

# NAS 303AM (SUS 303, UNS S30300)

## NAS Free-machining Stainless Steel

NAS 303AM (SUS 303, UNS S30300) is a high free-machining austenitic stainless steel in which machinability is improved by adding sulfur to Type 304. Although sulfur is an alloying element that reduces corrosion resistance, the corrosion resistance of NAS 303AM is close to that of Type 304 in mildly corrosion atmosphere. Nippon Yakin supplies this product in plate form.

### Steel Grade / Standard

NAS	JIS G 4304	ASTM A895
NAS 303AM	SUS 303	UNS S30300

### Chemical Composition

	C	Si	Mn	P	S	Ni	Cr	Mo
Specification (SUS 303)	≦0.15	≦1.00	≦2.00	≦0.20	≧0.15	8.00~10.00	17.00~19.00	(1)
Specification (UNS S30300)	≦0.15	≦1.00	≦2.00	≦0.20	≧0.15	8.00~10.00	17.00~19.00	

(1) Mo must not exceed 0.60%.

### Physical Properties

Density	[g/cm <sup>3</sup> ]		7.93
Specific heat	[J/kg · °C]		502
Electrical resistivity	[μΩ · cm]		72
Thermal conductivity	[W/m · K]	25 °C	16.3
Average coefficient of thermal expansion	[10 <sup>-6</sup> /°C]	0~100 °C	17.3
Magnetism			None
Melting range	[°C]		1,405~1,454

## Mechanical Properties

		0.2% proof stress [N/mm <sup>2</sup> ]	Tensile strength [N/mm <sup>2</sup> ]	Elongation [%]	Hardness		
					[HB]	[HRB]	[HV]
Specification (SUS 303)		≥205	≥520	≥35	≤187	≤90	≤200
Specification (UNS S30300)					≤202		
Example	Plate 20mm <sup>t</sup>	287	610	56	183	-	-
	Plate 50mm <sup>t</sup>	262	576	61	166	-	-

## Machinability

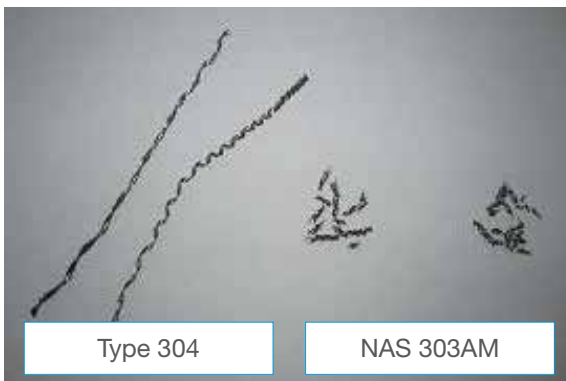
This material's machinability is controlled by dispersed sulfides. NAS 303AM has excellent machinability. NAS 303AM's excellent machinability enables remarkable extension of tool life, good surface finish, and other advantages during machining operations.

### 1. Drill speed test

<Test conditions>

- (1) Test sheet thickness: 3mm
- (2) Drill diameter: 1.2mm
- (3) Drill speed: 890rpm
- (4) Weight: 2.0kg
- (5) Water cooling

Alloy	Cutting speed [mm/sec]
NAS 303AM	0.67
Type 304	0.30



As the result of the drill speed test, a much higher cutting speed can be obtained with NAS 303AM in comparison with that of Type 304. The shapes of the cutting chips are shown in the photograph. As the chips of NAS 303AM are extremely small and brittle in comparison with those of Type 304. Load of the drill is also smaller in case of NAS 303AM.

Shape of cutting chips with NAS 303AM and Type 304

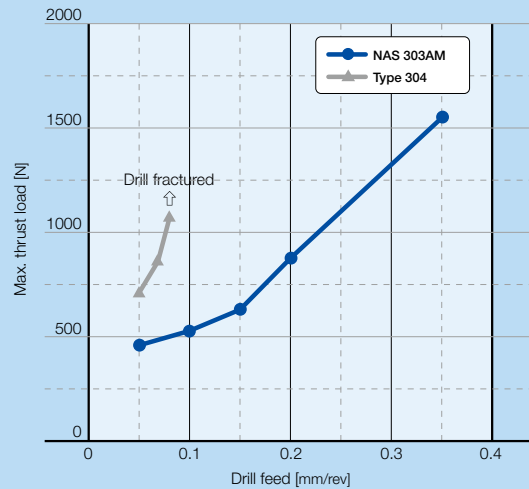
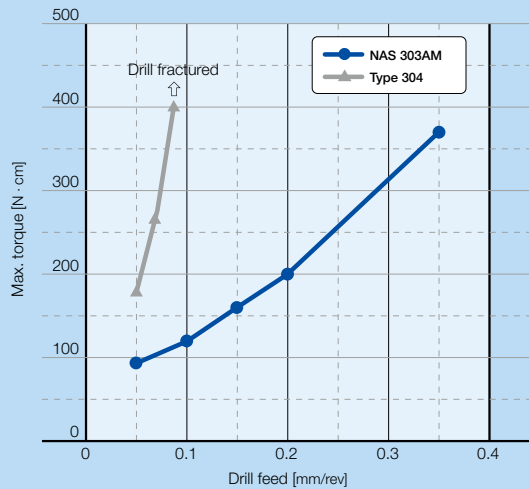
### 2. Drill cutting resistance test

