



Standard Specification for Reach-in Refrigerators, Freezers, Combination Refrigerator/Freezers, and Thaw Cabinets¹

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1. Scope

1.1 This specification covers the basic design and function of temperature regulated, continuous duty commercial, and marine refrigerators, freezers, combination refrigerator/freezers and thaw cabinets. The equipment will be stationary and of a vertical or horizontal type.

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 specification to comply with environmental regulations.

1.3 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for information only.

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

1.5 *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 ASTM Standards:²

A240 Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels

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

and for General Applications

B280 Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service

D3951 Practice for Commercial Packaging

F760 Specification for Food Service Equipment Manuals

F1166 Practice for Human Engineering Design for Marine Systems, Equipment, and Facilities

2.2 ANSI/UL Standards:³

ANSI/UL 471 Commercial Refrigerators and Freezers

ANSI/UL 969 Marking and Labeling Systems

ANSI/UL 1995 Heating and Cooling Equipment

2.3 NSF/ANSI International Standards:⁴

NSF/ANSI 2 Food Equipment

NSF/ANSI 7 Commercial Refrigerators and Freezers

NSF/ANSI 51 Food Equipment Materials

2.4 ASHRAE Standard:⁵

ANSI/ASHRAE 15 Safety Standard for Mechanical Refrigeration

ANSI/ASHRAE 72 Method of Testing Open and Closed Commercial Refrigerators and Freezers

2.5 NFPA Standard:⁶

NFPA 70 National Electrical Code, Article 500, Hazardous Locations

2.6 Canada National Standard/Canadian Standard:⁷

CAN/CSA C22.2 #120 Refrigeration Equipment

CSA C657 Energy Performance Standard for Commercial Refrigeration Equipment

2.7 Federal and Military Documents:⁸

Canada Energy Efficiency Regulations – SOR/2016

³ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036.

⁴ Available from NSF International, P.O. Box 130140, 789 N. Dixboro Rd., Ann Arbor, MI 48113-0140.

⁵ Available from American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc. (ASHRAE), 1791 Tullie Circle, NE, Atlanta, GA 30329.

⁶ Available from National Fire Protection Association (NFPA), 1 Batterymarch Park, Quincy, MA 02269-9101.

⁷ Available from Canadian Standards Association (CSA), 178 Rexdale Blvd., Toronto, ON M9W1R3, Canada.

⁸ Available from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098.

Department of Energy (DOE) 10 CFR 431 SUBPART C ENERGY EFFICIENCY PROGRAM FOR COMMERCIAL REFRIGERATORS, FREEZERS AND REFRIGERATOR-FREEZERS

DOE 10 CFR 429 CERTIFICATION, COMPLIANCE, AND ENFORCEMENT FOR CONSUMER PRODUCTS AND COMMERCIAL AND INDUSTRIAL EQUIPMENT

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

2.8 State Documents:

20 CCR 1605.2 California State Standard for Federally-Regulated Appliances

20 CCR 1606 Filing by Manufacturers; Listing of appliances in the MAEDbS

3. Terminology

3.1 Definitions:

3.1.1 ambient air temperature—temperature of the air surrounding the exterior of the cabinet or machinery compartment.

3.1.2 automatic defrost—process where heat is automatically introduced into the cooling coils to dissipate any ice or frost buildups on the coil.

3.1.3 capacity—term that refers to the total cubic foot area of the interior storage.

3.1.4 condensing units—each unit shall consist of a compressor, condenser, receiver (if required), fan, and motor.

3.1.5 evaporator coils (forced air)—forced circulation type cooling unit consists of a cooling coil, fan with motor, and enclosing casing.

3.1.6 evaporator coils (static)—refrigerated inner liner with the refrigerating coils incorporated in or attached to the walls of the unit or an alternate location.

3.1.7 explosion proof—refers to a specific requirement for equipment used in hazardous atmospheres.

3.1.8 horizontal cabinet—any cabinet of undercounter or counter height design whose width is its greatest dimension.

3.1.9 modular—particular method of cabinet construction, which allows the cabinet and some of its components to be disassembled and reassembled for ease of installation.

3.1.10 positive latching hardware—any latching mechanism that requires that the latch be disengaged before the door can be opened.

3.1.11 thaw—equipment designed to accelerate the defrosting process of perishable products.

3.1.12 undercounter—cabinet which has a maximum height of no more than 36 in. (916 mm).

3.1.13 unitary—single piece cabinet construction.

3.1.14 vertical cabinet—any cabinet with single or multiple door arrangements where the doors are vertically aligned at an angle of more than 45° from horizontal.

