SAE Aerospace
An SAE International Group

AEROSPACE MATERIAL SPECIFICATION

AMS 5378F

Issued	SEP 1947
Revised	OCT 1982
Noncurrent	NOV 1995
Reaf. Noncur.	JAN 2002
Cancelled	APR 2007

Superseding AMS 5378E

Alloy Castings, Investment, Corrosion and Heat Resistant
65.5Co - 25Cr - 1.8Ni - 5.0W
As Cast

(Composition similar to UNS R30023)

RATIONALE

AMS 5378F has been designated cancelled because survey of aerospace users indicated that this product is not being procured to this specification.

CANCELLATION NOTICE

This specification has been declared "CANCELLED" by the Aerospace Materials Division, SAE, as of April, 2007. By this action, this document will remain listed in the Numerical Section of the Index of Aerospace Material Specifications, indicating that it has been "CANCELLED".

Cancelled specifications are available from SAE.

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AEROSPACE MATERIAL SPECIFICATION

SAE AMS 5378E

Issued SEP 1947
Revised OCT 1982
Noncurrent NOV 1995
Reaf. Noncur. JAN 2002

Superseding AMS 5378D

Alloy Castings, Investment, Corrosion and Heat Resistant 35Co - 24.5Cr - 32.5Ni - 5.5Mo As Cast

UNS R30027

NONCURRENT NOTICE

This specification has been declared “NONCURRENT” by the Aerospace Materials Division, SAE, as of November 1995. It is recommended, therefore, that this specification not be specified for new designs.

“NONCURRENT” refers to those materials which have previously been widely used and which may be required on some existing designs in the future. The Aerospace Materials Division, however, does not recommend these as standard materials for future use in new designs. Each of these “NONCURRENT” specifications is available from SAE.

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1. SCOPE:

1.1 Form:

This specification covers a corrosion and heat resistant cobalt alloy in the form of investment castings.

1.2 Application:

Primarily for small parts, such as turbine blades and vanes, requiring high strength up to 1500°F (815°C) and oxidation resistance up to 2000°F (1095°C). Although difficult to machine, this alloy is more machinable than other similar cobalt-chromium-nickel alloys. Exposure to elevated temperatures may cause hardening of this alloy; e.g., exposure to approximately 1475°F (800°C) for 50 hr may result in hardness as high as 32 HRC.

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 2361	Elevated 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

2.2 ASTM Publications:

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

ASTM E8	Tension Testing of Metallic Materials
ASTM E18	Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials
ASTM E21	Elevated Temperature Tension Tests of Metallic Materials
ASTM E192	Reference Radiographs of Investment Steel Castings for Aerospace Applications
ASTM E354	Chemical Analysis of High-Temperature, Electrical, Magnetic, and Other Similar Iron, Nickel, and Cobalt 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 E354, 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	0.35	0.45
Manganese	--	1.00
Silicon	--	1.00
Phosphorus	--	0.04
Sulfur	--	0.03
Chromium	23.00	26.00
Nickel	30.00	35.00
Molybdenum	4.50	6.50
Iron	--	2.00
Cobalt	remainder	

3.2 Condition:

As cast.

3.3 Casting:

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 10,000 lb (4500 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 and tensile specimens conforming to 3.4.1 and 3.4.2, respectively. 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.

3.4.2 Tensile Specimens: Shall be cast from remelted metal from each master heat except when castings are poured directly from a master heat, in which case the specimens shall also be poured directly from the master heat. Specimens shall be of standard proportions in accordance with ASTM E8 with 0.250 in. (6.25 mm) diameter at the reduced parallel gage section. They shall be cast to size or shall be cast oversize and subsequently machined to 0.250 in. (6.25 mm) diameter. Center gating may be used.

3.5 Properties:

Castings and representative tensile specimens produced in accordance with 3.4.2 shall conform to the following requirements:

3.5.1 Tensile Properties:

3.5.1.1 Separately-Cast Specimens:

3.5.1.1.1 At 1500°F (815°C): Shall be as follows, determined in accordance with ASTM E21 on specimens heated to 1500°F ± 10 (815°C ± 5), held at heat for 20 to 30 min. before testing, and tested at 1500°F ± 10 (815°C ± 5):

Tensile strength, min	48,000 psi (330 MPa)
Elongation in 4D, min	12%

3.5.1.2 Specimens Cut from Castings: When specified on the drawing or when agreed upon by purchaser and vendor, tensile specimens conforming to ASTM E8 shall be machined from locations indicated on the drawing from castings selected at random from each master heat. 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 and/or AMS 2361.

3.5.2 Hardness: Shall be not higher than 22 HRC or equivalent, determined in accordance with ASTM E18:

3.6 Quality:

3.6.1 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.

3.6.1.1 Castings shall have smooth surfaces and shall be well cleaned. Metallic shot or grit shall not be used for final cleaning, unless otherwise permitted.

3.6.2 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.

3.6.3 When specified, castings shall be subjected to fluorescent penetrant inspection in accordance with AMS 2645.

3.6.4 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.

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

3.6.5.1 When permitted in writing by purchaser, defects in castings may be 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 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:

Tests to determine conformance to all technical requirements of this specification are classified as acceptance tests and as preproduction tests and shall be performed on each master heat or lot as applicable, prior to or on the first-article shipment of a casting to a purchaser, when a change in material and/or processing requires reapproval as in 4.4.2, and when purchaser deems confirmatory testing to be required.

4.2.1 For direct U.S. Military procurement, substantiating test data and, when requested, preproduction test material 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:.

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

4.3.2 Three tensile specimens in accordance with 3.4.2 from each master heat.

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

4.3.4 One or more castings from each master heat when properties of specimens machined from castings are required. 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 master heat.

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 separately for tensile specimens used for master heat qualification and for production of sample castings of each part number parameters for the control factors of processing which will produce tensile specimens meeting master heat qualification requirements and acceptable castings; these shall constitute the approved casting procedures and shall be used for producing subsequent master heat qualification specimens and production castings. If necessary to make any change in parameters for the control factors of processing, vendor shall submit for reapproval a statement of the proposed changes in processing and, when requested, sample test specimens, castings, or both. Production castings incorporating the revised operations shall not be shipped prior to receipt of reapproval.