SLM SOLUTIONS

F357

AMS4289

MATERIAL DATA SHEET

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MATERIAL

Aluminum – a lightweight and versatile material for more than 100 years now. Various processing routes (e.g. casting, rolling, forging) combined with good strength at a low mass density make aluminum an excellent choice for industrial applications. Good thermal and electrical conductivities as well as a high resistance in corrosive atmosphere complete the profile. Compared to AlSi10Mg, F357 features a reduced silicon content of around 7 %, leading to increased mechanical properties, while still maintaining exceptional weldability. F357 is almost identical to the commonly known casting alloy A357, except it is completely free of the toxic element beryllium. F357 is in accordance with AlSi7Mg0.6 and already today in extended usage within aerospace or automotive applications.

CHEMICAL COMPOSITION

AMS4289[1]

	Al	Si	Mg	Cu	Ti	Fe	Mn	Zn	B	Total each	Total other
Min.	Bal.	6.5	0.40		0.04						
Max.		7.5	0.7	0.20	0.20	0.10	0.10	0.10	0.002	0.05	0.15

POWDER PROPERTIES

Particle Size[1]	20 - 63 µm
Mass Density[2]	≈ 2.67 g/cm³
Particle Shape[3]	Spherical

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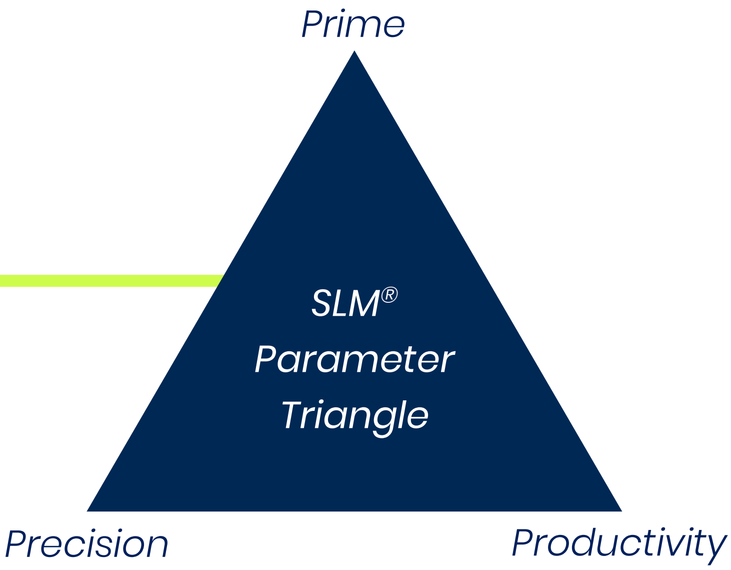
SLM® PARAMETERS

It only takes 3 tools to make you successful with metal additive manufacturing:

1. The **SLM® machine** fitting your needs,
2. The **metal powder** that defines the later purpose and functionality of a part,
3. Precisely engineered **SLM® parameters** as the missing link.

Our open parameters are the result of our vast experience in multi-laser technology and a diligent development and qualification procedure. They are key to produce fully functional parts with properties you can expect and rely on – whether you are new to AM or a large-scale production operator. We offer them in three categories to you: from high-resolution complex details (**Precision**) up to the highest build rates (**Productivity**) or right in between (**Prime**).



MATERIAL QUALIFICATION

As one of the inventors of the selective laser melting process, we impose the most comprehensive test procedures on ourselves: hundreds of samples, multiple systems, various powder batches, numerous heat-treatments, machined vs. near-net-shape tensile specimens, several surface roughness conditions and angles, fatigue behavior, corrosion investigation, creep testing... Did we miss anything? Get in touch with us!

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PRECISION SLM® 280

Parameter Set	F357_SLM280_PREC_MBP3_V1.0 (30 µm)
Machine Compatibility	SLM® 280 2.0, SLM® 280 Production Series (400 W)
Validated Data Preparation	Materialise SLM Build Processor
Theoretical System Build Rate[4]	45 cm³/h (Twin)
Minimum Relative Density[5]	99.9 %

Mechanical Properties[6]

M: Mean | MIN: Minimum (95 % population coverage / 95 % confidence level)[7]

Non-heat-treated (NHT)

	Tensile strength R_m [MPa]		Yield strength $R_{p0.2}$ [MPa]		Elongation at break A [%]	
Machined	**M**	**MIN**	**M**	**MIN**	**M**	**MIN**
Horizontal	420	415	290	285	11	9
Vertical	430	425	265	260	8	5
Near-Net-Shape	**M**		**M**		**M**	
Vertical	410	400	260	250	7	5

Hardness[8]

M: Mean | MIN: Minimum 95 % / 95 %)[7]

	Vickers hardness HV10	
	M	**MIN**
NHT	110	85

Surface Roughness[9]

M: Mean | MAX: Maximum (95 % population coverage / 95 % confidence level)[7]

	Roughness average Ra [µm]		Mean roughness depth Rz [µm]	
	M	**MAX**	**M**	**MAX**
As built	6	10	77	245
Corundum + Glass bead	5	10	31	67

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SLM SOLUTIONS

PRECISION NXG XII 600

Parameter Set	F357_NXG600_PREC_MBP3_V1 (30 µm)
Machine Compatibility	NXG XII 600
Validated Data Preparation	Materialise SLM Build Processor
Theoretical System Build Rate[4]	270 cm³/h (12 Lasers)
Minimum Relative Density[5]	99.96 %

Mechanical Properties[6]

M: Mean | MIN: Minimum (95 % population coverage / 95 % confidence level)[7]

Non-heat-treated (NHT)

