

DATA SHEET

CTS XHP

Identification

U.S Patent Number: 5,370,750

Type Analysis

Some figures are nominal except where noted.

Carbon	1.60 %	Manganese	0.50 %
Silicon	0.40 %	Chromium	16.00 %
Nickel	0.35 %	Molybdenum	0.80 %
Vanadium	0.45 %	Iron	Balance

CTS XHP is a powder metallurgy, air-hardening, high carbon, high chromium, corrosion-resistant alloy. It can be considered either a high hardness 440C stainless steel or a corrosion-resistant D-2 tool steel. CTS XHP possesses corrosion resistance equivalent to 440C stainless steel and can attain a maximum hardness of 64 HRC. In addition, the composition of CTS XHP has been balanced so that it can attain a minimum hardness of 60 HRC when air cooled from hardening temperatures of 1850-2000°F (1010-1093°C). CTS XHP is thus more forgiving during heat treatment than similar alloys.

Typical Applications: CTS XHP can be used for specialty knives where the alloy's fine carbide distribution can be used to produce a keenly sharp cutting edge. The material can be easily ground to the thin profiles required for cutting tools. CTS XHP knife blades can be finely polished to high luster or produced with uniform matte finish.

Corrosion Resistance

CTS XHP possesses corrosion resistance equivalent to Type 440C stainless. CTS XHP resists corrosion in normal domestic environments and very mild industrial environments, including many petroleum products and organic materials. For optimum corrosion resistance, surfaces must be free of scale and foreign particles and finished parts should be passivated. Detailed test data can be furnished upon request.

IMPORTANT NOTE: The following 4-level rating scale is intended for comparative purposes only. Corrosion testing is recommended; factors which effect corrosion resistance include temperature, concentration, pH, impurities, aeration, velocity, crevices, deposits, metallurgical condition, stress, surface finish, and dissimilar contact.

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

Physical Properties

Specific Gravity: 7.62

Density: 0.2750 lb/in³

Effect of Refrigeration on As-Hardened Condition

Hardness measurements are averages rounded to the nearest 0.5 HRC.

Sample Size: 1 inch diameter x 0.5-inch thickness

Heat Treatment: 25 minutes at hardening temperature, then air cool or oil quench to room temperature. Leave as-hardened or refrigerate at -100°F (-73°C) for 1 hour.

Air warm to room temperature.

Hardening Temperature		Air Cool Only	Air Cool + Refrigeration	Oil Quench Only	Oil Quench + Refrigeration
°F	°C				
1850	1010	62.0	62.5	62.5	63.5
1900	1038	62.5	63.5	63.0	64.0
1950	1066	62.5	64.0	62.5	64.5
2000	1093	58.5	64.0	57.0	64.0

Effect of Refrigeration on Tempered Hardness

Hardness measurements are averages rounded to the nearest 0.5 HRC.

Sample Size: 1 inch diameter x 0.5 inch thickness

Heat Treatment: 25 minutes at hardening temperature. Air cool or oil quench. Leave as-hardened, or refrigerate at -100°F (-73°C) for 1 hour. Air warm. Temper 1 hour at temperature. Air cool.

Tempering Temperature		Air Cool Only	Air Cool + Refrigeration	Oil Quench Only	Oil Quench + Refrigeration
°F	°C				
1900°F (1038°C) Hardening Temperature					
As-Hardened		62.5	63.5	63.0	64.0
200	93	63.0	64.0	63.0	64.0
250	121	63.0	64.0	63.0	64.0
300	149	62.0	63.0	62.0	63.0
350	177	61.0	62.0	61.0	62.0
400	204	60.5	62.0	60.5	61.0
450	232	60.0	61.0	59.5	60.5
500	260	59.0	60.5	59.0	60.0
600	316	58.0	--	--	-
800	427	58.0			
1950°F (1066°C) Hardening Temperature					
As-Hardened		62.5	64.0	62.5	64.5
200	93	62.5	65.0	62.5	65.0
250	121	62.5	65.0	62.0	65.0
300	149	62.0	64.0	61.5	64.0
350	177	61.0	63.0	60.5	63.0
400	204	60.5	62.5	60.0	62.5
450	232	59.5	61.5	59.0	61.5
500	260	59.0	61.0	57.5	60.5
600	316	57.5	--	--	--
800	427	57.5	--	--	--

For maximum corrosion resistance, do not temper above 800°F (427°C)

This data sheet is for informational purposes only. Alloy characteristics are subject to change due to chemical composition and/or processing. We do not certify the material's suitability for specific applications.



DATA SHEET

CTS XHP

Workability

Forging

CTS XHP forges very much like high-speed steels. Preheat to 1400-1500°F (760-816°C), then slowly heat slowly and uniformly to 1900-2100°F (1038-1149°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

The following chart contains suggested speeds and feeds for machining CTS XHP.

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)		Feed (ipr)
					Uncoated	Coated	
.150	T15	65	.015	C6	300	350	.015
.025	M42	75	.007	C7	350	450	.007

Turning - Cut-Off and Form Tools

Tool Material		Speed (fpm)	Feed (ipr)						
High Speed Tools	Carbide Tools		Cut-Off Tool Width (inches)				Form Tool Width (inches)		
			1/16	1/8	1/4	1/2	1	1 1/2	2
T15	C6	50	.001	.001	.0015	.001	.001	.001	.0015
	175		.003	.003	.0045	.003	.002	.002	.002

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 1/2	2
T15	57	C2	75	.003	.006	.010	.015	.018	.021

Drilling

High Speed Tools									
Tool Material	Speed (fpm)	Feed (inches per revolution) Nominal Hole Diameter (inches)							
		1/16	1/8	1/4	1/2	3/4	1	1 1/2	2
T15, M42	40-50	.001	.003	.005	.007	.009	.011	.014	.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
T15, M42	5-12	8-15	10-20	15-25

Milling - End-Peripheral

Depth of Cut (inches)	High Speed Tools				Carbide Tools							
	Tool Material	Speed (fpm)	Feed (ipt) Cutter Diameter (in)				Tool Material	Speed (fpm)	Feed (ipt) Cutter Diameter (in)			
			1/4	1/2	3/4	1-2			1/4	1/2	3/4	1-2
.050	M2, M7	70	.001	.002	.003	.004	C6	235	.001	.002	.004	.006

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 require increased or decreased in small steps.

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 presented as volume loss as required by the ASTM Standard. It should be noted therefore that a lower number means better wear resistance.

Heat Treatments:

CTS XHP

1925°F (1052°C) (25 minutes). Air Cool/-100°F (-73°C)
(1 hour) Air Warm/350°F (177°C) (1 hour) Air Cool

440C

1900°F (1038°C) (25 minutes). Oil Quench/-100°F (-73°C)
(1 hour) Air Warm/350°F (177°C) (1 hour) Air Cool

D-2

1850°F (1010°C) (25 minutes). Air Cool-As Hardened

Material	Hardness, HRC	Average ASTM Volume Loss (mm ³)
CTS XHP Alloy	62.5	35.1
440C	58.5	66.9
D2	63.5	37.6

Tapping

High Speed Tools	
Tool Material	Speed (fpm)
M1, M7, M10 Nitrided	8-18

Broaching

High Speed Tools		
Tool Material	Speed (fpm)	Chip Load (cpt)
T15, M42	10	.002

This data sheet is for informational purposes only. Alloy characteristics are subject to change due to chemical composition and/or processing. We do not certify the material's suitability for specific applications.

