Technical Datasheet CARPENTER TECHNOLOGY

CarTech® No. 484 Tool Steel

Identification

UNS Number
- T30102

AISI Number
- Type A2

Type Analysis

Single figures are nominal except where noted.

Carbon	1.00 %	**Manganese**	0.80 %
Silicon	0.30 %	**Chromium**	5.25 %
Molybdenum	1.10 %	**Vanadium**	0.20 %
Iron	Balance		

General Information

Description

CarTech No. 484 tool steel is an air hardening tool steel capable of being hardened throughout, even in heavy sections. This tool steel has been used for applications in which the sections are very large or involve extreme accuracy of size and extreme hazards in hardening.

CarTech No. 484 tool steel displays good balance between hardness and toughness. It is available as a DeCarb-Free product. DCF bars have been cold finished in the mill, thereby eliminating the need for bar bark removal.

Applications

CarTech No. 484 tool steel has been used in applications which require extreme accuracy and safety in hardening, and when the sections are heavy. Typical applications have included:

Large blanking dies
Thread roller dies
Long punches
Rolls
Master hubs
Trimming dies
Forming dies
Precision tools
Gauges
Coining dies

Properties

Physical Properties

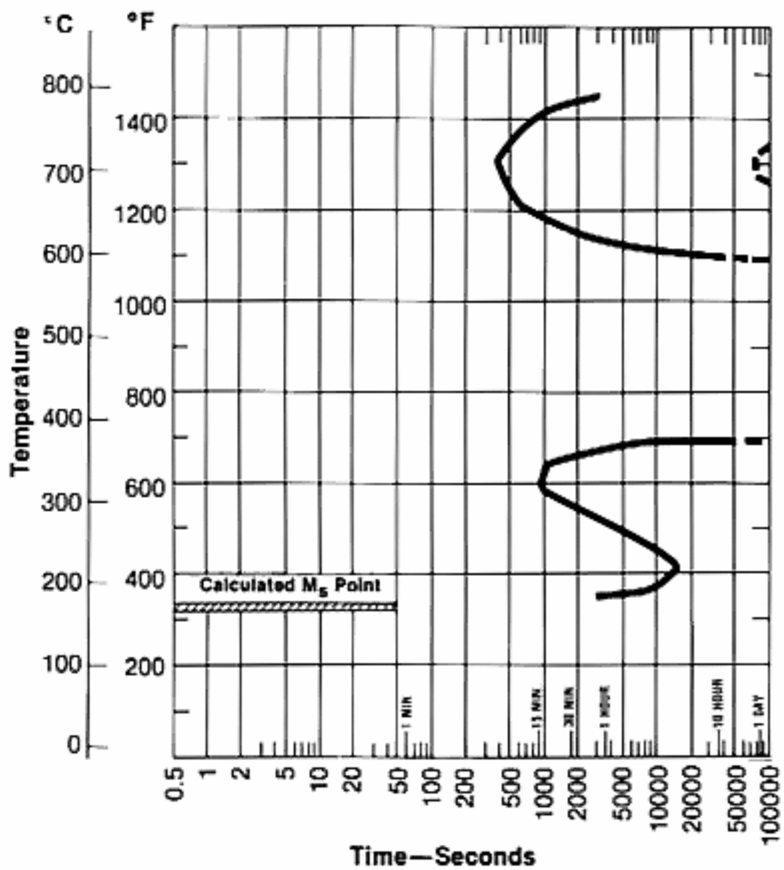
Specific Gravity	7.87	
Density	0.2840	lb/in³
Mean CTE		
68 to 212°F	5.96	x 10^{-6} in/in/°F
68 to 392°F	6.64	x 10^{-6} in/in/°F
68 to 572°F	7.05	x 10^{-6} in/in/°F
68 to 752°F	7.36	x 10^{-6} in/in/°F
68 to 932°F	7.60	x 10^{-6} in/in/°F
68 to 1112°F	7.75	x 10^{-6} in/in/°F
68 to 1292°F	7.92	x 10^{-6} in/in/°F
68 to 1382°F	7.98	x 10^{-6} in/in/°F

Mean coefficient of thermal expansion
The following figures are the average coefficients between room temperature and the specified elevated temperature. They represent material in the annealed condition and the dimensions are in in/in° temperature.

