ANSI/AHRI Standard 1201 (SI)

2013 Standard for

Performance Rating of Commercial Refrigerated Display Merchandisers and Storage Cabinets

Approved American National Standard
ANSI

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Approved by ANSI on October 1, 2013

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Note:

This standard supersedes ANSI/AHRI Standard 1200-2010.
For I-P ratings, see ANSI/AHRI Standard 1200 (I-P) – 2013.

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Printed in U. S.A.

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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.

1.1.1 *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.

1.1.2 *Review and Amendment*. This standard is subject to review and amendment as technology advances.

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:

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

2.2 *Exclusions.* This standard does not apply to the following:

2.2.1 Refrigerated vending machines
2.2.2 Ice makers
2.2.3 Soft serve extruders
2.2.4 Secondary coolant applications

Section 3. Definitions

All terms in this document will follow the standard industry definitions in the ASHRAE Wikipedia website (http://wiki.ashrae.org/index.php/ASHRAEwiki) unless otherwise defined in this section.

3.1 *Anti-condensate Energy Consumption (AEC).* The Total Daily Energy Consumption used in condensate removal on the outside of the Commercial Refrigerated Display Merchandiser or Storage Cabinet, which typically includes fan and condensate heater energy expressed in kW·h per day.

3.2 *Calculated Daily Energy Consumption (CDEC).* This is a value for Remote Commercial Refrigerated Display Merchandisers or Storage Cabinets based upon the requirements of this standard expressed in kW·h per day.

3.3 *Coefficient of Performance (COP).* A ratio of the cooling capacity in watts W to the power input value in watts W at any given set of Rating Conditions expressed in watts/watt, W/W.

3.4 *Commercial Refrigerated Display Merchandiser*. A cabinet cooled by a refrigerating system for displaying chilled and/or frozen food to be maintained within prescribed temperature limits.

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3.4.1 *Closed Commercial Refrigerated Display Merchandiser*. A refrigerated display merchandiser where food is accessible for removal by opening or moving doors or panels.

3.4.2 *Open Commercial Refrigerated Display Merchandiser*. A refrigerated display merchandiser where food is accessible for removal without opening or moving doors or panels.

3.4.3 *Remote Commercial Refrigerated Display Merchandiser*. A refrigerated display merchandiser that has a remote condensing unit.

3.4.4 *Self-contained Commercial Refrigerated Display Merchandiser*. A refrigerated display merchandiser that has a completely factory assembled and factory tested refrigerating system in which all of the refrigerant-containing parts are permanently connected at the factory.

3.4.5 *Service Over the Counter (SOC).* A commercial refrigerator or freezer equipped with sliding or hinged doors 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 no greater than 167.6 centimeters and is intended to serve as a counter for transactions between sales personnel and customers.

3.5 *Commercial Refrigerated Storage Cabinet.* A closed cabinet cooled by a refrigerating system for storing chilled and/or frozen food to be maintained within prescribed temperature limits.

3.5.1 *Remote Commercial Refrigerated Storage Cabinet*. A refrigerated storage cabinet that has a remote condensing unit.

3.5.2 *Self-contained Commercial Refrigerated Storage Cabinet*. A refrigerated storage cabinet that has a completely factory assembled and factory tested refrigerating system in which all of the refrigerant-containing parts are permanently connected at the factory.

3.6 *Compressor Energy Consumption (CEC).* The energy consumed by the compressor expressed in kW·h per day.

3.7 *Condensate Evaporator Pan Energy Consumption (PEC).* The amount of heat energy required to change condensate from liquid to a vapor in the evaporator pan expressed in kW·h per day.

3.8 *Defrost Energy Consumption (DEC).* The energy consumed during defrost cycles expressed in kW·h per day.

3.9 *Dew Point.* Refrigerant vapor saturation temperature at a specified pressure expressed in °C.

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

3.10 *Fan Energy Consumption (FEC).* The energy consumed by fan motors expressed in kW·h per day.

3.11 *Integrated Average Temperature.* The average of all test package measurements taken during the test expressed in °C.

3.12 *Lighting Energy Consumption (LEC).* The energy consumed by lighted shelves and lighting internal to the refrigerated display merchandiser or storage cabinet expressed in kW·h per day.

