

STEEL CASTINGS, SAND
0.80Cr - 1.8Ni - 0.35Mo (0.28 - 0.36C) (SAE 4330 Modified)
Annealed

UNS J23260

1. SCOPE:

1.1 Form: This specification covers a low-alloy steel in the form of sand castings.

1.2 Application: Primarily for light-to-medium-section castings requiring heat treatment to tensile strengths of 180,000 psi (1240 MPa) and higher.

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications shall apply. The applicable issue of other documents shall be as specified in AMS 2350.

2.1 SAE Publications: Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096.

2.1.1 Aerospace Material Specifications:

AMS 2350 - Standards and Test Methods

AMS 2360 - Room Temperature Tensile Properties of Castings

AMS 2369 - Quality Assurance Sampling of Carbon and Low-Alloy Steel Castings

AMS 2635 - Radiographic Inspection

AMS 2640 - Magnetic Particle Inspection

AMS 2645 - Fluorescent Penetrant Inspection

AMS 2694 - Repair Welding of Aerospace Castings

AMS 2804 - Identification, Castings

2.2 ASTM Publications: Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

ASTM A370 - Mechanical Testing of Steel Products

ASTM E350 - Chemical Analysis of Carbon Steel, Low-Alloy Steel, Silicon Electrical Steel, Ingot Iron, and Wrought Iron

ASTM E446 - Reference Radiographs for Steel Castings up to 2 in. (51 mm) in Thickness

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2.3 U.S. Government Publications: Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

2.3.1 Military Specifications:

MIL-H-6875 - Heat Treatment of Steel, Process for

2.3.2 Military Standards:

MIL-STD-794 - Parts and Equipment, Procedures for Packaging and Packing of

3. TECHNICAL REQUIREMENTS:

3.1 Composition: Shall conform to the following percentages by weight, determined by wet chemical methods in accordance with ASTM E350 or by spectrochemical or other analytical methods approved by purchaser:

	min	max
Carbon	0.28	0.36
Manganese	0.60	1.00
Silicon	0.50	0.90
Phosphorus	--	0.025
Sulfur	--	0.025
Chromium	0.65	1.00
Nickel	1.65	2.00
Molybdenum	0.30	0.45
Copper	--	0.35

3.2 Condition: Annealed.

3.3 Castings: A melt shall be the metal poured from a single furnace charge. A lot shall be all castings poured from a single melt, heat treated in the same furnace load, and presented for vendor's inspection at one time.

3.4 Test Specimens:

3.4.1 Chemical Analysis Specimens: Shall be of any convenient size, shape, and form.

3.4.2 Tensile Specimens: Shall be attached to castings, if practicable, or shall be standard keel blocks conforming to ASTM A370, unless purchaser permits use of cast-to-size specimens. Specimens shall be cast with each melt of metal for castings and, when requested, shall be supplied with the castings. Keel blocks shall be cast in molds made of suitable core sand, shall be poured directly after pouring the castings, and shall be kept in the mold until black. Metal for the specimens shall be part of the melt which is used for the castings.

3.5 Heat Treatment: Castings and separately-cast tensile specimens shall be annealed by heating to $1550^{\circ}\text{F} + 25$ ($845^{\circ}\text{C} + 15$) in an atmosphere neutral to the specified carbon range, holding at heat for not less than 1 hr, and cooling as required. Furnace surveys and calibration of temperature controllers and recorders shall be in accordance with MIL-H-6875 or with a survey and calibration program certified by the vendor as meeting the intent of MIL-H-6875.

3.6 Properties: Castings and separately-cast tensile specimens shall conform to the following requirements as applicable; hardness and tensile testing shall be performed in accordance with ASTM A370:

3.6.1 Castings As Annealed:

3.6.1.1 Hardness: Shall be not higher than 30 HRC, or equivalent.

3.6.1.2 Carburization or Decarburization: The carbon content shall be within the limits of 3.1 throughout the casting except that within 0.020 in. (0.50 mm) of the surface or 10% of wall thickness, whichever is smaller, the carbon content may be lower than specified in 3.1 provided all other specified properties are met.

3.6.2 After Hardening and Tempering: Separately-cast tensile specimens produced in accordance with 3.4.2 and castings shall meet the following requirements after being hardened by heating to $1575^{\circ}\text{F} + 25$ ($855^{\circ}\text{C} + 15$), holding at heat for not less than 30 min., and quenching in oil, and double tempered by heating to $750^{\circ}\text{F} + 15$ ($400^{\circ}\text{C} + 8$), holding at heat for $2\text{ hr} \pm 0.25$, and cooling in air after each tempering operation:

3.6.2.1 Tensile Properties of Separately-Cast Specimens:

Tensile Strength, min	180,000 psi (1240 MPa)
Yield Strength at 0.2% Offset, min	160,000 psi (1105 MPa)
Elongation in 4D, min	5%

3.6.2.2 Castings:

3.6.2.2.1 Hardness: Shall be 40 - 45 HRC, or equivalent.

3.6.2.2.2 Tensile Properties: When specified on the drawing or when agreed upon by purchaser and vendor, tensile specimens conforming to ASTM A370 shall be machined from castings selected at random from each lot. Size, location, and number of such specimens and required properties shall be as shown on the drawing or as agreed upon by purchaser and vendor and may be defined as specified in AMS 2360.

3.7 Quality:

3.7.1 Castings, as received by purchaser, shall be uniform in quality and condition, sound, and free from foreign materials and from imperfections detrimental to usage of the castings.