	Tensile strength R_m [MPa]		Yield strength $R_{p0.2}$ [MPa]		Elongation at break A [%]	
Machined	**M**	**MIN**	**M**	**MIN**	**M**	**MIN**
Vertical	425	420	275	270	8	5
Near-Net-Shape	**M**		**M**		**M**	
Vertical	405	400	265	260	7	4

Hardness[8]

M: Mean | MIN: Minimum (95 % population coverage / 95 % confidence level)[7]

	Vickers hardness HV5	
	M	**MIN**
NHT	119	117

Surface Roughness[9]

M: Mean | MAX: Maximum (95 % population coverage / 95 % confidence level)[7]

	Roughness average Ra [µm]		Mean roughness depth Rz [µm]	
	M	**MAX**	**M**	**MAX**
As built	5	8	29	43

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PRIME SLM® 280

Parameter Set	F357_SLM280_PRIM_MBP3_V1 (60 µm)
Machine Compatibility	SLM® 280 2.0, SLM® 280 Production Series (400 W)
Validated Data Preparation	Materialise SLM Build Processor
Theoretical System Build Rate[4]	54 cm³/h (Twin)
Minimum Relative Density[5]	99.7 %

Mechanical Properties[6]

M: Mean | MIN: Minimum (95 % population coverage / 95 % confidence level)[7]

Non-heat-treated (NHT)

	Tensile strength R_m [MPa]		Yield strength $R_{p0.2}$ [MPa]		Elongation at break A [%]	
Machined	M	MIN	M	MIN	M	MIN
Horizontal	415	400	280	270	8	5
Vertical	420	385	260	255	5	2
Near-Net-Shape	M		M		M	
Vertical	385	345	250	235	4	1

Hardness[8]

M: Mean | MIN: Minimum (95 % population coverage / 95 % confidence level)[7]

	Vickers hardness HV5	
	M	MIN
NHT	120	115

Surface Roughness[9]

M: Mean | MAX: Maximum (95 % population coverage / 95 % confidence level)[7]

	Roughness average Ra [µm]		Mean roughness depth Rz [µm]	
	M	MAX	M	MAX
As built	15	21	92	124

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PRODUCTIVITY SLM® 280

Parameter Set	F357_SLM280_PROD_MBP3_V1.0 (90 µm)
Machine Compatibility	SLM® 280 2.0, SLM® 280 Production Series (700 W)
Validated Data Preparation	Materialise SLM Build Processor
Theoretical System Build Rate[4]	145 cm³/h (Twin)
Minimum Relative Density[5]	99.4 %

Mechanical Properties[6]

M: Mean | MIN: Minimum (95 % population coverage / 95 % confidence level)[7]

Non-heat-treated (NHT)

	Tensile strength R_m [MPa]		Yield strength $R_{p0.2}$ [MPa]		Elongation at break A [%]	
Machined	M	MIN	M	MIN	M	MIN
Horizontal	385	380	245	235	7	5
Vertical	395	385	240	230	5	2
Near-Net-Shape	M		M		M	
Vertical	335	295	235	225	2	1

Hardness[8]

M: Mean | MIN: Minimum (95 % population coverage / 95 % confidence level)[7]

	Vickers hardness HV10	
	M	MIN
NHT	110	105

Surface Roughness[9]

M: Mean | MAX: Maximum (95 % population coverage / 95 % confidence level)[7]

	Roughness average Ra [µm]		Mean roughness depth Rz [µm]	
	M	MAX	M	MAX
As built	20	25	125	161

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DISCLAIMER

MDS_F357_2023-11.1_EN

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NOTES

[1] With respect to powder material. Compositions stated as mass or weight percent.

[2] Material density varies within the range of possible chemical composition variations.

[3] According to DIN EN ISO 3252:2001.

[4] Theoretical system build rate = layer thickness x scan speed x hatch distance. The value represents a com-parable indicator but remains a theoretical value after all. It does expressively not reflect true build rates, which are influenced by part geometry, ratio between hatch and contour areas, area of exposure, recoating times, and more.

[5] Optical density determination at test specimens by light microscopy according to internal specification. Relative density may vary depending on part geometry, orientation, volume, and other process factors. Population coverage: 95 %, confidence level: 95 %.

[6] Tensile testing was performed in accordance to DIN EN ISO 6892-1:2017 B and conducted at room temperature. Samples are either machined before testing or tested in near-net-shape without any surface finishing (geometry according to DIN 50125:2016-D6x30 and DIN 50125:2016-C6x30). Values include overlap samples, i.e. multiple lasers work simultaneously on one specimen. All data is derived from standardized SLM Solutions qualification jobs. Samples are built out of both virgin powder as well as used powder. Population coverage: 95 %, confidence level: 95 %.

[7] Minimum values are set by using tolerance interval method, which is a statistical approach based on the input of population coverage (PC) and confidence level (CL). Tolerance intervals ensure that a certain percentage of samples within a batch will be above the minimum value with a certain probability, e.g. the probability that 95 % of all samples will be above the stated minimum value (within a defined batch and tested according to mentioned specifications) is 95 %.

[8] Hardness testing according to DIN EN ISO 6507-1:2018. Measurement direction "2" according to VDI 3405 2.1. Values include overlap samples, i.e. multiple lasers work simultaneously on one specimen. All data is derived from standardized SLM Solutions qualification jobs. Samples are built out of both virgin powder as well as used powder.

[9] Roughness measurement on vertical walls according to DIN EN ISO 4288:1998; $\lambda c = 2.5$ mm. Glass bead blasting is an additional post-processing step after corundum blasting. Values include overlap samples, i.e. multiple lasers work simultaneously on one specimen. All data is derived from standardized SLM Solutions qualification jobs. Samples are built out of both virgin powder as well as used powder.