

- **ASTM C216 Facing Brick**
- **ASTM C652 Hollow Brick**
- **CSA A82 Fired Masonry Brick made from Clay or Shale**

Note: The Canadian (CSA) equivalent references are included in brackets behind the US (ASTM) references.

This specification covers brick intended for use in masonry, either as face brick or in structural applications. According to ASTM C216 (CSA A82), a solid brick can have core holes whose area is no more than 25% of the total bed surface of the brick. While 100% solid brick are normally available, most brick are manufactured with 25% core holes. ASTM C652 covers hollow brick which have core holes whose area is more than 25% of the total bed surface of the brick.

This profile covers many of the most important aspects of this specification. When a brick is specified by an architect, the specification identifies the brick's manufactured name, ASTM (CSA) specification number, the grade, the type and the brick's manufactured size. For example, a typical brick specification could be Hanson Brick #630 which meets ASTM C216 (CSA A82), grade SW, type FBS whose size is 2 1/4" by 3 1/2" by 7 5/8" (57mm x 90 mm x 190 mm) (modular size.)

The "grade" classifies the brick's ability to resist damage by freezing when wet. If the moisture inside a brick freezes, the water expands. If there are many cycles of freeze/thaw, the face of the brick may crack and fall off. There are two grades, SW severe weathering and MW moderate weathering. Grade SW is the most stringent and is normally required in most parts of the United States and Canada.

There are two physical properties of brick that are good predictors of the brick's ability to resist spalling or cracking of the face. These are the 24-hour cold water absorption of the brick and the saturation coefficient which is the ratio of the amount of cold water a submerged brick will absorb in 24 hours to the amount of boiling water a submerged brick will absorb in 5 hours.

The theory of the saturation coefficient is that if only part of the total pore space is occupied by water, there is room for expansion on freezing into the remaining pore space without disruption of the material. The smaller the saturation coefficient, normally the more durable the brick.

Compressive strength is the maximum weight the brick can support without breaking. For grade SW brick, the average compressive strength of 5 brick must exceed 3000 PSI (20.7 MPa) and the saturation coefficient cannot exceed .78.

There are two alternates if the average saturation coefficient exceeds .78. First, the cold water absorption of 5 brick cannot exceed 8.0%. Second, the brick must withstand 50 cycles of freeze/thaw testing.

A physical property of the brick which does not influence the durability of the brick but is measured is the initial rate of absorption, IRA. This property is measured to assist the mason in mortar selection and helps to determine if the brick require prewetting before installation to enhance the bond between the brick and the mortar. If the IRA of a brick exceeds 30 gm./min/30 sq. in., then ASTM C216/ASTM C652 (CSA A82) suggests that prewetting be done prior to installation. However, this is not a requirement.

The "type" of brick refers to the appearance. For ASTM C216, there are three type classifications: FBX, where the most precision is required; FBS, where average precision is required; and FBA, where non-uniformity in size and texture is permitted. There are several variables that are covered. The equivalent type classifications for ASTM C652 are HBX, HBS and HBA, respectively.

Chippage is another factor that is controlled by ASTM C216/ASTM C652 (CSA A82). The more restrictive the type, the smaller the allowable chip dimensions are permitted. Chips that are monitored can occur along the four edges or the corners. In addition, the more restrictive the type, the fewer the number of brick are allowed to have these defects and the smaller the allowable size of the chip. For FBS/HBS rough, 85% to 100% of the brick can have chips that are measured from an edge that range between 0 to 5/16" (0 to 8.0 mm) and measured from a corner that range between 0 to 1/2" (0 to 13.0 mm). No more than 15% of the brick can have chips that are measured from an edge that range between 5/16" to 7/16" (8.0 to 11.0 mm) and measured from a corner that range between 1/2" to 3/4" (13.0 to 19.0 mm). The cumulative length of the chips around the perimeter edges of face cannot exceed 10% of the perimeter length. ASTM C216/ASTM C652 (CSA A82) lists the allowable chippage size for all types.

Other than chips, the face or faces shall be free of cracks or imperfections when viewed from 15 feet (4.5 m) for FBX/HBX and 20 feet (6.1 m) for FBS/HBS and FBA/HBA. This implies that even if there are surface cracks, if the observer stands at 20 feet (6.1m) and the cracks are not visible then the brick is acceptable.

Size variations are also governed by ASTM C216/ASTM C652 (CSA A82) with FBX/HBX permitting smaller dimensional tolerances. The specifications list the permissible variations. These variations are plus or minus the specified dimension and are applied to each of the brick's three dimensions. For example a FBS/HBS brick that is specified as 7 5/8" (190 mm) long has a permissible variation of +/-1/4" (6 mm), which implies that the brick can be as short as 7 3/8" (184 mm) and as long as 7 7/8" (196 mm).

Finally, ASTM C216/ASTM C652 (CSA A82) indicates that once the brick has been installed the manufacturer is not responsible for chippage and size variations that exceed the allowable values in the code.