ANSI/AHRI Standard 1200-2023 (I-P)

2023 Standard for

Performance Rating of Commercial Refrigerated Display Merchandisers and Storage Cabinets

Approved by ANSI on 12 June 2023

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ICS Code: 97.130.20

Note:

This standard supersedes ANSI/AHRI Standard 1200-2013 (I-P).

For SI ratings, see ANSI/AHRI Standard 1201-2013 (SI).

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Intent

This standard is intended for the guidance of the industry, including manufacturers, engineers, installers, contractors, and users. The values reported using this standard allow comparison of energy consumption within each of the following product categories: Remote Commercial Refrigerated Display Merchandisers, Remote Commercial Refrigerated Storage Cabinets, Self-contained Commercial Refrigerated Display Merchandisers and Self-contained Commercial Refrigerated Storage Cabinets.

Review and Amendment

This standard is subject to review and amendment as technology advances.

2023 Edition

This edition of AHRI Standard 1200-2023 (I-P), Performance Rating of Commercial Refrigerated Display Merchandisers and Storage Cabinets was prepared by the Commercial Refrigeration Standards Technical Committee. It was approved by the Refrigeration Standards Subcommittee on 12 April 2023. It was approved as an American National Standard (ANS) on 12 June 2023.

Origin and Development of AHRI 1200

In 2002 the Commercial Refrigerator Manufacturers Division of ARI identified the need for a commercial refrigeration standard to assure that perishable foods stored, displayed, and dispensed in retail stores throughout the world for off-premises consumption are protected throughout the final stage in the distribution process. The first edition was developed providing a method whereby electrical energy consumption values of commercial refrigerators and freezers are determined using consistent and repeatable methods.

In 2004 ARI 1200 was harmonized with EN 441. Appendix D was added to provide TDA calculations. Section 3, Section 5.4, Table 3, and Table 4 were revised to include references to TDA calculations.

In 2006 changes were made to Section 5 and Appendix E to address energy differences for ballasts inside and outside the refrigerated area.

In 2008 the rating requirements were updated with a secondary method.

In 2010 the Commercial Refrigerator Manufacturers Section (CRM) made changes to Section 2.2 and Section 3.14. Appendix C was added to have consistency with DOE rule.

In 2013 changes were made to incorporate five interpretations and new DOE rules.

AHRI Standard 1200-2023 (I-P) contains the following update(s) to the previous edition:

- TDA figures and equations were updated for alignment with DOE TP and Standard.
- The Energy Efficiency Ratio (EER) table updated for refrigerant dependability and glide concerns.
- Refrigerant glide updated to in sections 4 and 5including definition, and rating requirement sections.
- Definitions updated to include Ice cream applications and edits to existing definitions.
- Added lighting options and updates to ASHRAE 72.
- Definition section updated to include lighting, and sensors to align with DOE TP requirements.
- Added various product types.
- Consideration of non-standard operating temperatures.

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Commercial Refrigeration Standards Technical Committee Scope:
The Commercial Refrigeration Standards Technical Committee (STC) is responsible for the development and maintenance of AHRI standards and guidelines pertaining to the performance ratings of Commercial Refrigerated Equipment that may include Display Merchandisers and Storage Cabinets, Walk-in Coolers and Freezers including insulated envelop and systems.

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Refrigeration Standards Subcommittee Scope:
Scope of the Refrigeration Standards Subcommittee is standards and guidelines related to the end products that are part of the AHRI Refrigeration Industry Sector.

These committee lists represent the membership at the time the Technical Committee and Standards Subcommittee were balloted on the final text of this edition. Since that time, changes in the membership may have occurred. Membership on these committees shall not in and of itself constitute an endorsement by the committee members, employers of AHRI, or any document developed by the committee on which the member serves.

