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An American National Standard

Standard Test Method for Performance of a Pasta Cooker[1]

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1. Scope

1.1 This test method covers the energy consumption and cooking performance of floor-model and countertop pasta cookers. The food service operator can use this evaluation to select a pasta cooker and understand its energy consumption and production capacity.

1.2 This test method is applicable to floor and countertop model gas and electric units with 1000 to 4000-in.[3] cooking capacity. Cooking capacity is a measurement of available cooking volume. The depth of the cooking capacity is measured from the heating elements or heat transfer surface, or both, to the water fill line. The width is measured from the inside edge of the cooking vat across to the other inside edge of the cooking vat. The length is measured from the front inside edge of the cooking vat to the rear inside edge of the cooking vat.

1.3 The pasta cooker can be evaluated with respect to the following (where applicable):

1.3.1 Energy input rate (11.2),

1.3.2 Water-boil efficiency (11.3),

1.3.3 Preheat energy consumption, time, and rate (11.4),

1.3.4 Idle/simmer (11.5),

1.3.5 Pilot energy rate (11.6), and

1.3.6 Pasta cooking preparation (11.7).

1.4 This test method is not intended to answer all performance criteria in the evaluation and selection of a pasta cooker.

1.5 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for information only.

1.6 *This test method does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASHRAE Documents:*

1989 ASHRAE *Handbook of Fundamentals*, Chapter 6, Table 2—Thermodynamic, Chapter 6, Table 2—Thermodynamic Properties of Water at Saturation[2]

ASHRAE Guideline 2—1986 (RA90), Engineering Analysis of Experimental Data, American Society of Heating, Refrigeration, and Air Conditioning Engineers, Inc.[2]

2.2 *AOAC Documents:*

AOAC 984.25 Moisture (Loss of Mass on Drying) in Frozen French Fried Potatoes[3]

AOAC 983.23 Fat in Foods: Chloroform-Methanol Extraction Method[3]

2.3 *ANSI Standard:*

ANSI Z83.13 Gas Food Service Equipment

3. Terminology

3.1 *Definitions:*

3.1.1 *auto-fill*, *n*—a water height sensor devise that activates a fresh water fill solenoid if the water level in the cooking vessel drops below predetermined height.

3.1.2 *overflow drain*, *n*—a drain for eliminating the excess foam and starch created during the cooking process.

3.1.3 *pasta cooker*, *n*—an appliance, including a cooking vessel, in which water is placed to such a depth that the cooking food is essentially supported by displacement of the water rather than by the bottom of the vessel. Heat is delivered to the water by means of an immersed electric element or band wrapped vessel (electric pasta cooker), or by heat transfer from gas burners through either the walls of the pasta cooker or through tubes passing through the water (gas pasta cooker).

3.1.4 *test method*, *n*—a definitive procedure for the identification, measurement, and evaluation of one or more qualities, characteristics, or properties of a material, product, system, or service that produces a test result.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *cold water bath*, *n*—a container filled with 60 to 80°F (15.6 to 26.7°C) water, that is used to cool the cooked pasta to stop the cooking process. The water bath needs enough water capacity to be able to completely cover the cooked pasta when a pasta basket is submerged into the cold water bath.

[1] This test method is under the jurisdiction of ASTM Committee F26 on Food Service Equipment and is the direct responsibility of Subcommittee F26.06 on Productivity and Energy Protocol.

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[2] Available from American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc. (ASHRAE), 1791 Tullie Circle, NE, Atlanta, GA 30329.

[3] Official Methods of Analysis of the Association of Official Analytical Chemists. Available from the Association of Official Analytical Chemists, 1111 N. 19th St., Arlington, VA 22209.

3.2.2 *energy input rate*, *n*—peak rate at which a pasta cooker consumes energy (Btu/h or kW).

3.2.3 *pilot energy rate*, *n*—average rate of energy consumption (Btu/h (kJ/h)) by a pasta cooker's continuous pilot, if applicable.

3.2.4 *production capacity*, *n*—maximum rate (lb/h (kJ/h)) at which a pasta cooker can bring the specified food product to a specified "cooked" condition.

