Technical Datasheet CARPENTER TECHNOLOGY

CarTech® 25Ni-20Cr-6Mo Stainless

Identification

UNS Number

• N08925/N08926

Type Analysis

Single figures are nominal except where noted.

Carbon (Maximum)	0.02 %	**Manganese (Maximum)**	2.00 %
Phosphorus (Maximum)	0.045 %	**Sulfur (Maximum)**	0.030 %
Silicon (Maximum)	0.50 %	**Chromium**	19.00 to 21.00 %
Nickel	24.00 to 26.00 %	**Molybdenum**	6.00 to 7.00 %
Copper	0.50 to 1.50 %	**Nitrogen**	0.10 to 0.25 %
Iron	Balance		

General Information

Description

CarTech 25Ni-20Cr-6Mo stainless is a superaustenitic stainless steel designed to resist pitting and crevice corrosion in acidic or neutral chloride environments. This resistance is provided by the chromium, molybdenum and nitrogen, while nickel stabilizes the austenitic structure. Nickel, in combination with copper also provides resistance to some acid environments.

Applications

CarTech 25Ni-20Cr-6Mo stainless is a candidate for service in chloride environments, such as brackish water, seawater and bleach. It may also be considered for sour service and various pharmaceutical and chemical process industry applications.

Corrosion Resistance

25Ni-20Cr-6Mo Stainless may be considered for applications in mild/moderate sulfuric and phosphoric acid applications and especially in acidic environments containing chloride impurities. The combination of chromium, molybdenum, nitrogen and nickel are intended to provide resistance to pitting and crevice attack with resistance to stress-corrosion cracking in many environments.

Important Note: *The following 4-level rating scale is intended for comparative purposes only. Corrosion testing is recommended; factors which affect corrosion resistance include temperature, concentration, pH, impurities, aeration, velocity, crevices, deposits, metallurgical condition, stress, surface finish and dissimilar metal contact.*

Nitric Acid	Good	Sulfuric Acid	Moderate
Phosphoric Acid	Good	Acetic Acid	Good
Sodium Hydroxide	Good	Salt Spray (NaCl)	Excellent
Sea Water	Excellent	Sour Oil/Gas	Good
Humidity	Excellent		

Properties

Physical Properties

Specific Gravity	8.06	
Density	0.2910	lb/in³
Mean Specific Heat	0.1200	Btu/lb/°F
Mean CTE		
70 to 200°F	8.40	x 10 $^{-6}$ in/in/°F
70 to 1200°F	9.40	x 10 $^{-6}$ in/in/°F
Thermal Conductivity (68 to 212°F)	94.80	BTU-in/hr/ft²/°F
Modulus of Elasticity (E)	27.8	x 10 ^{3} ksi

Electrical Resistivity	480.0	ohm-cir-mil/ft

Magnetic Properties

Maximum Permeability	1.01000	

Typical Mechanical Properties

Typical Mechanical Properties—25Ni-20Cr-6Mo Stainless

0.2% Yield Strength		Ultimate Tensile Strength		% Elongation in 2"
ksi	MPa	ksi	MPa	
48	330	100	690	42

Heat Treatment

Annealing

25Ni-20Cr-6Mo cannot be hardened by heat treatment. It may be annealed at 2000ºF to 2150ºF (1095ºC to 1175ºC), with a range for bar and wire in ASTM B 649-02 of 2010ºF to 2100ºF (1100ºC to 1150ºC). A water quench is suggested (or rapid air cool for larger sections). Prolonged exposure to about 950ºF to 1600ºF (510ºC to 870ºC) can cause formation of deleterious phases/carbides, which can reduce corrosion resistance. Excessive time at the annealing temperature can cause increased oxidation.

Workability

Hot Working

Hot working is preferably conducted between 1800ºF and 2100ºF (980ºC and 1150ºC), but can be carried out up to 2250ºF (1230ºC). Annealing is suggested after hot working.

Cold Working

25Ni-20Cr-6Mo cold works well with a work hardening rate similar to or somewhat greater than that of Type 316 stainless steel.

Machinability

The machinability of 25Ni-20Cr-6Mo stainless is generally similar to that of other nitrogen-strengthened austenitic stainless steels. It is suggested that work hardening be minimized, e.g. by using sharp, rigid tools having positive rake angles. Chip curlers or breakers may be helpful.