Room Temperature		Average Coefficient	
68°F to	20°C to	10^{-6}/°F	10^{-6}/°C
212	100	5.96	10.7
392	200	6.64	12.0
572	300	7.05	12.7
752	400	7.36	13.2
932	500	7.60	13.7
1112	600	7.75	14.0
1292	700	7.92	14.3
1382	750	7.98	14.4

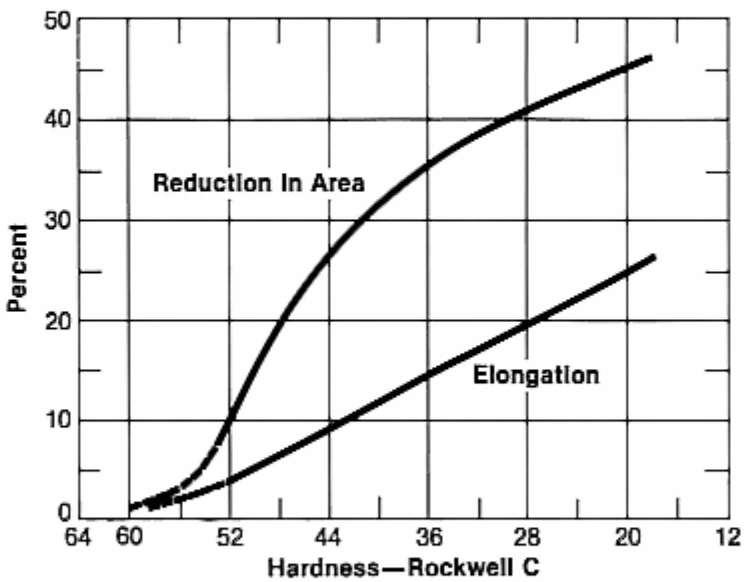
Modulus of Elasticity (E) 29.5 x 10^3 ksi

Isothermal transformation diagram
Austenitizing temperature—1750°F (954°C)

