North American Stainless

Flat Products Stainless Steel Sheet

T409

INTRODUCTION

NAS 409 is an 11% chromium, stabilized ferritic stainless steel. It is not as resistant to corrosion or high-temperature oxidation as the higher-alloyed stainless steels (for example NAS430 or NAS304), but is still far superior to mild steel and low alloy corrosion resisting steels and most coated mild steels.

Annealed NAS409 is ductile and does not harden to any appreciable extent by cold working. Thus AS409 can be formed using many mild roll forming, stretch-bending or pressing processes.

Although the weldability of NAS409 is regarded as being fair, it should not be used in the as-welded condition for dynamic or impact-loaded structures. As with most ferritic stainless steels, 409 can undergo grain growth in the heat-affected zones of weldments, which may adversely affect the mechanical properties in these zones. Applications involving welded NAS409 are thus generally limited to a maximum thickness of 2.5mm.

Being a ferritic stainless steel, NAS409 should not be used in cryogenic applications due to a danger of brittle fracture at sub-zero temperatures.

NAS409 finds its major application in tubing and stampings for motor vehicle exhaust systems, silencers and catalytic converters.

ASTM A240 recognizes three versions of 409 which vary by the type and amount of stabilizing elements used to tie up carbon and nitrogen. NAS produces all three versions.

PRODUCT RANGE for S40900; S40910; S40920; S40930:

This product is available as cold rolled form up to 60" wide in various different thicknesses.
For inquiry about minimum quantity, specific thickness and tolerances, contact inside sales at NAS.

Polish finish is rarely used on 409 but can be provided if desired.
Certification: ASTM A240/10, A480/10, ASME SA240/07, SA480/07, SAE J405, 1.4512

SPECIFICATIONS & TOLERANCES

North American Stainless supplies NAS409 to ASTM A240 (409) and EN 10088-2 (1.4512).

North American Stainless normally supplies material to the following tolerances:

HOT ROLLED	COLD ROLLED
ASTM A480M480	ASTM A480M480
ASME SA480M480	ASME SA480M480

EN 10051 EN ISO 9445

Other tolerances may be available on request.

CHEMICAL COMPOSITION

In accordance with ASTM A240 (409) and EN 10088-2 (1.4512)

Type	%C	%Si	%Mn	%P	%S	%Cr	%Ni	%N	%Ti (and Nb)
S40900	0.030	1.00	1.00	0.040	0.020	10.50 11.70	0.50	0.030	**
S40910	0.030	1.00	1.00	0.040	0.020	10.50 11.70	0.50	0.030	6x(C+N)-0.50, Nb≤ 0.17
S40920	0.030	1.00	1.00	0.040	0.020	10.50 11.70	0.50	0.030	8x(C+N);.15-0.50, Nb≤ 0.10
S40930	0.030	1.00	1.00	0.040	0.020	10.50 11.70	0.50	0.030	(Ti+Nb)≥.08+8x(C+N)-0.75, Ti≥0.05
1.4512	0.030	1.00	1.00	0.040	0.015	10.50 12.70	0.50	0.030	6x(C+N)-0.65

Note: S40900 can be satisfied by S40910, S40920 or S40930.

MECHANICAL PROPERTIES

In accordance with ASTM A240 (409) and EN 10088-2 (1.4512)

Type	Product Form	.2% Yield Stress ksi (MPa)	Tensile Strength ksi (MPa)	% Elongation In 2" or 50mm	Rockwell B (Brinell)
409	CR or HR	25 (170)	55 (380)	≥20	≤88 (179)
1.4512	CR or HR	32 (220)	55-81 (380-560)	≥25.0[1,2]	

1) Proportional elongation with the gauge length = $5.65\sqrt{S_0}$ (S_0 = cross-sectional area of test piece.)

2) For gauges <3mm, elongation gauge length is 50mm.

PROPERTIES AT ELEVATED TEMPERATURES

The properties quoted below are typical of annealed NAS 409. These values are given as a guideline only, and should not be used for design purposes.

SHORT TIME ELEVATED TEMPERATURE TENSILE STRENGTH

Temperature	°F (°C)	392	(200)	572	(300)	806	(430)	1004	(540)	1202	(650)
Tensile Strength	ksi (Mpa)	54	(370)	51	(350)	46	(315)	36	(250)	23	(158)
0.2% Yield Stress	ksi (Mpa)	24	(165)	22	(151)	20	(138)	17	(117)	13	(90)

MAXIMUM RECOMMENDED SERVICE TEMPERATURE (in oxidizing conditions)

Operating Condition	Temperature °F (°C)
Continuous	1150 (620)
Intermittent	1350 (730)

PHYSICAL PROPERTIES (@ 20°C unless otherwise specified)

Density	7.700 kg/m^3

Modulus of Elasticity in Tension	200GPA
Modulus of Elasticity in Torsion	77Gpa
Specific Heat Capacity	460J/kg K
Thermal conductivity: @ 100°C @ 500°C	23.0W/mK 25.0W/mK
Electrical resistivity	610η m
Mean Coefficient of Thermal Expansion: 0-100°C 0-315°C 0-540°C	11.1µm/mK 11.7µm/mK 12.5µm/mK
Melting Range	1480-1530°C
Relative Permeability	Ferromagnetic

THERMAL PROCESSING & FABRICATION

ANNEALING

Annealing is achieved by heating to between 700°C and 750°C for 90 minutes per 25mm thickness followed by an air quench.

STRESS RELIEVING

Stress relieving after welding is not normally required. Should this be necessary, temperatures between 200°C and 300°C are recommended.