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PERFORMANCE RATING OF COMMERCIAL REFRIGERATED DISPLAY MERCHANDISERS AND STORAGE CABINETS

Section 1. Purpose

1.1 *Purpose*

The purpose of this standard is to establish for Commercial Refrigerated Display Merchandisers and Storage Cabinets: definitions; test requirements; rating requirements; symbols and subscripts; minimum data requirements for Published Ratings; marking and nameplate data and conformance conditions.

Section 2. Scope

2.1 *Scope*

This standard applies to the following manufacturers' standard catalog Commercial Refrigerated Display Merchandisers and Storage Cabinets, provided that the cases are equipped and designed to work with electrically driven, direct expansion type systems or thermoelectric systems:

- Self-contained and Remote Commercial Refrigerated Display Merchandisers and Storage Cabinets; and
- Open and Closed Commercial Refrigerated Display Merchandisers

2.2 *Exclusions*

This standard does not apply to the following:

- Refrigerated vending machines
- Ice makers
- Soft serve extruders
- Secondary coolant applications
- Chef bases
- Buffet tables
- Preparation tables
- Walk-in coolers
- Blast chillers and freezers

Section 3. Definitions

All terms in this document will follow the standard industry definitions in the ASHRAE Terminology website unless otherwise defined in this section.

3.1 *Expressions of Provision*

Terms that provide clear distinctions between requirements, recommendations, permissions, options, and capabilities.

3.1.1 *"Can" or "cannot"*

Express an option or capability.

3.1.2 *"May"*

Signifies a permission expressed by the document.

3.1.3 *"Must"*

Indication of unavoidable situations and does not mean that an external constraint referred to is a requirement of the document.

3.1.4 *"Shall" or "shall not"*

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Indication of mandatory requirements to strictly conform to the standard and where deviation is not permitted.

3.1.5 *"Should" or "should not"*

Indication of recommendations rather than requirements. In the negative form, a recommendation is the expression of potential choices or courses of action that is not preferred but not prohibited.

3.2 *Standard Specific Definitions:*

3.2.1 *Anti-condensate Energy Consumption (AEC)*

The energy consumed to prevent collection of or evaporate condensate, or both on the outside of the Commercial Refrigerated Display Merchandiser or Storage Cabinet, that includes fan and condensate heater energy expressed in kW·h per day.

3.2.2 *Calculated Daily Energy Consumption (CDEC)*

A value for Remote Commercial Refrigerated Display Merchandisers or Storage Cabinets based upon the requirements of this standard expressed in kW·h per day.

3.2.3 *Commercial Refrigerated Display Merchandiser*

A cabinet cooled by a refrigerating system for displaying chilled or frozen products, or both, maintained within prescribed temperature limits.

3.2.3.1 *Closed Commercial Refrigerated Display Merchandiser*

A refrigerated display merchandiser where product is accessible for removal by opening or moving doors, drawers, or panels.

3.2.3.2 *Open Commercial Refrigerated Display Merchandiser*

A refrigerated display merchandiser where product is accessible for removal without opening or moving doors, drawers, or panels.

3.2.3.3 *Remote Commercial Refrigerated Display Merchandiser*

A refrigerated display merchandiser that is refrigerated by a field-installed condensing unit or refrigerating system.

3.2.3.4 *Self-contained Commercial Refrigerated Display Merchandiser*

A refrigerated display merchandiser that has all the refrigerant-containing parts of the refrigerating system completely factory assembled and tested.

3.2.3.5 *Service Over Counter (SOC)*

A commercial refrigerated display merchandiser equipped with sliding or hinged doors, drawers, or open in the back, intended for use by sales personnel, and with glass or other transparent material in the front for displaying merchandise. The equipment has a height not greater than sixty-six inches and is intended to serve as a counter for transactions between sales personnel and customers.

3.2.4 *Commercial Refrigerated Storage Cabinet*

A closed cabinet cooled by a refrigerating system for storing chilled or frozen products, or both maintained within prescribed temperature limits.

