



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

Eligibility Criteria Final Draft, Version 5.0

1 Following is the **Final Draft, Version 5.0** ENERGY STAR product specification for commercial refrigerators
2 and freezers. A product shall meet all of the identified criteria if it is to earn ENERGY STAR certification.

3 **1 Definitions**

4 Below are the definitions of the relevant terms in this document. Where applicable, the cited definitions
5 are aligned with the definitions in the U.S. Department of Energy's (DOE) Code of Federal Regulations
6 (CFR) found in 10 CFR Part 431ⁱ. When in conflict, the definitions in the CFR take precedence.

7 A) Product Types:

- 8 1) Commercial Refrigerator: A unit of commercial refrigeration equipment in which all refrigerated
9 compartments in the unit are capable of operating at or above 32°F (±2°F).
- 10 2) Commercial Freezer: A unit of commercial refrigeration equipment in which all refrigerated
11 compartments in the unit are capable of operating below 32°F (±2°F).
- 12 3) Commercial Refrigerator-Freezer: A unit of refrigeration equipment consisting of two or more
13 refrigerated compartments where at least one refrigerated compartment is capable of operating at or
14 above 32°F (±2°F) and at least one refrigerated compartment is capable of operating below 32°F
15 (±2°F).
- 16 4) Commercial Refrigerator, Freezer, and Refrigerator-Freezer: Refrigeration equipment that: (a) is not a
17 consumer product (as defined in §430.2 of 10 CFR Part 430); (b) is not designed and marketed
18 exclusively for medical, scientific, or research purposes; (c) operates at a chilled, frozen, combination
19 chilled and frozen, or variable temperature; (d) displays or stores merchandise and other perishable
20 materials horizontally, semi-vertically, or vertically; (e) has transparent or solid doors, sliding or hinged
21 doors, a combination of hinged, sliding, transparent, or solid doors, or no doors; (f) is designed for pull-
22 down temperature applications or holding temperature applications; and (g) is connected to a self-
23 contained condensing unit or to a remote condensing unit.
- 24 5) Commercial Hybrid: A unit of commercial refrigeration equipment that: (a) consists of two or more
25 thermally separated refrigerated compartments that are in two or more different equipment families;
26 and (b) is sold as a single unit.
- 27 6) Horizontal Closed: Equipment with hinged or sliding doors and a door angle greater than or equal to
28 45°.
- 29 7) Horizontal Open: Equipment without doors and an air-curtain angle greater than or equal to 80° from
30 the vertical.
- 31 8) Vertical Closed: Equipment with hinged or sliding doors and a door angle less than 45°.
- 32 9) Vertical Open: Equipment without doors and an air-curtain angle greater than or equal to 0° and less
33 than 10° from the vertical.
- 34 10) Closed Solid: Equipment with doors, and in which more than 75 percent of the outer surface area of
35 all doors on a unit are not transparent.
- 36 11) Closed Transparent: Equipment with doors, and in which 25 percent or more of the outer surface area
37 of all doors on the unit are transparent.

ⁱ 10 CFR Part 431, Subpart C, §431.62

- 38 12) Self-Contained Condensing Unit: A factory-made assembly of refrigerating components designed to
39 compress and liquefy a specific refrigerant that is an integral part of the refrigerated equipment and
40 consists of 1 or more refrigerant compressors, refrigerant condensers, condenser fans and motors,
41 and factory supplied accessories.
- 42 13) Ice Cream Freezer: A commercial freezer that is designed to operate at or below -5°F (±2°F) (- 21°C
43 ±1.1°C) and that the manufacturer designs, markets, or intends for the storing, displaying, or
44 dispensing of ice cream.
- 45 14) Convertible Temperature Equipment: Commercial refrigeration equipment that is capable of operating
46 as a refrigerator (Section 1.A.1.) and as a freezer (Section 1.A.2) with a user adjustable application
47 temperature.
- 48 15) Chef Base or Griddle Stand: Commercial refrigeration equipment that is designed and marketed for
49 the express purpose of having a griddle or other cooking appliance placed on top of it that is capable
50 of reaching temperatures hot enough to cook food.
- 51 16) Preparation or Buffet Table: A commercial refrigerator, freezer, or refrigerator-freezer with a food
52 condiment rail designed to hold open perishable food and may or may not be equipped with a lower
53 compartment that may or may not be refrigerated.
- 54 17) Semivertical Open: Equipment without doors and an air curtain angle greater than or equal to 10° and
55 less than 80° from the vertical.
- 56 18) Service Over Counter: Equipment that has sliding or hinged doors in the back intended for use by
57 sales personnel, with glass or other transparent material in front for displaying merchandise, and that
58 has a height not greater than 66 inches and is intended to serve as a counter for transactions between
59 sales personnel and customers.
- 60 19) Undercounter: A vertical closed commercial refrigerator or freezer that has no surface intended for
61 food preparation. The equipment is intended for installation under a separate counter or workspace.
62 This equipment may have doors or drawers and shall have a minimum height of 32-inches, including
63 legs or casters.
- 64 20) Worktop: A vertical closed commercial refrigerator or freezer that has a surface intended for food
65 preparation that is incapable of supporting cooking equipment. This equipment may have doors or
66 drawers and shall have a minimum height of 32-inches, including legs or casters.
- 67 21) Basic Model: All commercial refrigeration equipment manufactured by one manufacturer within a
68 single equipment class, having the same primary energy source, and that have essentially identical
69 electrical, physical, and functional characteristics that affect energy consumption.
- 70 22) Equipment Family: Classification determined by equipment geometry and door orientation, including:
71 Vertical Open (VOP), Semi-Vertical Open (SVO), Horizontal Open (HZO), Vertical Closed Transparent
72 (VCT), Vertical Closed Solid (VCS), Horizontal Closed Transparent (HCT), Horizontal Closed Solid
73 (HCS), Service Over Counter (SOC), and Chef Base (CB).

