that the basic model for which the waiver was requested contains a design characteristic which either prevents testing of the basic model according to the prescribed test procedures, or the prescribed test procedures may evaluate the basic model in a manner so unrepresentative of its true energy consumption characteristics, or water consumption characteristics (in the case of faucets, showerheads, water closets, and urinals) as to provide materially inaccurate comparative data. Waivers may be granted subject to conditions, which may include adherence to alternate test procedures specified by the Assistant Secretary for Conservation and Renewable Energy. The Assistant Secretary shall consult with the Federal Trade Commission prior to granting any waiver, and shall promptly publish in the Federal Register notice of each waiver granted or denied, and any limiting conditions of each waiver granted.

(m) Within one year of the granting of any waiver, the Department of Energy will publish in the Federal Register a notice of proposed rulemaking to amend its regulations so as to eliminate any need for the continuation of such waiver. As soon thereafter as practicable, the Department of Energy will publish in the Federal Register a final rule. Such waiver will terminate on the effective date of such final rule.

(n) In order to exhaust administrative remedies, any person aggrieved by an action under this section must file an appeal with the DOE's Office of Hearings and Appeals as provided in 10 CFR part 1003, subpart C.

APPENDIX A1 TO SUBPART B OF PART 430—UNIFORM TEST METHOD FOR MEASURING THE ENERGY CONSUMPTION OF ELECTRIC REFRIGERATORS AND ELECTRIC REFRIGERATOR-FREEZERS

1. Definitions

1.1 "HRF–1–1979" means the Association of Home Appliance Manufacturers standard for household refrigerators, combination refrigerator-freezers, and household freezers, also approved as an American National Standard as a revision of ANSI B 38.1–1970.

1.2 "Adjusted total volume" means the sum of (i) the fresh food compartment volume as defined in HRF–1–1979 in cubic feet, and (ii) the product of an adjustment factor and the net freezer compartment volume as defined in HRF–1–1979, in cubic feet.

1.3 "Anti-sweat heater" means a device incorporated into the design of a refrigerator or refrigerator-freezer to prevent the accumulation of moisture on exterior surfaces of the cabinet under conditions of high ambient humidity.

1.4 "All-refrigerator" means an electric refrigerator which does not include a compartment for the freezing and long time storage of food at temperatures below 32 °F. (0.0 °C.). It may include a compartment of 0.50 cubic feet capacity (14.2 liters) or less for the freezing and storage of ice.

1.5 "Cycle" means the period of 24 hours for which the energy use of an electric refrigerator or electric refrigerator-freezer is calculated as though the consumer activated compartment temperature controls were set so that the desired compartment temperatures were maintained.

1.6 "Cycle type" means the set of test conditions having the calculated effect of operating an electric refrigerator or electric refrigerator-freezer for a period of 24 hours, with the consumer activated controls other than those that control compartment temperatures set to establish various operating characteristics.

1.7 "Standard cycle" means the cycle type in which the anti-sweat heater control, when provided, is set in the highest energy consuming position.

1.8 "Automatic defrost" means a system in which the defrost cycle is automatically initiated and terminated, with resumption of normal refrigeration at the conclusion of the defrost operation. The system automatically prevents the permanent formation of frost on all refrigerated surfaces. Nominal refrigerated food temperatures are maintained during the operation of the automatic defrost system.

1.9 "Long-time Automatic Defrost" means an automatic defrost system where successive defrost cycles are separated by 14 hours or more of compressor-operating time.

1.10 "Stabilization Period" means the total period of time during which steady-state conditions are being attained or evaluated.

1.11 "Variable defrost control" means a long-time automatic defrost system (except the 14-hour defrost qualification does not apply) where successive defrost cycles are determined by an operating condition variable or variables other than solely compressor operating time. This includes any electrical or mechanical device. Demand defrost is a type of variable defrost control.
shall be 80 °F or the room air temperature; and ± 0.25 inches (2.9 cm) above 80 °F wet bulb °C.)

1.12 “Externally vented refrigerator or refrigerator-freezer” means an electric refrigerator or electric refrigerator-freezer that:

- has an enclosed condenser or an enclosed condenser/compressor compartment and a set of air ducts for transferring the exterior air from outside the building envelope into, through and out of the refrigerator or refrigerator-freezer; is capable of mixing exterior air with the room air before discharging into, through, and out of the condenser or condenser/compressor compartment; includes thermostatically controlled dampers or controls that enable the mixing of the exterior and room air at low outdoor temperatures, and the exclusion of exterior air when the outdoor air temperature is above 80 °F or the room air temperature; and may have a thermostatically actuated exterior air fan.