3.2.5 *production rate*, *n*—average rate (lb/h (kJ/h)) at which a pasta cooker brings the specified food product to a specified "cooked" condition. This does not necessarily refer to maximum rate.

3.2.6 *test*, *n*—a set of three loads of pasta cooked in a prescribed manner and sequential order.

3.2.7 *uncertainty*, *n*—measure of systematic and precision errors in specified instrumentation or measure of repeatability of a reported test result.

3.2.8 *water-boil efficiency*, *n*—quantity of energy (latent heat of vaporization) required to boil water from the pasta cooker, expressed as a percentage of the quantity of energy input to the pasta cooker during the boil-off period.

3.2.9 *working capacity*—the calculated capacity of the manufacturer's cooking baskets as determined by a specified method of calculation.

4. Summary of Test Method

4.1 All of the pasta cooking tests shall be conducted with the pasta cooker installed under a wall-mounted canopy exhaust ventilation hood that shall operate at an airflow based on 300 cfm/linear ft (460 L/s/linear m) of hood length. Additionally, an energy supply meeting the manufacturer's specification shall be provided for the gas or electric pasta cooker under test.

4.2 The pasta cooker under test is connected to the appropriate metered energy source. The measured energy input rate is determined and checked against the rated input before continuing with testing.

4.3 The pasta cooker is place on a platform scale and operated with a known weight of water contained in the pasta cooker and the thermostat(s) set to the maximum setting. After a specified weight of water was boiled off, the water-boil efficiency is calculated.

4.4 The water temperature in the cooking zone of the pasta cooker is monitored at a location chosen to represent the average temperature of the water while the pasta cooker maintains a specified cooking temperature. The pasta cooker's thermostat is calibrated to achieve the calculated simmer/idle temperature at a location chosen to represent the average temperature of the water while the pasta cooker is maintaining the idle condition.

4.5 Preheat energy, time, and rate are determined while the pasta cooker is operated with the thermostat(s) are set to specified temperature. The idle/simmer/energy are determined while the pasta cooker operated with the thermostat(s) are set to specified idle temperature. The rate of pilot energy consumption also is determined when applicable to the pasta cooker under test.

4.6 Energy consumption and time are monitored while the pasta cooker is used to cook three loads of dry, 0.072 ± 0.004 in. in diameter spaghetti pasta to a condition of 125 ± 3 % weight gain with the thermostat(s) set at a calibrated cooking temperature. Production capacity is based on the largest pasta load.

5. Significance and Use

5.1 The energy input rate test is used to confirm that the pasta cooker under test is operating in accordance with its nameplate rating.

5.2 Water-boil efficiency is a quick indicator of pasta cooker energy efficiency performance under boiling conditions. This information enables the food service operator to consider energy efficiency performance when selecting a pasta cooker.

5.3 The pasta cooker temperature calibration is used to ensure that the pasta cooker being tested is operating at the specified temperature. Temperature calibration also can be used to evaluate and calibrate the thermostat control dial(s).

5.4 Preheat energy and time can be useful to food service operators to manage energy demands and to estimate the amount of time required for preheating a pasta cooker.

5.5 Idle/simmer energy rate and pilot energy rate can be used to estimate energy consumption during non-cooking periods.

5.6 Production capacity is used by food service operators to choose a pasta cooker that matches their particular food output requirements.

6. Apparatus

6.1 *Analytical Balance Scale*, for measuring weights up to 10 lb, with a resolution of 0.01 lb (0.004 kg) and an uncertainty of 0.01 lb.

6.2 *Barometer*, for measuring absolute atmospheric pressure, to be used for adjustment of measured gas volume to standard conditions. Shall have a resolution of 0.2 in. Hg (670 Pa) and an uncertainty of 0.2 in. Hg.

6.3 *Canopy Exhaust Hook*, 4 ft (1.2 m) in depth, wall-mounted with the lower edge of the hood 6 ft, 6 in. (1.98 m) from the floor and with the capacity to operate at a nominal net exhaust ventilation rate of 300 cfm/linear ft (460 L/s/linear m) of active hood length. This hood shall extend a minimum of 6 in. (152 mm) past both sides and the front of the cooking appliance and shall not incorporate side curtains or partitions. Makeup air shall be delivered through face registers or from the space, or both.