3.1.15 worktop—a cabinet which has a maximum height of no more than 36 in. (916 mm) with an integral solid top that is flat or has a backsplash designed as a working surface.

4. Classification

4.1 General—Refrigerators, freezers, combination refrigerator/freezers or thaw cabinets covered by this specification are classified by types, grades, classes, styles, and sizes.

4.2 Type:

4.2.1 Type I—Refrigerator.

4.2.2 Type II—Freezer.

4.2.3 Type III—Combination refrigerator/freezer.

4.2.4 Type IV—Thaw cabinet.

4.3 Grades:

4.3.1 Grade 1—Vertical cabinet.

4.3.2 Grade 2—Horizontal cabinet.

4.4 Classes:

4.4.1 Class 1—Modular construction.

4.4.2 Class 2—Unitary (single piece) construction.

4.5 Sizes—The following tables depict the sizes of the various types of units. This specification does not purport to address all of the sizes that may be available, but is an overview of the most common sizes used in the industry today.

4.5.1 Vertical Cabinet, Style 1 (Refrigerator or Freezer):

| Sizes ft ³ (L) | Net Capacity Storage ft ³ (L) | Maximum Width in. (mm) | Maximum Overall Depth in. (mm) | Maximum Height without Legs in. (mm) |
|------------------------------|---|------------------------------|---|---|
| 5 (142) | 4 (113) | 33 (838) | 27 (686) | 64 (1626) |
| 10 (283) | 9 (255) | 32 (813) | 29 (737) | 66 (1676) |
| 15 (425) | 14 (396) | 39 (991) | 29 (737) | 72 (1829) |
| 20 (566) | 19 (538) | 51 (1295) | 29 (737) | 74 (1880) |
| 30 (850) | 29 (821) | 58 (1473) | 32 (813) | 74 (1880) |
| 40 (1133) | 39 (1104) | 68 (1727) | 34 (864) | 74 (1880) |
| 65 (1841) | 64 (1812) | 86 (2184) | 34 (864) | 74 (1880) |
| 85 (2407) | 84 (2379) | 112 (2845) | 34 (864) | 74 (1880) |

4.5.1.1 Depth shown is maximum overall with door installed.

4.5.1.2 Height does not include legs when applicable.

4.5.2 Horizontal Cabinet, Style 2 (Refrigerator or Freezer):

| Sizes ft ³ (L) | Net Capacity Storage ft ³ (L) | Maximum Width in. (mm) | Maximum Overall Depth in. (mm) | Maximum Height without Legs in. (mm) |
|------------------------------|---|------------------------------|---|---|
| 5 (142) | 4.5 (127) | 40 (1016) | 28 (711) | 28 (711) |
| 10 (283) | 8 (227) | 49 (1245) | 28 (711) | 28 (711) |
| 20 (566) | 18 (510) | 84 (2134) | 28 (711) | 28 (711) |
| 30 (850) | 27 (765) | 115 (2921) | 28 (711) | 28 (711) |

4.5.2.1 Depth shown is maximum overall with door installed.

4.5.2.2 Height does not include legs when applicable.

4.5.3 Combination Refrigerator/Freezer Cabinet:

| Sizes ft ³ (L) | Total Capacity Storage ft ³ (L) | Low Temperature Capacity ft ³ (L) | Maximum Width in. (mm) | Maximum Overall Depth in. (mm) | Maximum Height without Legs in. (mm) |
|------------------------------|---|---|------------------------------|---|--|
| 10 (283) | 9 (255) | 3 (85) | 31 (787) | 29 (737) | 66 (1676) |
| 15 (425) | 14 (396) | 6 (170) | 39 (991) | 29 (737) | 72 (1829) |
| 20 (566) | 19 (538) | 8 (227) | 51 (1295) | 29 (737) | 74 (1880) |
| 30 (850) | 29 (821) | 13 (368) | 64 (1626) | 32 (813) | 74 (1880) |
| 40 (1133) | 39 (1104) | 18 (510) | 68 (1727) | 34 (864) | 74 (1880) |

4.5.3.1 Depth shown is maximum overall with door installed.

4.5.3.2 Height does not include legs when applicable.

4.5.4 *Thaw Cabinets:*

| Size | Maximum Width in. (mm) | Maximum Depth in. (mm) | Maximum Height in. (mm) |
|-------------|------------------------------|------------------------------|-------------------------------|
| One Section | 48 (1219) | 32 (813) | 84 (2134) |
| Two Section | 72 (1829) | 32 (813) | 84 (2134) |

4.6 *Styles:*

4.6.1 *Style 1*—Manual loading, stationary or fixed shelving.

