



Performance Characteristics and Energy Consumption Measurement of Household Electric Coffee Makers

AHAM CM-1–2012



Preface

The Association of Home Appliance Manufacturers develops standards in accordance with AHAM's "Policy and Procedures Governing Technical Standards" which states:

"AHAM Standards shall be in the best interest, mutually, of consumers who use appliances, the industries which provide and service appliances, and other interested parties. They shall relate to actual use conditions and be technically and scientifically sound.

Use or observance of AHAM standards is voluntary.

This standard contains test procedures which may be applied to any brand or model of household electric coffee maker for measuring performance. Results of tests in accordance with this standard may be publicly stated.

Recommended levels of performance which are considered important to include but which are recommendations only.

With regard to safety, AHAM recommends that all appliance products – both major and portable -- manufactured or marketed in the United States be submitted to an appropriate independent laboratory for inspection and listing in conformance with the safety standards and procedures followed by such laboratories. The relevant standard for household electric coffee makers is ANSI/UL 1082, "Standard for Safety for Household Electric Coffee Makers and Brewing-Type Appliances."

AHAM welcomes comments and suggestions regarding this standard. Any standard may be reviewed and improved as needed. All standards must be updated or reconfirmed at least every five years. Any interested party, at any time, may request a change in an AHAM standard. Such requests should be addressed to AHAM's President, and should be accompanied by a statement of reason for the request and a suggested alternate proposal.

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CONTENTS

Section	Page
1. PURPOSE	1
2. SCOPE.....	1
3. DEFINITIONS	1
3.1. Household Automatic Percolator.....	1
3.2. Household Automatic Coffee Urn	1
3.3. Household Automatic Drip Coffee Maker.....	1
3.4. Single Serve Coffee Maker	2
3.5. Super Automatic, Single Serve Coffee Maker	2
3.6. Household Espresso Maker.....	3
3.7. Cup Volume.....	3
3.8. Energy usage	3
3.9. Off Mode.....	3
3.10. Standby Mode	4
3.11. Active Mode	4
4. STANDARD TEST CONDITIONS AND INSTRUMENTATION	4
4.1. Standard Voltage and Frequency.....	4
4.2. Test Area.	4
4.3. Instrumentation.	4
4.4. Time Keeping Instrument.....	4
4.5. Wattmeter.	4
4.6. Voltage Regulator System.....	4
4.7. Power Analyzer.	5
4.8. Thermocouples.	5
4.9. Sampling Rates.....	5
5. SAMPLING	5
5.1. Sample Selection Criteria	5
5.2. Sample Energy Requirement.	5
6. STANDARD METHOD FOR MEASURING PERFORMANCE	5
6.1. Performance Test Parameters.	5
6.2. Measuring Levels of Performance	6
7. ENERGY MEASUREMENTS.....	10
7.1. Method.	10
7.2. Coffee Preparation.....	10
7.3. Record Energy Management.	10
7.4. Record Total Watts.	10
7.5. Standby Energy.	10
8. REPORT	11
8.1. Information Collection.	11
9. SAFETY.....	11
ANNEX A DATA SHEETS	16
ANNEX B COFFEE BREWING CONTROL CHART	23



1. PURPOSE

This standard establishes a uniform, repeatable procedure or standard method for measuring specified product characteristics and energy use of household electric coffee makers.

The standard methods provide a means to compare and evaluate different brands and models of household electric coffee makers regarding characteristics significant to product performance and energy use.

The standard methods (including the recommended levels of performance, where they appear) are not intended to inhibit improvement and innovation in product testing, design or performance.

2. SCOPE

This standard applies to household electric coffee makers as defined in Section 3.

This standard does not apply to commercial coffee makers used in commercial kitchens, office buildings, etc.

This standard may be used to make measurements of the energy usage of the coffee maker portion of a multiple function product. This procedure may be used to measure the energy utilized by coffee makers that also have coffee bean grinders, toasters, egg cookers/warmers, or other functions for measurement of the coffee maker energy only.

This standard establishes uniform methods for measuring performance. This standard only includes recommended test criteria where necessary to enable tests to be carried out. In addition, recommended performance levels only appear where sufficient technical information is available to include such levels.

3. DEFINITIONS

3.1. Household Automatic Percolator

- 3.1.1. An electric appliance designed to heat water and brew by recirculation.
- 3.1.2. The appliance is designed to automatically terminate the brewing cycle when brewing is complete.
- 3.1.3. The appliance may incorporate means to maintain the beverage at serving temperature on completion of the brewing cycle.

