Technical Datasheet

CarTech® M42® High Speed Steel

Identification

UNS Number

• T11342

AISI Number

• Type M42

Type Analysis

Single figures are nominal except where noted.

Carbon	1.08 %	**Manganese**	0.25 %
Silicon	0.25 %	**Chromium**	3.75 %
Molybdenum	9.50 %	**Cobalt**	8.00 %
Vanadium	1.15 %	**Tungsten**	1.50 %
Iron	Balance		

General Information

Description

CarTech M42 high speed steel, a molybdenum-type super high speed steel containing high carbon and cobalt contents, is capable of being heat treated to high hardness levels.

This combination of composition and properties allows successful machining of high hardness materials and difficult-to-machine superalloys. Due to the alloy's high hardness, excellent hot hardness and wear resistance are obtained without loss of edge toughness.

Applications

CarTech M42 high speed steel has been used primarily to machine difficult-to-cut or high hardness alloys. Typical tools made from the alloy include:

Broaches
Chasers
Drills
End Mills
Counterbores
Form Cutters
Gear Cutters
Hobs
Taps
Milling Cutters

Heat Treatment

Decarburization

Super Star high speed steel, like all high speed steels, is subject to decarburization in hardening. The use of rectified salt baths or the proper atmosphere control in furnace hardening will impart good results in heat treating.

Normalizing

Normalizing is not recommended.

Annealing

To anneal, the steel should be packed in a container using a neutral packing compound or in a suitable protective atmosphere.

Heat uniformly to 1550/1600°F (843/871°C) ensuring that the entire section is at temperature. Cool slowly in the furnace at a rate not to exceed 40°F (22°C) per hour to 1000°F (538°C), then allow to cool naturally. This should produce a hardness of BHN 255 or less.

Hardening

For best results Super Star high speed steel should be heat treated from properly rectified salt baths or controlled atmosphere furnaces.

Preheat at 1500/1600°F (816/871°C) being sure to heat thoroughly, then transfer to the high heat of 2150/2200°F (1177/1204°C) in salt or 25°F (14°C) higher in atmosphere furnaces.

Quench in salt at 1000/1150°F (538/621°C) until equalized, then cool in air. The steel may also be quenched in warm oil. In either case, cool to 150°F (66°C) maximum before tempering, but do not allow parts to be at room temperature for extended periods before placing in the tempering furnace.

Deformation (Size Change) in Hardening

Super Star high speed steel changes size only slightly on hardening. When hardened from 2175°F (1191°C) in salt, a 1" (25.4 mm) cube will expand about 0.0005" (0.013 mm) and also expand the same amount when tempered at 1000°F (538°C). Average diameter cutters and form tools will open up slightly in the hole and expand slightly on the O.D.

Tempering

The alloy should normally be tempered between 950°F (510°C) and 1100°F (593°C). Tempering temperatures below 1000°F (538°C) usually do not provide adequate relief of hardening stresses and are not generally recommended.

Super Star high speed steel should be given triple temper cycle with a minimum of two hours at temperature each time. The tools must be cooled completely to room temperature following each cycle so that the tempering may be completely effective.

The following table displayed in the hyperlink below shows the results of various tempering temperatures.

Effect of Tempering Temperatures on Hardness - Super Star High Speed Steel
Average values

Tempering Temperatures (2 hrs. + 2 hrs. + 2 hrs.)		Hardness, Rockwell C	
		Hardening Temperature*	
°F	°C	2175°F (1190°C)	2200°F (1204°C)
900	482	67/68	66/67
950	510	69/70	69/70
1000	538	67/68	68/69
1050	566	66/67	67/68
1100	593	64	66/67

*All samples austenitized in salt and salt-quenched.

Workability

Forging

Preheat very slowly to 1500/1600°F (816/871°C) and equalize temperature, then increase furnace temperature rapidly to forging temperature of 1950/2050°F (1066/1121°C).

Do not forge under 1800°F (982°C). Reheat as often as necessary.

Forgings should be cooled slowly; bury in lime, ashes or expanded mica. Always anneal forgings after the slow cool.

Machinability

In the fully annealed condition, Super Star high speed steel is slightly easier to machine than 18-4-1 high speed steel. Comparatively, it can be given a machinability rating of about 45% of a 1% carbon tool steel.

Following are typical feeds and speeds for Super 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 65	.015 .007	M-42 M-47	220 250	250 300	.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	
55 190	.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	
35	.001	.002	.003	.005	.007	.008	.011	.013	M-1; 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			
30	.003	.005	.008	.012	.015	.018	M-7	100	C-2

Tapping

Speed, fpm	Tool Material
20	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	60	.001	.002	.003	.004	M-42	225	.0015	.0025	.004	.005	C-6
.050	55	.001	.002	.003	.004	M-42	220	.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	60	.006

Forms Manufactured

- Bar-Rounds

Edition Date: 03/01/1991

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