74
75 **Note:** For further clarification, proposed definitions are included in Section 1.A.19 and 20 for undercounter
76 and worktop tables categories of refrigeration equipment.

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78 2 SCOPE

79 2.1 Included Products

- 80 2.1.1 Products that (1) meet the definitions of a Commercial Refrigerator, Freezer, and Refrigerator-Freezer,
81 Commercial Hybrid; or Convertible Temperature Equipment and (2) fall under the eligible equipment
82 class designations in Section 2.1.1 i-xi., or a combination of equipment classes (see Section 1.A.4)
83 herein, are eligible for ENERGY STAR certification:
- 84 i. Horizontal Closed Solid Self-Contained Low Temperature (HCS.SC.L),

- 85 ii. Horizontal Closed Solid Self-Contained Medium Temperature (HCS.SC.M),
- 86 iii. Horizontal Closed Transparent Self-Contained Low Temperature (HCT.SC.L),
- 87 iv. Horizontal Closed Transparent Self-Contained Medium Temperature (HCT.SC.M),
- 88 v. Vertical Closed Solid Self-Contained Low Temperature (VCS.SC.L),
- 89 vi. Vertical Closed Solid Self-Contained Medium Temperature (VCS.SC.M),
- 90 vii. Vertical Closed Transparent Self-Contained Low Temperature (VCT.SC.L),
- 91 viii. Vertical Closed Transparent Self-Contained Medium Temperature (VCT.SC.M),
- 92 ix. Chef Base Self-Contained Medium Temperature (CB.SC.M)
- 93 x. Chef Base Self-Contained Low Temperature (CB.SC.L), and/or
- 94 xi. Service Over Counter Self-Contained Medium Temperature (SOC.SC.M).

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96 Examples of product types that are eligible for certification include: convertible temperature
97 equipment, reach-in, roll-in, or pass-through units; merchandisers; under-counters; worktops;
98 hybrid units; milk coolers; back bar coolers; bottle coolers; deep well units; beer-dispensing or
99 direct draw units; and bunker ~~freezers~~

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101 **Notes:** For convertible temperature equipment to be listed as a medium and low temperature
102 certified product, it must meet both medium and low temperature criteria if applicable.

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104 2.1.2 To be eligible for this specification, commercial refrigeration equipment shall be commercial-grade and
105 third-party certified to the applicable requirements set forth in the following quality and safety
106 standards:

- 107 i. ANSI/NSF International Standard for Food Equipment – Commercial Refrigerators and Freezers
108 (ANSI/NSF 7-2019); and
- 109 ii. UL Standard for Commercial Refrigerators and Freezers (UL-471).

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111 **Notes:** ANSI/NSF 7-2019 exempts equipment from some temperature performance requirements
112 based on the type of food that is intended to be stored in the unit. Examples of equipment that
113 would be exempt from the temperature performance requirements of this Standard include:
114 refrigerators intended only for the storage or display of non-potentially hazardous bottled or canned
115 products and refrigerators intended only for the display of unprocessed produce. Please refer to
116 ANSI/NSF 7-2019 to determine the applicable requirements for a specific equipment type.

