

NAS 625 (UNS N06625)

NAS Corrosion-Resistant Nickel Alloy

NAS 625 (NCF 625, UNS N06625) is a nickel-chromium-molybdenum alloy with an additional of niobium. Matrix stiffening provided by molybdenum and niobium results in high strength. The alloy resists a wide range of severe corrosion environments. Uses include parts in chemical and garbage incinerator plants. Nippon Yakin supplies this product in plate, sheet, and strip forms.

Steel Grade/Standard

NAS	JIS G4902	ASTM B443	EN
NAS 625	NCF 625	UNS N06625	—

Chemical Composition

	C	Si	Mn	P	S	Ni	Cr	Mo	Al	Ti	Fe	Co	Nb+Ta
Specification (NCF 625)	≤0.10	≤0.50	≤0.50	≤0.015	≤0.015	≥58.00	20.00~23.00	8.00~10.00	≤0.40	≤0.40	≤5.00	—	3.15~4.15
Specification (UNS N06625)	≤0.10	≤0.50	≤0.50	≤0.015	≤0.015	≥58.0	20.0~23.0	8.0~10.0	≤0.40	≤0.40	≤5.0	≤1.0	3.15~4.15

Physical Properties

Density	[g/cm ³]	8.44
Specific heat	[J/kg · K]	419
Electrical resistivity	[μΩ · cm]	129
Thermal conductivity	[W/m · K]	10.2
Average coefficient of thermal expansion [10 ⁻⁶ /°C]	20~200°C	12.8
	20~300°C	13.1
	20~400°C	13.6
Young's modulus	[MPa]	20.7 × 10 ⁴
Magnetism		None
Melting range	[°C]	1290~1350

