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An American National Standard

Standard Test Method for Energy Performance of Powered Open Warewashing Sinks[1]

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1. Scope

1.1 This test method evaluates the energy consumption of powered open warewashing sinks. The food service operator can use these tests to evaluate and select a suitable washing device and understand its energy consumption.

1.2 This test method applies to powered open warewashing sinks (powered sinks) with the following characteristics: a large main water sink with electrically powered water pump(s) and multiple high flow water nozzles. The unit may include gas or electric heaters to maintain water temperature. These powered sinks are designed to run for predetermined cycle duration and accommodate pots and pans of various shapes and sizes as well as cooking utensils. They are intended for stand alone use and require little supervision. The powered sink will be tested for the following (where applicable):

1.2.1 Maximum energy input rate (10.2),

1.2.2 Preheat energy consumption and duration (10.3),

1.2.3 Idle energy rate (10.4),

1.2.4 Pilot energy rate, if applicable (10.5), and

1.2.5 Washing cycle energy consumption (10.6).

NOTE 1—This test method applies only to the powered portion of the unit. Other compartments (sanitizing, rinsing, and so forth) are not evaluated.

1.3 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.4 *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

2.2 *ANSI Standard:*

2000 International Fuel Gas Code[3]

2.3 *ASHRAE Documents:*

ASHRAE Guideline 2 (RA90) Engineering Analysis of Experimental Data[4]

ASHRAE 1993 Fundamentals Handbook[4]

3. Terminology

3.1 *Definitions:*

3.1.1 *powered open warewashing sink, or powered sink, n*—an all-purpose, stainless steel water sink with electrically powered water pump(s) and multiple high flow water nozzles designed for cleaning pots, pans, and utensils. The main washing sink holds 60 to 100 gal of heated water. The unit may or may not feature a scrapper sink, rinse tank, sanitizing tank, scrap table, or a drain table, or both.

3.1.2 *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.

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

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *energy input rate, n*—peak rate at which a powered sink consumes energy (Btu/h or kW (kJ/h)).

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

[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.

3.2.2 *idle energy rate, n*—the rate of energy consumed (Btu/h or kW (kJ/h)) by the powered sink while holding or maintaining a water-filled wash sink at the 115°F (46°C) setpoint.

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

3.2.4 *preheat energy, n*—amount of energy consumed by the powered sink while preheating the wash sink water from 70 ± 5°F (21 ± 3°C) to 115°F (46°C), with the control(s) set to a calibrated 115°F (46°C).

3.2.5 *preheat rate, n*—average rate (°F/min) at which the powered sink's water is heated from 70 ± 5°F (21 ± 3°C) to 115°F (46°C), with the control(s) set to a calibrated 115°F (46°C).

3.2.6 *preheat time, n*—time required for the powered sink water to preheat from 70 ± 5°F (21 ± 3°C) to 115°F (46°C), with the control(s) set to a calibrated 115°F (46°C).

3.2.7 *washing energy, n*—amount of energy consumed (Btu or kWh (kJ)) during the powered sink's washing cycle.

3.2.8 *washing energy rate, n*—average rate of energy consumption (Btu/h or kW (kJ/h)) during the powered sink's washing cycle.

4. Summary of Test Method

4.1 The powered sink under test is connected to the appropriate metered energy supply. The measured energy input rate is determined and checked against the rated input before continuing with testing.

4.2 The amount of cold (70 ± 5°F (21 ± 3°C)) water required to fill the main water sink to capacity is measured.

4.3 The amount of energy and time required to preheat the powered sink's wash sink from 70 ± 5°F (21 ± 3°C) to 115°F (46°C) is determined.

4.4 The rate of idle energy consumption is determined with the powered sink set to maintain 115°F (46°C) and the pump motor(s) switched off.

4.5 Pilot energy rate is determined, when applicable, for gas powered sinks.

4.6 Washing cycle energy consumption is characterized for two different starting water temperatures: 70°F (21°C) and 115°F (46°C).

5. Significance and Use

5.1 The energy input rate test is used to confirm that the powered sink is operating properly prior to further testing.

5.2 Preheat energy and time can be useful to food service operators to manage power demands and to know how quickly the powered sink can be ready for operation when filled with cold water.

NOTE 2—It is typically recommended that powered sinks be filled with hot water prior to use. This test is useful for operations that have a limited supply of domestic hot water and would need to use cold water to fill the sink to capacity.

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

5.4 Washing cycle energy consumption can be used by the food service operator to estimate energy consumption during operating periods.

6. Apparatus

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

6.2 *Calibrated Exposed Junction Thermocouple Probes,* with a range from 50 to 200°F (10 to 93°C), with a resolution of 0.2°F (0.1°C) and an uncertainty of 0.5°F (0.3°C), for measuring the average temperature of the sink water, heating element temperature, and ambient air temperature.

6.3 *Gas Meter,* for measuring the gas consumption of the powered sink (if applicable), 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). If the meter is used for measuring the gas consumed by pilot lights, it shall have a resolution of at least 0.01 ft^3 (0.0003 m^3) and have a maximum uncertainty no greater than 2 % of the measured value.

6.4 *Pressure Gage,* for monitoring natural gas pressure. Shall have a range of zero to 10 in. H_2O, a resolution of 0.5 in. H_2O, and a maximum uncertainty of 1 % of the measured value.

6.5 *Primary Supply,* water heating system capable of supplying water at 115 ± 5°F (46 ± 3°C), as required by the powered sink.

6.6 *Stop Watch,* with a 1-s resolution.

