control value (*e.g.*, by label) by the manufacturer.

2.4 *Electrical standby mode power measurement*. Except as provided in section 2.4.1 of this appendix, for all electric heaters and unvented heaters with electrical auxiliaries, measure the standby power ($P_{W,SB}$) in accordance with the procedures in IEC 62301 Second Edition (incorporated by reference; see §430.3), with all electrical auxiliaries not activated. Voltage shall be as specified in section 1.4.1 *Electrical supply* of this appendix. The recorded standby power ($P_{W,SB}$) shall be rounded to the second decimal place, and for loads greater than or equal to 10W, at least three significant figures shall be reported.

2.4.1 The measurement of $P_{W,SB}$ is not required for heaters designed to be turned off by the user when the heater is not in use (*i.e.*, for units where turning the control to the OFF position will shut off the electrical supply to the heater). This provision applies only if an instruction to turn off the unit is provided on the heater (*e.g.*, by label) by the manufacturer.

* * * * *

APPENDIX H TO SUBPART B OF PART 430 [RESERVED]

APPENDIX I TO SUBPART B OF PART 430—UNIFORM TEST METHOD FOR MEASURING THE ENERGY CONSUMPTION OF CONVENTIONAL RANGES, CONVENTIONAL COOKING TOPS, CONVENTIONAL OVENS, AND MICROWAVE OVENS

NOTE: The procedures and calculations in this Appendix I need not be performed to determine compliance with energy conservation standards for conventional ranges, conventional cooking tops, conventional ovens, and microwave ovens at this time. However, any representation made after April 29, 2013 related to standby mode and off mode energy consumption of conventional ranges, conventional cooking tops, and conventional ovens, and any representation made after September 6, 2011 related to standby mode and off mode energy consumption of microwave ovens, must be based upon results generated under this test procedure, consistent with the requirements of 42 U.S.C. 6293(c)(2). Upon the compliance date of any energy conservation standard that incorporates standby mode and off mode energy consumption, compliance with the applicable provisions of this test procedure will also be required. Future revisions may add relevant provisions for measuring active mode in microwave ovens.

1. DEFINITIONS

1.1 *Active mode* means a mode in which the product is connected to a mains power source, has been activated, and is performing the main functions of producing heat by means of a gas flame, electric resistance heating, or microwave energy, or circulating air internally or externally to the cooking product. Delay start mode is a one-off, user-initiated, short-duration function that is associated with an active mode.

1.2 *Built-in* means the product is supported by surrounding cabinetry, walls, or other similar structures.

1.3 *Combined low-power mode* means the aggregate of available modes other than active mode, but including the delay start mode portion of active mode.

1.4 *Cycle finished mode* means a standby mode in which a conventional cooking top, conventional oven, or conventional range provides continuous status display following operation in active mode.

1.5 *Drop-in* means the product is supported by horizontal surface cabinetry.

1.6 *Fan-only mode* means an active mode that is not user-selectable and in which a fan circulates air internally or externally to the cooking product for a finite period of time after the end of the heating function, where the end of the heating function is indicated to the consumer by means of a display, indicator light, or audible signal.

1.7 *Forced convection* means a mode of conventional oven operation in which a fan is used to circulate the heated air within the oven compartment during cooking.

1.8 *Freestanding* means the product is not supported by surrounding cabinetry, walls, or other similar structures.

1.9 *IEC 62301 (First Edition)* means the test standard published by the International Electrotechnical Commission, titled ''Household electrical appliances—Measurement of standby power,'' Publication 62301 (First Edition 2005–06) (incorporated by reference; see §430.3).

1.10 *IEC 62301 (Second Edition)* means the test standard published by the International Electrotechnical Commission, titled ''Household electrical appliances—Measurement of standby power,'' Publication 62301 (Edition 2.0 2011–01) (incorporated by reference; see §430.3).

1.11 *Inactive mode* means a standby mode that facilitates the activation of active mode by remote switch (including remote control), internal sensor, or timer, or that provides continuous status display.

1.12 *Normal non-operating temperature* means the temperature of all areas of an appliance to be tested are within 5 °F (2.8 °C) of the temperature that the identical areas of the same basic model of the appliance would attain if it remained in the test room for 24

hours while not operating with all oven doors closed.

1.13 *Off mode* means a mode in which the product is connected to a mains power source and is not providing any active mode or standby mode function, and where the mode may persist for an indefinite time. An indicator that only shows the user that the product is in the off position is included within the classification of an off mode.

1.14 *Primary energy consumption* means either the electrical energy consumption of a conventional electric oven or the gas energy consumption of a conventional gas oven.

1.15 *Secondary energy consumption* means any electrical energy consumption of a conventional gas oven.

1.16 *Standard cubic foot (L) of gas* means that quantity of gas that occupies 1 cubic foot (L) when saturated with water vapor at a temperature of 60 °F (15.6 °C) and a pressure of 30 inches of mercury (101.6 kPa) (density of mercury equals 13.595 grams per cubic centimeter).

1.17 *Standby mode* means any modes where the product is connected to a mains power source and offers one or more of the following user-oriented or protective functions which may persist for an indefinite time: (a) To facilitate the activation of other modes (including activation or deactivation of active mode) by remote switch (including remote control), internal sensor, or timer; (b) continuous functions, including information or status displays (including clocks) or sensor-based functions. A timer is a continuous clock function (which may or may not be associated with a display) that provides regular scheduled tasks (*e.g.*, switching) and that operates on a continuous basis.

1.18 *Thermocouple* means a device consisting of two dissimilar metals which are joined together and, with their associated wires, are used to measure temperature by means of electromotive force.

1.19 *Symbol usage.* The following identity relationships are provided to help clarify the symbology used throughout this procedure.

A—Number of Hours in a Year
C—Specific Heat
E—Energy Consumed
Eff—Cooking Efficiency
H—Heating Value of Gas
K—Conversion for Watt-hours to Kilowatt-hours
K_e—3.412 Btu/Wh, Conversion for Watt-hours to Btu's
M—Mass
n—Number of Units
O—Annual Useful Cooking Energy Output
P—Power
Q—Gas Flow Rate
R—Energy Factor, Ratio of Useful Cooking Energy Output to Total Energy Input
S—Number of Self-Cleaning Operations per Year
T—Temperature
t—Time
V—Volume of Gas Consumed
W—Weight of Test Block

2. Test Conditions

2.1 *Installation.* A free standing kitchen range shall be installed with the back directly against, or as near as possible to, a vertical wall which extends at least 1 foot above and on either side of the appliance. There shall be no side walls. A drop-in, built-in, or wall-mounted appliance shall be installed in an enclosure in accordance with the manufacturer's instructions. These appliances are to be completely assembled with all handles, knobs, guards, and the like mounted in place. Any electric resistance heaters, gas burners, baking racks, and baffles shall be in place in accordance with the manufacturer's instructions; however, broiler pans are to be removed from the oven's baking compartment.

2.1.1 *Conventional electric ranges, ovens, and cooking tops.* These products shall be connected to an electrical supply circuit with voltage as specified in section 2.2.1 of this appendix with a watt-hour meter installed in the circuit. The watt-hour meter shall be as described in section 2.9.1.1 of this appendix. For standby mode and off mode testing, these products shall also be installed in accordance with Section 5, Paragraph 5.2 of IEC 62301 (Second Edition) (incorporated by reference; see §430.3), disregarding the provisions regarding batteries and the determination, classification, and testing of relevant modes.

2.1.2 *Conventional gas ranges, ovens, and cooking tops.* These products shall be connected to a gas supply line with a gas meter installed between the supply line and the appliance being tested, according to manufacturer's specifications. The gas meter shall be as described in section 2.9.2 of this appendix. Conventional gas ranges, ovens, and cooking tops with electrical ignition devices or other electrical components shall be connected to an electrical supply circuit of nameplate voltage with a watt-hour meter installed in the circuit. The watt-hour meter shall be as described in section 2.9.1.1 of this appendix. For standby mode and off mode testing, these products shall also be installed in accordance with Section 5, Paragraph 5.2 of IEC 62301 (Second Edition) (incorporated by reference; see §430.3), disregarding the provisions regarding batteries and the determination, classification, and testing of relevant modes.

2.1.3 *Microwave ovens.* Install the microwave oven in accordance with the manufacturer's instructions and connect to an electrical supply circuit with voltage as specified in section 2.2.1 of this appendix. The microwave oven shall also be installed in accordance with Section 5, Paragraph 5.2 of IEC 62301 (First Edition) (incorporated by

reference; see §430.3). A watt meter shall be installed in the circuit and shall be as described in section 2.9.1.3 of this appendix.

2.2 *Energy supply.*

2.2.1 *Electrical supply.*

2.2.1.1 *Voltage.* Maintain the electrical supply to the conventional range, conventional cooking top, and conventional oven being tested at 240/120 volts except that basic models rated only at 208/120 volts shall be tested at that rating. Maintain the voltage within 2 percent of the above specified voltages. For microwave oven testing, maintain the electrical supply to the microwave oven at 120/240 volts and 60 hertz. For conventional range, conventional cooking top, and conventional oven standby mode and off mode testing, maintain the electrical supply frequency at 60 hertz ±1 percent. Maintain the electrical supply for microwave oven testing within 1 percent of the specified voltage and frequency.