117 2.2 Excluded Products

118 2.2.1 Refrigerated buffet tables and preparation tables, walk-in coolers, blast chillers and freezers,
119 horizontal open equipment, vertical open equipment, semi-vertical open equipment, remote
120 condensing equipment, ice cream freezers, and equipment rated at the lowest application product
121 temperature (LAPT, see 10 CFR Part 431, Subpart C, §431.62 and section 2.2 of Appendix B to
122 Subpart C) are not eligible for ENERGY STAR. Products that are covered under other ENERGY
123 STAR product specifications (e.g., Residential Refrigerators and Freezers) are not eligible for
124 certification under this specification.

125
126 **Note:** Several stakeholders support the proposal to include chef bases (freezers and refrigerators) and service
127 over counter self-contained refrigerators within scope.

129 **3 CERTIFICATION CRITERIA**

130 **3.1 Significant Digits and Rounding**

131 3.1.1 All calculations shall be carried out with directly measured (unrounded) values. Final ratings for daily
 132 energy consumption shall be rounded to 0.01 kWh increments in accordance with the DOE test
 133 procedure provisions.

134 3.1.2 Directly measured or calculated values that are submitted for reporting on the ENERGY STAR website
 135 shall be calculated in accordance with the requirements for determining certified ratings for DOE.

136
 137
 138 **3.2 General Requirements**

139 3.2.1 Maximum Daily Energy Consumption (MDEC) Requirements:

140 **Table 1: ENERGY STAR Requirements for Commercial Refrigerators, Freezers, and Refrigerator-**
 141 **Freezerⁱⁱ**

Product Volume (in cubic feet)	Refrigerator	Freezer
Vertical Closed		
Solid	VCS.SC.M*	VCS.SC.L
0 < V < 15	0.0267V+0.8	0.21V+0.9
15 ≤ V < 30	0.05V+0.45	0.12V+2.248
30 ≤ V < 50		0.2578V-1.8864
50 ≤ V	0.025V+1.6991	0.14V+4.0
Transparent	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	0.105V-1.111	
Horizontal Closed		
Solid or Transparent	HCT.SC.M, HCS.SC.M	HCT.SC.L, HCS.SC.L
All volumes	0.05V+0.28	0.057V+0.55
Chef Bases**		
Doors or Drawers	CB.SC.M	CB.SC.L
All volumes	0.05V+2.1	0.22V+6.0
Service Over Counter		
Total Display Area (in square feet)	SOC.SC.M	N/A
0 < TDA < 20	0.32TDA+0.6	
20 ≤ TDA < 40	0.65TDA-6.0	
40 ≤ TDA	0.4667TDA+1.3333	

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

143 (1) Equipment family code (HCS= horizontal closed solid, HCT=horizontal closed transparent, VCS= vertical
 144 closed solid, VCT=vertical closed transparent, SOC= service over counter),

145 (2) Operating mode (SC=self-contained), and

146 (3) Rating Temperature (M=medium temperature (38 °F), L=low temperature (0 °F)).

147 ** CB = chef base or griddle stand as defined in Section 1.A.15.

ⁱⁱ The operating temperature range for commercial refrigerators and freezers is located at 10 CFR Part 431, Subpart C, §431.66(e)

Note: Multiple stakeholders agreed that the high levels of market penetration for VCS.SC.M and VCS.SC.L categories signify readiness for criteria revision. Stakeholders support the proposed criteria, which represent approximately 25% of the most energy efficient products and reasonably incentivize greater energy efficiency while accommodating consumer choice. However, stakeholders also noted the need to filter these datasets. As a result, EPA removed a number of models from the vertical closed solid self-contained equipment categories dataset such as equipment rated at the lowest application product temperature (LAPT) which can not achieve the regularly required DOE testing temperature. Only six LAPT models in the VCS.SC.M dataset were removed, which did not necessitate adjustments to the proposed levels in the Final Draft. The VCS.SC.M levels continue to reflect the performance of approximately the top 25% of products. However, 80 LAPT models were removed from the VCS.SC.L dataset, which prompted adjustments to less stringent criteria such that approximately 23% of equipment within that product class could qualify. These adjustments had a variable impact on the individual bins within the VCS.SC.L class. Only a few LAPT models were removed from volume bins $0 < V < 15$ and $15 \leq V < 30$, which led to an indication that reverting back to Version 4.0 criteria would be appropriate. On the other hand, most of the LAPT models removed from the VCS.SC.L dataset were in volume bins $30 \leq V < 50$ and $50 \leq V$. Criteria for these larger VCS.SC.L volume bins were adjusted such that they reflect the performance of approximately the top 30% of models in the market, based on available energy performance data. (The pass rates reported for all refrigeration classes are based on unique models in the dataset.)

