Designation: F1965 – 17 (Reapproved 2022)

An American National Standard

Standard Test Method for Performance of Deck Ovens[1]

This standard is issued under the fixed designation F1965; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method evaluates the energy consumption and cooking performance of deck ovens. The food service operator can use this evaluation to select a deck oven and understand its energy consumption.

1.2 This test method is applicable to gas and electric deck ovens.

1.3 The deck oven can be evaluated with respect to the following (where applicable):

1.3.1 Energy input rate and thermostat calibration (10.2),

1.3.2 Preheat energy consumption and time (10.3),

1.3.3 Idle energy rate (10.4),

1.3.4 Pilot energy rate (if applicable) (10.5), or

1.3.5 Cooking energy efficiency and production capacity (10.6).

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

1.5 *This standard 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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.6 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

A36/A36M Specification for Carbon Structural Steel

2.2 *ASHRAE Documents:*[3]

ASHRAE Handbook of Fundamentals, "Thermal and Related Properties of Food and Food Materials," Chapter 30, Table 1, 1989

ASHRAE Guideline 2-1986 (RA90) Engineering Analysis of Experimental Data

2.3 *Other Document:*[4]

AOAC Procedure 984.25 Moisture (Loss of Mass on Drying) in Frozen French Fried Potatoes

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *cooking energy efficiency, n*—quantity of energy imparted to the specified food product, expressed as a percentage of energy consumed by the deck oven during the cooking event.

3.1.2 *cooking energy rate, n*—average rate of energy consumption (Btu/h or kW) during the cooking energy efficiency tests. Refers to all loading scenarios (heavy, medium, light).

3.1.3 *deck oven, n*—an appliance that cooks the food product within a heated chamber. The food product can be placed directly on the floor of the chamber during cooking and energy may be delivered to the food product by convective, conductive, or radiant heat transfer. The chamber may be heated by gas or electric forced convection, radiants, or quartz tubes. Top and bottom heat may be independently controlled.

3.1.4 *energy input rate, n*—peak rate at which a deck oven consumes energy (Btu/h or kW).

3.1.5 *idle energy rate, n*—the deck oven's rate of energy consumption (Btu/h or kW), when empty, required to maintain its cavity temperature at the specified thermostat set point.

3.1.6 *oven cavity, n*—that portion of the deck oven in which food products are heated or cooked.

3.1.7 *pilot energy rate, n*—rate of energy consumption (Btu/h or kW) by a deck oven's continuous pilot (if applicable).

[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.

Current edition approved July 1, 2022. Published August 2022. Originally approved in 1999. Last previous edition approved in 2017 as F1965 – 17. DOI: 10.1520/F1965-17R22.

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

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

[4] Available from AOAC International, 481 North Frederick Avenue, Suite 500, Gaithersburg, Maryland 20877-2417.

3.1.8 *preheat energy, n*—amount of energy consumed (Btu or kWh), by the deck oven while preheating its cavity from ambient temperature to the specified thermostat set point.

3.1.9 *preheat time, n*—time (minutes) required for the deck oven cavity to preheat from ambient temperature to the specified thermostat set point.

3.1.10 *production capacity, n*—maximum rate (lb/h) at which a deck oven can bring the specified food product to a specified cooked condition.

3.1.11 *production rate, n*—rate (lb/h) at which a deck oven brings the specified food product to a specified cooked condition; does not necessarily refer to maximum rate. Production rate varies with the amount of food being cooked.

3.1.12 *thermal disk, n*—a metal 5-in. diameter, ¼-in. thick disk with thermal couple attached for measuring temperature.

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

4. Summary of Test Method

4.1 Accuracy of the deck oven thermostat is checked at a setting of 475 ± 5°F (246 ± 2.75°C) determined by the average of 5 disks, and the thermostat is adjusted as necessary.

4.2 Energy input rate is determined to confirm that the deck oven is operating within 5 % of the nameplate energy input rate. For gas deck oven, the pilot energy rate and the fan and control energy rate are also determined.

