



# ENERGY STAR® Program Requirements Product Specification for Commercial Refrigerators and Freezers

## Eligibility Criteria Draft 1: Version 4.0

Following is the **Draft 1 Version 4.0** product specification for ENERGY STAR qualified commercial refrigerators and freezers. A product shall meet all of the identified criteria if it is to earn the ENERGY STAR.

- 1) Definitions:** Below are the definitions of the relevant terms in this document. Where applicable, the cited definitions are identical with the definitions in DOE's regulations found in 10 Part CFR 431. When in conflict, the definitions in the Code of Federal Regulations (CFR) take precedence.
- A. **Commercial Refrigerator:** A unit of commercial refrigeration equipment in which all refrigerated compartments in the unit are capable of operating at or above 32°F ( $\pm 2^\circ\text{F}$ ).<sup>1</sup>
  - B. **Commercial Freezer:** A unit of commercial refrigeration equipment in which all refrigerated compartments in the unit are capable of operating below 32°F ( $\pm 2^\circ\text{F}$ ).<sup>1</sup>
  - C. **Commercial Refrigerator-Freezer:** A unit of refrigeration equipment consisting of two or more refrigerated compartments where at least one refrigerated compartment is capable of operating at or above 32°F ( $\pm 2^\circ\text{F}$ ) and at least one refrigerated compartment is capable of operating at or above 32°F ( $\pm 2^\circ\text{F}$ ).<sup>1</sup>
  - D. **Commercial Refrigerator, Freezer, and Refrigerator-Freezer:** Refrigeration equipment that: (a) is not a consumer product (as defined in §431.2 of part 430); (b) is not designed and marketed exclusively for medical, scientific, or research purposes; (c) operates at a chilled, frozen, combination chilled and frozen, or variable temperature; (d) displays or stores merchandise and other perishable materials horizontally, semi-vertically, or vertically; (e) has transparent or solid doors, sliding or hinged doors, a combination of hinged, sliding, transparent, or solid doors, or no doors; (f) is designed for pull-down temperature applications or holding temperature applications; and (g) is connected to a self-contained condensing unit or to a remote condensing unit.<sup>1</sup>
  - E. **Commercial Hybrid:** A unit of commercial refrigeration equipment that: (a) consists of two or more thermally separated refrigerated compartments that are in two or more different equipment families; and (b) is sold as a single unit.<sup>1</sup>
  - F. **Horizontal Closed:** Equipment with hinged or sliding doors and a door angle greater than or equal to 45°. <sup>1</sup>
  - G. **Horizontal Open:** Equipment without doors and an air-curtain angle greater than or equal to 80° from the vertical. <sup>1</sup>
  - H. **Vertical Closed:** Equipment with hinged or sliding doors and a door angle less than 45°. <sup>1</sup>
  - I. **Vertical Open:** Equipment without doors and an air-curtain angle greater than or equal to 0° and less than 10° from the vertical. <sup>1</sup>
  - J. **Closed Solid:** Equipment with doors, and in which more than 75 percent of the outer surface area of all doors on a unit are not transparent. <sup>1</sup>

