Technical Datasheet

CarTech® 420F Stainless

Identification

UNS Number

• S42020

Type Analysis

Single figures are nominal except where noted.

Carbon (Minimum)	0.15 %	**Manganese (Maximum)**	1.25 %
Phosphorus (Maximum)	0.060 %	**Sulfur (Minimum)**	0.150 %
Silicon (Maximum)	1.00 %	**Chromium**	12.00 to 14.00 %
Molybdenum (Maximum)	0.60 %	**Iron**	Balance

General Information

Description

CarTech 420F stainless is easy to machine, grind and polish, and has certain nongalling or nonseizing properties in service. It has been used for parts made on automatic screw machines, such as valve trim, pump shafts, needle valves, ball check valves, gears, cams, pivots, etc. This free-machining hardenable steel has been used mainly for machined parts requiring high hardness and good corrosion resistance. It is not recommended for vessels containing gases or liquids under high pressure. CarTech 420F and other free-machining stainless steels are not recommended for plastic mold cavities where a high mirror finish is essential.

Elevated Temperature Use

Carpenter Stainless Type 420F is not usually recommended for elevated temperature applications since corrosion resistance is reduced when used in the annealed condition or hardened and tempered above about 800°F (427°C).

Corrosion Resistance

Carpenter Stainless Type 420F has corrosion resistance similar to that of Type 416. It has resisted corrosion from mild atmospheres, fresh water, ammonia, many petroleum products and organic materials, and several mild acid environments.

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	Restricted	Sulfuric Acid	Restricted
Phosphoric Acid	Restricted	Acetic Acid	Restricted
Sodium Hydroxide	Moderate	Salt Spray (NaCl)	Restricted
Humidity	Good		

Properties

Physical Properties

Specific Gravity	7.65	
Density	0.2760	lb/in³
Mean Specific Heat (32 to 212°F)	0.1100	Btu/lb/°F
Mean CTE (32 to 212°F)	5.70	x 10^{-6} in/in/°F
Modulus of Elasticity (E)	29.0	x 10^{3} ksi
Electrical Resistivity (70°F)	331.0	ohm-cir-mil/ft

Heat Treatment

Annealing

For maximum softness, heat uniformly to 1550/1650°F (843/899°C) and cool slowly in furnace. Brinell hardness approximately 179.

Intermediate or process annealing treatment----heat uniformly to 1350/1450°F (732/788°C) and furnace cool or cool in air. Brinell hardness approximately 196.

Hardening

Heat to 1850/1950°F (1010/1066°C)---soak at heat and quench in warm oil.

Tempering

To retain maximum hardness and corrosion resistance, temper at 300/400°F (149/204°C) and cool in air. Rockwell C hardness approximately 52.

Typical Hardness

Pieces 1" (25.4 mm), hardened 1900°F (1038°C), oil quench, tempered one hour

Tempering Temperature		Hardness	
°F	°C	Brinell	Rockwell C
Not Tempered		512	52
300	149	512	52
400	204	512	52
500	260	495	50
600	316	495	50
700	371	478	49
800	427	478	49

For maximum corrosion resistance, Carpenter Stainless Type 420F should not be tempered over 800°F (427°C).

Workability

Hot Working

Preheat to 1400/1500°F (760/816°C), then heat uniformly to 2000/2200°F (1093/1204°C); forge; then cool forgings in a furnace heated to 1550°F (843°C) if possible. If not, warm dry lime or ashes can be used. If air cooled, cracking may occur. Anneal after forging; cool to room temperature before annealing. Do not forge below 1650°F (899°C)---reheat if necessary.

Cold Working

Carpenter Stainless Type 420F will withstand moderate cold work in the annealed condition, but it is not recommended for cold upsetting. The primary application for this steel has been in parts that are machined to shape.

Machinability

In automatic screw machines Carpenter Stainless Type 420F machines like SAE 2315 and 2340.

Following are typical feeds and speeds for Carpenter Stainless type 420F.

Turning—Single-Point and Box Tools

Depth of Cut (Inches)	High Speed Tools			Carbide Tools (Inserts)			
	Tool Material	Speed (fpm)	Feed (ipr)	Tool Material	Speed (fpm) Uncoated	Speed (fpm) Coated	Feed (ipr)
.150	T15	105	.015	C6	500	600	.015
.025	M42	130	.007	C7	575	675	.007

Turning—Cut-Off and Form Tools

Tool Material		Speed (fpm)	Feed (ipr)						
			Cut-Off Tool Width (inches)			Form Tool Width (inches)			
High Speed Tools	Carbide Tools		1/16	1/8	1/4	1/2	1	1 ½	2
M2		100	.001	.0015	.002	.0015	.0015	.001	.001
	C6	325	.004	.005	.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
T15	87	C2	110	.004	.006	.010	.014	.017	.021

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
M7, M10	65-75	.001	.003	.006	.010	.014	.017	.021	.025

Die Threading

FPM for High Speed Tools				
Tool Material	7 or less, tpi	8 to 15, tpi	16 to 24, tpi	25 and up, tpi
M1, M2, M7, M10	10-20	20-30	30-40	40-50

Milling, End-Peripheral

Depth of Cut (inches)	High Speed Tools						Carbide Tools					
	Tool Material	Speed (fpm)	Feed (ipt) Cutter Diameter (in) 1/4	1/2	3/4	1-2	Tool Material	Speed (fpm)	Feed (ipt) Cutter Diameter (in) 1/4	1/2	3/4	1-2
.050	M2, M7	135	.001	.002	.004	.005	C6	300	.001	.003	.005	.007

Tapping

High Speed Tools	
Tool Material	Speed (fpm)
M1, M7, M10	20-45

Broaching

High Speed Tools		
Tool Material	Speed (fpm)	Chip Load (ipt)
M2, M7	20	.003

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

Carpenter Stainless Type 420F is not recommended for welding.

Other Information

Applicable Specifications

- AMS 5620
- QQ-S-764
- ASTM A582

Forms Manufactured

- Bar-Rounds
- Billet
- Wire
- Wire-Rod

Technical Articles

- How to Passivate Stainless Steel Parts
- New Ideas for Machining Austenitic Stainless Steels
- Passivating and Electropolishing Stainless Steel Parts
- Unique Properties Required of Alloys for the Medical and Dental Products Industry

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