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Standard Specification for Gray Iron Castings for Elevated Temperatures for Non-Pressure Containing Parts[1]

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1. Scope

1.1 This specification covers three classes of gray iron suitable for castings exposed to temperatures encountered in such service as grate bars, stoker links, stoker parts, oil still furnace parts, firebox parts, ingot molds, glass molds, caustic pots, and metal melting pots.

NOTE 1—This specification is general, covering cast irons normally used for the above types of service, at temperatures as high as 1400°F (760°C). It is not intended to imply that all three classes are suitable throughout this entire temperature range without regard to actual service stresses. Some are suitable for long service at the lower temperatures only, unless low stresses are involved.

1.2 The three classes of gray iron covered by this specification are as follows:

1.2.1 *Class I*, possessing superior resistance to thermal shock,

1.2.2 *Class II*, possessing average resistance to thermal shock and a moderately good tensile strength (tensile strengths above 30 000 psi (207 MPa) may be expected), and

1.2.3 *Class III*, possessing a higher tensile strength than either Classes I or II (tensile strengths as high as 40 000 psi (276 MPa) may be expected).

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

2. Referenced Documents

2.1 *ASTM Standards:* [2]

A 48/A 48M Specification for Gray Iron Castings

3. Manufacture

3.1 The melting procedure shall be optional with the foundry.

4. *Physical Requirements* Physical Requirements

4.1 Some of the gray cast irons described in this specification are deliberately made of a soft, low-strength iron for resistance to thermal shock, and strength requirements are unnecessary. For applications in which a strength requirement is essential, room temperature tensile strengths may be specified up to those prescribed for Class 40 in Specification A 48.

5. Machinability

5.1 All machinable castings shall be limited in hardness at such locations on the castings as designated by the purchaser. The maximum hardness at the locations on castings that are to be machined shall be a matter of agreement between the manufacturer and the purchaser.

6. Chemical Composition

6.1 It is the intention of this specification to classify these irons in accordance with their carbon content equivalent calculated as follows:

$$\text{Carbon content equivalent} = C + 0.3\,(Si + P) \quad (1)$$

where:

C = carbon content, %,
Si = silicon content, %, and
P = phosphorus content, %,

6.2 The carbon content equivalent and the minimum carbon content for the various classes shall be as prescribed in Table 1. Table 2 prescribes the allowable silicon ranges predicated on the basis of various permissible carbon contents. It is recommended that embrittling impurities be held to the following maximum limits:

Phosphorus, max, %	0.60
Sulfur, max, %	0.15

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

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TABLE 1 Chemical Requirements

Class	Carbon Content Equivalent	Carbon, min, %
I	3.81–4.40	3.50
II	3.51–4.10	3.20
III	3.20–3.80	2.80

TABLE 2 Variations in Carbon and Silicon Contents

Class	Carbon, %	Silicon, %
I	3.50	0.90–2.70
	3.70	0.90–2.10
	3.90	0.90–1.50
II	3.20	0.90–2.70
	3.40	0.90–2.10
	3.50	1.80 max
III	2.80	1.20–2.70
	3.00	0.60–2.40
	3.20	0.60–1.80

6.3 The three basic classes may be alloyed with chromium. When chromium is present as an alloying element, each class shall be subdivided into types designated as follows:

Type	Chromium, %
A	0.20–0.40
B	0.41–0.65
C	0.66–0.95
D	0.96–1.20

6.4 All irons may be alloyed to increase the strength and to improve and stabilize the structure for elevated-temperature service. The alloying elements, which, in addition to chromium, are commonly added to improve these properties, are copper, molybdenum, nickel, and vanadium. Any combination of these alloying elements that assists in resisting oxidation or surface deterioration or in stabilizing the structure or retaining strength at elevated temperatures, may be used.

NOTE 2—The provisions of this specification permit the purchaser to select a grade of cast iron suitable for his service and to define the product as, for example:

Castings Class II, Type B, plus |Cz|Cz alloys. All surfaces marked "f" (for finish) with HBN 250, max.

7. Product Analysis

7.1 When alloying elements are agreed upon between the manufacturer and the purchaser, the purchaser may make check analyses from any casting, test bar, or lot of castings delivered under this specification. Results of such analyses shall be in accordance with the limits agreed upon.

8. Workmanship, Finish, and Appearance

8.1 The castings shall conform substantially to the dimensions on drawings furnished by the purchaser or to the dimensions predicated by the pattern supplied by the purchaser, if no drawing has been provided. The castings shall be free from injurious defects. Surfaces of the castings shall be free from burnt-on sand and shall be reasonably smooth. Runners, risers, fins, and other cast-on pieces shall be removed. In other respects the castings shall conform to whatever points may be specially agreed upon between the manufacturer and the purchaser.

9. Inspection

9.1 The inspector representing the purchaser shall have free entry, at all times while work on the contract of the purchaser is being performed, to all parts of the manufacturer's works that concern the manufacture of the material ordered. The manufacturer shall afford the inspector, without charge, all reasonable facilities to satisfy him that the material is being furnished in accordance with this specification. All tests and inspection shall be made at the place of manufacture prior to shipment, unless otherwise specified, and shall be so conducted as not to interfere unnecessarily with the operation of the works.

10. Rejection

10.1 Failure to meet the requirements of Section 7 or of physical tests, when required, shall be sufficient cause for rejection as defective castings.

11. Certification

11.1 Upon request of the purchaser, the manufacturer shall furnish a statement that the inspection and all of the tests have been made as specified; this statement shall contain the results of all specified tests.

12. Keywords

12.1 chemical composition; elevated temperature; gray iron; iron castings; non-pressure containing; tensile strength

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