AEROSPACE MATERIAL SPECIFICATION

AMS6396™	REV. F

Issued 1973-05
Revised 2015-12

Superseding AMS6396E

Steel Sheet, Strip, and Plate
0.80Cr - 1.8Ni - 0.25Mo (0.49 - 0.55C)
Annealed
(Composition similar to UNS K22950)

RATIONALE

AMS6396F results from 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 heavy-section, heat treated parts requiring good tensile and endurance strengths in combination with good ductility, 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.

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

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
SAE WEB ADDRESS: **http://www.sae.org**

SAE values your input. To provide feedback on this Technical Report, please visit
http://www.sae.org/technical/standards/AMS6396F

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 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 or by spectrochemical or other analytical methods approved by purchaser.

Table 1 - Composition

Element	min	max
Carbon	0.49	0.55
Manganese	0.65	0.85
Silicon	0.15	0.35
Phosphorus	--	0.025
Sulfur	--	0.025
Chromium	0.70	0.90
Nickel	1.65	2.00
Molybdenum	0.20	0.30
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, except that check analysis limit for carbon shall apply only to over maximum.

3.2 Condition

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

3.2.1 Sheet and Strip

Cold finished, bright or atmosphere spheroidize annealed, and descaled, or hot rolled, annealed if necessary, and pickled; having a 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 28 HRC, or equivalent (see 8.2).

3.3 Properties

The product shall conform to the following requirements; tensile and 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 of 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, 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, SI units

Nominal Thickness Millimeters	Total Depth of Decarburization Millimeter
9.52 to 12.50, incl	0.38
Over 12.50 to 25.00, incl	0.62
Over 25.00 to 50.00, incl	0.88

3.3.3 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

3.3.4 Response to Heat Treatment

Specimens from product oil quenched from 1500 °F ± 25 °F (815 °C ± 15 °C) and tempered for 2 hours ± 0.1 hour at not lower than 1100 °F (595 °C), shall have the following properties.

3.3.4.1 Tensile Properties

Shall be as shown in Table 4.

Table 4 - Minimum tensile properties

Property	Value
Tensile Strength	150.0 ksi (1,035 MPa)
Yield Strength at 0.2% Offset	130.0 ksi (895 MPa)
Elongation in 2 inches (50 mm) or 4D	8%

3.3.4.2 Hardness

Should be 301 to 363 HB, or equivalent (see 8.2), but the product shall not be rejected on the basis of hardness if the tensile properties of 3.3.4.1 are acceptable, determined on specimens taken from the same sample as that with nonconforming hardness, or from another sample with similar nonconforming hardness.