REFRACTORY MATERIALS

Refactory materials (materials that can withstand high temperatures) are used in the construction and maintenance of ceramic studio kilns. Firebrick, ceramic fiber and castable refractories are the three forms of refractories used in kilns, but firebrick is the most significant.

A BRICK WITH MANY FACES

Firebrick is a generic term that encompasses any brick that can withstand repeated heating and cooling at various temperature ranges. Additionally, firebricks must be able to withstand different atmospheres, provide various structural or insulating qualities, and due to the difficulty in cutting them, must be available in a variety of shapes to add flexibility to kiln design and construction.

HARD AND SOFT

There are two types of firebrick: hardbrick and softbrick. Hardbricks are very dense and durable and used for their structural qualities. They can be found most often as the main building component of large kilns, chimneys, fireboxes and burner ports—anywhere around direct flame. Softbricks are lightweight and made from a refractory clay body containing combustible materials. When fired, the materials burn out leaving a sponge like matrix of air pockets, which serve to provide insulating qualities to the brick. Also known as insulating firebricks (IFBs), these bricks absorb about half the energy as hardbricks during a firing. Softbrick range from 2000°F to 3300°F and are used as the brick of choice for constructing electric kilns or as insulating liners in reduction kilns.

GRADES ARE IMPORTANT

The main ingredient in firebricks is fireclay, which contains mostly alumina and silica, elements capable of withstanding high temperatures. Hardbricks are available in several grades, depending on their composition and properties, which determine the most efficient use of them in construction. High alumi-
na compositions start at 50% alumina and increase in alumina content to 98% for the highest purity and most expensive. It’s extremely rare that a potter would require an alumina content exceeding 70%.

**Low-duty:** Typically rated to 1750°F maximum service temperature. Primarily used for fireplace chimneys, and contains 24–26% alumina.

**Medium duty:** Temperature rating to 2700°F maximum service temperature. Uses include backup linings, lower-temperature ceramic kilns and chimneys, and contains 34–38% alumina.

**High Duty (first-quality firebrick):** Temperature rating to 2850°F maximum in purely heat service. Certain atmospheres can reduce this temperature rating by several hundred degrees, and contains 36–40% alumina. Uses include boilers, ceramic kilns, chimneys and back-up linings.

**Super Duty:** Temperature rating to 2900°F in pure heat service. Certain atmospheres can reduce this temperature rating by several hundred degrees. Same uses as high duty where higher temperatures are involved. Contains 40–44% alumina.

**High-Fired Super Duty:** Temperature rating between 3000°F–3150°F. A higher burned version of super duty firebrick designed to lower the porosity, increase physical strength and improve resistance to alkali attack and carbon monoxide disintegration. Contains 40–44% alumina.

**Shapes**

Most bricks are pressed or extruded. Common shapes are straights, arches, wedges, keys, rotary kiln blocks (RKBs) and square-edge tiles. Larger pieces are typically produced by air hammering the brick mix into wooden or steel molds sized for the desired shape dimensions.

The standard refractory brick size is 9×4½×2½ inches, also known as one brick equivalent (beq). This size is the most common used in pottery kiln construction. However, an equally popular standard size used in industrial furnace construction is the 9×4½×3-inch series. The 3-inch series brick reduces the number of joints in the kiln.

**Straights**—the standard straight is 9×4½×2½ inches or 9×4½×3 inches and available in larger sizes up to 18 inches long, 9 inches wide, and 4½ inches thick.

**Square edge tile**—This term refers to “big” straights, which comprise 12×12 inches up to 24×12 inches with thickness ranging from 1½ to 3 inches.

**Soaps**—A term used to describe a half brick in width such as 9×2¼×2½ inches or 9×2½×3 inches.

**Splits**—A term used to describe a the thickness of a brick thinner than 2½ inches, i.e., splits come in 1, 1¼, 1½, and 2 inch thicknesses.

**Arch**—This shape tapers in thickness along the width over its entire length and is used to make sprung or circular barrel arched roofs either 4½ inches or 6 inches in thickness.

**Wedge**—This shape tapers in thickness along the entire length of the brick and is used to make sprung or circular barrel arches 9, 12 or 13 inches in thickness.

**Skew**—A shape having a certain taper on one side or end to enable a sprung arch to be built. Four major types are available in both side and end skews that relate to the rise of the arch.

**Recommendations**

Here are some recommendations that will greatly assist you on your firebrick purchase.

- The vast majority of pottery kilns are constructed of high duty or super duty brick.
- Use extreme care when considering used refractories for building kilns. In most cases, you won’t know the conditions under which they were exposed. If they’ve been removed from a furnace, it’s usually because the lining failed. Properties of refractories deteriorate with exposure to extreme heat, chemical vapors, mechanical stress and thermal cycling.
- While insulating firebricks can be easily cut with any kind of saw, hardbricks require special equipment, like a tile cutting saw, to cut. Design your kiln to take full advantage of available shapes, and when possible to minimize the amount of hard bricks you have to cut.

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