3.13 *Product Temperature*. Commercial Refrigerated Display Merchandisers or Storage Cabinets shall be tested with one or more of the following Integrated Average Temperatures:

3.13.1 *Ice Cream Applications.* Commercial Refrigerated Display Merchandisers and Storage Cabinets intended specifically for the storage, display or dispensing of ice cream and so labeled by the manufacturer shall have an Integrated Average Product Temperature of -26.0°C ± 1.1°C.

3.13.2 *Low Temperature Applications.* Commercial Refrigerated Display Merchandisers and Storage Cabinets

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intended for Low Temperature Applications to include storing and displaying frozen foods, as well as ice cream products, shall have an Integrated Average Product Temperature of -18°C ± 1.1°C.

3.13.3 *Medium Temperature Applications.* Commercial Refrigerated Display Merchandisers and Storage Cabinets intended for Medium Temperature Applications, shall have an Integrated Average Temperature of 3.3°C ± 1.1°C.

3.13.4 *Application Product Temperature.* This test allows Integrated Average Temperatures other than 3.13.1, 3.13.2 and 3.13.3.

Note: Requirement 3.13.1 is defined to address products designed and labeled explicitly for Ice Cream Applications as defined in the United States Code of Federal Regulations 10 CFR Part 431 Section IV.B.5. Freezer display merchandisers and storage cabinets that are designed for use in both low temperature (frozen food) and Ice Cream Applications by making set point adjustments will be rated as a low temperature application (3.13.2).

3.14 *Published Rating.* A statement of the assigned values of those performance characteristics, under stated Rating Conditions, by which a unit may be chosen for its application. The term Published Rating 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.

3.14.1 *Application Rating*. A rating based on tests performed at application Rating Conditions (other than Standard Rating Conditions).

3.14.2 *Standard Rating*. A rating based on tests performed at Standard Rating Conditions.

3.15 *Rating Conditions*. Any set of operating conditions under which a single level of performance results and which causes only that level of performance to occur.

3.15.1 *Standard Rating Conditions*. Rating Conditions used as the basis of comparison for performance characteristics.

3.16 *"Shall"* or "*Should"*. "Shall" or "should" shall be interpreted as follows:

3.16.1 *Shall*. Where "shall" or "shall not" is used for a provision specified, that provision is mandatory if compliance with the standard is claimed.

3.16.2 *Should*. "Should" is used to indicate provisions which are not mandatory but which are desirable as good practice.

3.17 *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.

3.18 *Total Display Area (TDA).* The sum of the projected area(s) for visible product expressed in m^2.

3.18.1 *Transparent Surface*. A transparent surface shall have a minimum of 65% light transmission or 65% clear surface. For example, silk-screened glass may or may not be transparent depending on the amount of silkscreen applied."

3. 19 *Volume.* Two methods are defined for determining refrigerated volume.

3.19.1 *AHAM Volume Method.* The interior volume of a refrigerator as calculated by AHAM HRF-1.

3.19.2 *Load Line Volume Method*. The gross interior volume of the refrigerator contained within the load limit lines. This gross volume shall be calculated without display devices installed.

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Section 4. Test Requirements

4.1 *Test Requirements.* The tests required for this standard shall be conducted in accordance with ANSI/ASHRAE Standard 72.

4.1.1 *Dry-Bulb Temperature***.** The average test-room dry-bulb temperature shall be 24.0ºC ± 1.0ºC, when measured in accordance with ANSI/ASHRAE Standard 72.

4.1.2 *Wet-Bulb Temperature*. The average test-room wet-bulb temperature shall be 18.0ºC ± 1.0ºC, when measured in accordance with ANSI/ASHRAE Standard 72.

4.1.3 *Electrical Conditions.* Nameplate voltages for 60 Hertz systems are shown in Table 1 of AHRI Standard 110. Nameplate voltages for 50 Hertz systems shall include one or more of the utilization voltages shown in Table 1 of IEC Standard 60038. Tests shall be performed at the nameplate rated voltage and frequency unless otherwise specified in this standard. 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 to be published.

