Errata to Energy and Internal Volume of Refrigerating Appliances

AHAM HRF-1-2016

Correction Sheet
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Page 2, Clause 2, should read as follows:

2 Scope

This standard applies to refrigerators as defined in Section 3.1, refrigerator freezers as defined in Section 3.3, freezers as defined in Section 3.4 and wine chillers as defined in Section 3.5. This standard covers definitions, methods for computing volumes, methods for determining energy consumption and energy factor, and safety recommendations.

This standard only covers compressor driven refrigerators, refrigerator freezers, wine chillers and freezers.

Page 3, Clause 3.1, should read as follows:

3.1 Refrigerator

A cabinet or any part of a cabinet which is designed for the refrigerated storage of food at temperatures warmer than 32°F (0°C) and colder than 39°F (3.9° C), configured for general refrigerated storage. It may include a compartment for the freezing and storage of ice and/or for storage of food at temperatures colder than 32°F (0°C), but does not provide a separate low temperature compartment designed for the freezing and storage of food at temperatures colder than 8°F (-13.3°C).

NOTE: All temperatures are measured in accordance with Section 5.5.5 and 5.5.6 when tested at 90°F (32.2° C) ambient.

Page 6, Clause 3.32, 1st Paragraph, should read as follows:

3.32 **Steady State Condition**

Steady state conditions exist if the average temperature in each measured compartment taken at 1 minute intervals, or less, during a stabilization period are not changing at a rate greater than 0.042°F (0.023°C) per hour as determined by the applicable condition of (a) or (b) below.

Page 15, Clause 5.5.6.3, should read as follows:

5.5.6.3 **Wine Storage Compartment Temperature (Wine Chillers).** Temperatures shall be recorded as in Section 5.5.6.1.

Page 20, Tables 1 and 2 titles, should read as follows:

TABLE 5-1—TEMPERATURE SETTINGS FOR ALL-REFRIGERATORS

TABLE 5-2—TEMPERATURE SETTINGS FOR REFRIGERATORS WITH FREEZER COMPARTMENTS AND REFRIGERATOR-FREEZERS

Page 20, Table 2 notes, should read as follows:

Notes: Fzr = Freezer Compartment, FF = Fresh Food Compartment.

Page 21, Clause 5.7.2, should read as follows:

5.7.2 Automatic Defrost. If the model being tested has an automatic defrost system, the test time period shall be started after steady state conditions have been achieved, and shall be from one point during a defrost period to the same point during the next defrost period. If the model being tested has a long-time automatic defrost system, the alternative provisions of section 5.7.2.1 may be used. If the model being tested has a variable defrost control, the provisions of section 5.7.2.4 shall apply. If the model is a multiple-compressor product with automatic defrost, the provisions of section 5.7.2.6 shall apply. If the model being tested has long-time automatic or variable defrost control involving multiple defrost cycle types, such as for a product with a single compressor and two or more evaporators in which the evaporators are defrosted at different frequencies, the provisions of section 5.7.2.5 shall apply. If the model being tested has multiple defrost cycle types for which compressor run time between defrosts is a fixed time of less than 14 hours for all such cycle types, and for which the compressor run times between defrosts for different defrost cycle types are equal to or multiples of each other, the test period shall be from one point of the defrost cycle type with the longest compressor run time between defrosts to the same point during the next occurrence of this defrost cycle type. For such products not using the procedures of section 5.7.2.5, energy consumption shall be calculated as described in section 5.8.2.1.1 .

Page 22, Clause 5.7.2.1, should read as follows:

5.7.2.1 Long-Time Automatic Defrost. If the model being tested has a long-time automatic defrost system, the two-part test described in this section may be used. The first part is a stable period of compressor operation that includes no portions of the defrost cycle, such as precooling or recovery, that is otherwise the same as the test for a unit having no defrost provisions (section 5.7.1). The second part is designed to capture the energy consumed during all of the events occurring with the defrost control sequence that are outside of stable operation.

