



Standard Test Method for Performance of Refrigerated Buffet and Preparation Tables¹

This standard is issued under the fixed designation F2143; 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 covers evaluation of the energy consumption of refrigerated buffet and preparation tables. The food service operator can use this evaluation to select a refrigerated buffet and preparation table and understand its energy performance.

1.2 This test method is applicable to electric self-contained refrigerators used for holding and displaying refrigerated food in an open area.

1.3 The refrigerated buffet and preparation table can be evaluated with respect to the following (where applicable):

- 1.3.1 Maximum power, or maximum current draw (10.1),
- 1.3.2 Thermostat calibration (10.4), and
- 1.3.3 Energy consumption (10.5).

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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

- 2.1 *NSF Standard*:²
[ANSI/NSF 7 Commercial Refrigerators and Freezers](#)
- 2.2 *ASHRAE Guideline*:³
[ASHRAE Guideline 2-1986 \(RA90\) Engineering Analysis of Experimental Data](#)

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 May 1, 2016. Published August 2016. Originally approved in 2001. Last previous edition approved in 2010 as F2143 – 04 (2010). DOI: 10.1520/F2143-16.

² Available from NSF International, P.O. Box 130140, 789 N. Dixboro Rd., Ann Arbor, MI 48113-0140, <http://www.nsf.org>.

³ Available from American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc. (ASHRAE), 1791 Tullie Circle, NE, Atlanta, GA 30329, <http://www.ashrae.org>.

2.3 *ANSI/ASHRAE Standards*:⁴

[ANSI/ASHRAE 72-2014 Method of Testing Open Refrigerators for Food Stores](#)

2.4 *Food and Drug Administration, U.S. Public Health Service Regulation*:⁵
[Food Code, 1999](#)

3. Terminology

3.1 *Definitions*:

3.1.1 *production capacity, n*—maximum volumetric storage capacity (ft^3 (m^3)) at which the refrigerated buffet and preparation table's open display area can hold using a specified container filled to $\frac{1}{2}$ in. of the container rim.

3.1.2 *refrigerated buffet and preparation table, n*—buffet/preparation table herein, equipment designed with a refrigerated open top or open condiment rail.

3.1.3 *refrigerated buffet table or unit, n*—equipment designed with mechanical refrigeration that is intended to receive refrigerated food and maintain food product temperatures and is intended for customer service such as a salad bar. A unit may or may not be equipped with a lower refrigerated compartment.⁶

3.1.4 *refrigerated food preparation unit, n*—equipment designed with a refrigerated open top or open condiment rail such as refrigerated sandwich units, pizza preparation tables, and similar equipment. The unit may or may not be equipped with a lower refrigerated compartment.⁶

3.1.5 *self-contained refrigerator, n*—a refrigerator whose condensing unit is attached as an integral component of the unit.⁶

3.1.6 *storage refrigerator or freezer, n*—a refrigerator or freezer designed for cold storage of nonfrozen or frozen foods.

3.1.7 *storage capacity, n*—maximum volumetric storage capacity (ft^3 (m^3)) as determined by the manufacturer at which the refrigerated buffet or preparation table's storage component can hold food.

⁴ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

⁵ Available from National Technical Information Service (NTIS), 5285 Port Royal Rd., Springfield, VA 22161, <http://www.ntis.gov>.

⁶ Available from National Technical Information Service (NTIS), 5301 Shawnee Rd., Alexandria, VA 22312, <http://www.ntis.gov>.

3.1.8 *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 test results.

3.1.9 *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 Power is determined to confirm that the buffet/preparation table is operating within 5 % of the manufacturer’s rated power.

4.2 Buffet/preparation table energy consumption is determined with the upper lid in the raised position while the unit is used to maintain the temperature of water being held in the refrigerated rail and with the upper lid in the lowered position without any pans in the refrigerated rail.

4.3 Production capacity is determined by measuring the amount of water that the refrigerated rail can hold, using a specified container filled to ½ in. of the container rim.

5. Significance and Use

5.1 The power test is used to confirm that the buffet/preparation table is operating properly prior to further testing.

5.2 Buffet/preparation table energy consumption is a precise indicator of buffet/preparation table energy performance under the test loading condition and under a simulated overnight operating condition. This information enables the food service operator to consider energy performance when selecting a buffet/preparation table.

5.3 Production capacity is used by food service operators to choose a buffet/preparation table that matches their food output requirements.

6. Apparatus

6.1 *Analytical Balance Scale*, for measuring weights up to 25 lb, with a resolution of 0.01 lb and an uncertainty of 0.01 lb.