Stakeholders commented that the Draft 1 proposed criteria for chef bases were too stringent and that most chef bases use more energy per volume than worktops. Further, the dataset for the chef base refrigerator class (CB.SC.M) was updated: one model is no longer in production and was removed, and additional chef base data were added. These dataset revisions led to corresponding adjustments to the proposed criteria levels. As such, we anticipate that they reflect the performance of roughly the top 35% of the market. The result is that the proposed CB.SC.M criterion is set slightly above the DOE level for VCS.SC.M. Given the small sample size ($n=5$), the Agency is not able to accurately estimate the percentage of market that currently qualifies under the criteria proposed for CB.SC.L.

There was an inconsistency between the SOC.SC.M Total Display Area (TDA) ≤ 40 bin criterion formula in the Draft 1 specification and Draft 1 Data Pack, which was updated in the Final Draft and is now aligned. A stakeholder commented that a more stringent criterion for the $20 \leq TDA < 40$ display bin should be considered, while other stakeholders supported the proposed criterion. The SOC.SC.M criteria were not adjusted since the pass rate for unique models is currently at 31%. To have a seamless criteria transition from the $20 \leq TDA < 40$ bin to the $40 \leq TDA$ bin, the $40 \leq TDA$ bin criterion would also need to be adjusted, which would result in a threshold stringency that could severely limit selection of ENERGY STAR certified models in this category.

3.2.2 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 Part 431, Subpart C, Appendix B.

3.2.3 Determination of Total Display Area: The total display area (TDA) of a refrigerator or freezer shall be calculated in accordance with the DOE test procedure at 10 CFR Part 431, Subpart C, Appendix B.

3.2.4 Determining Maximum Daily Energy Consumption for Commercial Hybrid: This section applies to Commercial Hybrid Refrigerators, Freezers, and Refrigerator-Freezers. The maximum daily energy consumption (MDEC) of hybrid equipment shall be the sum of all individual compartment MDEC values. For purposes of hybrid equipment, the refrigerated volume associated with the different equipment families defines compartments. 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 refrigerator with a total volume of 50 cubic feet with one 25 cu. ft. compartment having a transparent door and the other 25 cu. ft. 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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 203 Transparent Door MDEC: (25 cu. ft. X 0.05) + 1.12 = 2.37 kWh/day
 204 Solid Door MDEC: (25 cu. ft. X 0.05) + 0.45 = 1.70 kWh/day
 205 MDEC for entire cabinet: 2.37 kWh/day + 1.70 kWh/day = 4.07 kWh/day
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207 **3.3 Additional Reporting Requirements**

208 3.3.1. Report the type of refrigerant used in the commercial refrigerator and freezer, for example: R-290, R-
 209 600a, or R-134a.
 210

211 **4 TESTING**

212 **4.1 Test Methods**

213 4.1.1 When testing commercial refrigerators and freezers, the following test methods shall be used to
 214 determine ENERGY STAR certification:
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216 **Table 2: Test Methods for ENERGY STAR Certification**

ENERGY STAR Requirement	Test Method Reference
Daily Energy Consumption (DEC), Refrigerated Volume (V) and Total Display Area (TDA)	10 CFR Part 431, Subpart C, Appendix B

217
 218
 219 **Note:** The current DOE testing standard 10 CFR Part 431, Subpart C, Appendix B, based on ANSI/ASHRAE
 220 Standard 72-2005, *Method of Testing Commercial Refrigerators and Freezers*, is appropriate for both chef
 221 bases and service over counter units
 222

223 **4.2 Number of Units Required for Testing**

224 4.2.1 One of the following sampling plans shall be used for purposes of testing for ENERGY STAR
 225 certification:

- i. 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 certify additional individual model variations within a basic model group as long as the definition for basic model group provided in Section 1 above is met; or
- ii. Units are selected for testing and results calculated according to the sampling requirements defined in 10 CFR Part 429, Subpart B § 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 certify additional model variations within a basic model group as long as the definition for basic model group provided in Section 1, above, is met. Further, all individual models within a basic model group must have the same certified rating based on the applicable sampling criteria this rating must be used for all manufacturer literature, the qualified product list, and certification of compliance to DOE standards.

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5 EFFECTIVE DATE

5.1.1 The ENERGY STAR Commercial Refrigerator and Freezer Version 5.0 specification shall take effect on TBD. To be certified 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: EPA anticipates completing the Version 5.0 process no later than March 16, 2022 with an effective date of **December 16, 2022**. Once a final specification is released, manufacturers may immediately begin certifying products to the new Version 5.0 specification, but will have nine months to transition to it, understanding that certification to the current version must cease 4.5 months after the final specification is published. Once the specification takes effect, products that do not meet the Version 5.0 criteria will be removed from the ENERGY STAR Product Finder and may no longer be marketed or labeled as ENERGY STAR unless retested and recertified.

6 FUTURE SPECIFICATION REVISIONS

6.1.1 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.