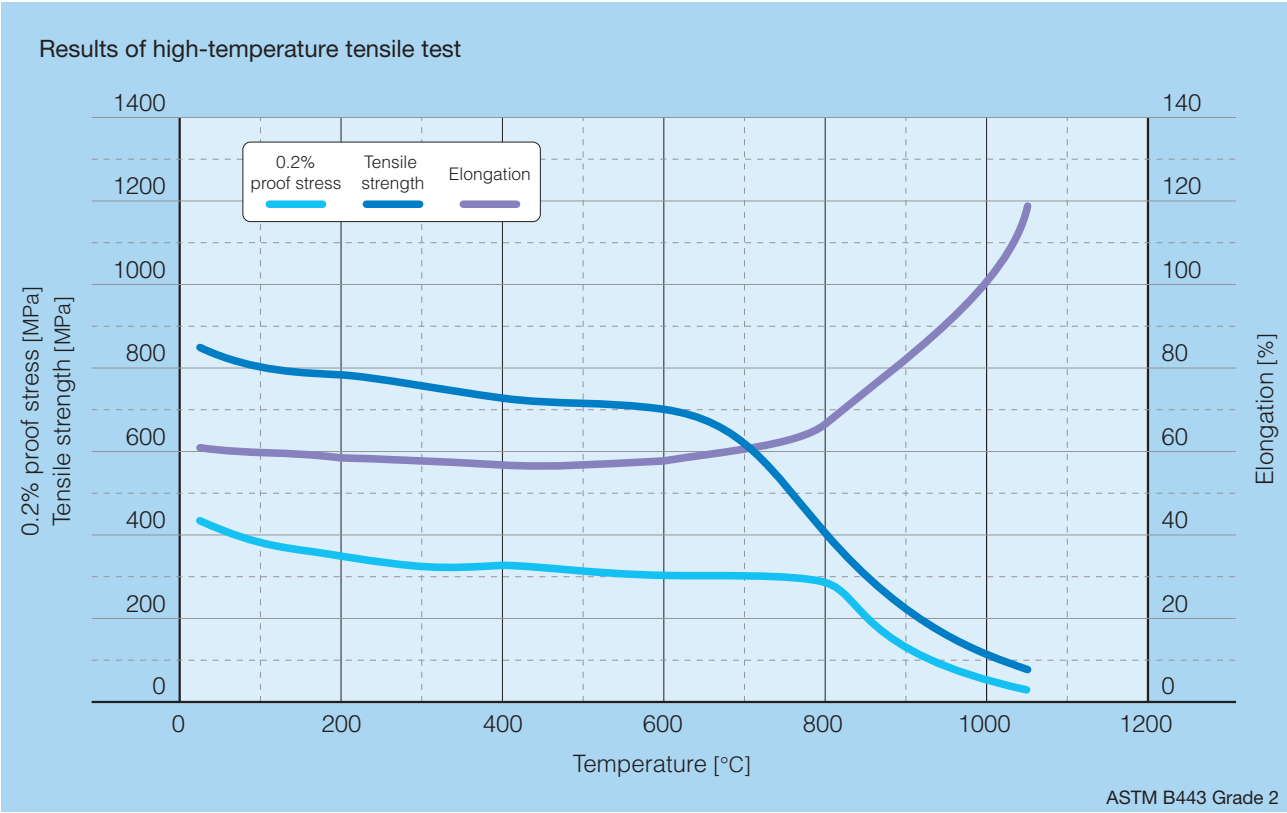
Mechanical Properties

Mechanical Properties at Room Temperature

			0.2% proof stress [MPa]	Tensile strength [MPa]	Elongation [%]	Hardness
JIS G4902 NCF625 (annealed)	>0.5mm, ≤3.0mm		≥415	≥830	≥30	—
	>3.0mm, ≤70mm		≥380	≥760	≥30	—
JIS G4902 NCF625 (solution treated)	>0.5mm, ≤70mm		≥275	≥690	≥30	—
ASTM B443 Grade 1 UNS N06625 (annealed)	Cold-rolled sheet, strip		≥414	≥827	≥30	—
	Hot-rolled plate (≤70mm)		≥379	≥758	≥30	—
	Cold-rolled sheet (≤9.5mm)		≥379	≥758	≥30	—
ASTM B443 Grade 2 UNS N06625 (solution annealed)			≥276	≥690	≥30	—
Example	Hot-rolled plate	11mm ^{†*}	407	826	62	HB 201
	Cold-rolled sheet	2.5mm ^{†*}	392	832	57	Hv 197

*All were solution annealed

High Temperatures Strength



Corrosion Resistance

Pitting Corrosion Resistance

Alloy	ASTM G48 Method A		ASTM G48 Method C
	22°C	50°C	Critical pitting corrosion temperature CPT (°C)
NAS 185N	○	○	70
NAS 254N	○	○	80
NAS 625	○	○	>103

Test conditions

ASTM G48 Method A (○: No pitting corrosion, x: Pitting corrosion)

- Test solution: 6%FeCl₃
- Test temperature: 22°C, 50°C (Recommended temperature in this test)
- Test time: 72h

ASTM G48 Method C

- Test solution: 6%FeCl₃ + 1%HCl
- Test time: 72h

Crevice Corrosion Resistance

Alloy	ASTM G48 Method D
	Critical crevice corrosion temperature CCT (°C)
NAS 185N	40
NAS 254N	45
NAS 625	50

Test conditions

ASTM G48 Method D

- Test solution: 6%FeCl₃ + 1%HCl
- Test time: 72h

Acid Resistance

Alloy	Corrosion rate in sulfuric acid at 80°C (mm/y)					
	5%	10%	20%	40%	60%	80%
NAS 185N	0.02	0.04	1.32	2.89	3.20	4.78
NAS 254N	0.02	0.05	1.02	2.11	2.16	7.76
NAS 625	0.01	0.03	0.04	1.36	2.33	3.55

Test time: 24h

(Reference)

Nippon Yakin	JIS	UNS No.	Chemical composition
NAS 185N	SUS 312L	S31254	20Cr-18Ni-6Mo-0.8Cu-0.2N
NAS 254N	SUS 836L	S32053	23Cr-25Ni-5.5Mo-0.2N
NAS 625	NCF 625	N06625	62Ni-22Cr-9Mo-3.7Nb-0.2Ti-0.2Al

Workability

Because the high-temperature strength of NAS 625 is extremely higher than that of Type 304, care is required when hot working. The cold workability of NAS 625 is basically the same as that of standard austenitic stainless steels such as Type 304, Type 316, etc. However, the fact that this is a high strength material must be considered in cold working.

Weldability

Various welding methods are applicable in the same manner as with the standard austenitic stainless steels, including shielded metal arc welding, TIG welding, and plasma welding. Susceptibility of NAS 625 to solidification cracking is higher than that of Type 304 and lower than that of Type 310S.

Heat Treatment

Solution annealing of NAS 625 is normally performed at 1093°C and higher followed by being quenched in water or rapidly cooled by other means. Annealing of NAS 625 is normally performed at 871°C and higher followed by being quenched in water or rapidly cooled by other means.

Pickling

A mixture of nitric acid and fluoric acid is used in pickling. However, because descaling is somewhat difficult in comparison with Type 304, alkali immersion before acid pickling, and if possible, shot blasting are extremely effective.

Applications

Chemical plants, nuclear power, seawater applications, jet engine parts, aircraft material, heat treatment furnace material, evaporators

For more information, please contact:
 Nippon Yakin Kogyo Co., Ltd.
 Material Solutions Sales Department
 San-Ei Bldg., 5-8, 1-chome Kyobashi, Chuo-ku,
 Tokyo 104-8365 Japan
 TEL: +81-3-3273-4649 FAX: +81-3-3273-4642
 E-Mail: inquiry@nyk.jp
 URL: <http://www.nyk.co.jp/en/>

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