Technical Datasheet

CarTech® Custom Flo 302HQ Stainless

Identification

UNS Number

• S30430

Type Analysis

Single figures are nominal except where noted.

Carbon (Maximum)	0.03 %	**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 %	**Copper**	3.00 to 4.00 %
Iron	Balance		

General Information

Description

CarTech Custom Flo 302HQ stainless has been used for severe cold heading operations. The analysis is designed to lower the tendency to cold work harden with the result that tool wear is minimized and cracking is eliminated. It has been used successfully for cold heading nuts and all standard head configurations of recessed head fasteners. It is an austenitic stainless steel and becomes only faintly magnetic after severe cold working.

Scaling

The safe scaling temperature for continuous service is 1600ºF (871ºC).

Corrosion Resistance

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

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	Humidity	Excellent

Properties

Physical Properties

Specific Gravity	7.92	
Density	0.2860	lb/in³
Mean Specific Heat (32 to 212°F)	0.1200	Btu/lb/°F
Mean CTE		
32 to 212°F	9.60	x 10 $^{-6}$ in/in/°F
32 to 600°F	9.90	x 10 $^{-6}$ in/in/°F
32 to 1200°F	10.4	x 10 $^{-6}$ in/in/°F

Mean Coefficient of Thermal Expansion

Temperature		10^{-6}/°F	10^{-6}/K
32°F to	0°C to		
212	100	9.6	17.3
600	316	9.9	17.8
1200	649	10.4	18.7

Thermal Conductivity		
212°F	113.0	BTU-in/hr/ft²/°F
932°F	149.0	BTU-in/hr/ft²/°F

Thermal Conductivity

Test Temperature		Btu-in/ft²•h•°F	W/m•K
°F	°C		
212	100	113	16.3
932	500	149	21.5

Modulus of Elasticity (E)	28.0	x 10 ³ ksi
Modulus of Rigidity (G)	12.5	x 10 ³ ksi
Electrical Resistivity (70°F)	433.0	ohm-cir-mil/ft

Magnetic Properties

Magnetic Permeability		
200 Oe, 21.000%	1.0050	Mu
200 Oe, 40.000%	1.0180	Mu
200 Oe, 52.000%	1.0500	Mu
200 Oe, 61.000%	1.0860	Mu
200 Oe, 69.000%	1.1660	Mu
200 Oe, 75.000%	1.2780	Mu
200 Oe, 80.000%	1.4210	Mu
200 Oe, 84.000%	1.5990	Mu
200 Oe, 88.000%	1.8730	Mu
200 Oe, 91.000%	2.2510	Mu
200 Oe, 92.000%	2.4870	Mu
Annealed, 200 Oe	1.0040	Mu

Magnetic Permeability at H = 200 Oersteads

% Cold Reduction	Permeability	% Cold Reduction	Permeability
As annealed	1.004	75	1.278
21	1.005	80	1.421
40	1.018	84	1.599
52	1.050	88	1.873
61	1.086	91	2.251
69	1.166	92	2.487

Starting material = 0.250″ round annealed wire

Typical Mechanical Properties

Typical Room Temperature and Cryogenic Mechanical Properties
Billet, annealed 1950°F (1066°C), water quenched

Test Temperature		0.2% Yield Strength		Ultimate Tensile Strength		% Elongation in 1" (25.4 mm) or 4D	% Reduction of Area	Charpy V-Notch Impact Strength	
°F	°C	ksi	MPa	ksi	MPa			ft-lb	J
74	23	31	214	72	496	69	85	240*	325*
-100	- 73	48	331	109	752	93	84	240*	325*
-320	-196	60	414	196	1351	69	71	190	258

*Specimens did not fracture completely. Annealed hardness was Rockwell B 70.

Heat Treatment

Annealing

Heat to 1850/2050ºF (1010/1120ºC) and quench in water.

Hardening

Cannot be hardened by heat treatment. Hardens very slowly by cold work.