2.2.1.2 *Supply voltage waveform.* For conventional range, conventional cooking top, and conventional oven standby mode and off mode testing, maintain the electrical supply voltage waveform indicated in Section 4, Paragraph 4.3.2 of IEC 62301 (Second Edition) (incorporated by reference; see §430.3). For microwave oven standby mode and off mode testing, maintain the electrical supply voltage waveform indicated in Section 4, Paragraph 4.4 of IEC 62301 (First Edition) (incorporated by reference; see §430.3).

2.2.2 *Gas supply.*

2.2.2.1 *Gas burner adjustments.* Conventional gas ranges, ovens, and cooking tops shall be tested with all of the gas burners adjusted in accordance with the installation or operation instructions provided by the manufacturer. In every case, the burner must be adjusted with sufficient air flow to prevent a yellow flame or a flame with yellow tips.

2.2.2.2 *Natural gas.* For testing convertible cooking appliances or appliances which are designed to operate using only natural gas, maintain the natural gas pressure immediately ahead of all controls of the unit under test at 7 to 10 inches of water column (1743.6 to 2490.8 Pa). The regulator outlet pressure shall equal the manufacturer's recommendation. The natural gas supplied should have a heating value of approximately 1,025 Btu's per standard cubic foot (38.2 kJ/L). The actual gross heating value, H_n, in Btu's per standard cubic foot (kJ/L), for the natural gas to be used in the test shall be obtained either from measurements made by the manufacturer conducting the test using equipment that meets the requirements described in Section 2.9.4 or by the use of bottled natural gas whose gross heating value is certified to be at least as accurate a value that meets the requirements in Section 2.9.4.

2.2.2.3 *Propane.* For testing convertible cooking appliances with propane or for testing appliances which are designed to operate using only LP-gas, maintain the propane pressure immediately ahead of all controls of the unit under test at 11 to 13 inches of water column (2740 to 3238 Pa). The regulator outlet pressure shall equal the manufacturer's recommendation. The propane supplied should have a heating value of approximately 2,500 Btu's per standard cubic foot (93.2 kJ/L). The actual gross heating value, H_p, in Btu's per standard cubic foot (kJ/L), for the propane to be used in the test shall be obtained either from measurements made by the manufacturer conducting the test using equipment that meets the requirements described in Section 2.9.4 or by the use of bottled propane whose gross heating value is certified to be at least as accurate a value that meets the requirements described in Section 2.9.4.

2.2.2.4 *Test gas.* A basic model of a convertible cooking appliance shall be tested with natural gas, but may also be tested with propane. Any basic model of a conventional range, conventional cooking top, or conventional oven which is designed to operate using only natural gas as the energy source must be tested with natural gas. Any basic model of a conventional range, conventional cooking top, or conventional oven which is designed to operate using only LP gas as the gas energy source must be tested with propane gas.

2.3 *Air circulation.* Maintain air circulation in the room sufficient to secure a reasonably uniform temperature distribution, but do not cause a direct draft on the unit under test.

2.4 *Setting the conventional oven thermostat.*

2.4.1 *Conventional electric oven.* Install a thermocouple approximately in the center of the usable baking space. Provide a temperature indicator system for measuring the oven's temperature with an accuracy as indicated in Section 2.9.3.2. If the oven thermostat does not cycle on and off, adjust or determine the conventional electric oven thermostat setting to provide an average internal temperature which is 325° ±5 °F (180.6° ±2.8 °C) higher than the room ambient air temperature. If the oven thermostat operates by cycling on and off, adjust or determine the conventional electric oven thermostat setting to provide an average internal temperature which is 325° ±5 °F (180.6° ±2.8 °C) higher than the room ambient air temperature. This shall be done by measuring the maximum and minimum temperatures in any three consecutive cut-off/cut-on actions of the electric resistance heaters, excluding the initial cut-off/cut-on action, by the thermostat after the temperature rise of 325° ±5 °F (180.6° ±2.8 °C) has been attained by the conventional electric oven. Remove the thermocouple after the thermostat has been set.

2.4.2 *Conventional gas oven.* Install five parallel-connected weighted thermocouples,

one located at the center of the conventional gas oven's usable baking space and the other four equally spaced between the center and the corners of the conventional gas oven on the diagonals of a horizontal plane through the center of the conventional gas oven. Each weighted thermocouple shall be constructed of a copper disc that is 1-inch (25.4 mm) in diameter and ⅛-inch (3.2 mm) thick. The two thermocouple wires shall be located in two holes in the disc spaced ½-inch (12.7 mm) apart, with each hole being located ¼-inch (6.4 mm) from the center of the disc. Both thermocouple wires shall be silver-soldered to the copper disc. Provide a temperature indicator system for measuring the oven's temperature with an accuracy as indicated in Section 2.9.3.2. If the oven thermostat does not cycle on or off, adjust or determine the conventional gas oven thermostat setting to provide an average internal temperature which is 325 °±5 °F (180.6 °±2.8 °C) higher than the room ambient air temperature. If the oven thermostat operates by cycling on and off, adjust or determine the conventional gas oven thermostat setting to provide an average internal temperature which is 325° ±5 °F (180.6 ±2.8 °C) higher than the room ambient air temperature. This shall be done by measuring the maximum and minimum temperatures in any three consecutive cut-off/cut-on actions of the gas burners, excluding the initial cut-off/cut-on action, by the thermostat after the temperature rise of 325° ±5 °F (180.6° ±2.8 °C) has been attained by the conventional gas oven. Remove the thermocouples after the thermostat has been set.

2.5 *Ambient room air temperature.*

2.5.1 *Active mode ambient room air temperature.* During the active mode test, maintain an ambient room air temperature, T_R, of 77° ±9 °F (25° ±5 °C) for conventional ovens and cooking tops, as measured at least 5 feet (1.5 m) and not more than 8 feet (2.4 m) from the nearest surface of the unit under test and approximately 3 feet (0.9 m) above the floor. The temperature shall be measured with a thermometer or temperature indicating system with an accuracy as specified in section 2.9.3.1.

2.5.2 *Standby mode and off mode ambient temperature.* For conventional range, conventional cooking top, and conventional oven standby mode and off mode testing, maintain room ambient air temperature conditions as specified in Section 4, Paragraph 4.2 of IEC 62301 (Second Edition) (incorporated by reference; see §430.3). For microwave oven standby mode and off mode testing, maintain room ambient air temperature conditions as specified in Section 4, Paragraph 4.2 of IEC 62301 (First Edition) (incorporated by reference; see §430.3).

2.6 *Normal non-operating temperature.* All areas of the appliance to be tested shall attain the normal non-operating temperature, as defined in section 1.12 of this appendix, before any testing begins. The equipment for measuring the applicable normal non-operating temperature shall be as described in sections 2.9.3.1, 2.9.3.2, 2.9.3.3, and 2.9.3.4 of this appendix, as applicable.

2.7 *Test blocks for conventional oven and cooking top.* The test blocks shall be made of aluminum alloy No. 6061, with a specific heat of 0.23 Btu/lb- °F (0.96 kJ/[kg ÷ °C]) and with any temper that will give a czoefficient of thermal conductivity of 1073.3 to 1189.1 Btu-in/h-ft^2- °F (154.8 to 171.5 W/[m ÷ °C]). Each block shall have a hole at its top. The hole shall be 0.08 inch (2.03 mm) in diameter and 0.80 inch (20.3 mm) deep. The manufacturer conducting the test may provide other means which will ensure that the thermocouple junction is installed at this same position and depth.

The bottom of each block shall be flat to within 0.002 inch (0.051 mm) TIR (total indicator reading). Determine the actual weight of each test block with a scale with an accuracy as indicated in Section 2.9.5.

2.7.1 *Conventional oven test block.* The test block for the conventional oven, W_1, shall be 6.25±0.05 inches (158.8±1.3 mm) in diameter, approximately 2.8 inches (71 mm) high and shall weigh 8.5±0.1 lbs (3.86±0.05 kg). The block shall be finished with an anodic black coating which has a minimum thickness of 0.001 inch (0.025 mm) or with a finish having the equivalent absorptivity.

2.7.2 *Small test block for conventional cooking top.* The small test block, W_2, shall be 6.25±0.05 inches (158.8±1.3 mm) in diameter, approximately 2.8 inches (71 mm) high and shall weigh 8.5±0.1 lbs (3.86±0.05 kg).

2.7.3 *Large test block for conventional cooking top.* The large test block for the conventional cooking top, W_3, shall be 9±0.05 inches (228.6±1.3 mm) in diameter, approximately 3.0 inches (76 mm) high and shall weigh 19±0.1 lbs (8.62±0.05 kg).

2.7.4 *Thermocouple installation.* Install the thermocouple such that the thermocouple junction (where the thermocouple contacts the test block) is at the bottom of the hole provided in the test block and that the thermocouple junction makes good thermal contact with the aluminum block. If the test blocks are to be water cooled between tests the thermocouple hole should be sealed, or other steps taken, to insure that the thermocouple hole is completely dry at the start of the next test. Provide a temperature indicator system for measuring the test block temperature with an accuracy as indicated in Section 2.9.3.3.

2.7.5 *Initial test block temperature.* Maintain the initial temperature of the test blocks, T_I, within ±4 °F (±2.2 °C) of the ambient room air temperature as specified in Section 2.5. If the test block has been cooled (or heated) to bring it to room temperature, allow the block to stabilize for at least 2

minutes after removal from the cooling (or heating) source, before measuring its initial temperature.

