



Designation: D4504 – 94 (Reapproved 2005)

# Standard Specification for Molded Polyethylene Open-Head-Pails for Industrial Shipping of Nonhazardous Goods<sup>1</sup>

This standard is issued under the fixed designation D4504; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This specification covers molded polyethylene, open-head, self-supporting, nonreusable pails intended for the packaging and transportation of nonhazardous goods. Pails are to have volume capacities between 1 and 7 gal (3.8 to 26.5 L).

1.2 Pails intended to contain hazardous goods (materials) shall be in accordance with and tested to United States Department of Transportation Code of Federal Regulations (CFR) Title 49, Parts (100–199).

1.3 The purpose of this specification is to establish performance requirements and test methods for molded open-head polyethylene pails.

1.4 Additives for the resin used and design of the pails are left to the discretion of the supplier, within the allowable limits of regulatory and performance requirements.

1.5 The following safety hazards caveat pertains to the test method portions, Section 10, 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:<sup>2</sup>

**D445 Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and Calculation of Dynamic Viscosity)**

**D996 Terminology of Packaging and Distribution Environments**

**D999 Test Methods for Vibration Testing of Shipping Containers**

**D1972 Practice for Generic Marking of Plastic Products**

**D1975 Test Method for Environmental Stress Crack Resistance of Plastic Injection Molded Open Head Pails**

**D4577 Test Method for Compression Resistance of a Container Under Constant Load**

**D5276 Test Method for Drop Test of Loaded Containers by Free Fall**

**E4 Practices for Force Verification of Testing Machines**

### 2.2 Other Documents:

**National Motor Freight Classification (NMFC)<sup>3</sup>**

**Uniform Freight Classification (UFC)<sup>4</sup>**

**Code of Federal Regulations Title 49 Parts 100–199 (CFR 49)<sup>5</sup>**

## 3. Terminology

3.1 *Definitions*—For definitions of terms used in this specification, see Terminology **D996**.

### 3.2 Definitions of Terms Specific to This Standard:

3.2.1 *open-head pail*—a pail with a full-diameter unrestricted opening at the top, and designed to be carried by hand. The pail body is usually of a tapered design to provide for nesting of pails during transportation and storage, prior to filling of contents. After filling of contents, the pail lid is applied to the pail body, providing a sealed container for storage and shipment of the contents. The pail lid may also have openings or fitments to allow for dispensing of contents without removing the lid. These openings are sealed with closures.

3.2.1.1 *Discussion*—The definition for open-head pail for hazardous materials differs (see Section 49 CFR Parts 100 to 199).

## 4. Classification

4.1 Products to be packaged in open-head pails may be liquid (**Note 1**), solid, paste, granular, or powder form.

**NOTE 1**—For the purpose of establishing test requirements, a liquid is here defined as having a viscosity of less than 5.0 Pa.S at a temperature of

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<sup>2</sup> 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.

<sup>3</sup> Available from National Motor Freight Traffic Association (NMFTA), 2200 Mill Rd., Alexandria, VA 22302.

<sup>4</sup> Available from National Railroad Freight Committee, Suite 1120, 222 South Riverside Plaza, Chicago, IL 60606.

<sup>5</sup> Available from U.S. Government Printing Office Superintendent of Documents, 732 N. Capitol St., NW, Mail Stop: SDE, Washington, DC 20401.

73.4 ± 3.6°F (23 ± 2°C), using the method described in Test Method D445.

4.2 Molded polyethylene open-head pails are classified as follows:

- 4.2.1 Pails for liquids.
- 4.2.2 Pails for nonliquids.

## 5. Ordering Information

5.1 A summary of ordering requirements, detailed in other sections of this specification include the following:

- 5.1.1 Materials of construction (see Section 6).
- 5.1.2 Ultraviolet protection (see 6.2).
- 5.1.3 Other materials not specifically covered in this specification (see 6.3 and 6.4).
- 5.1.4 Pail capacity (see 7.2).
- 5.1.5 Closure requirements, including tamper evident feature (see 7.3).
- 5.1.6 Provisions for handling.
- 5.1.7 Compatibility testing (see 7.8 and 7.9).
- 5.1.8 Inspection (see Section 11).
- 5.1.9 Marking (see Section 13).
- 5.1.10 Intended contents.
- 5.1.11 Whether pressure testing is required.

