

6 Chinese (Wok) Ranges

Introduction



Figure 6-1.
**Guangdong style
Chinese range.**

Photo: Montague Company



Figure 6-2.
**West-coast style
Chinese range.**

Photo: Montague Company

Ethnic menus are hot—Chinese, Vietnamese and Thai! As for equipment, the hottest thing—literally—is the Chinese range.¹ Chinese ranges also are finding their way into more non-traditional kitchens from family-style restaurants to hotels, as the trend towards “healthy eating” continues. If using the smaller, single-countertop induction units offered by several manufacturers, the Chinese range is usually found in the middle of a regular cooking line or at a stir-fry or wok station at a catered event.

Although the majority of Chinese ranges are custom-made, they are generally classified as either traditional Oriental units (Figure 6-1) unique to different cooking styles (Guangdong, Shanghai, Chiu Chow and Chop Suey) or as North American units (Figure 6-2), which differ in construction only—East Coast style and West Coast style. The heat source can be natural gas, propane or butane gas, and in the case of induction units, electricity. Natural gas is by far the most common fuel source. A gas valve at knee-level allows the chef to adjust the heat while using both hands to cook. Energy input rates range from 50 kBtu/h to as high as 160 kBtu/h or more, depending on the type of burner. The purpose of the high input rates is to facilitate the short term, high temperature cooking process used in the preparation of Oriental-menu items.

The basic Chinese range is constructed of heavy-gauge steel and averages 30-45 inches (760-1150 mm) in depth and 34-36 inches (860-910 mm) in work height, and is often equipped with a high back shelf and rack for woks and utensils.¹ Some ranges are insulated with fiberglass and feature flue risers for ventilation (e.g., East Coast-style ranges) or use the flue gases to heat the soup wells (e.g., the Guangdong, Shanghai and Chiu Chow ranges). Units without insulation or flue risers feature perforated water lines to flush water across the range top for cooling. A built-in slop trough at the back of the range top allows drainage for the water and any splattered food (e.g., West Coast-style ranges).

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Each range has one or more chambers or wells (openings) over which woks are placed for cooking. The overall width of the range is determined by the width required to accommodate the number and diameter of woks and bowls desired, allowing a 6-inch (150 mm) space between them.² The number, diameter and heat inputs of these chambers are specific to the chef's preferences and cooking style. Woks are available in diameters of 12 to 32 inches (300-800 mm). What is important, however, is the relationship between the wok itself and the chamber. The chamber diameter must be 2 to 4 inches (50-100 mm) smaller than the wok diameter in order to ensure a proper wok fit.¹ Traditional type ranges may also include several 12-inch (300 mm) soup-pot holders and open-burner sections.

Chambers are available in 10-, 12-, 14-, 16-, 18-, and 20-inch (250 mm, 300 mm, 350 mm, 400 mm, 450 mm, and 500 mm) diameters, increasing in increments of 2 inches (50 mm), and can go up to 30 inches (760 mm). The smaller-chamber diameters are used for northern-style Hunan, Szechwan and Mandarin cooking; medium-sized chambers are used for southern-style Cantonese cuisine. The large chambers are found in high-production kitchens.¹

Cooking Processes

The Chinese or wok range is a self-contained range, having one or more "wells" or chambers that are designed to use a wok as the cooking utensil. The primary cooking method is stir-frying. Stir-fried menu items require high cooking temperatures to quickly sear the exterior of the food, locking in the flavors while not destroying natural color and vitamins. A variety of foods cut into appropriate sizes and shapes, generally thin strips, may be combined in this technique (meat and vegetables, poultry and fish and so on). The food items are added to the hot cooking medium, traditionally peanut oil (used because of its flavor and its high smoking point) and stir-fried. That is, the food is kept in constant motion by stirring, lifting and tossing for a short amount of time over high heat.³

Types of Chinese Ranges

Traditional Oriental Units

Guangdong. The Guangdong range features 18- to 20-inch (450 to 500 mm) diameter cooking or wok chambers and 12-inch (300 mm) soup chambers

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that are heated by the flue gases from the rear of the range unit. Guangdong ranges are equipped with powered burners rated at 150 kBtu/h per burner.

