



# AEROSPACE MATERIAL SPECIFICATION

## AMS 5351C

Superseding 5351B

Society of Automotive Engineers, Inc.  
400 COMMONWEALTH DRIVE, WARRENDALE, PA. 15096

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### STEEL CASTINGS, SAND, CORROSION AND MODERATE HEAT RESISTANT 13Cr

#### 1. SCOPE:

- 1.1 Form: This specification covers a corrosion and moderate heat resistant steel in the form of sand castings.
- 1.2 Application: Primarily for parts, such as compressor housings, requiring oxidation resistance up to 1000° F (538° C) but useful at the higher temperatures only when stresses are low.

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

- 2.1 SAE Publications: Available from Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, Pennsylvania 15096.

##### 2.1.1 Aerospace Material Specifications:

- AMS 2350 - Standards and Test Methods
- AMS 2635 - Radiographic Inspection
- AMS 2640 - Magnetic Particle Inspection
- AMS 2645 - Fluorescent Penetrant Inspection
- AMS 2804 - Identification, Castings

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

- ASTM E10 - Brinell Hardness of Metallic Materials
- ASTM E18 - Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials
- ASTM E353 - Chemical Analysis of Stainless, Heat-Resisting, Maraging, and Other Similar Chromium-Nickel-Iron Alloys

- 2.3 Government Publications: Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, Pennsylvania 19120.

##### 2.3.1 Federal Standards:

- Federal Test Method Standard No. 151 - Metals; Test Methods

#### 3. TECHNICAL REQUIREMENTS:

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3.1 Composition: Shall conform to the following percentages by weight, determined by wet chemical methods  
 ∅ in accordance with ASTM E353, by spectrographic methods in accordance with Federal Test Method Standard No. 151, Method 112, or by other approved analytical methods:

	min	max
Carbon	--	0.15
Manganese	--	1.00
Silicon	--	1.50
Phosphorus	--	0.04
Sulfur	--	0.04
Chromium	11.50 - 14.00	
Nickel	--	1.00
Molybdenum	--	0.50
Copper	--	0.50

3.2 Condition: Normalized and tempered.

∅ 3.3 Casting: A melt shall be the metal poured from a single furnace charge.

3.4 Test Specimens: Chemical analysis specimens shall be of any convenient size, shape, and form for  
 ∅ vendor's tests. When chemical analysis specimens are required by purchaser, specimens shall be cast to a size, shape, and form agreed upon by purchaser and vendor.

3.5 Heat Treatment: Castings shall be normalized by heating to  $1850^{\circ}\text{F} + 25$  ( $1010^{\circ}\text{C} + 14$ ), holding at heat for not less than 1 hr per inch (25 mm) of maximum section thickness but in no case less than 30 min., and cooling in air and tempered by heating to a temperature not lower than  $1100^{\circ}\text{F}$  ( $593^{\circ}\text{C}$ ), holding at heat for the proper time to produce the specified hardness, and cooling in air.

3.6 Properties: Castings shall conform to the following requirements.

∅ 3.6.1 Hardness: 217 - 248 HB or equivalent, determined in accordance with ASTM E10.

3.6.2 Response to Heat Treatment: Specimens from castings 0.375 in. (9.53 mm) and under in section thickness  
 ∅ and 0.375-in.  $+ 0.010$  (9.52-mm  $+ 0.25$ ) thick specimens cut from thicker sections of a casting shall have hardness of 35 - 45 HRC or equivalent, determined in accordance with ASTM E18, after being heated to  $1750^{\circ}\text{F} + 10$  ( $954.4^{\circ}\text{C} + 5.6$ ), held at heat for 15 - 45 min., and cooled in still air.

3.7 Quality:

3.7.1 Castings shall be uniform in quality and condition, sound, and free from foreign materials and from  
 ∅ internal and external imperfections detrimental to fabrication or to performance of parts. Castings shall have smooth surfaces and shall be well cleaned. Metallic shot or grit shall not be used for final cleaning, unless otherwise permitted.

3.7.2 Castings shall be produced under radiographic control, unless otherwise specified. This control shall  
 ∅ consist of radiographic examination of castings in accordance with AMS 2635 until proper foundry technique, which will produce castings free from harmful internal imperfections, is established for each part number and of production castings as necessary to ensure maintenance of satisfactory quality.

3.7.3 When specified, castings shall be subject to magnetic particle inspection in accordance with AMS 2640  
 ∅ and/or fluorescent penetrant inspection in accordance with AMS 2645.

3.7.4 Radiographic, magnetic particle, fluorescent penetrant, and other quality standards shall be as agreed upon by purchaser and vendor.

3.7.5 Castings shall not be repaired by peening, plugging, welding, or other methods without written permission from purchaser.

3.7.5.1 When permitted in writing by purchaser, defects in castings may be removed and the castings repaired by welding provided the weld repair area has properties comparable to those of the parent metal.

Repair welds shall be subjected to the same inspection procedures and acceptance standards required of the casting and the weld repair area shall be suitably identified to facilitate inspection. The repair welding shall be performed prior to any heat treatment and nondestructive testing specified herein.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of castings shall supply all samples and shall be responsible for performing all required tests. Results of such tests shall be reported to the purchaser as required by

4.5. Purchaser reserves the right to perform such confirmatory testing as he deems necessary to assure that the castings conform to the requirements of this specification.

4.2 Classification of Tests: Tests to determine conformance to all technical requirements of this specification are classified as acceptance or routine control tests.

4.3 Sampling: Shall be in accordance with the following:

4.3.1 Two chemical analysis specimens in accordance with 3.4.1 and/or a casting from each melt.

4.3.2 Two preproduction castings in accordance with 4.4.1 of each part number.

4.4 Approval:

4.4.1 Sample castings from new or reworked patterns and the casting procedure shall be approved by purchaser before castings for production use are supplied, unless such approval be waived.

4.4.2 Vendor shall establish for production of sample castings of each part number the control factors of processing which will produce acceptable castings; these shall constitute the approved casting procedure and shall be used for producing production castings. If necessary to make any change in control factors of processing which could affect quality or properties of the castings, vendor shall submit for reapproval a statement of the proposed changes in processing and, when requested, sample revised castings. No production castings incorporating the revised operations shall be shipped prior to receipt of reapproval.

4.4.2.1 Control factors for producing castings include, but are not limited to, the following:

- Type of furnace and its capacity
- Size of furnace charge
- Furnace atmosphere
- Fluxing or deoxidation procedure
- Gating and risering practices
- Pouring temperature (Variation of  $\pm 50^{\circ}\text{F}$  ( $\pm 28^{\circ}\text{C}$ ) from established limits is permissible)
- Solidification and cooling procedures
- Cleaning operations
- Methods of routine inspection

4.4.2.1.1 Any of the above control factors of processing considered proprietary by the vendor may be assigned a code designation. Each variation in such factors shall be assigned a modified code designation.

4.5 Reports: