••• T-15 High Speed Steel (ASTM T15)

WM T-15 powder metallurgy high-speed steel is cobalt-bearing super high-speed steel which can be heat treated to a hardness as high as 67 RC. A high volume of hard vanadium carbides provides very high wear resistance. The cobalt content provides excellent resistance to softening at high service temperatures (red or hot hardness). These properties translate into extended retention of hard, sharp cutting edges on tools produced from **WM T-15**. Because of the powder metal manufacturing, it s far easier to grind and exhibits impact toughness that is more than double that of tradition, ingot-cast T15 high-speed steel.

Chemical Composition		
Carbon	1.60	
Manganese	0.30	
Silicon	0.30	
Chromium	4.00	
Tungsten	12.00	
Molybdenum	0.75	
Vanadium	4.90	
Cobalt	5.00	

Typical Applications

High-performance broaches, form tools, milling cutters, end mills, taps, and reamers.



Physical Properties

Density – 0.296 lb/in ³	}	
Specific gravity - 8.1	9	
Coefficient of Thermal Expansion		
70 - 200°F	5.90 x 10 ⁻⁶ in/in/°F	
70 - 400°F	5.90	
70 - 800°F	6.40	
70 - 1200°F	6.74	
70 - 1500°F	6.92	
Critical Temperatures:		
Ac1: 1520°F	Ac3: 1570°F	
Ar1: 144 <u>5</u> °F	Ar3: 1410°F	

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Preheating

1500-1550°F, equalize.

A second preheat at 1850-1900°F is recommended for vacuum hardening

Austenitizing (high heat)

Heat rapidly from the preheat. Furnace: 2150-2260°F Salt Bath: 2150-2250°F

PH: 880-621-1228

The use of lower austenitizing temperature will maximize impact toughness. The use of a higher austenitizing temperature will maximize hot hardness and wear resistance.

Quenching

For pressurized gas, the furnace should have a minimum quench pressure of 4 bars. A quench rate of approximately 400 °F per minute to below 1000 °F is critical to obtain the desired properties.

For oil, quench until black, about 900°F, then cool in still air to $150-125^{\circ}F$.

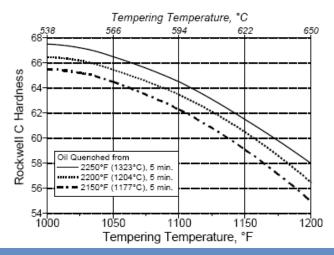
For salt maintained at 1000-1100°F, equalize in the salt, then cool in still air to 150-125°F.

Tempering

Temper immediately after quenching.

The typical tempering range is 1000-1100°F. Do not temper below 1000°F. Hold at temperature for 2 hours then air cool to ambient temperature. *Triple tempering is required.*

As Oil Quenched from	HRC
2150°F (1177°C), 5 minutes	66.5
2200°F (1204°C), 5 minutes	65.5
2225°F (1219°C), 5 minutes	65
2250°F (1232°C), 5 minutes	64



Annealing

Annealing must be performed after hot working and before rehardening.

Heat at a rate not exceeding 400°F per hour to 1575-1600°F, and hold at temperature for 1 hour per inch of maximum thickness; 2 hours minimum. Then cool slowly with the furnace at a rate not exceeding 30°F per hour to 1000°F. Continue cooling to ambient temperature in the furnace or in air. The resultant hardness should be approximately 277 HBW.

This information is intended to provide general data on our products and their uses and is based on our knowledge at the time of publication. No information should be construed as a guarantee of specific properties of the products described or suitability for a particular application. Walter Metals reserves the right to make changes in practices which may render some information outdated or obsolete. Walter Metals should be consulted for current information & capabilities.

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