2. Test Conditions

2.1 Ambient temperature. The ambient temperature shall be 90.0 ± 1 °F (32.3±0.6 °C) during the stabilization period and during the test period. The ambient temperature shall be 80±2 °F dry bulb and 67 °F wet bulb during the stabilization period and during the test period when the unit is tested in accordance with section 3.3.

2.2 Operational conditions. The electric refrigerator or electric refrigerator-freezer shall be installed and its operating conditions maintained in accordance with HRP–1–1979, section 7.4.3.3, except that the vertical ambient temperature gradient at locations 16 inches (25.4 cm) out from the centers of the two sides of the unit being tested is to be maintained during the test. Unless the area is obstructed by shields or baffles, the gradient is to be maintained from 2 inches (5.1 cm) above the floor or supporting platform to a height one foot (30.5 cm) above the unit under test. Defrost controls are to be operative and the anti-sweat heater switch is to be “on” during one test and “off” during a second test. Other exceptions are noted in 2.3, 2.4, and 5.1 below.

2.3 Conditions for automatic defrost refrigerators. For automatic defrost refrigerators, the freezer compartments shall not be loaded with any frozen food packages. Cylindrical metallic masses of dimensions 1.25±0.25 inches (2.6±0.6 cm) in diameter and height shall be attached in good thermal contact with each temperature sensor within the refrigerated compartments. All temperature measuring sensor masses shall be supported by nonthermally conductive supports in such a manner that there will be at least one inch (2.5 cm) of air space separating the thermal mass from contact with any surface. In case of interference with hardware at the sensor locations specified in section 5.1, the sensors shall be placed at the nearest adjacent location such that there will be a one inch air space separating the sensor mass from the hardware.

2.4 Conditions for all-refrigerators. There shall be no load in the freezer compartment during the test.

2.5 Steady State Condition. Steady state conditions exist if the temperature measurements in all measured compartments taken at four 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.

A. The average of the measurements during a two hour period if no cycling occurs or during a number of complete repetitive compressor cycles through a period of no less than two hours is compared to the average over an equivalent time period with three hours elapsed between the two measurement periods.

B. If A above cannot be used, the average of the measurements during a number of complete repetitive compressor cycles through a period of no less than two hours and including the last complete cycle prior to a defrost period, or if no cycling occurs, the average of the measurements during the last two hours prior to a defrost period; are compared to the same averaging period prior to the following defrost period.

2.6 Exterior air for externally vented refrigerator or refrigerator-freezer. An exterior air source shall be provided with adjustable temperature and pressure capabilities. The exterior air temperature shall be adjustable from 35±1 °F (1.7±0.6 °C) to 60±1 °F (32.2±0.6 °C).

2.6.1 Air duct. The exterior air shall pass from the exterior air source to the test unit through an insulated air duct.

2.6.2 Air temperature measurement. The air temperature entering the condenser or condenser/compressor compartment shall be maintained to ±3 °F (1.7 °C) during the stabilization and test periods and shall be measured at the inlet point of the condenser or condenser/compressor compartment (“condenser inlet”). Temperature measurements shall be taken from at least three temperature sensors or one sensor per 4 square inches of the air duct cross sectional area, whichever is greater, and shall be averaged. For a unit that has a condenser air fan, a minimum of three temperature sensors at the condenser fan discharge shall be required. Temperature sensors shall be arranged to be at the centers of equally divided cross sectional areas. The exterior air temperature, at its source, shall be measured and maintained to ±1 °F (0.6 °C) during the test period. The temperature measuring devices shall have an error not greater than ±0.5 °F (±0.3 °C). Measurements of the air temperature during the test period shall be taken at regular intervals not to exceed four minutes.
2.6.3 Exterior air static pressure. The exterior air static pressure at the inlet point of the unit shall be adjusted to maintain a negative pressure of 0.20±0.05” water column (62 Pa±12.5 Pa) for all air flow rates supplied to the unit. The pressure sensor shall be located on a straight duct with a distance of at least 7.5 times the diameter of the duct upstream and a distance of at least 3 times the diameter of the duct downstream. There shall be four static pressure taps at 90° angles apart. The four pressures shall be averaged by interconnecting the four pressure taps. The air pressure measuring instrument shall have an error not greater than 0.01” water column (2.5 Pa).