3.2. Household Automatic Coffee Urn

- 3.2.1. This appliance incorporates all of the features in 3.1 with the following additions.
- 3.2.2. This appliance is stationary when the beverage is dispensed.

3.3. Household Automatic Drip Coffee Maker

- 3.3.1. An electric appliance designed to heat water and brew coffee by a single pass through grounds
- 3.3.2. The appliance is designed to automatically terminate the brewing cycle.
- 3.3.3. The appliance is designed to prepare multiple servings of coffee (normally into a dispensing vessel until it is poured into a mug or cup) or a single (typically [add metric

equivalent] 8 to 16 oz.) serving of coffee (normally directly into a thermal mug or cup).

- 3.3.4. The appliances designed for multiple servings may incorporate one of the following means to maintain the beverage at serving temperature on completion of the brewing cycle:
 - 3.3.4.1. Heating Plate – The appliance uses a heating plate (also called hotplate) to keep the beverage at the serving temperature.
 - 3.3.4.2. Thermal Carafe – The appliance uses the insulating properties of a thermal carafe to keep the beverage at the serving temperature. This appliance does not have a heating plate/hotplate.
- 3.3.5. The appliance remains stationary throughout its use and the finished coffee beverage is dispensed into a separable container or cavity.
- 3.3.6. A coffeemaker employing a bean grinder feature such as a “Grind and Brew” coffeemaker shall be tested using such grinder active as intended during the Active Mode of operation.

Features employed in a coffeemaker that do not have any effect on the brewing process shall not be part of the test evaluation in Active Mode (Ex: A night light or lighted switch).

3.4. Single Serve Coffee Maker

- 3.4.1. An electric appliance whereby pressurized, heated water is forced through a pre-packaged hard or soft container containing coffee grounds integrated with a filtration element.
- 3.4.2. The appliance is designed to prepare a single serving of coffee directly into a thermal mug or cup.
- 3.4.3. The appliance may allow user selection of the volume of water that is forced through the coffee grounds for small or large cups.
- 3.4.4. The appliance is designed to automatically terminate the brewing cycle.
- 3.4.5. This appliance does not have a heating plate/hotplate to maintain temperature after the coffee is dispensed.
- 3.4.6. The appliance may incorporate means to preheat the water, or to maintain preheated water prior to preparation of the finished beverage.
- 3.4.7. This appliance is stationary when the beverage is dispensed.

3.5. Super Automatic, Single Serve Coffee Maker

- 3.5.1. A programmed, automated electric appliance whereby pressurized, heated water is forced through a measured portion of coffee grounds deposited into a filtration element.
- 3.5.2. The appliance is designed to prepare a single serving of coffee directly into a thermal mug or cup.
- 3.5.3. The appliance is designed to grind whole coffee beans on-demand and to deposit into the internal filtration element just prior to brewing.



- 3.5.4. The appliance may have an alternate brew cycle that allows pre-ground coffee to be manually measured and deposited into the filtration element instead of automated grinding of coffee beans.
- 3.5.5. The appliance may allow user selection of the volume of water that is forced through the coffee grounds for small or large cups.
- 3.5.6. The appliance is designed to automatically terminate the grinding cycle prior to brewing.
- 3.5.7. The appliance is designed to automatically terminate the brewing cycle.
- 3.5.8. The appliance is designed to automatically move the used coffee grounds to an integral refuse container.
- 3.5.9. This appliance does not have a heating plate/hotplate to maintain temperature after the coffee is dispensed.
- 3.5.10. The appliance may have a heated surface for holding (empty) cups for pre-warming.
- 3.5.11. The appliance may incorporate means to preheat the water, or to maintain preheated water prior to preparation of the finished beverage.
- 3.5.12. The appliance may incorporate means to further heat the water to generate steam on demand to be directed through an orifice located at the end of an accessory tube (steam wand) used for heating and frothing milk.
- 3.5.13. This appliance is stationary when the beverage is dispensed.

3.6. Household Espresso Maker

- 3.6.1. An electric appliance whereby pressurized, heated water is forced through coffee grounds.
- 3.6.2. The espresso maker may incorporate means to maintain the beverage at serving temperature on completion of the brewing cycle.
- 3.6.3. The espresso maker may incorporate means to preheat the water, or to maintain preheated water under pressure prior to preparation of the finished beverage.