2.8 [Reserved]

2.9 *Instrumentation.* Perform all test measurements using the following instruments, as appropriate:

2.9.1 *Electrical Measurements.*

2.9.1.1 *Watt-hour meter.* The watt-hour meter for measuring the electrical energy consumption of conventional ovens and cooking tops shall have a resolution of 1 watt-hour (3.6 kJ) or less and a maximum error no greater than 1.5 percent of the measured value for any demand greater than 5 watts. The watt-hour meter for measuring the energy consumption of microwave ovens shall have a resolution of 0.1 watt-hour (0.36 kJ) or less and a maximum error no greater than 1.5 percent of the measured value.

2.9.1.2 *Watt meter.* The watt meter used to measure the conventional oven, conventional range, or range clock power shall have a resolution of 0.2 watt (0.2 J/s) or less and a maximum error no greater than 5 percent of the measured value.

2.9.1.3 *Standby mode and off mode watt meter.* The watt meter used to measure conventional range, conventional cooking top, and conventional oven standby mode and off mode power consumption shall have a resolution as specified in Section 4, Paragraph 4.4 of IEC 62301 (Second Edition) (incorporated by reference, see §430.3). The watt meter used to measure microwave oven standby mode and off mode power consumption shall have a resolution as specified in Section 4, Paragraph 4.5 of IEC 62301 (First Edition) (incorporated by reference, see §430.3), and shall also be able to record a ''true'' average power as specified in Section 5, Paragraph 5.3.2(a) of IEC 62301 (First Edition).

2.9.2 *Gas Measurements.*

2.9.2.1 *Positive displacement meters.* The gas meter to be used for measuring the gas consumed by the gas burners of the oven or cooking top shall have a resolution of 0.01 cubic foot (0.28 L) or less and a maximum error no greater than 1 percent of the measured valued for any demand greater than 2.2 cubic feet per hour (62.3 L/h).

2.9.3 *Temperature measurement equipment.*

2.9.3.1 *Room temperature indicating system.* The room temperature indicating system shall be as specified in Section 2.9.3.4 for ranges, ovens and cooktops.

2.9.3.2 *Temperature indicator system for measuring conventional oven temperature.* The equipment for measuring the conventional oven temperature shall have an error no greater than ±4 °F (±2.2 °C) over the range of 65° to 500 °F (18 °C to 260 °C).

2.9.3.3 *Temperature indicator system for measuring test block temperature.* The system shall have an error no greater than ±2 °F (±1.1 °C) when measuring specific temperatures over the range of 65° to 330 °F (18.3 °C to 165.6 °C). It shall also have an error no greater than ±2 °F (±1.1 °C) when measuring any temperature difference up to 240 °F (133.3 °C) within the above range.

2.9.3.4 *Temperature indicator system for measuring surface temperatures.* The temperature of any surface of an appliance shall be measured by means of a thermocouple in firm contact with the surface. The temperature indicating system shall have an error no greater than ±1 °F (±0.6 °C) over the range 65° to 90 °F (18 °C to 32 °C).

2.9.4 *Heating Value.* The heating value of the natural gas or propane shall be measured with an instrument and associated readout device that has a maximum error no greater than ±0.5% of the measured value and a resolution of ±0.2% or less of the full scale reading of the indicator instrument. The heating value of natural gas or propane must be corrected for local temperature and pressure conditions.

2.9.5 *Scale.* The scale used for weighing the test blocks shall have a maximum error no greater than 1 ounce (28.4 g).

3. Test Methods and Measurements

3.1. *Test methods.*

3.1.1 *Conventional oven.* Perform a test by establishing the testing conditions set forth in section 2, *Test Conditions,* of this appendix and turn off the gas flow to the conventional cooking top, if so equipped. Before beginning the test, the conventional oven shall be at its normal non-operating temperature as defined in section 1.12 and described in section 2.6 of this appendix. Set the conventional oven test block W_1 approximately in the center of the usable baking space. If there is a selector switch for selecting the mode of operation of the oven, set it for normal baking. If an oven permits baking by either forced convection by using a fan, or without forced convection, the oven is to be tested in each of those two modes. The oven shall remain on for one complete thermostat ''cut-off/cut-on'' of the electrical resistance heaters or gas burners after the test block temperature has increased 234 °F (130 °C) above its initial temperature.

3.1.1.1 *Self-cleaning operation of a conventional oven.* Establish the test conditions set forth in section 2, *Test Conditions,* of this appendix. Turn off the gas flow to the conventional cooking top. The temperature of the conventional oven shall be its normal non-operating temperature as defined in section 1.12 and described in section 2.6 of this appendix. Then set the conventional oven's self-cleaning process in accordance with the manufacturer's instructions. If the self-cleaning process is adjustable, use the average time recommended by the manufacturer for a moderately soiled oven.

3.1.1.2 *Conventional oven standby mode and off mode power.* Establish the standby mode and off mode testing conditions set forth in

section 2, *Test Conditions,* of this appendix. For conventional ovens that take some time to enter a stable state from a higher power state as discussed in Section 5, Paragraph 5.1, Note 1 of IEC 62301 (Second Edition) (incorporated by reference; see §430.3), allow sufficient time for the conventional oven to reach the lower power state before proceeding with the test measurement. Follow the test procedure as specified in Section 5, Paragraph 5.3.2 of IEC 62301 (Second Edition) for testing in each possible mode as described in 3.1.1.2.1 and 3.1.1.2.2 of this appendix. For units in which power varies as a function of displayed time in standby mode, set the clock time to 3:23 at the end of the stabilization period specified in Section 5, Paragraph 5.3 of IEC 62301 (First Edition), and use the average power approach described in Section 5, Paragraph 5.3.2(a) of IEC 62301 (First Edition), but with a single test period of 10 minutes +0/−2 sec after an additional stabilization period until the clock time reaches 3:33.

3.1.1.2.1 If the conventional oven has an inactive mode, as defined in section 1.11 of this appendix, measure and record the average inactive mode power of the conventional oven, P_{IA}, in watts.

3.1.1.2.2 If the conventional oven has an off mode, as defined in section 1.13 of this appendix, measure and record the average off mode power of the conventional oven, P_{OM}, in watts.

3.1.2 *Conventional cooking top.* Establish the test conditions set forth in section 2, *Test Conditions,* of this appendix. Turn off the gas flow to the conventional oven(s), if so equipped. The temperature of the conventional cooking top shall be its normal nonoperating temperature as defined in section 1.12 and described in section 2.6 of this appendix. Set the test block in the center of the surface unit under test. The small test block, W_2, shall be used on electric surface units of 7 inches (178 mm) or less in diameter. The large test block, W_3, shall be used on electric surface units over 7 inches (178 mm) in diameter and on all gas surface units. Turn on the surface unit under test and set its energy input rate to the maximum setting. When the test block reaches 144 °F (80 °C) above its initial test block temperature, immediately reduce the energy input rate to 25±5 percent of the maximum energy input rate. After 15±0.1 minutes at the reduced energy setting, turn off the surface unit under test.

3.1.2.1 *Conventional cooking top standby mode and off mode power.* Establish the standby mode and off mode testing conditions set forth in section 2, *Test Conditions,* of this appendix. For conventional cooktops that take some time to enter a stable state from a higher power state as discussed in Section 5, Paragraph 5.1, Note 1 of IEC 62301 (Second Edition) (incorporated by reference; see §430.3), allow sufficient time for the conventional cooking top to reach the lower power state before proceeding with the test measurement. Follow the test procedure as specified in Section 5, Paragraph 5.3.2 of IEC 62301 (Second Edition) for testing in each possible mode as described in sections 3.1.2.1.1 and 3.1.2.1.2 of this appendix. For units in which power varies as a function of displayed time in standby mode, set the clock time to 3:23 at the end of the stabilization period specified in Section 5, Paragraph 5.3 of IEC 62301 (First Edition), and use the average power approach described in Section 5, Paragraph 5.3.2(a) of IEC 62301 (First Edition), but with a single test period of 10 minutes +0/-2 sec after an additional stabilization period until the clock time reaches 3:33.

3.1.2.1.1 If the conventional cooking top has an inactive mode, as defined in section 1.11 of this appendix, measure and record the average inactive mode power of the conventional cooking top, P_{IA}, in watts.

3.1.2.1.2 If the conventional cooking top has an off mode, as defined in section 1.13 of this appendix, measure and record the average off mode power of the conventional cooking top, P_{OM}, in watts.

3.1.3 *Conventional range standby mode and off mode power.* Establish the standby mode and off mode testing conditions set forth in section 2, *Test Conditions,* of this appendix. For conventional ranges that take some time to enter a stable state from a higher power state as discussed in Section 5, Paragraph 5.1, Note 1 of IEC 62301 (Second Edition) (incorporated by reference; see §430.3), allow sufficient time for the conventional range to reach the lower power state before proceeding with the test measurement. Follow the test procedure as specified in Section 5, Paragraph 5.3.2 of IEC 62301 (Second Edition) for testing in each possible mode as described in sections 3.1.3.1 and 3.1.3.2 of this appendix. For units in which power varies as a function of displayed time in standby mode, set the clock time to 3:23 at the end of the stabilization period specified in Section 5, Paragraph 5.3 of IEC 62301 (First Edition), and use the average power approach described in Section 5, Paragraph 5.3.2(a) of IEC 62301 (First Edition), but with a single test period of 10 minutes +0/−2 sec after an additional stabilization period until the clock time reaches 3:33.