6.4 *Convection Drying Oven*, with temperature controlled at 220 ± 5°F (100 ± 3°C), used to determine moisture content of both the dry and cooked pasta.

6.5 *Data Acquisition System*, for measuring energy and temperatures, capable of multiple temperature displays updating at least every 2 s.

6.6 *Flowmeter*, for measuring total water consumption of the appliance. Shall have a resolution of 0.01 gal and an uncertainty of 0.01 gal at a flow rate as low as 0.2 gpm.

6.7 *Gas Meter*, for measuring the gas consumption of a pasta cooker, shall be a positive displacement type with a resolution of at least 0.01 ft^3(0.0003 m^3) and a maximum uncertainty no greater than 1 % of the measured value for any demand greater than 2.2 ft^3(0.06 m^3)/h. If the meter is used for measuring the gas consumed by the pilot lights, it shall have a

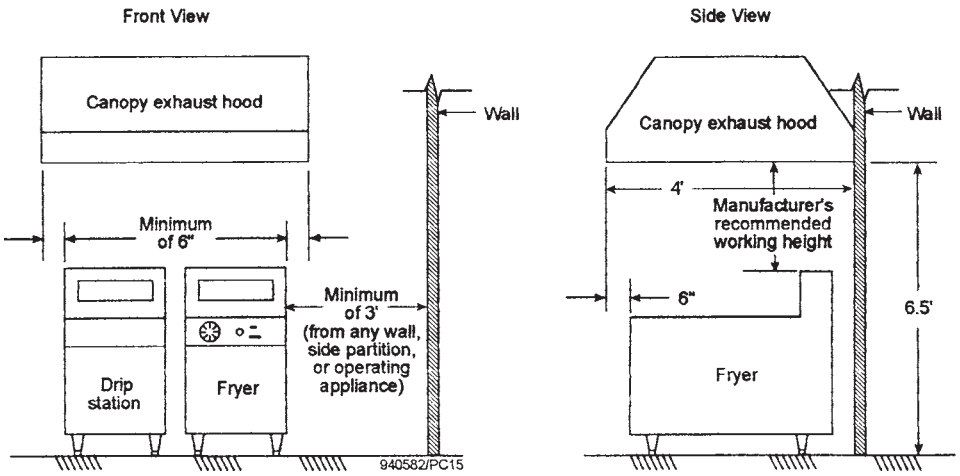

FIG. 1 Equipment Configuration

resolution of at least 0.01 ft^3 and a maximum uncertainty no greater than 2 % of the measured value.

6.8 *Platform Balance Scale*, or appropriate load cells, used to measure the loss of water from the pasta cooker during water boil test. The scale shall have a capacity to accommodate the total weight of the pasta cooker plus 200 lb (90.7 kg) of water, and shall have a precision of 0.2 lb (10 g) and an uncertainty of 0.2 lb when used to measure the loss of water from the pasta cooker.

6.9 *Pressure Gage*, for monitoring gas pressure. Shall have a range from 0 to 15 in. H_2O (0 to 3.7 kPa), a resolution of 0.5 in. H_2O (125 kPa), and a maximum uncertainty of 1 % of the measured value.

6.10 *Stopwatch*, with a 1-s resolution.

6.11 *Thermocouple Probe(s)*, industry standard Type *T* or Type *K* thermocouples capable of immersion, with a range from 50 to 400°F and an uncertainty of ±1°F (±0.56°C).

6.12 *Temperature Sensor*, for measuring natural gas temperature in the range from 50 to 100°F with an uncertainty of ±1°F (±0.56°C).

6.13 *Pasta Cooker Baskets*, supplied by the manufacturer of the pasta cooker under testing. A total of three baskets is required to test each pasta cooker in accordance with these procedures.

6.14 *Watt-Hour Meter*, for measuring the electrical energy consumption of a pasta cooker, shall have a resolution of at least 10 Wh and a maximum uncertainty no greater than 1.5 % of the measured value for any demand greater than 100 W. For any demand less than 100 W, the meter shall have a resolution of at least 10 Wh and a maximum uncertainty no greater than 10 %.

