13 Al

22 Ti | 24 Cr | 26 Fe | 27 Co | 28 Ni | 29 Cu

X Line 2000R Aluminum AlSi10Mg

Parameter for GE Additive's Concept Laser X Line 2000R

Data in this material datasheet represent material built with 60 µm layer thickness in a nitrogen or argon atmosphere on a Concept Laser X Line 2000R and requires build plate heating. Values listed are typical.

Aluminum AlSi10Mg

AlSi10Mg has a chemical composition according to ASTM F3318 and is an essential aluminum alloy in the world of additive manufacturing. As a good casting alloy for complex geometries, it combines light weight and excellent thermal conductivity. The alloy is ideally suited for part designs with thin walls such as ductwork or heat exchangers. Once post-processed, parts offer good strength and hardness superior to conventionally cast material, as well as good dynamic properties for industries in the aerospace, automotive, automation and tooling sectors. In summary this aluminum alloy holds great promises to bring additive manufacturing to high volume consumer applications.

X Line 2000R AlSi10Mg

The AlSi10Mg parameters for the Concept Laser X Line 2000R are developed leveraging the performance of the previous X Line generations. The productivity parameters deliver a good balance between surface quality needs and productivity. Furthermore, the parameters offer a very good density, leading to high strength and elongation – succeeding the minimum tensile properties specified in ASTM F3318 for additive manufactured parts in the as-built and stress relieved state. The parameter performance was validated both in nitrogen and argon atmospheres. A large variety of heat treatments have been evaluated in order to offer the best solution depending on the mechanical properties' requirements.

X Line 2000R Aluminum AlSi10Mg

With appropriate approval* AlSi10Mg can be used for lightweight components in aerospace and industrial applications.

Data in this material datasheet represents material built with 60 µm layer thickness in a nitrogen or argon atmosphere on a Concept Laser X Line 2000R and requires build plate heating. Values listed are typical.

POWDER CHEMISTRY

Aluminum AlSi10Mg powder chemical composition according to ASTM F3318.