Shanghai. This unit features 18- to 22-inch (450-500 mm) diameter cooking chambers and 12-inch (300 mm) soup chambers that are also heated by the range's flue gases. This range is equipped with powered burners rated at 150 kBtu/h per burner for the woks and with open burners rated at 40 kBtu/h per burner, located towards the back of the range top.

Chiu Chow. The Chiu Chow range, similar to the Shanghai range, features 18-to 22-inch (450-500 mm) diameter cooking chambers and 12-inch (300 mm) soup chambers heated by its flue gases. This range has powered burners for the woks rated at 150 kBtu/h each. This style of range also may have an open burner with a grate, rated at 40 kBtu/h, towards the back and centered between the two soup chambers.

Chop Suey. The Chop Suey range features 16- to 24-inch (400-600 mm) diameter wok cooking chambers. This type of range comes with open or jet burners rated between 80 and 125 kBtu/h per burner. It does not have a flue riser. A Canadian manufacturer incorporates what it calls a "new concept in chop Suey range design and engineering." The burners generate extremely high temperatures (2000°F (1100°C)) inside the chamber, without transferring heat onto the range. The gas chamber is completely isolated. The heat is focused on the wok or pan by flame guide rings, and then conducted out of the gas chamber by three separate ventilation systems.⁴

North American Units

East Coast Style. The East Coast-style range is insulated (front and sides) with fiberglass and features flue risers for ventilation. Some models also offer chambers lined with refractory brick for additional heat protection. Like traditional Oriental range styles, this unit's cooking chambers are 16 to 24 inches (400-600 mm) in diameter; the soup chambers are 12 inches (300 mm) in diameter. Energy inputs range from 80 kBtu/h per burner to 125 kBtu/h per burner, depending upon burner configuration—open or jet. This type of Chinese range is characterized by a rear food trough with an external sink and food strainer.

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West Coast Style. The West Coast-style range has neither insulation nor flues, but features perforated water lines to flush water across the range top for cooling. A built-in trough at the back of the range top allows drainage for the water. Steel cooking chambers measure from 16 to 24 inches (400 to 600 mm) in diameter. Energy input ranges between 50 kBtu/h and 160 kBtu/h. One manufacturer's unit features a unique well-venting system that carries heat away from the kitchen and into a vent opening in the high shelf.

Table 6-1 compares the specifications for the different types of Chinese ranges.

Table 6-1. Summary of Chinese Range Types.

Range Type	Cooking Chamber	Chamber Diameter (inch)	Burner Type	Input Rate per Burner (kBtu/h)
Traditional:				
Guangdong	Wok	18 - 20	Powered	150
	Soup	12	Open	40
Shanghai	Wok	18 - 22	Powered	150
	Soup	12	Open	40
Chiu Chow	Wok	18 - 22	Powered	150
	Soup	12	Open	40
Chop Suey	Wok	16 - 24	Open or Jet	80 - 130
North American:				
East Coast	Wok	16 - 24	Open or Jet	80 - 125
	Soup	12	Open	40 - 80
West Coast	Wok	16 - 24	Ring, or Jet	50 - 160

Controls

Although burners usually have modulating gas valves with adjustable inputs between on and off, they are typically operated at close to maximum input.

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Heating Technologies

Gas

Ring burners, jet burners or powered burners provide heat to the woks, depending on the style of cooking and the level of heat required. Chinese ranges designed to work with woks up to 18 inches (450 mm) in diameter require 53-kBtu/h burners; woks with diameters greater than 20 inches (500 mm) generally require 110-kBtu/h burners. Standard models are available with up to as many as 8 to 10 burners. Ring-type burners are typically used in conventional Chinese cooking and can produce between 55 kBtu/h and 110 kBtu/h outputs. Jet burners, rated between 120 kBtu/h and 130 kBtu/h, provide more intense heat and are used in Mandarin cooking. The jet burner is usually placed closer to the wok to create a faster, more intense heat and to decrease cooking time. Shielded-tip or duck-mouth burners, a variant of the jet burner, deliver the same intense heat, but have metal tips that prevent each port from becoming clogged with food.¹ Powered burners, rated at 150 kBtu/h and higher, are used for larger wok stations in traditional Oriental units.

