

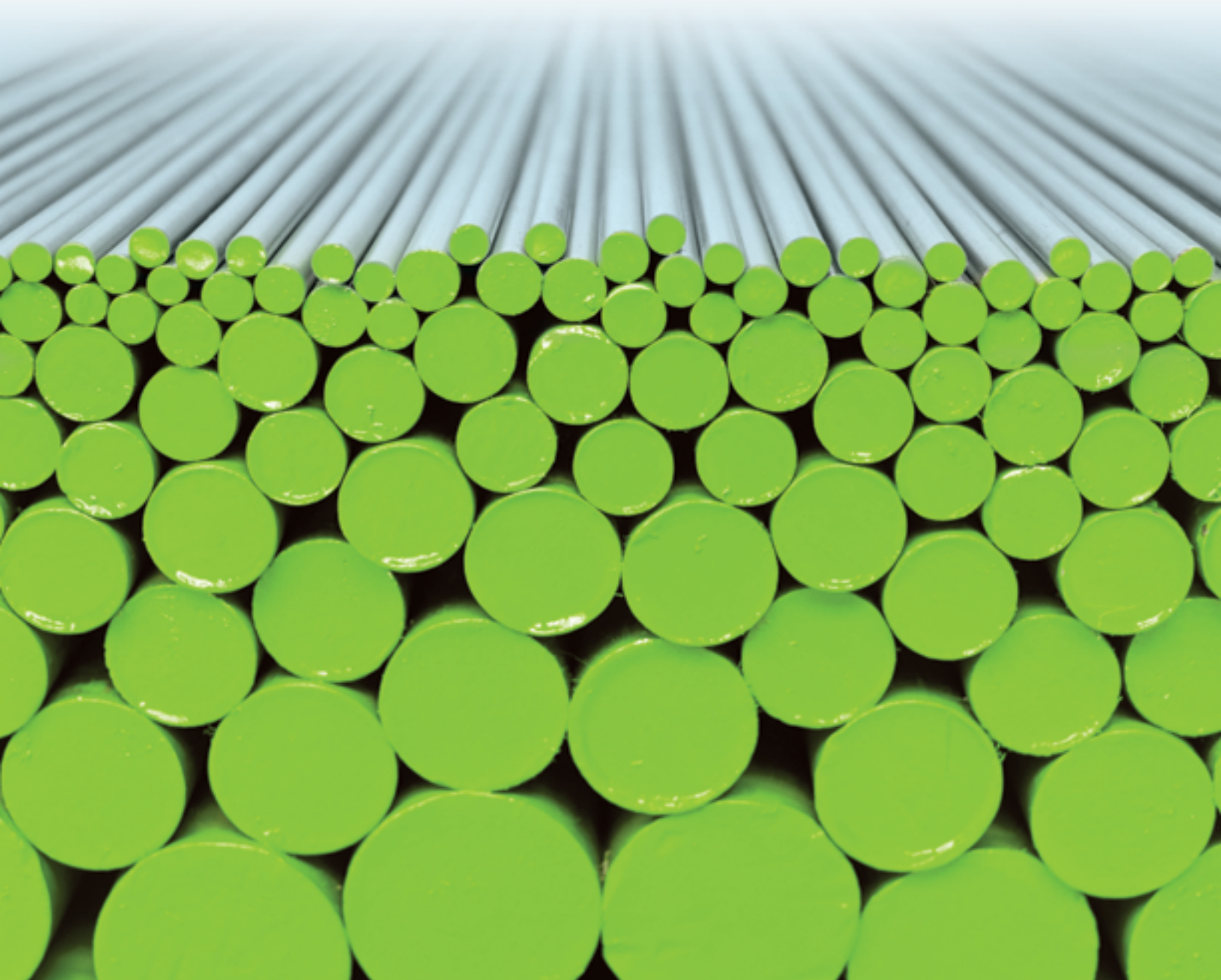


TOOLING ALLOYS

TOOL STEEL SELECTION

ZAPP

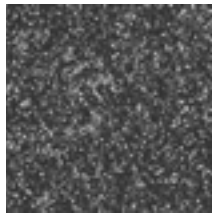
Z-SERIES PM | ENGINEERED SOLUTIONS



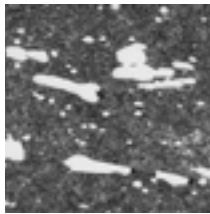
Z-SERIES PM TOOL STEEL SELECTION

PROPER TOOL STEEL SELECTION is a critical component in maximizing productivity and, thus, maximizing profits. With today's more highly alloyed and engineered work materials, the demands on tooling have increased significantly, pushing the limits for key performance properties including wear resistance, impact resistance, compressive strength and coating technology.

