

NAS185N (UNS S31254)

High Corrosion Resistant Super Stainless Steel

NAS185N (SUS312L, UNS S31254) is a high corrosion resistant austenitic stainless steel with a high nickel, high chromium, high molybdenum alloy design, and provides excellent corrosion resistance in severe corrosion environments such as seawater. Depending on the environment, it can be an economical alternative to Nickel alloy and pure titanium. Nippon Yakin supplies this product in plate, sheet and strip form.

Steel Grade/Standard

Nippon Yakin Grade	JIS G 4304/4305	ASTM A240	EN 10088-2/10028-7
NAS185N	SUS312L	UNS S31254	1.4547

Chemical Composition

	C	Si	Mn	P	S	Ni	Cr	Mo	Cu	N
Specification (SUS312L)	≤0.020	≤0.80	≤1.00	≤0.030	≤0.015	17.50~19.50	19.00~21.00	6.00~7.00	0.50~1.00	0.16~0.25
Specification (UNS S31254)	≤0.020	≤0.80	≤1.00	≤0.030	≤0.010	17.5~18.5	19.5~20.5	6.0~6.5	0.50~1.00	0.18~0.25
Specification* (EN 1.4547)	≤0.020	≤0.70	≤1.00	≤0.030	≤0.010	17.5~18.5	19.5~20.5	6.0~7.0	0.50~1.00	0.18~0.25

*EN 10088-2

Physical Properties

Density	[g/cm ³]		8.02
Specific heat	[J/kg · K]	20°C	464
Electrical resistivity	[μΩ · cm]		89.4
Thermal conductivity	[W/m · K]		12.3
Average coefficient of thermal expansion	[10 ⁻⁶ /°C]	20~100°C	15.3
		20~200°C	15.7
		20~300°C	16.1
		20~400°C	16.4
Young's modulus	[MPa]		19.7 × 10 ⁴
Magnetism			None
Melting range	[°C]		1360~1405

Mechanical Properties

Mechanical Properties at Room Temperature

		0.2% proof stress [MPa]	Tensile strength [MPa]	Elongation [%]	[HV]	Hardness [HBW]	[HRBW]
Specification (SUS312L)		≥ 300	≥ 650	≥ 35	≤ 230	≤ 223	≤ 96
Specification (UNS S31254)	Sheet and strip	≥ 310	≥ 690	≥ 35	—	≤ 223	≤ 96
	Plate	≥ 310	≥ 655	≥ 35	—	≤ 223	≤ 96
Example	Hot-rolled plate 8mm ^t	361	707	53	—	187	—
	Cold-rolled sheet 1.5mm ^t	379	744	41	182	—	—

Corrosion Resistance

NAS185N is a high Cr, high Mo stainless steel which provides excellent pitting corrosion resistance and crevice corrosion resistance in high Cl environments. As a high Ni steel, it also offers excellent stress corrosion cracking resistance.

Pitting Corrosion Resistance

Alloy	ASTM G48 Method A		ASTM G48 Method C
	22°C	50°C	Critical pitting corrosion temperature CPT (°C)
NAS255	○	×	50
NAS329J3L	○	×	50
NAS64	○	○	55
NAS185N	○	○	70

Test conditions

ASTM G48 Method A (○: No pitting corrosion, ×: 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)
NAS255	10
NAS329J3L	25
NAS64	30
NAS185N	40

Test conditions

ASTM G48 Method D

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

Stress Corrosion Cracking Resistance

Alloy	MgCl ₂ concentration (boiling point (°C) are in brackets)							
	45% (155°C)	42% (143°C)	40% (138°C)	38% (134°C)	35% (126°C)	30% (115°C)	25% (110°C)	20% (108°C)
NAS255	×	×	×	×	○	○	○	○
NAS329J3L	×	×	×	×	×	×	○	○
NAS64	×	×	×	×	×	×	○	○
NAS185N	×	×	×	×	○	○	○	○

Test conditions

- Immersion in boiling MgCl₂ solution
- Test time: 300h
- U-bend test specimen is used.

○: No stress corrosion cracking
×: Stress corrosion cracking

Acid Resistance

Alloy	Corrosion rate in sulfuric acid at 80°C (mm/y)					
	5%	10%	20%	40%	60%	80%
NAS255	<0.01	<0.01	0.78	2.95	0.48	5.01
NAS329J3L	0.01	0.17	4.65	365.9	1456	106.4
NAS64	<0.01	0.02	1.07	191.9	1054	60.72
NAS185N	0.02	0.04	1.32	2.89	3.20	4.78

Test time: 24h

Alloy	Corrosion rate in hydrochloric acid at 80°C (mm/y)			
	0.1%	1%	2%	3%
NAS255	<0.01	0.01	2.70	3.72
NAS329J3L	0.02	0.03	31.10	60.62
NAS64	0.01	0.01	12.94	30.51
NAS185N	0.01	0.02	4.20	7.21

Test time: 24h

(Reference)

Alloy	JIS	UNS No.	Chemical composition
NAS255	SUS890L	N08904	20Cr-24Ni-4.3Mo-1.5Cu
NAS329J3L	SUS329J3L	S32205	22Cr-5.3Ni-3.2Mo-0.16N
NAS64	SUS329J4L	S32506	25Cr-6.5Ni-3.3Mo-0.17N
NAS185N	SUS312L	S31254	20Cr-18Ni-6Mo-0.8Cu-0.2N

Workability

The hot and cold workability of NAS185N 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 both cold and hot 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. Alloy 276 welding consumable should be used.

Machinability

As a feature of high Ni stainless steels, although machining is difficult in comparison with the standard austenitic stainless steels, it is easier than with Ni-based alloys. A ultrahard tool should be used in machining if at all possible. It is also advisable to use a slower feed rate and deeper cutting depth.

Heat Treatment

Solution annealing of NAS185N should be performed at 1150°C and higher followed by being quenched in water or rapidly cooled by other means. (Conditions provided in ASTM A480/A480M)

Pickling

A mixture of nitric acid and hydrofluoric acid is used in pickling. However, due to the high corrosion resistance of NAS185N, scale is somewhat difficult to remove in comparison with Type 304. Therefore, the material should be immersed in an alkaline solution before pickling, or if possible, shot blasting is extremely effective.

Applications

Chemical plants, Flue gas desulfurization plants, Marine structures, Heat exchangers, Various types of bleaching equipment.

Certification

It is possible to manufacture UNS S31254 in accordance with the NORSOK standard below. The thickness is up to 40mm.

- NORSOK M-650
- NORSOK M-630 MDS R15

For more information, please contact:

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