

CarTech® 302 Stainless

Identification

UNS Number

• S30200

Type Analysis

Single figures are nominal except where noted.

Carbon (Maximum)	0.15 %	Manganese (Maximum)	2.00 %
Phosphorus (Maximum)	0.045 %	Sulfur (Maximum)	0.030 %
Silicon (Maximum)	1.00 %	Chromium	17.00 to 19.00 %
Nickel	8.00 to 10.00 %	Iron	Balance

General Information

Description

CarTech 302 stainless is a slightly higher carbon version of CarTech 304 stainless and has most frequently been used for wire applications. In the annealed condition it is austenitic, nonmagnetic, extremely tough and ductile.

Some typical applications have been springs, stampings, moldings, woven screens, cables, salt water fishing tackle, nitric acid vessels, dairy equipment, ice cream molds, camera parts, thermometers, and aerosol springs.

It has been frequently used in the annealed condition for its nonmagnetic properties, which are of vital importance to certain instruments.

Scaling

The safe scaling temperature for continuous service is 1600°F (871°C).

Corrosion Resistance

Annealed Carpenter Stainless Type 302 is resistant to atmospheric corrosion, foodstuffs, sterilizing solutions, many organic chemicals and dyestuffs, and a wide variety of inorganic chemicals.

Intergranular corrosion may be a problem if the material is heated between 800°F (427°C) and 1650°F (899°C) or cooled slowly through that range.

For optimum corrosion resistance, surfaces must be free of scale, lubricants, foreign particles, and coatings applied for drawing and heading. After fabrication of parts, cleaning and/or passivation should be considered.

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

Properties

Physical Properties

Specific Gravity	7.90
Density	0.2850 lb/in ³

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Mean Specific Heat (32 to 212°F)	0.1200 Btu/lb/°F
Mean CTE (32 to 1200°F)	10.4 x 10 ⁻⁶ in/in/°F
Electrical Resistivity (70°F)	433.0 ohm-cir-mil/ft

Typical Mechanical Properties

Typical Elevated Temperature Mechanical Properties Annealed condition

Test Temperature		0.2% Yield Strength		Short-Time Tensile Tests				Creep Tests	
				Ultimate Tensile Strength		% Elongation in 2" (50.8 mm)	% Reduction of Area	Stress for 1% Creep in 10,000 Hours	
°F	°C	ksi	MPa	ksi	MPa				
70	21	35	241	85	586	60	70	—	—
800	427	21	145	61	421	37	66	—	—
1000	538	19	131	55	379	36	69	17	117
1200	649	17	117	45	310	32	66	7	48
1400	760	14	97	30	207	33	55	2	14
1600	871	10	69	18	124	40	52	—	—

Typical Room Temperature Mechanical Properties 1" (25.4 mm) round bar, annealed 1900°F (1038°C)

0.2% Yield Strength		Ultimate Tensile Strength		% Elongation in 2" (50.8 mm)	% Reduction of Area	Brinell Hardness	Izod Impact Strength	
ksi	MPa	ksi	MPa				ft-lb	J
35	241	85	586	60	70	150	110	149

Heat Treatment

Annealing

Heat to 1850/2050°F (1010/1121°C) and quench in water. Brinell hardness approximately 150.

Hardening

Can be hardened only by cold working.

Workability

Hot Working

Carpenter Stainless Type 302 can be readily forged, hot headed, riveted and upset. Because of its high red-hardness, more power for a given reduction is required than with mild steel. Heat uniformly to 2100/2300°F (1149/1260°C). Do not forge below 1700°F (927°C). Forgings can be air-cooled without danger of cracking. For full corrosion resistance, forgings must be annealed.

Cold Working

Carpenter Stainless Type 302 is readily fabricated by cold working. It is extremely tough and ductile and responds well to deep drawing, bending, forming and upsetting. After cold working, it is slightly magnetic. The tensile strength and hardness of Carpenter Stainless Type 302 can be significantly increased by cold working.

Machinability

Carpenter Stainless Type 302 produces a long gummy chip, and chip curlers and breakers are important on the tools. Since it work hardens very rapidly, glazing can be prevented by keeping the tools cutting. Increasing the feed and slowing the speed will also be helpful. It machines similarly to copper-nickel alloys, except that Carpenter Stainless Type 302 work hardens. The machinability of Type 302 can be somewhat improved by using moderately cold-drawn bars.

Following are typical feeds and speeds for Carpenter Stainless Type 302.

Typical Machining Speeds and Feeds – Carpenter Stainless Type 302

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)	High Speed Tools			Carbide Tools (Inserts)			Feed (ipr)
	Tool Material	Speed (fpm)	Feed (ipr)	Tool Material	Speed (fpm)		
					Uncoated	Coated	
.150	T15	85	.015	C2	350	450	.015
.025	M42	100	.007	C3	400	525	.007

Turning—Cut-Off and Form Tools

Tool Material		Speed (fpm)	Feed (ipr)						
High Speed Tools	Carbide Tools		Cut-Off Tool Width (Inches)				Form Tool Width (Inches)		
			1/16	1/8	1/4	1/2	1	1 ½	2
M2	C2	75	.001	.0015	.002	.0015	.001	.001	.001
		275	.004	.0055	.007	.005	.004	.0035	.0035

Rough Reaming

High Speed		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
M7	70	C2	90	.003	.005	.008	.012	.015	.018

Drilling

High Speed Tools									
Tool Material	Speed (fpm)	Feed (inches per revolution) Nominal Hole Diameter (inches)							
		1/16	1/8	1/4	1/2	3/4	1	1 ½	2
M7, M10	50-60	.001	.002	.004	.007	.010	.012	.015	.018

Die Threading

FPM for High Speed Tools			
Tool Material	7 or less, tpi	8 to 15, tpi	
M1, M2, M7, M10	8-15	10-20	15-25 25-30

Milling, End-Peripheral

Depth of Cut (Inches)	High Speed Tools				Carbide Tools							
	Tool Material	Speed (fpm)	Feed (ipr) Cutter Diameter (in)		Tool Material	Speed (fpm)	Feed (ipr) Cutter Diameter (in)					
			1/4	1/2			3/4	1-2	1/4	1/2	3/4	1-2
.050	M2, M7	75	.001	.002	.003	.004	C2	270	.001	.002	.003	.005

Tapping

High Speed Tools	
Tool Material	Speed (fpm)
M1, M7, M10	12-25

Broaching

High Speed Tools		
Tool Material	Speed (fpm)	Chip Load (ipt)
M2, M7	15	.003

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.

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%.

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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

Carpenter Stainless Type 302 can be satisfactorily welded by the shielded fusion and resistance welding processes. Oxyacetylene welding is not recommended, since carbon pickup in the weld may occur. Since austenitic welds do not harden on air cooling, the welds should have good toughness. Where a filler metal is needed, AWS E/ER308 welding consumables should be considered. If greater resistance to weld hot cracking is necessary, E/ER312 has been used, although the carbon content of the weld may be higher. Resistance to intergranular corrosion may be restored by a postweld annealing treatment.

Other Information

Applicable Specifications

- ASME SA479
- ASTM A479
- MIL-S-7720
- ASTM A276
- ASTM A580

Forms Manufactured

- Bar-Flats
- Bar-Rounds
- Billet
- Wire
- Bar-Hexagons
- Bar-Squares
- Strip
- Wire-Rod

Technical Articles

- [Development of Type 204 Cu Stainless, A Low-cost Alternative to Type 304](#)

Disclaimer:

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