



## Properties of Screws Made of Special Materials

### Mechanical Properties

Properties	Inconel* (NCF600) [SNSI]	Pure Molybdenum [NSM] [SNFCM]	Hastelloy*C-276 (NW0276) [SNSH-C276]	Hastelloy*C-22 (NW6022) [SNSH-C22]	Monel 400 equiv. (UNS N0400) [SNSMN]	Nickel (NW2201) [SNSN]	Super Invar [SNSIV]	Phosphor Bronze (C5191) [SNSP]	Aluminum Alloy (A5056) [SNSA]
Tensile Strength (N/mm <sup>2</sup> )	548 - 695	515	793	786	517 - 620	343 - 411	470	590 or Higher	294
0.2% Proof Stress (N/mm <sup>2</sup> )	205 - 352	380	400	365	172 - 345	68 - 166	333	—	245
Elongation (%)	35 - 55	15	60	57	35 - 60	40 - 60	43	8	12
Hardness	65 - 85 (HRB)	—	—	92 (HRB)	60 - 80 (HRB)	75 - 100 (HB)	143 (HV)	—	98 (HB)

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Specific Gravity	8.42	10.2	8.89	8.61	8.80	8.89	8.15	8.83	2.64
Longitudinal Elastic Modulus (GPa)	207	327	205	209	179	206	132	105	71.7
Thermal Conductivity (W/(m·K))	16.7	142	—	—	22	79.5	10.47	67	112
Linear Expansion Coefficient (K <sup>-1</sup> )	13.4×10 <sup>-6</sup>	5.1×10 <sup>-6</sup>	11.2×10 <sup>-6</sup>	12.4×10 <sup>-6</sup>	14.2×10 <sup>-6</sup> (100°C)	13.4×10 <sup>-6</sup>	0.69×10 <sup>-6</sup>	18×10 <sup>-6</sup>	24.1×10 <sup>-6</sup>
Electric Resistance (μΩ·m)	1.0	0.058	1.3	1.2	0.5	0.085	0.77	0.13	0.064

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### Chemical Resistance of Inconel\*, Hastelloy\*, and Nickel Screws

Chemical Name	Temperature	Inconel*	Hastelloy*	Nickel
Dilute Sulfuric Acid	Room Temperature	A	AA	A
	Boiling Point	D	A	D
Concentrate Sulfuric Acid	Room Temperature	C	AA	C
	Boiling Point	D	D	D
Dilute Hydrochloric Acid	Room Temperature	B	AA	A
	Boiling Point	D	D	D
Concentrate Hydrochloric Acid	Room Temperature	D	AA	D
	Boiling Point	D	B	D
Dilute Nitric Acid	Room Temperature	D	AA	D
	Boiling Point	—	AA	D
Concentrate Nitric Acid	Room Temperature	A	AA	D
	Boiling Point	—	D	D
Dilute Phosphoric Acid	Room Temperature	AA	AA	AA
	Boiling Point	—	AA	D
Concentrate Phosphoric Acid	Room Temperature	AA	AA	AA
	Boiling Point	—	B	D
Sodium Hydroxide (Diluted)	Room Temperature	AA	—	AA
	Boiling Point	C	—	AA
Sodium Hydroxide (Diluted)	Room Temperature	AA	—	AA
	Boiling Point	C	—	AA

AA : Highly Excellent

C : Limit

A : Very Good

D : Not satisfactory

B : Satisfactory

\*Inconel is a registered trademark of Special Metals Corporation.

Hastelloy is a registered trademark of Haynes International, Inc.



### Important Information about Chemical Resistance Data

- A test piece was used to acquire the test data. Chemical resistance changes with performance conditions. Always carry out tests under performance conditions similar to actual conditions in advance.

### Magnetic Flux Density of Phosphor Bronze Screws

	Phosphor Bronze	SUSXM7(S.S. grade: A2)
Magnetic Flux Density (T)	0	5×10 <sup>-5</sup>

Measuring device : 5080 Gauss (Tesla) Meter by F.W.BELL

Measuring conditions : DC magnetic field measuring mode

Probe and sample separation distance: 5 mm

## The Properties of Ceramic Screws

### Physical Properties

	Al <sub>2</sub> O <sub>3</sub> (99.5% Alumina)
Specific Gravity	3.9 - 3.939
Flexural Strength (N/mm <sup>2</sup> )	360
Volume Resistivity (Ω·m)	> 10 <sup>12</sup>
Thermal Conductivity (W/(m·K))	32 (20°C)
Linear Expansion Coefficient (K <sup>-1</sup> )	7.2×10 <sup>-6</sup> (40 - 400°C)
Vickers Hardness (GPa)	15.5
Maximum Duty Temperature (°C)	1500

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### Chemical Resistance

Chemical Name	Temperature	Hour	Effect
35% Hydrochloric Acid	Boiling	30 minutes	⊙
70% Nitric Acid	Boiling	30 minutes	⊙
98% Sulfuric Acid	Boiling	30 minutes	⊙
90% Phosphoric Acid	Boiling	30 minutes	○
60% Hydrofluoric Acid	20°C	24 hours	△
10% Potassium Hydroxide	80°C	7 Days	⊙
Potassium Hydroxide	500°C (Boiling)	24 hours	△
Sodium Hydroxide	500°C (Boiling)	24 hours	○
Sodium Carbonate	900°C (Boiling)	24 hours	○
Sodium Sulfate	1000°C (Boiling)	24 hours	⊙
Potassium Fluoride	90°C (Boiling)	4 hours	×

⊙ : No Corrosion

△ : Moderate Corrosion

○ : Slight Corrosion

× : Heavy Corrosion



### Precautions for Ceramic Screws

- When tightening ceramic screws, use a torque driver or torque wrench and do not exceed the torsional torque. The recommended torque is 50% of the torsional torque.

M	Torsional Torque (N·m)
M3	0.04
M4	0.05
M5	0.10
M6	0.15
M8	0.30
M10	0.50

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- Heat resistance and chemical resistance change with performance conditions. Always carry out tests under performance conditions similar to actual conditions in advance.
- Ceramic screws may be damaged by impact. Take care when handling these screws.

- Also, ceramics screws with special specifications such as ventilation holes, dimensions, shapes, and cleanroom washing are available. Please contact us for details.

