

# P2000

## GMP F4452-50

### General Information & Applications

This austenitic high-nitrogen alloy steel (HNS) is characterized by excellent corrosion resistance, high toughness, and high strength.

HNS are the ideal solution for components subject to high corrosion stress in plant engineering for the chemical, food, and pharmaceutical industries, for components in the automotive and aerospace sectors, or for special applications where conventional steels cannot be used due to their often low strength combined with challenging environmental conditions.

In addition, the very low nickel content allows for application in areas with biocompatibility requirements, such as medical technology, the jewelry and consumer goods sector, and the food industry. The high final strength in combination with the degree of purity achieved enables excellent polishing results with high resistance to mechanical damage caused by scratches or high point loads.

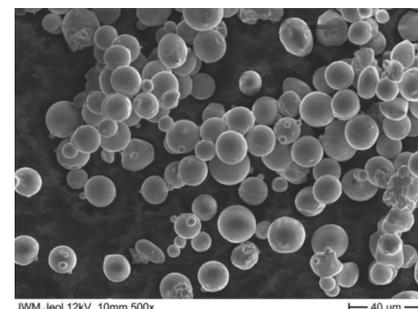
Georgsmarienhütte metal powder made from high-nitrogen alloy steel (HNS) analogous to the industry designation P2000 in accordance with 1.4452 (X13CrMnMoN18-14-3), preferred for processing via powder metallurgy or additive manufacturing.

### Physical Properties (Solid Steel)

Density (25 °C)	7.7 g/cm <sup>3</sup>
Thermal Expansion Coefficient 25 - 200 °C	16.5 10 <sup>-6</sup> K <sup>-1</sup>
Thermal Expansion Coefficient 25 - 400 °C	17.5 10 <sup>-6</sup> K <sup>-1</sup>
Specific Heat Capacity	500 Jkg <sup>-1</sup> K <sup>-1</sup>
Thermal Conductivity	15 Wm <sup>-1</sup> K <sup>-1</sup>
Young's Modulus	195 GPa
PREN (Pitting Resistance Equivalent Number)*	45 (36-49)
MARC (Measure of Alloying for Resistance to Corrosion)*	44 (33-48)

\*(Reference 1.4404 / AISI 316L: PREN: 23 - 28; MARC: 20 - 24)

### Appearance



### Powder Properties

Particle Size Distribution (nominal)	µm	15 - 45	MPIF05, ASTM B214, ISO 4497
Flowability (Hall)	s/50 g	< 20	MPIF03, ASTM B213, ISO 4490
Apparent Density	g/cm <sup>3</sup>	4.2 - 4.4	MPIF04, ASTM B212, ISO 3923/1
Tap Density	g/cm <sup>3</sup>	4.5 - 4.7	ASTM B257, ISO 3953

### Chemical Composition

Element	Fe	C	Si	Mn	Cr	Mo	V	Nb	Al	P	S	Ni	N
Content in wt.-%, min	Bal.			12	16	2.5							<b>0.75</b>
Content in wt.-%, max	Bal.	0.15	1	16	20	4	0.20	0.25	0.10	0.05	0.03	<b>&lt;0.3</b>	<b>1.00</b>

### Mechanical Properties (in processed condition, z-direction, averaged)

Condition	Tensile Strength	Yield Strength	Elongation	Hardness	Fatigue Strength <sup>1</sup>	Impact Energy
	MPa	MPa	%	HV10	MPa	J
PBF-LB as-built	1065	850	20	340	-	12
Wärmebehandelt <sup>2</sup>	950	670	25	280	370	45
HIP + WB	1020	670	45	260	480	105

<sup>1</sup>: Rotation-bending mode; R = -1; survival probability 50% | <sup>2</sup>: Temperature: 1080 °C, Time: 20 min