



Standard Test Method for Performance of Chinese (Wok) Ranges¹

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1. Scope

1.1 This test method evaluates the energy consumption and performance of Chinese ranges. The food service operator can use this evaluation to select a Chinese range and understand its energy performance.

1.2 This test method is applicable to nonthermostatically-controlled, gas and electric Chinese ranges, including both discreet burners, elements, and induction units.

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

- 1.3.1 Energy input rate (10.2),
- 1.3.2 Pilot energy rate, if applicable (10.3), and
- 1.3.3 Heatup energy efficiency and production capacity (10.5).

1.4 The values stated in inch-pound units are to be regarded as standard.

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

1.6 *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

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.

2.2 ANSI Standard:³

ANSI Z83.11 American National Standard for Gas Food Service Equipment

2.3 ASHRAE Standard:⁴

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

3. Terminology

3.1 Definitions:

3.1.1 *Chinese range, n*—an appliance that cooks food by a direct or indirect heat transfer, which is powered by a single heat source comprised of either a gas burner or an electrical element or induction technology that is independently controlled. Used in conjunction with woks.

3.1.2 *energy input rate, n*—peak rate at which Chinese range consumes energy (Btu/h or kW).

3.1.3 *heatup energy, n*—energy consumed by the Chinese ranges as it is used to raise the temperature of water in a wok from $70 \pm 2^\circ\text{F}$ to $200 \pm 2^\circ\text{F}$ under full input rate.

3.1.4 *heatup energy efficiency, n*—quantity of energy imparted to the water, expressed as a percentage of energy consumed by the Chinese range during the heatup event.

3.1.5 *heatup energy rate, n*—average rate of energy consumption (Btu/h or kW) during the heatup energy efficiency tests.

3.1.6 *heatup time, n*—time required to raise the temperature of the water from $70 \pm 2^\circ\text{F}$ to $200 \pm 2^\circ\text{F}$ during a heatup energy efficiency test.

3.1.7 *pilot energy rate, n*—average rate of energy consumption (Btu/h) by a Chinese range's continuous pilot, if applicable.

3.1.8 *production capacity, n*—maximum rate (lb/h) at which the Chinese range heats water in accordance with the heatup energy-efficiency test.

3.1.9 *testing capacity, n*—the capacity (gal) at which the wok is operated during the heatup test, which is at the water level mark.

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.

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

3.1.11 *water level mark, n*—a level of water, which is even (horizontal) with the top portion of the well or chamber, that cradles the wok. This will be used to determine the *testing capacity*.

3.1.12 *well/chamber, n*—the ring which supports the wok over the heat source.

3.1.13 *wok, n*—a bowl shaped vessel used to contain the water that is being heated by the Chinese range.

4. Summary of Test Method

4.1 The Chinese range is connected to the appropriate metered energy source, and energy input rate is determined for each type of cooking well on the Chinese range and for the entire Chinese range (all cooking wells operating at the same time) to confirm that the appliance is operating within 5 % of the nameplate energy input rate. The pilot energy consumption also is determined when applicable to the Chinese range being tested.

4.2 Energy consumption and time are monitored as each well of the Chinese range is used to heat the water in the wok from 70 to 200°F (21 to 93°C) at the full-energy input rate. Heatup energy efficiency and production capacity are calculated from this data.

5. Significance and Use

5.1 The energy input rate is used to confirm that the Chinese range under test is operating at the manufacturer's rated input. This test also indicates any problems with the electric power supply or gas service pressure.

5.2 The pilot light, where applicable, energy rate can be used by the food service operator to estimate energy consumption during noncooking periods.

5.3 Heatup energy efficiency is a precise indicator of Chinese range energy performance under full-load conditions. This information enables the food service operator to consider energy performance when selecting a Chinese range.

5.4 Production capacity is used by food service operators to choose a Chinese range that matches their food output requirements.

6. Apparatus

6.1 *Analytical Balance Scale*, for measuring water and wok weights with a resolution of 0.01 lb and an uncertainty of 0.01 lb.

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

6.3 *Canopy Exhaust Hood*, 4 ft in depth, wall-mounted with the lower edge of the hood 6 ½ ft from the floor and with the capacity to operate at nominal exhaust ventilation rate of 300 cfm per linear foot. This hood shall extend a minimum of 6 in.

past both sides of the cooking 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 channel displays updating at least every 2 s.

6.5 *Gas Meter*, for measuring the gas consumption of a Chinese range, shall be a positive displacement type with a resolution of at least 0.01 ft³ and a maximum uncertainty of no greater than 1 % of the measured value for any demand greater than 2.2 ft³/h. If the meter is used for measuring the gas consumed by the pilot lights, it shall have a resolution of at least 0.01 ft³ and a maximum uncertainty no greater than 2 % of the measured value.

6.6 *Pressure Gage*, for monitoring gas pressure. It shall have a range of zero to 15 in. H₂O, a resolution of 0.5 in. H₂O, and a maximum uncertainty of 1 % of the measured value.

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

6.8 *Temperature Sensor*, for measuring gas temperature in the range of 50 to 100°F with an uncertainty of ±1°F.

6.9 *Thermocouple(s)*, industry standard Type T or Type K thermocouple wire with a range of 50°F to 250°F and an uncertainty of ±1°F.

6.10 *Watt-Hour Meter*, for measuring the electrical energy consumption of a Chinese range, 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*, having a maximum hardness of three grains per gallon. Distilled water may be used.

7.2 *Wok*, due to the varying wok styles, shapes, and materials, the testing wok shall be the wok recommended by the manufacturer for the Chinese range to be tested.

8. Sampling

8.1 *Chinese Range*—Select a representative production model for performance testing.

9. Preparation of Apparatus

9.1 Install the Chinese range according to the manufacturer's instructions under a 4 ft deep canopy exhaust hood mounted against a wall with the lower edge of the hood 6 ½ ft from the floor. Position the Chinese range so the front edge is 6 in. inside the front edge of the hood. The length of the exhaust hood and active filter area shall extend a minimum of 6 in. beyond both sides of the Chinese range. In addition, both sides of the Chinese range shall be 3 ft from any side wall, side partition, or other operating appliance. The exhaust hood ventilation rate shall be 300 cfm per linear foot of the hood length. The associated heating or cooling system for the space shall be capable of maintaining an ambient temperature of 75