



AEROSPACE MATERIAL SPECIFICATION	AMS5366™	REV. F
	Issued 1947-09 Revised 2018-08 Reaffirmed 2023-11 Superseding AMS5366E	
Steel, Corrosion and Heat-Resistant, Investment Castings 25Cr - 20Ni (CK-20) As-Cast (Composition similar to UNS J94211)		

RATIONALE

AMS5366F revises chemical analysis standards (3.1), deletes the prior paragraph 3.4.2.2 which was not relevant to chemical analysis specimens, updates the default NDT acceptance requirement (3.7.4.1), prohibits unauthorized exceptions (3.8), updates reports (4.5.5), and results from a Five-Year Review and update of this specification.

AMS5366F has been reaffirmed to comply with the SAE Five-Year Review policy.

1. SCOPE

1.1 Form

This specification covers a corrosion and heat-resistant steel in the form of investment castings.

1.2 Application

These castings have been used typically for welded parts, such as diaphragm vanes, requiring oxidation resistance up to 2000 °F (1093 °C) but useful at higher temperature only when stresses are low, but usage is not limited to such applications.

2. APPLICABLE DOCUMENTS

The issue of the following documents in effect on the date of the purchase order forms a part of this specification to the extent specified herein. The supplier may work to a subsequent revision of a document unless a specific document issue is specified. When the reference document has been cancelled and no superseding document has been specified, the last published issue of that document shall apply.

SAE Executive Standards Committee Rules provide that: "This report is published by SAE to advance the state of technical and engineering sciences. The use of this report is entirely voluntary, and its applicability and suitability for any particular use, including any patent infringement arising therefrom, is the sole responsibility of the user."

SAE reviews each technical report at least every five years at which time it may be revised, reaffirmed, stabilized, or cancelled. SAE invites your written comments and suggestions.

Copyright © 2023 SAE International

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of SAE.

TO PLACE A DOCUMENT ORDER: Tel: 877-606-7323 (inside USA and Canada)
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
http://www.sae.org

SAE WEB ADDRESS:

For more information on this standard, visit
<https://www.sae.org/standards/content/AMS5366F/>

2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AMS2175	Castings, Classification and Inspection of
AMS2248	Chemical Check Analysis Limits, Corrosion and Heat-Resistant Steels and Alloys, Maraging and Other Highly Alloyed Steels, and Iron Alloys
AMS2360	Room Temperature Tensile Properties of Castings
AMS2694	In-Process Welding of Castings
AMS2700	Passivation of Corrosion Resistant Steels
AMS2804	Identification, Castings
ARP1917	Clarification of Terms Used in Aerospace Metals Specifications

2.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM A751	Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products
ASTM E8/E8M	Tension Testing of Metallic Materials
ASTM E1417E1417M	Liquid Penetrant Testing
ASTM E1742/E1742M	Radiographic Examination

3. TECHNICAL REQUIREMENTS

3.1 Composition

Shall conform to the percentages by weight shown in Table 1, determined by wet chemical methods in accordance with ASTM A751, by spectrochemical methods, or by other analytical methods acceptable to purchaser (see 8.2.1 and 8.2.2).

Table 1 - Composition

Element	Min	Max
Carbon	--	0.18
Manganese	--	2.00
Silicon	0.50	1.50
Phosphorus	--	0.04
Sulfur	--	0.03
Chromium	23.00	26.00
Nickel	19.00	22.00
Molybdenum	--	0.75
Copper	--	0.75

3.1.1 Producer may test for any element not otherwise listed in Table 1 and include this analysis in the report of 4.5. Limits of acceptability may be specified by purchaser (see 8.2.3).

3.1.2 Check Analysis

Composition variations shall meet the requirements of AMS2248.

3.2 Melting Practice

Castings and specimens shall be poured at casting producer's facility either from a melt (see 8.2.4) of a master heat, or directly from a master heat (see 3.4.2 and 8.2.5).