Typical Machining Speeds and Feeds – 25Ni-20Cr-6Mo Stainless

The speeds and feeds in the following charts are conservative recommendations for initial setup. Higher speeds and feeds may be attainable depending on machining environment.

Turning—Single-Point and Box Tools

Depth of Cut (Inches)	Micro-Melt® Powder High Speed Tools			Carbide Tools (Inserts)			
	Tool Material	Speed (fpm)	Feed (ipr)	Tool Material	Speed (fpm) Uncoated	Speed (fpm) Coated	Feed (ipr)
.150	M48, T15	66	.015	C6	250	300	.015
.025	M48, T15	84	.007	C7	300	350	.007

Turning—Cut-Off and Form Tools

Tool Material			Feed (ipr) Cut-Off and Form Tool Width (Inches)						
Micro-Melt® Powder HS Tools	Carbide Tools	Speed (fpm)	1/16	1/8	1/4	1/2	1	1 ½	2
M48, T15		48	.001	.001	.0015	.0015	.001	.0007	.0007
	C6	168	.004	.0055	.0045	.004	.003	.002	.002

Rough Reaming

Micro-Melt® Powder HS Tools		Carbide Tools		Feed (ipr) Reamer Diameter (Inches)					
Tool Material	Speed (fpm)	Tool Material	Speed (fpm)	1/8	1/4	1/2	1	1 ½	2
M48, T15	72	C2	80	.003	.005	.008	.012	.015	.018

Drilling

Tool Material	Speed (fpm)	High Speed Tools Feed (inches per revolution) Nominal Hole Diameter (inches)							
		1/16	1/8	1/4	1/2	3/4	1	1 ½	2
M42	45-50	.001	.002	.004	.007	.010	.012	.015	.018
C2 Coated	150	.0005	.002	.004	.006	.0077	.0088	.0098	.0098

Die Threading

Tool Material	FPM for High Speed Tools			
	7 or less, tpi	8 to 15, tpi	16 to 24, tpi	25 and up, tpi
T15, M42	4-8	6-10	8-12	10-15

Milling, End-Peripheral

Depth of Cut (in).	Micro-Melt® Powder High Speed Tools						Carbide Tools					
	Tool Mat'l	Speed (fpm)	Feed (ipt) Cutter Diameter (in) 1/4	1/2	3/4	1-2	Tool Mat'l	Speed (fpm)	Feed (ipt) Cutter Diameter (in) 1/4	1/2	3/4	1-2
.050	M8,T15	78	.001	.002	.003	.004	C2	245	.001	.002	.003	.005

Tapping

High Speed Tools	
Tool Material	Speed (fpm)
M7, M10	12-25

Broaching

Micro-Melt® Powder High Speed Tools		
Tool Material	Speed (fpm)	Chip Load (ipt)
M48, T15	12	.0030

Additional Machinability Notes

When using carbide tools, surface speed feet/minute (SFPM) can be increased between 2 and 3 times over the high-speed suggestions. Feeds can be increased between 50 and 100%.

Figures used for all metal removal operations covered are average. On certain work, the nature of the part may require adjustment of speeds and feeds. Each job has to be developed for best production results with optimum tool life. Speeds or feeds should be increased or decreased in small steps.

Weldability

25Ni-20Cr-6Mo stainless can be welded using gas-metal-arc (GMAW), gas-tungsten-arc (GTAW) or other conventional welding techniques. For best corrosion resistance, an over-matched filler metal, such as 9% molybdenum Pyromet® Alloy 625 is suggested.

Passivation

25Ni-20Cr-6Mo may be passivated to remove finely-divided particles of free iron from shop dirt or from machining with tools and coolants used for carbon steel. Passivation similar to that used for Type 316 stainless is suggested, i.e. 20% by vol. nitric acid at 120/140ºF (49/60ºC) for 30 minutes followed by thorough rinsing and drying. Careful observation and evaluation of passivated parts is useful to confirm that the desired results are obtained.

Other Information

Applicable Specifications

25Ni-20Cr-6Mo stainless can be ordered to these ASTM specifications and the corresponding ASME SA and SB specifications:

- ASTM A240
- ASTM A480
- ASTM B472
- ASTM B625
- ASTM B649

Forms Manufactured

- Bar
- Billet
- Strip
- Wire

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