3. Test Control Settings

3.1 Model with no user operable temperature control. A test shall be performed during which the compartment temperatures and energy use shall be measured. A second test shall be performed with the temperature control electrically short circuited to cause the compressor to run continuously.

3.2 Model with user operable temperature control. Testing shall be performed in accordance with one of the following sections using the standardized temperatures of:

- All-refrigerator: 38 °F. (3.3 °C) fresh food compartment temperature
- Refrigerator: 15 °F. (−9.4 °C) freezer compartment temperature
- Refrigerator-freezer: 5 °F. (−15 °C) freezer compartment temperature

Variable defrost control models: 5 °F (−15 °C) freezer compartment temperature and 38 ±2 °F fresh food compartment temperature during steady-state conditions with no door-openings. If both settings cannot be obtained, then test with the fresh food compartment temperature at 38±2 °F and the freezer compartment as close to 5 °F as possible.

3.2.1 A first test shall be performed with all compartment temperature controls set at their median position midway between their warmest and coldest settings. Knob detents shall be mechanically defeated if necessary to attain a median setting. A second test shall be performed with all controls set at either their warmest or their coldest setting (not electrically or mechanically bypassed), whichever is appropriate, to attempt to achieve compartment temperatures measured during the two tests which bound (i.e., one is above and one is below) the standardized temperature for the type of product being tested. If the compartment temperatures measured during these two tests bound the appropriate standardized temperature, then these test results shall be used to determine energy consumption. If the compartment temperature measured with all controls set at their coldest setting is above the standardized temperature, a third test shall be performed with all controls set at their warmest setting and the result of this test shall be used with the result of the test performed with all controls set at their coldest setting to determine energy consumption. If the compartment temperature measured with all controls set at their warmest setting is below the standardized temperature; and the fresh food compartment temperature is below 45 °F. (7.22 °C) in the case of a refrigerator or a refrigerator-freezer, excluding an all-refrigerator, then the result of this test alone will be used to determine energy consumption.

3.2.2 Alternatively, a first test may be performed with all temperature controls set at their warmest setting. If the compartment temperature is above the appropriate standardized temperature, and the fresh food compartment temperature is below 45 °F. (7.22 °C) in the case of a refrigerator or a refrigerator-freezer, excluding an all-refrigerator, then the result of this test alone will be used to determine energy consumption. If the above conditions are not met, then the unit shall be tested in accordance with 3.2.1 above.

3.2.3 Alternatively, a first test may be performed with all temperature controls set at their coldest setting. If the compartment temperature is above the appropriate standardized temperature, a second test shall be performed with all controls set at their warmest control setting and the results of these two tests shall be used to determine energy consumption. If the above condition is not met, then the unit shall be tested in accordance with 3.2.1 above.

3.3 Variable defrost control optional test. After a steady-state condition is achieved, the optional test requires door-openings for 12±2 seconds every 60 minutes on the fresh food compartment door and a simultaneous 12±2 second freezer compartment door-opening occurring every 4th time, to obtain 24 fresh food and six freezer compartment door-openings per 24-hour period. The first freezer door-opening shall be simultaneous with the fourth fresh food door-opening. The doors are to be opened 60° to 90° with an average velocity for the leading edge of the door of approximately 2 ft./sec. Prior to the initiation of the door-opening sequence, the defrost control mechanism may be reinitiated in order to minimize the test duration.

4. Test Period

4.1 Test Period. Tests shall be performed by establishing the conditions set forth in Section 2, and using control settings as set forth in Section 3, above.

4.1.1 Nonautomatic Defrost. If the model being tested has no automatic defrost system, the test time period shall start after steady state conditions have been achieved.
and be of not less than three hours in duration. During the test period, the compressor motor shall complete two or more whole compressor cycles (a compressor cycle is a complete “on” and a complete “off” period of the motor). If no “off” cycling will occur, as determined during the stabilization period, the test period shall be three hours. If incomplete cycling (less than two compressor cycles) occurs during a 24 hour period, the results of the 24 hour period shall be used.

4.1.2 Automatic Defrost. If the model being tested has an automatic defrost system, the test time period shall start after steady state conditions have been achieved and 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 alternate provisions of 4.1.2.1 may be used. If the model being tested has a variable defrost control, the provisions of section 4.1.2.2 or 4.1.2.3 shall apply. If the model has a dual compressor system the provisions of 4.1.2.4 shall apply.