Zapp Tooling Alloys' Z-Series PM family of tool steels is produced through a particle metallurgy process that offers a better solution for the most demanding tooling applications. In applications requiring extreme toughness, high wear resistance, and/or compressive strength, Zapp offers *Engineered Solutions*.



Z-WEAR PM



AISI D2

BENEFITS OF ZAPP Z-SERIES PM STEELS

The Particle Metallurgy process was developed to address key weaknesses of tool steel. Traditional ingot casting of highly alloyed tool steels has severe toughness challenges, caused by an undesirable microstructure. PM steels achieve a uniform microstructure, which dramatically increases toughness and allows for greater wear resistance.



Z-TUFF PM®

Designed specifically for high toughness applications in combination with good compressive strength.

- Typical application hardness of Rc 58-60. Attainable hardness of Rc 61 max
- Impact resistance levels of traditional shock resistant tool steels (AISI S7)

Z-WEAR PM®

Optimizes the combination of impact toughness, wear resistance and enhanced compressive strength.

- Enhanced compressive strength with working hardness capability to Rc 64 max
- Higher impact resistance than AISI A2, D2, M2 and PM M4

Z-M4 PM®

The standard traditional workhorse PM grade for cold work applications offering a good combination of impact and wear resistance with good compressive strength.

- Good compressive strength with working hardness of Rc 64 max
- Higher impact resistance than A2, D2 and M2 but lower toughness than Z-Wear PM

Z-10 PM®

Designed for applications requiring high wear resistance with reasonable toughness capabilities.

- Good compressive strength with working hardness of Rc 62 max, Rc 60-62 typical
- Excellent wear resistance with a carbide volume of 17.5%
- Expected wear improvement of approximately two times the performance of PM M4
- Toughness/impact resistance in the range of conventionally produced D2 and M2 at similar hardnesses

Z-12Ultra PM®

A new generation of PM tool steel with exceptional wear resistance, improved toughness, and high compressive strength.

- Excellent wear resistance up to 5x greater than D2 and 25% greater than A11
- Enhanced compressive strength with a typical working hardness of Rc 63-65
- Improved toughness up to 50% greater than D2 and A11

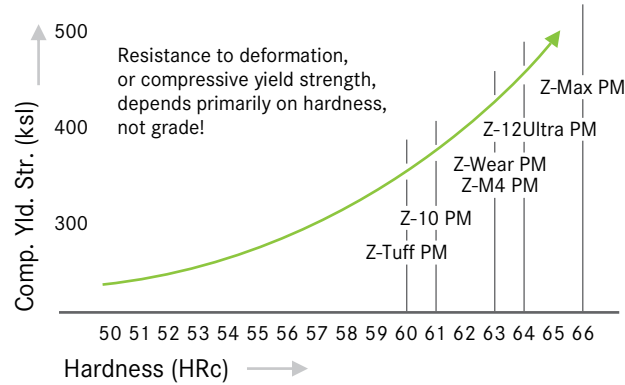
Z-MAX PM®

A Cobalt bearing PM grade designed for cold work applications requiring high wear resistance in combination with excellent compressive strength.

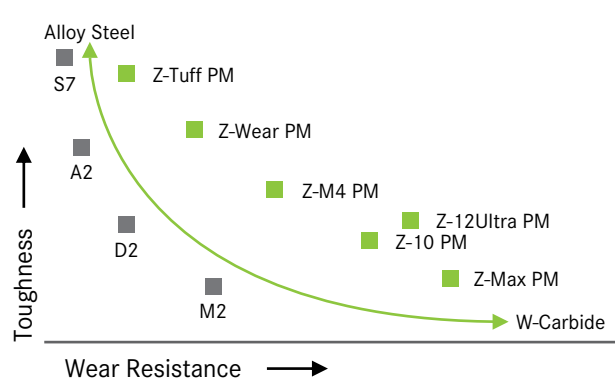
- Superior compressive strength with a standard cold work application hardness of Rc 64-66
- Excellent wear resistance with a carbide volume of 23.0%
- Wear resistance exceeds that of A11 due to higher carbide volume and attainable working hardness
- Cobalt content (9%) to enhance and strengthen material matrix