Electric

There are very few electric woks on the market. The induction wok uses an induction coil located beneath a ceramic cook top called an induction hob. As electric current flows through the coil, a corresponding field develops above the surface of the ceramic cook top. The field itself is not hot, and doesn't heat the ceramic: a hand placed on the range top will not be burned or heated. But the bottom of a metal pan set on the ceramic surface intersects the field, which induces a current in the pan. This current heats the pan bottom rapidly and the bottom becomes, in effect, an electric element. Because the field can only work on the metal (magnetic) wok, removing the wok automatically turns down the energy input to the appliance. Full input is restored instantly when a pot is placed on the hob. While idling without a wok on the induction hob, the induction element draws a small fraction of its full input energy, and adds no heat to the kitchen.

Changing the energy input to the induction coil can control heating. The response to change is rapid, comparable to a gas-open burner. Some induction

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woks have electronic controls that allow patterns of heating appropriate to different styles of cooking, for example, a full-input heating period to raise soup to a boil followed by a reduced input for simmer. Induction woks also include temperature-limiting switches that sense the temperature of the ceramic surface and cut off input when it exceeds safety conditions (e.g., when a wok has boiled dry).

Induction woks have some practical limitations. Currently commercial models exist, but mainly as single-unit hot plates.⁵ The coils are expensive and may prove too fragile for heavy-duty food service applications. Finally, the induction wok will only heat pots that are made of magnetic materials. At present, compatible cookware tends to be expensive and chefs may be reluctant to retool their kitchen for use with this new technology on a greater scale.

Chinese Range Performance

Energy Efficiency

The energy performance of Chinese ranges is not well documented. Recently, the Food Service Technology Center developed an efficiency test for Chinese ranges. The test method was subsequently approved and ratified by ASTM.⁶ Unfortunately, no reported energy efficiencies were identified by this study, although unpublished energy consumption data were available for estimating energy consumption (Table 6-2).

Table 6-2. Chinese Range Energy Efficiency.^a

Gas Chinese Ranges	15 – 30%
Electric Chinese Ranges	50 – 70%

^a Best estimate based on FSTC experience.

Chinese Range Energy Consumption

Projected energy consumption for gas Chinese ranges is presented in Table 6-3. An unpublished, proprietary end-use monitoring study showed that for all monitored equipment, woks consumed the largest measured daily energy consumption. Based on the median nominal chamber size of 20 inches (500

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mm), a median energy input rate of 100 kBtu/h (an actual 20-inch diameter chamber is rated at 107 kBtu/h) and an estimated 10 hours of operation, an average energy consumption rate of 30 kBtu/h was calculated for Chinese ranges. This corresponds to a duty cycle of 30%. The projected annual energy consumption was determined by assuming a 6-day, 52-week per year operation.

Table 6.3. Projected Energy Consumption for Gas Chinese Ranges.

Nominal Size	Rated Energy Input (kBtu/h)	Duty Cycle (%)	Avg. Energy Consumption (kBtu/h)	Typical Operating Hours (h/d) ^a	Annual Energy Consumption (kBtu) ^b
2 Wok Range	100 - 320				
(Median)	200	30	60	10	187,000

^aOperating hours or appliance "on time" is the total period of time that an appliance is operated from the time it is turned "on" to the time it is turned "off".

^bThe annual energy consumption calculation is based on the average energy consumption rate x the typical operating hours x 6 days per week x 52 weeks per year.

Ventilation Requirements

As for underfired broilers, the ventilation requirements for Chinese ranges are greater than for other categories of cooking equipment. Typical ventilation rates for a wall-mounted canopy hood over a Chinese range are between 350 and 450 cfm (175 and 225 L/s) per linear foot. The radiant heat gain from Chinese ranges contributes significantly to the heat gain of the kitchen. However, radiant factors have not been published.

Research and Development

The Chinese range is a very fundamental design, typically using low-cost components. Benchmark efficiencies are very low. Woks typically lack any end-user "pull" to raise the bar. However, consideration should be given to:

- End-use monitoring of Chinese ranges.
- Characterization of energy balance of wok-cooking process.

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- Establishment of criteria for the development of a high-efficiency gas wok burner.
- Development of an energy efficient, advanced performance Chinese range in partnership with a North American manufacturer of traditional Chinese ranges.
- Development of back-of-the house induction woks that can compete with traditional gas woks.

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Information in this module also references Manufacturers Product Literature, catalogues, and appliance specification sheets.