Section 5. Rating Requirements for Remote Commercial Refrigerated Display Merchandisers and Storage Cabinets

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

5.2 *CDEC for Remote Commercial Refrigerated Display Merchandisers and Storage Cabinets*. The total electrical load shall be measured and adjusted to determine CDEC. The electrical load categories shall include compressors, evaporator fan motors, lighting, surface anti-condensate load including fans and heaters, defrost heaters, condensate evaporator pans and any other suitable electrical loads when they are part of the unit. If measured electrical loads are not available, the following calculations shall be done to determine the CDEC.

$$CDEC = CEC + FEC + LEC + AEC + DEC + PEC \quad (1)$$

Remote Commercial Refrigerated Display Merchandisers and Storage Cabinets shall report the individual loads in the calculation of CDEC. Shown below are formulae for the required individual loads.

5.2.1 *Calculation of CEC*. The COP values in Table 1 shall be used to calculate CEC for a 24 hour period.

Note: The COP 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 Temperature Applications shall use a temperature that is 1.2°C 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 a temperature that is 1.7°C 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.

$$CEC = [(Q_{rt}) \cdot (t - t_{dt})] / (COP \cdot 1000) \quad (2)$$

5.2.2 *Calculation of FEC*. The FEC shall be measured data for all fan motors or calculated data using the motor efficiency:

$$FEC = (P_f \cdot t_f) / (1000) \quad (3)$$

Where:

$P_f = (P_{fi} \cdot n)$ (measured)

$P_f = (P_{fo} \cdot n) / (\eta_m)$ (calculated)

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5.2.3 *Calculation of LEC.*

$$LEC = (P_{li} \cdot t_l) / (1000) \quad (4)$$

5.2.4 *Calculation of AEC.*

$$AEC = (P_{ai} \cdot t_a) / (1000) \quad (5)$$

5.2.5 *Calculation of DEC.*

$$DEC = (P_d \cdot t_d) / (1000) \quad (6)$$

5.2.6 *Calculation of PEC.*

$$PEC = (P_c \cdot t_c) / (1000) \quad (7)$$

5.2.7 *Other Electric Energy Consumption.* If there are additional options that decrease or increase the electrical usage, they shall be noted under "Other Loads" (Section 8) with an appropriate calculation for energy consumption expressed in kW·h per day.

5.3 *Alternate Components - Direct Effects.* The energy consumption of substituted or alternate components shall be measured or calculated from the component's nameplate rating. The energy usage of the substituted or alternate components shall be used to recalculate the CDEC in Section 5.2. The energy consumption of the substituted or alternate components and the recalculated CDEC shall be reported as shown in Section 8.

5.3.1 *FEC.* When removing or substituting a fan motor, the fan energy shall be measured or calculated according to Section 5.2.2. The energy usage of the substituted or alternate components shall be used to recalculate the CDEC according to Section 5.2. The energy consumption of the substituted or alternate components and the recalculated CDEC shall be reported according to Section 8. When calculating the fan motor energy for substituting a fan motor, the airflow rate produced from the assembly shall be equal to the original configuration.

5.3.2 *LEC.* When removing or substituting lighting, the lighting energy shall be measured or calculated according to Section 5.2.3. The energy usage of the substituted or alternate components shall be used to recalculate the CDEC according to Section 5.2. The energy consumption of the substituted or alternate components and the recalculated CDEC shall be reported according to Section 8.

5.3.3 *AEC.* When removing or substituting an anti-condensate heater, the heater energy shall be measured or calculated according to Section 5.2.4. The energy usage of the substituted or alternate components shall be used to recalculate the CDEC according to Section 5.2. The energy consumption of the substituted or alternate components and the recalculated CDEC shall be reported according to Section 8.

5.3.4 *DEC.* When removing or substituting a defrost heater, the heater energy shall be measured or calculated according to Section 5.2.5. The energy usage of the substituted or alternate components shall be used to recalculate the CDEC according to Section 5.2. The energy consumption of the substituted or alternate components and the recalculated CDEC shall be reported according to Section 8.

5.3.5 *PEC.* When removing or substituting a condensate evaporator pan, the pan energy shall be measured or calculated according to Section 5.2.6. The energy usage of the substituted or alternate components shall be used to recalculate the CDEC according to Section 5.2. The energy consumption of the substituted or alternate components and the recalculated CDEC shall be reported according to Section 8.

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