

**AEROSPACE  
MATERIAL  
SPECIFICATION**

**AMS 5370B**  
Superseding AMS 5370A

Issued 3-1-55  
Revised 1-1-84

**STEEL CASTINGS, INVESTMENT, CORROSION AND HEAT RESISTANT  
19Cr - 9.5Ni  
Solution Heat Treated**

**UNS J92620**

**1. SCOPE:**

**1.1 Form:** This specification covers a corrosion and heat resistant steel in the form of investment castings.

**1.2 Application:** Primarily for small parts requiring corrosion and heat resistance up to 800°F (425°C), especially when such parts are welded during fabrication, for parts requiring oxidation resistance up to 1500°F (815°C) but useful at that temperature only when stresses are low, and for parts requiring resistance to fuming nitric acid.

**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 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 2635 - Radiographic Inspection  
AMS 2645 - Fluorescent Penetrant Inspection  
AMS 2694 - Repair Welding of Aerospace Castings  
AMS 2804 - Identification, Castings

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**REAFFIRMED**

10/9/5/95

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

ASTM A262 - Detecting Susceptibility to Intergranular Attack in Stainless Steels

ASTM A370 - Mechanical Testing of Steel Products

ASTM E192 - Reference Radiographs of Investment Steel Castings for Aerospace Applications

ASTM E353 - Chemical Analysis of Stainless, Heat-Resisting, Maraging, and Other Similar Chromium-Nickel-Iron Alloys

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

- 2.3.1 Federal Standards:

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

- 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 E353, by spectrographic methods in accordance with Federal Test Method Standard No. 151, Method 112, or by other analytical methods approved by purchaser:

	min	max
Carbon	--	0.050
Manganese	1.00 -	2.00
Silicon	0.75 -	1.50
Phosphorus	--	0.04
Sulfur	--	0.04
Chromium	18.00 -	21.00
Nickel	8.00 -	11.00
Molybdenum	--	0.75
Copper	--	0.75

- 3.2 Condition: Solution heat treated free from continuous carbide network.

- 3.3 Castings: Castings shall be poured either from remelted metal from a master heat or directly from a master heat. In either case, metal for casting shall be qualified as in 3.4.

- 3.3.1 A master heat is refined metal of a single furnace charge or metal blended as in 3.3.2. Gates, sprues, risers, and rejected castings shall be used only in preparation of master heats; they shall not be remelted directly, without refining, for pouring of castings.

- 3.3.2 Unless prohibited by purchaser, metal from two or more master heats may be blended provided that the composition of each master heat to be blended is within the limits of 3.1 and that the total weight of metal blended does not exceed 15,000 lb (6800 kg). Ingot and pig may be blended together, shot may be blended, but shot shall not be blended with ingot or pig. When two or more master heats are blended, the resultant blend shall be considered a master heat.
- 3.4 Master Heat Qualification: Each master heat shall be qualified by evaluation of chemical analysis specimens conforming to 3.4.1. A master heat may be considered conditionally qualified if vendor's test results show conformance to all applicable requirements of this specification. However, except when purchaser waives confirmatory testing, final qualification shall be based on purchaser's test results. Conditional qualification of a master heat shall not be construed as a guarantee of acceptance of castings poured therefrom.
- 3.4.1 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 solution heat treated by heating to  $2000^{\circ}\text{F} + 50$  ( $1095^{\circ}\text{C} + 30$ ), holding at heat for not less than 60 min. per inch (25 mm) of maximum section thickness but in no case less than 30 min., and cooling in air.
- 3.6 Properties: Castings shall conform to the following requirements:
- 3.6.1 Hardness: Shall be not higher than 86 HRB or equivalent, determined in accordance with ASTM A370.
- 3.6.2 Intergranular Corrosion: Specimens cut from castings, after sensitizing treatment, shall show no evidence of intercrystalline surface attack when examined microscopically after being exposed to the copper/copper sulfate/sulfuric acid test performed in accordance with ASTM A262, Practice E.
- 3.6.3 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 locations indicated on the drawing from a casting or castings selected at random from each lot. Property requirements for such specimens shall be as specified 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 internal and external imperfections detrimental to usage of the castings.

- 3.7.1.1 Castings shall have smooth surfaces and shall be well cleaned. Metallic shot or grit shall not be used for final cleaning, unless otherwise permitted by purchaser.
- 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 subjected to fluorescent penetrant inspection in accordance with AMS 2645.
- 3.7.4 Radiographic, fluorescent penetrant, and other quality standards shall be as agreed upon by purchaser and vendor. ASTM E192 may be used to define radiographic acceptance standards.
- 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  
Ø removed and the castings repaired by welding in accordance with AMS 2694.