<sup>1</sup> 10 CFR Subpart C §431.62

- K. Closed Transparent: Equipment with doors, and in which 25 percent or more of the outer surface area of all doors on the unit are transparent.<sup>1</sup>
- L. Self-Contained Condensing Unit: A factory-made assembly of refrigerating components designed to compress and liquefy a specific refrigerant that is an integral part of the refrigerated equipment and consists of 1 or more refrigerant compressors, refrigerant condensers, condenser fans and motors, and factory supplied accessories.<sup>1</sup>
- M. Ice Cream Freezer: A commercial freezer that is designed to operate at or below -5°F (±2°F) (-21°C ±1.1°C) and that the manufacturer designs, markets, or intends for the storing, displaying, or dispensing of ice cream.<sup>1</sup>
- N. Convertible Temperature Equipment: Refrigeration equipment or part thereof that: (a) is not a consumer product (as defined in §431.2 of part 430); (b) is not designed and marketed exclusively for medical, scientific, or research purposes; (c) has one or more compartments that operates at a chilled, frozen, or variable temperature condition between approximately 38°F and 0°F; (d) displays or stores merchandise and other perishable materials horizontally, semi-vertically, or vertically; (e) has hinged transparent and/or solid doors; (f) with a user adjustable application temperature set point within the operating range of 38°F and 0°F; and (g) is connected to a self-contained condensing unit or to a remote condensing unit.<sup>1</sup>
- O. Chef Base or Griddle Stand: Commercial refrigeration equipment that is designed and marketed for the express purpose of having a griddle or other cooking appliance placed on top of it that is capable of reaching temperatures hot enough to cook food.<sup>1</sup>
- P. Prep Table: A commercial refrigerator, freezer, or refrigerator-freezer in which a food condiment rail designed to hold open perishable food is located above the chilled or frozen storage compartment or compartments. The condiment rail is designed to hold perishable food product between 33°F and 41°F.
- Q. Semivertical Open: Equipment without doors and an air curtain angle greater than or equal to 10° and less than 80° from the vertical.<sup>1</sup>
- R. Service Over Counter: Equipment that has sliding or hinged doors in the back intended for use by sales personnel, with glass or other transparent material in front for displaying merchandise, and has a height not greater than 66 inches and is intended to serve as a counter for transactions between sales personnel and customers.<sup>1</sup>
- S. Basic Model: All commercial refrigeration equipment manufactured by one manufacturer within a single equipment class, having the same primary energy source, and that have essentially identical electric, physical, and functional characteristics that affect energy consumption.<sup>1</sup>
- T. Equipment Family: Classification determined by equipment geometry and door orientation, including: Vertical Open (VOP), Semi-Vertical Open (SVO), Horizontal Open (HZO), Vertical Closed Transparent (VCT), Vertical Closed Solid (VCS), Horizontal Closed Transparent (HCT), and Horizontal Closed Solid (HCS).

**Note:** In the Final Version 3.0 ENERGY STAR specification, EPA noted that definitions and associated references would be amended to align with the U.S. Department of Energy (DOE) Final Rule (10 CFR §431) for commercial refrigeration equipment (CRE), which was published on March 28, 2014. As such, several changes were made to the terminology and definitions provided in Section 1 to align with the DOE standards (10 CFR §431.62).

In addition to the existing Commercial Refrigerator, Freezer, and Refrigerator-Freezer definition, EPA has added sub-definitions for Commercial Refrigerators; Commercial Freezers; and Commercial Refrigerators-Freezers. EPA is proposing several minor modifications to the Equipment Family definition to align with terminology used in 10 CFR §431.66 (e) (1).

**Note (cont.):** EPA is incorporating a number of minor updates in this Draft 1, including: (1) an amendment to the Commercial Hybrid term and definition; (2) removal of the Solid Door Cabinet and Transparent Door Cabinet terms and definitions; (3) replacement of the Solid Door and Transparent Door terms with Closed Solid and Closed Transparent, respectively, along with amended definitions; (4) addition of the Self-Contained Condensing Unit term and definition; (5) replacement of the Drawer Cabinet term with Chef Base and Griddle Stand, and amendment of the definition; (6) addition of the Semi-Vertical Open and Service Over Counter terms and definitions; and (7) an amendment to the Basic Model definition.

## 2) Scope:

- A. **Included Products:** Products that (1) meet the definitions of a Commercial Refrigerator, Freezer, and Refrigerator-Freezer, or Commercial Hybrid; and (2) fall under the eligible equipment class definitions in Section 2.A.a-h, or a combination of equipment classes herein, are eligible for ENERGY STAR certification:
- a) Horizontal Closed Solid Self-Contained Low Temperature (HCS.SC.L),
  - b) Horizontal Closed Solid Self-Contained Medium Temperature (HCS.SC.M),
  - c) Horizontal Closed Transparent Self-Contained Low Temperature (HCT.SC.L),
  - d) Horizontal Closed Transparent Self-Contained Medium Temperature (HCT.SC.M),
  - e) Vertical Closed Solid Self-Contained Low Temperature (VCS.SC.L),
  - f) Vertical Closed Solid Self-Contained Medium Temperature (VCS.SC.M),
  - g) Vertical Closed Transparent Self-Contained Low Temperature (VCT.SC.L), and/or
  - h) Vertical Closed Transparent Self-Contained Medium Temperature (VCT.SC.M).

