

# Super Duplex steel (1.4410)

## Parameter set options

Layer thickness	Optimised for	Laser mode	Page
60 µm	Single laser per part	Continuous wave	4

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## Material description

Super Duplex stainless steel (DIN/W Nr. 1.4410) is a high strength steel designed to perform in highly corrosive environments. It has high content of chromium along with nickel, molybdenum and other minor elements.

It's great corrosion resistance and toughness for a relatively cost-competitive steel make it suitable for a wide variety of industries including oil and gas, chemical processing and marine and shipping.

## Material properties

- Excellent corrosion resistance
- Great toughness
- High strength
- Ferrous

## Applications

- Chemical processing
- Marine and shipping
- Oil and gas
- Water desalination

## Disclaimer

The mechanical property data featured in this document were obtained from tests performed in Renishaw's laboratories and they indicate the mechanical properties that can be achieved. The data is not intended as a guaranteed minimum specification.

## Glossary of terms

Term	Definition
Scan strategy	Determines the path the laser will take to melt the cross-sectional area of the parts featured in each layer of the build process.
Meander	A scan strategy that takes the form of a straight-line vector path that bounces back and forth from each side of the part border. Meander strategy is quick and ideal for parts with a small XY cross section.
Stripe	A scan strategy where the area within the part border is split into strips and a meander technique is used within each strip. Stripe is ideal for parts with a large XY cross section.

## Typical wrought material properties

Material property	Wrought material value
Density	7.80 g/cm <sup>3</sup>
Thermal conductivity	15 W/mK
Melting temperature	1 350 °C
Coefficient of thermal expansion <sup>1</sup>	13.4×10 <sup>-6</sup> K <sup>-1</sup>

<sup>1</sup> In the range of 20 °C to 100 °C.

## Recommended composition of powder

Element	Mass (%)
Iron	Balance
Chromium	24.0 to 26.0
Nickel	6.0 to 8.0
Molybdenum	3.0 to 5.0
Manganese	≤1.2
Silicon	≤0.8
Copper	≤0.5
Nitrogen	0.2 to 0.4
Phosphorus	≤0.4
Carbon	≤0.03
Sulphur	≤0.02

Recommended powder size distribution: 15 µm to 53 µm.

The values shown in this table are representative of a general composition powder. Contact your powder supplier for more detailed information about specific powders.

Please contact Renishaw for further information about specifications or if you require support in qualifying non-Renishaw powders.

## Parameter set summary

Layer thickness	Optimised for	Laser mode	Gas flow rate	Build rate	
60 µm	Single laser per part	Continuous wave	190 m <sup>3</sup> /h	One laser: 17.8 cm <sup>3</sup> /h	Four lasers: 71. cm <sup>3</sup> /h

**Material files:** SuperDuplex\_500QS\_B60\_M\_01\_A (meander scan strategy)  
SuperDuplex\_500QS\_B60\_S\_01\_A (stripe scan strategy)

## Properties of additively manufactured components

**NOTE:** This parameter set is optimised for bulk density. The material properties in this table are indicative only. Further modification of the material file may be required to suit your application.

		As built	Heat treated <sup>1</sup>
<b>Bulk density</b> <sup>2</sup>		≥99.8%	-
<b>Ultimate tensile strength</b> <sup>3</sup>	Horizontal (XY)	1 238 MPa ±19 MPa	920 MPa ±3 MPa
	Vertical (Z)	1 206 MPa ±28 MPa	877 MPa ±7 MPa
<b>Yield strength</b> <sup>3</sup>	Horizontal (XY)	1 149 MPa ±21 MPa	622 MPa ±7 MPa
	Vertical (Z)	1 075 MPa ±19 MPa	601 MPa ±6 MPa
<b>Elongation after fracture</b> <sup>3</sup>	Horizontal (XY)	17% ±2%	36% ±2%
	Vertical (Z)	12% ±3%	49% ±2%
<b>Modulus of elasticity</b> <sup>3</sup>	Horizontal (XY)	187 GPa ±7 GPa	190 GPa ±18 GPa
	Vertical (Z)	163 GPa ±10 GPa	173 GPa ±11 GPa
<b>Hardness (Vickers)</b> <sup>4</sup>	Horizontal (XY)	190 HV0.5 ±17 HV0.5	-
<b>Surface roughness</b> <sup>5</sup>	Vertical (Z) (Median Ra)	8 µm ±3 µm	8 µm ±1.6 µm

Mechanical test samples were created using four lasers, one laser per sample and with no downstream processing. Stripe scan strategy was used for all samples.

- <sup>1</sup> Heat treatment method used for testing: Under vacuum, heat at 10°C/min to 1 100 °C ± 10 °C, then hold temperature for 30 minutes. Quench in water.
- <sup>2</sup> Measured optically on 10 mm × 10 mm × 10 mm samples at 75× magnification.
- <sup>3</sup> Tested at ambient temperature to ASTM E8. Machined prior to testing. Values based on 16 samples.
- <sup>4</sup> Tested to ASTM E384-11 after polishing
- <sup>5</sup> Tested on as-built vertical surfaces using laser interferometry. Tested to JIS B 0601-2001 (ISO 4287:1997).

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