



Designation: **C 902 – 024**

Standard Specification for Pedestrian and Light Traffic Paving Brick¹

This standard is issued under the fixed designation C 902; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope*

1.1 This specification covers brick intended for use as paving material subjected to pedestrian and light vehicular traffic. The units are designed for use in pedestrian applications and vehicular areas that are subjected to low volumes of vehicular traffic, such as residential driveways and streets and commercial driveways (passenger drop-offs). The units are not intended to support heavy vehicular traffic covered by Specification C 1272 or for industrial applications covered by Specification C 410.

NOTE 1—Heavy vehicular traffic is defined as high volumes of heavy vehicles (trucks having 3 or more axles) in Specification C 1272.

1.2 The property requirements of this standard apply at the time of purchase. The use of results from testing of brick extracted from masonry structures for determining conformance or nonconformance to the property requirements (Section 4) of this specification is beyond the scope of this standard.

1.3 Brick are manufactured from clay, shale, or similar naturally occurring earthy substances and subjected to a heat treatment at elevated temperatures (firing). The heat treatment must develop sufficient fired bond between the particulate constituents to provide the strength and durability requirement of this specification (see firing, fired bond, and incipient fusion in Terminology C 43).

1.4 The brick are available in a variety of sizes, colors, and shapes. They are available in three classes according to exposure environment and three types according to type of traffic exposure.

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

¹ This specification is under the jurisdiction of ASTM Committee C15 on Manufactured Masonry Units and is the direct responsibility of Subcommittee C15.02 on Brick and Structural Clay Tile.

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*A Summary of Changes section appears at the end of this standard.

2. Referenced Documents

2.1 ASTM Standards:²

- C 43 Terminology of Structural Clay Products
- C 67 Test Methods of Sampling and Testing Brick and Structural Clay Tile
- C 88 Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
- C 410 Specification for Industrial Floor Brick
- C 418 Test Method for Abrasion Resistance of Concrete by Sandblasting
- C 1272 Specification for Vehicular Paving Brick

3. Classification

3.1 Light traffic paving brick are classified according to the severity of their use-environment. Two types of environment are considered: (1) weather and (2) traffic:

3.1.1 Weather:

3.1.1.1 *Class SX*—Brick intended for use where the brick may be frozen while saturated with water.

3.1.1.2 *Class MX*—Brick intended for exterior use where resistance to freezing is not a factor.

3.1.1.3 *Class NX*—Brick not intended for exterior use but which may be acceptable for interior use where protected from freezing when wet.

NOTE 2—A surface coating may be applied to any class of brick of this standard when protected from freezing while wet. The function of the coating is to prevent penetration of dirt or liquids into the pores of the brick. Coatings should be applied only after complete drying of the paving.

3.1.2 Traffic:

3.1.2.1 *Type I*—Brick subjected to extensive abrasion.

NOTE 3—Type I pavers would be used in such places as sidewalks and driveways in publicly occupied spaces.

3.1.2.2 *Type II*—Brick subjected to intermediate abrasion.

NOTE 4—Type II pavers would be used in such places as heavily traveled residential walkways and residential driveways.

3.1.2.3 *Type III*—Brick subjected to low abrasion.

NOTE 5—Type III pavers would be used in such places as floors or patios in single-family homes.

4. Physical Properties

4.1 *Freeze Thaw Resistance*—Use one of the following methods:

4.1.1 *Physical Property Requirements* —The brick shall conform to the physical requirements for the class specified as prescribed in Table 1.

4.1.1.1 *Absorption Alternative*—If the average water absorption is less than 6.0 % after 24-h submersion in room-temperature water, the requirement for saturation coefficient shall be waived.

4.1.2 *Freezing and Thawing Test Alternative* —The requirements for water absorption (24-h cold) and saturation coefficient specified in 4.1.1 shall be waived provided a sample of five brick, meeting all other requirements, passes the freezing and thawing test as described in the Rating section of the Freezing and Thawing procedures of Test Methods C 67 with no breakage and not greater than 0.5 % loss in dry weight of any individual unit.

NOTE 6—The 50 cycle freezing and thawing test is specified only as an alternative when brick do not conform to either Table 1 requirements for maximum water absorption and saturation coefficient, or to the restrictive absorption requirements in 4.1.1.1.

4.1.2.1 *Sulfate Soundness Test Alternative*—The requirements for water absorption (24-h cold) and saturation coefficient specified in 4.1.1 shall not be required if a sample of five brick survives 15 cycles of the sulfate soundness test in accordance with Sections 4, 5, and 8 of Test Method C 88 with no visible damage.

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*, Vol 04.05, volume information, refer to the standard's Document Summary page on the ASTM website.

TABLE 1 Freeze Thaw Resistance Property Requirements^A

Designation	Compressive Strength, flatwise, gross area, min, psi (MPa)		Cold Water Absorption, max, %		Saturation Coefficient, max ^B	
	Average of 5 Brick	Individual	Average of 5 Brick	Individual	Average of 5 Brick	Individual
Class SX	8000 (55.2)	7000 (48.3)	8.0	11.0	0.78	0.80
Class MX	3000 (20.7)	2500 (17.2)	14.0	17.0	no limit	no limit
Class NX	3000 (20.7)	2500 (17.2)	no limit	no limit	no limit	no limit

^A Minimum modulus of rupture values should be considered by the purchaser for uses of brick where support or loading may be severe.

