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An American National Standard

Standard Test Method for Energy Performance of Single-Rack, Door-Type Commercial Dishwashing Machines[1]

This standard is issued under the fixed designation F1696; 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 the evaluation of the energy and water consumption of single-rack, door-type commercial dishwashers (hereafter referred to as dishwashers). Dishwashers may have a remote or self-contained booster heater. This test method does not address cleaning or sanitizing performance.

1.2 This test method is applicable to both hot water sanitizing and chemical sanitizing stationary rack machines, which ~~include~~includes undercounter single rack ~~machines;~~machines, upright door-type ~~machines;~~machines, pot, pan, and utensil ~~machines;~~machines, fresh water rinse ~~machines;~~machines, and fill-and-dump machines. Dishwasher tank heaters are evaluated separately from the booster heater.

1.3 The following procedures are included in this test method:

1.3.1 *Procedures to Confirm Dishwasher is Operating Properly Prior to Performance Testing:*

1.3.1.1 Maximum energy input rate of the tank heaters (see 10.2).

1.3.1.2 Maximum energy input rate of the booster heater, if applicable (see 10.3).

1.3.1.3 Water consumption calibration (see 10.4).

1.3.1.4 Booster temperature calibration, if applicable (see 10.5).

1.3.1.5 ~~Wash tank~~ Tank temperature calibration (see 10.6).

1.3.2 *Energy Usage and Cycle Rate Performance Tests:*

1.3.2.1 Washing energy test (10.7).

1.3.2.2 ~~Tank heater idle~~ Idle energy rate (door(s) open and door(s) closed) (see 10.8).

~~1.3.2.3 Booster idle energy rate, if provided (see 10.9).~~

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 *ASTM Standards:*[2]

D3588 Practice for Calculating Heat Value, Compressibility Factor, and Relative Density of Gaseous Fuels

F857 Specification for Hot Water and Chemical Sanitizing Commercial Dishwashing Machines, Stationary Rack Type

F861 Specification for Commercial Dishwashing Racks

F953 Specification for Commercial Dishwashing Machines (Stationary Rack, Dump Type) Chemical Sanitizing

2.2 *NSF Standards:*[3]

NSF/ANSI 3 Commercial Warewashing Equipment

NSF/ANSI 170 Glossary of Foodservice Terms

[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] 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 NSF International, P.O. Box 130140, 789 N. Dixboro Rd., Ann Arbor, MI 48113-0140, http://www.nsf.org.

2.3 *ASHRAE Document:*[4]
ASHRAE Guideline 2-1986 (RA90) Engineering Analysis of Experimental Data

3. Terminology

3.1 *Definitions:*

3.1.1 *booster heater, n*—water heater for taking supply hot water (typically 140°F) up to 180°F for sanitizing rinse; the booster heater may be separate from dishwasher or integral.

3.1.2 *cycle rate, n*—the number of loaded dishracks washed per hour during the washing energy performance test.

3.1.3 *dishwasher, n*—a machine that uniformly washes, rinses, and sanitizes kitchen ware.

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

3.1.3.1 *Discussion*—

The machine shall be capable of removing physical soil from properly racked and prescraped tableware, and sanitizing multiple-use tableware.

3.1.4 *idle rate, n*—rate of energy consumed by the dishwasher while "holding" or maintaining the heated tank water at the thermostat(s) set point during the time period specified.

3.1.5 ~~*dishload,*~~*loads, n*—~~a peg type, polypropylene dishrack of a specified weight, loaded with fifteen 9-in. plates of a specified weight, used to put a thermal load on the dishwasher during the washing energy test.~~

3.1.5.1 *dishload, n*—a peg type, polypropylene dishrack of a specified weight, loaded with fifteen 9-in. plates of a specified weight, used to put a thermal load on the dishwasher during the washing energy test.

3.1.5.2 *glassload, n*—6 by 6, polypropylene glass rack of a specified weight, loaded with eighteen 8-oz (237 mL) water glasses, used to put a thermal load on the dishwasher during the washing energy test.

