Technical Datasheet

CarTech® Micro-Melt® 23 Alloy

Type Analysis

Single figures are nominal except where noted.

Carbon	1.30 %	**Manganese**	0.30 %
Silicon	0.35 %	**Chromium**	4.20 %
Molybdenum	5.00 %	**Vanadium**	3.10 %
Tungsten	6.30 %	**Iron**	Balance

General Information

Description

CarTech Micro-Melt 23 alloy is a general-purpose powder high speed tool steel possessing an excellent combination of wear resistance, toughness, and strength. Additional benefits of the alloy are low distortion in heat treat and good grindability. Typical working hardness range is HRC 62-66.

Applications

CarTech Micro-Melt 23 alloy may be considered for many types of tooling applications where a combination of good abrasion resistance, toughness, and temper resistance are required. In addition, it may be considered for cold working applications because of its combination of abrasion resistance and compressive strength. Finally, because of its low distortion during heat treatment, it may be considered for tools of complicated design.

Potential applications for this alloy may include:
Hobs
Milling Cutters
Punches
Thread Roll Dies
Form Tools
Taps
End Mills
Broaches
Drills
Rolls
Slitter Knives
General Cold Work Tooling

Corrosion Resistance

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.*

Humidity	Restricted	

Properties

Physical Properties

Density	0.2952	lb/in³
Mean Specific Heat (32 to 212°F)	0.1004	Btu/lb/°F

Mean CTE	
68 to 400°F	6.70 x 10^{-6} in/in/°F
68 to 600°F	7.00 x 10^{-6} in/in/°F
68 to 800°F	7.40 x 10^{-6} in/in/°F
68 to 1200°F	7.70 x 10^{-6} in/in/°F
Modulus of Elasticity (E)	30.0 x 10^{3} ksi

Typical Mechanical Properties

Hot Hardness

The hot hardness of Micro-Melt 23 alloy is good for general-purpose use and superior to that of AISI Type M2 H.S.S.

Toughness

Micro-Melt 23 alloy possesses good toughness, better than that of conventional high speed steels at similar hardness levels. In addition, it possesses better toughness than the more highly alloyed powder metal high speed tooling alloys such as Micro-Melt alloys M-4, T-15, HS-30, and 60 alloys.

Heat Treatment

Decarburization

Being a molybdenum-containing high speed steel, Micro-Melt 23 alloy is susceptible to decarburization during hardening. However, a controlled atmosphere furnace should insure that there is no decarburization during heat treatment. Salt bath or vacuum furnace treating is preferred for this alloy.

Annealing

Suitable precautions should be taken to prevent excessive decarburization or carburization. Heat slowly to 1560/1650°F (849/899°C), hold until the entire mass is heated through, and cool slowly (do not exceed 20°F [11°C] per hour) in the furnace to about 1290°F (699°C), after which the cooling rate may be increased. The annealed hardness should be maximum BHN 260 (HRC 26).

Hardening

A two-stage preheat is recommended as part of the hardening procedure. Preheat at 840/930°F (449/499°C), transfer to a second preheat at 1560/1650°F (849/899°C). Austenitize at 2000/2175°F (1093/1190°C), depending upon final hardness/toughness combination desired. When hardening in vacuum, the austenitizing temperature should be raised approximately 20/25°F (11/14°C) above that used for a salt bath. Parts may be air, oil, vacuum, or salt quenched. For oil quenching, an interrupted quench is recommended. Parts should be oil quenched to approximately 1000°F (538°C), removed from the bath, and air cooled. Similarly, parts may be quenched into a salt bath held at 1000°F (538°C), equalized, and air cooled. Vacuum furnaces with positive pressure quench capability can also be used. Parts should be allowed to cool to below 150°F (66°C) prior to tempering.

Stress Relieving

To relieve the stresses of machining, heat slowly to 1110/1290°F (599/699°C), hold 2 hours, furnace cool to about 930°F (500°C), then cool in still air.

Tempering

Tools should be tempered immediately after the completion of the quench. The tempering temperature may be varied according to the desired hardness, but is usually in the range 1000/1075°F (538/579°C). A triple temper is desired to ensure the elimination of excessive retained austenite. Each temper should be at least 1 hour at temperature, with parts cooled to room temperature between tempers. The hardness values for various austenitizing/tempering temperature combinations can be found in the Typical Mechanical Properties section of this data sheet.

Typical Hardness Results—Carpenter Micro-Melt 23 Alloy
All samples were heat treated in salt, oil quenched from the austenitizing temperature and tempered at the indicated temperature for 1 hour + 1 hour + 1 hour. Vacuum hardening may result in slightly lower hardness values. Alternately, to obtain similar hardness values when vacuum treating, the austenitizing temperature may be raised 20/25°F (-6.7/-3.9°C) above that shown.

Tempering Temperature		Hardening Temperature/Time		
°F	°C	2010°F/10 min. (1099°C)	2100°F/8 min. (1149°C)	2155°F/6 min. (1180°C)
1000	538	63/64	65/66	66/67
1025	552	62/63	65/66	66/67
1050	566	61/62	64/65	65/66
1075	579	60/61	63/64	64/65
1100	593	59/60	62/63	63/64

Other Information

Wear Resistance

Micro-Melt 23 alloy provides significantly better wear resistance than that of conventional grades such as AISI D2 and M2. Because of its lower alloy content, it does not provide wear resistance equivalent to the more highly alloyed powder high speed tooling alloys, such as Micro-Melt alloys M-4, T-15, HS-30, and 60 alloys.

Forms Manufactured

- Bar-Flats
- Bar-Squares
- HIP'd Shapes
- Bar-Rounds
- Billet
- Powder

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