Examples of product types that are eligible for qualification include: reach-in, roll-in, or pass-through units; merchandisers; under-counter units; hybrid units; milk coolers; back bar coolers; bottle coolers; glass frosters; deep well units; beer-dispensing or direct draw units; and bunker freezers.

To be eligible for this specification, commercial refrigeration equipment shall be commercial-grade and third-party certified to the applicable requirements set forth in the following quality and safety standards:

- a. ANSI/NSF International Standard for Food Equipment – Commercial Refrigerators and Freezers (ANSI/NSF 7-2014); and
- b. UL Standard for Commercial Refrigerators and Freezers (UL-471).

**Note:** ANSI/NSF 7-2014 exempts equipment from some temperature performance requirements based on the type of food that is intended to be stored in the unit. Examples of equipment that would be exempt from the temperature performance requirements of this Standard include: refrigerators intended only for the storage or display of non-potentially hazardous bottled or canned products and refrigerators intended only for the display of unprocessed produce. Please refer to ANSI/NSF 7-2014 to determine the applicable requirements for a specific equipment type.

**Note:** In Section 2.A.a., EPA has updated the referenced ANSI/NSF 7-2009 standard, for purposes of establishing intended commercial application, to the most current ANSI/NSF 7-2014.

- B. **Excluded Products:** Chef base or griddle stands, prep tables, service over counter equipment, horizontal open equipment, vertical open equipment, semi-vertical open equipment, convertible temperature equipment, and ice cream freezers are not eligible for ENERGY STAR. Products that are covered under other ENERGY STAR product specifications (e.g. Residential Refrigerators and Freezers) are not eligible for certification under this specification.

**Note:** EPA has replaced the term and definition for drawer cabinets with chef base or griddle stands to align with the terminology change made in Section 1.

### 3) Qualification Criteria:

#### A. Maximum Daily Energy Consumption (MDEC) Requirements:

Table 1: ENERGY STAR Requirements for Commercial Refrigerators, Freezers, and Refrigerator-Freezer <sup>2</sup>		
Product Volume (in cubic feet)	Refrigerator	Freezer
<b>Vertical Closed</b>		
<i>Solid</i>	VCS.SC.M*	VCS.SC.L
0 < V < 15	0.03V+0.85	0.13V+0.85
15 ≤ V < 30	0.066V+0.31	0.22V-0.5
30 ≤ V < 50	0.037V+1.18	0.25V-1.402
50 ≤ V	0.015V+2.28	0.1V+6.096
<i>Transparent</i>	VCT.SC.M	VCT.SC.L
0 < V < 15	0.10V+0.37	0.24V+0.7
15 ≤ V < 30	0.05V+1.12	0.22V+1.0
30 ≤ V < 50	0.07V+0.52	0.21V+1.298
50 ≤ V	0.105 V-1.231	0.2V+1.796
<b>Horizontal Closed</b>		
<i>Solid or Transparent</i>	HCT.SC.M, HCS.SC.M	HCT.SC.L, HCS.SC.L
All volumes	0.05V+0.28	0.057V+0.55

\* DOE Equipment Class designations relevant to ENERGY STAR eligible product scope

- (1) Equipment family code (HCS= horizontal closed solid, HCT=horizontal closed transparent, VCS= vertical closed solid, VCT=vertical closed transparent),
- (2) Operating mode (SC=self-contained), and
- (3) Rating Temperature (M=medium temperature (38 °F), L=low temperature (0 °F)).

**Note:** Since the last time this specification was revised, DOE issued new federal minimum efficiency requirements for CRE, with a compliance date of March 27, 2017. The new minimum standards, issued on March 28, 2014, come close to aligning with the performance criteria for several Version 3.0 ENERGY STAR CRE categories and in some cases exceed current ENERGY STAR levels. To ensure ENERGY STAR labeled CRE products continue to offer significant savings beyond standard products, EPA has proposed updates to the ENERGY STAR performance criteria presented in Table 1.