3.2.4.1 *Remote Commercial Refrigerated Storage Cabinet*

A refrigerated storage cabinet that is refrigerated by a field-installed condensing unit or refrigerating system.

3.2.4.2 *Self-contained Commercial Refrigerated Storage Cabinet*

A refrigerated storage cabinet that has all the refrigerant-containing parts of the refrigerating system completely factory assembled and tested.

3.2.5 *Compressor Energy Consumption (CEC)*

The energy consumed by the compressor expressed in kW·h per day.

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3.2.6 *Condensate Evaporator Pan Heater Energy Consumption (PEC)*

The energy consumed by the condensate evaporator pan heater expressed in kW·h per day.

3.2.7 *Defrost Energy Consumption (DEC)*

The energy consumed by the defrost heater(s) expressed in kW·h per day.

3.2.8 *Dew Point*

Refrigerant vapor saturation temperature at a specified pressure expressed in °F.

3.2.8.1 *Adjusted Dew Point*

An adjusted temperature lower than actual Dew Point temperature expressed in °F, resulting from suction line pressure losses, equal to saturated suction temperature at the compressor.

3.2.9 *Energy Efficiency Ratio (EER)*

A ratio of the cooling capacity in Btu/h to the power input values in watts at any given set of Rating Conditions expressed in Btu/(W·h).

3.2.10 *Fan Energy Consumption (FEC)*

The energy consumed by fan motors expressed in kW·h per day.

3.2.11 *High Glide Refrigerant*

A zeotropic refrigerant blend with a temperature glide that is greater than 2°F. Examples include but are not limited to R-407A, R-407C, R-407F, R-448A, and R-449A.

3.2.12 *Integrated Average Temperature*

The average of all test package measurements taken during the test expressed in °F.

3.2.13 *Lighting Energy Consumption (LEC)*

The energy consumed by the refrigerated display merchandiser or storage cabinet lighting used to illuminate interior refrigerated products expressed in kW·h per day.

3.2.14 *Product Applications*

One of four temperature ranges that a Commercial Refrigerated Display Merchandiser or Storage Cabinet is intended to maintain.

3.2.14.1 *High Temperature Applications*

An application where the Integrated Average Temperature is at, or above, 45°F.

3.2.14.2 *Ice Cream Applications*

An application where the Integrated Average Temperature is at, or below, -5°F, and intended for the display, storage, or dispensing of ice cream.

3.2.14.3 *Low Temperature Applications*

An application where the Integrated Average Temperature is at, or below, 32°F, and greater than -5°F.

3.2.14.4 *Medium Temperature Applications*

An application where the Integrated Average Temperature is greater than 32°F, and less than 45°F.

3.2.14.5 *Lowest Application Product Temperature (LAPT)*

For remote condensing equipment that is not capable of operating a successful test at a Standard Rating Condition, the LAPT is the temperature achieved with the Dew Point temperature set to the manufacturer's recommended setpoint. For self-contained equipment that is not capable of operating a successful test at a Standard Rating Condition, the LAPT is the temperature achieved at the lowest thermostat setting.

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3.2.15 *Published Rating*

A statement of the assigned values of those performance characteristics, under stated Rating Conditions, where a unit can be chosen to fit the application. These values apply to all units of the same nominal size and type (identification) produced by the same manufacturer. This includes the rating of all performance characteristics shown on the unit or published in specifications, advertising or other literature controlled by the manufacturer, at stated Rating Conditions.

3.2.15.1 *Application Rating*

A rating based on tests performed at application Rating Conditions other than Standard Rating Conditions.

3.2.15.2 *Standard Rating*

A rating based on tests performed at Standard Rating Conditions.

3.2.16 *Rating Conditions*

Any set of operating conditions where a single level of performance results and causes only that level of performance to occur.

3.2.16.1 *Standard Rating Conditions*

Rating Conditions used as the basis of comparison for performance.