3.1.3.1 If the conventional range has an inactive mode, as defined in section 1.11 of this appendix, measure and record the average inactive mode power of the conventional range, P_{IA}, in watts.

3.1.3.2 If the conventional range has an off mode, as defined in section 1.13 of this appendix, measure and record the average off mode power of the conventional range, P_{OM}, in watts.

3.1.4 *Microwave oven.*

3.1.4.1 *Microwave oven test standby mode and off mode power.* Establish the testing conditions set forth in section 2, *Test Conditions,* of this appendix. For microwave ovens that drop from a higher power state to a lower power state as discussed in Section 5, Paragraph 5.1, Note 1 of IEC 62301 (First Edition) (incorporated by reference; see §430.3), allow sufficient time for the microwave oven to reach the lower power state before proceeding with the test measurement. Follow the test procedure as specified in Section 5, Paragraph 5.3 of IEC 62301 (First Edition). For units in which power varies as a function of displayed time in standby mode, set the clock time to 3:23 and use the average power approach described in Section 5, Paragraph 5.3.2(a), but with a single test period of 10 minutes +0/−2 sec after an additional stabilization period until the clock time reaches 3:33. If a microwave oven is capable of operation in either standby mode or off mode, as defined in sections 1.17 or 1.13 of this appendix, respectively, or both, test the microwave oven in each mode in which it can operate.

3.2 *Test measurements.*

3.2.1 *Conventional oven test energy consumption.* If the oven thermostat controls the oven temperature without cycling on and off, measure the energy consumed, E_O, when the temperature of the block reaches T_O (T_O is 234 °F (130 °C) above the initial block temperature, T_I). If the oven thermostat operates by cycling on and off, make the following series of measurements: Measure the block temperature, T_A, and the energy consumed, E_A, or volume of gas consumed, V_A, at the end of the last ''ON'' period of the conventional oven before the block reaches T_O. Measure the block temperature, T_B, and the energy consumed, E_B, or volume of gas consumed, V_B, at the beginning of the next ''ON'' period. Measure the block temperature, T_C, and the energy consumed, E_C, or volume of gas consumed, V_C, at the end of that ''ON'' period. Measure the block temperature, T_D, and the energy consumed, E_D, or volume of gas consumed, V_D, at the beginning of the following ''ON'' period. Energy measurements for E_O, E_A, E_B, E_C, and E_D should be expressed in watt-hours (kJ) for conventional electric ovens, and volume measurements for V_A, V_B, V_C, and V_D should be expressed in standard cubic feet (L) of gas for conventional gas ovens. For a gas oven, measure in watt-hours (kJ) any electrical energy, E_{IO}, consumed by an ignition device or other electrical components required for the operation of a conventional gas oven while heating the test block to T_O.

3.2.1.1 *Conventional oven average test energy consumption.* If the conventional oven permits baking by either forced convection or without forced convection and the oven thermostat does not cycle on and off, measure the energy consumed with the forced convection mode, $(E_O)_1$, and without the forced convection mode, $(E_O)_2$, when the temperature of the block reaches T_O (T_O is 234 °F (130 °C) above the initial block temperature, T_I). If the conventional oven permits baking by either forced convection or without forced convection and the oven thermostat operates by cycling on and off, make the following series of measurements with and without the forced convection mode: Measure the block temperature, T_A, and the energy consumed, E_A, or volume of gas consumed, V_A, at the end of the last ''ON'' period of the conventional oven before the block reaches T_O. Measure the block temperature, T_B, and the energy consumed, E_B, or volume of gas consumed, V_B, at the beginning of the next ''ON'' period. Measure the block temperature, T_C, and the energy consumed, E_C, or volume of gas consumed, V_C, at the end of that ''ON'' period. Measure the block temperature, T_D, and the energy consumed, E_D, or volume of gas consumed, V_D, at the beginning of the following ''ON'' period. Energy measurements for E_O, E_A, E_B, E_C, and E_D should be expressed in watt-hours (kJ) for conventional electric ovens, and volume measurements for V_A, V_B, V_C, and V_D should be expressed in standard cubic feet (L) of gas for conventional gas ovens. For a gas oven that can be operated with or without forced convection, measure in watt-hours (kJ) any electrical energy consumed by an ignition device or other electrical components required for the operation of a conventional gas oven while heating the test block to T_O using the forced convection mode, $(E_{IO})_1$, and without using the forced convection mode, $(E_{IO})_2$.

3.2.1.2 *Conventional oven fan-only mode energy consumption.* If the conventional oven is capable of operation in fan-only mode, measure the fan-only mode energy consumption, E_{OF}, expressed in kilowatt-hours (kJ) of electricity consumed by the conventional oven for the duration of fan-only mode, using a watt-hour meter as specified in section 2.9.1.1 of this appendix. Alternatively, if the duration of fan-only mode is known, the watt-hours consumed may be measured for a period of 10 minutes in fan-only mode, using a watt-hour meter as specified in section 2.9.1.1 of this appendix. Multiply this value by the time in minutes that the conventional oven remains in fan-only mode, t_{OF}, and divide by 10,000 to obtain E_{OF}. The alternative approach may be used only if the resulting E_{OF} is representative of energy use during the entire fan-only mode.

3.2.1.3 *Energy consumption of self-cleaning operation.* Measure the energy consumption, E_S, in watt-hours (kJ) of electricity or the volume of gas consumption, V_S, in standard cubic feet (L) during the self-cleaning test set forth in section 3.1.1.1 of this appendix. For a gas oven, also measure in watt-hours (kJ) any electrical energy, E_{IS}, consumed by

ignition devices or other electrical components required during the self-cleaning test.

3.2.1.4 *Standby mode and off mode energy consumption.* Make measurements as specified in section 3.1.1.2 of this appendix. If the conventional oven is capable of operating in inactive mode, as defined in section 1.11 of this appendix, measure the average inactive mode power of the conventional oven, P_{IA}, in watts as specified in section 3.1.1.2.1 of this appendix. If the conventional oven is capable of operating in off mode, as defined in section 1.13 of this appendix, measure the average off mode power of the conventional oven, P_{OM}, in watts as specified in section 3.1.1.2.2 of this appendix.

3.2.2 *Conventional surface unit test energy consumption.*

3.2.2.1 *Conventional surface unit average test energy consumption.* For the surface unit under test, measure the energy consumption, $E_{CT,}$ in watt-hours (kJ) of electricity or the volume of gas consumption, V_{CT}, in standard cubic feet (L) of gas and the test block temperature, T_{CT}, at the end of the 15 minute (reduced input setting) test interval for the test specified in section 3.1.2 of this appendix and the total time, t_{CT}, in hours, that the unit is under test. Measure any electrical energy, E_{IC}, consumed by an ignition device of a gas heating element or other electrical components required for the operation of the conventional gas cooking top in watt-hours (kJ).

3.2.2.2 *Conventional surface unit standby mode and off mode energy consumption.* Make measurements as specified in section 3.1.2.1 of this appendix. If the conventional surface unit is capable of operating in inactive mode, as defined in section 1.11 of this appendix, measure the average inactive mode power of the conventional surface unit, $P_{IA,}$ in watts as specified in section 3.1.2.1.1 of this appendix. If the conventional surface unit is capable of operating in off mode, as defined in section 1.13 of this appendix, measure the average off mode power of the conventional surface unit, P_{OM}, in watts as specified in section 3.1.2.1.2 of this appendix.

3.2.3 *Conventional range standby mode and off mode energy consumption.* Make measurements as specified in section 3.1.3 of this appendix. If the conventional range is capable of operating in inactive mode, as defined in section 1.11 of this appendix, measure the average inactive mode power of the conventional range, $P_{IA,}$ in watts as specified in section 3.1.3.1 of this appendix. If the conventional range is capable of operating in off mode, as defined in section 1.13 of this appendix, measure the average off mode power of the conventional range, P_{OM}, in watts as specified in section 3.1.3.2 of this appendix.

3.2.4 *Microwave oven test standby mode and off mode power.* Make measurements as specified in Section 5, Paragraph 5.3 of IEC 62301 (First Edition) (incorporated by reference; see §430.3). If the microwave oven is capable of operating in standby mode, as defined in section 1.17 of this appendix, measure the average standby mode power of the microwave oven, P_{SB}, in watts as specified in section 3.1.4.1 of this appendix. If the microwave oven is capable of operating in off mode, as defined in section 1.13 of this appendix, measure the average off mode power of the microwave oven, P_{OM}, as specified in section 3.1.4.1 of this appendix.

3.3 *Recorded values.*

3.3.1 Record the test room temperature, T_R, at the start and end of each range, oven or cooktop test, as determined in Section 2.5.

3.3.2 Record measured test block weights W_1, W_2, and W_3 in pounds (kg).

3.3.3 Record the initial temperature, T_1, of the test block under test.

3.3.4 For a conventional oven with a thermostat which operates by cycling on and off, record the conventional oven test measurements T_A, E_A, T_B, E_B, T_C, E_C, T_D, and E_D for conventional electric ovens or T_A, V_A, T_B, V_B, T_C, V_C, T_D, and V_D for conventional gas ovens. If the thermostat controls the oven temperature without cycling on and off, record E_O. For a gas oven which also uses electrical energy for the ignition or operation of the oven, also record E_{IO}.