MACHINE CONFIGURATION

- Concept Laser X Line 2000R
- Nitrogen gas / argon gas
- Carbon brush

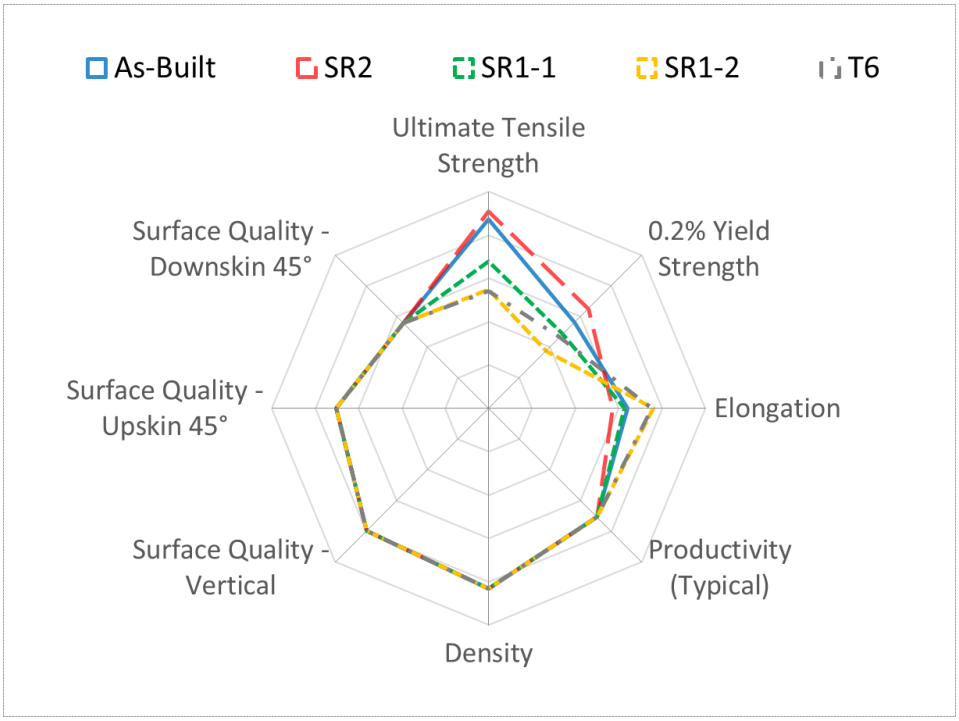
AVAILABLE PARAMETERS

- **Productivity Parameter 116** 60 µm layer thickness, nitrogen gas, carbon brush
- **Productivity Parameter 157** 60 µm layer thickness, argon gas, carbon brush

THERMAL TREATMENTS

1. As-Built
2. Stress Relief (SR1-1)
   Stress relief 270°C, 2 hours, cooled in air
3. Stress Relief (SR1-2)
   Stress relief 300°C, 2 hours, cooled in air
4. Stress Relief (SR2)
   Stress relief 180°C, 2 hours, cooled in air
5. Solution Anneal + Age (SOLN+AGE T6)
   SOLN: 530°C, 6 hours, cooled in air; AGE: 160°C, 6 hours, cooled in air

THERMAL TREATMENT COMPARISON



Spider Plot is generated by normalizing typical material data (containing both horizontal and vertical data) against a range defined for each material family. For **Aluminum Alloys**, the ranges are as follows: UTS: 0-500 MPa, 0.2%YS: 0-425 MPa, Elongation: 0-30 %, Density: 99-100 %, Productivity: 5-35 cm³/h, Surface Quality (all): 40-5 µm

TYPICAL BUILD RATE

Productivity Parameter 116

	(cm³/h)
Typical build rate[1] w/coating	20.0
Theoretical melting rate[2] bulk per Laser	43.6

[1]Using standard Factory Acceptance Test layout and 2 lasers
[2]Calculated (layer thickness x scan velocity x hatch distance)

PHYSICAL DATA AT ROOM TEMPERATURE

	Surface Roughness Ra** - Overhang (µm)		
	45°	60°	75°
Upskin	19	19	18
Downskin	24	19	17

	Surface Roughness Ra** (µm)
H	20
V	16

	Porosity (% Density)		Hardness (HV5)		Poisson's Ratio	
Thermal State	H	V	H	V	H	V
As-Built	99.8	99.8	122	--	--	--
SR1-1	99.8	99.8	100	--	--	--
SR1-2	99.8	99.8	86	--	--	--
T6	99.8	99.8	89	--	--	--
SR2	99.8	99.8	130	--	--	--

TENSILE DATA

Tensile testing done in accordance with ASTM E8 and ASTM E21

Test Temperature: RT

	Modulus of Elasticity (GPa)		0.2% Yield Strength (MPa)		Ultimate Tensile Strength (MPa)		Elongation (%)		Reduction of Area (%)	
Thermal State	H	V	H	V	H	V	H	V	H	V
As-Built	71	70	245	230	435	435	11.0	6.5	--	--
SR1-1	74	75	210	200	335	340	10.5	5.5	--	--
SR1-2	72	71	160	155	270	280	15.0	11.0	--	--
T6	71	72	200	190	275	260	13.0	12.5	--	--
SR2	75	74	285	265	450	455	9.0	5.0	--	--

H: HORIZONTAL (XY) orientation
V: VERTICAL (Z) orientation

* All of the figures contained herein are approximate only. The figures provided are dependent on a number of factors, including but not limited to, process and machine parameters, and the approval is brand specific and/or application specific. The information provided on this material data sheet is illustrative only and cannot be relied on as binding.
** Roughness measurements have been performed according to DIN EN ISO 4287 and DIN EN ISO 4288. In general analysis of the surface quality is strongly dependent on the methodology used and therefore deviations might be observed depending on methodology used. Vertical and horizontal sidewalls have been characterized using a tactile system, overhangs using an optical system.