3.1.6 ~~*dishwasher,*~~ *rated temperature, n*—~~for this test method,~~dishwasher's rated nameplate minimum ~~a machine that uniformly washes, rinses, and sanitizes eating and drinking utensils.~~operating tank temperature as determined by NSF/ANSI 3.

~~3.1.3.1 *Discussion*—~~

~~The machine shall be capable of removing physical soil from properly racked and prescraped items, and sanitizing multiple-use eating and drinking utensils.~~

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

3.1.8 *undercounter dishwasher, n*—Specification F953 Type III machines, a stationary rack machine with an overall height of 38 in. or less, designed to be installed under food preparation workspaces.

3.1.8.1 *Discussion*—

Undercounter dishwashers can be either chemical or hot water sanitizing, with an internal or external booster heater for the latter.

3.1.9 *upright door-type dishwasher, n*—Specification F857 Type I (straight through model) and Type II (corner model) and Specification F953 Type I (straight through model) and Type II (corner model) machines, stationary rack machine designed to accept a standard 20 by 20 in. dish rack which requires the raising of a door to place the rack into the wash/rinse chamber. Closing of the door typically initiates the wash cycle.

3.1.9.1 *Discussion*—

Single tank, door type models can be either chemical or hot water sanitizing, with an internal or external booster heater for the latter.

4. Summary of Test Method

4.1 The maximum energy input rate of the tank heater and the booster heater is determined to check whether the dishwasher is operating at the manufacturer's rated input. If the measured input rate is not within 5 % of the rated input, all further testing ceases and the manufacturer is contacted. The manufacturer may make appropriate changes or adjustments to the dishwasher.

NOTE 1—It is the intent of the testing procedure herein to evaluate the performance of a dishwasher at its rated gas pressure or electric voltage. If an electric unit 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 dishwasher is designed to operate at two voltages without a change in the resistance of the heating elements, the performance of the unit (for example, recovery time) may differ at the two voltages. Therefore the tests must be performed at both voltages and results reported accordingly.

4.2 The wash tank and booster temperature are retained at the manufacturer's factory settings.

4.3 The water consumption is adjusted to the manufacturer's rated water consumption per NSF/ANSI ~~Standard~~ 3. The pressure regulator valve is adjusted to 20 ± 1 psi and the water consumption measured. If this is not within ±0.15 GPM of the NSF rating or the manufacturer's rating if not listed to NSF standards, then the manufacturer shall be contacted.

4.4 The ~~tank heater~~ dishwasher energy rate is determined at idle, that is, when the tank ~~temperature~~temperature(s) is being maintained, but no washing is taking place. This test is run both with the door(s) closed and with the door(s) left open (see 10.8).

4.5 The booster heater idle energy rate is determined (see ~~10.9~~10.8).

4.6 The dishwasher and booster energy consumption per rack of dishes or glasses is determined by washing ~~10~~ racks loaded with a specified quantity of dishes or glasses (see 10.7).

4.7 Water consumption is monitored during testing to determine the rate of water usage.

5. Significance and Use

5.1 The maximum energy input rate test is used to confirm that the dishwasher is operating at the manufacturer's rated input prior to further testing. This test would also indicate any problems with the electric power supply, gas service pressure, or steam supply flow or pressure.

5.2 The tank and booster temperature are verified and water consumption is adjusted to NSF specifications to ensure that the test is applied to a properly functioning dishwasher.

5.3 Because much of a dishwasher's operating period is spent in the idle condition, tank heater and booster idle energy consumption rate is an important part of predicting an end user's energy consumption. The test is run with the door(s) open and with the door(s) closed, so that the energy use of both end-user behaviors can be characterized.

5.4 A washing energy test generates an energy per rack usage. This is useful both as a measure for comparing the energy performance of one dishwasher to another and as a predictor of an end users energy consumption.

5.5 Water-consumption characterization is useful for estimating water and sewage costs associated with dishwashing machine operation.

6. Apparatus

6.1 *One or Two Wh Meters,* for measuring the electrical energy consumption of the tank heaters, pump motor, and booster heater (if applicable), 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 %.~~10 % of the measured value.

