

Z-M4 PM^{speed}, PM High Speed Steel

Data Sheet - Tooling Alloys

ZAPP

Zapp is certified to ISO 9001



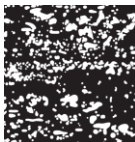
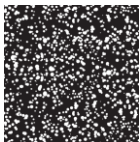
Key Features of Zapp's Powder Metallurgical High Speed Steel Z-M4 PM^{speed}

- PM 6-5-4
- Produced using powder metallurgical processes
- All-round material
- Wear resistant, tough and pressure resistant
- Case hardness up to 65 HRC possible

Typical Areas of Application

- Cutting, punching, and fine blanking tools
- Pressing and forming tools
- Thread rolling and roll tools
- Machining tools

Powder metallurgical vs. conventional microstructure



The homogeneous microstructure which is obtained by using powder metallurgical processes vs. the coarse carbide structure of conventionally produced steel

Physical properties

Modulus of elasticity E [GPa]	214
Density [kg/dm ³]	8.0
Thermal expansion coefficient [mm/(mm/K)] in a temperature range up to	
40 – 260 °C	11.5 x 10 ⁻⁶
Thermal conductivity [W/(m*K)]	19.0

Delivery condition

As-delivered condition	Soft-annealed, approx. 280 HB
Product form	Round bars, flat bars, sheets, plates
Surface finish	Mechanically machined

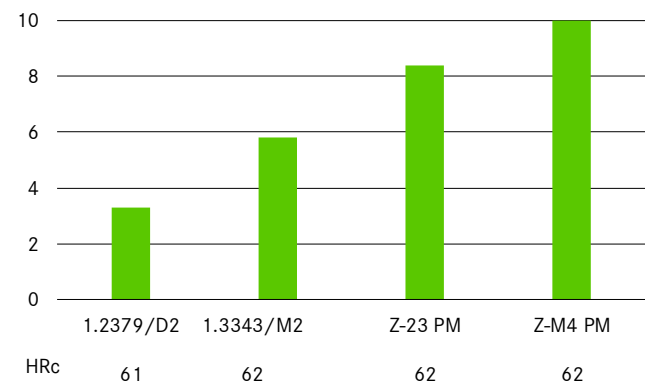
Typical chemical composition (weight %)

C	Cr	Mo	W	V
1.4	4.0	5.2	5.5	4.0

Qualitative comparison of the most important properties

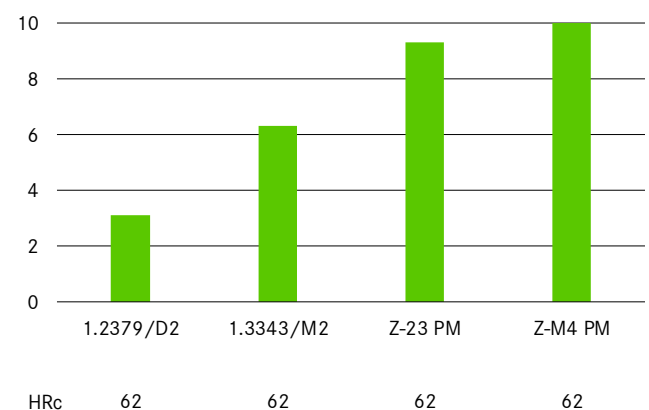
Toughness

■ relative toughness (1 = low up to 10 = high)



Wear resistance

■ relative wear resistance (1 = low up to 10 = high)



Heat Treatment

Soft Annealing

- In neutral atmosphere at ~ 870 °C and ~ 4 h exposure time (after through-heating)
- Followed by furnace cooling (optimum cooling rate max. 10 °C/h up to 540 °C)
- Soft annealing hardness ~ 280 HB

Stress Relief Annealing

~ 650 °C/~ 2 h exposure time (after through-heating)
followed by furnace cooling

Surface Treatments

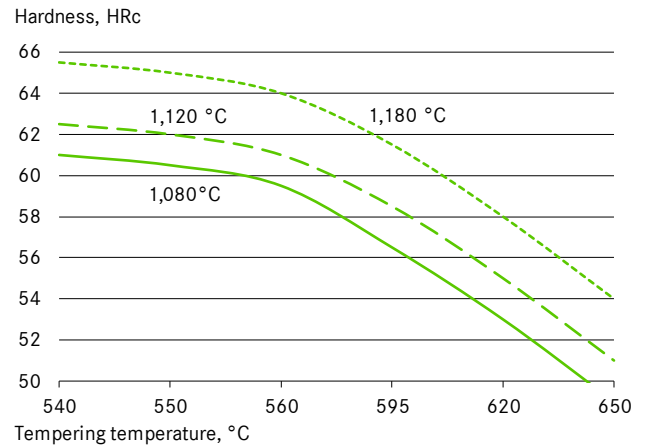
Tempering temperatures of ≥ 560 °C
provide the prerequisite for subsequent
nitriding or PVD coating.

You can find more materials at:
www.zapp.com/en-uk/materials/powder-metallurgical-tool-steel

Zapp Precision Metals GmbH ensures professional execution of all heat treatment steps as well as their preparation and post-processing (e.g., charging, hardness testing, straightening processes, etc.) – always with the aim of obtaining the optimum component properties!

We are happy to assist you with constructive advice!

Tempering diagram



Vacuum heat treatment instructions

Pre-heating	professional heating, 3 pre-heating stages recommended
Vacuum heating	from 1,080 to 1,200 °C, see table
Exposure time	from 5 to 30 minutes after through-heating, see table
Cooling	in vacuum, a quenching pressure of at least 6 bar is required
Tempering	at least 3 times for 2 hours each according to table, fourth tempering recommended, allow to equilibrate to room temperature in between

Desired hardness HRC ± 1	Hardening temperature °C	Exposure time at hardening temperature minutes	Tempering °C
59	1,080	30	560
60	1,100	25	560
61	1,120	20	560
62	1,150	15	560
63	1,160	15	560
64	1,180	10	560
65	1,200	5	560

The maximum specified hardening temperature of 1,200 °C should not be exceeded.

Hardening with further heat treatment processes is possible, but should be discussed in advance!

TOOLING ALLOYS

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