

Z-9 PM^{cold}, PM Tool Steel

Data Sheet – Tooling Alloys

ZAPP

Zapp is certified to ISO 9001



Key features of Zapp's powder metallurgical tool steel

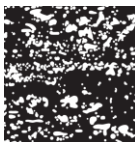
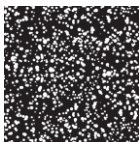
Z-9 PM^{cold}

- Produced using powder metallurgical processes
- Exceptionally high wear resistance to typical plastic molds and cold work tool steels
- High toughness
- Case hardness up to 57 HRC possible

Typical areas of application

- Cutting tools for thick sheet metal
- Powder compacting tools
- Extrusion dies
- Plastics processing tools

Powder metallurgical and conventional microstructure



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

Physical properties

Modulus of elasticity E [GPa]	221
Density [kg/dm ³]	7.5
Thermal expansion coefficient [mm/(mm/K)] in a temperature range up to 20 °C – 200 °C	11.2 x 10 ⁻⁶
Thermal conductivity [W/(m*K)]	20.5

Delivery condition

As-delivered condition	Soft-annealed, approx. 260 HB
Product form	Round bars, flat bars
Surface finish	Mechanically machined

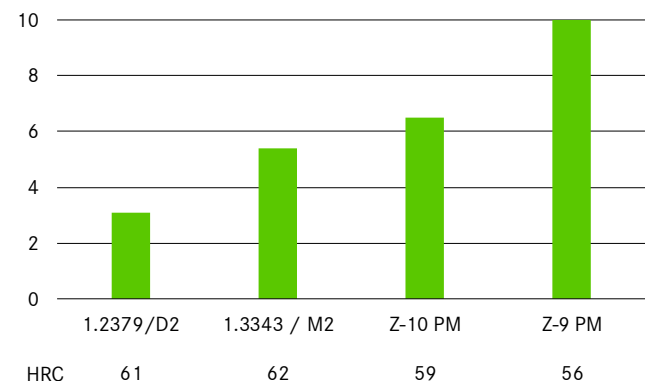
Typical chemical composition (weight %)

C	Cr	Mo	W	V
1.9	5.3	1.3	–	9.1

Qualitative comparison of the most important properties

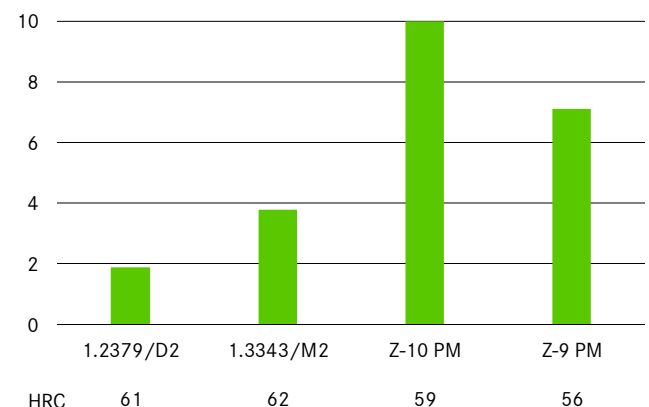
Toughness

■ 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 ~ 260 HB

Stress-relief annealing

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

Surface treatments

Tempering temperatures of ≥ 540 °C provide the prerequisite for subsequent nitriding or PVD coating.

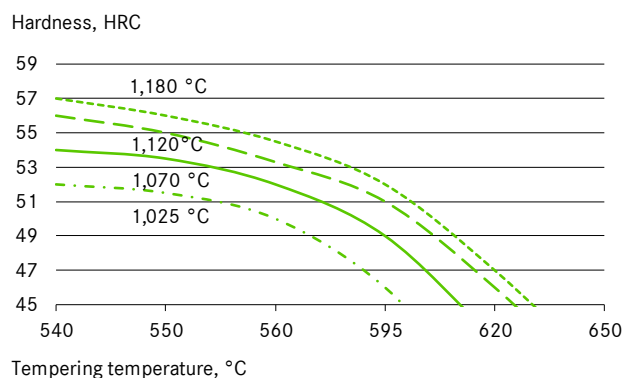
You can find more materials at:

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 1,070 to 1,180 °C, see table
Exposure time	from 15 to 60 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 \pm 1	Hardness temperature °C	Exposure time at hardness temperature minutes	Tempering °C
53	1,070	60	560
54	1,070	60	540
53	1,120	30	560
56	1,120*	30	540
57	1,180	15	540

* best combination of toughness/wear resistance

The maximum specified hardening temperature of 1,180 °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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Further information regarding our products and locations are available in our image brochure and on our homepage at www.zapp.com.

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