Technical Datasheet

CarTech® 80A Alloy

Identification

UNS Number

• N07080

DIN Number

• 2.4952

Type Analysis

Single figures are nominal except where noted.

Carbon	0.06 %	**Manganese**	0.35 %
Sulfur	0.007 %	**Silicon**	0.35 %
Chromium	20.00 %	**Nickel**	Balance
Copper	0.05 %	**Cobalt**	1.00 %
Titanium	2.35 %	**Aluminum**	1.25 %
Iron	0.75 %		

General Information

Description

CarTech 80A alloy, a nickel-base, high temperature, alloy containing a high percentage of chromium, is characterized by excellent creep-resisting properties, high oxidation resistance and high resistance to fatigue under very arduous conditions. Aluminum and titanium additions serve as hardening agents.

This alloy is heat treatable using gamma-prime precipitation.

The creep-resisting properties of CarTech 80A alloy are adversely affected by cold working the alloy following heat treatment, the effect being to cause an increase in the rate creep under given conditions. This has led to failure by rupture in a shortened time at a large elongation.

The properties of CarTech 80A alloy may be restored by re-heat treatment.

Corrosion Resistance

Pyromet alloy 80A displays high resistance to oxidation under conditions of repeated heating and cooling. The alloy forms a strong closely adherent oxide which serves to protect it from progressive attack.

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

Properties

Physical Properties

Specific Gravity	8.25	
Density	0.2950	lb/in³

Mean CTE		
70 to 200°F	7.00	x 10 -6 in/in/°F
70 to 600°F	7.40	x 10 -6 in/in/°F
70 to 1000°F	7.70	x 10 -6 in/in/°F
70 to 1400°F	8.20	x 10 -6 in/in/°F
70 to 1600°F	8.60	x 10 -6 in/in/°F

Mean coefficient of thermal expansion

Temperature		Coefficient of Expansion	
70°F to	21°C to	10⁻⁶/°F	10⁻⁶/°C
200	93	7.0	12.6
600	320	7.4	13.3
1000	540	7.7	13.9
1400	760	8.2	14.8
1600	870	8.6	15.5

Modulus of Elasticity (E)	30.0	x 10 3 ksi
Electrical Resistivity (70°F)	735.0	ohm-cir-mil/ft
Melting Range	2480 to 2540	°F

Typical Mechanical Properties

Elevated Temperature Stress Rupture Properties—Pyromet Alloy 80A

Test Temperature		Stress to Produce Rupture in:					
		100 Hrs.		300 Hrs.		1000 Hrs.	
°F	°C	ksi	MPa	ksi	MPa	ksi	MPa
1350	730	47	324	—	—	31.8	219
1380	750	40	278	33.6	232	25.8	178
1400	760	37	255	—	—	23	159

Elevated Temperature Tensile Properties—Pyromet Alloy 80A

Material heat treated 1975°F (1080°C) for 8 hours, air cooled plus 1300°F (700°C) for 16 hours, then air cooled.

Test Temperature		Ultimate Tensile Strength		0.2% Yield Strength		0.1% Proof Stress		% Elongation in 4D	% Reduction of Area
°F	°C	ksi	MPa	ksi	MPa	ksi	MPa		
RT	RT	145	1000	90	621	—	—	39	—
1000	540	127	876	77	531	—	—	37	—
1110	600	121	834	—	—	76	524	27	28
1200	650	115	793	80	552	—	—	21	—
1290	700	105	724	—	—	78	538	15	19
1400	760	87	600	73	503	—	—	17	—
1470	800	72	496	—	—	58	400	21	19
1600	870	45	310	38	262	—	—	30	—
1650	900	34	234	—	—	37	255	26	35

Heat Treatment

Solution Treatment

Heat to 1975°F (1080°C), hold at temperature for 8 hours, then air cool.

Age

Reheat to 1300°F (700°C), hold at temperature for 16 hours, then air cool.

Workability

Forging

Pyromet alloy 80A can be forged within the temperature range of 1800/2100°F (980/1150°C).

Careful control of the forging temperature and frictional heat buildup should be exercised to avoid hot shortness.

Cold shortness can occur with excessive deformation below 1800°F (980°C).

Long soaks are not necessary; an equalized temperature is adequate. Forging furnace fuels should be low in sulfur content as this element can cause catastrophic oxidation.

