Technical Datasheet

CarTech® M10 High Speed Steel

Identification

UNS Number

• T11310

AISI Number

• Type M10

Type Analysis

Single figures are nominal except where noted.

Carbon	0.85 %	**Manganese**	0.20 %
Silicon	0.30 %	**Chromium**	4.00 %
Molybdenum	8.00 %	**Vanadium**	2.00 %
Iron	Balance		

General Information

Description

CarTech M10 high speed steel is a general purpose molybdenum-bearing high speed steel possessing excellent wear resistance and cutting properties. The increased wear resistance and cutting ability of this electroslag remelted high speed steel are a result of its high vanadium and carbon content.

Applications

Typical applications for CarTech M10 high speed steel have included:

Blanking dies
Broaches
Chasers
Counterbores
Drills
Form cutters
Hobs
Lathe tools
Milling cutters
Planer tools
Punches
Reamers
Shear blades
Taps
Trimming dies
Cutting tools

Heat Treatment

Decarburization

While Ten Star high speed steel is somewhat susceptible to decarburization in hardening, means of preventing this are well known. If proper control of atmosphere is maintained, Ten Star high speed steel will present no difficulty with decarburization.

Normalizing

Normalizing is not recommended.

Annealing

Pack in a suitable container with clean cast iron borings, heat uniformly to 1550/1600°F (843/871°C) and cool slowly in the furnace to 1200°F (649°C) at a rate of 20/40° (11/22°C) per hour. Average Brinell hardness 207/248.

To relieve machining stresses for greater accuracy in hardening - first, rough machine, then anneal in the temperature range of 1250°/1300°F (677/704°C) and cool slowly - then finish machine.

Hardening

Ten Star high speed steel should be heat treated from neutral salt baths or properly adjusted controlled atmosphere furnaces. A dew point of +10°F (-12°C) is suggested for the high heat furnace when using controlled atmosphere.

First, preheat to 1400/1500°F (760/816°C), then transfer to a superheating furnace with a temperature maintained at 2150/2225°F (1177/1218°C). When neutral salt baths are used for hardening, the temperature should be dropped 25°F (14°C) as compared to other furnace temperatures.

Exercising the usual control of temperature and atmosphere, there should be no difficulty with decarburization.

Quench in oil - and be sure that tools are cooled below 200°F (93°C) before tempering (cool enough to hold in your hand).

Small sizes under about 1" (25.4 mm) in diameter or delicate sections may be hardened by cooling in still air. It is also acceptable to quench in molten salt at about 1000/1100°F (538/593°C), equalizing for about 5 minutes per inch followed by air cooling.

Deformation (Size Change) in Hardening

Ten Star high speed steel changes size slightly on hardening. A 1" (25.4 mm) cube will expand about 0.0005" (0.013 mm) in hardening at 2200°F (1204°C), and will expand a like amount when tempered at 1000°F (538°C). Cutters and form tools will open up slightly in the hole, and expand slightly on the OD.

Tempering

Be sure to allow sufficient time for the tool to reach the proper temperature and then start timing the tempering operation.

Tools should be tempered immediately after the completion of the quench. For best results with most tools, a range of 1000/1200°F (538/649°C) is suggested. For cutting tools, double or triple temper at 1000/1050°F (538/566°C) where maximum wear resistance is desired. The effect of various tempering temperatures on the Rockwell hardness is shown in the hyperlink entitled "Effect of Tempering Temperature on Hardness."

Effect of Tempering Temperature on Hardness - Ten Star High Speed Steel
Average values - Rockwell C scale.

Tempering Temperature 2 Hours at Heat		Hardening Temperature 2200° F (1204°C) 5 Minutes in Salt and Oil Quenched
°F	°C	
As hardened		65
800	427	61/62
900	482	62/63
1000	538	65
1050	566	64
1100	593	62
1200	649	55/56

Workability

Forging

Preheat very slowly to 1500/1600°F (816/871°C), then increase furnace temperature to full heat of 1950/2050°F (1066/1121°C). Do not forge under 1700°F (927°C). Reheat as often as necessary. Forgings should be cooled slowly in lime or ashes. Cool to at least 400°F (204°C) before reheating for annealing.

Machinability

Ten Star high speed steel is carefully annealed to produce the best machinability possible in this type of steel. It will machine somewhat easier than the 18-4-1 type. Its machinability rating is approximately 45% of a 1% carbon tool steel or 33% of AISI B1112 screw stock.

Following are typical feeds and speeds for Ten Star high speed steel.

Turning—Single Point and Box Tools

Depth of Cut In.	High Speed Tools			Carbide Tools			
	Speed, fpm	Feed, ipr	Tool Material	Speed, fpm		Feed, ipr	Tool Material
				Brazed	Throw Away		
.150 .025	60 75	.015 .007	M-42 M-42	225 280	280 370	.015 .007	C-6 C-7

Turning—Cut-Off and Form Tools

Speed, fpm	Feed, Inches per Rev.							Tool Material
	Cut-Off Tool Width, Inches			Form Tool Width, Inches				
	1/16	1/8	1/4	1/2	1	1-1/2	2	
60 220	.001 .002	.001 .003	.0015 .0045	.0015 .003	.001 .002	.0007 .0015	.0007 .0015	M-2 C-6

Drilling

Speed, fpm	Feed, Inches per Rev.								Tool Material
	Nominal Hole Diameter, Inches								
	1/16	1/8	1/4	1/2	3/4	1	1-1/2	2	
45	.001	.002	.003	.005	.007	.009	.011	.013	M-1; M-10

Tapping

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

Reaming

Speed, fpm	High Speed Tools							Carbide Tools	
	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	.012	.015	.018	M-1;M-2;M-7	150	C-2

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	70	.001	.002	.003	.004	M-2; M-7	275	.0015	.0025	.004	.005	C-6

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

- ASTM A600
- QQ-T-590

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	10	6	4	70	.006

Forms Manufactured

- Bar-Rounds

Edition Date: 01/01/1990

Visit us on the web at www.cartech.com