

CarTech® BioBlu® 27 Alloy

Type Analysis

Single figures are nominal except where noted.

Carbon (Maximum)	0.35 %	Manganese (Maximum)	1.00 %
Silicon (Maximum)	1.00 %	Chromium	26.00 to 30.00 %
Nickel (Maximum)	1.00 %	Molybdenum	5.00 to 7.00 %
Cobalt	Balance	Nitrogen (Maximum)	0.25 %
Iron (Maximum)	0.75 %		

General Information

Description

CarTech BioBlu 27 alloy is a non-magnetic cobalt-chromium-molybdenum alloy exhibiting high strength, corrosion resistance, and wear resistance.

CarTech BioBlu 27 alloy is a wrought powder metallurgy product produced by vacuum induction melting (VIM) followed gas atomization and hot isostatic pressing or by VIM plus electroslag remelting (ESR) to produce 100% billets. The finished mill product is supplied in the annealed, hot worked, or warm worked condition.

Applications

- Jewelry
- Watches
- Accessories

Corrosion Resistance

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	Excellent	Sulfuric Acid	Good
Phosphoric Acid	Good	Acetic Acid	Excellent
Sodium Hydroxide	Moderate	Salt Spray (NaCl)	Excellent
Sea Water	Good	Humidity	Excellent

Properties

Physical Properties

Specific Gravity	8.29
Density	0.2990 lb/in ³
Mean Specific Heat	
210°F	0.1130 Btu/lb/°F
570°F	0.1260 Btu/lb/°F
1100°F	0.1420 Btu/lb/°F
1700°F	0.1580 Btu/lb/°F
1800°F	0.1590 Btu/lb/°F
2000°F	0.1600 Btu/lb/°F

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Specific heat

Temperature		Specific Heat	
°F	°C	Btu(lb·°F)	(W·S)/Kg·°K
212	100	0.113	470
572	300	0.126	524
1112	600	0.142	590
1652	900	0.158	657
1832	1000	0.159	661
2012	1100	0.160	669

Mean CTE

68 to 212°F	7.32 x 10 ⁻⁶ in/in/°F
68 to 392°F	7.36 x 10 ⁻⁶ in/in/°F
68 to 572°F	7.48 x 10 ⁻⁶ in/in/°F
68 to 752°F	7.66 x 10 ⁻⁶ in/in/°F
68 to 932°F	7.86 x 10 ⁻⁶ in/in/°F
68 to 1112°F	8.04 x 10 ⁻⁶ in/in/°F
68 to 1292°F	8.38 x 10 ⁻⁶ in/in/°F
68 to 1472°F	8.61 x 10 ⁻⁶ in/in/°F
68 to 1652°F	8.86 x 10 ⁻⁶ in/in/°F
68 to 1832°F	9.13 x 10 ⁻⁶ in/in/°F
68 to 2048°F	9.19 x 10 ⁻⁶ in/in/°F
68 to 2102°F	9.49 x 10 ⁻⁶ in/in/°F

Mean coefficient of thermal expansion

Temperature		Mean Coefficient (Micro Inches/Inch)	
68°F to (°F)	20°C to (°C)	per °F	per °C
212	100	7.32	13.18
392	200	7.36	13.25
572	300	7.48	13.47
752	400	7.66	13.79
932	500	7.86	14.15
1112	600	8.04	14.47
1292	700	8.38	15.09
1472	800	8.61	15.50
1652	900	8.86	15.95
1832	1000	9.13	16.44
2048	1120	9.19	16.54
2102	1150	9.49	17.08

Thermal Conductivity

73°F	87.82 BTU-in/hr/ft ² /°F
212°F	100.8 BTU-in/hr/ft ² /°F
572°F	131.4 BTU-in/hr/ft ² /°F
1112°F	178.8 BTU-in/hr/ft ² /°F
1652°F	211.5 BTU-in/hr/ft ² /°F
1832°F	221.6 BTU-in/hr/ft ² /°F
2012°F	226.9 BTU-in/hr/ft ² /°F
2150°F	246.8 BTU-in/hr/ft ² /°F

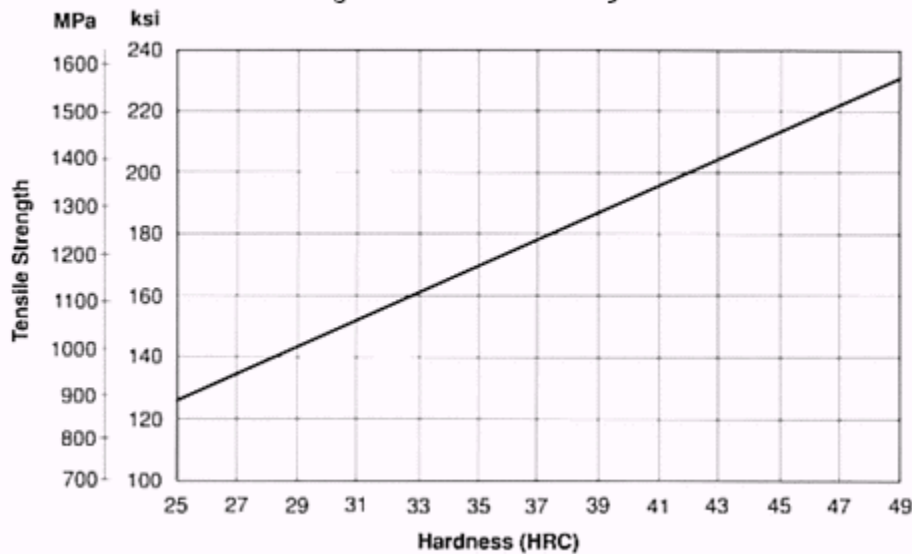
Thermal conductivity

Temperature		Thermal Conductivity	
°F	°C	(Btu·In)/(hr·ft ² ·°F)	W/(m·K)
73	23	87.82	12.66
212	100	100.80	14.53
572	300	131.36	18.93
1112	600	178.77	25.76
1652	900	211.54	30.49
1832	1000	221.57	31.93
2012	1100	226.94	32.71
2150	1177	246.80	35.57