4.3 Preheat energy and time are determined using average temperature of 5-disks.

4.4 Idle energy rate is determined at a thermostat setting using average temperature of 5-disks to achieve 475 ± 5°F (246 ± 2.75°C).

4.5 Cooking energy efficiency and production rate are determined during cooking tests using pizza as a food product.

5. Significance and Use

5.1 The energy input rate test and thermostat calibration are used to confirm that the deck oven is operating properly prior to further testing and to insure that all test results are determined at the same temperature.

5.2 Preheat energy and time can be useful to food service operators to manage power demands and to know how quickly the deck oven can be ready for operation.

5.3 Idle energy rate and pilot energy rate can be used to estimate energy consumption during noncooking periods.

5.4 Cooking energy efficiency is a precise indicator of deck oven energy performance while cooking a typical food product under various loading conditions. If energy performance information is desired using a food product other than the specified test food, the test method could be adapted and applied. Energy performance information allows an end user to better understand the operating characteristics of a deck oven.

5.5 Production capacity information can help an end user to better understand the production capabilities of a deck oven as it is used to cook a typical food product and this could help in specifying the proper size and quantity of equipment. If production information is desired using a food product other than the specified test food, the test method could be adapted and applied.

6. Apparatus

6.1 *Analytical Balance Scale,* for measuring weights up to 20 lb, with a resolution of 0.01 lb and an uncertainty of 0.01 lb.

6.2 *Barometer,* for measuring absolute atmospheric pressure, to be used for adjustment of measured natural gas volume to standard conditions, having a resolution of 0.2 in. Hg and an uncertainty of 0.2 in. Hg.

6.3 *Canopy Exhaust Hood,* 4 ft in depth, wall-mounted with the lower edge of the hood 6 ft, 6 in. from the floor and with the capacity to operate at a nominal exhaust ventilation rate of 300 cfm per linear foot of active hood length. This hood shall extend a minimum of 6 in. past both sides and the front of the cooking appliance and shall not incorporate side curtains or partitions.

6.4 *Convection Drying Oven,* with temperature controlled at 220 ± 5°F (104.4 ± 2.75°C), to be used to determine moisture content of pizza crust, pizza sauce, and pizza cheese.

6.5 *Gas Meter,* for measuring the gas consumption of a deck oven, shall be a positive displacement type with a resolution of at least 0.01 ft^3 and a maximum uncertainty no greater than 1 % of the measured value for any demand greater than 2.2 ft^3/h. If the meter is used for measuring the gas consumed by the pilot lights, it shall have a resolution of at least 0.01 ft^3 and a maximum uncertainty no greater than 2 % of the measured value.

6.6 *Pressure Gage,* for monitoring natural gas pressure, having a range from 0 to 10 in. H_2O, a resolution of 0.5 in. H_2O, and a maximum uncertainty of 1 % of the measured value.

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

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

6.9 *Thermocouple,* fiberglass insulated, 24 gage, Type K thermocouple wire, connected at the exposed ends by soldering the two wires together, or fiberglass insulated, 24-gage, Type K thermocouple wire, peened flat at the exposed ends and spot welded to steel disk surfaces with a strain gage welder.

6.10 *Thermocouple Probe,* Type K micro needle product probe with a response time from ambient to 200°F (93.3°C) of less than 20 s.

6.11 *Watt-Hour Meter,* for measuring the electrical energy consumption of a deck oven, having 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 %.

6.12 *Identification Markers,* required for keeping pizzas organized during handling process.

