

Aluminum Alloy Sheet
6.0Cu - 0.40Zr - (2004-F)
As Rolled

(Composition similar to UNS A92004)

RATIONALE

AMS4208C results from a Five Year Review and update of this specification.

1. SCOPE

1.1 Form

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

1.2 Application

This product has been used typically for parts requiring a high degree of formability (super-plasticity) and response to heat treatment, 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 724-776-4970 (outside USA), www.sae.org.

AMS2355 Quality Assurance, Sampling and Testing, Aluminum Alloys and Magnesium Alloy, Wrought Products (Except Forging Stock), and Rolled, Forged, or Flash Welded Rings

AS1990 Aluminum Alloy Tempers

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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 B 660	Packaging/Packing of Aluminum and Magnesium Products
ASTM B 666/B 666M	Identification Marking of Aluminum and Magnesium Products
ASTM E 21	Elevated Temperature Tension Tests of Metallic Materials

2.3 ANSI Publications

Available from American National Standards Institute, 25 West 43rd Street, New York, NY 10036-8002, Tel: 212-642-4900, www.ansi.org.

ANSI H 35.2	Dimensional Tolerances for Aluminum Mill Products
ANSI H 35.2M	Dimensional Tolerances for Aluminum Mill Products (Metric)

3. TECHNICAL REQUIREMENTS

3.1 Composition

Shall conform to the percentages by weight, shown in Table 1, determined in accordance with AMS2355:

TABLE 1 - COMPOSITION (2004-F)

Element	min	max
Silicon	--	0.20
Iron	--	0.20
Copper	5.5	6.5
Manganese	--	0.10
Magnesium	--	0.50
Zinc	--	0.10
Titanium	--	0.05
Zirconium	0.30	0.50
Other Elements, each	--	0.05
Other Elements, total	--	0.15
Aluminum	remainder	

3.2 Condition

As-rolled to the -F temper (See AS1990). Sheet shall not be flattened, leveled, or straightened.

3.3 Properties

Sheet shall conform to the following requirements, determined in accordance with AMS2355 on the mill product size, except as specified in 3.3.1:

3.3.1 As-Rolled (Super-plasticity)

Specimens, conforming to Figure 1, shall have the properties shown in Table 2 after being heated to 840 °F ± 10 (450 °C ± 6), held at heat for 20 to 30 minutes before testing, and tested in accordance with ASTM E 21 at 840 °F ± 10 (450 °C ± 6) using a constant crosshead speed of 0.5 inch per minute (12.5 mm/minute).

TABLE 2 - MINIMUM AS-ROLLED ELONGATION

Property	Value
Elongation in 0.5 inch (12.7 mm)	
Individual Tests	350%
Average of All Tests	400%

3.3.2 Pseudo As-Formed

Sheet shall have the room temperature properties shown in Table 3 after being heated to 840 °F ± 10 (450 °C ± 6), held at heat for 20 minutes ± 2, and cooled in air.

TABLE 3 - TENSILE PROPERTIES (PSEUDO AS-FORMED)

Property	Value
Tensile Strength	32.0 to 39.0 ksi (200 to 255 MPa)
Yield Strength at 0.2% Offset	16.0 to 25.0 ksi (90 to 152 MPa)
Elongation in 2 Inches (50.8 mm)	10% to 20%

3.3.3 After Solution and Precipitation Heat Treatment

Sheet shall have the properties shown in Table 4 after being solution heat treated by heating to 985 °F ± 10 (529 °C ± 6), holding at heat for 30 to 60 minutes, and quenching in warm (approximately 105 °F (41 °C)) water, with quenching being completed within 20 seconds, and precipitation heat treated by heating to 330 °F ± 10 (166 °C ± 6), holding at heat for 16 to 20 hours, and cooling in air or, when permitted by purchaser, heating to 365 °F ± 10 (185 °C ± 6), holding at heat for 3.5 to 5 hours, and cooling in air.

TABLE 4 - TENSILE PROPERTIES AFTER SOLUTION AND PRECIPITATION HEAT TREATMENT

Property	Value
Tensile Strength	54.0 to 68.0 ksi (352 to 448 MPa)
Yield Strength at 0.2% Offset	39.0 to 48.0 ksi (228 to 310 MPa)
Elongation in 2 Inches (50.8 mm)	8% to 20%

3.4 Quality

Sheet, as received by purchaser, shall be uniform in quality and condition, sound, free from foreign materials and free from edge cracking and any imperfections detrimental to usage of the sheet.

3.5 Tolerances

Shall be as follows:

3.5.1 Thickness

Shall conform to all applicable requirements of ANSI H 35.2 or ANSI H 35.2M.

3.5.2 Length and Width

±0.5 inch (±12.7 mm).

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

The vendor of sheet shall supply all samples for vendor'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 sheet conforms to specified requirements.

4.2 Classification of Tests

All technical requirements are acceptance tests and, except for composition, shall be performed on each lot.

4.3 Sampling and Testing

Shall be in accordance with AMS2355 and the following.

4.3.1 A lot shall be all sheet produced from one ingot processed and rolled to the same nominal thickness in one series of operations.

4.3.2 Specimens for as-rolled (super-plasticity) elongation (3.3.1) shall be taken and tested in duplicate in the longitudinal direction and also in the transverse direction from sheet 2.25 inches (57.1 mm) and over in nominal width.

4.4 Reports

The vendor of sheet shall furnish with each shipment a report stating that the sheet conforms to the composition, tolerances, and including the numerical values of mechanical properties. The report shall also state that the specification conforms to the other technical requirements. This report shall include the purchase order number, lot number, AMS4208C, size, and quantity. The identity of the producer and the size of the mill product shall be included.

4.5 Resampling and Retesting

Shall be in accordance with AMS2355.

5. PREPARATION FOR DELIVERY

5.1 Identification

Shall be in accordance with ASTM B 666/B 666M.

5.2 Protective Treatment

Product shall be protected from damage during storage and shipment by a method determined by vendor unless specified by purchaser. An example of a typical protective method includes, but is not limited to, interleaving with paper.

PRODUCT PRODUCED UNDER THIS SPECIFICATION SHALL NOT BE OILED.

5.3 Packaging

5.3.1 Each lot shall be packaged separately.

5.3.2 Sheet shall be prepared for shipment in accordance with ASTM B 660 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.