

Program Design Guidance

Self-Contained Commercial Refrigerators and Freezers

Self-contained commercial refrigerators and freezers are used throughout the foodservice industry for temporary storage of food near food preparation and service areas.

This document covers the following topics for self-contained commercial refrigerators and freezers:

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Equipment Description

Self-contained commercial refrigerators and freezers are used for storing food products at specified temperatures, with the condensing unit and compressor built into the cabinet. They consist of a case, insulation, shelves, refrigeration system, and defrost system. Additional accessories may also be present on the equipment, such as perimeter heaters and lighting options. They are available in a number of configurations, including: upright or chest; reach-in, roll-in, or pass-through; with solid, glass or a combination of solid and glass doors; with sliding or hinged doors; and with or without a worktop surface. Typical product names in the market include reach-in, roll-in, pass-through, merchandiser, undercounter, milk cooler, back bar cooler, bottle cooler, glass froster, deep well unit, beer-dispenser or beer cooler, and bunker freezer.

The information contained in this document does not apply to configurations that are not eligible for qualification under CEE and ENERGY STAR specifications, including drawer cabinets, prep tables (sandwich units, pizza prep units), deli cases, and open air units.

Product Performance Metrics

There are a number of performance indicators that end users consider when choosing a commercial refrigerator or freezer, which include:

- Interior and exterior finish (type and grade of material)
- Quality of construction
- Refrigeration system features and size
- Insulation
- Thermometer type (analog, digital)
- Controls
- Usability
- Warranty

Product Use and Lifetimes

Due to the nature of the businesses and facilities which operate commercial refrigerators and freezers, it is generally assumed that the vast majority of these units run 365 days a year, 24 hours/day. According to the Food Service Technology Center (FSTC), reach-in refrigerators and freezers typically last about 12 years¹, though lifetime can vary based on the quality of the unit and maintenance.

Specifications and Test Methods

CEE and ENERGY STAR have both developed efficiency specifications for commercial self-contained refrigerators and freezers. Both specifications are the same and cover both upright and chest solid and glass door refrigerators and freezers. ENERGY STAR maintains a list of qualified products. Links to the current CEE and ENERGY STAR specifications as well as the qualified product list are below. The efficiency criteria are detailed in the two specifications.

- [CEE Specification](#)
- [ENERGY STAR Specification](#)
- [ENERGY STAR Qualified Products List](#)

Refrigerators and freezers eligible for qualification under these specifications are covered by the following test method: [AHRI Standard 1200-2008](#), *Performance Rating of Commercial Refrigerated Display Merchandisers and Storage Cabinets*, which references ANSI/ASHRAE Standard 72-2005, *Method of Testing Commercial Refrigerators and Freezers*.

Product Availability

As of March 2009, there were approximately 52 refrigeration manufacturers making products that meet the U.S. federal standards effective January 1, 2010. These were: AHT Cooling Systems, Arctic Air, Ascend, Avanti, Axiom Equipment, Beverage Air, Blue Air, BSI, Coldstream, Continental Refrigerator, Criotec, Delfield, Duke, Edesa, Electrolux, Everest, Fagor, Fogel, Follet, Foster, Franke Contract Group, Franke, Inc., Frigidaire, General Refrigeration, Glastender, Green World, Habco, Hobart, Hoshizaki, Hussman, Imperial, Kelvinator, Koolaire, Kool Star, Master-Bilt, McCall Refrigeration, Metalfrío, Mimet, Newair, Ningbo Yingqi Metal Products Co., Ltd., NorLake, Patriot, Perlick, QBD, Randell, Silver King, Traulsen, True, TurboAir, Utility, Vendo, and Victory.

Table 1 below summarizes the model availability as of March 2009 for each product type and size subcategory covered by the CEE specification. Depending on product type and size category, product availability ranges from 0%-50% of products that meet the U.S. federal standards effective 1/1/2010, with all but one size subcategory of two product types qualifying approximately the top 25% of products. The two product type/size subcategories qualifying 0%

¹ The FSTC assumptions are used in the ENERGY STAR program. See the assumptions tab of the ENERGY STAR calculator located at: http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/Commercial_Refrigerators.xls.

and 50% of products are the smallest sizes of solid door freezers and glass door freezers respectively. It is important to note that the [data set](#) for each of these two product types is very small, with only 4 solid door freezers and 6 glass door freezers in the 0-15 cubic feet size category. Also, among the 0-15 cubic feet solid door units, there is very little differentiation from the federal standard or among each other, so even a small improvement over the 2010 federal code results in 0% product availability. With regards to small glass door freezers, the data set includes units manufactured and marketed in both the U.S. and Canada, though not always in both countries. The units manufactured and more heavily marketed in Canada (4 of the data points) use manual defrost whereas units manufactured and more heavily marketed in the U.S. (2 of the data points) use automatic defrost.

