA-395-60 Cast Ductile Iron

2.3 *ASME Boiler and Pressure Vessel Codes:*[3]
Section II
Section VIII

2.4 *MSS Standards:*[4]
MSS-SP-51 Class 150LW Corrosion Resistant Flanges and Cast Flanged Fittings

2.5 *Military Standards:*[5]
MIL-F-1183 Fittings Tube, Bronze, Cast (Silver Brazings)

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *entrainment separator, n*—a mechanical device inserted in a pipeline which by centrifugal force, baffles, or other means will separate a liquid from a gas (vapor).

3.1.2 *hydrostatic test, n*—the act of filling an entrainment separator vessel with water and applying internal pressure to all parts of the vessel.

3.1.3 *master gage, n*—the calibrated gage used to verify the accuracy of the test gage. This gage shall be recalibrated traceable to the National Bureau of Standards.

3.1.4 *pressure rating, n*—the maximum working pressure of an entrainment separator when operated at a specific temperature.

3.1.5 *proof test, n*—the act of filling an entrainment separator vessel with water and applying internal pressure to all parts

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

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

[5] Available from DLA Document Services, Building 4/D, 700 Robbins Ave., Philadelphia, PA 19111-5094, http://quicksearch.dla.mil.

of the vessel for the purpose of causing yielding of the vessel and bursting of the vessel.

3.1.6 *temperature ratings, n*—minimum and maximum temperatures at which the entrainment separator may be operated while at specific pressures.

3.1.7 *test gage, n*—the pressure gage that is used to check the internal pressure of the entrainment separator. The test gage shall be calibrated at least annually or at any time it is suspected to be in error by a calibrated master gage.

4. Materials and Manufacture

4.1 The pressure-temperature ratings established under this specification are based upon the manufacturer's usage of high quality materials produced under regular control of chemical and physical properties by a recognized process. The manufacturer shall be prepared to submit certification of compliance, verifying that his product has been so produced and that it has been manufactured from material with chemical and physical properties at least equal to the requirements of the appropriate standard or specification listed in 4.3 of this specification or Section II of the ASME Boiler and Pressure Vessel Code.

4.2 For materials not having values of allowable stress tabulated in Section VIII, Division I, of the ASME Boiler and Pressure Vessel Code, allowable stresses shall be determined in accordance with the procedures outlined in Appendix P of Section VIII, Division 1, of the ASME Boiler and Pressure Vessel Code.

4.3 Materials of construction shall be suitable for the service intended.

4.4 Bolting materials shall be at least equal to those listed in Table 1B of ASME B16.5. Bolting materials shall not be used beyond temperature limits specified in the governing codes.

5. Requirements

5.1 Entrainment separators covered in this specification shall be designed according to the lowest pressure-temperature rating of any individual component, or as established by proof tests.

5.2 The design pressure-temperature of entrainment separators covered in this specification will be established by the manufacturer using one of the following methods:

5.2.1 Design calculations in accordance with the requirements prescribed in the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, Part UG, of Subsection A and the applicable part of Subsection C.

5.2.2 Proof test in accordance with the requirements of UG 101 (m), UCI-101, or UCD-101 of Section VIII, Division 1, of the ASME Boiler and Pressure Vessel Code.

5.2.3 Where any part of the entrainment separator vessel cannot be designed within the scope of the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, Design Section, the pressure-temperature rating must be determined through proof and hydrostatic tests using the following formulas to determine the allowable operating limits of pressure and temperature. Operator safety should be considered when conducting these tests.

$$P = \left(\frac{P_{HT}}{4}\right) \times \left(\frac{S_1}{S_2}\right) \text{ (for steel vessels)}$$

$$P = \left(\frac{P_{HT}}{4}\right) \times \left(\frac{T_1}{T_2}\right) \text{ (for cast-iron vessels)}$$

where:

P = maximum allowable working pressure (psig) at design temperature,
P_{HT} = hydrostatic test pressure (psig) at test temperature,
S_1 = stress value at design temperature (psi),
S_2 = stress value at test temperature (psi),
T_1 = specified minimum tensile strength (psi), and
T_2 = actual tensile strength test specimen (psi).

5.2.3.1 Stress values S_1 and S_2 are determined from Section VIII, of the ASME Boiler and Pressure Vessel Code.

5.2.3.2 The value of P_{HT} to be used in determining the maximum allowable working pressure shall be the maximum pressure to which the entrainment separator was subjected to without permanent deformation or rupture.

5.2.3.3 Test water temperature[6] and entrainment separator temperature must be at equilibrium before hydrostatic test pressure is applied.

5.2.3.4 All possible air pockets must be purged while the entrainment separator vessel is being filled with water. Adequate vents shall be provided at all high points of the vessel.

5.2.3.5 External equipment not to be pressurized with the entrainment separator should be isolated or disconnected before applying the hydrostatic test pressure.

5.2.3.6 Hydrostatic test pressure shall be applied gradually to the entrainment separator and held stationary at each increment for a sufficient time in order that a visual inspection can be made for leaks or deformation of the vessel. The final value of hydrostatic test pressure that is not in conflict with 5.2.3.2 is called P_{HT}.

5.3 Pressure-temperature rating and construction of all pipe connections shall be in accordance with the following standards or specifications: ANSI B2.1, ASME B16.1, ASME B16.3, ASME B16.4, ASME B16.5, ASME B16.11, ASME B16.15, ASME B16.24, ASME B16.25, ASME SA-278, ANSI B16.31, MSS-SP-51, and MIL-F-1183.

6. Test Methods

6.1 All entrainment separators must be pressure tested in accordance with the following:

6.1.1 Each entrainment separator shall be tested by subjecting it to an internal hydrostatic test procedure, which at every point in the separator is at least equal to 1.5 times the maximum allowable working pressure, multiplied by the lowest ratio of the stress value for the design temperature.

$$\text{Test pressure} = 1.5 \times \text{maximum allowable pressure} \times \frac{\text{stress value at test temperature}}{\text{stress value at design temperature}}$$

[6] Test water temperature to be no less than 60 °F (10 °C), but not to exceed 125 °F (52 °C).