Designation: D5998 – 16

Standard Specification for Molded Polyethylene Shipping and Storage Drums[1]

This standard is issued under the fixed designation D5998; 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 self supporting, molded polyethylene, tight head drums designed for surface and air shipment, ranging in size from 5 gal (19 L) to and including 55 gal (208 L).

1.2 Virgin or recycled polyethylene plastics[2] or combinations thereof can be used provided the finished product meets the requirements of this specification.

NOTE 1—There is no known ISO equivalent to this standard.
NOTE 2—This standard is intended to replace MIL-D-43703C.

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

1.4 *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:*[3]
D883 Terminology Relating to Plastics
D1972 Practice for Generic Marking of Plastic Products (Withdrawn 2014)[4]
D3951 Practice for Commercial Packaging
D4504 Specification for Molded Polyethylene Open-Head-Pails for Industrial Shipping of Nonhazardous Goods
D4919 Guide for Testing of Hazardous Materials Packagings
D7209 Guide for Waste Reduction, Resource Recovery, and Use of Recycled Polymeric Materials and Products (Withdrawn 2015)[4]

2.2 *ANSI Standards:*[5]
ANSI Z1.4 Sampling Procedures and Tables for Inspection by Attributes

2.3 *Federal Regulations:*[6]
21 CFR 121 Federal Food, Drug, and Cosmetic Act and Regulations Promulgated Thereunder
21 CFR 177 Indirect Food Additives: Polymers
49 CFR 173 Shippers—General Requirements for Shipments and Packagings
49 CFR 178 Specifications for Packaging

2.4 *National Sanitation Foundation International:*[7]
NSF Standard No. 2 Food Service Equipment
NSF Standard No. 51 Plastics Materials and Components Used in Food Service Equipment

3. Terminology

3.1 For definitions or terms, see Terminology D883 or Guide D7209.

4. Requirements

4.1 *Materials*—Drums shall conform to 49 CFR 173.24 and 178.509 Type 1H1. The drum material and components shall conform to the Federal Food, Drug and Cosmetic Act, Food Additive Amendment 21 CFR 177, 1520 and NSF International Standard No. 2 and 51 when used for food products. Recycled plastic can be used when practical as long as the finished product meets the requirements of this specification.

4.2 *Design and Construction*—Drums shall conform to 49 CFR 173.24 and 178.509, Type 1H1. Drums shall be molded of materials specified in 4.1. Five gallon (19 L) drums shall be furnished with one or two carrying handles. Fifteen gallon (57 L) drums shall be furnished with one or two handles on the top or without handles. Drums greater than 20 gal shall be

[1] This specification is under the jurisdiction of ASTM Committee D20 on Plastics and is the direct responsibility of Subcommittee D20.15 on Thermoplastic Materials.

Current edition approved Sept. 1, 2016. Published September 2016. Originally approved in 1996. Last previous edition approved in 2010 as D5998 - 10. DOI: 10.1520/D5998-16.

[2] As defined in Guide D7209.

[3] 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.

[4] The last approved version of this historical standard is referenced on www.astm.org.

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

[6] Available from U.S. Government Printing Office Superintendent of Documents, 732 N. Capitol St., NW, Mail Stop: SDE, Washington, DC 20401, http://www.access.gpo.gov.

[7] Available from NSF International, P.O. Box 130140, 789 N. Dixboro Rd., Ann Arbor, MI 48113-0140, http://www.nsf.org.

***A Summary of Changes section appears at the end of this standard**

Copyright © ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959. United States

fabricated so that they can be individually handled by customary handling devices. Handling devices shall withstand the combined lifted weight of the drum and contents. Rolling rings on drums are optional, and when specified, a minimum of two are required.