EPA performed an extensive analysis of energy performance data assembled from the ENERGY STAR qualified products list (QPL), DOE's Compliance Certification Database, and the California Energy Commission's (CEC) database. This dataset includes 654 unique models (632 vertical models and 22 horizontal models) that meet DOE's 2017 minimum standards, which provides good indication of the current market, particularly for vertical refrigeration equipment. EPA also sought information from manufacturers on incremental efficiency gains that could be made with available components and technologies.

Based on the proposed levels, approximately 20-28% of all vertical units would be eligible for the ENERGY STAR. The percentage of horizontal units that meet the proposed levels is less clear due to the small market share for these products and the small corresponding dataset. As such, EPA has proposed a level that simply tracks with the forthcoming DOE minimum efficiency standard and seeks reasonable savings beyond this level. Additionally, due to limited data, EPA is proposing to retain a single level for all horizontal refrigerators (i.e., solid or transparent door models) and a single level for all horizontal freezers (i.e., solid and transparent door models). The dataset suggests that the proposed performance levels for horizontal refrigerators and freezers are attainable with product modifications as noted above.

<sup>2</sup> The operating temperature range for commercial refrigerators and freezers is located at 10 CFR Part 431.66 (e)

**Note (cont.):** EPA anticipates that as manufacturers reconfigure CRE in order to comply with the amended federal standard, there will be opportunities to reduce the incremental cost to achieve ENERGY STAR by leveraging existing technologies and design options. This includes design options such as higher efficiency lighting, improved insulation, and the use of alternative refrigerants. (EPA notes that this is not intended to be a definitive list of the technologies the Agency believes are available to improve efficiency in these products; however, several technology options are highlighted.)

*Increased Efficiency Lighting & Occupancy Sensors*

Market research indicates that lighting is a considerable source of energy consumption for CRE. EPA understands that light-emitting diode (LED) lighting increases energy efficiency and that will continue to experience substantial decreases in cost in the coming years. When higher efficiency lighting is combined with occupancy sensors that switch off or dim display case lighting when not necessary, additional energy efficiency gains are possible.

*Improved Insulation*

Based on market research, EPA understands that improving or increasing the amount of insulation can result in considerable energy savings.

*Alternative Refrigerants*

In April 2015, EPA's Significant New Alternatives Policy (SNAP) program finalized a list of acceptable climate-friendly, subject to use conditions, in CRE: HFC-32, propane (R-290), isobutane (R-600a), and a hydrocarbon blend R-441A.

Based on preliminary analysis and industry discussions, the transition to alternative refrigerants may be accompanied by component and design changes that, in some cases, compound energy savings. This is particularly true of hydrocarbon designs. The California Air Resources Board (ARB) estimates that in general, hydrocarbon refrigerants use 10-30% less energy than comparable HFC systems.<sup>3</sup>

EPA estimates that the models that will meet the proposed ENERGY STAR levels will represent the top performers in the marketplace when the new DOE standards take effect in 2017. EPA encourages stakeholder to provide feedback on the proposed ENERGY STAR performance criteria and provide additional details regarding other energy-efficient technologies.

- B. Determination of Refrigerated Volume: The refrigerated volume (V) of a refrigerator or freezer shall be calculated in accordance with the DOE test procedure at 10 CFR §431.64.
- C. Determining Maximum Daily Energy Consumption for Commercial Hybrid: This section applies to Commercial Hybrid equipment which is a commercial refrigerator, freezer, or refrigerator-freezer with a mixture of solid and transparent external doors with one or more compartments contained in a single cabinet. The maximum daily energy consumption (MDEC) of hybrid equipment shall be the sum of all individual compartment MDEC values. For purposes of hybrid equipment, compartments are defined by the refrigerated volume associated with the different exterior door types. The interior of these compartments may or may not be physically separated.

The refrigerated volume of each individual compartment shall be measured, and its MDEC limit determined, based on the compartment's volume and door type, as listed in Table 1 above. The sum of the volumes of each compartment shall be equivalent to the total volume of the cabinet.

