



<b>AEROSPACE MATERIAL SPECIFICATION</b>	<b>AMS5593™</b>	<b>REV. H</b>
	Issued 1963-07 Reaffirmed 2010-05 Revised 2021-09	
Superseding AMS5593G		
Nickel Alloy, Corrosion and Heat Resistant, Sheet, Strip, and Plate 45.5Ni - 25.5Cr - 3.2Co - 3.2Mo - 3.2W - 18.5Fe Solution Heat Treated (Composition similar to UNS N06333)		

### RATIONALE

AMS5593H is the result of a Five-Year Review and update of the specification. The revision adds strain rate to tensile tests (3.3.1.1), prohibits unauthorized exceptions (3.6, 4.1, 5.1.1, 8.6), and allows prior revisions (8.5).

#### 1. SCOPE

##### 1.1 Form

This specification covers a corrosion and heat resistant nickel alloy in the form of sheet, strip, and plate.

##### 1.2 Application

These products have been used typically for parts requiring heat and oxidation resistance up to 2150 °F (1177 °C), particularly where such parts may require welding during fabrication, 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 referenced document has been cancelled and no superseding document has been specified, the last published issue of that document shall apply.

##### 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](http://www.sae.org).

- |         |   |
|---------|---|
| AMS2242 | Tolerances, Corrosion and Heat Resistant Steel, Iron Alloy, Titanium, and Titanium Alloy Sheet, Strip, and Plate                          |
| AMS2248 | Chemical Check Analysis Limits, Corrosion and Heat-Resistant Steels and Alloys, Maraging and Other Highly-Alloyed Steels, and Iron Alloys |
| AMS2371 | Quality Assurance Sampling and Testing, Corrosion and Heat-Resistant Steels and Alloys, Wrought Products and Forging Stock                |

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SAE WEB ADDRESS:

**For more information on this standard, visit**  
<https://www.sae.org/standards/content/AMS5593H/>

- AMS2807 Identification, Carbon and Low-Alloy Steels, Corrosion and Heat-Resistant Steels and Alloys, Sheet, Strip, Plate, and Aircraft Tubing
- ARP1917 Clarification of Terms Used in Aerospace Specifications
- AS4194 Sheet and Strip Surface Finish Nomenclature

## 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](http://www.astm.org).

- ASTM A480/A480M Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip
- ASTM E3 Preparation of Metallographic Specimens
- ASTM E8/E8M Tension Testing of Metallic Materials
- ASTM E18 Rockwell Hardness of Metallic Materials
- ASTM E140 Hardness Conversion Tables for Metals Relationship Among Brinell Hardness, Vickers Hardness, Rockwell Hardness, Superficial Hardness, Knoop Hardness, Scleroscope Hardness, and Leeb Hardness
- ASTM E354 Chemical Analysis of High-Temperature, Electrical, Magnetic, and Other Similar Iron, Nickel, and Cobalt Alloys

## 3. TECHNICAL REQUIREMENTS

### 3.1 Composition

Shall conform to the percentages by weight shown in Table 1, determined in accordance with ASTM E354, or by other analytical methods acceptable to purchaser:

**Table 1 - Composition**

Element	Min	Max
Carbon	--	0.08
Manganese	--	2.00
Silicon	0.75	1.50
Phosphorous	--	0.030
Sulfur	--	0.030
Chromium	24.00	27.00
Nickel	44.00	47.00
Cobalt	2.50	4.00
Molybdenum	2.50	4.00
Tungsten	2.50	4.00
Copper	--	0.50
Tin	--	0.025
Lead	--	0.025
Iron	remainder	

### 3.1.1 Check Analysis

Composition variations shall meet the applicable requirements of AMS2248.

### 3.2 Condition

The product shall be supplied in the following condition:

#### 3.2.1 Sheet and Strip

Hot or cold rolled, solution heat treated to meet the requirements of 3.3, and, unless solution heat treatment is performed in an atmosphere yielding a bright finish, descaled having a surface finish in accordance with ASTM A480/A480M, AS4194, and 3.2.1.1 or 3.2.1.2 as applicable.

##### 3.2.1.1 Sheet

No. 2D finish.

##### 3.2.1.2 Strip

No. 1 strip finish.

#### 3.2.2 Plate

Hot rolled, solution heat treated, and descaled.

### 3.3 Properties

The product shall conform to the following requirements:

#### 3.3.1 Tensile Properties

Shall be as shown in Table 2, determined in accordance with ASTM E8/E8M.

3.3.1.1 Unless otherwise specified, the strain rate shall be set at 0.005 in/in/min (0.005 mm/mm/min) and maintained within a tolerance of  $\pm 0.002$  in/in/min (0.002 mm/mm/min) through 0.2% offset yield strain. The strain rate after yield may be increased to any value up to 0.5 in/in/min (or mm/mm/min) or equivalent crosshead speed as a function of gage length.

**Table 2 - Tensile properties**

Property	Value
Tensile Strength, max	120 ksi (827 MPa)
Elongation in 2 Inches (50 mm) or 4D, min	30%

#### 3.3.2 Hardness

Shall be not higher than 95 HRB, or equivalent (see 8.2), determined in accordance with ASTM E18. Product shall not be rejected on the basis of hardness if the tensile properties of 3.3.1 are acceptable, determined on specimens taken from the same sample as that with nonconforming hardness or from another sample with similar nonconforming hardness.

#### 3.3.3 Microstructure

Shall be free from continuous carbide network, determined by metallographic examination of specimens prepared in accordance with ASTM E3.

### 3.4 Quality

The product, 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 product.

### 3.5 Tolerances

Shall conform to all applicable requirements of AMS2242.

### 3.6 Exceptions

Any exceptions shall be authorized by the purchaser and reported as in 4.4.1.

## 4. QUALITY ASSURANCE PROVISIONS

### 4.1 Responsibility for Inspection

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

### 4.2 Classification of Tests

All technical requirements are acceptance tests and shall be performed on each heat or lot as applicable.

### 4.3 Sampling and Testing

Shall be in accordance with AMS2371.

### 4.4 Reports

The producer of the product shall furnish with each shipment a report showing the producer's name and the country where the metal was melted (e.g., final melt in the case of metal processed by multiple melting operations) and the results of tests for chemical composition of each heat and for tensile properties and hardness of each lot, and stating that the product conforms to the other technical requirements. This report shall include the purchase order number, heat and lot numbers, AMS5593H, size, and quantity.

4.4.1 When material produced to this specification has exceptions taken to the technical requirements listed in Section 3, the report shall contain a statement "This material is certified as AMS5593H(EXC) because of the following exceptions:" and the specific exceptions shall be listed (also see 5.1.1).

### 4.5 Resampling and Retesting

Shall be in accordance with AMS2371.

## 5. PREPARATION FOR DELIVERY

### 5.1 Identification

Shall be in accordance with AMS2807.

5.1.1 When technical exceptions are taken (see 4.4.1), the material shall be identified with AMS5593H(EXC).

### 5.2 Packaging

The product 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 product to ensure carrier acceptance and safe delivery.