4.2.1 *Openings*—The 5-gal (19-L) drum shall have one opening on the top except when specified (see 7.2) an air vent shall be added diametrically opposite the top opening. The 15-gal, 30-gal, and 55-gal (57-L, 114-L, and 208-L) drums shall have two openings. The opening shall not exceed 2.7 in. (69 mm) in diameter, and when specified shall have either a commercial clinch-on closure (flexible or reversible spout) or molded-in opening. The molded-in opening for the 5-gal (19-L) drum shall be externally threaded to accept a buttress threaded cap closure, an internally threaded opening to accept an NPS plug, or a commercial clinch-on closure. The molded-in opening for the 15-gal, 30-gal, and 55-gal (57-L, 114-L, and 208-L) drums shall have molded-in internal NPS or buttress threads (see 4.2.1.1). There shall be not less than two and one half buttress threads. The closure for flexible spout shall be a metal or plastic screw cap or plug having not less than two continuous full threads that match the opening and of sufficient length to completely engage a minimum of two threads when the cap with gasket or cap liner in place is screwed in.

4.2.1.1 *Plug and Gasket*—The buttress plug and gasket shall be made of material resistant to the lading and shall have not less than two continuous external buttress threads that match the internal thread of the opening. The plug shall have a ¾-in. (20-mm) NPS center reducer with molded-in diaphragm. The ¾-in. (20-mm) center reducer without molded diaphragm shall accept a ¾-in. (20-mm) NPT plug as allowed by appropriate shipping and storage regulations. Vented closure devices shall be used for surface shipments only as allowed by appropriate shipping and storage regulations.

4.2.1.2 *Safety Seals*—When specified, commercial safety seals shall be furnished with each drum for application to all openings of the drum. The safety seals shall either be fabricated from a corrosion-resistant material, or be coated with a corrosion-resistant finish. The safety seals shall be crimped onto the drums in such a manner that the seals are deformed and cannot be reused once they have been removed. The safety seals shall have instructions printed on them that describe the method of removal unless superseded by more important information such as a caution statement. Safety seals on drums containing food or potable water shall meet food contact requirements of 4.1.

4.2.1.3 *Torque Indicating or Torque Limiting Plug Wrench*—Torque wrenches capable of applying specified closure torque are to be used for tightening all closures as necessary.

4.3 *Marking*—Drum markings shall conform to 49 CFR Subpart L and other appropriate requirements. Also, the manufacturer's recommended closure torque range for prevention of leakage from threaded closure shall be durably marked by means of embossing, labeling, stenciling, lithographing, silk screening or stamping on the drum when a specified torque requirement is needed to meet performance requirements. Unless otherwise specified, the markings shall be embossed on the sidewall or bottom head of the drum in characters not less than ½ in. (13 mm) high. Unless otherwise specified, the top head of each drum shall be marked "DO NOT REUSE FOR FOOD." The marking shall be embossed or indelibly stenciled in a contrasting color in capital letters not less than ½ in. (13 mm) high.

4.4 *Capacity*—The minimum actual capacity shall be not less than rated capacity plus 4 %. The maximum actual capacity shall be not greater than the applicable rated capacity (see 1.2) plus 15 % for 5-gal (19-L) drums and shall not be greater than rated capacity plus 10 % for drums 15 gal (57 L) and over.

4.5 *Performance*—In addition to the requirements specified herein, drums shall not show cracks or leaks when subjected to tests specified in 5.3.5. Drums with repaired bodies and components shall not be acceptable.

4.6 *Workmanship*—The finished drums shall be free of lumps, blisters, or flash. The threads of the openings and plugs shall be clean, well formed, free of excess flash, and distortion. The seal of the openings and plugs shall be smooth and free of any defects that can affect the functionality of the closure. The color shall be uniform. The drum interior shall be clean and free of foreign matter. The caps and spouts shall be clean, free of excess flash or metal, and distortion.

5. Quality Assurance Provisions

5.1 Sampling inspection as part of manufacturing operations is an acceptable practice to ascertain conformance to requirements.

5.2 *Quality Conformance Inspection*—Unless otherwise specified, sampling for inspection shall be performed as agreed by parties involved or per regulations involved or in accordance with Practice ANSI Z1.4.

5.2.1 The end items shall be examined for conformance to the specified dimensions and for capacity. Any dimension not within the specified tolerance or any drum not meeting its capacity as specified in 4.4, shall be classified as a defect. The drums shall be examined for capacity in accordance with 5.3.6. The lot size shall be expressed in units of drums of one size. The sample unit shall be one drum.