6.2 *One or Two Gas Meters,* for measuring the gas consumption of tank heater or booster heater, or both, shall have 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/h (0.06 m^3~~/h).~~ /h), and shall be capable of measuring flows between at least 0.0 and 250 ft^3/h. If the meter is used for measuring the gas consumed by the pilot lights, it shall have a resolution of ~~a least 0.01 ft^3 (0.0003 m^3) and have a maximum error of~~ at least 0.01 ft^3 (0.0003 m^3~~) and~~), have a maximum ~~error~~uncertainty no greater than 2 % of the measured ~~value.~~value, and shall be capable of measuring flows between at least 0.0 and 10.0 ft^3/h.

6.3 *One or Two Steam Flow Meters,* for measuring the flow of steam to tank heaters and or booster heater. They shall have a resolution of at least 0.01 ft^3 ~~(0.0003~~ (0.0003 m^3~~) and~~), a maximum uncertainty ~~of 1 % of the measured value.~~no greater than 1 % of the measured value, and shall be capable of measuring flows between at least 0.0 and 50 ft^3/h.

6.4 *Pressure Gage,* for measuring the pressure of steam to steam coils. It shall have a resolution of at least 0.5 psig (3.4 ~~kPa) and~~ kPa), a maximum uncertainty of ~~1 %~~ 1 % of the measured ~~value.~~value, and shall be capable of measuring flows between at least 0 and 100 psig.

6.5 *Canopy Exhaust Hood,* mounted in agreement with ~~manufacturer's~~manufacturer's requirements and operating at the dishwasher manufacturer's recommended ventilation rate, if applicable, or a nominal 300 to 500 cfm ventilation rate ~~or in accordance with the manufacturer's recommendation, if applicable.~~ if the manufacturer foes not provide a recommended ventilation rate. Report the ventilation ~~rate.~~rate used for the tests.

6.6 *Pressure Gage,* for monitoring natural gas pressure. It shall have a range of 0 to 10 in. H_2O (0 to 2.5 kPa), a resolution of at least 0.1 in. H_2O (125 Pa), and a maximum uncertainty of 1 % of the measured value.

6.7 *Temperature Sensor,* for measuring natural gas ~~temperature~~ and ambient air temperatures in the range of ~~50°F~~50 to 100°F (10 to 40°C), with a resolution of at least 0.5°F (0.3°C) and ~~an~~ a maximum uncertainty of ±1°F ~~(0.5°C).~~(±0.5°C).

6.8 *Temperature Sensor,* for measuring steam temperatures, in the range of 200 to 300°F, with a resolution of at least 0.5°F and a maximum uncertainty of ±1°F.

6.9 *Barometer,* for measuring absolute atmospheric pressure, to be used for adjustment of measured natural gas volume to standard ~~conditions.~~ conditions, if the gas flow meter does not correct for pressure. It shall have a resolution of at least 0.2 in. Hg (670 Pa) and ~~an~~ a maximum uncertainty of 0.2 in. Hg (670 Pa).

6.10 *Flow Meter,* for measuring water consumption of the dishwasher. It shall have a resolution of 0.01 gal (40 mL), and an uncertainty of 0.01 gal (40 mL), at flow ~~rate~~rates as low as 0.2 gpm (13 mL/s).

6.11 *Stop Watch,* with a 0.1-s resolution.

6.12 *Analytical Balance Scale,* ~~or equivalent, for measuring weight of dishes and dish racks used in the dishload energy test. It shall have a resolution of 0.01 lb (5 g) and an uncertainty of 0.01 lb (5 g).~~

6.13 *Calibrated Exposed Junction Thermocouple Probes,* ~~with a range from −20°F to 400°F (−30 to 200°C), with a resolution of 0.2°F (0.1°C) and an uncertainty of 1.0°F (0.5°C), for measuring tank temperature and booster and dishwasher inlet temperature. Calibrated Type K Z4 GA thermocouple wire with stainless steel sheath and ceramic insulation is the recommended choice for booster and dishwasher inlet temperature. The thermocouple probe can be fed through a compression fitting so as to submerse the exposed junction in the booster and dishwasher inlets.~~

6.14 *Dishracks,* 12, Metro Mdl P2MO, 20 in. by 20 in., peg type, commercial, or acceptable equivalent. They shall weigh 4.6 ± 0.1 lb and are used in the washing energy test.

