



# AEROSPACE MATERIAL SPECIFICATION

## AMS 4085A

Society of Automotive Engineers, Inc.

400 COMMONWEALTH DRIVE, WARRENDALE, PA. 15096

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ALUMINUM ALLOY SHEET  
5.7Zn - 2.2Mg - 1.6Cu - 0.22Cr (7475-T761)

1. SCOPE:

1.1 Form: This specification covers an aluminum alloy in the form of sheet.

1.2 Application: Primarily for structural applications requiring material with high strength and resistance to exfoliation-corrosion, moderate fatigue strength, and high fracture-toughness.

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications (AMS) shall apply. The applicable issue of other documents shall be as specified in AMS 2350.

2.1 SAE Publications: Available from Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15096.

2.1.1 Aerospace Material Specifications:

AMS 2202 - Tolerances, Aluminum-Base and Magnesium-Base Alloy Sheet and Plate

AMS 2350 - Standards and Test Methods

AMS 2355 - Quality Assurance Sampling and Testing of Aluminum-Base and Magnesium-Base Alloys, Wrought Products (Except Forgings and Forging Stock) and Flash Welded Rings

2.2 ASTM Publications: Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

ASTM E338 - Sharp-Notch Tension Testing of High-Strength Sheet Materials

ASTM G34 - Exfoliation Corrosion Susceptibility in 7XXX Series Copper Containing Aluminum Alloys (EXCO Test)

2.3 Government Publications: Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

2.3.1 Military Standards:

MIL-STD-649 - Aluminum and Magnesium Products, Preparation for Shipment and Storage

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3. TECHNICAL REQUIREMENTS:

3.1 Composition: Shall conform to the following percentages by weight, determined in accordance with AMS 2355:

	min	max
Zinc	5.2	- 6.2
Magnesium	1.9	- 2.6
Copper	1.2	- 1.9
Chromium	0.18	- 0.25
Iron	--	0.12
Silicon	--	0.10
Manganese	--	0.06
Titanium	--	0.06
Other Impurities, each	--	0.05
Other Impurities, total	--	0.15
Aluminum	remainder	

3.2 Condition: Solution and precipitation heat treated.

3.3 Properties: Sheet 0.040 in. (1.02 mm) and over in nominal thickness shall conform to the following requirements, determined in accordance with AMS 2355 except that notch tensile testing shall be performed as in 3.3.3.1. Tensile properties, apparent critical-stress-intensity factor, and notch tensile strength/tensile yield strength ratio, requirements for sheet under 0.040 in. (1.02 mm) in nominal thickness shall be as agreed upon by purchaser and vendor.

3.3.1 Tensile Properties: Shall be as follows:

Tensile Strength, min	71,000 psi (490 MPa)
Yield Strength at 0.2% Offset, min	60,000 psi (414 MPa)
Elongation in 2 in. (50 mm), min	9%

3.3.2 Apparent Critical-Stress-Intensity Factor: Apparent critical-stress-intensity factor ( $K_{qc}$ ), determined in accordance with 3.3.2.1 or by other method agreed upon by purchaser and vendor, shall be as follows:

Ø	Nominal Thickness		$K_{qc}$ , min	
	Inch	(Millimetres)	ksi $\sqrt{\text{in.}}$	(MPa $\sqrt{\text{m}}$ )
	0.040 to 0.125, incl	(1.02 to 3.18, incl)	80	(88.0)
	Over 0.125 to 0.249, incl	(Over 3.18 to 6.32, incl)	70	(76.9)

3.3.2.1 Panels as in 4.3.2 shall be fixtured in a tensile test machine so that the jaw separation is 32 in. (813 mm) and the slot is centered between jaws. Panels shall be stressed in tension in the long-transverse direction at a rate of approximately 50,000 psi (345 MPa) per min. on the net section and the crack length at instability determined by a plot of load versus specimen deformation. The latter shall be measured using a compliance gage reading over a gage length of at least 2/3 the panel width and a suitable compliance correlation. Measurements should also be made by direct visual observation. Values of  $K_{qc}$  shall be calculated by the following equation:

$$K_{qc} = \frac{P(a)^{1/2}}{BW} \left[ 1.77 + 0.227 \left( \frac{2a}{W} \right) - 0.510 \left( \frac{2a}{W} \right)^2 + 2.7 \left( \frac{2a}{W} \right)^3 \right]$$

where,  $K_{qc}$  = Apparent critical-stress-intensity factor, ksi  $\sqrt{\text{in.}}$  (MPa  $\sqrt{\text{m}}$ )

P = Load at fracture instability (maximum load), in thousands of pounds (MN)

2a = Total crack length at fracture instability, in. (m)

B = Thickness, in. (m)

W = Width, in. (m)

3.3.2.1.1 All  $K_{qc}$  data are based on specimens which have not buckled during testing. Anti-buckling guides may be used for sheet having nominal thickness of 0.157 in. (4 mm) and under.

3.3.3 Notch Tensile Strength/Tensile Yield Strength (NTS/TYS) Ratio: Unless otherwise specified, the producer may guarantee that sheet meets the apparent critical-stress-intensity factor ( $K_{qc}$ ) requirements based on correlation with notch tensile strength/tensile yield strength (NTS/TYS) ratio in lieu of determining the apparent critical-stress-intensity factor (3.3.2) provided that he has established correlation between the two tests for his sheet.

3.3.3.1 Notch tensile strength in the long-transverse direction shall be determined in accordance with ASTM E338 on specimens conforming to Fig. 1 of this specification. The values shall be divided by the long-transverse tensile yield strength to obtain the NTS/TYS ratio.

3.3.4 Conductivity:

3.3.4.1 If the conductivity is 39% IACS (International Annealed Copper Standard) or higher and the yield strength does not exceed the specified minimum by 9000 psi (62 MPa) or more, the sheet is acceptable.

3.3.4.2 If the conductivity is 39% IACS or higher and the yield strength exceeds the specified minimum by 9000 psi (62 MPa) or more, the sheet shall also meet the requirements of 3.3.5 to be acceptable.

3.3.4.3 If the conductivity is at least 38% IACS but lower than 39% IACS, the sheet shall also meet the requirements of 3.3.5 to be acceptable.

3.3.4.4 If the conductivity is lower than 38% IACS, the sheet is not acceptable.

3.3.4.4.1 Sheet found to be unacceptable may be given additional precipitation heat treatment and if, after completion of such treatment, it meets the criteria of 3.3.4.1, 3.3.4.2, or 3.3.4.3, it shall be acceptable.

3.3.5 Exfoliation Resistance: Sheet less than 0.100 in. (2.54 mm) in nominal thickness, examined on the surface, and sheet 0.100 in. (2.54 mm) and over in nominal thickness (T), examined at a T/10 plane, shall not show exfoliation equal to or greater than that illustrated by Photo B, Fig. 2 of ASTM G34 after being subjected to the exfoliation test of ASTM G34.

3.4 Quality: Sheet, as received by purchaser, shall be uniform in quality and condition, sound, and free from foreign materials and from internal and external imperfections detrimental to usage of the sheet.

3.5 Tolerances: Unless otherwise specified, tolerances shall conform to all applicable requirements of AMS 2202.

#### 4. QUALITY ASSURANCE PROVISIONS:

- 4.1 Responsibility for Inspection: The vendor of sheet shall supply all samples and shall be responsible for performing all required tests. Results of such tests shall be reported to the purchaser as required by 4.4. Purchaser reserves the right to perform such confirmatory testing as he deems necessary to ensure that the sheet conforms to the requirements of this specification.
- 4.2 Classification of Tests:
- 4.2.1 Acceptance Tests: Tests to determine conformance to requirements for composition (3.1), tensile properties (3.3.1), apparent critical-stress-intensity factor (3.3.2), notch tensile strength/tensile yield strength ratio (3.3.3), conductivity (3.3.4), and tolerances (3.5) are classified as acceptance tests and shall be performed on each lot of product, except that the apparent critical-stress-intensity factor need not be determined if the notch tensile strength/tensile yield strength ratio indicates that the established correlation is met.
- 4.2.2 Periodic Tests: Tests to determine conformance to requirements for exfoliation resistance (3.3.5) are classified as periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.
- 4.3 Sampling: Shall be in accordance with AMS 2355 and the following; an inspection lot for tensile properties, apparent critical-stress-intensity factor, notch tensile strength/tensile yield strength ratio, and conductivity shall be all sheet of the same alloy, temper, section, and size traceable to a heat treatment lot and submitted for vendor's inspection at one time.
- 4.3.1 Specimens for the critical-stress-intensity factor test shall be panels nominally 44 in. (1120 mm) long by 16 in. (405 mm) wide by the thickness of the sheet. The panel shall have a slot 4 in. (100 mm) in length centered on the length and width of the specimen with the length of the slot parallel to the width of the specimen. The last 0.50 in. (12.7 mm) of each end of the slot shall be a sawed slot not over 0.010 in. (0.25 mm) wide. The 44 in. (1120 mm) dimension of the panel shall be in the long-transverse direction.
- 4.3.2 Specimens for notch-tensile testing shall be taken from sheet in the long-transverse direction. Configuration of the specimen shall conform to Fig. 1 of this specification.
- 4.3.3 Specimens for conductivity testing shall be the tensile test samples.
- 4.3.4 At least one sample shall be taken from each lot for exfoliation resistance testing if the yield strength exceeds the specified minimum by more than 9000 psi (62 MPa) or if conductivity is between 38% and 39% IACS.
- 4.4 Reports:
- 4.4.1 The vendor of sheet shall furnish with each shipment three copies of a report stating that the sheet conforms to the chemical composition and other technical requirements of this specification. This report shall include the purchase order number, material specification number and its revision letter, size, and quantity.
- 4.4.2 The vendor of finished or semi-finished parts shall furnish with each shipment three copies of a report showing the purchase order number, material specification number and its revision letter, contractor or other direct supplier of sheet, part number, and quantity. When sheet for making parts is produced or purchased by the parts vendor, that vendor shall inspect each lot of sheet to determine conformance to the requirements of this specification, and shall include in the report a statement that the sheet conforms, or shall include copies of laboratory reports showing the results of tests to determine conformance.

- 4.5 Resampling and Retesting: Shall be in accordance with AMS 2355.
5. PREPARATION FOR DELIVERY:
- 5.1 Identification: Each sheet shall be marked on one face, in the respective location indicated below, with the alloy number and temper, AMS 4085, inspection lot number, manufacturer's identification, and nominal thickness. The characters shall be of such size as to be clearly legible, shall be applied using a suitable marking fluid, and shall be sufficiently stable to withstand normal handling. The markings shall have no deleterious effect on the sheet or its performance.
- 5.1.1 Flat Sheet Under 6 In. (152 mm) Wide: Shall be marked in one or more lengthwise rows of characters recurring at intervals not greater than 3 ft (914 mm). The inspection lot number may appear in the row marking or may appear at only one location on each sheet.
- 5.1.2 Flat Sheet 6 - 60 In. (152 - 1524 mm), Incl, Wide and 36 - 200 In. (914 - 5080 mm), Incl, Long: Shall be marked in lengthwise rows of characters recurring at intervals not greater than 3 ft (914 mm), the rows being spaced approximately 6 in. (152 mm) on centers across the width and staggered. Every third row shall show the manufacturer's identification and nominal thickness. The other rows shall show the alloy number and temper and AMS 4085. The inspection lot number may be included in the rows with the alloy, temper, and specification designations or may appear at only one location on each sheet.
- 5.1.3 Flat Sheet Over 60 In. (1524 mm) Wide or Over 200 In. (5080 mm) Long: Shall be marked as in 5.1.2 or, at vendor's discretion, shall be marked in one or two rows of characters recurring at intervals not greater than 3 ft (914 mm) and running around the periphery of the piece. If one row is used, it shall show all information of 5.1 except that the inspection lot number may be omitted. If two rows are used, one row shall show the alloy number and temper and AMS 4085; the second row shall show the manufacturer's identification and nominal thickness. The inspection lot number may be included in the line with the manufacturer's identification and nominal thickness or may appear at only one location on each sheet.
- 5.1.3.1 If peripheral marking is applied to the full sheet as produced but partial sheets are supplied, an arrow shall also be applied near one corner indicating the direction of rolling.
- 5.2 Protective Treatment: Flat sheet shall be protected, during shipment and storage, by interleaving with suitable paper sheets.
- 5.3 Packaging:
- 5.3.1 Sheet 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 sheet to ensure carrier acceptance and safe delivery. Packaging shall conform to carrier rules and regulations applicable to the mode of transportation.
- 5.3.2 For direct U.S. Military procurement, packaging shall be in accordance with MIL-STD-649, Level A or Level C, as specified in the request for procurement. Commercial packaging as in 5.3.1 will be acceptable if it meets the requirements of Level C.
6. ACKNOWLEDGMENT: A vendor shall mention this specification number and its revision letter in all quotations and when acknowledging purchase orders.
7. REJECTIONS: Sheet not conforming to this specification or to authorized modifications will be subject to rejection.