6.7 *Temperature Sensor,* for measuring natural gas temperature in the range of 50 to 100°F (10 to 37.8°C), with a resolution of 0.5°F (0.3°C) and an uncertainty of ±1°F (0.6°C).

6.8 *Thermocouple Probe,* industry standard type T or type K thermocouples capable of immersion with a range of 50 to 200°F (10 to 93°C) and an uncertainty of ±1°F.

6.9 *Watt-Hour Meter,* for measuring the electrical energy consumption of a powered sink, 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

7.1 *Water,* to fill the water sink shall meet the manufacturer's specifications for quality and hardness.

7.2 *Powered Sink Detergent,* to be added to the water shall meet power washer manufacturer's specifications for type and amount. Otherwise, the detergent shall be a standard liquid

type with labeling specifying use in power washers and four ounces (4 oz) shall be added to the primary wash tank for all tests.

8. Sampling and Test Units

8.1 *Powered Sink*—A representative production model with heater shall be selected for performance testing.

9. Preparation of Apparatus

9.1 Install the appliance in accordance with the manufacturer's instructions and under a dedicated hood if necessary. Both sides of the powered sink shall be a minimum of 6 in. (305 mm) from any wall, side partition, or other operating appliance. 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 or the powered sink, or both, are operating.

9.2 Connect the powered sink 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 powered sink 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 if the voltage supply is not within ±2.5 % of the manufacturer's nameplate voltage. For gas powered sinks, record gas temperature, pressure, and heating value. Record barometric pressure.

9.3 For an electric powered sink, confirm (while the powered sink elements are energized) that the supply voltage is within ±2.5 % of the operating voltage specified by the manufacturer (see Note 3). Record the voltage for each test. Pump and heater energy consumption shall be separately monitored and reported for all tests.

NOTE 3—It is the intent of the test procedure herein to evaluate the performance of a powered sink at its rated gas pressure or electric voltage. If an electric powered sink 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 powered sink is designed to operate at two voltages without a change in the resistance of the heating elements, the performance of the powered sink (for example, the preheat time) may differ at the two voltages.

9.4 For a gas powered sink, adjust (during maximum energy input) the gas supply pressure downstream from the powered sink's pressure regulator to within ±2.5 % of the operating manifold pressure specified by the manufacturer. Make adjustments to the powered sink following the manufacturer's recommendations for optimizing combustion.

9.5 Install a temperature sensor to record ambient temperatures of the test room. Measure the height of the powered sink. The sensor shall be placed 24 in. (610 mm) away from the front of the powered sink and at a height of half the powered sink's height.

9.6 Firmly attach eight thermocouple probes evenly along the front and rear sides of the water sink only. For the front wall, two thermocouple probes shall be located (⅓ × height of the water fill line from the bottom), above the bottom of the sink (⅓ × width of the sink), and one from the right and one from the left wall. Two more thermocouples shall be located (⅔ × height of the water fill line from the bottom), above the bottom of the sink (⅓ × width of the sink), and one from the right and one from the left wall. These steps shall be repeated exactly for the rear wall. See Fig. 1. For example, for a water sink with a front wall dimension of 18 in. to the fill line and 48 in. from left to right shall have two thermocouples located 6 in. from the bottom at 16 in. from either side and two thermocouples 12 in. from the bottom and 16 in. from either side. Repeat for rear wall. (See Fig. 1 for thermocouple location illustration.)

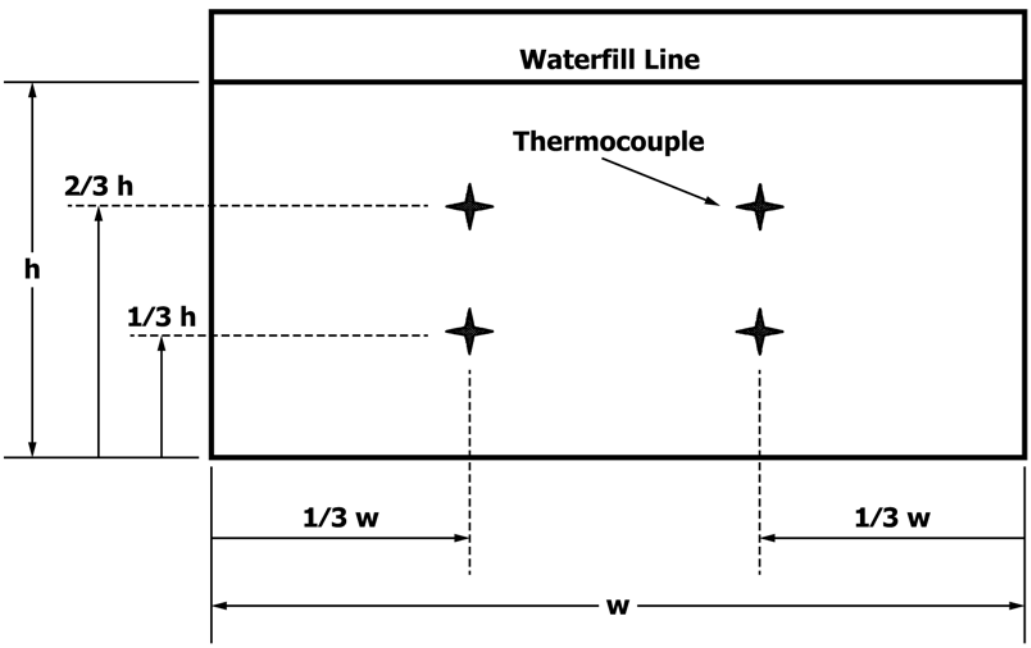

FIG. 1 Diagram of Thermocouple Placement per 9.6