4.1.2.1 Long-time Automatic Defrost. If the model being tested has a long-time automatic defrost system, the test time period may consist of two parts. A first part would be the same as the test for a unit having no defrost provisions (section 4.1.1). The second part would start when a defrost is initiated when the compressor “on” cycle is terminated prior to start of the defrost heater and terminates at the second turn “on” of the compressor or four hours from the initiation of the defrost heater, whichever comes first. See diagram in Figure 1 to this section.

Figure 1

Long Time Automatic Defrost Diagram
4.1.2.2 Variable defrost control. If the model being tested has a variable defrost control system, the test shall consist of three parts. Two parts shall be the same as the test for long-time automatic defrost (section 4.1.2.1). The third part is the optional test to determine the time between defrosts (section 5.2.1.3). The third part is used by manufacturers who choose not to accept the default value of F of 0.20, to calculate CT.

4.1.2.3 Variable defrost control optional test. After steady-state conditions with no door openings are achieved in accordance with section 3.3 above, the test is continued using the above daily door-opening sequence until stabilized operation is achieved. Stabilization is defined as a minimum of three consecutive defrost cycles with times between defrosts that will allow the calculation of a Mean Time Between Defrosts (MTBD1) that satisfies the statistical relationship of 90 percent confidence. The test is repeated at least one more unit of the model and until the Mean Time Between Defrosts for the multiple unit tests (MTBD2) satisfies the statistical relationship. If the time between defrosts is greater than 96 hours (compressor “on” time) and this defrost period can be repeated on a second unit, the test may be terminated at 96 hours (CT) and the absolute time value used for MTBD for each unit.

4.1.2.4 Dual compressor systems with automatic defrost. If the model being tested has separate compressor systems for the refrigerator and freezer sections, each with its own automatic defrost system, then the two-part method in 4.1.2.1 shall be used. The second part of the method will be conducted separately for each automatic defrost system. The auxiliary components (fan motors, anti-sweat heaters, etc.) will be identified for each system and the energy consumption measured during each test.

5. Test Measurements

5.1 Temperature Measurements. Temperature measurements shall be made at the locations prescribed in Figures 7.1 and 7.2 of HRF-1-1979 and shall be accurate to within ±0.5°F (0.3°C) of true value. No freezer temperature measurements need be taken in an all-refrigerator model.

If the interior arrangements of the cabinet do not conform with those shown in Figure 7.1 and 7.2 of HRF-1-1979, measurements shall be taken at selected locations chosen to represent approximately the entire refrigerated compartment. The locations selected shall be a matter of record.

5.1.1 Measured Temperature. The measured temperature of a compartment is to be the average of all sensor temperature readings taken in that compartment at a particular time. Measurements shall be taken at regular intervals not to exceed four minutes.

5.1.2 Compartment Temperature. The compartment temperature for each test period shall be an average of the measured temperatures taken in a compartment during a complete cycle or several complete cycles of the compressor motor (one compressor cycle is one complete motor “on” and one complete motor “off” period). For long-time automatic defrost models, compartment temperatures shall be those measured in the first part of the test period specified in 4.1.1. For models equipped with variable defrost controls, compartment temperatures shall be those measured in the first part of the test period specified in 4.1.2.2 above.

5.1.2.1 The number of complete compressor motor cycles over which the measured temperatures in a compartment are to be averaged to determine compartment temperature shall be equal to the number of minutes between measured temperature readings, rounded up to the next whole minute or a number of complete cycles over a time period exceeding one hour. One of the cycles shall be the last complete compressor motor cycle during the test period.

5.1.2.2 If no compressor motor cycling occurs, the compartment temperature shall be the average of the measured temperatures taken during the last thirty-two minutes of the test period.

5.1.2.3 If incomplete cycling occurs, the compartment temperatures shall be the average of the measured temperatures taken during the last three hours of the last complete “on” period.

5.2 Energy Measurements

5.2.1 Per-day Energy Consumption. The energy consumption in kilowatt-hours per day for each test period shall be the energy expended during the test period as specified in section 4.1 adjusted to a 24 hour period. The adjustment shall be determined as follows:

5.2.1.1 Nonautomatic and automatic defrost models. The energy consumption in kilowatt-hours per day shall be calculated equivalent to:

\[ ET = EP \times \frac{1440}{T} \]

where

\( ET \) = test cycle energy expended in kilowatt-hours per day,

\( EP \) = energy expended in kilowatt-hours during the test period,

\( T \) = length of time of the test period in minutes, and

1440 = conversion factor to adjust to a 24 hour period in minutes per day.

