NAS255 (UNS N08904) High Corrosion Resistant Stainless Steel

NAS255 (UNS N08904, SUS890L) is an austenitic stainless steel with superior corrosion resistance in comparison with Type 316L. Due to addition of Cu (1.5%), this material displays excellent corrosion resistance against reducing acids such as sulfuric acid and phosphoric acid. It is used in chemical plants and a wide range of other applications. Nippon Yakin supplies this product in plate, sheet and strip form.

Steel Grade/Standard												
Nippor	Yakin Gra	ade	JIS G	G 4304/430)5	ASTM	A240		EN			
١	AS255		S	SUS890L		UNS N	108904		1.4539			
Chemical Composition												
	С	Si	Mn	Р	S	Ni	Cr	Мо	Cu	Ν		
Specification (SUS890L)	≦0.020	≦1.00	≦2.00	≦0.045	≦0.030	23.00~ 28.00	19.00~ 23.00	4.00~ 5.00	1.00~ 2.00	_		
Specification (UNS N08904)	≦0.020	≦1.00	≦2.00	≦0.045	≦0.035	23.0~ 28.0	19.0~ 23.0	4.00~ 5.00	1.00~ 2.00	≦0.10		

Physical Properties

Density	[g/cm ³]		8.05
Specific heat	[J/kg · K]		452
Electrical resistivity	[μΩ · cm]		97.2
Thermal conductivity	[W/m · K]		12.2
Average coefficient of thermal expansion	[10 ⁻⁶ /°C]	20~100°C	14.4
		20~200°C	14.9
		20~300°C	15.3
		20~400°C	15.7
Young's modulus	[MPa]		19.0 × 10 ⁴
Magnetism			None
Melting range	[°C]		1360~1397

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Mechanical Properties

Mechanical Properties at Room Temperature

		0.2% proof stress Tensile strength Elongation [MPa] [%]		Elongation [%]	Hardness [HRBW]	
Specification (SUS890L)		≧215	≧215 ≧490		≦90	
Specification (UNS N08904)		≧220	≧490	≧35	≦90	
Exar	Hot-rolled plate 12mm ^t	247	593	57	86	
nple	Cold-rolled sheet 2mm ^t	291	632	43	79	

Corrosion Resistance

Because NAS255 contains high concentrations of chromium, nickel and molybdenum, it offers excellent pitting corrosion resistance, crevice corrosion resistance, stress corrosion cracking (SCC) resistance and acid resistance in comparison with Type 304 and Type 316L.

Pitting Corrosion Resistance

Allow	ASTM G48	B Method A	ASTM G48 Method C		
AllOy	22°C	50°C	Critical pitting corrosion temperature CPT (°C)		
SUS304	×	×	10		
SUS316L	×	×	15		
NAS255	\bigcirc	×	50		

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

Test solution: 6%FeCl₃

ASTM G48 Method C

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

• Test temperature: 22°C, 50°C (Recommended temperature in this test)

• Test time: 72h

Crevice Corrosion Resistance

Alley	ASTM G48 Method D				
AllOy	Critical crevice corrosion temperature CCT (°C)				
SUS304	<-10				
SUS316L	<-10				
NAS255	10				

Test conditions ASTM G48 Method D

• Test solution: 6%FeCl₃ + 1%HCl

Test time: 72h

Stress Corrosion Cracking Resistance

		MgCl₂ concentration (boiling point (°C) are in brackets)						
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)
SUS304	×	×	×	×	×	×	×	×
SUS316L	×	×	×	×	×	×	×	0
NAS255	×	×	×	×	0	0	\bigcirc	0

Test conditions • Immersion in boiling MgCl₂ solution

• Test time: 300h

○: No stress corrosion cracking

• U-bend test specimen is used.

×: Stress corrosion cracking

Acid Resistance

	Corrosion rate in sulfuric acid at 80°C (mm/y)							
AllOy	5%	10%	20%	40%	60%	80%		
SUS304	1.93	14.59	195.2	1347	231.8	151.4		
SUS316L	1.67	4.69	71.91	764.9	704.5	33.74		
NAS255	< 0.01	< 0.01	0.78	2.95	0.48	5.01		

Test time: 24h

Allov	Corrosion rate in hydrochloric acid at 80°C (mm/y)					
, moy	0.1%	1%	2%	3%		
SUS304	0.02	2.42	7.16	18.99		
SUS316L	0.02	2.73	6.75	14.88		
NAS255	< 0.01	0.01	2.70	3.72		

Test time: 24h

(Reference)

Alloy	JIS	UNS No.	Chemical composition
SUS304	SUS304	S30400	18Cr-8Ni
SUS316L	SUS316L	S31603	17Cr-12Ni-2Mo
NAS255	SUS890L	N08904	20Cr-24Ni-4.3Mo-1.5Cu



Cold and hot workability are approximately equal to those of Type 304, 316, and other standard austenitic stainless steels.

Weldability

Weldability is on the same level as ordinary austenitic stainless steels. Preheating and post-heating are not necessary. As welding electrodes, in applications under severe corrosion environments, use of welding consumables with equal or higher corrosion resistance is recommended. When the corrosion environment is not severe, and when the purpose of welding is for joining, matching welding consumables may be used.

Heat Treatment

Solution annealing of NAS255 should be performed at 1095°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 NAS255, 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, Heat exchangers, Food manufacturing plants.

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