

AEROSPACE MATERIAL SPECIFICATION



AMS-S-18729A

Issued DEC 1998
Cancelled JAN 2002

Superseding AMS-S-18729

Steel Plate, Sheet, and Strip, Alloy 4130
Aircraft Quality

CANCELLATION NOTICE

This specification has been declared "CANCELLED" by the Aerospace Materials Division, SAE, as of January 2002 and has been superseded by the following:

For condition "A" use AMS 6351. The requirements of the latest issue of AMS 6351 shall apply when AMS-S-18729 condition "A" is specified.

For condition "MA" use AMS 6350. The requirements of the latest issue of AMS 6350 shall apply when AMS-S-18729 condition "MA" is specified.

For condition "N" use AMS 6345. The requirements of the latest issue of AMS 6345 shall apply when AMS-S-18729 condition is specified.

By this action, this document will remain listed in the Numerical Section of the Index of Aerospace Material Specifications, noting that it has been superseded.

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This document has been taken directly from U.S. Military Specification MIL-S-18729C, Amendment 1 and contains only minor editorial and format changes required to bring it into conformance with the publishing requirements of SAE technical standards. The initial release of this document is intended to replace MIL-S-18729C, Amendment 1. Any part numbers established by the original specification remain unchanged.

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1. SCOPE:

1.1 Scope:

This specification covers chrome-molybdenum alloy 4130, steel sheet, strip, and plate of thickness to and including 1.50 inches.

1.2 Classification:

Materials shall be furnished in the following conditions, as specified (see 6.2):

Physical condition:

(A) Annealed

(MA) Modified annealed

(N) Normalized or otherwise heat treated by the producer

2. APPLICABLE DOCUMENTS:

The following publications, of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein.

2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

AMS 2252	Tolerances, Alloy Steel Sheet, Strip, and Plate
AMS 2259	Chemical Check Analysis Limits, Wrought Low Alloy and Carbon Steel
AMS 2301	Aircraft Quality Steel Cleanliness, Magnetic Particle Inspection Procedure
AMS 2640	Magnetic Particle Inspection

2.2 U.S. Government Publications:

Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

FED-STD-48	Tolerances for Steel and Iron Wrought Products
FED-STD-151	Metals; Test Methods
FED-STD-183	Continuous Identification Marking of Iron and Steel Products
MIL-STD-163	Steel Mill Products, Preparation for Shipment and Storage

3. REQUIREMENTS:

3.1 Quality:

The steel shall be of aircraft quality, suitable for the fabrication, by appropriate commercial procedures, of reliable parts which may be inspected by magnetic particle inspection methods conforming to AMS 2640, with frequency/severity ratings in accordance with AMS 2301 not greater than 0.80/0.67.

3.2 Data:

Data shall be supplied as required (see 6.2).

3.3 Chemical composition:

The chemical composition shall be as specified in table I.

3.4 Transverse mechanical properties:

Transverse mechanical properties shall be as specified in table II.

3.5 Transverse bending requirements, materials under 0.749 inch and less in thickness:

Materials shall withstand bending without cracking, at room temperature with the axis of bending transverse to the direction of rolling, through an angle as indicated in table III. Condition A material shall be bent around a diameter equal to the thickness of the sample; and condition N and MA materials, around a diameter equal to three times the thickness of the material.

TABLE I. Chemical composition

Element	Analysis (percent)	Tolerances ^{1/} (percent)
Carbon	0.28 - 0.33	±0.02
Manganese	.40 - 0.60	± .03
Phosphorus	.025 max	+ .005
Sulfur	.025 max	+ .005
Silicon	.20 - 0.35	± .02
Chromium	.80 - 1.10	± .05
Molybdenum	.15 - 0.25	± .02
Nickel	.25 max	+ .03

3.6 Grain size:

The austenitic grain size of the steel shall be predominantly No. 5 or finer, with grains as large as No. 3 permissible.

3.7 Response to thermal treatment:

Materials 0.250 inch or less in nominal thickness shall develop hardness of Rockwell C26 minimum when heat treated as prescribed in 4.9.2. Materials from 0.251 inch to 1.5 inch in nominal thickness shall develop the applicable minimum center hardness of table IV when heat treated as prescribed by 4.9.3.

TABLE II. Transverse mechanical properties

Condition	Tensile strength (minimum)	Yield strength at 0.2 percent off-set or at extension indicated (minimum)		Elongation in 2 inches (minimum)
	psi	psi	Extension under load, inch in 2 inches	(N) (percent)
(A)	85,000 max.			
(MA)	95,000 max.			
(N)				
Thickness less than 0.062	95,000	75,000	0.0091	8.0
Thickness over 0.062 to 0.125 inch, incl.	95,000	75,000	.0091	10.0
Thickness over 0.125 to 0.187 inch, incl.	95,000	75,000	.0091	12.0
Thickness over 0.187 to 0.249 inch, incl.	90,000	70,000	.0087	15.0
Thickness over 0.249 to 0.749 inch, incl.	90,000	70,000	.0087	16.0
Thickness over 0.749 to 1.500 inch, incl	90,000	70,000	.0087	18.0

3.8 Surface condition:

Surfaces of materials shall be descaled and oiled. Sheet and strip materials shall receive a final cold pass to ensure smoothness.

3.9 Decarburization:

Material .250 inch and under shall be free from any zone of complete decarburization as determined microscopically on prepared sections and from partial decarburization to such an extent that the average hardness at the surface of a hardened specimen as determined by Rockwell A hardness tests shall be within two Rockwell A hardness numbers of the average subsurface hardness of the same specimen. This test is not applicable to materials less than .025 inch in thickness.