5.2.1.2 Long-time Automatic Defrost. If the two part test method is used, the energy consumption in kilowatt-hours per day shall be calculated equivalent to:

\[ ET = \left( \frac{1440 \times EP1}{T1} \right) + \left( \frac{EP2 - (EP1 \times T2 / T1) \times 12}{CT} \right) \]
ET and 1440 are defined in 5.2.1.1.

Where 1440, EP1, T1, EP2, 12, and CT are defined in 5.2.1.1, where:

EP1 = energy expended in kilowatt-hours during the first part of the test.

EP2 = energy expended in kilowatt-hours during the second part of the test.

T1 and T2 = length of time in minutes of the first and second test parts respectively.

CT = defrost timer run time in hours required to cause it to go through a complete cycle, to the nearest tenth hour per cycle, and 12 = factor to adjust for a 50% run time of the compressor in hours per day.

5.2.1.3 Variable defrost control. The energy consumption in kilowatt-hours per day shall be calculated equivalent to:

\[
ET = (1440 \times ET1/T1) + (EP2 - (EP1 \times T2/T1)) \times 12/CT
\]

where 1440 is defined in 5.2.1.1 and EP1, EP2, T1, T2 and 12 are defined in 5.2.1.2.

CT = compressor "on" time between defrosts (tenths of an hour).

CTa = compressor "on" time between defrosts maximum time between defrost cycles in tenths of an hour (greater than CTi but not more than 96 hours).

\(F = \frac{\text{ratio of per day energy consumption in excess of the least energy and the maximum difference in day energy consumption and is equal to}}{\text{}}\)

\[
F = \frac{1}{(1/CTa - 1/CTb)}\left(\frac{1}{CTa} - \frac{1}{CTb}\right)
\]

5.2.1.4 Optional test method for variable defrost controls.

\[CT = \frac{\Sigma X}{N}\]

where:

MTBD = mean time between defrosts

X = in time between defrost cycles

N = number of defrost cycles

5.2.1.5 Dual compressor systems with dual automatic defrost. The two-part test method in section 4.1.2.2 must be used, the energy consumption in kilowatt per day shall be calculated equivalent to:

\[
ET = (1440 \times ET1/T1) + (EP2a - (EP1a \times T2/T1)) \\
\times 12/CT \times (EP2b - (EP1b \times T2/T1)) \times 12/CT
\]

Where 1440, EP1, T1, EP2, 12, and CT are defined in 5.2.1.2.
cycle tests shall be conducted to measure energy consumption of the unit with air mixing controls disabled and the condenser inlet air temperatures set at 90 °F (32.2 °C) and 80 °F (26.7 °C). Both tests shall be conducted with all compartment temperature controls set at the position midway between their warmest and coolest settings and the anti-sweat heater switch off. Record the energy consumptions ec and ecm, in kWh/day.

5.4.2.2 Energy consumption at 90 °F. The unit shall be tested at 90 °F (32.2 °C) exterior air temperature to record the energy consumptions (e90), in kWh/day. For a given setting of the anti-sweat heater, i corresponds to each of the two states of the compartment temperature control positions.

5.4.2.3 Energy consumption at 60 °F. The unit shall be tested at 60 °F (26.7 °C) exterior air temperature to record the energy consumptions (e60), in kWh/day. For a given setting of the anti-sweat heater, i corresponds to each of the two states of the compartment temperature control positions.

5.4.2.4 Energy consumption if mixing controls do not operate properly. If the operability of temperature and mixing controls has not been verified as required under 5.4.1, the unit shall be tested at 50 °F (10.0 °C) and 30 °F (−1.1 °C) exterior air temperatures to record the energy consumptions (e50) and (e30). For a given setting of the anti-sweat heater, i corresponds to each of the two states of the compartment temperature control positions.

5.4.2.5 Energy consumption for a cycle type is expressed in kilowatt-hours per cycle to the nearest one hundredth (0.01) kilowatt-hour and shall depend upon the temperature attainable in the fresh food compartment as shown below.

