

TOOLING ALLOYS

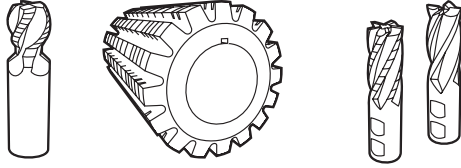
DATA SHEET ZAPP Z-M48 PM



ZAPP IS CERTIFIED TO ISO 9001

TOOLING ALLOYS

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CHEMICAL COMPOSITION

Carbon	1.50 %
Chromium	4.00 %
Vanadium	3.10 %
Tungsten	9.75 %
Molybdenum	5.25 %
Cobalt	9.00 %

DESCRIPTION

ZAPP Z-M48 PM is a tungsten-moly-vanadium-cobalt (super-) high speed steel produced by powder metallurgy methods that can be heat treated to a maximum attainable hardness of HRC 67-69. It offers high levels of wear resistance, red hardness, and compressive strength which make it suitable for use in various heavy duty cutting tool applications involving difficult to machine materials. It can be effective in select cold work applications when under-hardened to optimize toughness. The particle metallurgy processing also provides improved machinability, grindability, heat treat response, and dimensional stability when compared to similar grades produced by conventional methods.

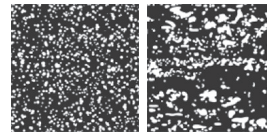
TYPICAL APPLICATIONS

- _ form tools
- _ gear tools
- _ broaches
- _ misc. cutting tools
- _ precision wear parts
- _ roll forming tools
- _ punches and dies

PHYSICAL PROPERTIES

Modulus of elasticity E [psi x 10 ⁶]	31
Density [lb/in ³]	0.298
Thermal conductivity 72 °F [BTU/hr-ft-°F]	TBD
Coefficient of thermal expansion 100 - 1000 °F [in/in/°F]	TBD

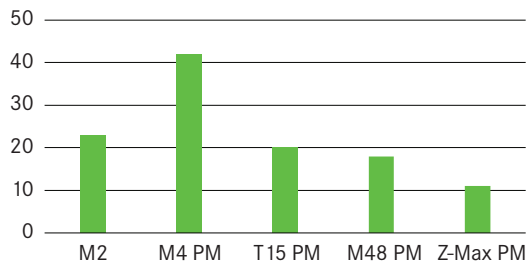
POWDER METALLURGICAL AND CONVENTIONAL MICROSTRUCTURE



The uniform distribution of carbides in the powder-metallurgical structure compared to conventional tool steels with big carbides and carbide clusters.

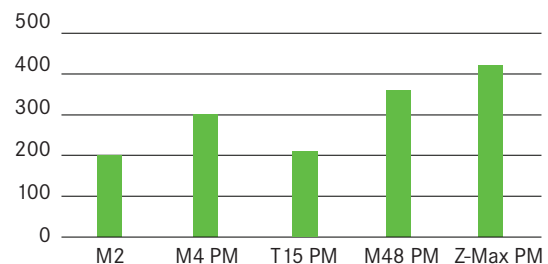
RELATIVE TOUGHNESS (ESTIMATED)

■ Charpy C-Notch impact test



WEAR RESISTANCE (ESTIMATED)

■ Crossed Cylinder wear test



STRESS RELIEVING (HARD)

Heat to 25°F (15°C) less than the temperature of the last temper and soak for one hour.

CRITICAL TEMPERATURE

1550°F (845°C)

SIZE CHANGE DURING HARDENING

+0.002in/in (at HRC 67.5)

THERMAL PROCESSING

ANNEALING

Heat uniformly in a protective atmosphere (or vacuum) to 1600°F (870°C) and soak for two hours. Slow cool 30°F (15°C) per hour until 1000°F (540°C). Parts can then be cooled in air or furnace as desired. Hardness expected is BHN 245–275.

STRESS RELIEVING (SOFT)

Heat uniformly to 1100–1300°F (595–700°C), soak for two hours, and cool in air or furnace.