ENGINEERED SOLUTIONS

HARDNESS vs. COMPRESSIVE YIELD



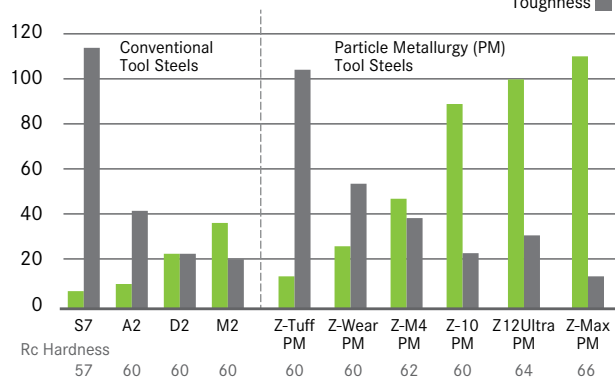
WEAR RESISTANCE/TOUGHNESS COMPROMISE



CHEMISTRY

	Z-Tuff PM	Z-Wear PM	Z-M4 PM	Z-10 PM	Z-12Ultra PM	Z-Max PM
Carbon	.65	1.15	1.42	2.45	2.48	2.00
Chromium	7.50	7.50	4.00	5.25	4.20	4.00
Vanadium	1.00	2.40	4.00	9.75	8.00	5.00
Molybdenum	2.00	1.60	5.25	1.30	3.10	5.00
Tungsten	-	1.00	5.50	-	4.20	10.00
Cobalt	-	-	-	-	-	9.00
Nickel	1.50	-	-	-	-	-
Relative Toughness	105	54	40	25	32	17
Relative Wear Resistance	18	30	45	86	100	110

WEAR RESISTANCE/TOUGHNESS



TOOL STEEL UPGRADE GUIDE

IF YOU ARE USING...	S7	A2	D2	DC53	3V	PM M4	A11
AND YOU NEED TO IMPROVE:							
Wear Resistance	Z-Tuff PM	Z-Wear PM	Z-Wear PM	Z-Wear PM	Z-Wear PM	Z-10 PM	Z-12Ultra PM
Impact Resistance	N/A	Z-Tuff PM	Z-Wear PM	Z-Wear PM	Z-Tuff PM	Z-Wear PM	Z-12Ultra PM
Compressive Strength	Z-Tuff PM	Z-Wear PM	Z-Wear PM	Z-Wear PM	Z-Wear PM	Z-12Ultra PM	Z-12Ultra PM
Compressive Strength & Wear Resistance	Z-Tuff PM	Z-Wear PM	Z-Wear PM	Z-Wear PM	Z-Wear PM	Z-12Ultra PM	Z-12Ultra PM
AND YOU NEED SIGNIFICANTLY IMPROVED							
Wear Resistance	Z-Wear PM	Z-M4 PM	Z-12Ultra PM	Z-12Ultra PM	Z-12Ultra PM	Z-12Ultra PM	Z-Max PM
Impact Resistance	N/A	Z-Tuff PM	Z-Tuff PM	Z-Tuff PM	Z-Tuff PM	Z-Tuff PM	Z-Wear PM
Compressive Strength	Z-Wear PM	Z-M4 PM	Z-M4 PM	Z-M4 PM	Z-M4 PM	Z-Max PM	Z-Max PM
Compressive Strength & Wear Resistance	Z-Wear PM	Z-M4 PM	Z-M4 PM	Z-M4 PM	Z-M4 PM	Z-Max PM	Z-Max PM

* 3V, 10V are registered trademarks of Crucible Industries LLC. DC53 is a registered trademark of Daido Steel Ltd

CONTACT

ZAPP MATERIALS ENGINEERING

UNITED STATES

Zapp Tooling Alloys, Inc. (Sales office)
475 International Circle
Summerville, South Carolina 29483
Phone +1 (843) 871-2157
Toll-free +1 (888) 928-9927
ztales@zapp.com, www.zapp.com

Zapp Tooling Alloys, Inc. (Production)
8100 100th St
Pleasant Prairie, WI 53158

GERMANY

Zapp Materials Engineering GmbH
TOOLING ALLOYS
Zapp-Platz 1
40880 Ratingen
P.O. Box 10 18 62
40838 Ratingen
Germany
Phone +49 2102 710-548
Fax +49 2102 710-596
toolingalloys@zapp.com

The illustrations, drawings, dimensional and weight data and other information included in this brochure 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.