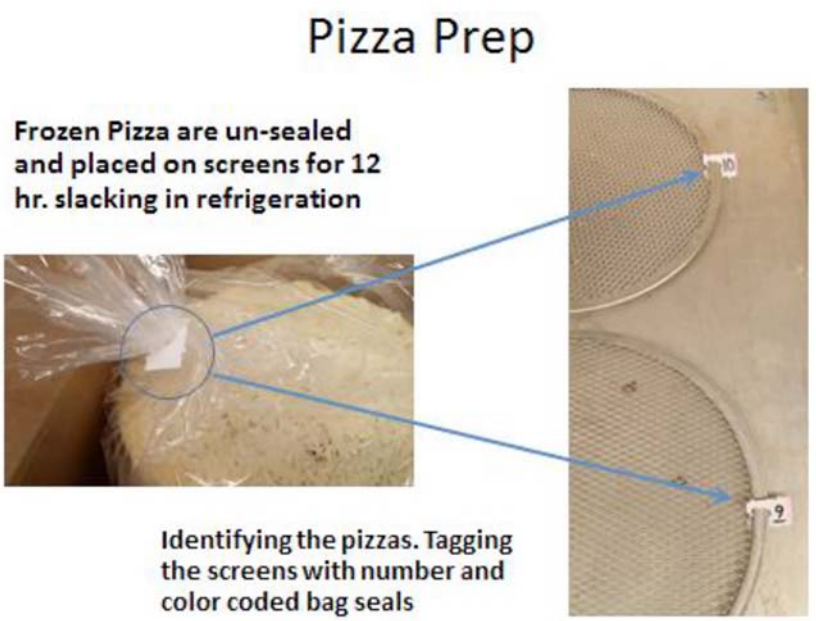


FIG. 1 Identifying Pizzas

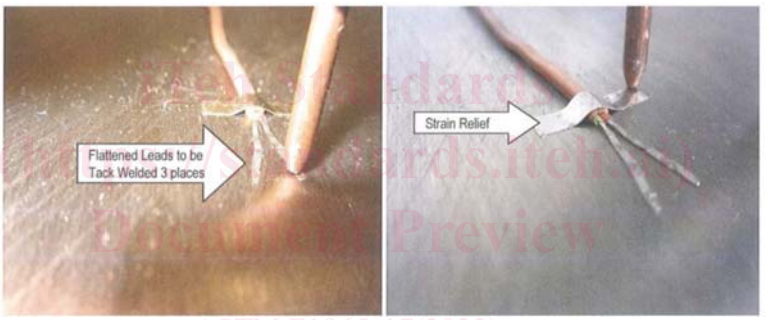
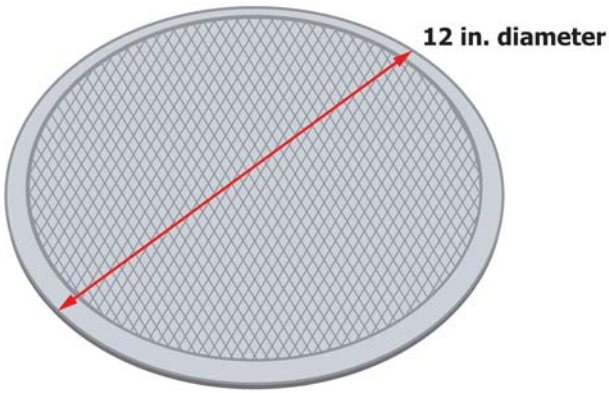


FIG. 2 Thermocouple Welding

NOTE 1—The plastic bag seals numbered and color coded have shown to be a good method. See Fig. 1.

6.13 *Thermal Steel Disk*—Using a strain gauge welder, attach one high temperature thermocouple to the center of one side of a steel disk. The disk is to be 5 in. (127 mm) in diameter, ¼ in. (6.3 mm) thick, composed of structural-grade carbon steel in accordance with Specification A36/A36M, free of rust or corrosion. The disks shall be flat to within 0.010 in. (0.25 mm) over the diameter. Add strain relief to each disk to facilitate handling of the disks. See Fig. 2 and Fig. 3.

