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

Eligibility Criteria
Draft 2: Version 3.0

Following is the **Draft 2 Version 3.0** 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 431.62. When in conflict, the definitions in the Code of Federal Regulations (CFR) take precedence.

A. 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]

B. Commercial Hybrid Refrigerator, Freezer, and Refrigerator-Freezer: A commercial refrigerator, freezer, or refrigerator-freezer that has two or more chilled and/or frozen compartments that are: (a) in two or more different equipment families, (b) contained in one cabinet, and (c) sold as a single unit.[1]

Note: Equipment families are defined in 10 CFR §431.62, and include Horizontal Closed (HC), Horizontal Open (HZO), Semivertical Open (SVO), Vertical Closed (VC), and Vertical Open (VOP).

C. Horizontal Closed: Equipment with hinged or sliding doors and a door angle greater than or equal to 45°.[1]

D. Horizontal Open: Equipment without doors and an air-curtain angle greater than or equal to 80° from the vertical.[1]

E. Vertical Closed: Equipment with hinged or sliding doors and a door angle less than 45°.[1]

F. Vertical Open: Equipment without doors and an air-curtain angle greater than or equal to 0° and less than 10° from the vertical.[1]

G. Solid Door Cabinet: A commercial refrigerator, freezer, or refrigerator-freezer in which all outer doors on all sides of the unit are solid doors. These doors may be sliding or hinged.

H. Transparent Door Cabinet: A commercial refrigerator, freezer, or refrigerator-freezer in which all outer doors on at least one side of the unit are transparent doors. These doors may be sliding or hinged.

I. Solid Door: A door where less than 75% of the surface area is composed of a transparent material.

1 10 CFR §431.62

J. Transparent Door: A door with greater than or equal to 75% of the surface area is composed of a transparent material.

K. Ice Cream Freezer: A commercial freezer that is designed to operate at or below -5°F (-21°C) and that the manufacturer designs, markets, or intends for the storing, displaying, or dispensing of ice cream.[1]

L. Convertible Temperature Equipment: Commercial refrigeration equipment that is designed to operate as a freezer or refrigerator, allowing a user to adjust a single compartment operating temperature from -5°F (freezer) up to 40°F (refrigerator) or any setting in between

M. Door Angle:

a. For equipment with a flat door, the angle between a vertical line and the line formed by the plane of the door, when the equipment is viewed in cross-section; and

b. For equipment with curved doors, the angle formed between a vertical line and the straight line drawn by connecting the top and bottom points where the display area transparent joins the cabinet, when the equipment is viewed in cross-section.[1]

N. Basic Model: All units of a given type of commercial refrigerator, freezer, or refrigerator-freezer (or class thereof) manufactured by one manufacturer that have the same primary energy source, which have electrical characteristics that are essentially identical, and which do not have any differing electrical, physical, or functional characteristics that affect energy consumption.[1]

Note: To ensure greater consistency where EPA's intention is to harmonize with a DOE regulatory definition, the Agency has added language that states when in cases of conflict, the definition in the CFR takes precedence.

EPA has included a note under Section 1.B, above, to clarify what is meant by equipment families in the Commercial Hybrid definition.

To eliminate redundancy and confusion, EPA has removed the definition of Mixed Solid/Transparent Door Cabinets as it is synonymous with the CFR Commercial Hybrid Refrigerator, Freezer, and Refrigerator-Freezer definition.

EPA is proposing a definition for Convertible Temperature Equipment in an effort to further differentiate between included and excluded products.

Scope:

A. Included Products: Products that meet the definitions of a Commercial Refrigerator, Freezer, and Refrigerator-Freezer or a Commercial Hybrid Refrigerator, Freezer, and Refrigerator-Freezer and are among the following equipment classes are eligible for ENERGY STAR qualification, with the exception of products listed in Section 2.B:

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 (HVCT SC)
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 7-2009); and

b. UL Standard for Commercial Refrigerators and Freezers (UL-471).

Note: ANSI/NSF 7-2009 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 7-2009 to determine the applicable requirements for a specific equipment type.

B. Excluded Products: Drawer cabinets, 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, Hot Food Holding Cabinets) are not eligible for qualification under this specification.

Note: Stakeholders provided comments suggesting that EPA should consider expanding the Commercial Refrigerators and Freezers Version 3.0 specification scope to include other commercial refrigeration equipment subject to federal regulations.

EPA may consider expanding the scope to include additional commercial refrigeration equipment in future specifications only if a robust data set is made available that demonstrates significant product differentiation and energy saving potential.