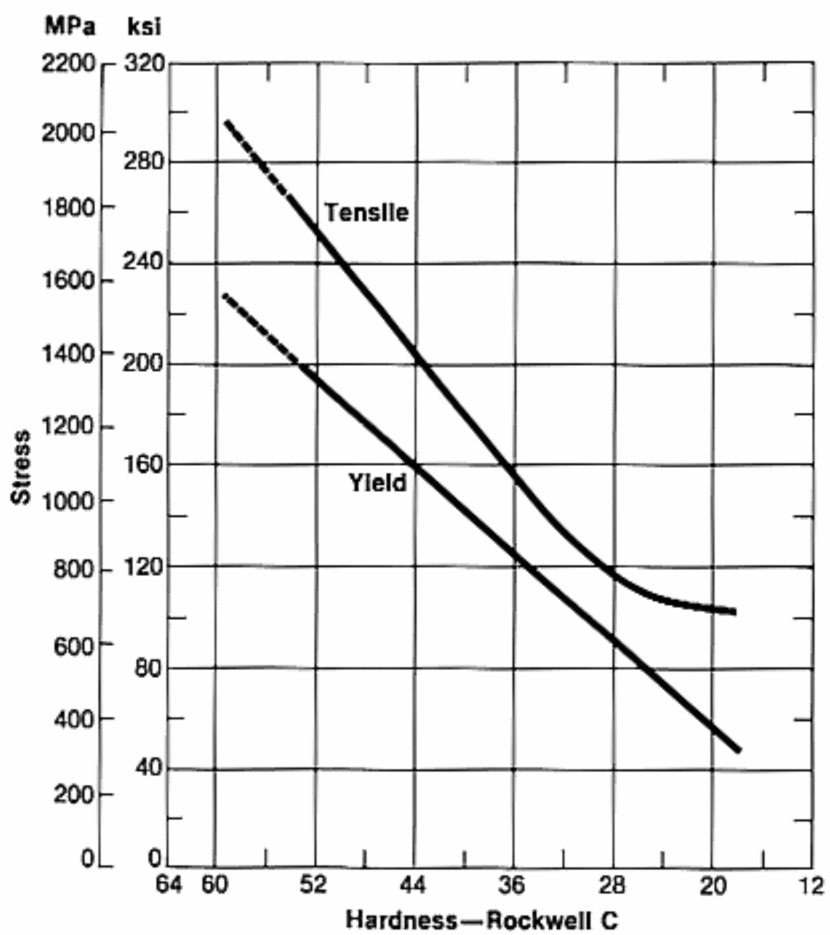


Typical Mechanical Properties

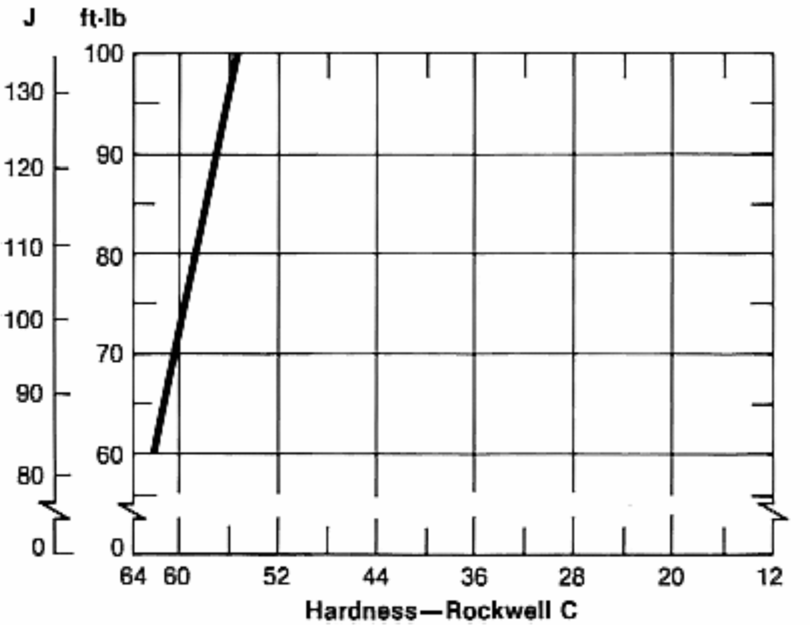
Reduction In Area and Elongation—No. 484 Tool Steel



Tensile and Yield Strengths—No. 484 Tool Steel



Typical Unnotched Izod Impact Strength—No. 484 Tool Steel



Heat Treatment

Decarburization

Like all high carbon tool steels, No. 484 tool steel is subject to decarburization during thermal processing and precautions must be taken to control this condition.

Modern furnaces are available which provide environments designed to minimize decarburization.

Normalizing

Normalizing No. 484 tool steel is not recommended and is not necessary after furnace cooling as described above.

Annealing

For annealing, this tool steel should be either packed in a suitable container, using a neutral packing compound, or placed in a controlled atmosphere furnace.

Heat uniformly to 1550/1600°F (843/871°C) and cool very slowly in the furnace at a rate of not more than 20°F (11°C) per hour until the furnace is black. The furnace may then be turned off an allowed to cool naturally. This will produce a maximum hardness of Brinell 228.

Hardening

Tools made from No. 484 tool steel may be hardened by placing them in a furnace maintained at a temperature of 1725/1775°F (940/969°C). Let the tools heat naturally to the furnace temperature, soak for 20 minutes plus 5 minutes per inch of thickness and air quench.