3.3.5 For a conventional oven that can be operated with or without forced convection and the oven thermostat controls the oven temperature without cycling on and off, measure the energy consumed with the forced convection mode, $(E_O)_1$, and without the forced convection mode, $(E_O)_2$. If the conventional oven operates with or without forced convection and the thermostat controls the oven temperature by cycling on and off, record the conventional oven test measurements T_A, E_A, T_B, E_B, T_C, E_C, T_D, and E_D for conventional electric ovens or T_A, V_A, T_B, V_B, T_C, V_C, T_D, and V_D for conventional gas ovens. For a gas oven that can be operated with or without forced convection, measure any electrical energy consumed by an ignition device or other electrical components used during the forced convection mode, $(E_{IO})_1$, and without using the forced convection mode, $(E_{IO})_2$.

3.3.6 Record the measured energy consumption, E_S, or gas consumption, V_S, and for a gas oven, any electrical energy, E_{IS}, for the test of the self-cleaning operation of a conventional oven.

3.3.7 For conventional ovens, record the conventional oven standby mode and off mode test measurements P_{IA} and P_{OM}, if applicable. For conventional cooktops, record the conventional cooking top standby mode and off mode test measurements P_{IA} and P_{OM}, if applicable. For conventional ranges, record the conventional range standby mode and off mode test measurements P_{IA} and P_{OM}, if applicable.

3.3.8 For the surface unit under test, record the electric energy consumption, E_{CT}, or the gas volume consumption, V_{CT}, the final test block temperature, T_{CT}, and the total test time, t_{CT}. For a gas cooking top which uses electrical energy for ignition of the burners, also record E_{IC}.

3.3.9 Record the heating value, Hn, as determined in section 2.2.2.2 of this appendix for the natural gas supply.

3.3.10 Record the heating value, Hp, as determined in section 2.2.2.3 of this appendix for the propane supply.

3.3.11 Record the average standby mode power, P_{SB}, for the microwave oven standby mode, as determined in section 3.2.4 of this appendix for a microwave oven capable of operating in standby mode. Record the average off mode power, P_{OM}, for the microwave oven off mode power test, as determined in section 3.2.4 of this appendix for a microwave oven capable of operating in off mode.

4. Calculation of Derived Results From Test Measurements

4.1 *Conventional oven.*

4.1.1 *Test energy consumption.* For a conventional oven with a thermostat which operates by cycling on and off, calculate the test energy consumption, E_O, expressed in watt-hours (kJ) for electric ovens and in Btus (kJ) for gas ovens, and defined as:

$$E_O = E_{AB} + \left[\left(\frac{T_O - T_{AB}}{T_{CD} - T_{AB}}\right) \times \left(E_{CD} - E_{AB}\right)\right]$$

for electric ovens, and,

$$E_O = \left(V_{AB} \times H\right) + \left[\left(\frac{T_O - T_{AB}}{T_{CD} - T_{AB}}\right) \times \left(V_{CD} - V_{AB}\right) \times H\right]$$

for gas ovens,

Where:

H = either H_n or H_p, the heating value of the gas used in the test as specified in section 2.2.2.2 and section 2.2.2.3 of this appendix, expressed in Btus per standard cubic foot (kJ/L).

T_O = 234 °F (130 °C) plus the initial test block temperature.

and,

$$E_{AB} = \frac{(E_A + E_B)}{2}, \quad E_{CD} = \frac{(E_C + E_D)}{2},$$

$$V_{AB} = \frac{(V_A + V_B)}{2}, \quad V_{CD} = \frac{(V_C + V_D)}{2},$$

$$T_{AB} = \frac{(T_A + T_B)}{2}, \quad T_{CD} = \frac{(T_C + T_D)}{2},$$

Where:

T_A = block temperature in °F (°C) at the end of the last ''ON'' period of the conventional oven before the test block reaches T_O.

T_B = block temperature in °F (°C) at the beginning of the ''ON'' period following the measurement of T_A.

T_C = block temperature in °F (°C) at the end of the ''ON'' period which starts with T_B.

T_D = block temperature in °F (°C) at the beginning of the ''ON'' period which follows the measurement of T_C.

E_A = electric energy consumed in Wh (kJ) at the end of the last ''ON'' period before the test block reaches T_O.

E_B = electric energy consumed in Wh (kJ) at the beginning of the ''ON'' period following the measurement of T_A.

E_C = electric energy consumed in Wh (kJ) at the end of the ''ON'' period which starts with T_B.

E_D = electric energy consumed in Wh (kJ) at the beginning of the ''ON'' period which follows the measurement of T_C.

V_A = volume of gas consumed in standard cubic feet (L) at the end of the last ''ON'' period before the test block reaches T_O.

V_B = volume of gas consumed in standard cubic feet (L) at the beginning of the ''ON'' period following the measurement of T_A.

V_C = volume of gas consumed in standard cubic feet (L) at the end of the ''ON'' period which starts with T_B.

V_D = volume of gas consumed in standard cubic feet (L) at the beginning of the ''ON'' period which follows the measurement of T_C.

4.1.1.1 *Average test energy consumption.* If the conventional oven can be operated with or without forced convection, determine the average test energy consumption, E_O and E_{IO}, in watt-hours (kJ) for electric ovens and Btus (kJ) for gas ovens using the following equations:

$$E_O = \frac{(E_O)_1 + (E_O)_2}{2}$$

$$E_{IO} = \frac{(E_{IO})_1 + (E_{IO})_2}{2}$$

Where:

$(E_O)_1$ = test energy consumption using the forced convection mode in watt-hours (kJ) for electric ovens and in Btus (kJ) for gas ovens as measured in section 3.2.1.1 of this appendix.

$(E_O)_2$ = test energy consumption without using the forced convection mode in watt-hours (kJ) for electric ovens and in Btus (kJ) for gas ovens as measured in section 3.2.1.1 of this appendix.

$(E_{IO})_1$ = electrical energy consumption in watt-hours (kJ) of a gas oven in forced convection mode as measured in section 3.2.1.1 of this appendix.

$(E_{IO})_2$ = electrical energy consumption in watt-hours (kJ) of a gas oven without using the forced convection mode as measured in section 3.2.1.1 of this appendix.

4.1.2 *Conventional oven annual energy consumption.*

4.1.2.1. *Annual cooking energy consumption.*

4.1.2.1.1. *Annual primary energy consumption.* Calculate the annual primary energy consumption for cooking, E_{CO}, expressed in kilowatt-hours (kJ) per year for electric ovens and in Btu's (kJ) per year for gas ovens, and defined as:

$$E_{CO} = \frac{E_O \times K_e \times O_O}{W_l \times C_p \times T_S} \text{ for electric ovens,}$$

Where:

E_O=test energy consumption as measured in Section 3.2.1 or as calculated in Section 4.1.1 or Section 4.1.1.1.

K_e=3.412 Btu/Wh (3.6 kJ/Wh,) conversion factor of watt-hours to Btu's.

O_O=29.3 kWh (105,480 kJ) per year, annual useful cooking energy output of conventional electric oven.

W_l=measured weight of test block in pounds (kg).

C_p=0.23 Btu/lb-°F (0.96 kJ/kg ÷ °C), specific heat of test block.

T_S=234 °F (130 °C), temperature rise of test block.

$$E_{CO} = \frac{E_O \times O_O}{W_l \times C_p \times T_S} \text{ for gas ovens,}$$

Where:

E_O=test energy consumption as measured in Section 3.2.1. or as calculated in Section 4.1.1 or Section 4.1.1.1.

O_O=88.8 kBtu (93,684 kJ) per year, annual useful cooking energy output of conventional gas oven.

W_l, C_p and T_S are the same as defined above.

4.1.2.1.2 *Annual secondary energy consumption for cooking of gas ovens.* Calculate the annual secondary energy consumption for cooking, E_{SO}, expressed in kilowatt-hours (kJ) per year and defined as:

$$E_{SO} = \frac{E_{IO} \times K_e \times O_O}{W_l \times C_p \times T_S},$$

Where:

E_{IO}=electrical test energy consumption as measured in Section 3.2.1 or as calculated in Section 4.1.1.1.

O_O=29.3 kWh (105,480 kJ) per year, annual useful cooking energy output.

K_e, W_l, C_p, and T_S are as defined in Section 4.1.2.1.1.

4.1.2.2 *Annual conventional oven self-cleaning energy.*

4.1.2.2.1 *Annual primary energy consumption.* Calculate the annual primary energy consumption for conventional oven self-cleaning operations, E_{SC}, expressed in kilowatt-hours (kJ) per year for electric ovens and in Btus (kJ) for gas ovens, and defined as: $E_{SC} = E_S \times S_e \times K$, for electric ovens,

Where:

E_S = energy consumption in watt-hours, as measured in section 3.2.1.3 of this appendix.

S_e = 4, average number of times a self-cleaning operation of a conventional electric oven is used per year.

K = 0.001 kWh/Wh conversion factor for watt-hours to kilowatt-hours.

or

$E_{SC} = V_S \times H \times S_g$, for gas ovens,

Where:

V_S = gas consumption in standard cubic feet (L), as measured in section 3.2.1.3 of this appendix.

