



AEROSPACE MATERIAL SPECIFICATION	AMS6356™	REV. H
	Issued 1962-01 Revised 2015-12	
Superseding AMS6356G		
Steel, Sheet, Strip, and Plate 0.95Cr - 0.20Mo - (0.30 - 0.35C) (4132) (Composition similar to UNS G41300)		

RATIONALE

AMS6356H is a Five Year Review and update of this specification that revises grain size testing, decarburization testing methods and reporting.

1. SCOPE

1.1 Form

This specification covers an aircraft-quality, low-alloy steel in the form of sheet, strip, and plate.

1.2 Application

These products have been used typically for heat-treated parts and structures that may require welding during fabrication, but usage is not limited to such applications. Product, 0.375 inch (9.52 mm) and under in nominal thickness, can be through-hardened to a minimum tensile strength of 180 ksi (1241 MPa) and proportionately lower strength in heavier section thicknesses.

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.

- AMS2252 Tolerances, Low-Alloy Steel Sheet, Strip, and Plate
- AMS2259 Chemical Check Analysis Limits, Wrought Low-Alloy and Carbon Steels
- AMS2301 Steel Cleanliness, Aircraft Quality Magnetic Particle Inspection Procedure

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- AMS2370 Quality Assurance Sampling and Testing, Carbon and Low-Alloy Steel Wrought Products and Forging Stock
- AMS2807 Identification, Carbon and Low-Alloy Steels, Corrosion and Heat-Resistant Steels and Alloys, Sheet, Strip, Plate, and Aircraft Tubing

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 A255 Determining the Hardenability of Steel
- ASTM A370 Mechanical Testing of Steel Products
- ASTM E112 Determining Average Grain Size
- ASTM E290 Bend Testing of Material for Ductility
- ASTM E350 Chemical Analysis of Carbon Steel, Low-Alloy Steel, Silicon Electrical Steel, Ingot Iron, and Wrought Iron
- ASTM E384 Knoop and Vickers Hardness of Materials

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 E350, by spectrochemical methods, or by other analytical methods acceptable to purchaser.

Table 1 - Composition

Element	min	max
Carbon	0.30	0.35
Manganese	0.40	0.60
Silicon	0.15	0.50
Phosphorus	--	0.025
Sulfur	--	0.025
Chromium	0.80	1.10
Molybdenum	0.15	0.25
Nickel	--	0.25
Copper	--	0.35

- 3.1.1 Aluminum, vanadium and columbium are optional grain refining elements and need not be determined or reported unless used to satisfy the average grain size requirements of 3.3.1.2.

3.1.2 Check Analysis

Composition variations shall meet the applicable requirements of AMS2259.

3.2 Condition

The product shall be supplied in the following condition; hardness shall be determined in accordance with ASTM A370:

3.2.1 Sheet and Strip

Cold finished, bright or atmosphere annealed, and descaled if necessary; or hot rolled, annealed if necessary, and descaled; having hardness not higher than 95 HRB, or equivalent (see 8.2).

3.2.2 Plate

Hot rolled, annealed if necessary, and descaled, having hardness not higher than 95 HRB, or equivalent (see 8.2).

3.2.2.1 If allowed by the purchaser, cold rolled, annealed if necessary, and descaled, having hardness not higher than 95 HRB, or equivalent (see 8.2).

3.2.3 If product is ordered spheroidize annealed, the degree of spheroidization shall be as agreed upon by purchaser and producer.

3.3 Properties

The product shall conform to the following requirements; hardness testing shall be performed in accordance with ASTM A370:

3.3.1 Average Grain Size

Average grain size shall be determined by either 3.3.1.1 or 3.3.1.2.

3.3.1.1 Shall be ASTM No. 5 or finer, determined in accordance with ASTM E112.

3.3.1.2 The product of a heat shall be considered to have an ASTM No. 5 or finer austenitic grain size if one or more of the following are determined by heat analysis (see 8.5):

3.3.1.2.1 A total aluminum content of 0.020 to 0.050%.

3.3.1.2.2 An acid soluble aluminum content of 0.015 to 0.050%.

3.3.1.2.3 A vanadium content of 0.02 to 0.08%.

3.3.1.2.4 A columbium content of 0.02 to 0.05%.

3.3.2 Decarburization

Decarburization shall be evaluated by one of the two methods of 3.3.2.1 or 3.3.2.2.

3.3.2.1 Metallographic Method

A cross section taken perpendicular to the surface shall be prepared, etched, and visually examined metallographically at a magnification not to exceed 100X. The product shall not show a layer of complete (ferrite) or partial decarburization exceeding the limits of Table 2.

3.3.2.2 Hardness Traverse Method

The total depth of decarburization shall be determined by a traverse method using microhardness testing in accordance with ASTM E384, at a magnification not exceeding 100X, conducted on a hardened but untempered specimen protected during heat treatment to prevent changes in surface carbon content. Tempering is generally not recommended, but if tempered, the tempering temperature shall be not higher than 300 °F (149 °C). Depth of decarburization is defined as the perpendicular distance from the surface to the depth under that surface where there is not further increase in hardness. Such measurements shall be far enough away from any adjacent surface to be uninfluenced by any decarburization on the adjacent surface. Acceptance shall be as listed in Table 2.

3.3.2.3 When determining the depth of decarburization, it is permissible to disregard local areas provided the decarburization of such areas does not exceed the limits in Table 2 by more than 0.005 inch (0.13 mm) and the width is 0.065 inches (1.65 mm) or less.

3.3.2.4 In case of dispute, the total depth of decarburization determined using the microhardness traverse method shall govern.

Table 2A - Maximum total depth of decarburization limits, inch/pound units

Nominal Thickness Inches	Total Depth of Decarburization Inch
0.375 to 0.500, incl	0.015
Over 0.500 to 1.000, incl	0.025
Over 1.000 to 2.000, incl	0.035

Table 2B - Maximum total depth of decarburization limits, SI units

Nominal Thickness Millimeters	Total Depth of Decarburization Millimeter
9.52 to 12.70, incl	0.38
Over 12.70 to 25.40, incl	0.64
Over 25.40 to 50.80, incl	0.89

3.3.3 Hardenability of Each Heat

Shall be J1/16 inch (1.6 mm) = 57 HRC maximum and J3/16 inch (4.8 mm) = 46 HRC minimum, determined on the standard end-quench test specimen in accordance with ASTM A255 except that the steel shall be normalized at 1700 °F ± 10 °F (927 °C ± 6 °C) and the test specimen austenitized at 1600 °F ± 10 °F (871 °C ± 6 °C).

3.3.4 Bending

Product 0.749 inch (19.02 mm) and under in nominal thickness shall be tested in accordance with ASTM E290 using a sample prepared nominally 0.75 inch (19.0 mm) in width with its axis of bending parallel to the direction of rolling and shall withstand without cracking when bending at room temperature through the angle and bend radius shown in Table 3. In case of dispute, the results of tests using the guided bend test of ASTM E290 shall govern.

Table 3 - Bend requirements

Nominal Thickness Inch	Nominal Thickness Millimeters	Bend Angle Degrees	Bend Radius t = nominal thickness
Up to 0.249, incl	Up to 6.32, incl	180	1/2t
Over 0.249 to 0.749, incl	Over 6.32 to 19.02, incl	90	1/2t

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.

3.4.1 Steel shall be aircraft-quality conforming to AMS2301.

3.5 Tolerances

Shall conform to all applicable requirements of AMS2252.

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.