Control of decarburization can be accomplished by using any one of the several modern heat-treating furnaces designed for this purpose. If endothermic atmospheres are used, a dew point between +40/50°F (+4/10°C) is suggested. In older type manually operated exothermic atmosphere furnaces, an oxidizing atmosphere is required. Excess oxygen of about 4 to 6% is preferred.

If no atmosphere is available, the tool should be pack hardened or wrapped in stainless steel foil to protect its surface.

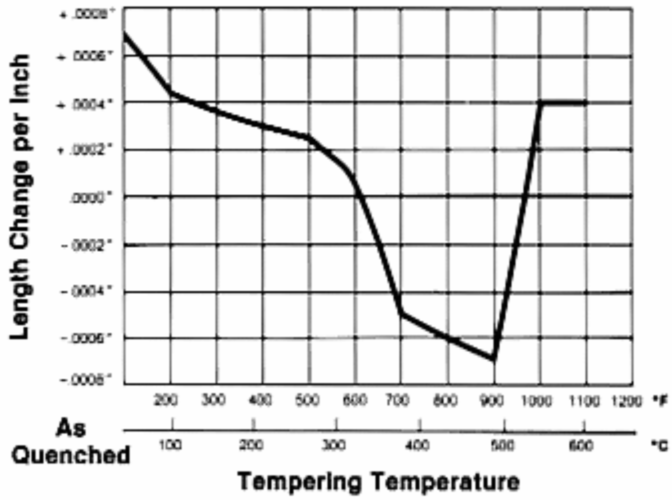
Deformation (Size Change) in Hardening

Remember that tool steels hold size best when quenched from the proper hardening temperature. If overheated they tend to show shrinkage after tempering. No. 484 tool steel is particularly sensitive to this problem and therefore should never be hardened from a temperature above 1775°F (968°C). The temperatures used to develop this data are shown in the hyperlink entitled "Size Change in Hardening".

No. 484 tool steel can be expected to expand when tempered below 600°F (316°C) but to shrink when tempered between 600 and 975°F (316 and 524°C). The following size change hyperlink entitled "Size Change in Hardening" illustrates typical length changes of

No. 484 tool steel after having been properly hardened and tempered. Note that the length change information is presented in inches per inch of original length.

Size Change in Hardening—No. 484 Tool Steel
1" (25.4 mm) diameter, air quenched from 1750°F (954°C), tempered 1 hour at temperature.



Stress Relieving

To relieve machining stresses for greater accuracy in hardening, first rough machine, then heat to a temperature of 1200/1250°F (649/677°C) for a minimum of one hour at temperature and cool slowly. After cooling, parts may be finish machined.

Tempering

The best combination of hardness and toughness is obtained by tempering No. 484 tool steel at 400°F (204°C). For greater ductility with some sacrifice in hardness, temper at 700°F (371°C). The following table shows the effect of tempering.

Effect of Tempering Temperature—No. 484 Tool Steel
Air quenched from 1775°F (969°C) and tempered 1 hour at heat.

Tempering Temperature		Rockwell C Hardness
°F	°C	
As Hardened		63/64
300	149	63/64
350	177	61/63
400	204	60/62
450	232	59/61
500	260	58/60
600	316	57/59
700	371	57/59
800	427	57/59
900	482	57/59
1000	538	56/58
1100	593	50/51
1200	649	44/45

Workability

Forging

No. 484 tool steel forges very much like a high-speed steel.

Heat uniformly and forge from a temperature between 1950 and 2050°F (1066 and 1121°C). Do not continue forging below 1700°F (927°C); reheat as often as necessary.

Small, simple forgings can be cooled slowly in lime.

The best practice for large forgings is to place them in a furnace heated to about 1550°F (843°C), soak uniformly at this heat, then shut off the heat and cool the job slowly in the furnace. This is not an anneal; after the forging is cold, it must be annealed as described in the "annealing" section.

Machinability

The machinability of No. 484 tool steel may be rated between 60/65% of Type W-1 tool steel or about 40 to 50% of B1112.