**Example:** Consider a vertical closed refrigeration cabinet with a total volume of 50 cubic feet with one compartment having a transparent door and the other compartment having a solid door. The MDEC of the equipment would be the sum of the MDEC for the two compartments. The requirement used to calculate the MDEC for each compartment is based on the compartment's volume and door type:

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<sup>3</sup> Comments on SNAP proposed rule. Bart E. Croes, Chief, Research Division, California Air Resources Board (ARB). 9/2/14. Docket #EPA-HQ-OAR-2013-0748-0062

Transparent Door MDEC: (25 cu. ft. X 0.05) + 1.12 = 2.37 kWh/day

Solid Door MDEC: (25 cu. ft. X 0.066) + 0.31 = 1.96 kWh/day

MDEC for entire cabinet: 2.37 kWh/day + 1.96 kWh/day = 4.33 kWh/day

C. Significant Digits and Rounding:

- a. All calculations shall be carried out with directly measured (unrounded) values. Final ratings for daily energy consumption should be rounded to 0.01 kWh increments in accordance with the DOE test procedure provisions.
- b. Directly measured or calculated values that are submitted for reporting on the ENERGY STAR website shall be calculated in accordance with the requirements for determining certified ratings for DOE.

**4) Test Requirements:**

- A. One of the following sampling plans shall be used to test energy performance for qualification to ENERGY STAR:
  - a. A single unit is selected, obtained, and tested. The measured performance of this unit and of each subsequent unit manufactured must be equal to or better than the ENERGY STAR specification requirements. Results of the tested unit may be used to qualify additional individual model variations within a basic model as long as the definition for basic model provided in Section 1, above, is met; or
  - b. Units are selected for testing and results calculated according to the sampling requirements defined in 10 CFR Part 429, Subpart B §§ 429.11 and 429.42. The certified rating must be equal to or better than the ENERGY STAR specification requirements. Results of the tested unit may be used to qualify additional model variations within a basic model as long as the additional model variations meet the definition for basic model provided in Section 1.N, above. Further, all individual models within a basic model must have the same certified rating per DOE's regulations in Part 429 and this rating must be used for all manufacturer literature, the qualified product list, and certification of compliance to DOE energy conservation standards.
- B. When testing commercial refrigerators and freezers, the following test methods shall be used to determine ENERGY STAR qualification:

<b>Table 2: Test Methods for ENERGY STAR Qualification</b>	
<b>ENERGY STAR Requirement</b>	<b>Test Method Reference</b>
Daily Energy Consumption (DEC)	10 CFR Part 431 Subpart C, 10 CFR Part 431.64, and 10 CFR Part 431.66(e),

**Note:** The referenced test method in Table 2, above, has been updated to align with DOE's final regulatory standard.

Only those test procedures in 10 CFR §431.64 relevant to vertical closed and horizontal closed, self-contained refrigerators, freezers, and refrigerator-freezers are applicable to this specification. Total energy consumption of the product shall be measured, which includes both the auxiliary energy and refrigeration energy consumption.

For ENERGY STAR, all eligible commercial refrigerators and freezers with standard accessories and power management devices shall undergo testing as specified in 10 CFR § 431.64. For purposes of ENERGY STAR certification, energy management systems may be activated during testing provided they are permanently installed and activated in the refrigeration product. The unit must be shipped with the power management activated.

- 5) **Effective Date:** The ENERGY STAR Commercial Refrigerator and Freezer Version 4.0 specification shall take effect on **TBD**. To qualify for ENERGY STAR, a product model shall meet the ENERGY STAR specification in effect on the model's date of manufacture. The date of manufacture is specific to each unit and is the date on which a unit is considered to be completely assembled.

**Note:** The effective date for the ENERGY STAR Version 4.0 specification is noted as being TBD in Section 5; however, at the very latest, the specification effective date will be on or before March 27, 2017.

- 6) **Future Specification Revisions:** EPA reserves the right to change the specification should technological and/or market changes affect its usefulness to consumers, industry, or the environment. In keeping with current policy, revisions to the specification are arrived at through industry discussions. In the event of a specification revision, please note that ENERGY STAR certification is not automatically granted for the life of a product model.