4.6.2 *Style 2*—Roll-in cart loading.

5. Ordering Information

5.1 *Ordering Data*—Purchasers shall select refrigerators, freezers, combination refrigerator/freezers or thaw cabinet equipment and any preferred options and include the following information in the purchasing document:

5.1.1 Title, number, and date of this specification,

5.1.2 Type, grade, class, style, and size of unit required,

5.1.3 Desired exterior and interior finishes,

5.1.4 Quantity to be furnished,

5.1.5 Electrical power supply characteristics; voltage, phase, frequency,

5.1.6 Number of doors, swing, type (solid or glass),

5.1.7 Accessory equipment: such as spare parts, maintenance parts required, or other options available by the manufacturer, or a combination thereof,

5.1.8 When Federal/Military procurement is required, review and implement the applicable supplementary requirements (see S1 through S8.8.3),

5.1.9 When specified, the purchaser shall be furnished certification that samples representing each lot have been either tested or inspected as directed in this specification and the requirements have been met. When specified, a copy of the test results shall be furnished, (see 14.1 through 14.3),

5.1.10 Level of preservation and packing required if other than as stated in Practice D3951 (see 17.1),

5.1.11 Other custom features or requirements desired, and

5.1.12 Labeling requirements (if different than 15.1).

6. Materials and Manufacture

6.1 *General*—Refrigerators, freezers, combination refrigerator/freezers or thaw cabinets shall conform to NSF/ANSI No. 7. Materials used shall be new and free from defects or reclaimed and recycled conforming to the same quality standards for new materials.

6.1.1 *Corrosion-Resistant Steel*—Corrosion-resistant steel shall conform to Specification A240 and the requirements on 300 or 430 series of stainless steels as applicable.

6.1.2 *Non-Corrosion Resistant Steel*—Mild steel used shall have been treated with a coating of either zinc, chrome, nickel, paint, or similar material to inhibit corrosion.

6.1.3 *Aluminum*—Aluminum alloys shall conform to the requirements of NSF/ANSI No. 7.

6.1.4 *Seamless Copper Tubing*—All copper refrigerant lines used in the system shall be of seamless copper tubing conforming to Specification B280.

6.1.5 *Hardware, Fittings, Fasteners*—All materials used as hardware, fittings, and fasteners shall be of a corrosion-resistant material.

6.1.6 *Ozone Depleting Compounds*—Ozone depleting compounds shall not be used as a refrigerant or as a component of foam insulation and shall be the manufacturer's standard chemicals.

7. Design and Construction

7.1 *General*—Refrigerators, freezers, combination refrigerator/freezers, or thaw cabinets shall be the manufacturer's standard product delivered assembled, ready for mounting, and connected to electricity and used as applicable. Storage temperatures of units shall meet the requirements specified by NSF/ANSI No. 7.

7.2 *Refrigeration Equipment:*

7.2.1 *Condensing Unit*—Service lines for the attachment of manifold gages and accessories shall be provided on both the low and high sides of the system. The capacity of each condensing unit shall be adequate for the intended application.

7.2.2 *Condensing Unit Location*—On vertical type cabinets, the condensing unit may be located on either the top or bottom of the storage compartment. With a horizontal configuration, the condensing unit can be located either to the back, left, or right of the storage compartment unless it is remote.

7.2.3 *Refrigerated Metering*—If a thermal expansion valve is used, it shall adhere to the ASHRAE 15, which addresses system working pressures.

7.2.4 *Evaporated Coil Assembly (Forced Air)*—The coiling coil shall be finned tube construction using copper tubes. The coil tube sheets shall be aluminum, copper, or brass. The fan hub shall be corrosion resistant. The fan and motor shall be direct mounted. The grill opening, shroud, and enclosing casing shall be corrosion resistant.

7.2.5 *Condensate Drain*—All models incorporating forced air evaporators shall provide a thermostatically controlled vaporizer pans as means of disposing of evaporator runoff. An alternate means of condensate evaporation, which allow connection to plumbing, is acceptable. When condensate evaporators are used, they shall have a minimum capacity of 32 oz.

7.3 *Modular Construction:*

7.3.1 *Panel Construction*—Modular units consisting of panel construction must fit together in such a way that, when reassembled, the panels cannot move more than 1/16 in. (1.6 mm) in any direction.