5.2.2 Drums shall be selected randomly for testing and shall be subjected to tests specified in 5.3. Testing parameters and failure criteria shall conform to the requirements for 49 CFR 178, Subpart M or other regulations appropriate.

5.3 *Methods of Inspection*—Drums are to be tested in accordance with the requirements for Packaging Group II unless other requirements prevail.

5.3.1 *Drop Test*—Drums shall be tested in accordance with 49 CFR 178.603.

5.3.2 *Leakproofness Test*—Drums shall be tested for leakproofness in accordance with 49 CFR 178.604.

5.3.3 *Hydrostatic Pressure Test*—Drums shall be tested in accordance with 49 CFR 178.605.

5.3.4 *Stacking Test*—Drums shall be tested in accordance with 49 CFR 178.606.

5.3.5 *Handling Test*—The drum shall be filled with water to 98 % ± 2 % of rated capacity. The handling device to be tested shall be used to lift the drum to a height of 3 ft (914 mm), then lowered to the ground. This shall be repeated twice and then held at a height of 3 ft (914 mm) for a period of 10 min. Failure to comply with the requirements of 3.2 shall be cause for rejection of the item.

5.3.6 *Capacity Test*—The overflow capacity, *Vo*, in gallons (litres) of the drum shall be determined by pouring fresh water at 68 ± 2°F (20 ± 1°C) into the drum until no more water can be added and recording the weight, W_2, in pounds (kilograms). Subtract the initial weight, W_1, in pounds (kilograms) of the drum and calculate the overflow capacity, in gallons (litres). The outage is the capacity excess between the rated (marked) capacity, *V*, in gallons (litres) and the overflow capacity. Calculate the overflow capacity and outage using the following formulas:

Example:

$$\text{overflow capacity} = Vo, \text{ gal} = \frac{W_{2,}\ \text{lb} - W_{1,}\ \text{lb}}{8.33,\ \text{lb/gal}} \quad (1)$$

where:

W_1 = initial weight, lb, and
W_2 = final weight, lb.

$$\text{outage}\ (\%) = \frac{100\left(Vo - V_{\text{rated}}\right)}{V_{\text{rated}}} \quad (2)$$

where:

Vo = overflow capacity, gal, and
V_{rated} = rated capacity, gal.

6. Product Marking

6.1 Containers intended to transport hazardous materials must be marked in conformance to the requirements of 49 CFR 178.503.

6.2 Containers not intended to transport hazardous materials must be legibly and permanently embossed in characters at least 0.47 in. (12 mm) in height. Markings must show the following information:

6.2.1 Manufacturer's name or registered trademark.

6.2.2 Container rated capacity with units (gallons or litres, or both).

6.2.3 Minimum wall thickness with units (inches or millimetres) if required for reuse.

6.2.4 Month and year of manufacture (date check or other legible method). No minimum letter height requirement.

NOTE 3—In order to facilitate identification for recycling or re-use, each drum should be marked to identify the material of composition in conformance with the appropriate ASTM or ISO standards.

7. Packaging

7.1 *Packing*—Packing shall be commercial.

7.1.1 *Commercial Packing*—Drums shall be packed in accordance with Practice D3951 if specified.

7.2 *Marking*—In addition to any special marking required by the contract or order, shipments shall be marked in accordance with Practice D3951, as applicable.

8. Keywords

8.1 barrel; container; plastic container; polyethylene drum; recycled plastic

SUMMARY OF CHANGES

Committee D20 has identified the location of selected changes to this standard since the last issue (D5998 - 10) that may impact the use of this standard. (September 1, 2016)

(1) Upated wording in 1.3.
(2) Added title to reference document in 2.3.
(3) Deleted documents in old 2.4, which were not referenced in the standard.
(4) Editorially changed Eq 2.

ASTM International takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, at the address shown below.

This standard is copyrighted by ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States. Individual reprints (single or multiple copies) of this standard may be obtained by contacting ASTM at the above address or at 610-832-9585 (phone), 610-832-9555 (fax), or service@astm.org (e-mail); or through the ASTM website (www.astm.org). Permission rights to photocopy the standard may also be secured from the Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923, Tel: (978) 646-2600; http://www.copyright.com/