#### **4. QUALITY ASSURANCE PROVISIONS:**

- 4.1 Responsibility for Inspection: The vendor of castings shall supply all  
Ø samples for vendor's tests 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 sample and to perform any confirmatory testing deemed necessary to ensure that the castings conform to the requirements of this specification.

#### **4.2 Classification of Tests:**

- 4.2.1 Acceptance Tests: Tests to determine conformance to requirements for  
Ø composition (3.1), hardness (3.6.1), quality (3.7), and, when specified, tensile properties of specimens cut from castings (3.6.3), are classified as acceptance tests and shall be performed on each master heat or lot as applicable.
- 4.2.2 Periodic Tests: Tests to determine conformance to requirements for  
Ø intergranular corrosion (3.6.2) are classified as periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.

- 4.2.3 Preproduction Tests: Tests to determine conformance to all technical requirements of this specification are classified as preproduction tests and shall be performed prior to or on the first-article shipment of a casting to a purchaser, when a change in material or processing, or both, requires reapproval as in 4.4.2, and when purchaser deems confirmatory testing to be required.
- 4.2.3.1 For direct U.S. Military procurement, substantiating test data and when requested, preproduction castings shall be submitted to the cognizant agency as directed by the procuring activity, the contracting officer, or the request for procurement.
- 4.3 Sampling: Shall be in accordance with the following; a lot shall be all castings of the same part number, poured from a single master heat, solution heat treated as a batch, and presented for vendor's inspection at one time.
- 4.3.1 Two chemical analysis specimens in accordance with 3.4.1 from each master heat or a casting from each lot.
- 4.3.2 Two preproduction castings in accordance with 4.4.1 of each part number.
- 4.3.3 One or more castings from each lot when properties of specimens machined from castings are specified. Size, location, and number of specimens machined from castings shall be as specified on the drawing or as agreed upon by purchaser and vendor. When size, location, and number of specimens are not specified, not less than two tensile specimens, one from the thickest section and one from the thinnest section, shall be cut from a casting or castings from each lot.
- 4.4 Approval:
- 4.4.1 Sample castings from new or reworked master patterns and the casting procedure shall be approved by purchaser before castings for production use are supplied, unless such approval be waived by purchaser.
- 4.4.2 Vendor shall establish for production of sample castings of each part number, parameters for the process control factors 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 parameters for the process control factors, vendor shall submit for reapproval a statement of the proposed changes in processing and, when requested, test specimens, sample castings, or both. Production castings incorporating the revised operations shall not 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  
Type and size of furnace charge  
Time molten metal is in furnace  
Furnace atmosphere  
Fluxing or deoxidation procedure  
Number of ladles used in pour  
Mold refractory formulation  
Mold back-up material  
Gating practices  
Mold preheat and pouring temperatures (variations of  $\pm 25^{\circ}\text{F}$  ( $\pm 15^{\circ}\text{C}$ ) from established limits are permissible)  
Solidification and cooling procedures  
Solution heat treatment cycle  
Cleaning operations  
Methods of inspection

- 4.4.2.1.1 Any of the above process control factors for which parameters are considered proprietary by the vendor may be assigned a code designation. Each variation in such parameters shall be assigned a modified code designation.

#### 4.5 Reports:

- 4.5.1 The vendor of castings shall furnish with each shipment three copies of a report showing the results of tests for chemical composition of at least one casting, or of specimens as in 3.4.1 cast in a mold with parts, from each master heat represented and the results of tests on each lot to determine conformance to the other acceptance test requirements, and stating that the castings conform to the other technical requirements of this specification. When properties of specimens cut from castings are specified, the report shall include the results of tests to determine conformance to such requirements. This report shall include the purchase order number, master heat number or code symbol, AMS 5370B, part number, and quantity from each master heat.
- 4.5.2 The vendor of finished or semi-finished parts shall furnish with each shipment three copies of a report showing the purchase order number, AMS 5370B, contractor or other direct supplier of castings, part number, and quantity. When castings for making parts are produced or purchased by the parts vendor, that vendor shall inspect castings from each lot represented to determine conformance to the requirements of this specification and shall include in the report either a statement that the castings conform or copies of laboratory reports showing the results of tests to determine conformance.