



Standard Specification for Automotive Malleable Iron Castings¹

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1. Scope

1.1 This specification covers castings of ferritic, pearlitic, tempered pearlitic, and tempered martensitic grades of malleable iron used in the products of the automotive and allied industries. Castings shall be heat treated to meet this specification.

1.2 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for information only.

2. Referenced Documents

2.1 ASTM Standards:²

E 10 Test Method for Brinell Hardness of Metallic Materials

3. Grades

3.1 The specified grades with required hardness range and final heat treatment are shown in Table 1.

3.2 The foundry may also produce Grades M4504 and M5003 by liquid quenching and tempering or alloying, or both.

4. Hardness

4.1 The foundry shall exercise the necessary controls and inspection procedures to ensure compliance with the specified hardness range. Hardness readings shall be taken in accordance with Test Method E 10 after sufficient material has been removed from the casting surface to ensure representative hardness readings. The area or areas on the casting where hardness is to be checked shall be established by agreement between supplier and purchaser and shown on the drawing.

5. Microstructure Requirements

5.1 Grade M3210 Ferritic Malleable Iron:

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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.

TABLE 1 Grades of Malleable Iron

Grade	Casting Hardness Range	Heat Treatment
M3210	156 HB max 4.8 BID ^A min	annealed
M4504	163–217 HB 4.7–4.1 BID ^A	air quenched and tempered
M5003	187–241 HB 4.4–3.9 BID ^A	air quenched and tempered
M5503	187–241 HB 4.4–3.9 BID ^A	liquid quenched and tempered
M7002	229–269 HB 4.0–3.7 BID ^A	liquid quenched and tempered
M8501	269–302 HB 3.7–3.5 BID ^A	liquid quenched and tempered

^A Brinell impression diameter (BID) is the diameter in millimetres of the impression of a 10-mm ball at 3000-kg load.

5.1.1 The microstructure of Grade M3210 malleable iron shall consist of temper-carbon nodules distributed in a matrix of ferrite.

5.1.2 Because of reaction with the annealing furnace atmosphere, some depletion of carbon and silicon occurs at the surface of the castings. This usually results in a rim which can consist of coarse lamellar pearlite underlying a graphite-free ferritic surface layer. If the pearlite layer is excessive, it can result in poor machinability. The rim, therefore, shall not exceed a depth greater than 0.050 in. (1.27 mm) as measured from the casting surface.

5.1.3 The area below the rim can contain some pearlite; however, it shall not exceed the amount shown in Fig. 1.

5.2 Grades M4504, M5003, M7002, and M8501:

5.2.1 The microstructure of these other grades of malleable iron shall consist of temper-carbon nodules distributed in a matrix of ferrite and lamellar pearlite or tempered pearlite in air-quenched castings or a matrix of tempered martensite in the case of liquid-quenched castings.

5.2.2 Because of reaction with the annealing furnace atmosphere, some depletion of carbon and silicon occurs at the surface of the castings. This usually results in a rim which can consist of a graphite-free layer sometimes containing more or less combined carbon than the underlying material.

5.3 All grades shall be free of primary graphite.

5.4 All grades shall not exceed 2 % spheroidal primary carbides in the microstructure.