7. Reagents and Materials [4]

7.1 *Water*, having a maximum hardness of three grains per gallon. Distilled water may be used.

7.2 *Deionized or Distilled Water*, Shall be used for the water-boil efficiency test, with a conductivity of no greater than 100 mΩ.

7.3 *Pasta Noodles*, will be a dry-type spaghetti shape. The spaghetti shall be manufactured from 100 % durum semolina wheat. The spaghetti diameter shall be 0.072 ± 0.004 in., with a specified initial moisture content (10 ± 2 %).

NOTE 1—Borden® Prince line is 100 % durum semolina wheat spaghetti-shape pasta and has been shown to be an acceptable product for testing by PG & E's Food Service Technology Center.

8. Sampling

8.1 *Pasta Cooker*—Select a representative production model for performance testing.

9. Preparation of Apparatus

9.1 Measure the pasta cookers vat's cooking capacity. The pasta cooker's cooking vat may be shaped in such a way that simple measurements do not yield the true cooking capacity. In this case fill the pasta cooker with water till the bottom edge of the cooking capacity is reached. Then measure the volume of water required to fill the cooking capacity to the top.

9.2 Install the appliance according to the manufacturer's instructions under a 4-ft (1.2-m) deep canopy exhaust hood mounted against the wall, with the lower edge of the hood 6 ft, 6 in. (1.98 m) from the floor. Position the pasta cooker with the front edge of the water in the cooking vat inset 6 in. (152 mm) from the front edge of the hood at the manufacturer's recommended working height. The length of the exhaust hood and active filter area shall extend a minimum of 6 in. (152 mm) past the vertical plane of both sides of the pasta cooker. In addition, both sides of the pasta cooker shall be a minimum of 3 ft (0.9 m) from any side wall, side partition, or other operating appliance. A drip and cold bath station position next to the pasta cooker is recommended. Equipment configuration is shown in Fig. 1. The exhaust ventilation rate shall be 300 cfm/linear ft (460 L/s/linear m) of hood length. The associated heating or cooling system shall be capable of maintaining an ambient temperature of 75 ± 5°F (24 ± 3°C) within the testing environment when the exhaust ventilation system is operating.

9.3 Connect the pasta cooker to a calibrated energy test meter. For gas installations, install a pressure regulator downstream from the meter to maintain a constant pressure of gas for all tests. Install instrumentation to record both the pressure

[4] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036.

and temperature of the gas supplied to the pasta cooker and the barometric pressure during each test so that the measured gas flow can be corrected to standard conditions. For electric installations, a voltage regulator may be required during tests if the voltage supply is not within ±2.5 % of the manufacturer's nameplate voltage.

9.4 For an electric pasta cooker, while the pasta cooker elements are energized, confirm that the supply voltage is within ±2.5 % of the operating voltage specified by the manufacturer. Record the test voltage for each test.

NOTE 2—If an electric pasta cooker is rated for dual voltage, for example, 208/240 V, the pasta cooker shall be evaluated as two separate appliances in accordance with this test method. It is the intent of the testing procedure herein to evaluate the performance of a pasta cooker at its rated gas pressure or electric voltage. If an electric pasta cooker is rated dual voltage, that is, designed to operate at either 208 or 240 V with no change in components, the voltage selected by the manufacturer or tester, or both, shall be reported. If a pasta cooker is designed to operate at two voltages without changing the resistance of the heating elements, the performance of the pasta cooker, for example, preheat time, may differ at the two voltages.

9.5 For a gas pasta cooker, during maximum energy input, adjust the gas supply pressure downstream from the appliance's pressure regulator to within ±2.5 % of the operating manifold pressure specified by the manufacturer. Make adjustments to the pasta cooker following the manufacturer's recommendations for optimizing combustion. Proper combustion may be verified by measuring air-free CO in accordance with ANSI Z83.13.

9.6 Make the pasta cooker ready for use in accordance with the manufacturer's instructions. Clean the pasta cooker by boiling with the manufacturer's recommended cleaner and water and then rinsing the inside of the cooking-vat thoroughly before starting each test procedure.

