

3D PRINTING WITH METALS

In this process, metal powder is fused into an solid object. Our systems achieve very high levels of detail. We can produce your objects using stainless steel, tool steel, aluminium, Inconel, cobalt chrome, brass or copper that features high electrical conductivity and this enables new applications. All products are impermeable and feature high stability. Depending on the material, with PROTIQ you can achieve wall thickness as thin as 0.4 mm.

MATERIAL				MS1 – 1.2709	PH1 – 1.4540	1.4542	316L – 1.4404	CX	Zamak 5
				tool steel	stainless steel				zinc
									
	properties	state	unit						
general properties	density, laser-melted	–	g/cm ³	8 – 8,1	7,7	7,7 – 7,8	7,9	7,7	6,2 – 6,4
mechanical properties**	tensile strength	„as built“	MPa	1.100 ± 100	1.200 ± 50	1.100 ± 50	620 ± 50	1080	218 ± 40
		„after heat treatment“	MPa	2.030 ± 70	min. 1.340	1.150 ± 150	–	1.730 ± 10	–
	yield strength (Rp 0,2%)	„as built“	MPa	1.000 ± 100	950 ± 150	750 ± 80	490 ± 65	840	185 ± 15
		„after heat treatment“	MPa	1.950 ± 70	min. 1.200	1050 ± 150	–	1.660 ± 10	–
	elongation at break	„as built“	%	9 ± 4	17 ± 4	13 ± 2	min. 30	14	1,5 ± 0,5
		„after heat treatment“	%	4 ± 2	min. 10	18 ± 3	–	6	–
	elastic modulus	„as built“	GPa	–	–	–	–	–	28 ± 3
		„after heat treatment“	GPa	–	–	–	–	–	–
thermal properties	thermal conductivity	„as built“	W/(m*K)	–	13,7 ± 0,8	–	–	–	–
		„after heat treatment“	W/(m*K)	–	15,7 ± 0,8	–	–	–	–
	specific heat capacity	„as built“	J/kg*K	450 ± 20	460 ± 20	–	–	–	–
		„after heat treatment“	J/kg*K	450 ± 20	470 ± 20	–	–	–	–
	electrical conductivity (edge/core)	„as built“	MS/m	–	–	–	–	–	–
		„after heat treatment“	MS/m	–	–	–	–	–	–
	roughness after sandblasting (Ra/Rz)	–	µm	4 – 6,5/20 – 50	5 /25	2,5 – 4,5/15 – 40	3 – 7/20 – 40	5/26	4 – 6 / 25 – 35
	precision	–	mm	± 0,1 / ± 0,7 %	± 0,1 / ± 0,7 %	± 0,1 / ± 0,7 %	± 0,1 / ± 0,7 %	± 0,1 / ± 0,7 %	± 0,1 / ± 0,7 %
typical process-related properties*	minimum wall thickness	–	mm	0,4	0,4	0,4	0,4	0,4	0,6

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MATERIAL				AlSi10Mg	AlMgSi0,5	AlSi9Cu3	RS-Kupfer	CuNi2SiCr	Pure-Copper
				aluminium			copper		
									
