



Standard Specification for Freezers, Ice Cream, Soft Serve, Shake¹

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This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This specification covers commercial ice cream, soft serve, and shake freezers, which freeze and dispense frozen product (dairy, yogurt, custard, etc.) on a continuous basis. Included are conventional and heat-treatment freezers.

1.2 Equipment covered under this specification may contain a substance (or be manufactured with a substance) that harms public health and environment by destroying ozone in the upper atmosphere. This specification does not purport to address environmental regulations. It is the responsibility of the user of this standard to comply with environmental regulations (see 7.5).

1.3 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.

1.4 *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:²

- A167 Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
- A176 Specification for Stainless and Heat-Resisting Chromium Steel Plate, Sheet, and Strip
- D3951 Practice for Commercial Packaging
- F760 Specification for Food Service Equipment Manuals
- F1166 Practice for Human Engineering Design for Marine Systems, Equipment, and Facilities³

¹ This specification is under the jurisdiction of ASTM Committee F26 on Food Service Equipment and is the direct responsibility of F26.03 on Storage and Dispensing Equipment.

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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.

2.2 ANSI/UL Standard:³

Standard No. 621 for Ice Cream Makers

2.3 ANSI/NSF International Standard:⁴

Standard No. 6 for Dispensing Freezers

2.4 ANSI Standards:⁵

B1.1 Unified Inch Screw Threads (UN and UNR Thread Form)

Z1.4 Sampling Procedures and Tables for Inspection by Attributes

2.5 Military Standards:⁶

MIL-R-12323 Refrigerators and Related Equipment, Packaging and Packing

MIL-STD-167/1 Mechanical Vibrations of Shipboard Equipment, Type I—Environmental and Type II—Internally Excited

MIL-STD-461 Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment

MIL-STD-1399/300 Interface Standard for Shipboard Systems Section 300A Electric Power, Alternating Current

3. Terminology

3.1 *corrosion-resistant steel*—corrosion-resisting steel shall conform to any of the 300 Series of Specification A167, or the 400 Series of Specification A176, where permitted by ANSI/NSF Std. 6.

3.2 *heat-treatment freezers*—operate as conventional freezers and heat daily all product to 150°F (66°C) minimum for at least 30 min to destroy undesirable microorganisms.

3.3 *overrun*—the increase in volume due to the addition of air to frozen softserve and shake products, calculated by this formula:

$$\frac{A - B}{B} \times 100 = \text{percent overrun} \quad (1)$$

³ Available from Underwriters Laboratories, Inc., 333 Pfingsten Rd., Northbrook, IL 60062.

⁴ Available from NSF International, P.O. Box 130140, Ann Arbor, MI 48113-0140.

⁵ Available from American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.

⁶ Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.

where:

- A = weight of the liquid mix, and
 B = weight of same volume of frozen product.

3.4 *recovered materials*—materials that have been collected or recovered from solid waste and reprocessed to become a source of raw materials, as opposed to virgin raw materials.

4. Classification

4.1 *General*—Ice cream freezers covered by this specification are classified by type, size, group, style, class, and grade.

4.2 Type:

- 4.2.1 *Type I*—Commercial soft-serve freezer.
 4.2.2 *Type II*—Commercial shake freezer.
 4.2.3 *Type III*—Combination commercial soft-serve and shake freezer.

4.3 Size:

- 4.3.1 *Size 1*—1.0 to 4.9 gal/h (3.8 to 18.6 L/h) finished product output.⁷
 4.3.2 *Size 5*—5.0 to 9.9 gal/h (18.9 to 37.5 L/h) finished product output.⁷
 4.3.3 *Size 10*—10.0 to 14.9 gal/h (37.9 to 56.4 L/h) finished product output.⁷
 4.3.4 *Size 15*—15.0 to 19.9 gal/h (56.8 to 75.3 L/h) finished product output.⁷
 4.3.5 *Size 20*—20.0 to 29.9 gal/h (75.7 to 113.2 L/h) finished product output.⁷
 4.3.6 *Size 30*—30.0 to 39.9 gal/h (113.6 to 151.0 L/h) finished product output.⁷
 4.3.7 *Size 40*—40.0 to 99.9 gal/h (151.4 to 378.1 L/h) finished product output.⁷

4.4 Group:

- 4.4.1 *Group 1*—One freezing cylinder.
 4.4.2 *Group 2*—Two freezing cylinders.
 4.4.3 *Group 3*—Three freezing cylinders.
 4.4.4 *Group 4*—Four freezing cylinders.

