Technical Datasheet

Carpenter CTS™ B75P Alloy

Type Analysis

Single figures are nominal except where noted.

Carbon	1.10 %	**Manganese**	1.00 %
Phosphorus	0.040 %	**Sulfur**	0.030 %
Silicon	1.00 %	**Chromium**	14.50 %
Molybdenum	4.00 %	**Vanadium**	1.20 %
Iron	77.13 %		

General Information

Description

Carpenter CTS™ B75P alloy is a powder metal processed, air-hardening, martensitic stainless steel that offers corrosion resistance comparable with Type 440C stainless combined with excellent wear resistance and tempered hardness capability up to HRC 63.

Applications

Carpenter CTS B75P alloy is a premium steel that has been shown to provide superior edge retention and suitable corrosion resistance for cutlery and blade applications.

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

Properties

Physical Properties

Density	0.2800	lb/in³

Heat Treatment

Carpenter CTS B75P alloy is subject to decarburization during thermal processing, and precautions must be taken to control this condition.

Annealing

Carpenter CTS B75P alloy should be annealed in a neutral atmosphere. Heat uniformly to 1600/1650°F (871/899°C), then cool very slowly in the furnace at a rate of not more than 20°F (11°C) degrees per hour until the furnace is black. The furnace should then be turned off and allowed to cool naturally. Annealed hardness is 240/265 HBN.

Hardening

Preheat to 1400/1500°F (760/816°C), then increase temperature to 1950/2050°F (1066/1121°C), soak for 30 minutes, then quench in warm oil or cool in air. Be careful to not overheat the material.

Tempering

Carpenter CTS B75P can be tempered over a range of temperatures from 500°F (260°C) to 1025°F (552°C), soaked at least two hours then air cooled to room temperature. Specific tempering treatment chosen will depend upon a number of factors including the austenitizing temperature utilized, application of a refrigeration treatment and the desired combination of final hardness, toughness and corrosion resistance (see hardness table). Double tempering is necessary for tempering temperatures of 900°F (482°C) and higher. Tempering at temperatures of 800°F to 1100°F (427°C to 593°C) will reduce toughness and corrosion resistance.

Sub-Zero Cooling

After hardening, the alloy may be refrigerated at -100/-120°F (-73/-84°C) for at least one hour, then warmed to room temperature prior to tempering to minimize retained austenite. Refrigeration is most effective when performed within two hours after the austenitizing treatment.

Effects of Austenitizing Temperature, Cold Treatment and Tempering Treatment on Average Hardness (HRC) – Carpenter CTS B75P Alloy
0.175 in. thick (4.4 mm) Strip

Austenitizing Temperature	Sub-zero Treatment*	Tempering Treatment	Hardness (HRC)
2050F (1121C), 30 min., AC	-	-	62
	-	975F (524C), 2Hrs., AC + 975F (524C), 2 Hrs., AC	63
	-	1000F (538C), 2Hrs., AC + 1000F (538C), 2 Hrs., AC	62
	-	1025F (552C), 2Hrs., AC + 1025F (552C), 2 Hrs., AC	59.5
	-	500F (260C), 2Hrs., AC	58
	-	600F (316C), 2Hrs., AC	57.5
	-100F (-73C), 1-Hr., AW	-	64
	-100F (-73C), 1-Hr., AW	975F (524C), 2Hrs., AC + 975F (524C), 2 Hrs., AC	63
	-100F (-73C), 1-Hr., AW	1000F (538C), 2Hrs., AC + 1000F (538C), 2 Hrs., AC	62
	-100F (-73C), 1-Hr., AW	1025F (552C), 2Hrs., AC + 1025F (552C), 2 Hrs., AC	59.5
	-100F (-73C), 1-Hr., AW	500F (260C), 2Hrs., AC	61.5
	-100F (-73C), 1-Hr., AW	600F (316C), 2Hrs., AC	61.5
1950F (1066C), 30 min., AC	-	-	61.5
	-	975F (524C), 2Hrs., AC + 975F (524C), 2 Hrs., AC	59
	-	1000F (538C), 2Hrs., AC + 1000F (538C), 2 Hrs., AC	58
	-	1025F (552C), 2Hrs., AC + 1025F (552C), 2 Hrs., AC	55.5
	-	500F (260C), 2Hrs., AC	57.5
	-	600F (316C), 2Hrs., AC	57.5
	-100F (-73C), 1-Hr., AW	-	62
	-100F (-73C), 1-Hr., AW	975F (524C), 2Hrs., AC + 975F (524C), 2 Hrs., AC	59.5
	-100F (-73C), 1-Hr., AW	1000F (538C), 2Hrs., AC + 1000F (538C), 2 Hrs., AC	58
	-100F (-73C), 1-Hr., AW	1025F (552C), 2Hrs., AC + 1025F (552C), 2 Hrs., AC	55.5
	-100F (-73C), 1-Hr., AW	500F (260C), 2Hrs., AC	58
	-100F (-73C), 1-Hr., AW	600F (316C), 2Hrs., AC	58

* Application of the sub-zero treatment should be applied within 2 hours after hardening.
For maximum hardness potential, austenitizing at 2050°F, followed by subzero treatment and double tempering at 975°F is suggested.
A good combination of hardness, toughness and corrosion resistance can be achieved by austenitizing at 2050°F, followed by subzero treatment and tempering at 500°F.

Workability

Forging

Carpenter CTS B75P alloy forges much like high-speed steels. Preheat to 1400/1500°F (760/816°C), then heat slowly and uniformly to 2100/2150°F (1149/1177°C). Do not forge below 1700°F (927°C), and reheat as often as necessary. Cool in a furnace heated to

about 1550°F (843°C), soak uniformly at this temperature, then shut off the heat and cool slowly in the furnace. Anneal after forging. Cool to room temperature before annealing.

Machinability

For most machining operations, Carpenter CTS B75P cuts best when in the annealed condition. Because of its high carbon content, it machines similarly to high-speed steels.

Other Information

Wear Resistance

The wear characteristics in the table below were generated using ASTM G65 Procedure “A”, the Standard Practice for Conducting Dry Sand/Rubber Wheel Abrasion Tests. The data are presented as volume loss as required by the ASTM Standard. It should be noted, therefore, that a lower number means better wear resistance.

ASTM G65 Dry Sand/Rubber Wheel Abrasion Test Results – Carpenter CTS B75P Alloy

Material	Heat Treatment	Hardness (HRC)	Average Volume Loss (mm^3)
CTS B75P	2050F (1121C), 30 Min., AC + 975F (524C), 2 Hrs., AC + 975F (524C), 2 Hrs., AC	63	53.3
CTS B75P	2050F (1121C), 30 Min., AC + -100F (-73C), 1 Hr., AW + 975F (524C), 2 Hrs., AC + 975F (524C), 2 Hrs., AC	63	56.4
CTS B75P	2050F (1121C), 30 Min., AC + 500F (260C), 2 Hrs., AC	58	74.9
CTS B75P	2050F (1121C), 30 Min., AC + -100F (-73C), 1 Hr., AW + 500F (260C), 2 Hrs., AC	61.5	62.3
Reference Grades			
440C	1900F (1038C), 25 Min., OQ + -100F (-73C), 1Hr., AW + 350F (177C), 1 Hr., AC	58.5	66.9
D2	1850F (1010C), 25 Min., AC (As Hardened)	63.5	37.6

Forms Manufactured

- Strip

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