^B The saturation coefficient is the ratio of absorption by 24-h submersion in room temperature water to that after 5-h submersion in boiling water.

NOTE 7—The sulfate soundness test is an optional substitute test for the freezing-and-thawing test (4.1.2).

4.1.3 *Performance Alternative*— If information on the performance of the units in a similar application of similar exposure and traffic is furnished by the manufacturer or his agent and is found acceptable by the specifier of the pavement material, or his agent, the physical requirements in 4.1.1 may be waived.

4.1.4 *Molded Brick (Soft Mud, Semi-Dry Pressed, and Dry Pressed Brick)*—The requirements listed in Table 1 shall be changed for molded brick to permit maximum absorption of 16.0 % average and 18.0 % individual, and minimum compressive strengths of 4000 psi (27.6 MPa) average and 3500 psi (24.1 MPa) individual for Class SX, provided that the requirements for saturation coefficient of Table 1 are met.

NOTE 8—The resistance of brick to weathering cannot be predicted with complete assurance at the present state of knowledge. There is no known test that can predict weathering resistance with complete accuracy.

Brick in general is superior in weathering resistance to other building materials. There are innumerable instances of satisfactory performance beyond 200 years and even into the thousands of years. Nevertheless, there are some brick that cannot survive a few winters of a severe freezing and thawing environment.

The durability requirements of the specification attempt to exclude such brick. This specification utilizes the best knowledge available at this time and is based on extensive research by several investigators. The durability requirements have an excellent correlation with in-use performance. Nevertheless, it is known that some brick that meet this specification may not be serviceable in severe climates. Furthermore, other brick that do not meet these specifications may show superior serviceability in the most severe climate. The best indication of brick durability is its service experience record.

~~4.2 Unless otherwise specified by the purchaser, brick of Classes SX and MX shall be accepted instead of Class NX, and Class SX shall be accepted instead of Class MX. Type I and Type II shall be accepted instead of Type III, and Type I shall be accepted instead of Type II.~~

~~4.3~~

4.2 *Abrasion Resistance* —The brick shall meet the requirements of either column (1) or (2) of Table 2 for the applicable traffic use (see 3.1.2).³

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TABLE 2 Abrasion Resistance Property Requirements^A

	(1) Abrasion Index, ^B max	(2) Volume Abrasion Loss, ^C max, cm ³ /cm ²
Type I	0.11	1.7
Type II	0.25	2.7
Type III	0.50	4.0

^A Select the sample according to the sampling procedure of Test Methods C 67. The brick shall meet the requirements of either column (1) or (2). The values listed shall not be exceeded by any individual unit within the sample.

^B The abrasion index is calculated from the cold absorption in percent and the compressive strength in pounds per square inch as follows:

$$\text{Abrasion index} = \frac{100 \times \text{absorption}}{\text{compressive strength}} \quad (1)$$

Compressive strength values are influenced by specimen shape (particularly the height to width ratio of the test specimen). Therefore, a shape is specified which conforms to the data on which the abrasion index is based.⁴

The compressive strength shall be determined on specimens measuring 3⁷/₈ by 2¹/₄ in. ± 1/4 in. (98 by 98 by 57 mm ± 6 mm) for length, width, and height respectively. The brick shall be without core holes, other perforations or frogs. Other shaped specimens may be used provided that the producer submits evidence acceptable to the purchaser that the change in shape gives equivalent strength results to those of the specified shape.

The abrasion resistance should be determined according to Column 2 in those cases where the procedural requirements for compressive strength cannot be met.

^C The volume abrasion loss shall be determined in accordance with Test Method C 418, with the following changes in procedure:

(1) The sand shall be a natural silica sand from Ottawa, IL, graded to pass a No. 50 (300-µm) sieve and retained on a No. 100 (150-µm) sieve.

(2) The test shall be run on dry brick.

(3) The duration of the test shall be 2 min.

(4) The rate of sand flow shall be 400 g/min.

(5) The volume loss shall be determined by filling the abraded depression with modeling clay, striking off level with the original surface of the brick, and removing and weighing the modeling clay. The volume loss shall be calculated from the bulk density of the modeling clay. The bulk density shall be determined on each lot of modeling clay.

An alternative method of determining the weight of clay used in filling the sand-blast cavity is to determine the weight of the modeling clay sample before and after filling the cavity.

NOTE 9—Skid/slip resistance should be considered by the purchaser for uses of brick where pedestrian traffic is anticipated. Methods of testing this characteristic are under study and it is hoped that a specification for this property can be added in future revisions of this standard when suitable test methods are developed.

5. Efflorescence

5.1 Brick are not required to be tested for efflorescence to comply with this specification unless requested by the specifier or purchaser. When the efflorescence test is requested by the specifier or purchaser, the brick shall be sampled at the place of manufacture, and tested in accordance with Test Methods C 67, and a rating for efflorescence shall be “not effloresced.” If the rating for efflorescence is “effloresced,” the brick represented by the testing do not meet the efflorescence requirements of this specification.