Poisson's Ratio	0.300
Modulus of Elasticity (E)	35.0 x 10 ³ ksi
Modulus of Rigidity (G)	13.4 x 10 ³ ksi

Typical Mechanical Properties

Hardness vs. Tensile Strength – BioBlu™ 27 Alloy



Typical Room Temperature Mechanical Properties – BioBlu™ 27 Alloy

Condition	0.2% Yield Strength		Ultimate Tensile strength		% Elongation in 4D	% Reduction of Area	HRC Hardness
	ksi	MPa	ksi	MPa			
Annealed	85	585	150	1035	25	23	30
Warm Worked	135	930	190	1310	26	23	40
Hot Worked	110	760	160	1100	25	23	33

Heat Treatment

Annealing

BioBlu™ 27 alloy is typically annealed at 2000 to 2050°F (1093 to 1121°C) for 1 to 2 hours followed by water quenching. Finer grain size can be maintained through the use of lower annealing temperatures with corresponding increases in annealed hardness.

Workability

Cold Working

High strength levels can be achieved in BioBlu™ 27 alloy through either hot/cold work or cold work only processes. Significant loss of ductility results from even small amounts of cold work.

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Machinability

BioBlu™ 27 alloy is difficult to machine in any heat treated condition due to its extremely high work hardening rate, low thermal conductivity, and the presence of hard, abrasive carbides and intermetallics in the microstructure. Tool geometry, rigidity, and adequate machine power are all extremely important considerations.

The following tables summarize suggested machining conditions for BioBlu™ 27 alloy:

Turning—Single-Point and Box Tools

Condition	Depth of Cut (Inches)	High Speed Tools			Carbide Tools			
		Speed (fpm)	Feed (ipr)	Tool Matl.	Speed (fpm)		Feed (ipr)	Tool Matl.
					Brazed	Throw Away		
BHN less than 260	.100	20	.010	M-42	70	80	.010	C-2
	.025	25	.007		90	100	.007	C-3
BHN 260 to 340	.100	15	.010	M-47	65	75	.010	C-2
	.025	25	.007		80	95	.007	C-3
BHN greater than 340	.100	12	.010	M-42	60	70	.010	C-2
	.025	15	.005	M-47	70	80	.007	C-3

Turning—Cutoff and Form Tools

Condition	Speed (fpm)	Feed (ipr)							Tool Matl.
		Cutoff Tool Width (Inches)			Form Tool Width (Inches)				
		1/16	1/8	1/4	1/2	1	1-1/2	2	
BHN less than 300	15	.002	.004	.005	.004	.002	.002	.001	M-42
	45	.003	.0045	.006	.004	.003	.0025	.0015	C-2
BHN greater than 300	15	.002	.003	.004	.003	.002	.002	.001	M-42
	45	.003	.003	.0045	.003	.0025	.002	.001	C-2

Reaming

Condition	Speed (fpm)	High Speed Tool						Carbide Tools		
		Feed Inches Per Rev						Tool Matl.	Speed (fpm)	Tool Matl.
		Reamer Diameter, In.								
		1/8	1/4	1/2	1	1-1/2	2			
BHN less than 300	20	.002	.006	.008	.010	.012	.014	M-42	60	C-2
BHN greater than 300	15	.002	.006	.008	.010	.012	.014	M-42	50	C-2

Drilling

Condition	Speed (fpm)	Feed (ipr)							Tool Matl.
		Cutoff Tool Width, Inches			Form Tool Width, Inches				
		1/16	1/8	1/4	1/2	1	1-1/2	2	
BHN less than 300	20	--	.002	.003	.003	.004	--	--	M-42
BHN greater than 300	15	--	.002	.003	.003	.004	--	--	

Threading, Die

Condition	Speed (fpm)				Tool Material
	7 or less	8 to 15	16 to 24	25 and up T.P.I.	
BHN less than 300	4-6	5-8	6-10	8-12	M-2, M-7, M-10
BHN greater than 300	3-4	3-5	4-8	5-10	M-42

Milling, End-Peripheral

Condition	Depth of Cut in.	High Speed Tool						Carbide Tool					
		Speed (fpm)	Feed (ipt)				Tool Matl.	Speed fpm	Feed (ipt)				Tool Matl.
			Cutter Diameter (in.)						Cutter Diameter (in.)				
			1/4	1/2	3/4	1-2			1/4	1/2	3/4	1-2	
BHN less than 300	.050	15	.002	.002	.003	.004	M42	60	.001	.002	.003	.004	C-2
BHN greater than 300		12	.0015	.0015	.002	.003		50	.0015	.0015	.002	.003	

Tapping

Condition	Speed (fpm)	Tool Material
BHN less than 300	10	M1, M7, M10
BHN greater than 300	7	M1, M7, M10, Nitrided

Broaching

Condition	Speed (fpm)	Chip Load (ipt)	Tool Material
BHN less than 300	8	.002	M-42
BHN greater than 300	6	.002	

Other Information

Forms Manufactured

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

Disclaimer:

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Edition Date: 9/10/2010