Workability

Hot Working

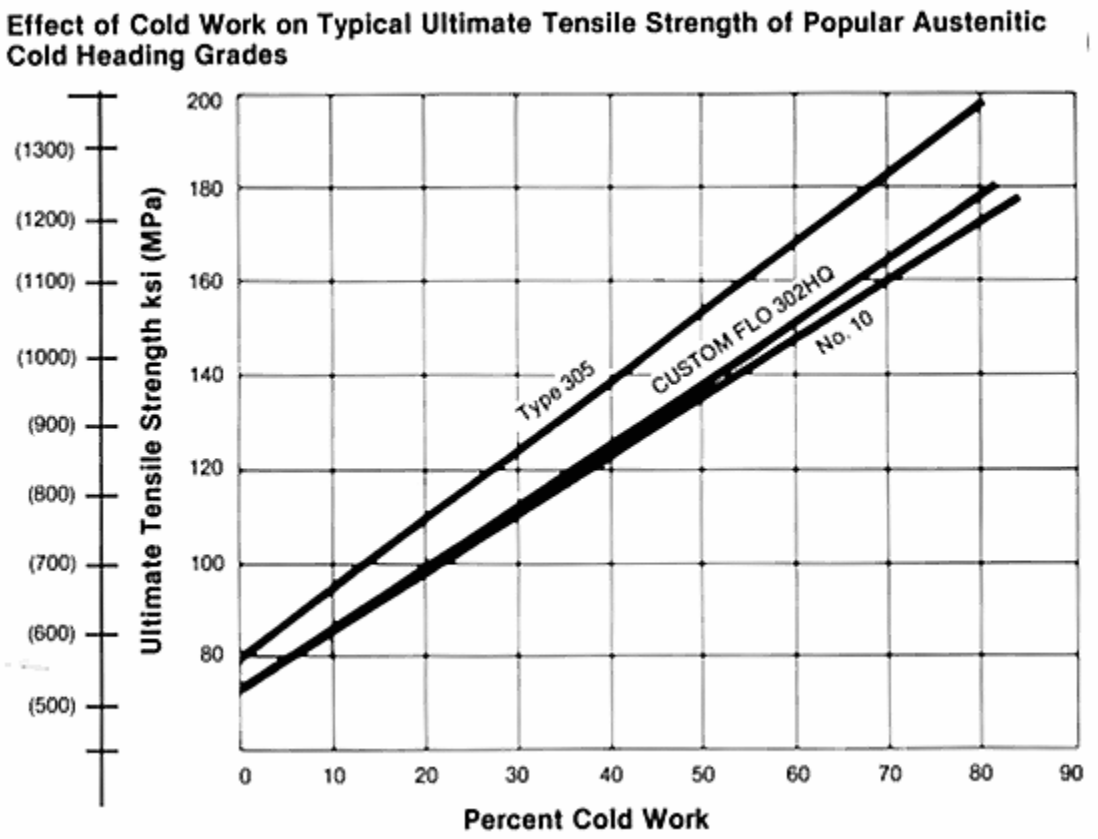
This steel can be readily forged, hot headed, upset and riveted. After hot-working operations, it should be annealed.

Forging

Heat uniformly to 2100/2300ºF (1150/1260ºC). Do not forge below 1700ºF (927ºC). Small forgings can be air-cooled, but better corrosion resistance can be obtained if they are water-quenched from the hammer. Large pieces should be annealed after forging.

Cold Working

Custom Flo 302HQ work hardens very slowly and is particularly suitable for cold heading.



Machinability

Custom Flo 302HQ machines with tough and stringy chip. To prevent glazing, keep the tools cutting-increasing the feed and slowing the speed will also be helpful. The machinability can be somewhat improved by moderate cold working.

Following are typical feeds and speeds for Carpenter Stainless Custom Flo 302HQ.

Typical Machining Speeds and Feeds – Carpenter Custom Flo 302HQ

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)			
	Tool Material	Speed (fpm)	Feed (ipr)	Tool Material	Speed (fpm) Uncoated	Speed (fpm) Coated	Feed (ipr)
.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)						
			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		75	.001	.0015	.002	.0015	.001	.001	.001
	C2	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

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	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	16 to 24, tpi	25 and up, 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 (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	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%.

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

Custom Flo 302HQ 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/ER308L welding consumables should be considered. It can be welded without danger or loss of corrosion resistance due to intergranular carbide precipitation. Usually the alloy can be used in the as-welded condition; however, for service in the most severe environments, the welded structure should be reannealed after welding.

Other Information

Applicable Specifications

- ASTM A276
- ASTM A493
- ASTM F593

Forms Manufactured

- Bar-Rounds
- Strip
- Wire
- Wire-Rod

Technical Articles

- Alloy Selection for Cold Forming (Part I)
- Alloy Selection for Cold Forming (Part II)
- How to Passivate Stainless Steel Parts
- How to Select the Right Stainless Steel or High Temperature Alloy for Heading
- New Engineering University Research Study Simplifies Selection of Coatings for Cold Heading
- Passivating and Electropolishing Stainless Steel Parts

Edition Date: 04/01/1987

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