



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

Eligibility Criteria Final Draft: Version 4.0

Following is the **Final Draft 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 ($\pm 2^\circ\text{F}$).¹
 - B. **Commercial Freezer:** A unit of commercial refrigeration equipment in which all refrigerated compartments in the unit are capable of operating below 32°F ($\pm 2^\circ\text{F}$).¹
 - 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 ($\pm 2^\circ\text{F}$).¹
 - 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.¹
 - 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.¹
 - F. **Horizontal Closed:** Equipment with hinged or sliding doors and a door angle greater than or equal to 45°. ¹
 - G. **Horizontal Open:** Equipment without doors and an air-curtain angle greater than or equal to 80° from the vertical. ¹
 - H. **Vertical Closed:** Equipment with hinged or sliding doors and a door angle less than 45°. ¹
 - I. **Vertical Open:** Equipment without doors and an air-curtain angle greater than or equal to 0° and less than 10° from the vertical. ¹

¹ 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.¹
- 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.¹
- 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.¹
- 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.¹
- 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.¹
- 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.¹
- 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.¹
- 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.¹
- 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.¹
- 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).

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 designations 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 ²		
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: One stakeholder inquired about the use of climate-friendly refrigerants and the potential impact they could have on energy performance, and product availability of ENERGY STAR certified products. Approximately 17% of all ENERGY STAR certified models are currently using climate-friendly refrigerants. A third of these will continue to meet the Version 4.0 levels, providing consumers with both energy efficient and low-GWP equipment options. According to preliminary data from various resources, efficiency gains are possible through the adoption of some climate-friendly refrigerants and can range from approximately 5% - 30% (depending on volume, application and other factors). Based on outreach to multiple stakeholders, EPA understands that many partners plan to introduce additional models, which make use of climate-friendly refrigerants, throughout this year and over the next several years.

One stakeholder asked for clarification on the approach for the VCT.SC.L category, which includes a consistent reduction in allowable energy use of 20% across all VCT.SC.L sizes. For this specification revision, EPA has identified the baseline as the federal minimum performance standards for commercial refrigeration equipment (CRE) issued by the U.S. Department of Energy (DOE), which will take effect in 2017. Therefore, the Version 4.0 levels proposed for the VCT.SC.L category represent a consistent 20% reduction from the forthcoming federal minimum performance standards, not a 20% reduction from the existing Version 3.0 ENERGY STAR performance levels.

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

Note cont. One stakeholder requested that EPA reconsider the Version 4.0 performance levels, using only currently listed (Version 3.0) ENERGY STAR models as the primary dataset for consideration. To avoid setting levels that are overly restrictive and undermine program goals by limiting the range of models that could achieve certification, the ENERGY STAR program consistently makes use of the broadest set of market information available when revising performance requirements. As such, EPA considered data from the ENERGY STAR QPL, the California Energy Commission's Appliance Efficiency Database, and the DOE's Compliance Certification Management System (CCMS). The Agency has confirmed that these products are widely available and represent the full range of current models.

One stakeholder requested confirmation that currently certified VCS.SC.L (0-15 ft³) and VCT.SC.L products will meet Version 4.0 levels. As described above, although currently certified models in these equipment classes may not meet the Version 4.0 levels, EPA has confirmed that other available products meet the proposed performance requirements. Further, based on recent feedback from many stakeholders, EPA understands models in these equipment classes meeting the Version 4.0 requirements will be available to consumers by the effective date of this specification.

- 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:

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

Solid Door MDEC: $(25 \text{ cu. ft.} \times 0.066) + 0.31 = 1.96 \text{ kWh/day}$

MDEC for entire cabinet: $2.37 \text{ kWh/day} + 1.96 \text{ kWh/day} = 4.33 \text{ kWh/day}$

- C. Significant Digits and Rounding:
- 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.
 - 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:

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),

- 5) **Effective Date:** The ENERGY STAR Commercial Refrigerator and Freezer Version 4.0 specification shall take effect on March 27, 2017. 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 will be March 27, 2017, to coincide with the effective date of the forthcoming federal minimum efficiency standard.

Stakeholders requested that EPA consider sustaining the Version 3.0 specification, in the event that the effective date of the DOE minimum efficiency standard becomes delayed. In light of the relatively high market share (57%) of products meeting Version 3.0 and anticipated range of products meeting Version 4.0 the Agency intends to make this specification effective on 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 achieved through market research and 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.