



AEROSPACE MATERIAL SPECIFICATION

AMS5659™/H900

Issued

2022-09

Steel, Corrosion-Resistant, Bars, Wire, Forgings, Rings, and Extrusions
15Cr - 4.5Ni - 0.30Cb (Nb) - 3.5Cu
Solution and Precipitation Heat Treated (H900)
(Composition similar to UNS S15500)

RATIONALE

AMS5659/H900 is a new specification for the purchase of corrosion-resistant steel product in the solution and precipitation heat treated (H900) condition.

1. SCOPE

1.1 Form

This specification covers a corrosion-resistant steel product 12 inches (305 mm) and under in nominal diameter, thickness or, for hexagons, least distance between parallel sides, and having a maximum cross-sectional area of 144 in² (930 cm²) in the solution and precipitation heat treated (H900) condition.

1.1.1 The aged product may be supplied directly by a producer or by another entity performing the functions of a producer as defined in AS6279. The latter would be accomplished by precipitation heat treatment of solution treated material previously certified to AMS5659. The entity assuming responsibility for the aging operation is designated the producer of AMS5659/H900.

1.2 Application

These products have been used typically for parts requiring corrosion resistance and high strength up to 600 °F (316 °C) with good ductility and strength in the transverse direction in large section sizes, but usage is not limited to such applications (see 8.1).

1.3 Classification

Melting practice classification shall be in accordance with AMS5659.

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.

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For more information on this standard, visit

<https://www.sae.org/standards/content/AMS5659/H900/>

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.

AMS2241	Tolerances, Corrosion- and Heat-Resistant Steel, Iron Alloy, Titanium, and Titanium Alloy Bars and Wire
AMS2759/3	Heat Treatment, Precipitation-Hardening Corrosion-Resistant, Maraging, and Secondary Hardening Steel Parts
AMS2761	Heat Treatment of Steel Raw Materials
AMS5659	Steel, Corrosion Resistant, Bars, Wire, Forgings, Rings, and Extrusions, 15Cr - 4.5Ni - 0.30Cb (Nb) - 3.5Cu, Consumable Electrode Remelted, Solution Heat Treated, Precipitation Hardenable
AS6279	Standard Practice for Production, Distribution, and Procurement of Metal Stock

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 A370 Mechanical Testing of Steel Products

3. TECHNICAL REQUIREMENTS

3.1 Composition

Shall be in accordance with AMS5659.

3.2 Melting Practice

Shall be in accordance with AMS5659.

3.3 Condition

Shall be in accordance with AMS5659 and the following.

3.3.1 The product shall be supplied in the precipitation hardened (H900) heat treat condition.

3.3.2 Bar shall not be cut from plate (see also 4.3.3).

3.4 Heat Treatment

Shall be in accordance with AMS5659 and the following.

3.4.1 Precipitation Heat Treatment

3.4.1.1 Shall be in accordance with the requirements applicable to either AMS2761 or AMS2759/3 at the producer's option, except acceptance testing and criteria shall be as specified in 3.5.3.1.

3.4.1.2 When product certified as AMS5659 (solution treated material) is precipitation heat treated to meet AMS5659/H900 by an entity other than the producer of the original product, the heat treatment source shall be accredited by a recognized industry agency for stainless steel heat treatment acceptable to the purchaser.

3.4.2 Stress Relief Heat Treatment

- 3.4.2.1 A stress relief heat treatment when performed after precipitation heat treatment is optional. When performed stress relief shall be accomplished by heating to 800 °F $\pm$ 25 °F (427 °C $\pm$ 14 °C) and soaking for at least 1 hour plus 1 hour additional for each inch (25 mm) of thickness or fraction thereof greater than 1 inch (25 mm). When load thermocouples are used, the soaking time shall be at least 1 hour.
- 3.4.2.2 Stress relieving as above may be performed after straightening to meet dimensional tolerances of AMS2241 unless prohibited by purchaser or cognizant engineering organization (see 8.3) but must still meet all properties (see 3.5).

3.5 Properties

All products shall conform to the following requirements:

3.5.1 Macrostructure

Shall be in accordance with AMS5659.

3.5.2 Microstructure

Shall be in accordance with AMS5659.

3.5.3 Tensile Properties

Shall be in accordance with the following:

3.5.3.1 Bars

Product, 12 inches (305 mm) and under in nominal diameter, thickness or, for hexagons, least distance between parallel sides, and having a maximum cross-sectional area of 144 square inches (930 sq cm) shall be as shown in Table 1. Tensile testing shall be performed in accordance with ASTM A370.

- 3.5.3.1.1 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 ± 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 0.5 mm/mm/min) or equivalent crosshead speed as a function of gage length. The requirement for compliance becomes effective for material produced 1 year after the publication date of this specification.

Table 1A - Tensile properties, inch/pound units

Condition	Sample Orientation	Tensile Strength ksi	Minimum Yield Strength at 0.2% Offset ksi	Minimum Elongation in 2 Inches or 4D %	Minimum Reduction of Area %
H900	Longitudinal	190-225	170	10	35
	Transverse	190-225	170	6	20

Note: Properties have been taken from the response to heat treatment requirements of AMS5659 and were not independently substantiated using SAE AMS procedures.

Table 1B - Tensile properties, SI units

Condition	Sample Orientation	Tensile Strength MPa	Minimum Yield Strength at 0.2% Offset MPa	Minimum Elongation in 50 mm or 4D %	Minimum Reduction of Area %
H900	Longitudinal	1310-1552	1172	10	35
	Transverse	1310-1552	1172	6	20

Note: Properties have been taken from the response to heat treatment requirements of AMS5659 and were not independently substantiated using SAE AMS procedures.

3.5.3.1.2 Transverse tensile property requirements apply only to bars from which a test specimen not less than 2-1/2 inches (63.5 mm) long can be taken. If the cross-sectional dimensions of the product permit, the transverse testing shall be of the short-transverse (ST) direction; otherwise, the orientation shall be long transverse (LT). For rounds, align the samples at the centerline.

3.5.3.1.2.1 Products tested in the transverse direction need not be tested in the longitudinal direction.

3.5.3.2 All other product forms

The property requirements of 3.5.3.1 shall apply. Test plans shall be as agreed upon between producer and purchaser.

3.5.3.3 When the ultimate tensile strength exceeds 225 ksi (1552 MPa), one additional aging cycle may be performed. The set temperature for the additional aging may be higher than 900 °F (482 °C), but not more than 25 °F (14 °C) higher. The soaking time shall be not more than the original precipitation heat treatment cycle.

3.5.3.4 When the tensile properties as specified in Table 1 are not met, it is permissible to again perform solution heat treatment in accordance with AMS5659 and precipitation heat treatment to the requirements specified in 3.4, and retest.

3.5.3.5 Tensile property requirements for product outside of the range covered by 1.1 shall be agreed upon between purchaser and producer (see also 4.3.4).

3.5.3.6 Hardness

Not applicable.

3.6 Quality

Shall be in accordance with AMS5659.

3.7 Tolerances

Shall be in accordance with AMS5659 and the following.

3.7.1 If stress relieved after aging, the straightness tolerance of AMS2241 for heat treated product shall apply.

3.8 Production, distribution, and procurement of metal stock shall comply with AS6279. After production and certification to the specified requirements, cutting in a plane perpendicular to the short transverse dimension is permitted. The requirement for compliance with AS6279 becomes effective 18 months after publication of this document.

3.9 Exceptions

Any exceptions shall be authorized by purchaser and reported as in 4.3.4.