6.15 *Glassracks,* Six, 36 glass compartment medium plus, 19 ¾ by 19 ¾ in. Six ⅜ in. high with compartments measuring 2 ⅞ by 2 ⅞ by 4 13⁄16 in., commercial, or acceptable equivalent. They shall weigh 4.8 ± 0.2 lb and are used in the washing energy test. Polypropylene holding 36 glasses (height).

6.16 *Plates,* ~~150,~~180, 9 in., ceramic-glazed, weighing an average of 1.3 ± 0.05 lb each. If ~~plates,~~plates meeting ~~this~~these criteria cannot be obtained, then it will be necessary to acquire saucers, as specified in ~~6.15~~6.18. See 9.11 prior to obtaining these plates.

~~NOTE 2—Inter-American® Mdl #132[5] are within the specified weight range and are inexpensive.~~

6.17 *Glasses,* 108, 8 oz (237 mL) double bulge milk glasses 3 ⅝ in. in height and 2 ⅝ in. in diameter (for example: Libbey 618, Anchor/Oneida 7708U), weighing an average of 0.35 each. If glasses meeting this criteria cannot be obtained, then add or remove no more than one glass per rack that will together equal the required total weight of 5.75 ± 0.25 lb .

6.18 *Saucers,* 30, ceramic-glazed, weighing less than 0.5 lb each. See 9.11 for an explanation of why these may be required.

6.19 *Surface Temperature Thermocouple Probe,* for measuring the plate or glass temperature. Resolution and uncertainty shall be the same as in ~~6.12~~6.13.

6.20 *Vessel,* for capturing the sanitizing and post-sanitizing rinse water, shall be large enough (depending on the tank volume) to capture the water consumed during the entire water consumption test.

7. Materials

7.1 As specified in ~~6.13~~6.14, the dishracks or glassracks must be made of polypropylene. This is required because the test method assumes a specific heat of 0.39 Btu/lb°F. One verification that a rack is polypropylene is if it has the recycling symbol ±x5 on it (and the letters "PP" below it).

8. Sampling

8.1 *Dishwasher*—A representative production model shall be selected for performance testing.

9. Preparation of Apparatus

9.1 Install the dishwasher in accordance with the manufacturer's instructions under a 3-ft by 3-ft canopy exhaust hood, operating at a nominal ventilation rate of ~~300 to 500 cfm~~ 100 cfm per linear foot of hood space or in accordance with manufacturer's recommendation, if applicable. Record the ventilation rate used for the testing. The associated heating or cooling system shall be capable of maintaining an ambient temperature of 75 ± 5°F within the testing environment when the exhaust ventilation system is working and the appliance is being operated. All packing material and protective packaging should be removed.

9.2 Install the booster heater (if it is not integral to the dishwasher) in accordance with the manufacturer's recommendations. The pipe from the booster outlet to the dishwasher inlet shall be minimized, and shall be wrapped with ½-in. insulation along its entire length.

9.3 Connect the booster to a supply of water that is within ±3°F of its rated input temperature (not to exceed 140 ± 3°F). For condensing heat recovery machines, connect the supply to 70 ± 3°F water. For testing purposes, the dishwasher may be connected to a source of water that is at the manufacturer specified final rinse temperature ±1°F in lieu of an external booster heater.

9.4 Connect the dishwasher ~~(including tank heater, motors and controls) and~~ and booster to calibrated energy test ~~meters. The dishwasher and booster may be monitored as one energy load, but it is preferable to monitor them separately.~~ meters so that all energy (including tank heater, motors, and controls) is monitored. For machines with internal booster heaters, the booster heater energy use shall separately submetered from the machine tank heater, motors and controls. Separate monitoring will broaden the usefulness of the data and enhance the accuracy of the result.

9.5 For gas installations, install a pressure regulator (downstream from the meter) to maintain a constant (manifold) pressure of gas supplied to the dishwasher and booster heater (if applicable) for all tests. Install instrumentation to record both the pressure and temperature of the gas supplied to the dishwasher and the barometric pressure during each test so that the measured gas flow can be corrected to standard conditions.