Table 1. Product availability

Subcategory	# of manufacturers with products that meet 2010 federal standards	# of manufacturers with products that meet CEE specification	# of models that meet 2010 federal standards	# of models that meet CEE specification	% of models that meet CEE specification
Vertical Solid Door Refrigerators					
0 < V < 15	11	2	30	7	23%
15 <= V < 30	11	5	43	12	28%
30 <= V < 50	10	5	34	9	26%
50 <= V	8	2	17	5	28%
Vertical Glass Door Refrigerators					
0 < V < 15	12	4	55	14	25%
15 <= V < 30	15	7	56	14	25%
30 <= V < 50	9	3	33	8	24%
50 <= V	6	2	16	4	25%
Chest Refrigerators (Solid or Glass)					
All	8	3	36	9	25%
Vertical Solid Door Freezers					
0 < V < 15	3	0	4	0	0%
15 <= V < 30	9	5	21	5	24%
30 <= V < 50	12	4	29	7	24%
50 <= V	5	2	15	4	27%
Vertical Glass Door Freezers					
0 < V < 15	3	2	6	3	50%
15 <= V < 30	6	2	7	2	29%
30 <= V < 50	4	3	10	3	30%
50 <= V	5	2	6	2	33%
Chest Freezers (Solid or Glass)					
All	10	5	66	16	24%

Market penetration data is not available for the current performance levels. Collection of market penetration data at the current performance levels will be conducted by ENERGY STAR beginning in 2010.

Price Differential

Table 2 below depicts the price differential between qualifying and non-qualifying units for each product type and size subcategory covered by the CEE specification. The price differential information was developed using list price data for all models in the data set listed in AutoQuotes.^{2,3} The data set is limited to those units that provided test data as of March 2009 demonstrating compliance with the 2010 federal standards. This pricing information is not necessarily indicative of the incremental cost to achieve higher efficiency, only the current list pricing strategies of the manufacturers at the point in time when it was collected.

Table 2. Price differential of qualifying versus non-qualifying refrigeration products.

Size Category	Non-Qualifying Products Average List Price	Qualifying Products Average List Price	List Price Differential (Qualifying minus Non-Qualifying)	Price Differential @ 50% Off List
Solid Door Refrigerators				
0<V<15	\$3,945.91	\$3,484.00	-\$461.91	-\$230.95
15<=V<30	\$6,503.00	\$6,513.17	\$10.17	\$5.08
30<=V<50	\$9,463.91	\$12,111.17	\$2,647.26	\$1,323.63
50<=V	\$14,662.60	\$17,694.20	\$3,031.60	\$1,515.80
Glass Door Refrigerators				
0<V<15	\$4,103.76	\$3,181.67	-\$922.10	-\$461.05
15<=V<30	\$6,395.26	\$8,739.33	\$2,344.07	\$1,172.04
30<=V<50	\$7,460.07	\$12,155.60	\$4,695.53	\$2,347.76
50<=V	\$12,345.20	\$16,747.75	\$4,402.55	\$2,201.28
Chest Refrigerators (Solid and Glass)				
All Sizes	\$4,089.67	\$4,097.38	\$7.71	\$3.85
Solid Door Freezers				
0<V<15	\$9,430.75	n/a	n/a	n/a
15<=V<30	\$8,885.62	\$7,204.67	-\$1,680.95	-\$840.47
30<=V<50	\$10,900.38	\$13,033.33	\$2,132.95	\$1,066.47
50<=V	\$17,351.00	\$18,738.25	\$1,387.25	\$693.63
Glass Door Freezers				
0<V<15	\$5,888.00	n/a	n/a	n/a
15<=V<30	\$8,839.67	\$14,899.00	\$6,059.33	\$3,029.67
30<=V<50	\$12,151.00	\$12,578.50	\$427.50	\$213.75
50<=V	\$16,997.67	\$19,299.00	\$2,301.33	\$1,150.67
Chest Freezers (Solid and Glass)				
All Sizes	\$5,409.35	\$1,487.70	-\$3,921.65	-\$1,960.83

² AutoQuotes provides list pricing information only. End user prices are often calculated as a percent off the list price. End user prices can vary based on a number of factors, including manufacturer, dealer, purchase volume, etc. It is typical to estimate end user prices at approximately 50% off list price, which is the assumption used in this analysis.