9.7 To prepare apparatus for conducting the water-boil efficiency test, place the pasta cooker on a platform balance scale, or load cells, located under the exhaust ventilation hood described in 9.1. The scale, or load cells, shall not reduce the distance between the cooking surface and the lower edge of the exhaust hood by more than 8 in. (200 mm) for the water-boil test than for the cooking test.

9.8 To prepare the pasta cooker for temperature calibration, attach an immersion-type thermocouple in the cooking vat before beginning any test. The thermocouple used to calibrate the pasta cooker shall be located in the back of the cooking vat, about ½ in. (13 mm) from the back edge of the cooking vat, ½ in. (13 mm) above the heat transfer area or elements, or both, and located in the center in relation to the sides of the cooking vat.

9.9 Fresh water supply to pasta cooker should be monitored to ensure that the water temperature is 65 ± 5°F (18 ± 3°C).

9.10 Install the flowmeter to the pasta cooker water inlet such that the total water flow to the appliance is measured.

9.11 For all tests, record the altitude of the testing facility.

10. Calibration

10.1 Fresh water temperature supplied to the pasta cooker shall be 65 ± 5°F (18 ± 3°C).

NOTE 3—If the fresh water temperature is not within the specified temperature, mix the supply water with hot or cold sources to meet the desired temperature. The supply water can be tempered to obtain the proper supply water temperature.

NOTE 4—The manufacturer may have a calibration procedure that may give some insight into their thermostatic control strategy. The manufacturer's calibration procedure may be used initially to help in the calibration of the cooking temperature. After applying the manufacturer's calibration procedure confirm calibration with 10.2.

10.2 Ensure the pasta cooker water is loaded to the indicated fill line. Preheat and allow the pasta cooker to stabilize for 30 min before beginning temperature calibration.

10.3 The pasta cooker water temperature shall be measured by attaching a calibrated immersion thermocouple type in the rear of the cooking zone as detailed in 9.8. Adjust the pasta cooker temperature control(s) to achieve a rolling boil. Record the water temperature over a 1-h period to verify temperature of the water at the rolling boil condition. The water temperature recorded over the 1-h period shall be considered as the average temperature for the pasta cooker.

10.4 Report on pasta cooker temperature calibration in accordance with Section 12.

10.5 To determine the idle/simmer temperature, subtract seven degrees Fahrenheit from the calibrated pasta cooking temperature (rolling boil temperature determined in 10.3).

NOTE 5—Boiling temperature is a function of altitude and can be less than 212°F. The intent of this test procedure is to idle/simmer at the same differential temperature for all altitudes.

10.6 Adjust the pasta cooker temperature control(s) to achieve the calculated idle/simmer temperature in 10.5. The water temperature recorded over three completed thermostat cycles at this point shall be considered as the average temperature for the pasta cooker. If the average temperature is not ±2°F (±1°C) of the calculated idle/simmer temperature in 10.5, repeat adjustment of the pasta cooker temperature control(s) until the pasta cooker vat temperature is within 2°F.

10.7 Record the temperature achieved in 10.6 as the idle/simmer temperature.

11. Procedure

11.1 *General*:

11.1.1 For gas appliances, record the following for each test run:

11.1.1.1 Higher heating value;

11.1.1.2 Standard gas pressure and temperature used to correct measured gas volume to standard conditions;

11.1.1.3 Measured gas temperature;

11.1.1.4 Measured gas pressure;

11.1.1.5 Barometric pressure; and,

11.1.1.6 Energy input rate during or immediately prior to test.

NOTE 6—The preferred method for determining the heating value of the gas supplied to the pasta cooker under test is by using a calorimeter or gas chromatograph in accordance with accepted laboratory procedures. The use of bottled natural gas with a certified heating value within the specified 1025 ± 25-Btu/ft^3(38160 ± 930-kJ/m^3) range is an acceptable alternative.

11.1.2 For a gas pasta cooker, add electric energy consumption to gas energy for all tests, with the exception of the energy input rate test (see 11.2).