H = H_n or H_p, the heating value of the gas used in the test as specified in sections 2.2.2.2 and 2.2.2.3 of this appendix in Btus per standard cubic foot (kJ/L).

S_g = 4, average number of times a self-cleaning operation of a conventional gas oven is used per year.

4.1.2.2.2 *Annual secondary energy consumption for self-cleaning operation of gas ovens.* Calculate the annual secondary energy consumption for self-cleaning operations of a gas oven, E_{SS}, expressed in kilowatt-hours (kJ) per year and defined as:

$E_{SS} = E_{IS} \times S_g \times K$,

Where:

E_{IS} = electrical energy consumed during the self-cleaning operation of a conventional gas oven, as measured in section 3.2.1.3 of this appendix.

S_g = 4, average number of times a self-cleaning operation of a conventional gas oven is used per year.

K = 0.001 kWh/Wh conversion factor for watt-hours to kilowatt-hours.

4.1.2.3 *Annual combined low-power mode energy consumption of a single conventional oven.* Calculate the annual standby mode and off

mode energy consumption for conventional ovens, E_{OTLP}, expressed in kilowatt-hours (kJ) per year and defined as:

$E_{OTLP} = [(P_{IA} \times S_{IA}) + (P_{OM} \times S_{OM})] \times K$,

Where:

P_{IA} = conventional oven inactive mode power, in watts, as measured in section 3.2.1.4 of this appendix.

P_{OM} = conventional oven off mode power, in watts, as measured in section 3.2.1.4 of this appendix.

S_{TOT} equals the total number of inactive mode and off mode hours per year;

If the conventional oven has fan-only mode, S_{TOT} equals $(8{,}540.1 - (t_{OF}/60))$ hours, where t_{OF} is the conventional oven fan-only mode duration, in minutes, as measured in section 3.2.1.2 of this appendix, and 60 is the conversion factor for minutes to hours; otherwise, S_{TOT} is equal to 8,540.1 hours.

If the conventional oven has both inactive mode and off mode, S_{IA} and S_{OM} both equal $S_{TOT}/2$;

If the conventional oven has an inactive mode but no off mode, the inactive mode annual hours, S_{IA}, is equal to S_{TOT} and the off mode annual hours, S_{OM}, is equal to 0;

If the conventional oven has an off mode but no inactive mode, S_{IA} is equal to 0 and S_{OM} is equal to S_{TOT};

K = 0.001 kWh/Wh conversion factor for watt-hours to kilowatt-hours.

4.1.2.4 *Total annual energy consumption of a single conventional oven.*

4.1.2.4.1 *Conventional electric oven energy consumption.* Calculate the total annual energy consumption of a conventional electric oven, $E_{AO,}$ expressed in kilowatt-hours (kJ) per year and defined as:

$E_{AO} = E_{CO} + E_{SC}$,

Where:

E_{CO} = annual primary cooking energy consumption as determined in section 4.1.2.1.1 of this appendix.

E_{SC} = annual primary self-cleaning energy consumption as determined in section 4.1.2.2.1 of this appendix.

4.1.2.4.2 *Conventional electric oven integrated energy consumption.* Calculate the total integrated annual electrical energy consumption of a conventional electric oven, $IE_{AO,}$ expressed in kilowatt-hours (kJ) per year and defined as:

$IE_{AO} = E_{CO} + E_{SC} + E_{OTLP}, + (E_{OF} \times N_{OE})$,

Where:

E_{CO} = annual primary cooking energy consumption as determined in section 4.1.2.1.1 of this appendix.

E_{SC} = annual primary self-cleaning energy consumption as determined in section 4.1.2.2.1 of this appendix.

E_{OTLP} = annual combined low-power mode energy consumption as determined in section 4.1.2.3 of this appendix.

E_{OF} = fan-only mode energy consumption as measured in section 3.2.1.2 of this appendix.

N_{OE} = representative number of annual conventional electric oven cooking cycles per year, which is equal to 219 cycles for a conventional electric oven without self-clean capability and 204 cycles for a conventional electric oven with self-clean capability.

4.1.2.4.3 *Conventional gas oven energy consumption.* Calculate the total annual gas energy consumption of a conventional gas oven, E_{AOG}, expressed in Btus (kJ) per year and defined as:

$E_{AOG} = E_{CO} + E_{SC}$,

Where:

E_{CO} = annual primary cooking energy consumption as determined in section 4.1.2.1.1 of this appendix.

E_{SC} = annual primary self-cleaning energy consumption as determined in section 4.1.2.2.1 of this appendix.

If the conventional gas oven uses electrical energy, calculate the total annual electrical energy consumption, E_{AOE}, expressed in kilowatt-hours (kJ) per year and defined as:

$E_{AOE} = E_{SO} + E_{SS}$,

Where:

E_{SO} = annual secondary cooking energy consumption as determined in section 4.1.2.1.2 of this appendix.

E_{SS} = annual secondary self-cleaning energy consumption as determined in section 4.1.2.2.2 of this appendix.

If the conventional gas oven uses electrical energy, also calculate the total integrated annual electrical energy consumption, IE_{AOE}, expressed in kilowatt-hours (kJ) per year and defined as:

$IE_{AOE} = E_{SO} + E_{SS} + E_{OTLP} + (E_{OF} \times N_{OG})$,

Where:

E_{SO} = annual secondary cooking energy consumption as determined in section 4.1.2.1.2 of this appendix.

E_{SS} = annual secondary self-cleaning energy consumption as determined in section 4.1.2.2.2 of this appendix.

E_{OTLP} = annual combined low-power mode energy consumption as determined in section 4.1.2.3 of this appendix.

E_{OF} = fan-only mode energy consumption as measured in section 3.2.1.2 of this appendix.

N_{OG} = representative number of annual conventional gas oven cooking cycles per year, which is equal to 183 cycles for a conventional gas oven without self-clean capability and 197 cycles for a conventional gas oven with self-clean capability.

4.1.2.5. *Total annual energy consumption of multiple conventional ovens.* If the cooking appliance includes more than one conventional oven, calculate the total annual energy consumption of the conventional ovens using the following equations:

4.1.2.5.1 *Conventional electric oven energy consumption.* Calculate the total annual energy consumption, $E_{TO,}$ in kilowatt-hours (kJ) per year and defined as:

$E_{TO} = E_{ACO} + E_{ASC}$,

Where:

$$E_{ACO} = \frac{1}{n}\sum_{i=1}^{n}\left(E_{CO}\right)_i ,$$

is the average annual primary energy consumption for cooking, and where:

n = number of conventional ovens in the basic model.

E_{CO} = annual primary energy consumption for cooking as determined in section 4.1.2.1.1 of this appendix.

$$E_{ASC} = \frac{1}{n}\sum_{i=1}^{n}\left(E_{SC}\right)_i ,$$

average annual self-cleaning energy consumption,

Where:

n = number of self-cleaning conventional ovens in the basic model.

E_{SC} = annual primary self-cleaning energy consumption as determined according to section 4.1.2.2.1 of this appendix.

4.1.2.5.2 *Conventional electric oven integrated energy consumption.* Calculate the total integrated annual energy consumption, $IE_{TO,}$ in kilowatt-hours (kJ) per year and defined as:

$IE_{TO} = E_{ACO} + E_{ASC} + E_{OTLP} + (E_{OF} \times N_{OE})$,

Where:

$$E_{ACO} = \frac{1}{n}\sum_{i=1}^{n}\left(E_{CO}\right)_i ,$$

is the average annual primary energy consumption for cooking, and where:

n = number of conventional ovens in the basic model.

E_{CO} = annual primary energy consumption for cooking as determined in section 4.1.2.1.1 of this appendix.

$$E_{ASC} = \frac{1}{n}\sum_{i=1}^{n}\left(E_{SC}\right)_i ,$$

average annual self-cleaning energy consumption,

Where:

n = number of self-cleaning conventional ovens in the basic model.

E_{SC} = annual primary self-cleaning energy consumption as determined according to section 4.1.2.2.1 of this appendix.

E_{OTLP} = annual combined low-power mode energy consumption for the cooking appliance as determined in section 4.1.2.3 of this appendix.

E_{OF} = fan-only mode energy consumption as measured in section 3.2.1.2 of this appendix.

N_{OE} = representative number of annual conventional electric oven cooking cycles per year, which is equal to 219 cycles for a conventional electric oven without self-clean capability and 204 cycles for a conventional electric oven with self-clean capability.

4.1.2.5.3 *Conventional gas oven energy consumption.* Calculate the total annual gas energy consumption, E_{TOG}, in Btus (kJ) per year and defined as:

$E_{TOG} = E_{ACO} + E_{ASC}$,

Where:

E_{ACO} = average annual primary energy consumption for cooking in Btus (kJ) per year and is calculated as:

$$E_{ACO} = \frac{1}{n}\sum_{i=1}^{n}\left(E_{CO}\right)_i ,$$

Where:

n = number of conventional ovens in the basic model.

E_{CO} = annual primary energy consumption for cooking as determined in section 4.1.2.1.1 of this appendix.

and,

E_{ASC} = average annual self-cleaning energy consumption in Btus (kJ) per year and is calculated as:

$$E_{ASC} = \frac{1}{n}\sum_{i=1}^{n}\left(E_{SC}\right)_i ,$$

Where:

n = number of self-cleaning conventional ovens in the basic model.

E_{SC} = annual primary self-cleaning energy consumption as determined according to section 4.1.2.2.1 of this appendix.