FIG. 3 Disk Thermocouple



Screen Spec

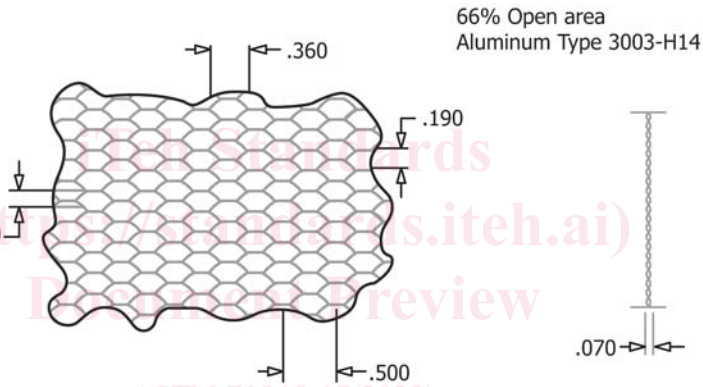


FIG. 4 Pizza Screen

6.14 *Strain Gauge Welder,* capable of welding thermocouples to steel.[5]

NOTE 2—The 28-gauge (0.3 mm) stainless steel shim wrapped over the thermocouple wire and tack-welded to the disk make effective strain reliefs for this application.

7. Reagents and Materials

7.1 *Pizza Crust*—Shall be a nominal 11.75 ± 0.25 in. diameter, prebaked or parbaked (self-rising) crust, enriched flour (wheat flour, malted barley flour, niacin, reduced iron, thiamine mononitrated riboflavin, folic acid). Refrigerate to 38 ± 2°F (3.3 ± 1.1°C).

7.2 *Pizza Sauce*—Shall be a simple, tomato based sauce with tomatoes, water, tomato paste. A moisture content of 90 ± 2 % by weight, based on a gravimetric moisture analysis. Refrigerate to 38 ± 2°F (3.3 ± 1.1°C).

7.3 *Pizza Cheese*—Shall be a part skim, low moisture, shredded mozzarella cheese, parmesan cheese (pasteurized cultured part-skim milk, salt, enzymes), provolone cheese (pasteurized milk, cheese cultures, salt, enzymes), white cheddar cheese (pasteurized milk, cheese cultures, salt, enzymes). Refrigerate to 38 ± 2°F (3.3 ± 1.1°C).

7.4 *Pizza*—Shall be comprised of a pizza crust, pizza sauce, and pizza cheese. Each uncooked pizza should have a weight of 1.7 ± 0.1 lb. Moisture content of the uncooked pizza shall be 48 ± 3 % by weight, based on a gravimetric analysis.[6]

7.5 *Pizza Screen*—Shall be a 12 in. diameter, aluminum pizza screen used for pizza handling during prep. Refrigerate to 38 ± 2°F (3.3 ± 1.1°C). (See Fig. 4).

[5] The sole source of supply of the strain gauge welder (Eaton Model W1200) known to the committee at this time is Eaton Corp., 1728 Maplelawn Road, Troy, MI 48084. If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,[1] which you may attend.

[6] The Food Service Technology Center has found that Villa Prima – Frozen (25.85 oz), 4 Cheese Pizza – complies with the pizza specification requirements for this test method. The sole source of supply of the pizza known to the committee at this time is Schwan's Food Company Inc., Marshall, MN, 56258 (Item # 73184). If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,[1] which you may attend.

7.6 Gravimetric moisture analysis shall be performed as follows: to determine moisture content, place a thawed, refrigerated 38 ± 2°F (3.3 ± 1.1°C) pizza sample of the test food on a dry, aluminum sheet pan and place the pan in a convection drying oven at a temperature of 220 ± 5°F (104 ± –15°C) for a period of 24 h. Weigh the sample before it is placed in the oven and after it is removed and determine the percent moisture content based on the percent weight loss of the sample. The sample must be thoroughly chopped (⅛ in. or smaller squares) and spread evenly over the surface of the sheet pan in order for all of the moisture to evaporate during drying and it is permissible to spread the sample on top of baking paper in order to protect the sheet pan and simplify cleanup.

