Designation: A823 – 99 (Reapproved 2023)

Standard Specification for Statically Cast Permanent Mold Gray Iron Castings[1]

This standard is issued under the fixed designation A823; 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 gray iron castings that are statically cast in permanent molds.

1.2 No precise quantitative relationship can be stated between the properties of the iron in various locations of the same casting or between the properties of a casting and those of a test specimen cast from the same iron (see Appendix X1).

1.3 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

A247 Test Method for Evaluating the Microstructure of Graphite in Iron Castings

A644 Terminology Relating to Iron Castings

E8/E8M Test Methods for Tension Testing of Metallic Materials

E10 Test Method for Brinell Hardness of Metallic Materials

2.2 *Federal Standard:*[3]

Fed. Std. No. 123 Marking for Shipment

2.3 *Military Standard:*[3]

MIL-STD-129 Marking for Shipment and Storage

3. Terminology

3.1 Definitions for many terms common to iron castings are found in Terminology A644. A classification of graphite structure is found in Test Method A247.

4. Classification

4.1 Castings ordered and produced under this specification are classified into a number of grades based on the properties of separately cast test bars. The test bar shall be selected on the basis of the controlling section size of the casting (see 9.1 and 9.2 and Table 1).

4.2 Castings may be produced in the as-cast state provided the requirements of this standard in Table 1 are met. However, annealing or normalizing heat treatments are usual and customary and are a basis for classification.

4.3 The grades are designated A for annealed or N for normalized. This is followed by an S or a C to designate a solid or a cored casting, followed by an A, B, C, or S to designate the test bar to be poured with the castings. Examples of proper designations are as follows:

Permanent Mold Castings, ASTM Specification A823, Grade N-SB

Permanent Mold Castings, ASTM Specification A823, Grade A-CC

5. Ordering Information

5.1 Orders for material to this specification shall include the following information:

5.1.1 ASTM designation number and year of issue.

5.1.2 Grade of iron required (see Section 4 and Table 1).

5.1.3 The size of the separately cast test bar (letter classification A, B, C, or S) which best represents the thickness of the controlling section of the casting (see 4.1 and Table 2).

5.1.4 Location for Brinell Hardness determination (see 10.1.1).

5.1.5 Lot size (see Section 16).

5.1.6 Special requirements (see Section 17).

5.1.7 Special preparation for delivery (see Section 22).

5.1.8 Saving tested specimens or unbroken test bars (see 19.1.1).

[1] This specification is under the jurisdiction of ASTM Committee A04 on Iron Castings and is the direct responsibility of Subcommittee A04.01 on Grey and White Iron Castings.

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

[3] Available from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098, http://www.dodssp.daps.mil.

TABLE 1 Permanent Mold Gray Iron Specifications

Grade	Tensile Strength, min, ksi (MPa)[A]	BHN
	Uncored—Annealed	
A-SA	30 000 (207)	163–207
A-SB	25 000 (172)	163–207
A-SC	20 000 (138)	163–207
A-SS	18 000 (124)	143–207
	Cored—Annealed	
A-CA	30 000 (207)	143–207
A-CB	25 000 (172)	143–207
A-CC	20 000 (138)	143–207
	Uncored—Normalized	
N-SA	30 000 (207)	170–229
N-SB	25 000 (172)	170–229
N-SC	20 000 (138)	170–229
N-SS	18 000 (124)	149–229
	Cored—Normalized	
N-CA	30 000 (207)	170–229
N-CB	25 000 (172)	149–229
N-CC	20 000 (138)	149–229

[A] Refer to Fig. X1.1 for the relationship between tensile strength and section size.

TABLE 2 Diameters and Lengths of Cast Test Bars

Test Bar	As-Cast Diameter, in. (mm)[A]			Length, in. (mm)	
	Nominal (Mid-Length)	Minimum (Bottom)	Maximum (Top)	Minimum (Specified)	Maximum (Recommended)
A	0.88 (22.4)	0.85 (21.6)	0.96 (24.4)	5.0 (125)	6.0 (150)
B	1.20 (30.5)	1.14 (29.0)	1.32 (33.5)	6.0 (150)	9.0 (230)
C	2.00 (50.8)	1.90 (48.3)	2.10 (53.3)	7.0 (175)	10.0 (255)
S[B]	. . .	. . .	. . .	. . .	. . .

[A] The diameter is the controlling section for the appropriate permanent mold specification (see Section 9).
[B] All dimensions of test bar S shall be agreed upon by the manufacturer and the purchaser.

6. Chemical Composition

6.1 The chemical composition shall be such as to produce the mechanical properties required by this specification. As a reference, typical compositions covering all grades are shown in Table X1.1 in Appendix X1.

6.2 By agreement between the manufacturer and purchaser, chemical composition requirements may be specified.

7. Heat Treatment

7.1 Although castings may be provided in the as-cast condition, when necessary, heat treatment shall be such as to produce the mechanical properties required in this standard.

8. Tensile Requirements

8.1 Test bars representing castings conforming to this specification shall meet the requirements for tensile strength described in Table 1.

9. Cast Test Bars

9.1 Test bars shall be separate castings poured from the same iron as the castings they represent and shall have dimensions as shown in Table 2. Allowance may be made for reasonable pattern draft within the tolerances shown in Table 2. Test bars A, B, and C are all standard test bars in the form of simple cylinders. Test bar S is special and is intended for use where the controlling section of the casting is over 2 in.

9.2 The test bar selected shall be based on the controlling section size of the casting. This shall be determined by the dimensions of the largest cylinder that will fit into the controlling section of the casting with the additional requirement that the height of the cylinder must be at least equal to its diameter.

9.3 The test bars shall be cast in a permanent mold. The mold shall be of similar material, design, and construction as that used to make the production castings. The test bar permanent mold shall be preheated with three consecutive pours, after which, starting with the fourth pour, the bars can be used for the tension test. A suitable design for a mold is shown in Fig. 1.

9.4 By specific agreement between the manufacturer and the purchaser, test bars removed from the castings may be substituted for separately cast test bars. The location from which the bars are taken shall be as agreed between the parties and indicated on the casting drawing or database equivalent.

9.5 Where test specimens are to represent heat-treated castings, they shall accompany the castings in the same heat-treat lot(s), or by agreement be subjected to the same thermal cycle that the castings undergo.

10. Hardness Requirements

10.1 Brinell hardness readings taken on the castings shall conform to the requirements in Table 1.

10.1.1 The area or areas on the castings where the hardness is to be determined shall be established by agreement between manufacturer and purchaser and shall be shown on the casting drawing.

10.1.2 Brinell hardness shall be determined in accordance with Test Method E10. Sufficient surface material shall be removed (generally 0.010 to 0.030 in.) to ensure that the measured hardness is representative of the basic iron structure.

10.1.3 Brinell hardness measurements shall be undertaken at room temperature, defined as 50 to 95 °F (10 to 35 °C).

11. Dimensional Requirements

11.1 The castings shall conform to the dimensions or drawings furnished by the purchaser, or, if there are no drawings, to the dimensions predicted by the pattern equipment supplied by the purchaser.

12. Workmanship and Finish

12.1 The surface of the casting shall be inspected visually, particularly in critical areas, for such surface defects as cracks, hot tears, adhering sand and scale, cold shuts, and gas holes.

12.2 No repairing by plugging or welding of any kind shall be permitted unless written permission is granted by the purchaser.

13. Number of Tests and Retests

13.1 The manufacturer shall cast and prepare at least three test bars for each lot of castings intended to conform to this specification. The manufacturer shall conduct the specified tests unless the manufacturer and purchaser agree that the tests shall be made by another qualified laboratory. Only one bar