³ AutoQuotes contains list price information for most foodservice equipment sold in the United States. However, it typically does not include information for chain specific equipment. The database also does not contain pricing information for manufacturers that do not subscribe to the service, which are generally the smallest manufacturers and manufacturers that do not typically sell in the United States market, such as Canadian manufacturers. Additional research to obtain pricing information on models not listed in AutoQuotes was not conducted.

Energy Savings

Refrigerators and freezers designed with energy efficiency in mind can save considerable electricity compared to standard units. Design attributes that can help realize these savings include^{4,5}:

- Hot gas defrost
- Improved heat exchangers
- Hot gas antisweat heating
- Defrost controls
- Increased and / or improved insulation
- High efficiency motors
- High efficiency compressors
- High efficiency lighting
- Improved face frame design
- Condensate line trap

Table 3 below depicts estimated energy savings between baseline refrigeration units and units that meet or exceed the CEE performance specification. Baseline calculations are based on the U.S. federal standards as of January 1, 2010. Because the U.S. federal standards do not break out chest configured units, the baseline calculations for chest type units are based on the 2010 federal standard for all solid and glass door units. The calculated volume refers to the size unit that was used for this energy savings analysis. The size chosen for each subcategory is the midpoint for each subcategory, with the exception of chest units. For chest units, 14 cubic feet was chosen because most chest type units range in size from 3 to 25 cubic feet, and 14 is the midpoint for this group.

⁴ Arthur D. Little, Inc., “Energy Savings Potential for Commercial Refrigeration Equipment,” 1996.

⁵ Arthur D. Little, Inc., “Application of Best Industry Practices to the Design of Commercial Refrigerators,” 2002.

Table 3. Annual Potential Energy Savings

Volume Category (cubic feet)	Calculated Volume (cubic feet)	Baseline Annual Energy Consumption per Unit (kWh)	Qualifying Products Annual Energy Consumption per Unit (kWh)	Annual Energy Savings per Unit (kWh)	% Energy Savings
Solid Door Refrigerators					
0<V<15	7.5	1,018	759	260	26%
15<=V<30	22.5	1,566	1,107	459	29%
30<=V<50	40	2,205	1,414	790	36%
V<=50	62.5	3,026	1,886	1,140	38%
Glass Door Refrigerators					
0<V<15	7.5	1,548	827	720	47%
15<=V<30	22.5	2,205	1,533	672	30%
30<=V<50	40	2,971	2,243	728	25%
V<=50	62.5	3,957	3,057	900	23%
Solid Door Freezers					
0<V<15	7.5	1,599	1,141	458	29%
15<=V<30	22.5	3,789	2,920	869	23%
30<=V<50	40	6,344	4,615	1,728	27%
V<=50	62.5	9,629	5,916	3,713	39%
Glass Door Freezers					
0<V<15	7.5	3,550	1,988	1,562	44%
15<=V<30	22.5	7,656	5,655	2,001	26%
30<=V<50	40	12,447	8,578	3,869	31%
V<=50	62.5	18,606	11,543	7,063	38%
Chest Refrigerator - Solid					
ALL	14	1,256	812	443	35%
Chest Refrigerator – Glass					
ALL	14	1,832	812	1,020	56%
Chest Freezer – Solid					
ALL	14	2,548	1,427	1,121	44%
Chest Freezer – Glass					
ALL	14	5,329	1,427	3,902	73%

Additional Resources

- ENERGY STAR [Commercial Refrigeration](#) Web page. ENERGY STAR includes specifications, qualified product lists, savings calculators, case studies, and general savings information for commercial refrigerators and freezers. Links to other commercial foodservice equipment categories are also provided.
- Pacific Gas and Electric Food Service Technology Center Life Cycle Cost [Calculators](#). On this Web page, the FSTC provides life cycle cost calculators for glass and solid door refrigerators and freezers. Calculators for other foodservice equipment categories are also provided.