Forgings may be air or fan cooled. Exercise care in water quenching as quench cracks may occur, especially in large sections.

Machinability

Pyromet alloy 80A is machinable in all conditions; however, it cannot be machined economically on light machine tools nor machined at operating speeds used on ordinary steel.

The machinability of this alloy is similar to that of an annealed high-speed steel.

In general, material given only an intermediate age at 1525/1575°F (829/857°C) is not as readily machined as material double aged at 1525/1575°F plus 1275/1325°F (829/875°C plus 690/718°C).

Following are typical feeds and speeds for Pyromet alloy 80A.

Turning—Single-Point and Box Tools

Condition	Depth of Cut In.	High-Speed Tools			Carbide			
		Speed, fpm	Feed, ipr	Tool Material	Speed, fpm		Feed, ipr	Tool Material
					Brazed	Throw Away		
Solution Treated	.100	20	.010	M-42	70	80	.010	C-2
	.025	25	.007		80	90	.007	C-3
Aged	.100	20	.010	M-47	65	75	.010	C-2
	.025	25	.007		75	85	.007	C-3

Turning—Cut-Off and Form Tools

Condition	Speed, fpm	Feed, ipr							Tool Material
		Cut-Off Tool Width, Inches			Form Tool Width, Inches				
		1/16	1/8	1/4	1/2	1	1-1/2	2	
Solution Treated	15	.002	.004	.005	.004	.002	.002	.001	M-42
	45	.003	.0045	.006	.004	.003	.0025	.0015	C-2
Aged	15	.002	.003	.004	.003	.002	.002	.001	M-42
	45	.003	.003	.0045	.003	.0025	.002	.001	C-2

Drilling

Condition	Speed, fpm	Feed, ipr								Tool Material
		Nominal Hole Diameter, Inches								
		1/16	1/8	1/4	1/2	3/4	1	1-1/2	2	
Solution Treated	20	—	.002	.003	.003	.004	—	—	—	M-42
Aged	15	—	.002	.003	.003	.004	—	—	—	

Tapping

Condition	Speed, fpm	Tool Material
Solution Treated	10	M-1;M-7;M-10
Aged	7	M-1;M-7;M-10; Nitrided

Reaming

Condition	High-Speed Tool							Carbide Tool	
	Speed, fpm	Feed, Inches per Rev — Reamer Diameter, Inches					Tool Material	Speed, fpm	Tool Material
		1/8	1/4	1/2	1	1-1/2	2		
Solution Treated	20	.002	.006	.008	.010	.012	.014	M-42	60	C-2
Aged	15	.002	.006	.008	.010	.012	.014		50	

Die Threading

Condition	Speed, fpm				Tool Material
	7 or Less	8 to 15	16 to 24	25 and up T.P.I.	
Annealed	4-6	5-8	6-10	8-12	M-2;M-7;M-10
Aged	3-4	3-5	4-8	5-10	M-42

Milling—End Peripheral

Condition	Depth of Cut In.	High-Speed Tools						Carbide Tools					
		Speed, fpm	Feed—Inches per tooth — Cutter Diameter, Inches				Tool Material	Speed, fpm	Feed—Inches per tooth — Cutter Diameter, Inches				Tool Material
			1/4	1/2	3/4	1-2			1/4	1/2	3/4	1-2	
Solution Treated	.050	15	.002	.002	.003	.004	M-42	60	.001	.002	.003	.004	C-2
Aged		12	.0015	.0015	.002	.003		50	.0015	.0015	.002	.003	

Broaching

Condition	Speed, fpm	Chip Load, Inches per tooth	Tool Material
Solution Treated	8	.002	M-42
Aged	6	.002	

Additional Machinability Notes

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 and feeds should be increased or decreased in small steps.

Other Information

Applicable Specifications

- ASME SB637
- ASTM B637

Forms Manufactured

- Bar-Rounds
- Billet

Technical Articles

- A Designer's Manual On Specialty Alloys For Critical Automotive Components
- Carpenter 286-LNi Alloy - A Lower Cost Option for High Temperature Auto and Truck Fasteners
- Selecting High Temperature Alloys for Fasteners in Automotive Exhaust Systems
- Trends in High Temperature Alloys

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