

# NAS 325N (UNS N08031)

## NAS High Corrosion Resistance Stainless Steel

NAS 325N (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

NAS	JIS	ASTM B625	EN
NAS 325N	—	UNS N08031	—

### Chemical Composition

	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/cm <sup>3</sup> ]	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 <sup>-6</sup> /°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 <sup>4</sup>
Magnetism		None
Melting range	[°C]	1330~1397

Mechanical Properties

Mechanical Properties at Room Temperature

		0.2% proof stress [MPa]	Tensile strength [MPa]	Elongation [%]	Hardness [HRB]
Specification (ASTM B625)		≥276	≥650	≥40	—
Example	Cold-rolled sheet 2.0mm <sup>t</sup>	396	785	50	182 (Hv)
	Hot-rolled sheet 25mm <sup>t</sup>	358	731	63	174

Corrosion Resistance

NAS 325N 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)
NAS 255	○	×	50
NAS 329J3L	○	×	50
NAS 64	○	○	55
NAS 185N	○	○	70
NAS 325N	○	○	100

Test conditions ASTM G48 Method A (○: No pitting corrosion, ×: Pitting corrosion)  
 • Test solution: 6%FeCl<sub>3</sub>  
 • Test temperature: 22°C, 50°C (Recommended temperature in this test)  
 • Test time: 72h

ASTM G48 Method C  
 • Test solution: 6%FeCl<sub>3</sub> + 1%HCl  
 • Test time: 72h

Crevice Corrosion Resistance

Alloy	ASTM G48 Method D
	Critical crevice corrosion temperature CCT (°C)
NAS 255	10
NAS 329J3L	25
NAS 64	30
NAS 185N	40
NAS 325N	50

Test conditions ASTM G48 Method D  
 • Test solution: 6%FeCl<sub>3</sub> + 1%HCl  
 • Test time: 72h

## Stress Corrosion Cracking Resistance

Alloy	MgCl <sub>2</sub> 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)
NAS 255	×	×	×	×	○	○	○	○
NAS 329J3L	×	×	×	×	×	×	○	○
NAS 64	×	×	×	×	×	×	○	○
NAS 185N	×	×	×	×	○	○	○	○
NAS 325N	×	×	×	×	○	○	○	○

Test conditions

- Immersion in boiling MgCl<sub>2</sub> 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%
NAS 255	<0.01	<0.01	0.78	2.95	0.48	5.01
NAS 329J3L	0.01	0.17	4.65	365.9	1456	106.4
NAS 64	<0.01	0.02	1.07	191.9	1054	60.72
NAS 185N	0.02	0.04	1.32	2.89	3.20	4.78
NAS 325N	—	—	<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%
NAS 255	<0.01	0.01	2.70	3.72
NAS 329J3L	0.02	0.03	31.10	60.62
NAS 64	0.01	0.01	12.94	30.51
NAS 185N	0.01	0.02	4.20	7.21
NAS 325N	—	—	—	<0.01

Test time: 24h

(Reference)

Nippon Yakin	JIS	UNS No.	Chemical composition
NAS 255	SUS 890L	N08904	20Cr-24Ni-4.3Mo-1.5Cu
NAS 329J3L	SUS 329J3L	S32205	22Cr-5.3Ni-3.2Mo-0.16N
NAS 64	SUS 329J4L	S32506	25Cr-6.5Ni-3.3Mo-0.17N
NAS 185N	SUS 312L	S31254	20Cr-18Ni-6Mo-0.8Cu-0.2N
NAS 325N	—	N08031	27Cr-31Ni-6.5Mo-1.2Cu-0.2N

**Workability**

NAS 325N 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 NAS 325N 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 NAS 325N 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 NAS 325N, 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 equipment, papermaking plants, heat exchangers using seawater, offshore structures

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