	properties	state	unit						
general properties	density, laser-melted	–	g/cm ³	2,67	2,68	2,7	8,7 – 8,9	–	8,9
mechanical properties**	tensile strength	„as built“	MPa	410 ± 20	80 ± 40	380 ± 40	220 ± 30	251 ± 10	220 ± 10
		„after heat treatment“	MPa	340 ± 20	–	–		595 ± 10	
	yield strength (Rp 0,2%)	„as built“	MPa	250 ± 20	75 ± 40	200 ± 40	165 ± 20	190 ± 10	140 ± 20
		„after heat treatment“	MPa	220 ± 10	–	–		508 ± 10	
	elongation at break	„as built“	%	6 ± 2	3,3 ± 1	2,5 ± 1	20 ± 5	34 ± 5	50 ± 10
		„after heat treatment“	%	7 ± 2	–	–		15 ± 5	
	elastic modulus	„as built“	GPa	65 ± 5	–	62 ± 10	95 ± 15	89 ± 5	–
		„after heat treatment“	GPa	65 ± 5	–	62 ± 10		97 ± 5	
thermal properties	hardness	„as built“	HRC	120 [HBW]	52 [HBW]	–	62 – 71 [HV10]	–	61 – 66 [HV10]
		„after heat treatment“	HRC	–	–	–		–	
	thermal conductivity	„as built“	W/(m*K)	103 ± 5	103 ± 5	–	265	–	400 ± 15
		„after heat treatment“	W/(m*K)	–	–	–		–	
	specific heat capacity	„as built“	J/kg*K	–	–	–	394	–	–
		„after heat treatment“	J/kg*K	–	–	–		–	
	electrical conductivity (edge/core)	„as built“	MS/m	–	–	–	50/32	–	57
		„after heat treatment“	MS/m	–	–	–		–	
typical process-related properties*	roughness after sandblasting (Ra/Rz)	–	µm	7 – 10/50 – 60	3 – 5/20 – 30	–	8 – 9/40 – 50	–	8 – 9/40 – 50
	precision	–	mm	± 0,1 / ± 0,7 %	± 0,1 / ± 0,7 %	± 0,1 / ± 0,7 %	± 0,1 / ± 0,7 %	± 0,1 / ± 0,7 %	± 0,1 / ± 0,7 %
	minimum wall thickness	–	mm	0,6	0,4	–	0,6***	–	0,6***

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* These values can vary, depending on part geometry and dimensions.

** The mechanical properties can vary, depending on x-, y- and z-position of the test object and illumination parameters.

*** minimum wall thickness for media-tight components: 1 mm

MATERIAL				CoCrW	IN625	IN718	TiAl6V4 Gr. 5	TiAl6V4 Gr.23 Eli	RS-Messing
				CobaltChrome	Inconel		titanium		brass
									
	properties	state	unit						
general properties	density, laser-melted	–	g/cm ³	8,6	8,4	8,15	4,41	4,42	8,2
mechanical properties**	tensile strength	„as built“	MPa	–	900 ± 50	1.000 ± 100	1280 ± 90	1290 ± 80	310 ± 30
		„after heat treatment“	MPa	1030	min. 827	min. 1.241	1090 ± 20	1160 ± 20	–
	yield strength (Rp 0,2%)	„as built“	MPa	–	615 ± 50	700 ± 150	1100 ± 90	1150 ± 80	260 ± 10
		„after heat treatment“	MPa	635	min. 414	min. 1.034	1000 ± 20	1060 ± 50	–
	elongation at break	„as built“	%	–	35 ± 5	17 ± 4	6 ± 4	8 ± 4	8 ± 3
		„after heat treatment“	%	10	min. 30	min. 12	13 ± 2	10 ± 3	–
	elastic modulus	„as built“	GPa	–	140 ± 20	160 ± 20	–	–	80 ± 5
		„after heat treatment“	GPa	230	160 ± 20	170 ± 20	–	118 ± 4	–
thermal properties	hardness	„as built“	HRC	–	–	30	41 ± 3	320 ± 15 [HV5]	100 – 109 [HV10]
		„after heat treatment“	HRC	–	–	43 – 47	–	37 ± 2	–
	thermal conductivity	„as built“	W/(m*K)	–	–	–	–	–	–
		„after heat treatment“	W/(m*K)	–	–	12	–	6,7	–
	specific heat capacity	„as built“	J/kg*K	–	–	–	–	–	–
		„after heat treatment“	J/kg*K	–	–	–	–	–	–
	electrical conductivity (edge/core)	„as built“	MS/m	–	–	–	–	–	8/8
		„after heat treatment“	MS/m	–	–	–	–	–	–
typical process-related properties*	roughness after sandblasting (Ra/Rz)	–	µm	–	4 – 6,5/20 – 50	4 – 6,5/20 – 50	4-9/35-60	4 – 8 (Ra)	7– 9 / 40 – 50
	precision	–	mm	± 0,1 / ± 0,7 %	± 0,1 / ± 0,7 %	± 0,1 / ± 0,7 %	± 0,2 / ± 0,7 %	± 0,1 / ± 0,7 %	± 0,1 / ± 0,7 %
	minimum wall thickness	–	mm	–	0,3 – 0,4	0,4	0,4	0,2	0,6

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