NOTE 3—The moisture content of pizza crust, pizza sauce, and pizza cheese can be determined by a qualified chemistry lab using the AOAC Procedure 984.25.

8. Sampling

8.1 *Deck Oven*—Select a representative production model for performance testing.

9. Preparation of Apparatus

9.1 Install the appliance in accordance with the manufacturer's instructions under a canopy exhaust hood. Position the deck oven so that a minimum of 6 in. is maintained between the edge of the hood and the vertical plane of the front and sides of the appliance. In addition, both sides of the deck oven shall be a minimum of 3 ft from any side wall, side partition, or other operating appliance. The exhaust ventilation rate shall be 300 cfm per linear foot of hood length. The associated heating or cooling system shall be capable of maintaining an ambient temperature of 75 ± 5°F (23.8 ± 2.75°C) within the testing environment when the exhaust ventilation system is operating.

NOTE 4—The ambient temperature requirements are designed to simulate real world kitchen temperatures and are meant to provide a reasonable guideline for the temperature requirements during testing. If a facility is not able to maintain the required temperatures, then it is reasonable to expect that the application of the procedure may deviate from the specified requirements (if it cannot be avoided) as long as those deviations are noted on the Results Reporting Sheets.

9.2 Connect the deck oven 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 and temperature of the gas supplied to the deck oven 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.

9.3 For an electric deck oven, confirm (while the deck oven elements are energized) that the supply voltage is within ±2.5 % of the operating voltage specified by the manufacturer. Record the test voltage for each test.

NOTE 5—If an electric deck oven is rated for dual voltage (208/240 V), the deck oven shall be evaluated as two separate appliances in accordance with this test method.

9.4 For a gas deck oven, adjust (during maximum energy input) 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 appliance following the manufacturer's recommendations for optimizing combustion.

10. Procedure

10.1 *General:*

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

10.1.1.1 Higher heating value,

10.1.1.2 Standard gas pressure and temperature used to correct measured gas volume to standard conditions,

10.1.1.3 Measured gas temperature,

10.1.1.4 Measured gas pressure,

10.1.1.5 Barometric pressure, and

10.1.1.6 Energy input rate during or immediately prior to test (for example, during the preheat for that days testing).

10.1.1.7 If oven is equipped with an oven cavity vent, close the vent for all tests. Exception if manufacture requests test to be conducted with vent open. (Record as a deviation in test report).

NOTE 6—Using a calorimeter or gas chromatograph in accordance with accepted laboratory procedures is the preferred method for determining the higher heating value of gas supplied to the deck oven under test. It is recommended that all testing be performed with gas having a higher heating value of 1000 to 1075 Btu/ft^3.

10.1.2 For gas deck ovens, add electric energy consumption to gas energy for all tests, with the exception of the energy input rate test (10.3).

10.1.3 For electric deck ovens, record the following for each test run:

10.1.3.1 Voltage while elements are energized and

10.1.3.2 Energy input rate during or immediately prior to test (for example, during the preheat for that days testing).

10.1.4 For each test run, confirm that the peak input rate is within ±5 % of the rated nameplate input. If the difference is greater than 5 %, terminate testing and contact the manufacturer. The manufacturer may make appropriate changes or adjustments to the deck oven.

10.2 *Energy Input Rate and Thermostat Calibration:*

10.2.1 Install a thermocouple in the center of the oven cavity (side to side, front to back, and top to bottom).

10.2.1.1 Install a thermocouple at the appliance temperature sensor (typically side wall within oven cavity).

10.2.1.2 Electric oven with lower deck control, install a thermocouple on temperature sensor.

10.2.1.3 Place five thermal disks on the cooking deck, one disk center deck (side to side, front to back), two disks placed centered left third of deck and from back wall to front door equally spaced. Two disks placed centered side to side on right third of deck and from back wall to front door equally spaced. Refer to Fig. 5.