6.2 *Pans*, for holding water. Standard 4-in. (102-mm) deep ¼-size steam table pans are used in this test method. Pans shall have nominal dimensions of 6 × 6¹⁵/₁₆ × 4 in. (162 × 176 × 102 mm). Metal pans shall be used. The weight of the pan shall be

0.70 ± 0.07 lb. The buffet/preparation table manufacturer may provide alternative pans if the unit is designed specifically to only be used with the alternative pans. If alternative pans are used, they shall have nominal dimensions as close to that of the standard pans as is available. All pans must be equipped with thermocouples for temperature measurement. An example of a typical setup is shown in Fig. 1. The thermocouple lead shall be long enough to allow connection to the monitoring device while the pans are in the storage refrigerator.

6.3 *Electronic Humidity Sensor*, for measuring the relative humidity within the test environment with a range of 25 to 45 % and an uncertainty of ±2 %.

6.4 *Thermocouple Probe*, capable of immersion with a range of 30° to 50°F and an uncertainty of ±1°F. Preferably industry standard type T or type K thermocouples.

6.5 *Power Meter*, for measuring the electrical energy consumption of a buffet/preparation table, shall have a resolution of at least 1 W 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 1 W and a maximum uncertainty no greater than 10 %.

6.6 *Air Velocity Meter*, for measuring air velocity around the buffet/preparation table with an uncertainty of ±10 % at 100 ft/min (0.51 m/s) and capable of measuring air velocities at 50 ft/min (0.25 m/s).

7. Reagents and Materials

7.1 *Water*—Distilled water shall be used.

8. Sampling, Test Units

8.1 *Buffet/Preparation Table*—Select a representative production model for performance testing.

9. Preparation of Apparatus

9.1 Install the buffet/preparation table according to the manufacturer’s instructions. Position the buffet/preparation table so that there is 6 in. clearance maintained between a back wall and the back vertical plane of the buffet/preparation table. In addition, both sides of the buffet/preparation table shall be a minimum of 12 in. from any side wall, or side partition (see

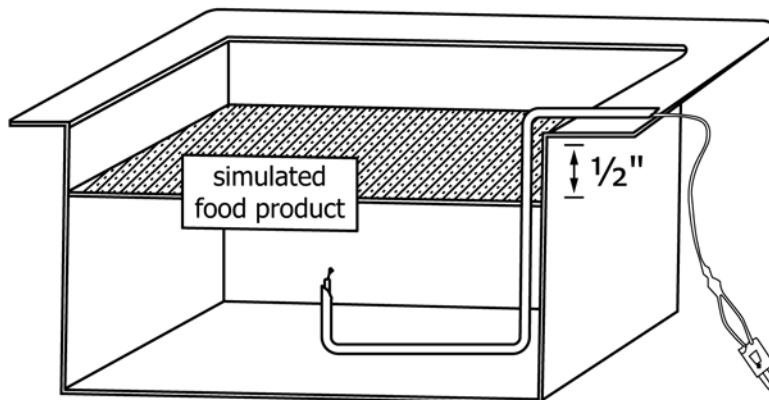


FIG. 1 Pan With Thermocouple Probe

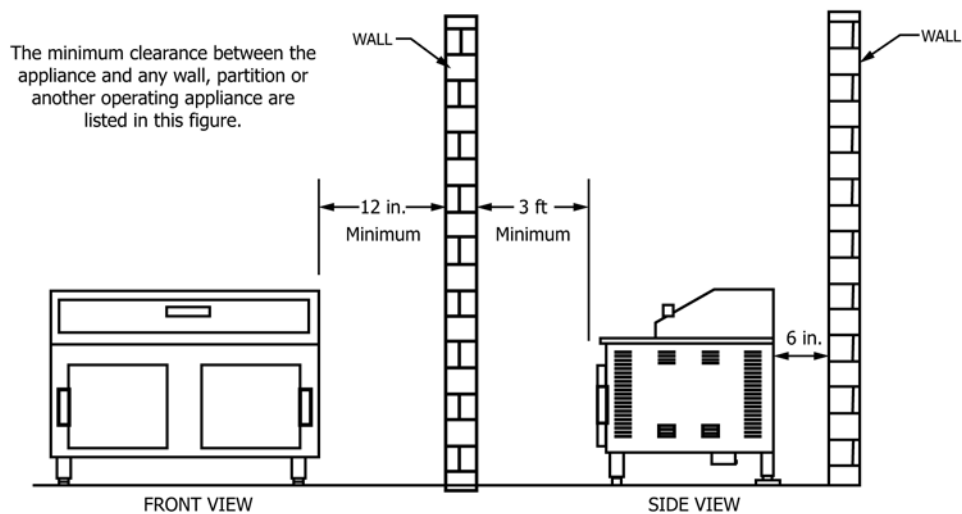


FIG. 2 Example of Appliance Placement

Fig. 2). Walls can be portable or suspended from ceiling. There shall be a minimum of 3 ft of clearance between the front vertical plane of the buffet/preparation table and any wall or partition. Report appliance placement relative to test room walls in results reporting section.