3) Qualification Criteria:

A. Maximum Daily Energy Consumption Requirements:

Table 1: ENERGY STAR Requirements for Commercial Refrigerators, Freezers, and Refrigerator-Freezer[2]		
Product Volume (in cubic feet)	**Refrigerator**	**Freezer**
Vertical Closed		
Solid Door Cabinets	*VCS. SC. M**	*VCS.SC.L*
0 < V < 15	0.02V+1.60	0.25V+1.55
15 ≤ V < 30	0.09V+0.55	0.20V+2.30
30 ≤ V < 50	0.01V+2.95	0.25V+0.80
50 ≤ V	0.06V+0.45	0.14V+6.30
Transparent Door Cabinets	*VCT.SC.M*	*VCT.SC.L*
0 < V < 15	0.10V+1.07	0.56V+1.61
15 ≤ V < 30	0.15V+0.32	0.30V+5.50
30 ≤ V < 50	0.06V+3.02	0.55V-2.00
50 ≤ V	0.08V+2.02	0.32V+9.49
Horizontal Closed		
Solid or Transparent Door Cabinets	HCT.SC.M, HCS.SC.M	HCT.SC.L, HCS.SC.L
All volumes	0.06V+0.60	0.10V+0.20

* DOE Equipment Class designations relevant to ENERGY STAR eligible product scope
(1) Equipment family code (HCS= horizontal close solid, HCT=horizontal close transparent, VCS= vertical closed solid, VCT=vertical close transparent),
(2) Operating mode (SC=self-contained), and
(3) Rating Temperature (M=medium temperature (38 °F), L=low temperature (0 °F)).

Note: In response to stakeholder request, EPA evaluated the impact of the removal of the term "Refrigerator-Freezer" in the title of Table 1, above. However, upon further consideration, EPA has deemed it necessary to leave the term in to align with the proposed definitions in Section 1, above, and eligible products.

EPA made a slight adjustment to the proposed commercial refrigerator and freezer maximum daily energy consumption (MDEC) performance criteria based on user feedback to the levels proposed in Draft 1. EPA received a suggestion to consider separating levels based on product sub-type in addition to the existing classifications. Stakeholders expressed concern that sub-types, such as bar back and pass-through designs, would effectively be excluded from the specification using the Draft 1 levels. In response, EPA re-analyzed the commercial refrigerator and freezer data sets and made adjustments which would allow some previously excluded models to qualify.

Adjustments were also made to the proposed levels to address additional stakeholder concern about efficiency requirements on contiguous internal cabinet volume bins (e.g. MDEC level was slightly less for a 15 ft^3 freezer when compared to that of a 14.99 ft^3 freezer due to how EPA had segmented products into bins). The amended levels ensure that any internal cabinet volume section breaks have been eliminated.

Some stakeholders requested that EPA evaluate the V2.1 energy performance levels for vertical, closed and transparent door freezers with an internal cabinet volume of less than 15 ft^3 since no products are currently qualified to meet the existing performance levels. EPA had proposed to maintain the current requirements for this size bin in Draft 1. However, EPA amended this performance level such that the top performers within this category will be eligible for certification, providing end users with sufficient options in the marketplace.

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

Note cont.
During the November 15, 2012 ENERGY STAR Commercial Refrigerators and Freezers Version 3.0 webinar and the subsequent May 20, 2013 Draft 1 stakeholder meeting held at the National Restaurant Association (NRA) Show, EPA led a discussion on the impact of natural refrigerants on energy performance. Stakeholders in both venues noted that while these alternative refrigerants currently have a limited presence in the U.S. market compared to conventional refrigerants, there are potential great energy savings opportunities. EPA will continue to watch the market acceptance of these refrigerants and anticipates considering their use in future revisions of this specification. Presently, due to the limited market presence, EPA has not made refrigerant a differentiating factor in this V3 spec. EPA will continue to list the qualified models refrigerant on the qualified product listing.

B. Determination of Refrigerated Volume: The refrigerated volume (V) of a refrigerator or freezer shall be calculated in accordance with the DOE test procedure in 10 CFR §431.64.

C. Determining Maximum Daily Energy Consumption for Commercial Hybrid Refrigerator, Freezer, and Refrigerator-Freezer: This section applies to Commercial Hybrid Refrigerator, Freezer, and Refrigerator-Freezer, 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 transparent half door and one solid half door on the same side. 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 cu. ft. X 0.15) + 0.32 = 4.07 kWh/day
Solid Door MDEC: (25 cu. ft. X 0.09) + 0.55 = 2.80 kWh/day

MDEC for entire cabinet: 4.07 kWh/day + 2.80 kWh/day = 6.87 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(d)

Note: Only those test procedures in 10 CFR §431.64 relevant to horizontal closed and vertical closed 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.

5) Effective Date: The ENERGY STAR Commercial Refrigerator and Freezer Version 3.0 specification shall take effect in 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: EPA plans on finalizing this specification by the end of 2013. Once finalized, manufacturers may immediately begin submitting products for third party certification under the new Version 3.0.

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 qualification is not automatically granted for the life of a product model.