

AlSi10Mg Aluminum

AlSi10Mg is the aluminum alloy we print most on our EOS DMLS systems. It is light, it carries structural loads, and its chemistry matches a common casting grade, so it can replace a cast part without a die. Heat treatment shifts its strength, ductility, and conductivity to suit the job.

EN AC-43000

Chemistry in compliance with DIN EN 1706

2.64–2.67 g/cm³

Typical density (ISO 3369) across published processes

25–70 μm

Generic powder particle size distribution

About this alloy

AlSi10Mg is aluminum with about 10% silicon and a small amount of magnesium. The silicon helps the powder melt and refreeze cleanly under the laser, and the magnesium lets the metal age harden, which is what T6 heat treatment uses to adjust its properties. The powder chemistry complies with DIN EN 1706 (EN AC-43000). Evology has run DMLS in-house since 2004.

Typical applications

Heat exchangers with internal channels, lightweight structural brackets and knuckles, automotive and aerospace components, and short-run casting replacements.

Powder chemical composition (wt.-%)

ELEMENT	MIN.	MAX.
Al	Balance	Balance
Si	9.0	11.0
Fe	—	0.55
Cu	—	0.05
Mn	—	0.45
Mg	0.25	0.45
Ni	—	0.05
Zn	—	0.10
Pb	—	0.05
Sn	—	0.05
Ti	—	0.15

Published process options

SYSTEM	LAYER	BUILD RATE	MIN. WALL	PLATFORM TEMP	INERT GAS
EOS M 290	30 µm	5.1 mm³/s	0.4 mm	35 °C	Argon
EOS M 290	60 µm	10.5 mm³/s	—	100 °C	Argon
EOS M 300-4	60 µm	up to 4 × 10.5 mm³/s	—	165 °C	Argon
EOS M 400	90 µm	27.8 mm³/s	—	165 °C	Nitrogen
EOS M 400-4	30 µm	4 × 7.4 mm³/s	—	165 °C	Nitrogen
EOS M 400-4	40 µm	4 × 7.0 mm³/s	0.3 mm	35 °C	Argon
EOS M 400-4	80 µm	4 × 18.1 mm³/s	0.4 mm	165 °C	Nitrogen

Thinner layers favor surface finish and mechanical properties; thicker layers build faster. The 80 µm M 400-4 process has a published as-built surface roughness of Ra 15 µm. Platform temperatures above 100 °C with high laser energy input can age the material during long builds.

Mechanical properties, as manufactured (ISO 6892-1, B10)

PROCESS	ORIENTATION	YIELD RP0.2 [MPa]	TENSILE RM [MPa]	ELONGATION A [%]
EOS M 290, 30 µm	Vertical	230	460	6.3
EOS M 290, 30 µm	Horizontal	270	450	10.2
EOS M 290, 60 µm	Vertical	240	440	4
EOS M 290, 60 µm	Horizontal	250	440	7
EOS M 300-4, 60 µm	Vertical	213	398	4
EOS M 300-4, 60 µm	Horizontal	228	377	7
EOS M 400, 90 µm	Vertical	240	380	2
EOS M 400, 90 µm	Horizontal	260	400	3
EOS M 400-4, 30 µm	Vertical	230	430	3
EOS M 400-4, 30 µm	Horizontal	250	400	5
EOS M 400-4, 40 µm	Vertical	230	450	5
EOS M 400-4, 40 µm	Horizontal	250	440	8
EOS M 400-4, 80 µm	Vertical	220	360	2
EOS M 400-4, 80 µm	Horizontal	250	380	2

Testing on machined (turned) samples. Values are averages and depend on platform temperature, job layout, and position on the build plate.

