

# NAS 254N (UNS S32053)

## NAS High Corrosion Resistant Super Stainless Steel

NAS 254N (SUS 836L, UNS S32053, ASME Code Case 2445-2) is a high corrosion resistance austenitic stainless steel with a high nickel, high chromium, high molybdenum alloy design, and provides excellent corrosion resistance in severe corrosion environments such as high temperature seawater. Depending on the environment, this stainless steel offers high economy combined with corrosion resistance comparable to that of Nickel alloy and pure titanium. Nippon Yakin supplies this product in plate, sheet and strip form.

### Steel Grade/Standard

NAS	JIS G4304/4305	ASTM A240	EN
NAS 254N	SUS 836L	UNS S32053	—

### Chemical Composition

	C	Si	Mn	P	S	Ni	Cr	Mo	N
Specification (SUS 836L)	≤0.030	≤1.00	≤2.00	≤0.045	≤0.030	24.00~26.00	19.00~24.00	5.00~7.00	≤0.25
Specification (UNS S32053)	≤0.030	≤1.00	≤1.00	≤0.030	≤0.010	24.0~26.0	22.0~24.0	5.0~6.0	0.17~0.22

### Physical Properties

Density	[g/cm <sup>3</sup> ]	8.06
Specific heat	[J/kg · K]	457
Electrical resistivity	[μΩ · cm]	94.7
Thermal conductivity	[W/m · K]	11.9
Average coefficient of thermal expansion [10 <sup>-6</sup> /[°C]]	30~100°C	14.6
	30~200°C	15.2
	30~300°C	15.5
	30~400°C	15.8
Young's modulus	[MPa]	19.7 × 10 <sup>4</sup>
Magnetism		None
Melting range	[°C]	1330~1390

Mechanical Properties

Mechanical Properties at Room Temperature

		0.2% proof stress [MPa]	Tensile strength [MPa]	Elongation [%]	Hardness [HBW]	Hardness [HRBW]	Hardness [HV]
Specification (SUS 836L)		≥275	≥640	≥40	≤217	≤96	≤230
Specification (UNS S32053)		≥295	≥640	≥40	≤217	≤96	—
Example	Cold-rolled sheet 2mm <sup>t</sup>	385	760	46	—	86	—
	Hot-rolled plate 16mm <sup>t</sup>	336	725	56	172	—	—

Corrosion Resistance

NAS 254N 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)
NAS 255	○	×	50
NAS 329J3L	○	×	50
NAS 64	○	○	55
NAS 254N	○	○	80

Test conditions    ASTM G48 Method A (○: No pitting corrosion, ×: Pitting corrosion)    ASTM G48 Method C

- Test solution: 6%FeCl<sub>3</sub>    • Test solution: 6%FeCl<sub>3</sub> + 1%HCl
- Test temperature: 22°C, 50°C (Recommended temperature in this test)    • Test time: 72h
- 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 254N	45

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 254N	×	×	×	○	○	○	○	○

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 254N	0.02	0.05	1.02	2.11	2.16	7.76

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 254N	0.01	0.02	0.01	9.14

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 254N	SUS 836L	S32053	23Cr-25Ni-5.5Mo-0.2N

### Workability

The hot and cold workability of NAS 254N 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 NAS 254N should be performed at the temperature range from 1080 to 1180°C 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 NAS 254N, 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

- Seawater environments: Marine structures, seawater desalination systems, heat exchangers using seawater, condenser tubes, etc.
- Chemical plants: PC manufacturing plants, bis-phenol A manufacturing plants, carbon black manufacturing plants, etc.
- Pulp and paper plants: Various types of bleaching systems, scrubbers, etc.
- Medical and pharmaceutical product plants: Centrifugal separators, reaction tanks, etc.
- Food product plants: Soy sauce fermentation tanks, salty mirin tanks, dressing manufacturing equipment, etc.
- Pollution prevention systems: Thermal power plant flue gas desulfurization plants, etc.

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