

# NAS355N

## NAS High Corrosion Resistant Nickel Alloy

NAS355N is a high corrosion resistant nickel alloy, providing corrosion resistance in high-concentration chloride ion or sulfuric acid environments and in extremely severe corrosive environments where both high-concentration chloride ions and sulfuric acid exist. Nickel content of this alloy has been significantly reduced compared to conventional high corrosion resistant nickel alloys, making it a good balance between cost and corrosion resistance performance. Nippon Yakin supplies this product in plate, sheet and strip form.

### Grade/Standard

NAS	JIS	ASTM	EN
NAS355N	—	—	—

### Chemical Composition

	C	Si	Mn	P	S	Ni	Cr	Mo	Cu	N
Specification (NAS)	≤0.030	≤1.00	≤1.00	≤0.020	≤0.005	35.00~ 36.00	22.00~ 24.00	7.00~ 8.00	3.00~ 4.00	0.19~ 0.24

[wt %]

### Physical Properties

Density	[g/cm <sup>3</sup> ]	8.16
Specific heat	[J/kg · K]	431
Electrical resistivity	[μΩ · cm]	107.4
Thermal conductivity	[W/m · K]	9.99
Average coefficient of thermal expansion [10 <sup>-6</sup> /°C]	30~100°C	13.7
	30~200°C	14.2
	30~300°C	14.5
	30~400°C	14.9
Young's modulus	[MPa]	18.7 × 10 <sup>4</sup>
Magnetism		None
Melting range	[°C]	1320~1366



**NIPPON YAKIN KOGYO CO., LTD.**

Mechanical Properties

Mechanical Properties at Room Temperature

	0.2% proof stress [N/mm <sup>2</sup> ]	Tensile strength [N/mm <sup>2</sup> ]	Elongation [%]	Hardness		
				[Hv]	[HBW]	[HRBW]
Specification (NAS)	≥295	≥640	≥35	≤230	≤217	≤96
Example Cold-rolled sheet 2mm <sup>t</sup>	422	807	49	196	—	91

Corrosion Resistance

Pitting Corrosion Resistance

Alloy	ASTM G48 Method A		ASTM G48 Method C
	22°C	50°C	Critical pitting temperature (CPT) (°C)
NAS335X	○	×	30
NAS64	○	○	55
NAS185N	○	○	70
NAS254N	○	○	80
NAS354N	○	○	103
NAS355N	○	○	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)
NAS335X	<0
NAS64	30
NAS185N	40
NAS254N	45
NAS354N	60
NAS355N	55

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

## Stress Corrosion Cracking Resistance

Alloy	45% (155°C)	42% (143°C)	40% (138°C)	38% (134°C)	35% (126°C)	30% (115°C)	25% (110°C)	20% (108°C)
NAS335X	×	×	×	×	○	○	○	○
NAS64	×	×	×	×	×	×	○	○
NAS185N	×	×	×	×	○	○	○	○
NAS254N	×	×	×	○	○	○	○	○
NAS354N	×	○	○	○	○	○	○	○
NAS355N	×	○	○	○	○	○	○	○

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%
NAS335X	0.01	0.02	0.31	0.12	0.09	2.15
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
NAS254N	0.02	0.05	1.02	2.11	2.16	7.76
NAS354N	0.01	0.03	0.03	2.06	3.02	4.99
NAS355N	<0.01	0.01	0.01	0.01	0.08	1.12

Test time: 24h

Alloy	Corrosion rate in hydrochloric acid at 80°C (mm/y)			
	0.1%	1%	2%	3%
NAS64	0.01	0.01	12.94	30.51
NAS185N	0.01	0.02	4.20	7.21
NAS254N	0.01	0.02	0.01	9.14
NAS354N	0.02	0.03	0.02	7.35
NAS355N	—	<0.01	0.02	3.65

Test time: 24h

(Reference)

Nippon Yakin	JIS	UNS No.	Chemical composition
NAS335X	NCF020	N08020	20Cr-33Ni-2.5Mo-3Cu-0.4Nb
NAS64	SUS329J4L	S32506	25Cr-6.5Ni-3.3Mo-0.17N
NAS185N	SUS312L	S31254	20Cr-18Ni-6Mo-0.8Cu-0.2N
NAS254N	SUS836L	S32053	23Cr-25Ni-5.5Mo-0.2N
NAS354N	NCF354	N08354	23Cr-35Ni-7.5Mo-0.2N
NAS355N	—	—	23Cr-35Ni-7.5Mo-3Cu-0.2N

### Workability

The hot and cold workability of NAS355N 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 processes.

### Weldability

Various welding methods are applicable in the same manner as with standard austenitic stainless steels, including shielded metal arc welding, TIG welding, and plasma welding. Alloy 276 welding consumable should be used.

### Heat Treatment

Solution heat treatment is performed at 1030°C~1180°C using water cooling.

### Pickling

A mixture of nitric acid and hydrofluoric acid is used in pickling. However, due to the high corrosion resistance of NAS355N, 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

- Flue gas desulfurization systems
- Chemical plants
- Heat exchangers

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