



SURFACE VEHICLE STANDARD

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Automotive Ductile Iron Castings for High Temperature Applications

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1. **Scope**

This SAE Standard covers the hardness, chemical analysis and microstructural requirements for ductile iron castings intended for high temperature service in automotive and allied industries. Commonly known as SiMo ductile iron, typical applications are in piston-engine exhaust manifolds and turbocharger parts. Castings may be specified in the as-cast or heat treated condition.

For design purposes, the Appendix provides general information on the application of high temperature ductile iron castings, their processing conditions, chemical composition, mechanical properties and microstructure.

2. **References**

2.1 **Applicable Publications**

The following publications form a part of this specification to the extent specified herein. Unless otherwise specified, the latest issue of SAE publications shall apply.

2.1.1 SAE PUBLICATIONS

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J417—Hardness Tests and Hardness Number Conversions
SAE J434—Automotive Ductile (Nodular) Iron Castings

2.1.2 ASTM PUBLICATIONS

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM A 247—Test Method for Evaluating the Microstructure of Graphite in Iron Castings
ASTM A 439—Austenitic Ductile Iron Castings
ASTM A 536—Standard Specification for Ductile Iron Castings
ASTM E 10—Test Method for Brinell Hardness of Metallic Material
ASTM E 351—Chemical Analysis of Cast Iron - All Types
ASTM E 1999—Analysis of Cast Iron by Optical Emission Spectrometry

2.2 Related Publications

The following publications are provided for information purposes only and are not a required part of this document.

2.2.1 SAE PUBLICATION

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J2515—High Temperature Materials for Exhaust Manifolds [See especially the comprehensive bibliography therein.]

2.2.2 ASM PUBLICATIONS

Available from ATTN: MSC/Book Order, ASM International, PO Box 473, Novelty, OH 44072-9901.

Metals Handbook, Vol. 1 & 15, 10th Ed. 1990 & 1988. ASM International, Materials Park, OH, J.R. Davis (ed.); ASM Specialty Handbook - Cast Irons, 1996. ASM International, Materials Park, OH

2.2.3 ASTM PUBLICATION

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

STP-455—Gray, Ductile, and Malleable Iron Castings Current Capabilities

2.2.4 IRON CASTING PUBLICATION

Iron Castings Handbook, 2nd edition, 1981. Iron Castings Society, Cleveland, OH.

2.2.5 OTHER PUBLICATIONS

H.D. Angus; Cast Iron: Physical and Engineering Properties, 2nd Ed. 1976. BCIRA, Birmingham, UK
R. Elliott; Cast Iron Technology, 1988. Butterworth & Co., London, UK
Data Handbook for Ductile Cast Irons, 1997. Castings Development Centre, Sheffield, UK

3. Grades

The specified grades, chemical analysis requirements and casting hardness ranges are shown in Table 1.

TABLE 1—GRADES OF HIGH TEMPERATURE DUCTILE IRON

GRADE	Casting Hardness, HB	Silicon, %	Molybdenum, %
1	187 - 241	3.50 - 4.50	0.50 maximum
2	187 - 241	3.50 - 4.50	0.51 - 0.70
3	196 - 269	3.50 - 4.50	0.71 - 1.00