9.6 For an electric tank or booster heater, confirm (while the elements are energized) that the supply voltage is within ±2.5 % of the operating voltage specified by the manufacturer. If it is not, a voltage regulator may be required during the tests. Record the test voltage for each test.

9.7 For a gas tank or booster heater, 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, as applicable.

9.8 Install the flow meter (see ~~6.9~~6.10) such that total water flow to the booster and dishwasher is measured.

9.9 Install a temperature sensor (see ~~6.12~~6.13) in the wash tank near the thermostat bulb.

9.10 Install a temperature sensor (see ~~6.12~~6.13) in the final rinse at the inlet to the rinse manifold, and in the inlet to the booster heater. The sensors should be installed with the probe immersed in the water.

NOTE 2— ~~Install the thermocouple probes described in 6.12 into the water inlets for dishwasher rinse and booster. The thermocouple probe shall be installed so that the thermocouple is immersed in the incoming water.~~ A compression fitting should be installed first into the plumbing for both inlets. A junction fitting may be installed in the plumbing line that would be compatible with the compression fitting.

9.11 *Preparation of ~~Dish-Loads:~~ Dish-Loads (for upright door machines):*

9.11.1 This section describes preparation of ~~ten~~18 dishloads and two empty racks to be used in the washing energy ~~test.~~test for upright door machines.

9.11.2 An important feature of the washing energy test is that every dishwasher is subjected to the same thermal load. To accomplish this, the tester must control some of the factors that affect the thermal load. These factors are:

9.11.2.1 The total weight of the dishes,

9.11.2.2 The weight of the (empty) racks, and

9.11.2.3 The initial temperature of the dishes and racks.

9.11.3 The weight of the racks is specified in ~~6.13~~6.14 as 4.6 lb or greater. If they weigh more than 4.6 lb, trim away material until they weigh 4.6 ± 0.1 lb. To see what parts of the rack are not needed for the test and may therefore be trimmed, it may be desirable to load the rack as they will be used during the test. The loading is explained in 9.11.4 and 9.11.5.

9.11.4 Prepare ten dishloads as described in this and the following step (9.11.5). The ten dishloads must have 19.5 ± 0.75 lb of plates. Ideally, this simply requires fifteen 9-in. plates. If the total weight of the fifteen 9-in. plates does not fall within the range, then use the saucers to adjust the total weight. A maximum of three saucers can be added per rack.

9.11.5 Space the plates and saucers evenly on the racks.

9.11.6 The bulk temperature of the dishloads must be 75 ± 2°F. This can be accomplished by storing the dishloads together in a room with an ambient temperature of 75 ± 2°F. Avoid any circumstances that would result in some dishes being at different temperature from others, such as being stored in the air path of an HVAC supply register. Determine the bulk temperature using a surface temperature probe (~~6.16~~6.19), measuring the temperature of at least three plates (one front, one center, and one rear) of each dishrack. Average these temperatures to determine the bulk temperature.

9.12 *Preparation of Glass-Loads (for undercounter machines):*

9.12.1 This section describes preparation of six glass loads and two empty racks to be used in the washing energy test for undercounter dishmachines.

9.12.2 An important feature of the washing energy test is that every dishwasher is subjected to the same thermal load. To accomplish this, the tester must control some of the factors that affect the thermal load. These factors are:

9.12.2.1 The total weight of the glasses,

9.12.2.2 The weight of the (empty) racks, and

9.12.2.3 The initial temperature of the glasses and racks.

9.12.3 The weight of the racks is specified in 6.14 as 4.6 lb or greater. If they weigh more than 4.6 lb, trim away material until they weigh 4.6 ± 0.1 lb. To see what parts of the rack are not needed for the test and may therefore be trimmed, it may be desirable to load the rack as they will be used during the test. The loading is explained in 9.12.4 and 9.12.5.

9.12.4 Prepare six glassloads as described in this and the following step (9.12.5). The six glassloads must have 5.75 ± 0.25 lb of glasses. Ideally, this simply requires eighteen glasses described in 6.17. If the total weight of the eighteen glasses does not fall within the range, then add or remove no more than one glass per rack.