6.2.1 If the fresh food compartment temperature is always below 38.0 °F (3.3 °C), the average per-cycle energy consumption shall be equivalent to:

\[ E = ET_1 \]

where

\[ E = \text{Total per-cycle energy consumption in kilowatt-hours per day} \]

ET is defined in 5.2.1, and Number 1 indicates the test period during which the highest fresh food compartment temperature is measured.

6.2.1.1 If the fresh food compartment temperatures measured for a test period is greater than 38.0 °F (3.3 °C), the average per-cycle energy consumption shall be equivalent to:

\[ E = ET_1 + \frac{(ET_2 - ET_1) \times (38.0 - TR_1) \times (TR_2 - TR_1)}{TF_1 \times TF_2} \]

where

E is defined in 6.2.1.1.

ET is defined in 5.2.1.

TR = Fresh food compartment temperature determined according to 5.1.2 in degrees F.

Number 1 and 2 indicates measurements taken during the first and second test period as appropriate, and

38.0 = Standardized fresh food compartment temperature in degrees F.

6.2.2 Refrigerators and refrigerator-freezers. The average per-cycle energy consumption for a cycle type is expressed in kilowatt-hours per cycle to the nearest one hundredth (0.01) kilowatt-hour and shall be defined in the applicable following manner.

6.2.2.1 If the fresh food compartment temperature is always at or below 45.0 °F (7.2 °C) in both of the tests and the freezer compartment temperature is always at or below 15.0 °F (−9.4 °C) in both tests of a refrigerator or at or below 5.0 °F (−15.0 °C) in both tests of a refrigerator-freezer, the per-cycle energy consumption shall be:

\[ E = ET_1 \]

where

E is defined in 6.2.1.1.

ET is defined in 5.2.1, and

Number 1 indicates the test period during which the highest freezer compartment temperature was measured.

6.2.2.2 If the conditions of 6.2.2.1 do not exist, the per-cycle energy consumption shall be defined by the higher of the two values calculated by the following two formulas:

\[ E = ET_1 + \frac{(ET_2 - ET_1) \times (45.0 - TR_1) \times (TR_2 - TR_1)}{TF_1 \times TF_2} \]

and

\[ E = ET_1 + \frac{(ET_2 - ET_1) \times (K - TF_1) \times (TF_2 - TF_1)}{TF_1 \times TF_2} \]
where

- \( E \) is defined in 6.2.1.1.
- \( ET \) is defined in 5.2.1.
- \( TR \) and number 1 and 2 are defined in 6.2.1.2.
- \( TF \) = Freezer compartment temperature determined according to 5.1.2 in degrees F.

45.0 is a specified fresh food compartment temperature in degree F, and

- \( k \) is a constant 15.0 for refrigerators or 5.0 for refrigerator-freezers each being standardized freezer compartment temperature in degrees F.

6.2 Externally vented refrigerator or refrigerator-freezers. Per-cycle energy consumption measurements for the externally vented refrigerator or refrigerator-freezer shall be calculated in accordance with the requirements of this Appendix, as modified in sections 6.3.1–6.3.7.

6.3.1 Correction factor. A correction factor, \( K \), shall be calculated as:

\[
K = \frac{e_{\text{coo}}}{e_{\text{ccc}}}
\]

where \( e_{\text{coo}} \) and \( e_{\text{ccc}} \) = the energy consumption test results as determined under 5.4.2.1.

6.3.2 Combining test results of different settings of compartment temperature controls. For a given setting of the anti-sweat heater, follow the calculation procedures of 6.2 to combine the test results for energy consumption of the unit at different temperature control settings for each condenser inlet air temperature tested under 5.4.2.2, 5.4.2.3, and 5.4.2.4, where applicable. \( (e_{60b}), (e_{50b}), (e_{60}), \) and \( (e_{50}) \). The combined values are \( e_6, e_{50}, e_{60}, \) and \( e_{50} \), where applicable, in kWh/day.

6.3.3 Energy consumption corrections. For a given setting of the anti-sweat heater, the energy consumption \( E \) is required to be calculated, for a given setting of the anti-sweat heater, for units not tested under 5.4.2.4, and for the regions in figure 1 using one of the following equations and the coefficients in the table A:

\[
E_c = a \times E_{60} + b \times E_{30} + c \times E_{75} + d \times E_{50} + e \times E_{50}
\]

where:

- \( E_{60}, E_{30}, \) and \( E_{75} \) are defined in 6.3.3,
- \( E_{50} \) and \( E_{50} \) are defined in 6.3.5, and
- the coefficients are weather associated weighting factors.