If the oven also uses electrical energy, calculate the total annual electrical energy consumption, E_{TOE}, in kilowatt-hours (kJ) per year and defined as:

$E_{TOE} = E_{ASO} + E_{AAS}$,

Where:

$$E_{ASO} = \frac{1}{n}\sum_{i=1}^{n}\left(E_{SO}\right)_i ,$$

is the average annual secondary energy consumption for cooking,

Where:

n = number of conventional ovens in the basic model.

E_{SO} = annual secondary energy consumption for cooking of gas ovens as determined in section 4.1.2.1.2 of this appendix.

$$E_{AAS} = \frac{1}{n}\sum_{i=1}^{n}\left(E_{SS}\right)_i ,$$

is the average annual secondary self-cleaning energy consumption,

Where:

n = number of self-cleaning ovens in the basic model.

E_{SS} = annual secondary self-cleaning energy consumption of gas ovens as determined in section 4.1.2.2.2 of this appendix.

If the oven also uses electrical energy, also calculate the total integrated annual electrical energy consumption, IE_{TOE}, in kilowatt-hours (kJ) per year and defined as:

$IE_{TOE} = E_{ASO} + E_{AAS} + E_{OTLP} + (E_{OF} \times N_{OG})$,

Where:

$$E_{ASO} = \frac{1}{n}\sum_{i=1}^{n}\left(E_{SO}\right)_i ,$$

is the average annual secondary energy consumption for cooking,

Where:

n = number of conventional ovens in the basic model.

E_{SO}= annual secondary energy consumption for cooking of gas ovens as determined in section 4.1.2.1.2 of this appendix.

$$E_{AAS} = \frac{1}{n}\sum_{i=1}^{n}\left(E_{SS}\right)_i ,$$

is the average annual secondary self-cleaning energy consumption,

Where:

n = number of self-cleaning ovens in the basic model.

E_{SS} = annual secondary self-cleaning energy consumption of gas ovens as determined in section 4.1.2.2.2 of this appendix.

E_{OTLP} = annual combined low-power mode energy consumption as determined in section 4.1.2.3 of this appendix.

E_{OF}= fan-only mode energy consumption as measured in section 3.2.1.2 of this appendix.

N_{OG} = representative number of annual conventional gas oven cooking cycles per year, which is equal to 183 cycles for a conventional gas oven without self-clean capability and 197 cycles for a conventional gas oven with self-clean capability.

4.1.3 *Conventional oven cooking efficiency.*

4.1.3.1 *Single conventional oven.* Calculate the conventional oven cooking efficiency, Eff_{AO}, using the following equations:

For electric ovens:

$$Eff_{AO} = \frac{W_l \times C_p \times T_S}{E_O \times K_e},$$

and,

For gas ovens:

$$Eff_{AO} = \frac{W_l \times C_p \times T_S}{E_O + \left(E_{IO} \times K_e\right)},$$

Where:

W_l=measured weight of test block in pounds (kg).

C_p=0.23 Btu/lb-°F (0.96 kJ/kg÷ °C), specific heat of test block.

T_S=234 °F (130 °C), temperature rise of test block.

E_O=test energy consumption as measured in Section 3.2.1 or calculated in Section 4.1.1 or Section 4.1.1.1.

K_e=3.412 Btu/Wh (3.6 kJ/Wh), conversion factor for watt-hours to Btu's.

E_{IO}=electrical test energy consumption according to Section 3.2.1 or as calculated in Section 4.1.1.1.

4.1.3.2 *Multiple conventional ovens.* If the cooking appliance includes more than one conventional oven, calculate the cooking efficiency for all of the conventional ovens in the appliance, Eff_{TO}, using the following equation:

$$Eff_{TO} = \frac{n}{\sum_{i=1}^{n}\left(\frac{1}{Eff_{AO}}\right)_i},$$

Where:

n=number of conventional ovens in the cooking appliance.

Eff_{AO}=cooking efficiency of each oven determined according to Section 4.1.3.1.

4.1.4 *Conventional oven energy factor and integrated energy factor.*

4.1.4.1 *Conventional oven energy factor.* Calculate the energy factor, or the ratio of useful cooking energy output to the total energy input, R_O, using the following equations:

$$R_O = \frac{O_O}{E_{AO}},$$

For electric ovens,

Where:

O_O = 29.3 kWh (105,480 kJ) per year, annual useful cooking energy output.

E_{AO} = total annual energy consumption for electric ovens as determined in section 4.1.2.4.1 of this appendix.

For gas ovens:

$$R_O = \frac{O_O}{E_{AOG} + \left(E_{AOE} \times K_e\right)},$$

Where:

O_O = 88.8 kBtu (93,684 kJ) per year, annual useful cooking energy output.

E_{AOG} = total annual gas energy consumption for conventional gas ovens as determined in section 4.1.2.4.3 of this appendix.

E_{AOE} = total annual electrical energy consumption for conventional gas ovens as determined in section 4.1.2.4.3 of this appendix.

K_e = 3,412 Btu/kWh (3,600 kJ/kWh), conversion factor for kilowatt-hours to Btu's.

4.1.4.2 *Conventional oven integrated energy factor.* Calculate the integrated energy factor, or the ratio of useful cooking energy output to the total integrated energy input, IR_O, using the following equations:

$$IR_O = \frac{O_O}{IE_{AO}},$$

For electric ovens,

Where:

O_O = 29.3 kWh (105,480 kJ) per year, annual useful cooking energy output.

IE_{AO} = total integrated annual energy consumption for electric ovens as determined in section 4.1.2.4.2 of this appendix.

For gas ovens:

$$IR_O = \frac{O_O}{E_{AOG} + \left(IE_{AOE} \times K_e\right)},$$

Where:

O_O = 88.8 kBtu (93,684 kJ) per year, annual useful cooking energy output.

E_{AOG} = total annual gas energy consumption for conventional gas ovens as determined in section 4.1.2.4.3 of this appendix.

IE_{AOE} = total integrated annual electrical energy consumption for conventional gas ovens as determined in section 4.1.2.4.3 of this appendix.

K_e = 3,412 Btu/kWh (3,600 kJ/kWh), conversion factor for kilowatt-hours to Btus.

4.2.1.1 *Electric surface unit cooking efficiency*. Calculate the cooking efficiency, $Eff_{SU,}$ of the electric surface unit under test, defined as:

$$Eff_{SU} = W \times C_P \times \left(\frac{T_{SU}}{K_e \times E_{CT}}\right),$$

Where:

W = measured weight of test block, W_2 or W_3, expressed in pounds (kg).

C_p = 0.23 Btu/lb- °F (0.96 kJ/kg ÷ °C), specific heat of test block.

T_{SU} = temperature rise of the test block: final test block temperature, T_{CT}, as determined in section 3.2.2 of this appendix, minus the initial test block temperature, T_I, expressed in °F (°C) as determined in section 2.7.5 of this appendix.

K_e = 3.412 Btu/Wh (3.6 kJ/Wh), conversion factor of watt-hours to Btus.

E_{CT} = measured energy consumption, as determined according to section 3.2.2.1 of this appendix, expressed in watt-hours (kJ).

4.2.1.2 *Gas surface unit cooking efficiency*. Calculate the cooking efficiency, $Eff_{SU,}$ of the gas surface unit under test, defined as:

$$Eff_{SU} = \left(\frac{W_3 \times C_P \times T_{SU}}{E}\right),$$

Where:

W_3 = measured weight of test block as measured in section 3.3.2 of this appendix, expressed in pounds (kg).

C_p and T_{SU} are the same as defined in section 4.2.1.1 of this appendix.

and,

$E = V_{CT} + (E_{IC} \times K_e)$,

Where:

V_{CT} = total gas consumption in standard cubic feet (L) for the gas surface unit test as measured in section 3.2.2.1 of this appendix.

E_{IC} = electrical energy consumed in watt-hours (kJ) by an ignition device of a gas surface unit as measured in section 3.2.2.1 of this appendix.

K_e = 3.412 Btu/Wh (3.6 kJ/Wh), conversion factor of watt-hours to Btus.

4.2.1.3 *Conventional cooking top cooking efficiency*. Calculate the conventional cooking top cooking efficiency, Eff_{CT}, using the following equation:

$$\mathrm{Eff_{CT}} = \frac{1}{\mathrm{n}} \sum_{\mathrm{i=1}}^{\mathrm{n}} \left(\mathrm{Eff_{SU}}\right)_{\mathrm{i}},$$

Where:

n=number of surface units in the cooking top.

Eff_{SU}=the efficiency of each of the surface units, as determined according to Section 4.2.1.1 or Section 4.2.1.2.

4.2.2 *Conventional cooking top annual energy consumption.*

4.2.2.1 *Conventional electric cooking top.*

4.2.2.1.1 *Annual energy consumption of a conventional electric cooking top.* Calculate the annual electrical energy consumption of an electric cooking top, $E_{CA,}$ in kilowatt-hours (kJ) per year, defined as:

$$E_{CA} = \frac{O_{CT}}{Eff_{CT}},$$

Where:

O_{CT} = 173.1 kWh (623,160 kJ) per year, annual useful cooking energy output.

Eff_{CT} = conventional cooking top cooking efficiency as defined in section 4.2.1.3 of this appendix.

