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An American National Standard

Standard Test Method for
Performance of Large Open Vat Fryers[1]

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1. Scope

1.1 This test method covers the energy consumption and cooking performance of large-vat open, deep fat fryers. The food service operator can use this evaluation to select a fryer and understand its energy efficiency and production capacity.

1.2 This test method is applicable to floor model gas and electric fryers with 50 lb (23 kg) and greater fat capacity and an 18-in. and larger vat size.

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

1.3.1 Energy input rate (10.2),

1.3.2 Preheat energy and time (10.4),

1.3.3 Idle energy rate (10.5),

1.3.4 Pilot energy rate (10.6, if applicable),

1.3.5 French fry cooking energy rate and efficiency (10.9),

1.3.6 French fry production capacity and frying medium temperature recovery time (10.9),

1.4 This test method is not intended to answer all performance criteria in the evaluation and selection of a fryer, such as the significance of a high energy input design on maintenance of temperature within the cooking zone of the fryer.

1.5 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.

1.6 *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.*

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 Document:*[3]
ANSI Z83.11 American National Standard for Gas Food Service Equipment

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

2.4 *Other Standards:*
AOAC 983.23 Fat in Foods: Chloroform-Methanol Extraction Method[5]

3. Terminology

3.1 *Definitions:*

3.1.1 *large vat fryer, n*—(hereafter referred to as fryer) an appliance designed for cooking large quantities of fish or chicken, in which oils are placed in the cooking vessel to such a depth that the cooking food is essentially supported by displacement of the cooking fluid rather than by the bottom of the vessel. Often referred to as chicken or fish fryers.

3.1.2 *test method, n*—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 result.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *cold zone, n*—volume in the fryer below the heating elements or heat exchanger surface designed to remain cooler than the cook zone.

3.2.2 *cook zone, n*—volume of oil in which food is cooked.

3.2.3 *cooking energy, n*—total energy consumed by the fryer as it is used to cook breaded chicken product under heavy- and light-load conditions.

3.2.4 *cooking-energy efficiency, n*—quantity of energy imparted to the chicken during the cooking process expressed as a percentage of the quantity of energy consumed by the fryer during the heavy- and light-load tests.

3.2.5 *cooking energy rate, n*—average rate of energy consumed by the fryer while "cooking" a heavy or light load of chicken.

3.2.6 *energy input rate, n*—peak rate at which a fryer consumes energy (Btu/h (kJ/h) or kW), typically reflected during preheat.

3.2.7 *idle energy rate, n*—average rate of energy consumed (Btu/h (kJ/h) or kW) by the fryer while "holding" or "idling" the frying medium at the thermostat(s) set point.

3.2.8 *pilot energy rate, n*—average rate of energy consumption (Btu/h (kJ/h)) by a fryer's continuous pilot (if applicable).

3.2.9 *preheat energy, n*—amount of energy consumed (Btu (kJ) or kWh) by the fryer while preheating the frying medium from ambient room temperature to the calibrated thermostat(s) set point.

3.2.10 *preheat rate, n*—average rate (°F/min (°C/min)) at which the frying medium temperature is heated from ambient temperature to the fryer's calibrated thermostat(s) set point.

3.2.11 *preheat time, n*—time required for the frying medium to preheat from ambient room temperature to the calibrated thermostat(s) set point.

3.2.12 *production capacity, n*—maximum rate (lb/h (kg/h)) at which a fryer can bring the specified food product to a specified "cooked" condition.

3.2.13 *production rate, n*—average rate (lb/h (kg/h)) at which a fryer brings the specified food product to a specified "cooked" condition. Production rate does not necessarily refer to maximum rate (production capacity), but varies with the amount of food being cooked.

3.2.14 *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

Note 1—All of the fryer tests shall be conducted with the fryer installed under a wall-mounted canopy exhaust ventilation hood that shall operate at an air flow rate based on 300 cfm per linear foot (460 L/s per linear metre) of hood length. Additionally, an energy supply meeting the manufacturer's specifications shall be provided for the gas or electric fryer under test.

4.1 The fryer 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 frying medium temperature in the cook zone is monitored at a location chosen to represent the average temperature of the frying medium while the fryer is "idled" at 350°F (177°C). Fryer temperature calibration to 350°F (177°C)

is achieved at the location representing the average temperature of the frying medium.

4.3 The preheat energy and time and idle energy rate are determined while the fryer is operating with the thermostat(s) set at a calibrated 350°F (177°C). The rate of pilot energy consumption also is determined, when applicable, to the fryer under test.

4.4 Energy consumption and time are monitored while the fryer is used to cook six loads of frozen, ¼-in. (6-mm) shoestring potatoes to a condition of 30 ± 1 % weight loss with the thermostat set at a calibrated 350°F (177°C). Cooking-energy efficiency is determined for heavy-load test conditions. French fry production capacity is based on the heavy-load test.

5. Significance and Use

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

5.2 Fryer temperature calibration is used to ensure that the fryer being tested is operating at the specified temperature. Temperature calibration also can be used to evaluate and calibrate the thermostat control dial.

5.3 Preheat energy and time can be used by food service operators to manage their restaurants' energy demands, and to estimate the amount of time required for preheating a fryer.

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

5.5 Preheat energy, idle energy rate, pilot energy rate, and heavy- and light-load cooking energy rates can be used to estimate the fryer's energy consumption in an actual food service operation.

5.6 Cooking-energy efficiency is a direct measurement of fryer efficiency at different loading scenarios. This information can be used by food service operators in the selection of fryers, as well as for the management of a restaurant's energy demands.

5.7 Production capacity is used by food service operators to choose a fryer that matches their food output requirements.

6. Apparatus

6.1 *Analytical Balance Scale,* for measuring weights up to 50 lb (23 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 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 (460 L/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 cooking appliance and