6.3.4 Energy profile equation. For a given setting of the anti-sweat heater, the energy consumption \( E_c \) in kWh/day, at a specific exterior air temperature between 80 °F (26.7 °C) and 60 °F (18.3 °C) shall be calculated by the following equation:

\[
E_c = a + bT_x
\]

where,

- \( T_x \) = exterior air temperature in °F;
- \( a = 3E_{60} - 2E_{50} \), in kWh/day;
- \( b = (E_{80} - E_{60})/30 \), in kWh/day per °F.

6.3.5 Energy consumption at 80 °F (26.7 °C), 75 °F (23.9 °C) and 65 °F (18.3 °C). For a given setting of the anti-sweat heater, calculate the energy consumption at 80 °F (26.7 °C), 75 °F (23.9 °C) and 65 °F (18.3 °C) exterior air temperatures, \( E_{60}, E_{75}, \) and \( E_{50} \), respectively, in kWh/day, using the equation in 6.3.4.

6.3.6 National average per cycle energy consumption. For a given setting of the anti-sweat heater, calculate the national average energy consumption, \( E_n \), in kWh/day, using one of the following equations:

\[
E_n = 0.523 \times E_{60} + 0.165 \times E_{30} + 0.181 \times E_{75} + 0.131 \times E_{50}
\]

for units not tested under 5.4.2.4.

\[
E_n = 0.257 \times E_{60} + 0.266 \times E_{30} + 0.165 \times E_{75} + 0.131 \times E_{50}
\]

for units tested under 5.4.2.4.

where,

- \( E_{60}, E_{30}, \) and \( E_{75} \) are determined under section 6.3.3,
- \( E_{50} \) and \( E_{50} \) are defined in 6.3.5, and
- the coefficients are weather associated weighting factors.

6.3.7 Regional average per cycle energy consumption. If regional average per cycle energy consumption is required to be calculated, for a given setting of the anti-sweat heater, calculate the regional average per cycle energy consumption, \( E_{nc} \), in kWh/day, for the regions in figure 1 using one of the following equations and the coefficients in the table A:

\[
E_{nc} = a_1 \times E_{60} + b \times E_{30} + c \times E_{75} + d \times E_{50} + e \times E_{50}
\]

where:

- \( E_{60}, E_{30}, \) and \( E_{75} \) are defined in 6.3.3,
- \( E_{50} \) and \( E_{50} \) are defined in 6.3.5, and
- \( a_1, a, b, c, d, e \) are weather associated weighting factors for the Regions, as specified in Table A:

<table>
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<th>Regions</th>
<th>a1</th>
<th>a</th>
<th>b</th>
<th>c</th>
<th>d</th>
<th>e</th>
</tr>
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1. Definitions.

1.1 “HRF–1–1979” means the Association of Home Appliance Manufacturers standard for household refrigerators, combination refrigerators-freezers, and household freezers, also approved as an American National Standard as a revision of ANSI B38.1–1970.

1.2 “Anti-sweat heater” means a device incorporated into the design of a freezer to prevent the accumulation of moisture on exterior surfaces of the cabinet under conditions of high ambient humidity.

1.3 “Cycle” means the period of 24 hours for which the energy use of a freezer is calculated as though the consumer-activated compartment temperature controls were preset so that the desired compartment temperatures were maintained.

1.4 “Cycle type” means the set of test conditions having the calculated effect of operating a freezer for a period of 24 hours with the consumer-activated controls other than the compartment temperature control set to establish various operating characteristics.

1.5 “Standard cycle” means the cycle type in which the anti-sweat heater switch, when provided, is set in the highest energy consuming position.

1.6 “Adjusted total volume” means the product of, (1) the freezer volume as defined in HRF–1–1979 in cubic feet, times (2) an adjustment factor.

1.7 “Automatic Defrost” means a system in which the defrost cycle is automatically initiated and terminated, with resumption of normal refrigeration at the conclusion of defrost operation. The system automatically prevents the permanent formation of frost on all refrigerated surfaces. Nominal refrigerated food temperatures are maintained during the operation of the automatic defrost system.

1.8 “Long-time Automatic Defrost” means an automatic defrost system where successive defrost cycles are separated by 14 hours or more of compressor-operating time.

1.9 “Stabilization Period” means the total period of time during which steady-state conditions are being attained or evaluated.

1.10 “Variable defrost control” means a long-time automatic defrost system (except the 14-hour defrost qualification does not