6. Size

6.1 The size of the brick shall be as specified by the purchaser or produced by the manufacturer as a stock item.

6.2 The tolerances on dimension and warpage shall depend on the application specified. When the application is not specified, the requirements for Application PS shall govern.

6.2.1 *Application PS*—Paving brick intended for general use and installed with a mortar joint between individual units, or in an installation without mortar joints between units when they are laid in running or other bonds not requiring extremely close dimensional tolerances.

6.2.2 *Application PX*—Paving brick intended for installation without mortar joints between the units, where exceptionally close dimensional tolerances are required as a result of special bond patterns or unusual construction requirements.

6.2.3 *Application PA*—Paving brick manufactured and selected to produce characteristic architectural effects resulting from nonuniformity in size, color, and texture of individual units. (The textures may exhibit inclusion of nonuniform nodules of mineral substances or purposely introduced cracks that enhance the appearance of the units.) The requirements on warpage and dimensional tolerances as specified in 6.3 and 6.4 do not apply to this application.

6.3 *Dimensional Tolerance*—Brick shall not depart from the specified size by more than the individual tolerance for the application specified as prescribed in Table 4.

6.4 *Warpage*—The concave and convex warpage (distortion) of any face intended to be the exposed surface or edge of the paving shall not exceed the values of Table 3 when sampled and measured in accordance with Test Methods C 67.

7. Visual Inspection

7.1 The brick shall be free of cracks or other imperfections detracting from the appearance of a designated sample when viewed from a distance of 15 ft (4.6 m) for Application PX and a distance of 20 ft (6 m) for Application PS.

7.2 The parts of the brick that will be exposed in place shall be free of chips that exceed the limits given in Table 5.

7.3 Unless otherwise agreed upon by the purchaser and the seller, a delivery of brick shall contain not more than 5 % brick that do not meet the combined requirements of Tables 4-5, including broken brick.

7.4 After brick are placed in usage the manufacturer or the manufacturer’s agent shall not be held responsible for compliance of brick with the requirements of this specification for chippage and dimensional tolerances.

8. Sampling and Testing

8.1 The brick shall be sampled and tested in accordance with applicable sections in Test Methods C 67.

8.2 The manufacturer or the seller shall furnish specimens for tests without charge. The place or places of selection shall be designated when the purchase order is placed.

NOTE 10—Unless otherwise specified in the purchase order, the cost of the tests is typically borne as follows: If the results of the tests show that the brick do not conform to the requirements of this specification, the cost is typically born by the seller. If the results of the tests show that the brick do conform to the requirements of the specification, the cost is typically borne by the purchaser.

9. Keywords

9.1 brick; fired masonry unit; light traffic; paving; pedestrian traffic

³McBurney, J. W., Brink, R. H., Eberle, A. R., “Relation of Water Absorption and Strength of Brick to Abrasive Resistance,” *Proceedings, ASTM Standards*, Vol 04.02: 40, 1940, pp. 1143–1151.

TABLE 3 Tolerances on Distortion

Specified Dimension in. (mm)	Permissible Distortion, max in. (mm)	
	Application PX	Application PS
8 (203) and under	1/16 (1.6)	3/32 (2.4)
Over 8 (203) to 12 (305)	3/32 (2.4)	1/8 (3.2)
Over 12 (305) to 16 (406)	1/8 (3.2)	5/32 (4.0)

TABLE 4 Tolerances on Dimensions

Dimension, in. (mm)	Maximum Permissible Variation from Specified Dimension, plus or minus in. (mm)		
	Application PS	Application PX	Application PA
3 (76) and under	1/8 (3.2)	1/16 (1.6)	no limit
Over 3 to 5 (76 to 127) incl	3/16 (4.7)	3/32 (2.4)	no limit
Over 5 to 8 (127 to 203) incl	1/4 (6.4)	1/8 (3.2)	no limit
Over 8 (203)	5/16 (7.9)	7/32 (5.6)	no limit

TABLE 5 Maximum Permissible Extent of Chippage from Edges and Corners

NOTE—The aggregate length of chips on a single unit shall not exceed 10 % of the perimeter of the exposed face of the brick.

Application	Chippage in Inches (Millimetres) in from	
	Edge	Corner
PS	5/16 (7.9)	1/2 (12.7)
PX	1/4 (6.4)	3/8 (9.5)
PA	as specified by purchaser	

SUMMARY OF CHANGES

Committee C15 has identified the location of selected changes to this standard since the last issue (C 902-01a2) that may impact the use of this standard.

- (1) Prior paragraph 4.2 was removed. It accepted a higher Class instead of lower Class and higher Type instead of lower Type.
- (2) In Table 1, a footnote to consider modulus of rupture was deleted.

Committee C15 has identified the location of selected changes to this standard since the last issue (C 902-01a) that may impact the use of this standard.

- (1) Paragraphs 6.2 through 6.3 were revised to clarify the intent of the tolerance requirements.

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