3.7. Cup Volume

- 3.7.1. Brew maximum volume according to manufacturers' instructions.
- 3.7.2. The manufacturer's cup volume is determined by dividing the final beverage quantity by the number of cups indicated and recorded in milliliters (or fluid ounces).

3.8. Energy usage

- 3.8.1. Energy usage—the amount of electrical energy consumed by a coffee maker during the brewing, holding, and stand by energy, measured in Joules (watt-hours).

3.9. Off Mode

Off Mode describes the status of an appliance when it is connected to the main electricity supply and is providing no consumer-interactive function. Off Mode may persist for an indefinite period of time. Providing the product with an on/off switch satisfies this condition.

Off Mode may include:

1. LED or some other indication of off mode condition;
2. Electric noise reduction capacitor, choke or filter;
3. The state where a one-way remote control device has turned the product off, but cannot be used to activate the product.
4. May include electrical energy flow to a transformer of some electronics units.

3.10. Standby Mode

Standby Mode is the lowest-power consumption mode when the appliance is connected to the main electricity supply and is used in accordance with the manufacturer's instructions. Standby Mode power usage is the power (wattage) consumed by an appliance at the factory setting.

Standby Mode may persist for an indefinite period of time. Standby Mode may allow activation of other modes by local or remote switch.

All products will default to this mode as delivered from the factory.

Products may have provision for the consumer to add or delete product functions that alter the as-shipped standby energy mode. The power consumption in these user-selected modes may exceed the power consumption in the lowest-power consumption mode. The consumer must be informed how to make these selections and that their selection(s) will override the lowest power consumption mode.

Standby Mode applies only to products that are not continuous run products. A continuous run product is performing in active mode 100% of time that it is plugged into the main electricity supply.

The appliance shall be tested at factory or "default" settings. Where there are no indications for such settings, the appliance shall be tested as shipped (See Section 5.2 IEC 62301 Ed. 1).

3.11. Active Mode

When a product is not in Off Mode or Standby Mode, it is in Active Mode.

4. STANDARD TEST CONDITIONS AND INSTRUMENTATION

- 4.1. Standard Voltage and Frequency.** For purposes of this standard, all tests will be conducted at 120 Volts, 60 Hertz (Hz). The test voltage will be measured at the appliance plug when the appliance is energized and will be maintained throughout testing.
- 4.2. Test Area.** Test in an area free of direct drafts and maintained at a temperature of $73 \pm 9^{\circ}\text{F}$ ($23 \pm 5^{\circ}\text{C}$).
- 4.3. Instrumentation.** Electrical measurements must be accurate to within $\pm 1\%$.
- 4.4. Time Keeping Instrument.** Automatic power measuring and recording device.
- 4.5. Wattmeter.** Equipment used to measure the input watts to the coffee maker, to provide measurements with an accuracy within $\pm 1\%$.
- 4.6. Voltage Regulator System.** To control the input voltage to the coffee maker. The regulator shall have capability of maintaining the coffee maker's rated voltage $\pm 1\%$ and rated frequency having a wave form that is essentially sinusoidal with 3% maximum harmonic distortion for the duration of the test.

- 4.7. **Power Analyzer.** An automatic power measuring and recording device that will give combined measurements.
- 4.8. **Thermocouples.** J type with AWG 24-30 wire size.
- 4.9. **Sampling Rates.** Sample at 1 per second.

5. SAMPLING

- 5.1. **Sample Selection Criteria.** A minimum of three units of the same model coffee maker selected at random in accordance with good statistical practice shall constitute the population sample.
- 5.2. **Sample Energy Requirement.** To determine the best estimate of energy usage associated with the population of the coffee maker models being tested, the arithmetic mean of the energy consumed by the sample from the population shall be established by testing it to a 90% confidence level within +/- 5% of the mean value of the energy usage rating.