<Test conditions>

- (1) Test sheet thickness: 10mm
- (2) Drill diameter: 5mm
- (3) Drill speed: 1500rpm (constant)
- (4) Drill Feed : 0.05-0.35mm/rev
- (5) Water soluble cutting fluid was used.
- (6) Measurement item: Cutting resistance of drill (Torque and thrust load)

Alloy	Feed [At 0.05mm/rev]		Max. feed [mm/rev]
	Max. torque [N · m]	Max. thrust load [N]	
NAS 303AM	93	443	0.35 or more
Type 304	185	704	Drill fractured at 0.08

Results of cutting resistance test of NAS 303AM and Type 304  
 Sheet thickness: 10mm, drill speed: 1,500rpm



In the results of the drill cutting resistance test, at the same feed rate, the maximum torque and the maximum thrust load of NAS 303AM are both much lower in comparison with those of Type 304, and drilling is also possible at a far faster drill feed rate than that at which the drill fractured with Type 304. Thus, the productivity of NAS 303AM in cutting work is greatly improved.

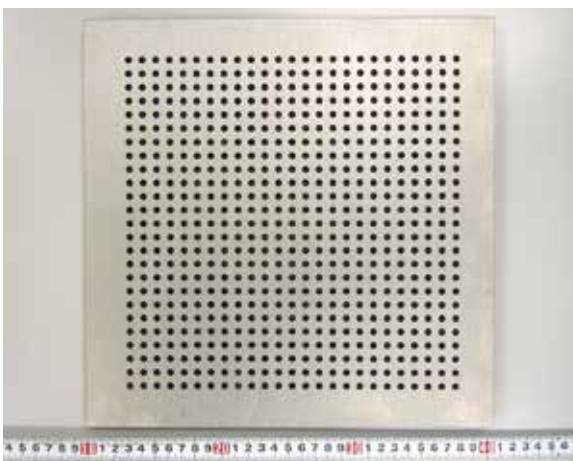
### 3. Drill life test

<Test conditions>

- (1) Test sheet thickness: 10mm
- (2) Drill diameter: 5mm
- (3) Drill speed: 1500rpm
- (4) Drill Feed : 0.07mm/rev
- (5) Water soluble cutting liquid was used.
- (6) Measurement item: Number of holes that can be drilled with one drill (up to max. 625)

The number of holes that can be drilled with one drill under these test conditions with Type 304 is 1 hole (the drill fractured while drilling 2nd hole). In contrast, with NAS 303AM, the maximum number of 625 holes are drilled without drill fracture.

With NAS 303AM, tool life is greatly improved thanks to the low load on the cutting tool.



NAS 303AM



Type 304

## Corrosion Resistance

### 1. Salt Spray Test (SST)

<Test conditions> JIS Z 2371,  
 “Methods of salt spray testing”  
 (1) Spraying with 5% NaCl aqueous solution  
 (2) 35 °C  
 (3) 72hr test

Alloy	Test result
NAS 303AM	No rust
Type 304	No rust

In the salt spray test, rust is not observed with NAS 303AM.

### 2. Pitting potential measurement

<Test conditions> JIS G 0577, “Method of pitting potential measurement for stainless steels”  
 (1) 3.5% NaCl aqueous solution (method B)  
 (2) 30 °C  
 (3) Test surface: Polished to 600 grit  
 (4) Measurement of pitting potential  $V_c \times 100$ .

Alloy	Pitting potential $V_c \times 100$ [V vs. SCE]
NAS 303AM	0.19
Type 304	0.32
Type 430	0.08

In the pitting potential measurements, the pitting potential of NAS 303AM shows a lower value than Type 304 but a higher value than Type 430, indicating that NAS 303AM has comparatively high pitting corrosion resistance.

### Bending Formability

NAS 303AM is not suitable for bending forming and similar processing, as its ductility is lower than that of Type 304 due to its high sulfur content.

### Weldability

NAS 303AM is not recommended for applications requiring welding.

### Heat Treatment

Because NAS 303AM is an austenitic stainless steel, heat treatment is equivalent to that with the standard austenitic stainless steels. The following heat treatment conditions are normally used :

Solution heat treatment: 1,010-1,150°C ; Water cooling

### Pickling

A mixed acid of nitric acid and hydrofluoric acid is used in pickling. Please avoid over-pickling. In some cases surface roughening may occur.

#### For more information, please contact:

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