HARDENING

Vacuum, salt, or protective atmosphere methods are generally used. Care must be taken to prevent decarburization.

Preheat: Heat to 1550–1600°F (845–870°C) until temperature is equalized. Additional preheat steps including 1250–1300°F (680–700°C) and 1850–1900°F (1010–1040°C) are suggested when using programmed control during vacuum processing.

Austenitizing: Temperatures in the range of 2050°F (1120°C) to 2175°F (1190°C) are commonly used with the specific temperature and soak time determined by the hardness required. Higher hardening temperatures will provide maximum wear resistance and hardness while temperatures lower in the range will provide increased toughness. Refer to chart for further information.

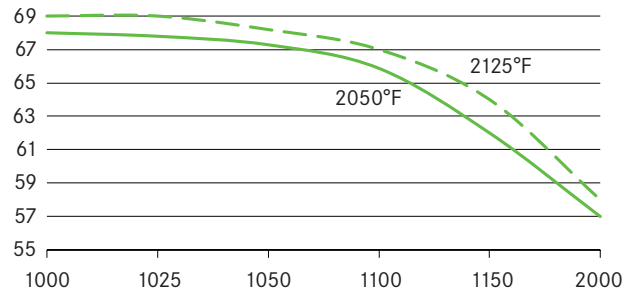
Quenching: Methods include use of high pressure gas (minimum 5 bar preferred), salt bath, or oil. Quench rate through the temperature range of 1900°F (1040°C) to 1300°F (700°C) is critical to the development of optimum structure and properties. Part temperature can then be equalized at 1000–1100°F (540–595°C) after which cooling can continue to below 150°F (66°C) or “hand warm.” Step quenching in this manner will help to minimize distortion in larger section sizes.

TEMPERING

Tempering should be performed immediately after quenching. Temperatures in the range of 1000°F (540°C) to 1100°F (595°C) are generally used depending on the hardness required. Heat uniformly to the selected temperature and soak for two hours. Triple tempering is essential with a fourth temper recommended when using high end hardness. Tempering temperatures of less than 1000°F (540°C) should not be used, and care must be taken to cool parts fully to room temperature between each temper.

TEMPERING DIAGRAM

Hardness HRC



Tempering temperature °F

HEAT TREATMENT INSTRUCTIONS

1st preheating	1250 – 1300°F
2nd preheating	1550 – 1600°F
Hardening	as specified in table
Tempering	2+2+2+2 hours at 1000°F minimum

Required hardness HRC ± 1	Austenitizing soak temp [°F]	Austenitizing soak time [Min]*	Tempering temperature [°F]**
63-65	2050	20	1050
65-67	2125	15	1050
67-69	2175	10	1025
68-70	2190	5	1025

* Process variation and part section size can affect results. Soak times should be based on actual part temperatures. Use of load thermocouples is highly recommended during batch processing.

** An increase in tempering temperature by 25° F can be used to reduce hardness 1 to 2 points HRC. Tempering temperatures less than 1000 °F should not be used.

STRAIGHTENING

Should be done warm (or during quench) using temperatures in the range of 400°F (200°C) to 800°F (430°C).

SURFACE TREATMENT

This grade is an excellent substrate material for use with the various commercially available PVD coating processes. Coating vendors should be consulted to select the optimum process for a given application. Care must be exercised during CVD and other surface treatment processes that can alter the original heat treatment of the tool.

Further information regarding Zapp products and locations is available in the Z-series PM brochure and at www.zapp.com

The illustrations, drawings, dimensional and weight data and other information included in these data sheets are intended only for the purposes of describing our products and represent non-binding average values. They do not constitute quality data, nor can they be used as the basis for any guarantee of quality or durability. The applications presented serve only as illustrations and can be construed neither as quality data nor as a guarantee in relation to the suitability of the material. This cannot substitute for comprehensive consultation on the selection of our products and on their use in a specific application. The brochure is not subject to change control.

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