COLIBRIUM ADDITIVE
a GE Aerospace company

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

L-PBF Nickel 625

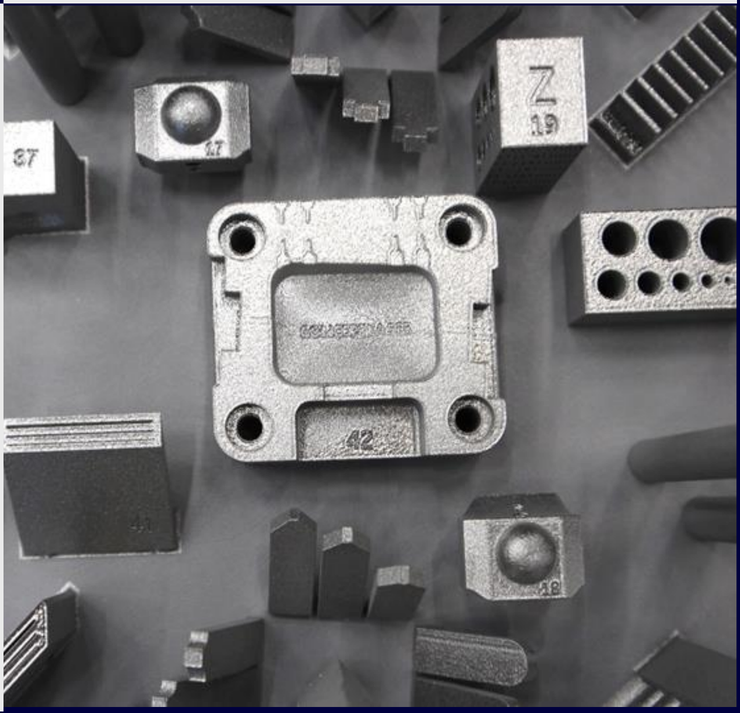
Parameters for Colibrium Additive's X Line 2000R

Nickel 625

Austenitic nickel-chromium superalloy Nickel 625 possesses excellent resistance to oxidation and corrosion combined with high strength over a wide temperature range from cryogenic temperatures to 982°C. The high (creep) strength is derived by solid-solution hardening of the nickel-chromium matrix, thus no age-hardening has to be applied. The alloy can be readily welded, which makes this alloy suitable for additive manufacturing. Typically, Nickel 625 is widely used in aerospace, marine engineering, chemical processing, oil and gas industry as well as power industry applications.

X Line 2000R Nickel 625

The Nickel 625 parameter for the Colibrium Additive X Line 2000R is developed leveraging the experience with the alloy on the M2 Series 5 generation. The base parameter is a 60 µm parameter that delivers a good balance between surface quality and productivity. Furthermore, the parameter offers a very high density leading to good strength and elongation properties.



X Line 2000R Nickel 625

Machine Configuration

X Line 2000R

Dual-laser architecture

Argon gas

Powder Chemistry

Nickel 625 powder chemical composition according to ASTM F3056 / AMS7000/ UNS N06625

Particle size: 15-45 µm

Thermal States

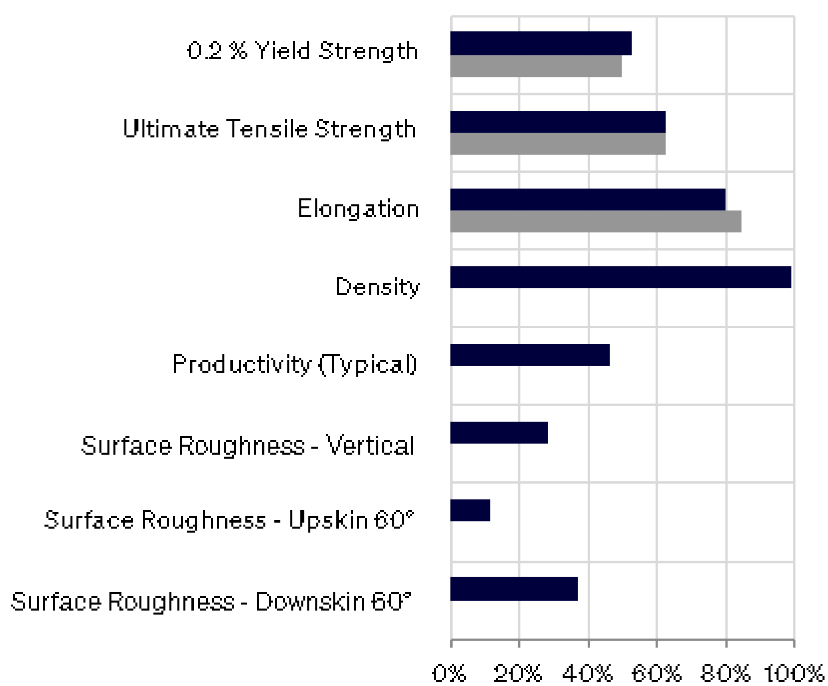
As-Built (AB)

Stress Relief (SR)

870°C for 1 hour in argon; furnace cooling

Parameter Availability and Thermal State Comparison

- Base Parameter 310 AB
  400 W, 60 µm layer thickness, rubber recoater
- Base Parameter 310 SR
  400 W, 60 µm layer thickness, rubber recoater



Bar plot is generated by normalizing typical material data (containing both horizontal and vertical data) against a range defined for each material family. For nickel-based alloys, the ranges are as follows: 0.2%YS: 0-1200 MPa, UTS: 0-1500 MPa, Elongation: 0-50%, Density: 99-100%, Productivity: 5-60 cm³/h, Surface Quality (all): 5-40 µm. 0% in the bar plot indicates the lower range value, 100% indicates the upper range value.

Base Parameter 310 - 400 W / 60 µm

Typical Build Rate

	(cm^3/h)
Typical build rate with coating[1]	30.5
Theoretical melting rate bulk per laser[2]	22.5

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

Tensile Performance at Room Temperature

Thermal State	Modulus of Elasticity (GPa)		0.2% Yield Strength (MPa)		Ultimate Tensile Strength (MPa)	
	H	V	H	V	H	V
As-Built	180	140	685	580	980	890
SR1	175	150	620	575	980	900

Thermal State	Elongation (%)	
	H	V
As-Built	37.0	43.0
SR1	39.0	45.5

Physical Properties at Room Temperature

	Overhang Surface Roughness, Ra (µm)		
	45°	60°	75°
Upskin	11	9	8
Downskin	32	18	13

Surface Roughness, Ra (µm)	
H	---
V	15

Thermal State	Relative Density (%)		Hardness (HV10)
	H	V	H
As-Built	99.9	99.9	271
SR1	---	---	276

Data Sheet Nomenclature and Notation

H: Horizontal, perpendicular to build direction.
V: Vertical, parallel to build direction.
Other angles are measured from horizontal.

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.

Tensile evaluations were performed according to ASTM E8 or E21, depending on test temperature.