9.12.5 Insert the glasses inverted in each opening of the rack.

9.12.6 The bulk temperature of the glassloads must be 75 ± 2°F. This can be accomplished by storing the glassloads together in a room with an ambient temperature of 75 ± 2°F. Avoid any circumstances that would result in some glasses being at different temperature from others, such as being stored in the air path of an HVAC supply register. Determine the bulk temperature using a surface temperature probe (6.19), measuring the temperature of at least three glasses (one front, one center, and one rear) of each glassrack. Average these temperatures to determine the bulk temperature.

10. Procedure

10.1 *General:*

10.1.1 Obtain and record the following for each run of every test (gas and electric units).

10.1.1.1 Voltage while elements are energized, and

10.1.1.2 Measured peak input rate during or immediately prior to test (does not include motor starting load).

10.1.2 For dishwashers with a gas-powered tank heater or booster, the following shall be obtained and recorded for each run of every test:

10.1.2.1 Higher heating value,

10.1.2.2 Standard gas conditions for calculation in 11.3,

10.1.2.3 Measured gas temperature,

10.1.2.4 Measured line gas pressure (before pressure regulator),

10.1.2.5 Barometric pressure, and

10.1.2.6 Measured peak input rate during or immediately prior to test.

NOTE 3—For a gas appliance, the quantity of heat (energy) generated by the complete combustion of the fuel is known as the heating value, heat of combustion, or calorific value of that fuel. For natural gas, this heating value varies according to the constituents of the gas. It is measured in Btu/ft^3. The heating value should be obtained during testing and used in the determination of the energy input to the appliance.

NOTE 4—The preferred method for determining the heating value of gas supplied to the dishwasher under testing is by using a calorimeter or gas chromatograph in accordance with accepted laboratory procedures. It is recommended that all testing be performed with gas with a heating value between 1000 and 1075 Btu/ft^3 (37 300 to 40 100 kJ/m^3). The use of "bottle" natural gas with a certified heating value within the specified 1000 to 1075 Btu/ft^3 (37 300 to 40 100 kJ/m^3) range is an acceptable alternative.

10.1.3 For gas dishwashers, energy calculations shall be in accordance with 11.3.

10.1.4 For dishwashers that use steam coils for tank heat, the supplied steam pressure, steam temperature at dishwasher inlet, steam temperature at dishwasher outlet, and average flow rate shall be recorded for each run of every test.

10.1.5 For each run of every test, 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 dishwasher.

NOTE 5—When the test procedure specifies to use the manufacturer's recommendations, instructions, specifications, or requirements, the information source should be used in the following order of preference: nameplate data, user manual, specification sheet, communication with manufacturer.

10.2 *Tank Heater Maximum Energy Input Rate:*

10.2.1 *Gas Tank Heaters*—Fill the dishwasher tank with 70 ± 10°F water, initiate the tank heaters, and when the burners cycle off, immediately drain the ~~tank and proceed with~~tank. Re-fill the dishwasher tank with 70 ± 10°F water and energize the ~~10.2.2.~~tank heaters. Commence monitoring time and energy consumption when the heaters cycle on. When the heaters cycle off, note the time and total energy consumption.

NOTE 6—For some gas appliances, the input rate changes as the burner orifices heat up from room temperature to operational temperature. Section 10.2.1 is provided to minimize this effect.

10.2.2 *Electric Tank Heaters*—Directly measure the power during a complete heater "on" cycle

10.2.3 ~~Fill~~Determine the ~~dishwasher tank with 70 ± 10°F water, and energize the tank heaters. Commence monitoring time and energy consumption. When the heaters cycle~~tank heater maximum energy input rate in accordance with 11.4~~off, note the time and total energy consumption. For electric tank heaters, a direct measurement of power may be substituted for the monitoring of time and energy consumption.~~, for the dishwasher under test. Report the measured input rate and confirm that it is within 5 % of the nameplate rated input or manufacturer specification. If the difference is greater than 5 %, terminate testing and contact the manufacturer. The manufacturer may make appropriate changes or adjustments to the dishwasher.