



Standard Test Method for Performance of Water-Bath Rethermalizers¹

This standard is issued under the fixed designation F2473; 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 energy consumption and rethermalizing performance of floor-model and countertop water-bath rethermalizers. The food service operator can use this evaluation to select a water-bath rethermalizer and understand its energy consumption and production capacity.

1.2 This test method is applicable to floor and countertop model gas and electric units.

1.3 The water-bath rethermalizer can be evaluated with respect to the following (where applicable):

- 1.3.1 Energy input rate (10.2),
- 1.3.2 Preheat energy consumption, time, and rate (10.4),
- 1.3.3 Idle energy rate (10.5),
- 1.3.4 Pilot energy rate (10.6),
- 1.3.5 Retherm energy rate (10.8),
- 1.3.6 Production capacity (10.8), and
- 1.3.7 Retherm-energy efficiency (10.8).

1.4 This test method is not intended to answer all performance criteria in the evaluation and selection of a water-bath rethermalizer.

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 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.*

1.7 *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.*

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 June 1, 2023. Published July 2023. Originally approved in 2005. Last previous edition approved in 2018 as F2473 – 12 (2018). DOI: 10.1520/F2473-12R23.

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:³

ANSI Z83.11 Gas Food Service Equipment

2.3 ASHRAE Documents:⁴

ASHRAE Handbook of Fundamentals Chapter 6, Table 2—Thermodynamic; Chapter 6, Table 2—Thermodynamic Properties of Water at Saturation

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

2.4 NSF Standards:⁵

NSF Listing-Food Equipment and Related, Components and Material

NSF/ANSI 4 Commercial Cooking, Rethermalization and Powered Hot Food Holding and Transport Equipment

3. Terminology

3.1 Definitions:

3.1.1 *auto-fill, n*—water height sensor device that activates a fresh water fill solenoid when the water level in the rethermalizer drops below a predetermined height.

3.1.2 *energy input rate, n*—peak rate at which a water-bath rethermalizer consumes energy (Btu/h (kJ/h) or kW).

3.1.3 *idle energy rate, n*—average rate of energy consumed (Btu/h or kW) by the rethermalizer while holding or maintaining the water vat at the thermostat(s) set point.

3.1.4 *over-flow drain, n*—drain for eliminating the excess foam and starch created during the rethermalizing process.

3.1.5 *pilot energy rate, n*—average rate of energy consumption (Btu/h (kJ/h)) by a water-bath rethermalizer's continuous pilot (if applicable).

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.

⁴ Available from American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc. (ASHRAE), 1791 Tullie Circle, NE, Atlanta, GA 30329.

⁵ Available from NSF International, P.O. Box 130140, 789 N. Dixboro Rd., Ann Arbor, MI 48113-0140.

3.1.6 *preheat energy, n*—amount of energy consumed (Btu or kWh) by the rethermalizer while heating the water vat from ambient room temperature to the calibrated thermostat(s) set point.

3.1.7 *preheat rate, n*—average rate (°F/min) at which the water vat temperature is heated from ambient temperature to the rethermalizer's calibrated thermostat(s) set point.

3.1.8 *preheat time, n*—time required for the water vat to heat from ambient room temperature to the calibrated thermostat(s) set point.

3.1.9 *production capacity, n*—maximum rate (lb/h (kg/h)) at which water-bath rethermalizer can bring the refrigerated clam chowder to a specified rethermalized condition.

3.1.10 *retherm energy, n*—total energy consumed by the rethermalizer as it is used to reheat bags of refrigerated clam chowder.

3.1.11 *retherm-energy efficiency, n*—quantity of energy required to warm the specified food product (clam chowder soup), expressed as a percentage of the quantity of energy input to the water-bath rethermalizer during the reheating period.

3.1.12 *retherm energy rate, n*—average rate of energy consumed by the rethermalizer while reheating bags of refrigerated clam chowder.

3.1.13 *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 results.

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

3.1.15 *water-bath rethermalizer, n*—appliance, including a rethermalizing vessel, in which water is placed to such a depth that the food is essentially supported by displacement of the water rather than by the bottom of the vessel, which is designed for the purpose of reheating pre-cooked food contained in vacuum-sealed, boilable bags.

4. Summary of Test Method

4.1 The water-bath rethermalizer 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.

4.2 The water temperature in the rethermalizing zone of the water-bath rethermalizer is monitored at a location chosen to represent the average temperature of the water while the water-bath rethermalizer maintains a specified rethermalizing temperature.

4.3 Preheat energy, time, and rate are determined while the water-bath rethermalizer is operated with the thermostat(s) set to specified temperature.

4.4 The idle energy is determined while the water-bath rethermalizer is operated in a ready-to-use state with the thermostat(s) set to the calibrated temperature. The rate of pilot energy consumption also is determined when applicable to the water-bath rethermalizer under test.

4.5 Energy consumption and time are monitored while the water-bath rethermalizer is used to reheat three full loads of refrigerated, prepackaged clam chowder soup. Retherm-energy efficiency, retherm energy rate, and production capacity are determined from these tests.

5. Significance and Use

5.1 The energy input rate test is used to confirm that the water-bath rethermalizer under test is operating in accordance with its nameplate rating.

5.2 The water-bath rethermalizer temperature calibration is used to ensure that the water-bath rethermalizer being tested is operating at the specified temperature. Temperature calibration also can be used to evaluate and calibrate the thermostat control dial(s).

5.3 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 water-bath rethermalizer.

5.4 Idle energy rate and pilot energy rate can be used to estimate energy consumption during non-rethermalizing periods.

5.5 Production capacity is used by food service operators to choose a water-bath rethermalizer that matches their particular food output requirements.

5.6 Retherm-energy efficiency is a precise indicator of the water bath rethermalizer's energy performance under full-load condition. This information enables the operator to consider energy performance when selecting a water-bath rethermalizer.

6. Apparatus

6.1 *Analytical Balance Scale*, for measuring weights up to 15 lb (6.8 kg), with a resolution of 0.01 lb (0.004 kg) and an uncertainty of 0.01 lb (0.004 kg).

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 (670 Pa).

6.3 *Canopy Exhaust Hood*, 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 per linear foot (460L/s per linear metre) of active hood length. This hood shall extend a minimum of 6 in. (152 mm) past both sides and the front of the rethermalizing 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 *Data Acquisition System*, for measuring energy and temperatures, capable of multiple temperature displays updating at least every 2 s.

6.5 *Flow Meter*, for measuring total water consumption of the appliance. Shall have a resolution of 0.01 gal (0.04 L) and an uncertainty of 0.01 gal (0.04 L) at a flow rate as low as 0.2 gpm (0.8 lpm).