3.2.17 *Refrigerated Volume (V_r)*

The interior total volume of a Commercial Refrigerated Display Merchandiser or Storage Cabinet as calculated by Appendix C is intended to provide a uniform means of determining the dimensions used to calculate volume, taking into account the special features or functional components, or both that are located within the refrigerated compartment(s). The calculation is not intended to provide a means of measuring the product-storage capacity. This volume calculation only applies to Closed Commercial Refrigerated Display Merchandisers and Storage Cabinets.

3.2.18 *Total Daily Energy Consumption (TDEC)*

A calculated energy consumption value for Self-contained Commercial Refrigerated Display Merchandisers and Storage Cabinets based upon the requirements of this standard expressed in kW·h per day.

3.2.19 *Angle Normal*

The view from a vector perpendicular to a plane tangent to the surface, or the view that has an angle of 90 degrees from the surface.

3.2.20 *Total Display Area (TDA)*

The sum of the projected area(s) of visible product, expressed in ft^2 such as portions where product can be viewed from an *angle normal*, or perpendicular, to the transparent area or opening, as calculated by Appendix D.

3.2.20.1 *Transparent Surface*

A transparent surface has greater than or equal to 45% light transmittance, as determined in accordance with the ASTM Standard E 1084-86 (Reapproved 2015).

Section 4. Test Requirements

4.1 *Test Requirements*

The tests required for this standard shall be conducted in accordance with ASHRAE Standard 72-2022, except the applications and conditions included in this section.

4.1.1 *Integrated Average Temperature*

An Integrated Average Temperature of the test simulators shall be maintained based on the Product Application.

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4.1.1.1 *High Temperature Applications*

Commercial Refrigerated Display Merchandisers and Storage Cabinets intended for High Temperature Applications shall have an Integrated Average Temperature of 55°F ± 2.0°F.

4.1.1.2 *Ice Cream Applications*

Commercial Refrigerated Display Merchandisers and Storage Cabinets intended specifically for the storage, display or dispensing of ice cream shall have an Integrated Average Temperature of -15.0°F ± 2.0°F. Equipment that is not designed, marketed, or intended specifically for the storage, display or dispensing of ice cream, is not qualified to be an "ice-cream application". For example, multi-purpose equipment for *low temperature applications* manufactured for storage and display of frozen foods as well as ice cream do not meet the definition in Section 3.2.14.2.

4.1.1.3 *Low Temperature Applications*

Commercial Refrigerated Display Merchandisers and Storage Cabinets intended for Low Temperature Applications to include storing and displaying frozen products, as well as ice cream products, shall have an Integrated Average Temperature of 0.0°F ± 2.0°F.

4.1.1.4 *Medium Temperature Applications*

Commercial Refrigerated Display Merchandisers and Storage Cabinets intended for Medium Temperature Applications shall have an Integrated Average Temperature of 38°F ± 2.0°F.

4.1.1.5 *Lowest Application Product Temperature (LAPT)*

Models not capable of maintaining Integrated Average Temperatures as specified in Section 4.1.1.1, through Section 3.2.14.5 shall be rated at the lowest Integrated Average Temperature a given unit is capable of maintaining to comply with the steady-state stabilization requirements specified in ASHRAE 72. For remote condensing equipment that is not capable of operating a successful test at a Standard Rating Condition, the LAPT is the temperature achieved with the Dew Point temperature set to the manufacturer's recommended setpoint. For self-contained equipment that is not capable of operating a successful test at a Standard Rating Condition, the LAPT is the temperature achieved at the lowest thermostat setting. The manufacturer shall maintain and provide justification for the reason(s) that the product cannot obtain the Standard Rating Condition.

Note: Commercial Refrigerated Display Merchandisers and Storage Cabinets that are designed for use in multiple temperature applications as defined in Sections 3.2.14.1 through Section 3.2.14.5 by making set point adjustments should be rated under each applicable temperature specified.