6. STANDARD METHOD FOR MEASURING PERFORMANCE

- 6.1. **Performance Test Parameters.** The following items detail the testing parameters or ambient conditions.
 - 6.1.1. Coffee for Percolator or Automatic Drip. Conduct tests using type and amount of coffee defined in the manufacturer's instructions to achieve maximum capacity. If the manufacturer's instructions do not specify the type of coffee to be used, Folgers Classic Roast (Medium) Regular Grind should be used. If a range is specified, the maximum amount of coffee is to be used.
 - 6.1.2. Coffee for Espresso. Conduct tests using type and amount of coffee defined in the manufacturer's instructions. If the manufacturer's instructions do not specify the type of coffee to be used, Café Bustelo Espresso Grind should be used.
 - 6.1.3. Water Temperature. Fill the coffee maker with water to maximum recommended capacity at $73 \pm 9^{\circ}\text{F}$ ($23 \pm 5^{\circ}\text{C}$). Use the manufacturer's recommended vessel for filling.
 - 6.1.4. Cup Size. For purposes of conducting performance tests, 150 ml (5 fluid ounces) will be the standard cup size for percolators, urns, and automatic drip coffee makers, unless indicated by the manufacturer. A 60 ml (2 fluid ounces) cup will be the standard cup size for espresso makers.
 - 6.1.5. Beverage Setting. Set the brew strength selector, if incorporated, at the normal or medium brew strength setting. If the brew strength is not indicated in "weak," "normal," "regular," or "strong" use the factory default setting.
 - 6.1.6. Brew Cycle Automatic Drip Coffee Makers, Espresso Makers, Super Automatics and Single Serves. Energize the coffee maker and permit to operate until the brewing cycle is completed. The termination of the brewing cycle is defined by the initial cycling of thermostat after dispensing the measured volume of water in the reservoir for automatic style coffeemaker. The open state of the thermostat is defined as the power consumed in the standby mode for ADC and steam style espresso makers. Specific appliances like super automatics, displacement style drip brewers and certain single serve brewers have a standby mode whereby power is cycled (a cycle being from thermostat closed to thermostat open) thru an internal heater that supplies hot water

on demand as long as the unit remains powered on.

NOTE: For Espresso Makers which include a preheat function, the brew time will include the preheat time. For espresso makers with a capacity greater than 4 cups, the brew time will be the preheat time plus the time to deliver 4 cups. The brew time will not include the frothing time.

- 6.1.7. Keep Warm Cycle. The cycle immediately following the brew cycle whereby the thermostat is cycling power to the heating plate at periodic rate for the purpose of maintaining the serving temperature of the coffee in the glass carafe. For the purposes of this test procedure, the keep warm cycle shall be terminated automatically or manually after elapsed time of 2 hours.
- 6.1.8. Brew Cycle Time—Percolators and Urns. Record the time from when the unit is actuated until the completion of the brewing cycle as defined by the manufacturer's instructions.
- 6.1.9. Coffee Maker Temperature. The temperature of the unpackaged coffee maker (including all components) should be maintained at an ambient temperature for at least 2 hours (per Section 4.2) prior to testing.
- 6.1.10. Coffee Filters--Automatic Drip Coffee Makers. Unless otherwise specified in the standard, the testing is to be conducted using paper coffee filters as specified by the manufacturer in the operating instructions. If the instructions do not specify a type or grade of filter, Mellita white filters are to be used, applicable to the size and shape of the coffee brew basket.

6.2. Measuring Levels of Performance

- 6.2.1. Beverage Temperature on Completion of Brewing - Multiple Serving Coffee Makers (Percolators, Urns and Automatic Drip Coffee Makers) Begin the brew cycle following the manufacturer's recommendations, including pre-rinsing of the thermal carafe with hot water if specified. The beverage temperature in the multiple serving dispensing vessel of the coffee maker (carafe, etc.) is to be measured using an appropriate temperature probe at the geometric center of the dispensing vessel/carafe. Leave the dispensing vessel on the heating plate (if present). Measurements should be taken at the following times and recorded:
 - a) Immediately after the completion of the brewing cycle
 - b) Two minutes after completion of the brewing cycle.
 - c) One hour after the completion of the brewing cycle
 - d) At the completion of the warming element automatic cycle termination or no more than 2 hours. Notate whether the unit has an automatic warming cycle termination or the cycle was manually discontinued after 2 hours.

It is generally accepted that brewed coffee temperature in the multiple serving dispensing vessel should be between the range of 77°C and 93°C (170°F and 200°F). The upper finished brew temperature assures that coffee does not reach a boiling point which can affect the taste and aroma. The lower temperature limit assures generally acceptable drinking temperature when pouring into a cold cup, adding cream, sugar and a spoon.

If the product allows different dispensing vessel temperatures, the test should be conducted at the setting used by the product in "as shipped" or default condition.