10.2.2 Set the temperature control to 475 ± 5°F (246 ± 2.75°C) and turn the deck oven on. Record the time and energy consumption from the time when the unit is turned on until the time when any of the burners or elements first cycle off.

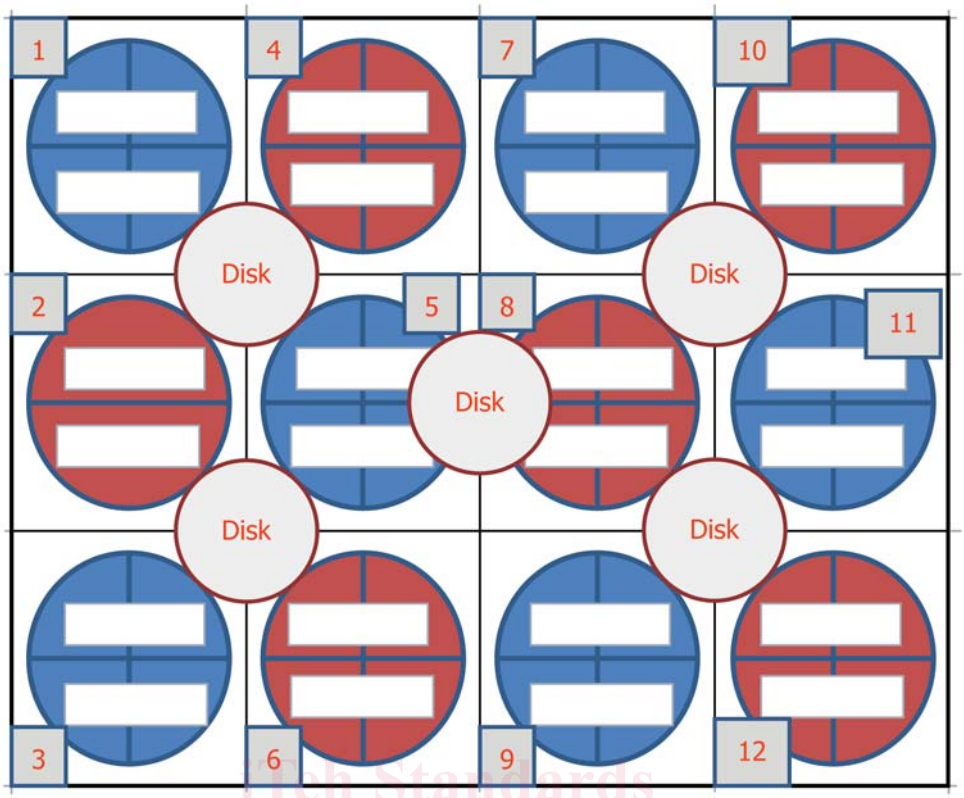


FIG. 5 Disk Locations on 12-Pizza Deck

10.2.3 Calculate and record the deck oven's energy input rate and compare the result to the rated nameplate input. For gas deck ovens, only the burner energy consumption is used to compare the calculated energy input rate with the rated gas input; any electrical energy use shall be calculated and recorded separately as the fan/control energy rate.

10.2.4 Allow the deck oven to idle for 60 min after the burners or elements commence cycling at the thermostat set point.

10.2.5 After the 60–min idle period, start monitoring the deck oven average disk temperatures of the five thermal disks over a 30-min period. If this recorded temperature is 475 ± 5°F (246 ± 2.75°C), then the deck oven's thermostat is calibrated.

10.2.6 If the average disk temperatures are not 475 ± 5°F (246 ± 2.75°C), adjust the deck oven's temperature control following the manufacturer's instructions and repeat 10.2.5 until it is within this range. Record the corrections made to the controls during calibration. This thermostat dial position or display setting will be used as the calibrated set-point for remainder of test.