4.1.2 *Electrical Conditions*

For all dual nameplate voltage equipment covered by this standard, tests shall be performed at both voltages, or at the lower voltage if only a single rating is published.

4.1.3 *Circulation of Air*

For self-contained refrigerators designed to be installed next to a wall in the direction of the exhaust or intake, or both, a vertical partition or wall shall be located at the minimum clearance as specified in the installation instructions. If the installation instructions do not provide minimum clearance, the vertical partition or wall shall be located 4 ± 0.5 in from the sides or rear of the cabinet and extend at least 12 in beyond each side of the cabinet from the floor to not less than 12 in above the top of the cabinet.

Section 5. Rating Requirements

5.1 *Rating Requirements for Remote Commercial Refrigerated Display Merchandisers and Storage Cabinets*

5.1.1 *General*

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This section identifies the necessary data required to calculate the CDEC for Remote Commercial Refrigerated Display Merchandisers and Storage Cabinets.

5.1.2 *CDEC for Remote Commercial Refrigerated Display Merchandisers and Storage Cabinets*

The total electrical load shall be determined using Equation 1.

CEC shall be calculated as described in Section 5.1.2.1.

All other electrical loads shall be measured, either individually or at any shared power supply. These shall include evaporator fan motors, lighting, surface anti-condensate load including fans and heaters, defrost heaters, condensate evaporator pans and any other applicable electrical loads when these are part of the unit as seen in Equation 1.

The following calculations shall be done to determine the CDEC.

$$CDEC = CEC + [FEC + LEC + AEC + DEC + PEC + OEC] \quad \textbf{1}$$

The values are expressed in kW·h per day.

Remote Commercial Refrigerated Display Merchandisers and Storage Cabinets shall record any measured or calculated loads in the calculation of CDEC. Shown below are formulae for the required individual loads under the calculation approach.

5.1.2.1 *Calculation of CEC*

The EER values in Table 1 shall be used to calculate CEC for a 24-hour period. See Equation 2.

The EER values in Table 1 are based on an evaporator temperature and the Commercial Refrigerated Display Merchandiser or Storage Cabinet classification. Commercial Refrigerated Display Merchandisers and Storage Cabinets for Medium and High Temperature Applications shall use an adjusted dew point temperature that is 2.0°F lower than the Commercial Refrigerated Display Merchandiser or Storage Cabinet Dew Point.

Commercial Refrigerated Display Merchandisers and Storage Cabinets for Low Temperature/Ice Cream Applications shall use an adjusted dew point temperature that is 3.0°F lower than the Commercial Refrigerated Display Merchandiser or Storage Cabinet Dew Point. Table 1 shall be used for consistency, understanding that other compressor selections can lead to a different efficiency.

$$CEC = [(Qrt) \cdot (t - tdt)] / (EER \cdot 1000) \quad \textbf{2}$$

For High Glide Refrigerants, the EER used in the CEC calculation shall be determined based on adjusted mid-point evaporator temperature.

The mid-point evaporator temperature, T_m, shall be calculated using the following steps (See Appendix E for example calculation):

1) The entering liquid refrigerant temperature and entering liquid refrigerant pressure of the Commercial Refrigerated Display Merchandiser or Storage Cabinet shall be used to calculate the entering refrigerant enthalpy, h_i.
2) The entering refrigerant enthalpy and suction vapor pressure shall be used to calculate the inlet evaporator refrigerant temperature, T_i.
3) The saturated suction refrigerant Dew Point temperature, T_{sd}, shall be calculated from the suction vapor pressure.
4) The inlet evaporator refrigerant temperature shall be subtracted from the saturated suction refrigerant Dew Point temperature to determine the total refrigerant glide in the evaporator.
   $T_{sd} - T_i = T_g$
5) Divide T_g by 2 and subtract this number from T_{sd}.
6) Round the result to the nearest integer to find T_m, the mid-point evaporator temperature.

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