4.2.2.1.2 *Integrated annual energy consumption of a conventional electric cooking top.* Calculate the total integrated annual electrical energy consumption of an electric cooking top, $IE_{CA,}$in kilowatt-hours (kJ) per year, defined as:

$$IE_{CA} = \frac{O_{CT}}{Eff_{CT}} + E_{CTLP},$$

Where:

O_{CT} = 173.1 kWh (623,160 kJ) per year, annual useful cooking energy output.

Eff_{CT} = conventional cooking top cooking efficiency as defined in section 4.2.1.3 of this appendix.

E_{CTLP} = conventional cooking top combined low-power mode energy consumption = $[(P_{IA} \times S_{IA}) + (P_{OM} \times S_{OM})] \times K$,

Where:

P_{IA} = conventional cooking top inactive mode power, in watts, as measured in section 3.1.2.1.1 of this appendix.

P_{OM} = conventional cooking top off mode power, in watts, as measured in section 3.1.2.1.2 of this appendix.

If the conventional cooking top has both inactive mode and off mode annual hours, S_{IA} and S_{OM} both equal 4273.4;

If the conventional cooking top has an inactive mode but no off mode, the inactive mode annual hours, S_{IA}, is equal to 8546.9, and the off mode annual hours, S_{OM}, is equal to 0;

If the conventional cooking top has an off mode but no inactive mode, S_{IA} is equal to 0, and S_{OM} is equal to 8546.9;

K = 0.001 kWh/Wh conversion factor for watt-hours to kilowatt-hours.

4.2.2.2 *Conventional gas cooking top*

4.2.2.2.1 *Annual cooking energy consumption.* Calculate the annual energy consumption for cooking, E_{CC}, in Btu's (kJ) per year for a gas cooking top, defined as:

$$E_{CC} = \frac{O_{CT}}{Eff_{CT}},$$

Where:

O_{CT}=527.6 kBtu (556,618 kJ) per year, annual useful cooking energy output.

Eff_{CT}=the gas cooking top efficiency as defined in Section 4.2.1.3.

4.2.2.2.2 *Total integrated annual energy consumption of a conventional gas cooking top.* Calculate the total integrated annual energy consumption of a conventional gas cooking top, $IE_{CA,}$ in Btus (kJ) per year, defined as:

$IE_{CA} = E_{CC} + E_{CTSO}$,

Where:

E_{CC} = energy consumption for cooking as determined in section 4.2.2.2.1 of this appendix.

E_{CTSO} = conventional cooking top combined low-power mode energy consumption = $[(P_{IA} \times S_{IA}) + (P_{OM} \times S_{OM})] \times K$,

Where:

P_{IA} = conventional cooking top inactive mode power, in watts, as measured in section 3.1.2.1.1 of this appendix.

P_{OM} = conventional cooking top off mode power, in watts, as measured in section 3.1.2.1.2 of this appendix.

If the conventional cooking top has both inactive mode and off mode annual hours, S_{IA} and S_{OM} both equal 4273.4;

If the conventional cooking top has an inactive mode but no off mode, the inactive mode annual hours, S_{IA}, is equal to 8546.9, and the off mode annual hours, S_{OM}, is equal to 0;

If the conventional cooking top has an off mode but no inactive mode, S_{IA} is equal to 0, and S_{OM} is equal to 8546.9;

K = 0.001 kWh/Wh conversion factor for watt-hours to kilowatt-hours.

4.2.3 *Conventional cooking top energy factor and integrated energy factor.*

4.2.3.1 *Conventional cooking top energy factor.* Calculate the energy factor or ratio of useful cooking energy output for cooking to the total energy input, $R_{CT,}$ as follows:

For an electric cooking top, the energy factor is the same as the cooking efficiency as determined according to section 4.2.1.3 of this appendix.

For gas cooking tops,

$$R_{CT} = \frac{O_{CT}}{E_{CC}},$$

Where:

O_{CT} = 527.6 kBtu (556,618 kJ) per year, annual useful cooking energy output of cooking top.

E_{CC} = energy consumption for cooking as determined in section 4.2.2.2.1 of this appendix.

4.2.3.2 *Conventional cooking top integrated energy factor.* Calculate the integrated energy factor or ratio of useful cooking energy output for cooking to the total integrated energy input, $IR_{CT,}$ as follows:

For electric cooking tops,

$$IR_{CT} = \frac{O_{CT}}{IE_{CA}},$$

Where:

O_{CT} = 527.6 kBtu (556,618 kJ) per year, annual useful cooking energy output of cooking top.

IE_{CA} = total annual integrated energy consumption of cooking top determined according to section 4.2.2.1.2 of this appendix.

For gas cooking tops,

$$IR_{CT} = \frac{O_{CT}}{IE_{CA}},$$

Where:

O_{CT} = 527.6 kBtu (556,618 kJ) per year, annual useful cooking energy output of cooking top.

IE_{CA} = total integrated annual energy consumption of cooking top determined according to section 4.2.2.2.2 of this appendix.

4.3 *Combined components.* The annual energy consumption of a kitchen range (*e.g.,* a cooking top and oven combined) shall be the sum of the annual energy consumption of each of its components. The integrated annual energy consumption of a kitchen range shall be the sum of the annual energy consumption of each of its components plus the total annual fan-only mode energy consumption for the oven component, E_{TOF}, defined as:

$E_{TOF} = E_{OF} \times N_R$,

Where:

E_{OF} = conventional oven fan-only mode energy consumption, in kilowatt-hours, as measured in section 3.2.1.2 of this appendix.

N_R = representative number of annual conventional oven cooking cycles per year, which is equal to 219 cycles for a conventional electric oven without self-clean capability, 204 cycles for a conventional electric oven with self-clean capability, 183 cycles for a conventional gas oven without self-clean capability, and 197 cycles for a conventional gas oven with self-clean capability.

plus the conventional range integrated annual combined low-power mode energy consumption, E_{RTLP}, defined as:

$E_{RTLP} = [(P_{IA} \times S_{IA}) + (P_{OM} \times S_{OM})] \times K$

Where:

P_{IA} = conventional range inactive mode power, in watts, as measured in section 3.1.3.1 of this appendix.

P_{OM} = conventional range off mode power, in watts, as measured in section 3.1.3.2 of this appendix.

S_{TOT} equals the total number of inactive mode and off mode hours per year;

If the conventional oven component of the conventional range has fan-only mode, S_{TOT} equals (8,329.2 − (t_{OF}/60)) hours, where t_{OF} is the conventional oven fan-only mode duration, in minutes, as measured in section 3.2.1.2 of this appendix, and 60 is the conversion factor for minutes to hours; otherwise, S_{TOT} is equal to 8,329.2 hours.

If the conventional range has both inactive mode and off mode, S_{IA} and S_{OM} both equal S_{TOT}/2;

If the conventional range has an inactive mode but no off mode, the inactive mode annual hours, S_{IA}, is equal to S_{TOT}, and the off mode annual hours, S_{OM}, is equal to 0;

If the conventional range has an off mode but no inactive mode, S_{IA} is equal to 0, and S_{OM} is equal to S_{TOT};

K = 0.001 kWh/Wh conversion factor for watt-hours to kilowatt-hours.

The annual energy consumption for other combinations of ovens and cooktops will also be treated as the sum of the annual energy consumption of each of its components. The energy factor of a combined component is the sum of the annual useful cooking energy output of each component divided by the sum of the total annual energy consumption of each component. The integrated energy factor of other combinations of ovens and cooktops is the sum of the annual useful cooking energy output of each component divided by the sum of the total integrated annual energy consumption of each component.

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APPENDIX J1 TO SUBPART B OF PART 430—UNIFORM TEST METHOD FOR MEASURING THE ENERGY CONSUMPTION OF AUTOMATIC AND SEMI-AUTOMATIC CLOTHES WASHERS

Manufacturers may use Appendix J1 to certify compliance with existing DOE energy conservation standards until the compliance date of any amended standards that address standby and off mode power consumption for residential clothes washers. After this date, all residential clothes washers shall be tested using the provisions of Appendix J2.

1. Definitions and Symbols

1.1 *Adaptive control system* means a clothes washer control system, other than an adaptive water fill control system, which is capable of automatically adjusting washer operation or washing conditions based on characteristics of the clothes load placed in the clothes container, without allowing or requiring consumer intervention or actions. The automatic adjustments may, for example, include automatic selection, modification, or control of any of the following: wash water temperature, agitation or tumble cycle time, number of rinse cycles, and spin speed. The characteristics of the clothes load, which could trigger such adjustments, could, for example, consist of or be indicated by the presence of either soil, soap, suds, or any other additive laundering substitute or complementary product.

NOTE: Appendix J1 does not provide a means for determining the energy consumption of a clothes washer with an adaptive control system. Therefore, pursuant to 10 CFR 430.27, a waiver must be obtained to establish an acceptable test procedure for each such clothes washer.

1.2 *Adaptive water fill control system* means a clothes washer water fill control system which is capable of automatically adjusting the water fill level based on the size or weight of the clothes load placed in the clothes container, without allowing or requiring consumer intervention or actions.

1.3 *Bone-dry* means a condition of a load of test cloth which has been dried in a dryer at maximum temperature for a minimum of 10 minutes, removed and weighed before cool down, and then dried again for 10 minute periods until the final weight change of the load is 1 percent or less.

1.4 *Clothes container* means the compartment within the clothes washer that holds the clothes during the operation of the machine.