- 3.9.1 Material over 0.250 inch in thickness shall be free of decarburization to such an extent that the difference in average hardness readings between the surface of the test specimen, prepared in accordance with table VI, and a depression ground to a depth of at least 0.080 inch is not greater than two Rockwell C points. (See 4.10.2).

3.10 Dimensional tolerances:

The variation between measured and ordered dimensions shall not exceed the respective tolerance limits of AMS 2252, except that width and length tolerances for sheared and gas-cut plate shall comply with the tables titled "Alloy Steel Plates, Width and Length of Sheared Plates, One Inch and Under in Thickness, Shearing Tolerances" and "Alloy Steel Plates, Gas Cut Rectangular Plates, Width and Length Tolerances," respectively, of FED-STD-48.

3.11 Identification of product:

Plate, sheet, and strip shall be legibly marked in accordance with FED-STD-183. The following marking items shall be included:

Physical condition
Heat number
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- 3.11.1 Coiled sheet and strip: The coiled sheet and strip shall be suitably tagged with the above information, using an oilproof tag, and shall also be marked near the outer end of the coil.

TABLE III. Angle of bend

Thickness of material	Angle of bend (min)	
	Material in condition (A)	Material in conditions (MA) and (N)
	Inch	Degrees
Under 0.090	180	180
0.090 to 0.187, incl	180	135
Over 0.187 to 0.249, incl	180	90
Over 0.249 to 0.749, incl	90	90

3.12 Workmanship:

Material shall be sound, of uniform quality and condition, free from scale and injurious defects such as cracks, seams, tears, grooves, laminations, pits, and blisters. Slight surface imperfections which are completely removable without reducing the section thickness below the minimum permissible dimensional tolerance limits, shall not be considered injurious defects.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for inspection:

Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own facilities or any other commercial laboratory acceptable to the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

TABLE IV. Hardness, as quenched

Nominal thickness range (inches)	Rockwell C value (min)
0.250 to 0.375, incl	42
Over 0.375 to 0.500, incl	38
Over 0.500 to 0.625, incl	32
Over 0.625 to 0.750, incl	29
Over 0.750 to 0.875, incl	27
Over 0.875 to 1.500, incl	26

4.2 Classification of inspection:

The inspection of the steel is classified as quality conformance inspection.

4.3 Examination of product:

4.3.1 Sampling for examination of dimensions, finish, workmanship, preparation for delivery and identification marking: Units of product shall be randomly selected in accordance with table V to represent each lot of material of one heat, the same nominal dimensions, and offered for acceptance at one time.

4.3.2 Samples shall be examined visually or by appropriate methods for conformance with specified requirements.

4.4 Chemical analysis:

4.4.1 Sampling: One sample for check chemical analysis shall be selected in accordance with Method 111 or 112 of FED-STD-151, to represent each heat in the shipment.

4.4.1.1 Samples for check chemical analysis may be waived at the discretion of the procuring activity, provided that all of the material under inspection can be identified as being made from a heat previously analyzed and found to be in conformance with the chemical composition specified herein.

4.4.1.2 The method of selecting samples as specified above is based on the assumption that the material is produced from ingots from the same heat and is essentially homogeneous in all respects. If the material is taken from stock and is not identifiable as to heat and method of manufacture, or if the identity of any portion of the shipment is obscure in any respect, additional samples shall be selected in accordance with Table VI.

TABLE V. Sampling for examination of product

Lot size	Sample size	Acceptance number
1 to 15	All	0
16 to 180	15	0
181 to 300	35	0
301 to 500	50	1
Over 500	75	2

4.4.2 Method: Analysis shall be by wet chemical (Method 111), spectrochemical (Method 112 of FED-STD-151), or chemical methods except for carbon, which shall be by the combustion method.

4.5 Tensile test:

4.5.1 Sampling: Two tensile test samples shall be selected to represent each 200 sheets or 100 plates or each 10 coils, or less, of product of the same thickness and condition, and submitted for acceptance at one time.

4.5.2 Method: Tension test specimens shall be prepared and tested in accordance with Method 211 of FED-STD-151. Round test specimens shall conform to the type R1 shown on figure 2 of Method 211. Flat test specimens shall conform to types F1 and F2 of figure 3, Method 211. All tension test specimens shall be prepared with the longitudinal axis perpendicular to the direction of rolling.

4.6 Bend test:

4.6.1 Sampling: Three samples shall be selected from each 200 sheets or 100 plates or from each coil of product from each heat, of the same thickness and condition and submitted for acceptance at one time.

4.6.2 Preparation of specimens: Transverse bend specimens shall be prepared in accordance with Method 231 of FED-STD-151.

4.6.3 Method: Specimens shall be bent cold, Method 231 of FED-STD-151, either by pressure or by blows, except that in the event of dispute, bending shall be by pressure. The formation of cracks not over 1/16 inch in aggregate length, at the corners on the outside of the bend, shall not be cause for rejection.

4.7 Grain size:

4.7.1 Sampling: One sample shall be selected to represent each heat of steel from which material is presented for acceptance.

4.7.2 Test method: Specimens shall be sectioned and polished to appropriate fineness by metallographic methods and suitably etched to reveal the grain structure. The austenitic grain size shall be determined in accordance with Method 311, of FED-STD-151.

4.8 Response to thermal treatment:

4.8.1 Sampling: Two samples shall be selected to represent each heat of alloy from which materials are submitted for acceptance. In the event the heat number is not known, one sample shall be selected from each 200 sheets or 100 plates or from each coil of product of the same thickness and presented for acceptance at one time.

4.8.2 Method (material 0.250 inch and less in thickness): Specimens measuring 1 by 2 inches shall be cut from the samples, quenched in oil from $1,600^{\circ} \pm 10^{\circ} \text{F}$, and tempered at not less than 900°F for 30 minutes at heat. Hardness tests shall be conducted in accordance with Method 243 of FED-STD-151.