TOOLING ALLOYS
DATA SHEET ZAPP Z-12Ultra PM

ZAPP IS CERTIFIED TO ISO 9001

TOOLING ALLOYS
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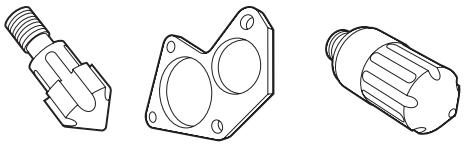


CHEMICAL COMPOSITION

Carbon	2.48 %
Chromium	4.20 %
Vanadium	8.00 %
Tungsten	4.20 %
Molybdenum	3.10 %

DESCRIPTION

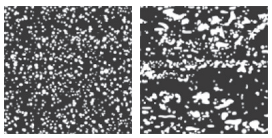
Z-12Ultra PM is a significant advancement in high-performance cold work tool steel. The high content of vanadium and tungsten carbides result in excellent wear resistance, while the unique matrix maintains toughness superior to D2, M2 and A11 PM for increased tool life.

In addition, its higher attainable hardness makes it an ideal choice for those applications where compressive strength is also a requirement.

TYPICAL APPLICATIONS

_ Industrial knives
_ Powder compaction tooling
_ Motor lamination tooling
_ Fineblanking tooling
_ Wear parts for plastics processing
_ Metal punches

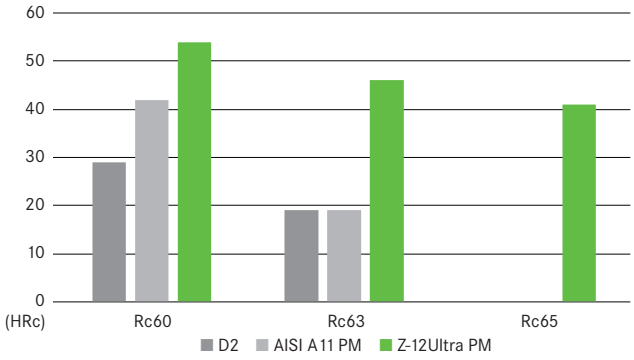
POWDER METALLURGICAL AND CONVENTIONAL MICROSTRUCTURE



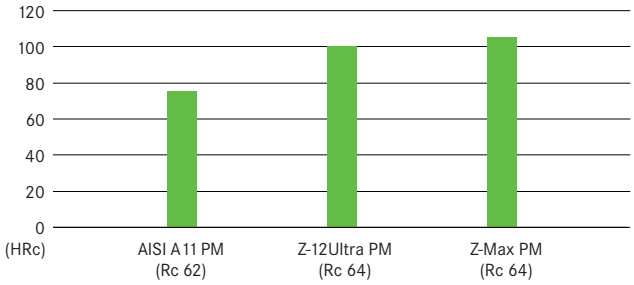
The uniform distribution of smaller spherical carbides in the powder metallurgical structure compared to conventional tool steels with large angular carbides and carbide clusters.

TOUGHNESS

Un-notched Charpy Impact Values



RELATIVE WEAR RESISTANCE



PHYSICAL PROPERTIES

Modulus of Elasticity	36 x10^6 psi @ room temp when heat treated
Density	0.28 lbs/in^3 @ room temp when soft annealed
Coefficient of Thermal Expansion	6.7 x10^{-6}/°F @ 750°F
Thermal Conductivity	13.9 BTU/h/ft °F @ room temp

THERMAL PROCESSING

ANNEALING

Heat uniformly in vacuum or a protective atmosphere to 1600°F and soak at this temperature of 3 hours. Slowly cool the material down to 1290°F with a cooling speed of 18°F per hour, while in the furnace. Final cooling can take place at room temperature in still air.

STRESS RELIEVING

Rough machined material is stress relieved by heating to 1100°F-1300°F. Once complete heat penetration has been realized (min 2 hours), the material should be allowed to cool in the furnace to 1025°F followed by cooling at room temperature in still air.

HARDENING

Vacuum, salt or protective atmosphere methods are generally used. Care should be taken to prevent decarburization.
Preheat – Refer to table
Austenitizing – Refer to table
Quenching – Quenching after hardening can be done in a hot bath at 1025°F, in air or as interrupted oil quenching. Maximum hardness is achieved when cooling in a salt bath or in oil.

TEMPERING

Tempering should be performed immediately after quenching. Heat uniformly to 1025°F and soak for 2 hours. Triple tempering is essential for optimal mechanical properties. Care must be taken to cool parts fully to room temperature (hand warm) between each temper.

STRESS RELIEVING (HARDENED)

Hardened material should be heated to 50°F–100°F below tempering temperature for two hours then cooled at room temperature in still air.

STRAIGHTENING

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

SIZE CHANGE DURING HARDENING

+ 0.14% length and + 0.10% diameter from soft annealed to fully heat treated.

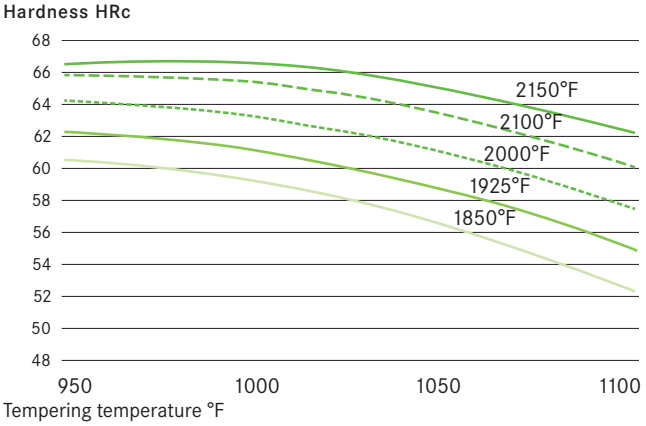
HEAT TREATMENT INSTRUCTIONS

1st preheat	850°F–950°F
2nd preheat	1350°F–1450°F
3rd preheat	1850°F–1925°F
Hardening	Refer to table below
Tempering	3 x 2 hours each. Refer to table below

Quenching after hardening in hot bath at approx. 1025°F or in vacuum at least at four bar overpressure.

Required hardness HRc	Austenitizing temp [°F]	Holding time at austenitizing temp [Min]	Tempering temperature [°F]
58–60	1850	30	1025
59–61	1925	30	1025
61–63	2000	25	1025
62–64	2100	20	1025
63–65	2150	15	1025

TEMPERING DIAGRAM



SURFACE TREATMENT

Z-12Ultra PM is an excellent substrate material for use with the various commercially available PVD coating processes. Conventional nitriding (.001" maximum depth) and steam tempering are also good options. 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**

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