4.5 Style:

- 4.5.1 *Style 1*—Floor.
 4.5.2 *Style 2*—Countertop.

4.6 Class:

- 4.6.1 *Class 1*—Air-cooled condenser.
 4.6.2 *Class 2*—Liquid-cooled condenser.
 4.6.3 *Class 3*—Remote air-cooled condenser.

4.7 Grade:

- 4.7.1 *Grade 1*—Nonheat-treatment freezer.
 4.7.2 *Grade 2*—Heat-treatment freezer (see 3.2).

5. Ordering Information

5.1 *Ordering Data*—Purchasers shall select the preferred options permitted herein and include the following information in procurement documents:

- 5.1.1 Title, number, and date of this specification;
 5.1.2 Type, size, group, style, class, and grade of freezer required (see 4.1);

5.1.3 When hardware and fittings are to be other than as specified (see 6.2);

5.1.4 Voltage and frequency (hertz) of input power (see 7.1.1);

5.1.5 If sampling and inspection procedures are required, see 10.2;

5.1.6 Level of preservation and packing required if other than as stated in Practice D3951 (see 15.1);

5.1.7 When mounting options are required (see 5.4);

5.1.8 When Federal/Military procurement is required, review and implement the applicable supplementary requirements (see Supplementary Requirements S1 and S2);

5.1.9 Type of refrigerant, insulation, and other manufacturing processes required (see 7.5); and

5.1.10 When a certification report is required.

5.2 *Freezer Selection and Application*—Prior to the use of Section 4 classifications, the purchaser will ensure the user is not restricted by some aspect of the freezer design such as weight or external dimensions that would prevent the unrestricted use of the classifications listed in Section 4.

5.3 *Freezer Availability*—Although Section 4 lists a wide range of sizes, classes, groups, and styles for commercial types of freezers, not all combinations may be available.

5.4 Mounting Options (see 5.1.7):

- 5.4.1 Casters.
 5.4.2 Legs.
 5.4.3 Brackets.
 5.4.4 Seals.

5.5 *Supplementary Requirements*—The supplementary requirements shall apply only when specified by the purchaser in the contract or order.

6. Materials

6.1 *General*—Freezers shall conform to the applicable documents listed in Section 2. Materials used shall be free from defects that would affect the performance or maintainability of individual components or of the overall assembly. Materials not specified herein shall be of the same quality used for the intended purpose in commercial practice. Unless otherwise specified herein, all equipment, material, and articles incorporated in the work covered by this specification are to be new or fabricated using materials produced from recovered materials to the maximum extent possible without jeopardizing the intended use. None of the preceding shall be interpreted to mean that the use of used or rebuilt products are allowed under this specification unless otherwise specified.

6.2 *Hardware and Fittings*—Unless otherwise specified (see 5.1), all hardware and fittings shall be corrosion-resistant or suitably processed to resist corrosion in accordance with the manufacturer's standard practice.

6.3 *Threaded Parts*—All threaded parts shall conform to ANSI B1.1.

7. Design and Construction

7.1 Electrical Requirements:

⁷ Per freezing cylinder. Combination freezers may require two size ratings, for example: 15 soft serve/20 shake.

7.1.1 *Nominal Input Power*—Unless otherwise specified (see 5.1), the freezer shall be designed to operate on one of the following:

- 7.1.1.1 120 V, 60 Hz, single phase;
- 7.1.1.2 208 V, 60 Hz, single phase;
- 7.1.1.3 240 V, 60 Hz, single phase;
- 7.1.1.4 208 to 240 V, 60 Hz, single phase;
- 7.1.1.5 208 V, 60 Hz, three phase;
- 7.1.1.6 240 V, 60 Hz, three phase;
- 7.1.1.7 208 to 240 V, 60 Hz, three phase; and
- 7.1.1.8 480 V, 60 Hz, three phase.

7.1.2 *Electric Motors*—All electric motors shall have bearings that require no additional lubrication.

7.2 *Steel Fabrication*—The steel used in fabrication shall be free from kinks, sharp bends, and other conditions that would be deleterious to the finished product. Manufacturing processes shall not reduce the strength of the steel to a value less than intended by the design. Manufacturing processes shall be done neatly and accurately. All bends shall be made by controlled means to ensure uniformity of size and shape.