## 6. Materials

6.1 Materials for the construction of the pail shall be compatible with the intended contents. Effects of impact, vibration, temperature, warehouse stacking, and ultraviolet exposure should be considered.

6.2 If ultraviolet protection is required, it shall be provided by the addition of carbon black or other suitable pigments with ultraviolet stabilizers and inhibitors. These additives should be compatible with the contents and should retain their effectiveness during the life of the pail.

6.3 Materials for purposes other than ultraviolet protection may be added, provided such additives permit the pail to meet the requirements of this specification.

6.4 Used materials, except regrind from the same concurrent production process shall not be acceptable for manufacturing new pails unless otherwise specified.

## 7. Other Requirements

7.1 The pail shall show good workmanship such as absence of flashing, dents, and scratched surfaces.

7.2 *Capacity*—Pails covered by this specification shall be range in rated (marked) capacity from 1 to 7 gal (3.8 to 26.5 L). Minimum actual liquid capacity shall not be less than rated capacity plus 4 %, and maximum actual capacity shall not be greater than 4 % above rated capacity plus one quart, measured with cover attached and contents and pail at 73.4 ± 5°F (23.8 ± 3°C).

7.3 *Closure*—The closure for the pail (when used) shall be in compliance with carrier regulatory requirements and shall ensure protection of contents from leakage, ease of closure, and removal. Gaskets, when used with the closure, and the closure, shall be compatible with the intended contents.

7.4 *Drop Strength*—The pails shall show no evidence of rupture, cracks, or leakage when tested in accordance with 10.2.1.

7.5 *Stacking Strength*—Two vertically stacked pails shall withstand testing without sidewall buckling sufficient to cause damage and shall have a total top-to-bottom deflection of both pails of not more than 1 in. (25.4 mm), when tested in accordance with 10.2.2. In addition, there shall be no evidence of leakage or sifting of contents from the pail when tested in accordance with 10.2.2.2.

7.6 *Vibration (Stack)*—The pails shall show no evidence of rupture, cracks, or leakage when tested in accordance with 10.2.3.

7.7 *Repetitive Shock Test (Optional)*—The pails shall show no evidence of rupture, cracks, or leakage when tested in accordance with 10.2.4.

7.8 *Compatibility, Permeation*—The pail shall perform satisfactorily when tested in accordance with 10.2.5.

7.9 *Resistance to Environmental Stress Cracking*—The pail shall perform satisfactorily when tested in accordance with 10.2.5.3.

7.10 *Special Requirements*—Pail requirements, additional to those in 7.2 through 7.9, if needed by a purchaser, must be specified in the procurement document and as agreed between purchaser and supplier.

## 8. Sampling

8.1 *Lotting*—A lot shall consist of all pails of one size and design, produced from the same materials and under essentially the same manufacturing conditions and offered for delivery at one time.

8.2 *Sampling Pails*—Select sample pails for test at random from a continuous production lot. As a minimum, the number of pails required is 17 as outlined for design qualification tests (see Section 10 and Supplementary Requirements).

## 9. Specimen Preparation

9.1 Prepare pail specimens in accordance with NMFC, item 258 and UFC Rule 40, where applicable, and as agreed between the pail purchaser and supplier.

## 10. Methods of Testing Pails for Design Qualification

10.1 *General*—The test procedures described in this section are to be used to determine physical performance capability of a specific design and thereby, to qualify such a design under the performance requirements of this specification. Additional sampling and testing of these pails, as may be agreed upon between purchaser and supplier, is not precluded by this section. Test methods to determine compatibility of the contents (lading) with the pail will depend on the specific contents to be contained. If the available technical information and prior use experience cannot substantiate an application decision, it shall be the responsibility of the shipper of the filled pail to ensure that the content is compatible with the pail, and that if the content is liquid, that it will not permeate to an extent that a damaging condition could be caused during transportation, storage, and handling.

10.2 *Specific Test Methods for Design Qualification:*

10.2.1 *Drop Strength Test:*

10.2.1.1 Perform drop strength test on pails intended for nonhazardous liquids and nonliquids as follows: