

ΠΑΡΑΡΤΗΜΑ «Α»

ΔΙΑΓΩΝΙΣΜΟΣ 785



Aluminum 2024-T4; 2024-T351

Subcategory: 2000 Series Aluminum Alloy; Aluminum Alloy; Metal; Nonferrous Metal

Close Analogs: none

Composition Notes: A Zr + Ti limit of 0.20 percent maximum may be used with this alloy designation for extruded and forged products only, but only when the supplier or producer and the purchaser have mutually so agreed. Agreement may be indicated, for example, by reference to a standard, by letter, by order note, or other means which allow the Zr + Ti limit.

Aluminum content reported is calculated as remainder.

Composition information provided by the Aluminum Association and is not for design.

Key Words: Aluminium 2024-T351; AA2024-T351, Aluminium 2024-T4; UNS A92024; ISO AlCu4Mg1; NF A-U4G1 (France); DIN AlCuMg2; AA2024-T4, ASME SB211; CSA CG42 (Canada)

Component	Wt. %	Component	Wt. %	Component	Wt. %
Al	90.7 - 94.7	Mg	1.2 - 1.8	Si	Max 0.5
Cr	Max 0.1	Mn	0.3 - 0.9	Ti	Max 0.15
Cu	3.8 - 4.9	Other, each	Max 0.05	Zn	Max 0.25
Fe	Max 0.5	Other, total	Max 0.15		

Material Notes: General 2024 characteristics and uses (from Alcoa): Good machinability and surface finish capabilities. A high strength material of adequate workability. Has largely superceded 2017 for structural applications.

Uses: Aircraft fittings, gears and shafts, bolts, clock parts, computer parts, couplings, fuse parts, hydraulic valve bodies, missile parts, munitions, nuts, pistons, rectifier parts, worm gears, fastening devices, veterinary and orthopedic equipment, structures.

Data points with the AA note have been provided by the Aluminum Association, Inc. and are NOT FOR DESIGN.

Physical Properties	Metric	English	Comments
Density	2.78 g/cc	0.1 lb/in ³	AA; Typical
Mechanical Properties	Metric	English	Comments
Hardness, Brinell	120	120	AA; Typical; 500 g load; 10 mm ball
Hardness, Knoop	150	150	Converted from Brinell Hardness Value
Hardness, Rockwell A	46,80	46,80	Converted from Brinell Hardness Value

CRP MECCANICA S.r.l.

Sede Legale e Amministrativa/Headquarters and Administration Office
 Via Cesare Della Chiesa 21 - 41126 Modena
 Tel./Phone +39-059-330544/821135/826025
 Fax +39-059-822071/381148
 C.F./P.IVA/Registro Imprese Modena IT00782680367 (VAT number)
 Capitale sociale Euro 564.000 i. v.



Hardness, Rockwell B	75	75	Converted from Brinell Hardness Value
Hardness, Vickers	137	137	Converted from Brinell Hardness Value
Ultimate Tensile Strength	469 MPa	68000 psi	AA; Typical
Tensile Yield Strength	324 MPa	47000 psi	AA; Typical
Elongation at Break	19 %	19 %	AA; Typical; 1/2 in. (12.7 mm) Diameter
Elongation at Break	20 %	20 %	AA; Typical; 1/16 in. (1.6 mm) Thickness
Modulus of Elasticity	73.1 GPa	10600 ksi	AA; Typical; Average of tension and compression. Compression modulus is about 2% greater than tensile modulus.
Ultimate Bearing Strength	814 MPa	118000 psi	Edge distance/pin diameter = 2.0
Bearing Yield Strength	441 MPa	64000 psi	Edge distance/pin diameter = 2.0
Poisson's Ratio	0.33	0.33	
Fatigue Strength	138 MPa	20000 psi	AA; 500,000,000 cycles completely reversed stress; RR Moore machine/specimen
Fracture Toughness	26 MPa-m ^{1/2}	23.7 ksi-in ^{1/2}	K(IC) in S-L Direction
Fracture Toughness	32 MPa-m ^{1/2}	29.1 ksi-in ^{1/2}	K(IC) in T-L Direction
Fracture Toughness	37 MPa-m ^{1/2}	33.7 ksi-in ^{1/2}	K(IC) in L-T Direction
Machinability	70 %	70 %	0-100 Scale of Aluminum Alloys
Shear Modulus	28 GPa	4060 ksi	
Shear Strength	283 MPa	41000 psi	AA; Typical
Electrical Properties	Metric	English	Comments
Electrical Resistivity	5.82e-006 ohm-cm	5.82e-006 ohm-cm	AA; Typical at 68°F
Thermal Properties	Metric	English	Comments
CTE, linear 68°F	23.2 µm/m-°C	12.9 µin/in-°F	AA; Typical; Average over 68-212°F range.
CTE, linear 250°C	24.7 µm/m-°C	13.7 µin/in-°F	Average over the range 20-300°C
Specific Heat Capacity	0.875 J/g-°C	0.209 BTU/lb-°F	
Thermal Conductivity	121 W/m-K	840 BTU-in/hr-ft ² -°F	AA; Typical at 77°F

CRP MECCANICA S.r.l.

Sede Legale e Amministrativa/Headquarters and Administration Office
 Via Cesare Della Chiesa 21 - 41126 Modena
 Tel./Phone +39-059-330544/821135/826025
 Fax +39-059-822071/381148
 C.F./P.IVA/Registro Imprese Modena IT00782680367 (VAT number)
 Capitale sociale Euro 564.000 i. v.



Melting Point	502 - 638 °C	935 - 1180 °F	AA; Typical range based on typical composition for wrought products 1/4 inch thickness or greater. Eutectic melting is not eliminated by homogenization.
Solidus	502 °C	935 °F	AA; Typical
Liquidus	638 °C	1180 °F	AA; Typical
Processing Properties	Metric	English	Comments
Annealing Temperature	413 °C	775 °F	
Solution Temperature	256 °C	493 °F	

References are available for this material.

Source: [MatWeb, The Online Materials Database](#)

CRP MECCANICA S.r.l.

Sede Legale e Amministrativa/Headquarters and Administration Office
Via Cesare Della Chiesa 21 - 41126 Modena
Tel./Phone +39-059-330544/821135/826025
Fax +39-059-822071/381148
C.F./P.IVA/Registro Imprese Modena IT00782680367 (VAT number)
Capitale sociale Euro 564.000 i. v.



Aluminum 7075-T6; 7075-T651

Subcategory: 7000 Series Aluminum Alloy; Aluminum Alloy; Metal; Nonferrous Metal

Close Analogs: none

Composition Notes: A Zr + Ti limit of 0.25 percent maximum may be used with this alloy designation for extruded and forged products only, but only when the supplier or producer and the purchaser have mutually so agreed. Agreement may be indicated, for example, by reference to a standard, by letter, by order note, or other means which allow the Zr + Ti limit.

Aluminum content reported is calculated as remainder.

Composition information provided by the Aluminum Association and is not for design.

Key Words: Aluminium 7075-T6; Aluminium 7075-T651, UNS A97075; ISO AlZn5.5MgCu; Aluminium 7075-T6; Aluminium 7075-T651; AA7075-T6

Component	Wt. %	Component	Wt. %	Component	Wt. %
Al	87.1 - 91.4	Mg	2.1 - 2.9	Si	Max 0.4
Cr	0.18 - 0.28	Mn	Max 0.3	Ti	Max 0.2
Cu	1.2 - 2	Other, each	Max 0.05	Zn	5.1 - 6.1
Fe	Max 0.5	Other, total	Max 0.15		

Material Notes: General 7075 characteristics and uses (from Alcoa): Very high strength material used for highly stressed structural parts. The T7351 temper offers improved stress-corrosion cracking resistance.

Applications: Aircraft fittings, gears and shafts, fuse parts, meter shafts and gears, missile parts, regulating valve parts, worm gears, keys, aircraft, aerospace and defense applications; bike frames, all terrain vehicle (ATV) sprockets.

Data points with the AA note have been provided by the Aluminum Association, Inc. and are NOT FOR DESIGN.

Physical Properties	Metric	English	Comments
Density	2.81 g/cc	0.102 lb/in ³	AA; Typical

Mechanical Properties	Metric	English	Comments
	150	150	AA; Typical; 500

CRP MECCANICA S.r.l.

Sede Legale e Amministrativa/Headquarters and Administration Office
 Via Cesare Della Chiesa 21 - 41126 Modena
 Tel./Phone +39-059-330544/821135/826025
 Fax +39-059-822071/381148
 C.F./P.IVA/Registro Imprese Modena IT00782680367 (VAT number)
 Capitale sociale Euro 564.000 i. v.



Hardness, Brinell			g load; 10 mm ball
Hardness, Knoop	191	191	Converted from Brinell Hardness Value
Hardness, Rockwell A	53,50	53,50	Converted from Brinell Hardness Value
Hardness, Rockwell B	87	87	Converted from Brinell Hardness Value
Hardness, Vickers	175	175	Converted from Brinell Hardness Value
Ultimate Tensile Strength	572 MPa	83000 psi	AA; Typical
Tensile Yield Strength	503 MPa	73000 psi	AA; Typical
Elongation at Break	11 %	11 %	AA; Typical; 1/16 in. (1.6 mm) Thickness
Elongation at Break	11 %	11 %	AA; Typical; 1/2 in. (12.7 mm) Diameter
Modulus of Elasticity	71.7 GPa	10400 ksi	AA; Typical; Average of tension and compression. Compression modulus is about 2% greater than tensile modulus.
Poisson's Ratio	0.33	0.33	
Fatigue Strength	159 MPa	23000 psi	AA; 500,000,000 cycles completely reversed stress; RR Moore machine/specimen
Fracture Toughness	20 MPa-m ^{1/2}	18.2 ksi-in ^{1/2}	K(IC) in S-L Direction
Fracture Toughness	25 MPa-m ^{1/2}	22.8 ksi-in ^{1/2}	K(IC) in T-L Direction
Fracture Toughness	29 MPa-m ^{1/2}	26.4 ksi-in ^{1/2}	K(IC) in L-T Direction
Machinability	70 %	70 %	0-100 Scale of Aluminum Alloys
Shear Modulus	26.9 GPa	3900 ksi	
Shear Strength	331 MPa	48000 psi	AA; Typical
Electrical Properties	Metric	English	Comments
Electrical Resistivity	5.15e-006 ohm-cm	5.15e-006 ohm-cm	AA; Typical at 68°F
Thermal Properties	Metric	English	Comments

CRP MECCANICA S.r.l.

Sede Legale e Amministrativa/Headquarters and Administration Office
 Via Cesare Della Chiesa 21 - 41126 Modena
 Tel./Phone +39-059-330544/821135/826025
 Fax +39-059-822071/381148
 C.F./P.IVA/Registro Imprese Modena IT00782680367 (VAT number)
 Capitale sociale Euro 564.000 i. v.



CTE, linear 68°F	23.6 $\mu\text{m}/\text{m}\cdot^\circ\text{C}$	13.1 $\mu\text{in}/\text{in}\cdot^\circ\text{F}$	AA; Typical; Average over 68-212°F range.
CTE, linear 250°C	25.2 $\mu\text{m}/\text{m}\cdot^\circ\text{C}$	14 $\mu\text{in}/\text{in}\cdot^\circ\text{F}$	Average over the range 20-300°C
Specific Heat Capacity	0.96 J/g·°C	0.229 BTU/lb·°F	
Thermal Conductivity	130 W/m·K	900 BTU-in/hr-ft ² ·°F	AA; Typical at 77°F
			AA; Typical range based on typical composition for wrought products 1/4 inch thickness or greater.
Melting Point	477 - 635 °C	890 - 1175 °F	Homogenization may raise eutectic melting temperature 20-40°F but usually does not eliminate eutectic melting.
Solidus	477 °C	890 °F	AA; Typical
Liquidus	635 °C	1175 °F	AA; Typical
Processing Properties	Metric	English	Comments
Annealing Temperature	413 °C	775 °F	
Solution Temperature	466 - 482 °C	870 - 900 °F	
Aging Temperature	121 °C	250 °F	

References are available for this material.

Source: [MatWeb, The Online Materials Database](#)

CRP MECCANICA S.r.l.

Sede Legale e Amministrativa/Headquarters and Administration Office

Via Cesare Della Chiesa 21 - 41126 Modena

Tel./Phone +39-059-330544/821135/826025

Fax +39-059-822071/381148

C.F./P.IVA/Registro Imprese Modena IT00782680367 (VAT number)

Capitale sociale Euro 564.000 i. v.