Mechanical properties, EOS T6 heat treated (ISO 6892-1, B10)

PROCESS	ORIENTATION	YIELD RP0.2 [MPa]	TENSILE RM [MPa]	ELONGATION A [%]
EOS M 290, 30 µm	Vertical	250	310	11
EOS M 290, 30 µm	Horizontal	260	320	11
EOS M 290, 60 µm	Vertical	250	320	8
EOS M 290, 60 µm	Horizontal	260	320	9
EOS M 300-4, 60 µm	Vertical	250	320	11
EOS M 300-4, 60 µm	Horizontal	258	331	11
EOS M 400, 90 µm	Vertical	230	300	5
EOS M 400, 90 µm	Horizontal	230	300	5
EOS M 400-4, 40 µm	Vertical	230	300	10
EOS M 400-4, 40 µm	Horizontal	250	300	10
EOS M 400-4, 80 µm	Vertical	210	300	6
EOS M 400-4, 80 µm	Horizontal	220	310	8

EOS has not published T6 values for the 30 µm M 400-4 process. T6 gives up some tensile strength for elongation and evens out the difference between build directions.

Density and defects, as manufactured

PROCESS	AVG. DEFECT PERCENTAGE	DENSITY (ISO 3369)
EOS M 290, 30 µm	0.04% (0.1–0.2% after T6)	e 2.67g/cm ³
EOS M 290, 60 µm	0.2%	e 2.66g/cm ³
EOS M 300-4, 60 µm	0.08% (max. defect 150 µm)	—
EOS M 400, 90 µm	0.2%	e 2.65g/cm ³
EOS M 400-4, 30 µm	0.15%	e 2.64g/cm ³
EOS M 400-4, 40 µm	< 0.1%	e 2.67g/cm ³
EOS M 400-4, 80 µm	0.3%	e 2.65g/cm ³

Thermal conductivity (ISO 22007-2:2015), M 290 30 µm [W/m·K]

ORIENTATION	AS MANUFACTURED	EOS T6	STRESS-RELIEVED
Vertical	100	165	160
Horizontal	110	155	165

Electrical conductivity (ASTM E1004), M 290 30 µm [% IACS]

ORIENTATION	AS MANUFACTURED	EOS T6	STRESS-RELIEVED
Horizontal	25	44	44

Coefficient of thermal expansion (ASTM E228)

TEMPERATURE	CTE
25–100 °C	20×10 ⁻⁶ /K
25–200 °C	22×10 ⁻⁶ /K
25–300 °C	27×10 ⁻⁶ /K

Fatigue and gas tightness

PROPERTY	TYPICAL VALUE	METHOD
Fatigue strength, lower limit (M 290, 30 µm)	110 MPa	HCF, ASTM E466-15, 20 million cycles, fully reversed
Fatigue strength, lower limit (M 400-4, 40 µm)	110 MPa	HCF, ASTM E466-15, 10 million cycles, fully reversed
Gas tightness, 2 mm wall (M 290, 30 µm)	10 ⁻⁶ mbar l/s	Helium leak test, EN 13185:2001

Aluminum alloys have no true fatigue limit. Fatigue life depends on geometry and especially on surface finish. The high-cycle tests above used machined samples with no heat treatment.

Heat treatment

EOS T6 is an AM-optimized cycle, about 40% shorter than a conventional T6. Solution annealing: 30 minutes at 530 °C, then an immediate water quench. Artificial aging: 6 hours at 165 °C, then cooling in air. Parts go into a preheated oven, overheating stays within 5 °C, and the delay between solution annealing and quench stays under 30 seconds. Oven type and load can shift the results, so bulky or complex parts need uniform heating and cooling. A small increase in porosity after heat treatment is possible.

When parts have to come off the build plate before T6, the usual first step is a stress relief of 90 minutes at 270 °C. After stress relief alone, typical properties are about 200 MPa yield, 310 MPa tensile, and 9% elongation. EOS recommends T6 whenever controlled mechanical properties and low scatter matter, and after builds at elevated platform temperature.

Source and notes

Values are drawn from the EOS Aluminium AlSi10Mg material data sheet, status 01/2022 ([OEM source](#)), which documents powder chemistry and measured part properties on EOS Laser Powder Bed Fusion systems. Results vary with system parameters, job layout, test geometry, and post-processing. They are not a guarantee of properties on your part.

Full page: <https://www.evologymfg.com/manufacturing-capabilities/dmls-direct-metal-laser-sintering/alsi10mg-aluminum>