Page 22, Clause 5.7.2.2, should read as follows:

5.7.2.2 Cycling Compressor System. For a system with a cycling compressor, the second part of the test starts at the termination of the last regular compressor “on” cycle. The average temperatures of the fresh food and freezer compartments measured from the termination of the previous compressor “on” cycle to the termination of the last regular compressor “on” cycle must both be within 0.5 °F (0.3 °C) of their average temperatures measured for the first part of the test. If any compressor cycles occur prior to the defrost heater being energized that cause the average temperature in either compartment to deviate from its average temperature for the first part of the test by more than 0.5 °F (0.3 °C), these compressor cycles are not considered

regular compressor cycles and must be included in the second part of the test. As an example, a “precooling” cycle, which is an extended compressor cycle that lowers the temperature(s) of one or both compartments prior to energizing the defrost heater, must be included in the second part of the test. The test period for the second part of the test ends at the termination of the first regular compressor “on” cycle after both compartment temperatures have fully recovered to their stable conditions. The average temperatures of the compartments measured from this termination of the first regular compressor “on” cycle until the termination of the next regular compressor “on” cycle must both be within 0.5 °F (0.3 °C) of their average temperatures measured for the first part of the test. See Figure 5-3. Note that Figure 5-3 illustrates the concepts of precooling and recovery but does not represent all possible defrost cycles.

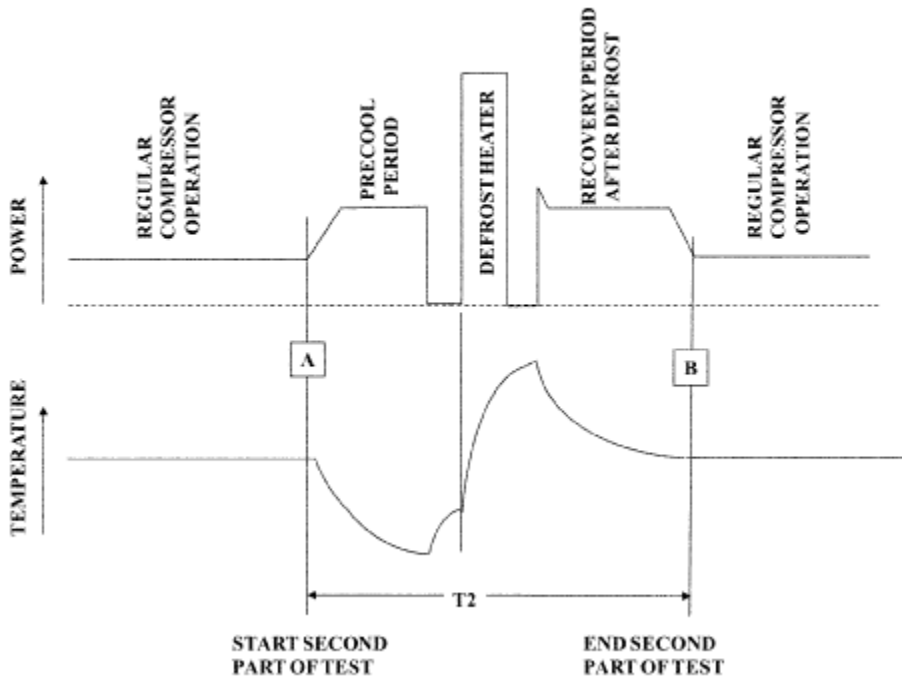
Page 23, Clause 5.7.2.3, should read as follows:

5.7.2.3 Non-cycling Compressor System. For a system with a non-cycling compressor, the second part of the test starts at a time before defrost during stable operation when the temperatures of both fresh food and freezer compartments are within 0.5 °F (0.3 °C) of their average temperatures measured for the first part of the test. The second part stops at a time after defrost during stable operation when the temperatures of both compartments are within 0.5 °F (0.3 °C) of their average temperatures measured for the first part of the test. See Figure 5-4.

