Technical Datasheet

CarTech® CTS® BD1N Alloy

Type Analysis

Single figures are nominal except where noted.

Carbon	0.85 to 0.95 %	**Manganese (Maximum)**	1.00 %
Phosphorus (Maximum)	0.030 %	**Sulfur (Maximum)**	0.010 %
Silicon (Maximum)	1.00 %	**Chromium**	15.00 to 17.00 %
Molybdenum (Maximum)	0.50 %	**Nitrogen**	0.10 to 0.15 %
Iron	Balance		

General Information

Description

CarTech CTS BD1N alloy is a nitrogen-bearing, high-carbon chromium martensitic steel that is balanced to provide superior hardness capability to CTS BD1 alloy. CarTech CTS BD1N alloy can achieve a tempered hardness capability of HRC 60-63.

Applications

CarTech CTS BD1N alloy is an excellent candidate for cutlery applications that demand high hardness, edge retention and corrosion resistance.

Corrosion Resistance

Carpenter CTS BD1N alloy, like CTS BD1 alloy, has corrosion resistance similar to that of Type 410. It can resist corrosion from mild atmospheres, fresh water, steam, ammonia, many petroleum products and organic materials and several mild acid environments.

This grade is used in the hardened plus tempered condition. Optimum corrosion resistance is obtained with a temper below about 800°F (427°C).

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

Properties

Physical Properties

Density	0.2800	lb/in³

Heat Treatment

Carpenter CTS BD1N alloy is subject to decarburization during thermal processing, and precautions must be taken to control this condition.

Annealing

Carpenter CTS BD1N alloy should be annealed in a neutral atmosphere. Heat uniformly to 1550/1600F (843/871C), then cool very slowly in the furnace until the furnace is black. The furnace then can be turned off and allowed to cool naturally. Fully annealed hardness is HRC 25 maximum.

Hardening

Preheat to 1400/1500F (760/816C) then increase temperature to 1900/1950F (1038/1066C), soak for 15 to 30 minutes, quench in warm oil or cool in air. Do not overheat. This cycle is specifically tailored for knife stock and other applications might require modifications.

Tempering

Carpenter CTS BD1N alloy can be tempered over a range of temperatures from 300F (149C) to 800F (427C), soaked at least one hour then air cooled to room temperature. The 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). To remove transformation stresses, yet retain peak hardness, temper at 300F (149C) to 350F (177C). Tempering at temperatures of 800F (427C) and higher will reduce toughness and corrosion resistance.

Sub-Zero Cooling

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

Effects of Austenitizing Temperature, Cold-Treatment and Tempering Treatment on Hardness–Carpenter® CTS® BD1N Alloy
0.1565" thick (3.98 mm) Strip
(1 of 2 tables)

Austenitizing Temperature*	Sub-Zero Treatment	Tempering Treatment	Hardness (HRC)
1850F (1010C), 20 Min., AC	--	300F (149C), 1 Hr., AC	60
		400F (204C), 1 Hr., AC	58.5
		500F (260C), 1 Hr., AC	58
		600F (316C), 1 Hr., AC	57.5
		700F (371C), 1 Hr., AC	57.5
		800F (427C), 1 Hr., AC	58
	-100F (-73C), 1-Hr., AW	300F (149C), 1 Hr., AC	61
		400F (204C), 1 Hr., AC	58.5
		500F (260C), 1 Hr., AC	58
		600F (316C), 1 Hr., AC	57.5
		700F (371C), 1 Hr., AC	57.5
		800F (427C), 1 Hr., AC	58
1900F (1038C), 20 Min., AC	--	300F (149C), 1 Hr., AC	61
		400F (204C), 1 Hr., AC	58.5
		500F (260C), 1 Hr., AC	58.5
		600F (316C), 1 Hr., AC	57.5
		700F (371C), 1 Hr., AC	57.5
		800F (427C), 1 Hr., AC	57.5
	-100F (-73C), 1-Hr., AW	300F (149C), 1 Hr., AC	62
		400F (204C), 1 Hr., AC	59
		500F (260C), 1 Hr., AC	59
		600F (316C), 1 Hr., AC	59
		700F (371C), 1 Hr., AC	59
		800F (427C), 1 Hr., AC	59

*If utilized, application of the sub-zero treatment should be applied within 2 hours after hardening.

Effects of Austenitizing Temperature, Cold-Treatment and Tempering Treatment on Hardness – Carpenter® CTS® BD1N Alloy
0.1565" thick (3.98 mm) Strip
(2 of 2 tables)

Austenitizing Temperature*	Sub-Zero Treatment	Tempering Treatment	Hardness (HRC)
1925F (1052C), 20 Min., AC	-	300F (149C), 1 Hr., AC	61
		400F (204C), 1 Hr., AC	58
		500F (260C), 1 Hr., AC	58
		600F (316C), 1 Hr., AC	56.5
		700F (371C), 1 Hr., AC	56.5
		800F (427C), 1 Hr., AC	56.5
	-100F (-73C), 1-Hr., AW	300F (149C), 1 Hr., AC	62
		400F (204C), 1 Hr., AC	60
		500F (260C), 1 Hr., AC	60
		600F (316C), 1 Hr., AC	60
		700F (371C), 1 Hr., AC	59.5
		800F (427C), 1 Hr., AC	60
1950F (1066C), 20 Min., AC	-	300F (149C), 1 Hr., AC	60
		400F (204C), 1 Hr., AC	58
		500F (260C), 1 Hr., AC	58
		600F (316C), 1 Hr., AC	56
		700F (371C), 1 Hr., AC	56
		800F (427C), 1 Hr., AC	56.5
	-100F (-73C), 1-Hr., AW	300F (149C), 1 Hr., AC	63
		400F (204C), 1 Hr., AC	60
		500F (260C), 1 Hr., AC	60
		600F (316C), 1 Hr., AC	60
		700F (371C), 1 Hr., AC	60
		800F (427C), 1 Hr., AC	60

*If utilized, application of the sub-zero treatment should be applied within 2 hours after hardening.

Workability

Hot Working

Carpenter CTS BD1N alloy should be handled like a high-speed tool steel. Preheat to 1400/1500F (760/816C), then heat slowly and uniformly to 2000/2200F (1093/1204C).Do not forge below 1700F (927C), and reheat as often as necessary. Cool in a furnace heated to about 1550F (843C), soak uniformly at this temperature, then shut off the heat and cool slowly in the furnace. Alternatively, the material could be cooled in an insulating medium such as dry ashes or vermiculite. Anneal after forging. Cool to room temperature before annealing.

Machinability

For most machining operations, CTS BD1N alloy is most readily machined in the annealed condition. Because of its high carbon content, this alloy machines similarly to high-speed steels.

Other Information

Forms Manufactured

- Plate
- Strip

Edition Date: 10/13/2014

Visit us on the web at www.cartech.com