larger size (4½ × 2½ × 9 in.), to be laid with a thin coating of refractory mortar in lieu of standard mortar joints. Fire clays typically burn to a white or buff color, so fire bricks are usually in this color range as well.

Glazed bricks are fired with ceramic coatings which fuse to the clay body in the kiln and produce an impervious surface in clear or color, matte or gloss finish. Most colors are fired at temperatures around 2100°F. The glaze, which is about the same consistency as thick house paint, is sprayed on the raw clay unit, and both are fired together. These are called single-fired glazed bricks and are covered by ASTM C1405, *Standard Specification for Glazed Brick* (*Single Fired, Solid Brick Units*). Requirements include unit strength and durability as well as properties of the glaze itself. Units are defined as Grade S (select) and Grade SS (select-sized, or ground edge), where a high degree of mechanical perfection, narrow color range, and minimum variation in size are required. Units may be either Type I, single-faced, or Type II, double-faced (opposite faces glazed). Type II units are generally special-order items and are not widely used. For weathering, units are designated as Exterior Class or Interior Class (*see Fig. 3-11*).

Some color glazes such as bright reds, primary yellows, burgundies, and oranges must be fired at lower temperatures, ranging from 1300 to 1800°F. A red glaze burns clear if it gets too hot because the cadmium and lead ingredients are not stable at high temperatures. This requires two firings. First the brick is fired at normal kiln temperatures, then the glaze is applied and the units are fired again at a low temperature. This two-fire process greatly increases the cost of the brick, and usually limits such colors to accents and specialty applications. Some low-fired glazes are prone to crazing because they are not as hard as high-fired glazes. Standards for *double-fired* glazed brick are outlined in ASTM C126, *Standard Specification for Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units.* Requirements cover compressive strength, imperviousness, chemical resistance, crazing, and limitations on distortion and dimensional variation. Durability and weather resistance are not covered, so for exterior use, the body of the brick should be specified to conform to the requirements for ASTM C216 face brick, Grade SW, Type FBX, with the glaze in accordance with ASTM C126 standards. Glazed brick may suffer severe freeze-thaw damage in cold climates if not adequately protected from moisture permeance, and is not recommended for copings or other horizontal surfaces in any climate. Units are manufactured in Grade S (select) and Grade SS (select sized, or ground edge), where a high degree of mechanical perfection, narrow color range, and minimum variation in size are required. Units may be either

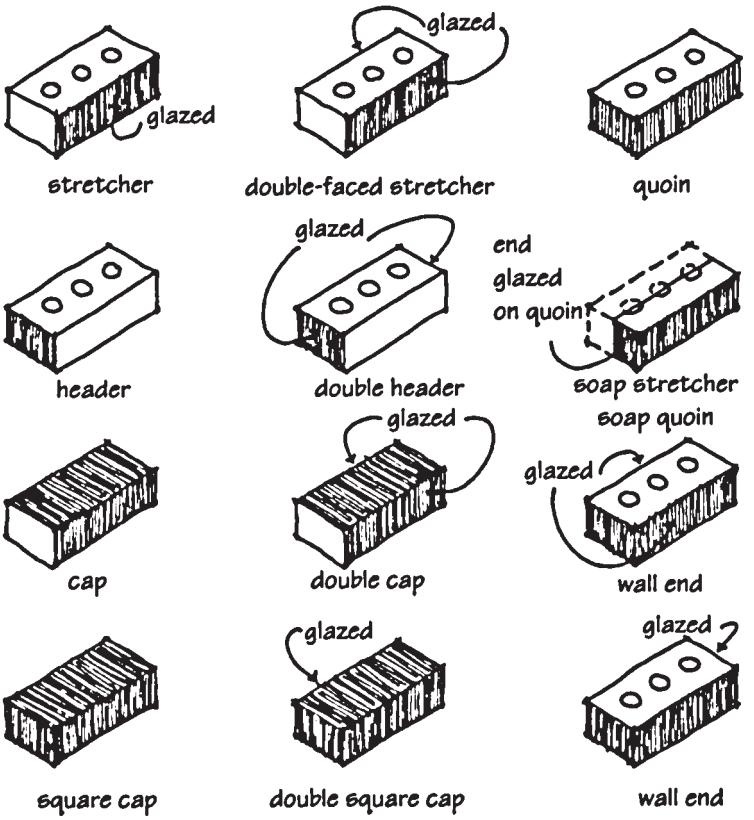
ASTM C1405 Physical Requirements

Class	Minimum Compressive Strength, Gross Area (psi)		Maximum Water Absorption by 24 hr. Cold, 7°	Maximum Saturation Coefficient	
	Average of 5 Brick	Individual Brick		Average of 5 Brick	Individual Brick
Exterior	6000	5000	7.0	0.78	0.80
Interior	3000	2500	–	–	–

Figure 3-11 ASTM C1405 glazed brick. (*Copyright ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428. Reprinted with permission.*)

Type I, single-faced, or Type II, double-faced (opposite faces glazed). Type II units are generally special-order items and are not widely used. Glazed brick is commonly available in several sizes, and in stretchers, jambs, corners, sills, and other supplementary shapes (*see Fig. 3-12*).

The naturally high abrasion resistance of ceramic clay products makes them very durable as paving materials. *Paving brick* is unique in color, pattern, and texture and is often specified as a wearing surface for roadways, walks, patios, drives, and interior floors. ASTM C902, *Standard Specification for Pedestrian and Light Traffic Paving Brick,* lists specific physical requirements. Three traffic uses



- **Type I** Single-faced units for general use where only one finished face will be exposed.
- **Type II** Two-faced units for general use where two opposite finished faces will be exposed.

- **Grade S** Select—For use with comparatively narrow mortar joints.
- **Grade SS** Select Sized or Ground Edge—For use where variation of face dimension must be very small.

- **Class** Exterior
- **Class** Interior

Figure 3-12 Glazed brick types, grades, and classes.