9.2 The testing environment during energy tests shall be maintained as follows: ambient temperature of $86 \pm 2^\circ\text{F}$ ($30 \pm 1^\circ\text{C}$), no vertical temperature gradient exceeding $1.5^\circ\text{F}/\text{ft}$ ($2.5^\circ\text{C}/\text{m}$), relative humidity of $35 \pm 5\%$ and maximum air current velocity of $50\text{ ft}/\text{min}$ ($0.25\text{ m}/\text{s}$) across the surfaces of the test pans while the buffet/preparation table is not operating.

9.3 Ambient temperatures shall be measured at two locations along a vertical line at the center line of the buffet/preparation table. The first shall be $5.9 \pm 2\text{ in.}$ ($150 \pm 50\text{ mm}$) above the highest point on the buffet/preparation table. The second shall be at the geometric center of the buffet/preparation table. Both points shall be located $36 \pm 2\text{ in.}$ ($914 \pm 50\text{ mm}$) out from the front face of the buffet/preparation table. It shall be verified that no location around the perimeter of the buffet/preparation table at the same heights as the two points has an average temperature lower than that specified for the test conditions.

9.4 Connect the buffet/preparation table to a calibrated energy test meter. A voltage regulator may be required during tests if the voltage supply is not within $\pm 2.5\%$ of the manufacturer's rated voltage.

9.5 Confirm (while the buffet/preparation table compressor(s) are energized) that the supply voltage is within $\pm 2.5\%$ of the operating voltage specified by the manufacturer during the entire test period. Record the test voltage throughout each test.

NOTE 1—It is the intent of the testing procedure herein to evaluate the performance of a buffet/preparation table at its rated voltage. If a unit is rated for dual voltage (that is, designed to operate at either 208 or 240 V with no change in components), the voltage selected by the manufacturer and/or tester shall be reported. If a buffet/preparation table is designed to operate at two voltages without a change in components, the performance of the unit (for example, holding energy rate) may differ at the two voltages.

9.6 If the buffet/preparation table is equipped with a refrigerated compartment, the compartment air temperature shall be monitored to evaluate the buffet/preparation table's ability to maintain the air temperature between 33°F (1°C) and 41°F (5°C). The compartment shall be empty, and three thermocouples shall be used to monitor air temperatures. If the buffet/preparation table is not equipped with a refrigerated compartment then skip steps 9.6.1 – 9.6.3.

9.6.1 For buffet/preparation tables with refrigerated compartments position thermocouple no. 1 when viewed from the front of the refrigerated table $5 \pm 0.25\text{ in.}$ ($127 \pm 6\text{ mm}$) from the left interior wall. Center the thermocouple in the compartment relative to the front and the back. For refrigerated compartments with overhead cooling, position the thermocouple $2 \pm 0.25\text{ in.}$ ($51 \pm 6\text{ mm}$) above the bottom horizontal plane of the compartment. For units where the evaporator is not suspended from the ceiling, the thermocouple shall be placed $5 \pm 0.25\text{ in.}$ ($127 \pm 6\text{ mm}$) down from the ceiling.

9.6.2 Position thermocouple no. 2 centered front-to-back, top-to-bottom, and left-to-right.

9.6.3 Position thermocouple no. 3 when viewed from the front of the refrigerated table $5 \pm 0.25\text{ in.}$ ($127 \pm 6\text{ mm}$) from the right interior wall and $5 \pm 0.25\text{ in.}$ ($127 \pm 6\text{ mm}$) above the internal floor of the compartment. Center the thermocouple in the compartment relative to the front and the back.

10. Procedure

NOTE 2—Prior to starting this test, the tester should read the operating manual and fully understand the operation of the appliance.

10.1 General:

10.1.1 Record the following for each test run: (1) voltage, (2) current, (3) power, (4) relative humidity, (5) ambient temperature, (6) pan water temperatures, and (7) refrigerated compartment air temperatures. All data points shall be measured continuously in 1 min intervals or less for each test. For (1) voltage, (2) current, and (3) power the recorded values shall be the average reading over each 1 min or shorter interval.

10.1.2 For each test run, confirm that the peak amperage draw rate is below the manufacturer's rated maximum amperage. If the measured amperage is greater than the rated