10.2.7 In accordance with 11.4, calculate and report the deck oven energy input rate, fan/control energy rate where applicable, and rated nameplate input.

10.3 *Preheat Energy Consumption and Time:*

10.3.1 Verify that the deck oven cavity temperature is 75 ± 5°F (23.8 ± 2.75°C). Set the calibrated temperature control to achieve 5-disk average of 475 ± 5°F (246 ± 2.75°C) and turn the deck oven on.

10.3.2 Record the time, temperature, and energy consumption required to preheat the deck oven, from the time when the unit is turned on until the time when the deck oven 5-disk average reaches 475 ± 5°F (246 ± 2.75°C) temperature. Recording should occur at intervals of 5 s or less to accurately document the temperature rise of the oven cavity.

NOTE 7—Research at PG&E's Food Service Technology Center indicates that a deck oven is sufficiently preheated and ready to cook when the oven deck temperature has reached 475°F measured by 5-disk average and stable for 1 h.

10.3.3 In accordance with 11.5, calculate and report the preheat energy consumption and time and generate a preheat temperature vs. time graph.

10.4 *Idle Energy Rate:*

10.4.1 Set the calibrated temperature control to 475 ± 5°F (246 ± 2.75°C) (5-disk average) and preheat the deck oven.

10.4.2 Allow the deck oven to idle for 60 min after the burners or elements commence cycling.

10.4.3 At the end of 60 min, begin recording the deck oven's idle energy consumption, at 475 ± 5°F (246 ± 2.75°C), for a minimum of 2 h. Record the length of the idle period.

10.4.3.1 Record the oven center and sensor temperature during 2 h idle.

10.4.4 In accordance with 11.6, calculate and report the deck oven's idle energy rate.

10.5 *Pilot Energy Rate:*

10.5.1 For a gas deck oven with a standing pilot, set the gas valve at the pilot position and set the deck oven's temperature control to the off position.

10.5.2 Light and adjust the pilot according to the manufacturer's instructions.

10.5.3 Monitor gas consumption for a minimum of 8 h of pilot operation.

10.5.4 In accordance with 11.7, calculate and report the pilot energy rate.

10.6 *Pizza Preparation:*

10.6.1 Determine how many pizzas the deck oven can cook at one time, based on how many whole, 12-in. diameter pizzas can fit completely within the oven cavity, with the oven door closed, in accordance with the manufacturer's recommended oven operation. This number of pizzas divided by half, rounded up to the nearest whole pizza is designated as a heavy load. Prepare enough pizzas (7.4) for a minimum of four runs of heavy loading scenario.

10.6.1.1 Remove frozen pre-assembled pizza from sealed wrap (save bag seal for identification marker) and place pizza on a pizza screen.

10.6.1.2 Identify each pizza with a marker (the Food Service Technology Center has found that bag seal works well as marker) as shown in (Fig. 1).

10.6.1.3 Weigh each uncooked pizza on pizza screen, record the weight and identification marker.

10.6.1.4 Place two pizza screens with pizza centered on screen, on a full sized sheet pan (18 by 26 in.). Cover the pizzas with plastic wrap to inhibit moisture loss, place in a refrigerator, and thaw the pizzas until they stabilize at 38 ± 2°F (3.3 ± 1.1°C). Do not test with pizzas that have been in the refrigerator more than 24 h.

NOTE 8—The test pizzas should not be stored in the refrigerator for long periods, more than 24 h, because the pizza crust may absorb excessive moisture from the sauce and evaporation may reduce the moisture content of the sauce, changing the thermal characteristics of the pizza. The 24-h period is a practical time specification that allows the preparation of test pizzas on day one, overnight chilling and stabilization and application of the procedure the following day.

NOTE 9—When stacking multiple pans in the refrigerator, spacers are necessary between the pans in order to protect the pizzas from damage. Researchers at PG&E's Food Service Technology Center have found that sauce cups can be used as spacers.