HOT WORKING

Uniform heating of the steel in the range of 950°C to 1050°C is required. The finishing temperature should be below 750°C. Extended holding times above 1000°C should be avoided as excessive grain growth may occur and ductility may be detrimentally affected. All hot-working operations should be followed by annealing, pickling and passivating to restore the mechanical properties and corrosion resistance.

COLD WORKING

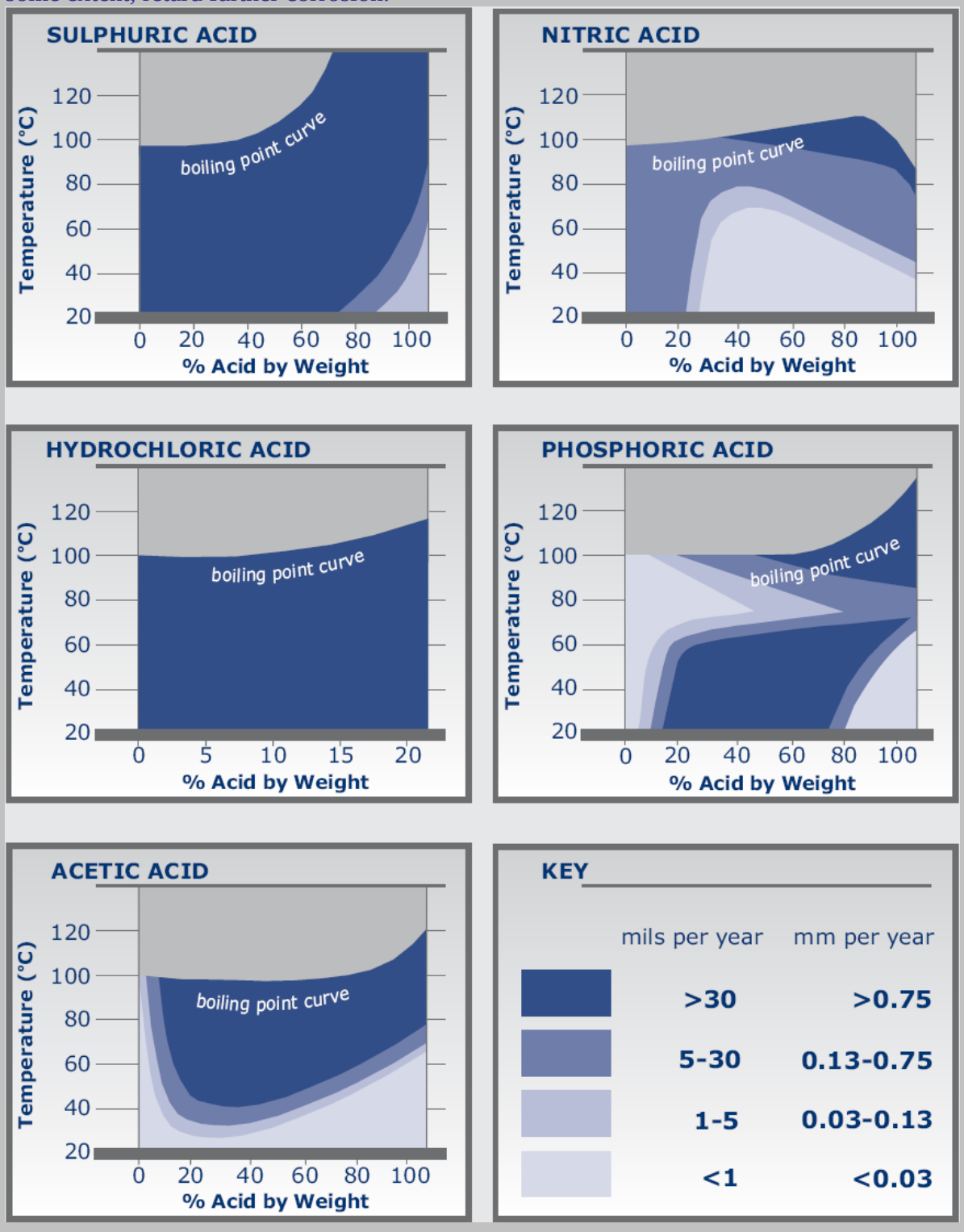
NAS409 has good formability characteristics with useful mechanical properties. Its good ductility allows it to be readily formed by bending and deep drawing. NAS409 does not undergo significant work hardening when cold formed.

WELDING

NAS409 has proven itself to be highly successful in TIG, laser, HF, MIG and spot-welding operations. However, being ferritic, NAS409 is prone to grain growth in the heat-affected zone of weldments. As such, the tensile, fatigue and toughness properties in the welded condition are relatively poor. NAS409 should thus not be used for applications where tensile or dynamic loading will be experienced. NAS409 is generally limited to a combined thickness of 3mm in the welded condition (i.e., for lap joints) this is equivalent to 2 x 1.5mm thickness being welded together. Edge welds are not recommended for NAS409. The use of austenitic filler metals such as types 308L, 309L or 316L will improve the ductility of welds to some extent but all welding procedures should nevertheless endeavor to maintain minimum heat inputs. The weld discoloration should be removed by pickling and passivating to restore maximum corrosion resistance.

CORROSION RESISTANCE

While being significantly more corrosion resistant than mild or low-alloy corrosion-resistant steels, NAS409 has a lower corrosion resistance than the higher-chromium type NAS430. NAS409 should only be used in mildly corrosive conditions where aesthetics is not a prime requirement. A light surface patina or discoloration will form in most corrosive environments and this patina will, to some extent, retard further corrosion.



Technical Service: For further information, email qualitycontrol@northamericanstainless.com
For new product development requirements, contact sales@northamericanstainless.com.

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