BAKER INDUSTRIES

Aluminum AlSi10Mg

MATERIAL DATA SHEET

AlSi10Mg is a typical casting alloy with good casting properties and is typically used for cast parts with thin walls and complex geometry. It offers good strength, hardness and dynamic properties and is therefore also used for parts subject to high loads. Parts in Aluminum AlSi10Mg are ideal for applications which require a combination of good thermal properties and low weight. They can be machined, spark-eroded, welded, micro shot-peened, polished and coated if required.

General process & Geometric data

Typical achievable part accuracy [1]	± 100 µm
Smallest wall thickness [2]	approx. 0.3 – 0.4 mm approx. 0.012 – 0.016 inch
Surface roughness, *- as built, cleaned* [3]	Ra 6 - 10 µm, Rz 30 - 40 µm Ra 0.24 - 0.39 x 10^{-3} inch Rz 1.18 - 1.57 x 10^{-3} inch
- after micro shot-peening	Ra 7 - 10 µm, Rz 50 - 60 µm Ra 0.28 - 0.39 x 10^{-3} inch Rz 1.97 - 2.36 x 10^{-3} inch
Volume rate [4]	7.4 mm^3/s (26.6 cm^3/h) 1.6 in^3/h

Physical & Chemical properties of parts

Material composition	Al (balance)	Mn (≤ 0.45 wt-%)	Pb (≤ 0.05 wt-%)
	Si (9.0 - 11.0 wt-%)	Mg (0.2 - 0.45 wt-%)	Sn (≤ 0.05 wt-%)
	Fe (≤ 0.55 wt-%)	Ni (≤ 0.05 wt-%)	Ti (≤ 0.15 wt-%)
	Cu (≤ 0.05 wt-%)	Zn (≤ 0.10 wt-%)	
Relative density	approx. 99.85 %		
Density	2.67 g/cm^3 0.096 lb/in^3		

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Mechanical properties of parts - as built

	Horizontal Axis (XY)	*Vertical Axis (Z)*
Tensile Strength [5]	460 ± 20 MPa 66.7 ± 2.9 ksi	460 ± 20 MPa 66.7 ± 2.9 ksi
Yield strength (Rp 0.2 %) [5]	270 ± 10 MPa 39.2 ± 1.5 ksi	240 ± 10 MPa 34.8 ±1.5 ksi
Modulus of elasticity	75 ± 10 GPa 10.9 ± 0.7 Msi	70 ± 10 GPa 10.2 ± 0.7 Msi
Elongation at break [5]	(9 ± 2) %	(6 ± 2) %
Hardness [6]	approx. 119 ± 5 HBW	
Fatigue strength [7]	- - - - - - - - - -	approx. 97 ± 7 MPa approx. 14.1 ± 1.0 ksi
Thermal conductivity (at 20 °C)	approx. 103 ± 5 W/m°C	approx. 119 ± 5 W/m°C
Specific heat capacity	approx. 920 ± 50 J/kg°C	approx. 910 ± 50 J/kg°C

Mechanical properties of parts - heat treated [8]

	Horizontal Axis (XY)	*Vertical Axis (Z)*
Tensile Strength [5]	345 ± 10 MPA 50.0 ± 1.5 ksi	350 ± 10 MPa 50.8 ± 1.5 ksi
Yield strength (Rp 0.2 %) [5]	230 ± 15 MPa 33.4 ± 2.2 ksi	230 ± 15 MPa 33.4 ± 2.2 ksi
Modulus of elasticity	70 ± 10 GPa 10.2 ± 0.7 Msi	60 ± 10 GPa 8.7 ± 0.7 Msi
Elongation at break [5]	12 ± 2%	11 ± 2%
Thermal conductivity (at 20 °C)	approx. 173 ± 10 W/m°C	approx. 173 ± 10 W/m°C
Specific heat capacity	approx. 890 ± 50 J/kg°C	approx. 890 ± 50 J/kg°C

[1] Based on users' experience of dimensional accuracy for typical geometries. Part accuracy is subject to appropriate data preparation and post-processing.

[2] Mechanical stability dependent on the geometry (wall height etc.) and application.

[3] Due to the layer-wise building, the surface structure depends strongly on the orientation of the surface, for example sloping and curved surfaces exhibit a stair-step effect. The values also depend on the measurement method used. The values quoted here given an indication of what can be expected for horizontal (up-facing) or vertical surfaces.

[4] The volume rate is a measure of the building speed during laser exposure. The overall building speed is dependent on the average volume rate, the time required for coating (depends on the number of layers) and other factors, e.g. DMLS settings.

[5] Mechanical strength tested as per ISO 6892-1:2009 (B) annex D, proportional specimens, specimen diameter 5 mm, original gauge length 25 mm (1 inch).

[6] Hardness test in accordance with Brinell (HBW 2.5/62.5) as per DIN EN ISO 6506-1. Note that measured hardness can vary significantly depending on how the specimen has been prepared.

[7] Fatigue test with test frequency of 50 Hz, R = -1, measurement stopped on reaching 5 million cycles without fracture.

[8] Stress relieve: anneal for 2 h at 300 °C (572 °F).