NAS325N (UNS N08031)

High Corrosion Resistance Stainless Steel

NAS325N (UNS N08031) is a stainless steel with extremely superior corrosion resistance and can be used in many severe corrosion environments. In addition to local corrosion resistance approaching that of nickel-base corrosion-resistant alloys, it also provides excellent acid resistance. Nippon Yakin supplies this product in plate, sheet and strip form.

Steel Grade/Standard

Nippon Yakin Grade	JIS	ASTM B625	EN
NAS325N	—	UNS N08031	—

Chemical Composition

[wt %]

	C	Si	Mn	P	S	Ni	Cr	Mo	Cu	N
Specification (ASTM B625)	≦0.015	≦0.3	≦2.0	≦0.020	≦0.010	30.0~ 32.0	26.0~ 28.0	6.0~ 7.0	1.0~ 1.4	0.15~ 0.25

Physical Properties

Density	[g/cm³]		8.07
Specific heat	[J/kg · K]		448
Electrical resistivity	[μΩ · cm]		105
Thermal conductivity	[W/m · K]		10.7
Average coefficient of thermal expansion	[10^{-6}/°C]	30~100°C	15.0
		30~200°C	14.8
		30~300°C	15.0
		30~400°C	15.4
Young's modulus	[MPa]		19.2×10^4
Magnetism			None
Melting range	[°C]		1330~1397

NIPPON YAKIN KOGYO CO., LTD.

Mechanical Properties

Mechanical Properties at Room Temperature

		0.2% proof stress [MPa]	Tensile strength [MPa]	Elongation [%]	Hardness [HRBW]
Specification (ASTM B625)		≧276	≧650	≧40	—
Example	Cold-rolled sheet 2.0mm^t	396	785	50	182 (HV)
	Hot-rolled plate 25mm^t	358	731	63	174

Corrosion Resistance

NAS325N has excellent pitting corrosion resistance due to its high contents of chromium and molybdenum. It also has excellent acid resistance to sulfuric acid, etc.

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
NAS325N	○	○	100

Test conditions

ASTM G48 Method A (○: No pitting corrosion, ×: Pitting corrosion)
- Test solution: 6%$FeCl_3$
- Test temperature: 22°C, 50°C (Recommended temperature in this test)
- Test time: 72h

ASTM G48 Method C
- Test solution: 6%$FeCl_3$ + 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
NAS325N	50

Test conditions

ASTM G48 Method D
- Test solution: 6%$FeCl_3$ + 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	×	×	×	×	○	○	○	○
NAS325N	×	×	×	×	○	○	○	○

Test conditions
- Immersion in boiling $MgCl_2$ 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
NAS325N	—	—	<0.01	0.02	0.03	3.54

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
NAS325N	—	—	—	<0.01

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
NAS325N	—	N08031	27Cr-31Ni-6.5Mo-1.2Cu-0.2N

Workability

NAS325N has cold and hot workability similar to that of standard austenitic stainless steels. However, the high strength of this material must be considered in both cold working and hot working.

Weldability

Welding can be performed by TIG, MIG, and shield metal arc welding in much the same manner as with standard austenitic stainless steels. Alloy 276 welding consumable should be used.

Machinability

As a feature of high Ni stainless steels, machining of NAS325N is difficult in comparison with standard austenitic stainless steels, but it is easier than with nickel-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 NAS325N is normally performed at the temperature range from 1150 to 1180°C followed by being quenched in water or rapidly cooled by other means.

Pickling

A mixture of nitric acid and hydrofluoric acid is used in pickling. However, due to the high corrosion resistance of NAS325N, 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, Environment-related equipment, Oil and gas extraction, Heat exchangers.

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
URL: https://www.nyk.co.jp/en/

2024.02.29