- 3.2.1 Revert (gates, sprues, risers, and rejected castings) may be used only in the preparation of master heats; revert shall not be remelted directly without refining for pouring of castings. Melting of revert creates a new master heat.
- 3.2.2 Portions of two or more qualified master heats (see 3.4.2) may be melted together and poured into castings using a procedure authorized by purchaser (see 8.2.6).
- 3.2.3 If melts (see 8.2.4) are modified by replenishment (see 8.2.7), the producer shall have a written procedure acceptable to the purchaser which defines the controls, test, and traceability criteria for both castings and separately cast specimens. Control factors of 4.4.2.2 shall apply.

3.3 Condition

Castings shall be delivered in the as-cast condition.

3.4 Test Specimens

Specimens shall be either separately cast, integrally cast (see 8.2.8), or machined from a casting, and shall conform to 3.2.

- 3.4.1 If specimens are separately cast, the producer shall have a written procedure acceptable to the purchaser. Control factors of 4.4.2.2 shall apply.
- 3.4.2 Each master heat shall be qualified by evaluation of chemical analysis specimens.
 - 3.4.2.1 If replenishments are made at remelt as in 3.2.3, frequency of sampling and testing used by the producer for qualification to 3.4.2 shall be acceptable to purchaser.

3.4.3 Chemical Analysis Specimens

Shall be of any convenient size and shape.

3.4.4 Tensile Specimens

Room-temperature tensile properties are not required for qualification. If the purchaser requires these properties (see 3.6.1), tensile specimens shall be of standard proportions in accordance with ASTM E8/E8M (see 8.3) with 0.250-inch (6.35-mm) diameter at the reduced parallel gage section.

- 3.4.4.1 Separately-cast and integrally-cast specimens may be either cast to size and/or cast oversize and subsequently machined to 0.250-inch (6.35-mm) diameter.
- 3.4.4.2 When integrally cast specimens and/or specimens machined from casting are specified, specimen size and location shall be agreed upon by the purchaser and producer (see 8.2.9 and 8.5).

3.5 Heat Treatment

Not applicable (see 8.4).

3.6 Properties

3.6.1 Room Temperature Tensile Properties

May be specified by the purchaser in accordance with AMS2360.

3.7 Quality

3.7.1 Castings, as received by the purchaser, shall be uniform in quality and condition, sound, and free from foreign materials and from imperfections detrimental to usage of the castings. Castings shall be free of cracks, laps, hot tears, and cold shuts, and free of scale and other process-induced surface contamination which would obscure defects.

3.7.1.1 Unless otherwise specified, castings shall be sufficiently cleaned such that, after passivation by the purchaser, the castings shall meet the corrosion test requirement of AMS2700.

3.7.2 Castings shall be produced under radiographic control. This control shall consist of radiographic examination of each casting part number until foundry manufacturing controls in accordance with 4.4.2 have been established. Additional radiography shall be conducted in accordance with the frequency of inspection specified by the purchaser, or as necessary to ensure continued maintenance of internal quality.

3.7.2.1 Radiographic inspection shall be conducted in accordance with ASTM E1742/E1742M, or another method specified by the purchaser.

3.7.3 When specified, additional nondestructive testing shall be performed as follows:

3.7.3.1 Fluorescent penetrant inspection in accordance with ASTM E1417/E1417M, or another method specified by the purchaser.

3.7.4 Acceptance standards for radiographic, fluorescent penetrant, visual, and other inspection methods shall be as agreed upon by the purchaser and producer (see 8.2.9). AMS2175 may be used to specify acceptance standards (casting grade) and frequency of inspection (casting class).

3.7.4.1 When acceptance standards are not specified, the following applies: Castings shall meet Grade C of AMS2175, and radiographic indications of gas holes, sand spots, and inclusions shall be cause for rejection when closer to the edge than twice their maximum dimension.

3.7.5 Castings shall not be peened, plugged, impregnated, or welded unless authorized by the purchaser.

3.7.5.1 When authorized by the purchaser, welding in accordance with AMS2694 or another welding program acceptable to the purchaser may be used.

3.8 Any exceptions shall be authorized by the purchaser and reported as in 4.5.5.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

The producer of castings shall supply all samples for the producer's tests, and shall be responsible for the performance of all required tests. The purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the castings conform to specified requirements.