7.3.2 *Fastening Methods*—For modular constructed units, in the assembly process, only those types of fastening methods can be used which would allow the unit to be disassembled at a future date without the use of special tools or methods which might damage or disfigure the unit. No permanent fastening

means of the sub-components to one another, such as welding, brazing, soldering, or the use of epoxies or other adhesives is acceptable.

7.3.3 Access Caps—The caps used to seal the panel fastener access hole, when installed shall be watertight and have flared edges. Access caps, as installed, shall conform to NSF/ANSI No. 7.

7.3.4 Modular Refrigeration Systems—The refrigeration system shall be furnished fully assembled, and operational. It will have been previously charged, tested, and all controls properly adjusted. The system shall have the capability, if being partially disassembled and reassembled, at the time of installation, without the need of an additional refrigerant charge or control adjustments. The condensing unit shall be able to be removed from the condensing unit compartment for ease in moving the cabinet base section.

7.3.5 Modular Refrigerant Couplings—The refrigeration lines shall be connected by using self-sealing refrigerant couplings. The couplings are to be specifically designed for refrigeration applications and shall be used in sets (liquid and suction lines). There shall be a minimum of two sets in a system. Larger systems may require additional sets. The refrigerant couplings are to be a type, which would allow for future system opening at the coupling without its failure.

7.3.6 Modular Installation—Modular units shall be capable of being assembled and installed in the location where they are to be used. A minimum of 3 in. (76 mm) of space, in excess of the finished height and width, is required to accommodate the unit. The total installation of the unit is to be accomplished from the front of the unit without access to the exterior sides, back, or top.

8. Performance Requirements

8.1 Operation—Refrigerators, freezers, combination refrigerator/freezers or thaw cabinets shall conform to ANSI/UL Standard 471, NSF/ANSI No. 7, and DOE 10 CFR Part 431.

9. Workmanship, Finish, and Appearance

9.1 Workmanship—All components and assemblies of the units shall be free from 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, blowholes, and sprues. External surfaces 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. All aspects of the equipment fabrication, assembly, and construction shall be such as not to cause physical harm to the operator while being able to maintain the designed working temperature.

9.2 Finish—The final product must be free from any sharp edges or concealed objects, which may impart injury. No components which may fall off during normal use will be considered an acceptable part of the design.

10. Sampling

10.1 A representative production model may be selected for performance testing at the request of the purchaser.

11. Test Methods

11.1 Compliance and Operational—Equipment shall be designed, constructed, and tested to be in compliance with ANSI/UL Standard 471, NSF/ANSI No. 7, and DOE 10 CFR Part 431.

12. Inspection

12.1 Component and Material Inspection—Incoming components and materials shall be inspected by the manufacturer to the design parameters as specified on drawings or purchase documents, or both, as agreed upon between the purchaser and supplier.

13. Rejection and Rehearing

13.1 Material that fails to conform to the requirements of this specification may be rejected. Rejection should be reported to the producer or supplier promptly and in writing. In case of dissatisfaction with the results of the test, the producer or supplier may make claim for a rehearing.

14. Certification

14.1 General—When specified in the purchase order or contract, the purchaser shall be furnished certification that the samples representing each lot have been either tested or inspected as directed in this specification and the requirements have been met.

14.2 Sanitation—Acceptable evidence of meeting the requirements of NSF/ANSI Standards shall be one of the following:

14.2.1 A current NSF listing and display of the NSF mark on the unit.

14.2.2 A certification for the unit issued by NSF under their one-time contract evaluation/certification service.

14.2.3 A certified test report from a nationally recognized laboratory acceptable to the purchaser, indicating that the unit has been tested and conforms to NSF/ANSI No. 7.

14.3 Safety—Acceptable evidence of meeting the requirements of ANSI/UL Standard 471 shall be one of the following:

14.3.1 A current UL listing and display of the UL seal on the unit.

14.3.2 A certified test report from a nationally recognized laboratory acceptable to the purchaser indicating that the unit has been tested and conforms to ANSI/UL Standard 471.

14.4 Energy—Applicable evidence of meeting the United States Department of Energy (DOE) and National resource of Canada (NRCAN) minimum energy requirements.

14.4.1 Current listed model with DOE Compliance Certification Management System (CCMS) database as outlined in 10 CFR 429.42.

14.4.2 California Energy Commission Database per Title 20 Appliance Efficiency Regulations relating to Modernized Appliance Efficiency Database System (MAEDbS).⁹

14.4.3 Current listed models with NRCAN database as outlined in Canada's Energy Efficiency Act and Energy Efficiency Regulations, SOR 2016.

⁹ Available from <https://ww2.energy.ca.gov/appliances/2018-AAER-10/>.