NOTE 10—A minimum of four test runs is specified, however, more test runs may be necessary if the results do not meet the uncertainty criteria specified in Annex A1.

10.6.1.5 Prepare a minimum of four additional pizzas for use in cook time determination. The actual number of pizzas needed for the cook time determination will vary with the number of trials needed to establish a cooking time that demonstrates a 195 ± 3°F (90.5 ± 1.7°C) final pizza temperature after cooking.

10.7 *Cook Time Determination:*

10.7.1 Remove all disks from cooking chamber.

10.7.2 Set the calibrated temperature control to 475 ± 5°F (246 ± 2.75°C), preheat the deck oven and allow it to idle for 60 min. Estimate a cook time for pizza. The cook time includes the time that the pizza is in direct contact with the oven deck, regardless of whether the oven door is open or closed. The cook time does not include the time that the pizza is being placed-into or removed-from the oven.

10.7.3 Remove a pizza from the refrigerator 38 ± 2°F (3.3 ± 1.1°C) and place the pizza directly on the oven deck (do not use a pizza screen or pan) in the center of the oven. Do not allow more than 1 min to elapse from the time a pizza is removed from the refrigerator until it is placed on the oven deck.

10.7.4 Allow the pizza to cook for the duration of the estimated cook time and then remove the pizza from the deck oven and place the pizza on an insulated, nonmetallic surface such as corrugated cardboard. A standard cardboard pizza box is acceptable.

10.7.5 Determine the final temperature of the pizza by placing six thermocouple probes on the surface of the pizza. Locate the probes 3 in. from the center of the pizza and spaced equidistant from each other as shown in Fig. 6. The probes should penetrate the cheese and rest on the sauce-crust interface directly beneath the cheese. Allow no more than 10 s from the time the pizza is removed from the oven deck to the time the probes are placed on the pizza. Allow time for the thermocouple probes to stabilize after the probes are placed on the pizza and record the highest average temperature of all six probes (see Fig. 7). If the final pizza temperature is not 195 ± 3°F (90.5 ± 1.7°C), adjust the cook time and repeat the cook time determination test as necessary to produce a 195 ± 3°F (90.5 ± 1.7°C) final temperature.

NOTE 11—FSTC testing has shown this single center pizza cook test will typically require at least 10 s longer cook time during a full load cook.

NOTE 12—It is recommended that the six thermocouple probes be attached to a simple, lightweight, rigid structure that will maintain the proper spacing and upright position of the probes and will therefore help maintain the consistency of the temperature readings. Fig. 8 shows a thermocouple structure that is made of poly(methyl methacrylate) (PMMA) and includes a simple handle for easy placement of the structure on the pizza. This structure can be gently set on top of the pizza during cook time determination with just enough force to penetrate the cheese but not enough to push the probes beyond the sauce-crust interface. Because the sauce migrates into the crust during cooking, it is relatively easy to remain in the sauce-crust interface during temperature measurement.

10.7.6 Record the determined cook time for use during the cooking energy efficiency and production capacity tests.

10.8 *Cooking Energy Efficiency and Production Capacity:*

10.8.1 Set the calibrated temperature control to 475 ± 5°F (246 ± 2.75°C) 5-disk average, preheat the deck oven and allow it to idle for 60 min.

10.8.2 The cooking energy efficiency and production capacity tests are to be run a minimum of four times. Additional test runs may be necessary to obtain the required precision for the reported test results (see Annex A1).

10.8.3 Monitor the oven's thermostat cycle and wait for the oven to cycle "on" remove from refrigerator one pan (two pizzas) and ready to load, removing off of pizza screen on to pizza spatula. As soon as the burners or elements cycle "off," open the deck oven door. Place the pizza(s) directly on the oven deck (do not use a pizza screen or pan). Start monitoring time and energy immediately upon placing the first pizza on the oven deck. Do not allow more than 1 min to elapse from the time a pizza is removed from the refrigerator until it is placed