Technical Datasheet CARPENTER TECHNOLOGY

CarTech® Micro-Melt® M3 Class 2 Alloy

Identification

UNS Number

- T11323

AISI Number

- Type M3

Type Analysis

Single figures are nominal except where noted.

Carbon	1.25 %	**Manganese**	0.30 %
Sulfur	0.070 %	**Silicon**	0.40 %
Chromium	4.00 %	**Molybdenum**	6.00 %
Vanadium	3.00 %	**Tungsten**	6.25 %
Iron	Balance		

General Information

Description

CarTech Micro-Melt M3 Class 2 alloy is a powder metal tungsten-molybdenum high speed steel possessing the superior wear resistance characteristics required for difficult cutting operations.

The advantages of CarTech Micro-Melt premium powder high speed steels include ease of grinding, response to heat treatment, more uniform structure, greater wear resistance and improved toughness.

In addition, Carpenter's unique hot rolling and rotary forging capabilities impart minimal distortion characteristics to these alloys.

Applications

CarTech Micro-Melt M3 Class 2 alloy has been used for:

Broaches
Form tools
Drills
Counterbores
Milling cutters
End mills
Chasers
Taps
Lathe tools
Planer tools
Reamers

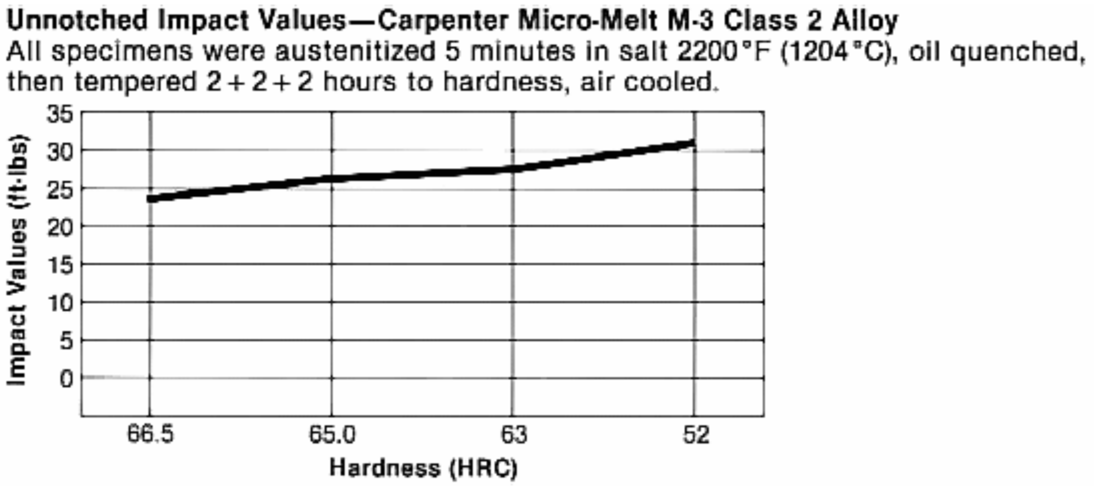
Properties

Physical Properties

Specific Gravity	8.16	
Density	0.2910	lb/in^3
Modulus of Elasticity (E)	30.0	$x 10^3$ ksi

Typical Mechanical Properties

The determination of accurate, meaningful mechanical properties on high-strength, notch-sensitive materials is extremely difficult. Nevertheless, the hyperlink titled "Unnotched Impact Values" gives some idea as to the toughness of Micro-Melt M3 Class 2 alloy.



Heat Treatment

Decarburization

Micro-Melt M3 Class 2 alloy is somewhat susceptible to decarburization in hardening. Means of preventing this are well-known. If proper control of atmosphere is maintained, this alloy will present no difficulty with decarburization.

Normalizing

Normalizing is not recommended.

Annealing

Heat slowly to 1575°F/1625°F (857/885°C), hold until the entire mass is heated through, and cool slowly (not to exceed 20°F [11°C] per hour) in the furnace to about 1000°F (538°C), after which the cooling rate may be increased.

Suitable precautions should be taken to prevent excessive carburization or decarburization.

Hardening

Preheat at 1500/1600°F (816/871°C) in a neutral salt bath. After thorough preheating, transfer to a furnace with a temperature maintained at 2200/2250°F (1204/1232°C) and oil quench.

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 temperatures of 1000/1100°F (548/593°C), equalizing for 5 minutes per inch, followed by air cooling.

Stress Relieving

To relieve the strains of machining, heat slowly to 1150/1250°F (621/677°C), allow to equalize, 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 of 1000/1050°F (538/566°C). Triple tempering is always suggested.

The effect of various hardening and tempering temperatures on the Rockwell hardness is illustrated in the hyperlink titled "Effect of Hardening and Tempering Temperature on Hardness".

Effect of Hardening and Tempering Temperature on Hardness—Carpenter Micro-Melt M-3 Class 2 Alloy
All specimens were oil quenched and triple tempered at 2 hours + 2 hours + 2 hours and air cooled

Tempering Temperature		Rockwell C Hardness	
°F	°C	Quenched from 2200°F (1204°C)	Quenched from 2250°F (1232°C)
As Quenched		65/66	64/65
900	482	64/65	64/65
1000	538	65/66	66/67
1025	552	64/65	65/66
1050	566	63/64	64/65
1100	593	62/63	63/64
1150	621	57/59	58/60

Workability

Forging

Preheat slowly to 1400/1500°F (760/816°C) allowing plenty of time for heat equalization, then raise the temperature slowly to 2050°F (1121°C) and forge at this temperature.

Do not forge under 1700°F (927°C); reheat as often as necessary.

Small forgings may be cooled slowly in vermiculite.

The best practice for large forgings is to place them in a furnace heated to about 1400/1450°F (760/788°C), soak uniformly at this heat, then shut off the heat and let the forgings cool in the furnace. This is not an anneal.

When the forgings are cool, they should be properly annealed.

Other Information

Forms Manufactured

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

Technical Articles

- A New Guide for Selecting Ferrous Alloys, Tungsten Carbides and Ceramics for Tooling

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