4.2 Classification of Tests

4.2.1 Acceptance Tests

Composition (3.1), tensile properties if specified (3.6.1), and the applicable requirements of quality (3.7) are acceptance tests and shall be performed as specified in 4.3.

4.2.2 Periodic Tests

Corrosion resistance (3.7.1.1) and radiographic soundness (3.7.2) are periodic tests and shall be performed at a frequency selected by the producer unless a frequency of testing is specified by the purchaser.

4.2.3 Preproduction Tests

All technical requirements are preproduction tests and shall be performed on sample castings (4.3.2), when a change in control factors occurs (4.4.2.2), and when the purchaser deems confirmatory testing to be required.

4.3 Sampling and Testing

The minimum testing performed by the producer shall be in accordance with the following:

- 4.3.1 One chemical analysis specimen or a casting from each master heat shall be tested for conformance with Table 1; if 3.4.2.1 applies, test frequency shall be acceptable to the purchaser.
- 4.3.2 One preproduction casting in accordance with 4.4 shall be tested to requirements of the casting drawing and to all technical requirements.
 - 4.3.2.1 Dimensional inspection sample quantity shall be as specified by the purchaser.
- 4.3.3 When specified by the purchaser (see 8.7), tensile property tests shall be conducted to determine conformance with 3.6.1. Sampling and test frequency is dependent upon the type and origin of specimen specified by the purchaser (see 3.4.4 and 3.6), or selected by the producer (see 4.3.3.4). When 3.4.2.1 applies, specimen source and test frequency shall be acceptable to the purchaser.
 - 4.3.3.1 For separately cast specimens in the as-cast condition, one specimen from each master heat shall be tested for conformance with 3.6.1.
 - 4.3.3.2 For integrally cast specimens in the as-cast condition, two specimens from each lot (see 8.2.10) shall be randomly selected and tested for conformance to 3.6.1.
 - 4.3.3.3 For specimens machined from casting, one casting shall be randomly selected from each lot and tested in the as-cast condition at each location shown on the engineering drawing for conformance with 3.6.1.
 - 4.3.3.3.1 When size and location of specimens are not shown, two specimens shall be tested, one from the thickest section and one from the thinnest section. Once established under 4.4.2.2, test locations may be changed only as agreed upon by the purchaser and producer.
 - 4.3.3.4 When acceptable to the purchaser, specimens machined from casting may be used in lieu of both separately cast and integrally cast specimens, and integrally cast specimens may be used in lieu of separately cast specimens. In each case, the resultant properties must conform to requirements specified by the purchaser (see 8.7).
 - 4.3.3.4.1 When specimens are selected for test as in 4.3.3.4 from an origin other than that specified by the purchaser, the producer shall include in the report of 4.5 a description of the source of the specimen that was tested.
 - 4.3.3.5 When casting size, section thickness, gating method, or other factors do not permit conformance with 4.3.3.2 or 4.3.3.3, sampling and testing shall be agreed upon by the purchaser and producer.
- 4.3.4 Castings shall be inspected in accordance with 3.7 to the methods, frequency, and acceptance standards specified by the purchaser.

4.4 Approval

Sample casting(s) from new or reworked master patterns produced under the casting procedure of 4.4.2 shall be approved by the purchaser before castings for production use are supplied, unless such approval be waived by the purchaser.

- 4.4.1 For each casting part number, the producer shall establish parameters for process control factors that will consistently produce castings and test specimens meeting the requirements of the casting drawing and this specification. These parameters shall constitute the approved casting procedure and shall be used for production of subsequent castings and test specimens. If necessary to make any change to these parameters, the producer shall submit a statement of the proposed change for purchaser reapproval. When requested, the producer shall also submit test specimens, sample castings, or both to the purchaser for reapproval.

- 4.4.1.1 Production castings produced prior to receipt of the purchaser's approval shall be at the producer's risk.
- 4.4.1.2 Control factors for producing castings and separately cast specimens include, but are not limited to, the following factors. The supplier's procedures shall identify tolerances, ranges, and/or control limits, as applicable. Control factors for separately cast specimens must generally represent, but need not be identical to, those factors used for castings (see 3.2.3 and 3.4.1).