Page 24, Figure 2, should appear as follows:

Figure 5.4

Long-time Automatic Defrost Diagram for Non-Cycling Compressors



*Average compartment temperature(s) at times A & B must be within 0.5 °F of the average temperature(s) for the first part of the test.

Page 24, Clause 5.7.2.5, should read as follows:

5.7.2.5 Systems with Multiple Defrost Frequencies. This section applies to models with long-time automatic or variable defrost control with multiple defrost cycle types, such as models with single compressors and multiple evaporators in which the evaporators have different defrost frequencies. The two-part method in 5.7.2.1 shall be used. The second part of the method will be conducted separately for each distinct defrost cycle type.

Page 26-27, Clause 5.8.1.2.4, should read as follows:

5.8.1.2.4 Fresh Food Compartment Temperature. The fresh food compartment temperature shall be calculated as:

$$TR = \frac{\sum_{i=1}^{R}(TR_i) \times (VR_i)}{\sum_{i=1}^{R}(VR_i)}$$

Where:

R is the total number of applicable fresh food compartments, which include the first fresh food compartment and any number of separate auxiliary fresh food compartments (including separate auxiliary convertible compartments tested as fresh food compartments in accordance with section 5.5.2g);

TR_i is the compartment temperature of fresh food compartment "i" determined in accordance with section 5.5.6.1; and

VR_i is the volume of fresh food compartment "i".

Page 27, Clause 5.8.1.2.5, should read as follows:

5.8.1.2.5 Freezer Compartment Temperature. The freezer compartment temperature shall be calculated as:

$$TF = \frac{\sum_{i=1}^{F}(TF_i) \times (VF_i)}{\sum_{i=1}^{F}(VF_i)}$$

Where:

F is the total number of applicable freezer compartments, which include the first freezer compartment and any number of separate auxiliary freezer compartments (including separate auxiliary convertible compartments tested as freezer compartments in accordance with section 5.5.2g);

TF_i is the compartment temperature of freezer compartment "i" determined in accordance with section 5.5.6.2; and

VF_i is the volume of freezer compartment "i".

Page 27-28, Clause 5.8.1.2.6, should read as follows:

5.8.1.2.6 Wine Compartment Temperature

The wine compartment temperature shall be calculated as:

$$TW = \frac{\sum_{i=1}^{W}(TW_i) \times (VW_i)}{\sum_{i=1}^{W}(VW_i)}$$

Where:

W is the total number of applicable wine compartments, which include the first wine compartment and any number of separate auxiliary wine compartments (including separate auxiliary convertible compartments tested as wine compartments in accordance with section 5.5.2g);

TW_i is the compartment temperature of wine compartment "i" determined in accordance with section 5.5.6.3; and

VW_i is the volume of wine compartment "i".

Page 29-30, Clause 5.8.2.1.4, should read as follows:

5.8.2.1.4 Multiple-compressor Products with Automatic Defrost. The two-part test method in Section 5.7.2.2 shall be used, the energy consumption in kilowatt per day shall be calculated equivalent to:

$$ET = \left(1440 \times \frac{EP1}{T1}\right) + \sum^{D} \left[\left(EP2_i - \left(EP1 \times \frac{T2_i}{T1}\right)\right) \times \left(\frac{12}{CT_i}\right)\right]$$

where

1440, EP1, T1, and 12 are defined in 5.2.1.2;

i = a variable that can equal 1, 2, or more that identifies each individual compressor system that has automatic defrost;

D = the total number of compressor systems with automatic defrost;

$EP2_i$ = energy expended in kilowatt-hours during the second part of the test for compressor system i;

$T2_i$ = length of time in minutes of the second part of the test for compressor system i;

CT_i = the compressor run time between defrosts for compressor system i in hours rounded to the nearest tenth of an hour, for long-time automatic

defrost control equal to a fixed time in hours, and for variable defrost control equal to

$(CT_{Li} \times CT_{Mi}) / (F \times (CT_{Mi} - CT_{Li}) + CT_{Li})$;

Where:

CT_{Li} = for compressor system i, the shortest compressor run time between defrosts used in the variable defrost control algorithm (greater than or equal to 6 but less than or equal to 12 hours), or the shortest compressor run time between defrosts observed for the test (if it is shorter than the shortest run time used in the control algorithm and is greater than 6 hours), or 6 hours (if the shortest observed run time is less than 6 hours), in hours rounded to the nearest tenth of an hour;

CT_{Mi} = for compressor system i, the maximum compressor run time between defrosts in hours rounded to the nearest tenth of an hour (greater than CT_{Li} but not more than 96 hours); and

F = default defrost energy consumption factor, equal to 0.20.
For variable defrost models with no values for CT_{Li} and CT_{Mi} in the algorithm, the default values of 6 and 96 shall be used, respectively

Page 31-32, Clause 5.9.2.2, should read as follows:

5.9.2.2 If the conditions of 5.9.2.1 do not exist, the per-cycle energy consumption shall be defined by the higher of the two values calculated by the following two formulas:

$$E = ET1 + \left[(ET2 - ET1) \times \frac{(39.0 - TR1)}{(TR2 - TR1)}\right] + IET$$

and

$$\mathrm{E} = \mathrm{ET1} + \left[(\mathrm{ET2} - \mathrm{ET1}) \times \frac{(\mathrm{K_2} - \mathrm{TF1})}{(\mathrm{TF2} - \mathrm{TF1})}\right] + \mathrm{IET}$$

Where:

E is defined in 5.9.2.1;

ET is defined in 5.8.2.1.1;

IET is defined in 5.9.2.1;

TR and the numbers 1 and 2 are defined in 5.8.1.2.4;

TF = freezer compartment temperature determined according to 5.8.1.2.5 in degrees F;

39.0 is a specified fresh food compartment temperature in degrees F; and

K_2 is a constant 15.0 for refrigerators or 0.0 for refrigerator-freezers, each being standardized freezer compartment temperatures in degrees F.

Page 32, Clause 5.9.4.1, should read as follows:

5.9.4.1 If the wine storage compartment temperature is always at or colder than 55°F (12.8°C) in both of the tests, the per-cycle energy consumption shall be:

$$E = ET1$$

Where:

E = total per-cycle energy consumption in kWh/day;

ET is defined in Section 5.8.2.1.1;

Number 1 indicates the test period during which the warmest wine storage compartment temperature is measured.

Page 33-34, Clause 5.9.5, should read as follows:

5.9.5 Variable Anti-Sweat Heater Models**. The standard cycle energy consumption of an electric refrigerator-freezer with a variable anti-sweat heater control (E_{std}), expressed in kilowatt-hours per day, shall be calculated equivalent to:**

E_{std} = E + (Correction Factor) where E is determined by 5.9.1.1, 5.9.1.2, 5.9.2.1, or 5.9.2.2, whichever is appropriate, with the anti-sweat heater disabled (e.g., anti-sweat heater switch in the off position, disabling the heater using software, disabling the heater by physical disconnection, etc…).

Correction Factor = (Anti-sweat Heater Power × System-loss Factor) × (24 hrs/1 day) × (1 kW/1000 W)

Where:

Anti-sweat Heater Power = 0.034 * (Heater Watts at 5%RH)

+ 0.211 * (Heater Watts at 15%RH)

+ 0.204 * (Heater Watts at 25%RH)

+ 0.166 * (Heater Watts at 35%RH)

+ 0.126 * (Heater Watts at 45%RH)

+ 0.119 * (Heater Watts at 55%RH)

+ 0.069 * (Heater Watts at 65%RH)

+ 0.047 * (Heater Watts at 75%RH)

+ 0.008 * (Heater Watts at 85%RH)

+ 0.015 * (Heater Watts at 95%RH)

Heater Watts at a specific relative humidity = the nominal watts used by all heaters at that specific relative humidity, 72 °F (22.2 °C) ambient, and reference temperatures of fresh food (FF) average temperature of 39 °F (3.9 °C) and freezer (FZ) average temperature of 0 °F (−17.8 °C).

System-loss Factor = 1.3.