Following are typical feeds and speeds for No. 484 tool steel.

The machinability of No. 484 tool steel may be rated between 60/65% of Type W-1 tool steel or about 40 to 50% of B1112.

The following charts include typical machining parameters used to machine No. 484 tool steel. The data listed should be used as a guide for initial machine setup only.

Turning—Single-Point and Box Tools

Depth of Cut, In.	High-Speed Tools			Carbide			
	Speed, fpm	Feed, ipr	Tool Material	Speed, fpm		Feed, ipr	Tool Material
				Brazed	Throw Away		
.150	75	.015	M-2	270	315	.015	C-6
.025	85	.007	M-3	315	380	.007	C-7

Turning—Cut-Off and Form Tools

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	
60	.001	.0015	.002	.0015	.001	.001	.0007	M-2
205	.003	.0045	.006	.003	.0025	.0025	.0015	C-6

Drilling

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	
45	.001	.001	.003	.005	.007	.008	.010	.012	M-1;M-10

Reaming

High-Speed Tool								Carbide Tool	
Speed, fpm	Feed, Inches per Rev						Tool Material	Speed, fpm	Tool Material
	Reamer Diameter, Inches								
	1/8	1/4	1/2	1	1-1/2	2			
45	.003	.005	.008	.011	.015	.018	M-7	150	C-2

Tapping

Speed, fpm	Tool Material
25	M-1; M-7; M-10

Die Threading

Speed, fpm				Tool Material
7 or Less	8 to 15	16 to 24	25 and up, T.P.I.	
8-12	12-18	18-25	20-30	M-1;M-2;M-7;M-10

Milling—End Peripheral

Depth of Cut, In.	High-Speed Tools						Carbide Tools					
	Speed, fpm	Feed—Inches per tooth				Tool Material	Speed, fpm	Feed—Inches per tooth				Tool Material
		Cutter Diameter, Inches						Cutter Diameter, Inches				
		1/4	1/2	3/4	1-2			1/4	1/2	3/4	1-2	
.050	75	.001	.002	.003	.004	M-2;M-7	300	.0015	.0025	.004	.005	C-6

Broaching

Speed, fpm	Chip Load, Inches per tooth	Tool Material
15	.003	M-42

Sawing—Power Hack Saw

Pitch—Teeth per Inch				Speed	Feed
Material Thickness, Inches					
Under 1/4	1/4-3/4	3/4-2	Over 2	Strokes/Minute	Inches/Stroke
10	6	6	4	140	.006
10	6	6	4	70	.003
10	10	6	4	85	.003
10	10	6	4	55	.005
10	8	6	4	75	.003

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 be increased or decreased in small steps.

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 or feed should be increased or decreased in small steps.

Other Information

Wear Resistance

The wear characteristics of No. 484 tool steel shown in the following chart were generated using ASTM-G65 Procedure A titled "Standard Practice for Conducting Dry Sand/Rubber Wheel Abrasion Tests". The data are presented as a volume loss as required by the ASTM Standard. Note, therefore, that a lower number indicates better wear resistance.

DrySand/Rubber Wheel Abrasion Test—No. 484 Tool Steel
All specimens air hardened from 1777°F (969°C) and tempered for 1 hour.

Tempering Temperature		Rockwell C Hardness	Average Volume Loss ASTM
°F	°C		
As Hardened		64/65	57.7
400	204	60.5	61.2
450	232	60	62.6
1025	552	56.5	75.7
1100	593	51/52	83.4
1200	649	45/46	107.7

Applicable Specifications

- ASTM A681
- QQ-T-570

Forms Manufactured

- Bar-Flats
- Bar-Rounds

Technical Articles

- A New Guide for Selecting Ferrous Alloys, Tungsten Carbides and Ceramics for Tooling
- A Three-Point Program for Improving the Performance of Cold Work Tooling
- The ABC's of Alloy Selection, Heat Treating and Maintaining Cold Work Tooling

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