Composition of ceramic cores, if used

Arrangement and number of patterns in the mold (including integrally cast specimens, if applicable)

Size, shape, and location of gates and risers

Mold refractory formulation

Grain refinement methods, if applicable

Mold back-up material (weight, thickness, or number of dips)

Type of furnace, atmosphere, and charge for melting

Mold preheat and metal pouring temperatures

Fluxing or deoxidation procedure

Replenishment procedure, if applicable

Time molten metal is in furnace

Solidification and cooling procedures

Cleaning operations (mechanical and chemical)

Heat treatment

Straightening

Final inspection methods

Location of specimens machined from a casting, if applicable

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

- 4.4.1.2.1.1 Unless otherwise agreed upon by the purchaser and producer, the purchaser shall be entitled to review proprietary control factor details and coding at the producer's facility.

4.5 Reports

The producer of castings shall furnish with each shipment a certification document declaring that castings have been processed, tested, and inspected as specified and that the results of the inspections and tests conform to requirements.

- 4.5.1 Unless otherwise specified, the producer shall furnish test report(s) showing the results of tests and inspections conducted in accordance with 4.2 and 4.3.

- 4.5.1.1 Chemical analysis determinations, property test data, and the results of any retests conducted shall be expressed numerically to reflect actual quantitative test values.

- 4.5.1.2 Inspection and preproduction results shall be reported at the frequency specified by, and in a format acceptable to, the purchaser.

- 4.5.1.3 Nonconformances shall be documented and approved by purchaser in accordance with the purchaser's material review requirements.

- 4.5.2 The certification document and test report(s) shall include or be traceable to the purchase order number, master heat identification, AMS5366F, part number, quantity, and, when required (see 5.1.2), the list of individual serial numbers or serial number range.

- 4.5.2.1 If 4.3.3.4.1 applies, the mechanical property test report shall denote the source of the specimens that were tested.

4.5.3 Test reports for acceptance testing of 4.2 shall be as follows:

4.5.3.1 For Each Master Heat

Composition (see 4.3.1)

Tensile properties, when specified (see 4.3.3.1)

4.5.3.2 For Each Lot

Inspection results (see 4.3.4)

Tensile properties, when specified (see 4.3.3.2 and 4.3.3.3)

4.5.4 The producer shall retain records of processing and inspection in accordance with purchaser requirements.

4.5.5 When castings produced to this specification have exceptions authorized by purchaser taken to the technical requirements listed in Section 3, the report shall contain a statement, "This material is certified as AMS5366F(EXC) because of the following exceptions," and the specific exceptions shall be listed.

4.6 Resampling and Retesting

If results of a valid test fail to meet specified requirements, two additional specimens in accordance with 4.3 from the same master heat, modified melt (see 3.2.3), or lot, as applicable, shall be tested for each nonconforming characteristic. Results of each additional test, and the average of the results of all tests (original and retests) shall meet specified requirements; otherwise, the master heat or lot shall be rejected. Results of all tests shall be reported.

4.6.1 A test may be declared invalid if failure is due to specimen mispreparation, test equipment malfunction, improper test procedure, or the presence of random process defects such as inclusions or gas holes in a tensile specimen.

5. PREPARATION FOR DELIVERY

5.1 Identification

Unless otherwise specified by the purchaser, individual castings shall be identified in accordance with AMS2804.

5.1.1 Traceability

Individual castings shall be traceable to their conditions of manufacture and inspection up to and including the point of acceptance by the purchaser.

5.1.2 Serialization

When specified (see 4.5.2 and 8.7), each casting shall be serialized with a unique non-repeating serial number.

5.2 Packaging

Castings shall be prepared for shipment in accordance with commercial practice and in compliance with applicable rules and regulations pertaining to the handling, packaging, and transportation of the castings to ensure carrier acceptance and safe delivery.

6. ACKNOWLEDGMENT

A producer shall mention this specification number and its revision letter in all quotations and when acknowledging purchase orders.

7. REJECTIONS

Castings not conforming to this specification, or to modifications authorized by purchaser, will be subject to rejection.