7.3 *Lubrication*—All bearings (unless lifetime lubricated), gears, and sliding parts shall have provision and instructions for lubrication. Bearings or parts in the food zone requiring lubrication shall be identified in the operator’s manual and acceptable food grade lubricants shall be specified by the manufacturer.

7.4 *Interchangeability*—All units of the same classification furnished with similar options under a specific contract shall be identical to the extent necessary to ensure interchangeability of component parts, assemblies, accessories, and spare parts.

7.5 Use of ozone-depleting chemicals must comply with national regulations.

7.5.1 *Refrigerants*—Unless otherwise specified (see 5.1), shall be the manufacturer’s standard chemical(s).

7.5.2 *Insulation*—Unless otherwise specified (see 5.1), shall be the manufacturer’s standard chemical(s).

7.5.3 *Other*—Unless otherwise specified (see 5.1), shall be cleaned or processed using the manufacturer’s standard chemical(s).

8. Performance Requirements

8.1 *Operation*—When tested in accordance with Section 11, the freezers shall operate without failure of the major functional components.

NOTE 1—*Performance Profile*: A new standard is to be developed for an energy-consumption profile.

9. Workmanship, Finish, and Appearance

9.1 All components and assemblies of the freezer shall be free of dirt and other extraneous materials, burrs, slivers, tool and grind marks, dents, and cracks. Castings, molded parts, and stampings shall be free of voids, sand pits, blow holes, and sprues. External surfaces shall be free of sharp edges and corners. All sheet metals used in the fabrication of the freezer shall be free from kinks, dents, and other deformities. Forming and welding shall not cause damage to the metal and shall be done neatly and accurately.

10. Sampling

10.1 A representative production model shall be selected for performance testing.

10.2 Unless otherwise specified in the contract or purchase order, samples selected for testing and inspection by attributes shall be determined in accordance with ANSI Z1.4.

11. Test Methods

11.1 This test method measures the ability of a freezer to continuously produce frozen product at a given rate. If a production rate is not stated by the manufacturer, the freezer should meet the minimum rate of the appropriate ASTM size (see 4.3).

11.2 Test Preparation:

11.2.1 Ambient air temperature should be 75 to 80°F (24 to 27°C) for air-cooled freezers. Inlet cooling water shall be 80°F (27°C) minimum for water-cooled freezers.

11.2.2 Test mix formulations shall contain 32 to 37 % solids for softserve and 24 to 28 % solids for shake. Mix temperature should be 40 to 42°F (4 to 6°C) when put into the freezer.

11.2.3 Finished product parameters for the capacity test shall be within this range:

Softserve	18 to 20°F (–8 to –7°C)	50 % max overrun
Shake, without syrup	26 to 29°F (–3 to –2°C)	60 % max overrun

11.2.4 The freezer shall be set up in accordance with the manufacturer’s instructions. Start the initial freeze down and allow the unit to cycle off. Draw approximately one pint of product to start a refrigeration cycle. Begin the capacity test when the freezer cycles off.

11.2.5 Draw product into an 8-oz (237-mL) container for Size 1 and 5 freezers. For all other freezers use a 16-oz (473-mL) container. Determine the draw rate by dividing 225 by the manufacturer’s rating (finished volume gallons per hour (litres per hour)) when drawing an 8-oz (237-mL) sample. Divide 450 by the manufacturer’s rating (finished volume gallons per hour (litres per hour)) when drawing a 16-oz (473-mL) sample. See Table 1 for typical rating samples.

11.2.6 Record finished product temperature and overrun percentage in accordance with Table 2.

11.2.7 The capacity test shall be conducted for one hour. Additional mix at 40 to 42°F (4 to 6°C) may be added to the mix reservoir during the test.

11.3 Precision and Bias:

11.3.1 No statement is made about either the precision or bias of the test method in 11.2.5 for measuring the gallons per hour (litres per hour) capacity since the result merely states

TABLE 1 Typical Rating Examples

Gallons per Hour	Litres per Hour	Sample Size, oz	Seconds per Sample
1	3.8	8	225
5	19	8	45
10	38	16	45
15	57	16	30
20	76	16	22.5
30	114	16	15
40	151	16	11.25
100	379	16	4.5