



# ENERGY STAR® Program Requirements

## Product Specification for Commercial Refrigerators and Freezers

### Eligibility Criteria

#### Draft 2: Version 4.0

Following is the **Draft 2 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 aligned 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 below 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>

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<sup>1</sup> 10 CFR Subpart C §431.62

- 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>
- 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:** Stakeholders were generally supportive of EPA aligning terminology and definitions provided within the 2017 DOE federal standard (10 CFR §431.62). One stakeholder had concern over the replacement of the term “Drawer Cabinet” with “Chef Base or Griddle Stand”. The stakeholder suggested that models using drawers should have their own definition. However, the broad definition of Chef Base or Griddle Stand sufficiently includes refrigerated equipment with drawers, and is pulled from 10 CFR 431.62.

**Note Cont.** As such, the Agency continues to group refrigerated cabinets with drawers under the Chef Base or Griddle Stand term. Finally, EPA reminds stakeholders that products within the definition of Chef Base or Griddle Stand remain excluded from the scope of this specification at this time.

## 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.

- 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.

### 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
Vertical Closed		
<i>Solid</i>	VCS.SC.M*	VCS.SC.L
0 < V < 15	0.022V+0.97	0.21V+0.9
15 ≤ V < 30	0.066V+0.31	0.12V+2.248
30 ≤ V < 50	0.04V+1.09	0.285V-2.703
50 ≤ V	0.024V+1.89	0.142V+4.445
<i>Transparent</i>	VCT.SC.M	VCT.SC.L
0 < V < 15	0.095V+0.445	0.232V+2.36
15 ≤ V < 30	0.05V+1.12	
30 ≤ V < 50	0.076V+0.34	
50 ≤ V	0.105 V-1.111	
Horizontal Closed		
<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:** Based on an analysis of energy performance data, ongoing industry discussions, and market research, EPA continues to see strong value and opportunity for advancing efficiency within this market and believes the levels proposed in this Draft 2 recognize leadership, deliver consumer savings, and are achievable.

Prior to the development of the Draft 1 V4.0 specification, EPA performed an extensive analysis on available energy performance data to determine the proposed levels. Following the release of Draft 1, EPA had received comments suggesting the levels were too stringent. Several stakeholders indicated that many currently available models would need to undergo re-engineering in order to meet the DOE 2017 requirements. EPA understands that many models are currently undergoing design changes and performance data on all of these upgraded models is not available for inclusion in the dataset, at this time. While EPA anticipates changes in the market over the next few years, the Agency was successful in assembling some data on re-designed CRE that reflects the market shift and, included this additional data in the Draft 2 analysis.

In considering additional data and stakeholder concerns regarding the stringency of the Draft 1 levels, EPA has re-evaluated the levels for this Draft 2 specification. In many cases, the levels did not change significantly. EPA believes 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 made these adjustments in an effort to expand ENERGY STAR product availability and variety, while maintaining consumer energy savings and reasonable payback.

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

**Note Cont.** While most levels for vertical equipment shifted, VCS.SC.M (15-30); VCT.SC.M (15-30); and the horizontal levels for both solid and transparent door refrigerators and freezers remain unchanged from Draft 1. EPA reviewed the data of VCT.SC.L equipment and identified several models that were inadvertently included in the data set that do not meet the VCT.SC.L criteria. The incorrectly characterized data points were removed from the data set for this Draft 2 analysis, meaning the compliance rates of all sizes of VCT.SC.L levels were significantly reduced. Based on discussions with several stakeholders, EPA is proposing a slightly different approach for the VCT.SC.L category, which includes a straight percentage reduction of 20% for all VCT.SC.L sizes. EPA recognizes that the compliance rates for medium and large size VCT.SC.L equipment is limited based on available data, but several stakeholders agreed this is an achievable level for ENERGY STAR Version 4.0.

#### *Design Traits for VCS.SC.L CRE*

One stakeholder suggested that EPA consider conducting a design trait analysis to determine if smaller models in the data set (e.g., VCS.SCL (0-15Ft<sup>3</sup>)) are cold wall manual defrost or forced air automatic defrost. EPA was unable to complete this level of analysis as some of the data EPA received for consideration is masked, and the Agency is not able to see all specific design attributes of some models. The stakeholder expressed concern about the proposed levels, regarding availability of models with either manual or automatic defrost, noting that certain design features may be required by specific applications. EPA encourages manufacturers that offer these products to provide additional information so EPA can more effectively address this type of question.

#### *Alternative Refrigerants*

In April 2015, EPA's Significant New Alternatives Policy (SNAP) program finalized a list of acceptable climate-friendly refrigerants for CRE, subject to use conditions. EPA has learned from partners who have made use of alternatives, that in many cases, they deliver energy savings for CRE. Based on available performance data, the Agency sees use of alternatives as pathway to meeting the proposed levels. Approximately 17% of all ENERGY STAR certified unique models are currently using alternative refrigerants, and EPA understands from manufacturers that many more will be available over the course of the year. EPA is encouraged to see that numerous manufacturers have successfully incorporated the use of climate-friendly refrigerants into various types and model configurations.

EPA encourages stakeholders 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:

$$\text{Transparent Door MDEC: } (25 \text{ cu. ft.} \times 0.05) + 1.12 = 2.37 \text{ kWh/day}$$

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:

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

**Note:** 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 shall be shipped with the power management activated, if applicable. One stakeholder asked whether ENERGY STAR models would still meet performance requirements if power management system were de-activated. From discussions with manufacturers, EPA understands that it is unlikely that these features will be disabled in the field, as doing so, would in most cases require an override from a manufacturer service representative.

- 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 to coincide with the effective date of the forthcoming CRE minimum efficiency standard.

- 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.