ZAPP MATERIALS ENGINEERING

TOOL ALLOYS

zapp

CONTENTS

05 EXCLUSIVE PRACTICAL EXPERIENCE

06 ASP® 2000 STEELS

08 CPM® STEELS

10 MAIN ADVANTAGES OF THE POWDER METALLURGICAL HIGH PERFORMANCE STEELS

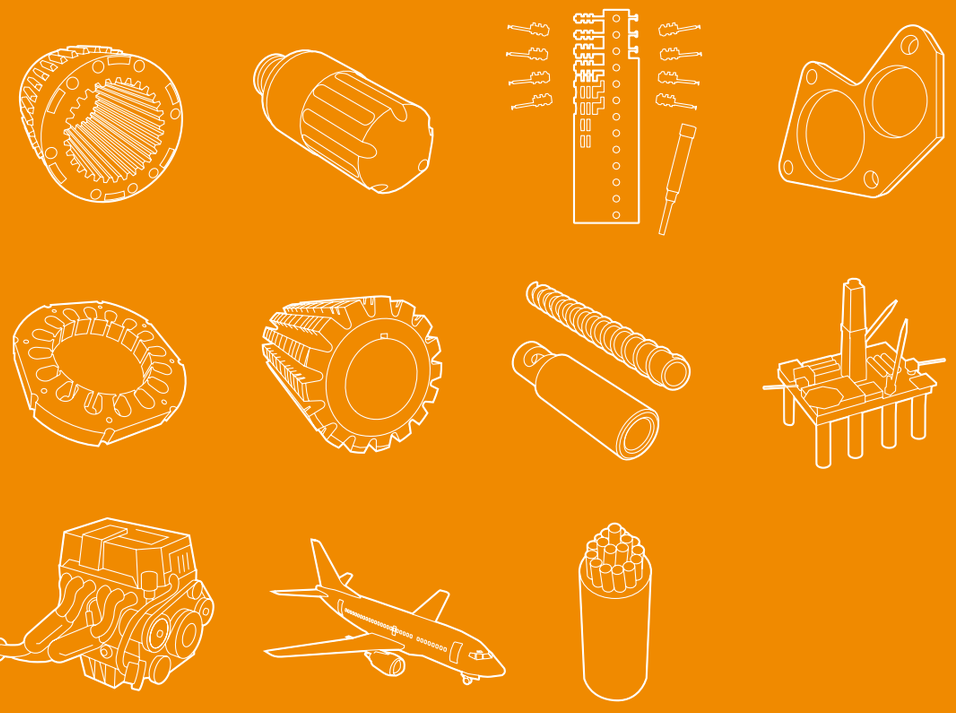
12 TOOL STEELS

14 SERVICES AND SPECIAL FACILITIES

15 LOGISTICS AND QUALITY

16 LIST OF ADDRESSES

Zapp – a premium supplier. Founded in 1701 by Hermann Zapp in Ründeroth, Germany. Today, the Zapp Group has commitments worldwide with production sites and service centers. Its core activities lie in the manufacture of ready-to-use fabricated products made of high performance materials for demanding applications. The Zapp Group is composed of three divisions: Precision Wire, Precision Strip, and Materials Engineering for specialty materials and tool alloys. Our objective is to ensure that every customer has a competitive advantage as a result of close mutual cooperation.



EXCLUSIVE PRACTICAL EXPERIENCE WITH CONVENTIONAL AND POWDER METALLURGICAL STEELS

In modern tool engineering, there are two possible materials from which highly stressed tools can be made – conventional tool steels or powder metallurgical high performance (PM) materials. Which is the most economical, and when?

A BACKGROUND OF 25 YEARS

As the distributor for the world's leading manufacturers of PM products, we also have acquired comprehensive practical experience of these products. As a result, we are able to make precise statements as to the price/performance ratio of the two types of steel. To this must be added our exhaustive knowledge of their applications and our ability to make logical recommendations, not only about the materials themselves but also about heat treatment and spark erosion processing. In combination, the final effect will lead to an increase in your productivity.

POWDER METALLURGICAL MATERIALS – THE OPTIMUM IN STEEL TECHNOLOGY

At first sight, admittedly, the high cost production method employed makes PM materials relatively expensive. In return, however, they satisfy the most exacting requirements. Moreover, they appreciably improve machine utilization. If you are now wondering whether these advantages apply in your particular case, simply call us, send us an e-mail or write to us. We will analyze the problem, indicate alternative solutions and advise you accordingly.

PRACTICE MAKES PERFECT PRODUCTS

Our practical experience, however, not only helps our customers throughout the world. It also serves as a constant driving force behind the product development work of our suppliers.

FOR A NEW TECHNOLOGICAL GENERATION

Even today, we are intensively occupied with the future activities of countless industries. Thus, a new generation of plastics is creating a demand for new technologies in their processing. These, in turn, call for tool alloys which are a match for the new challenges. Other sectors in which technological advances are constantly being made are the automotive industry, the food industry and the sinter press and metalworking industries. We should be seen as a premium resource, capable of finding new answers to new questions.

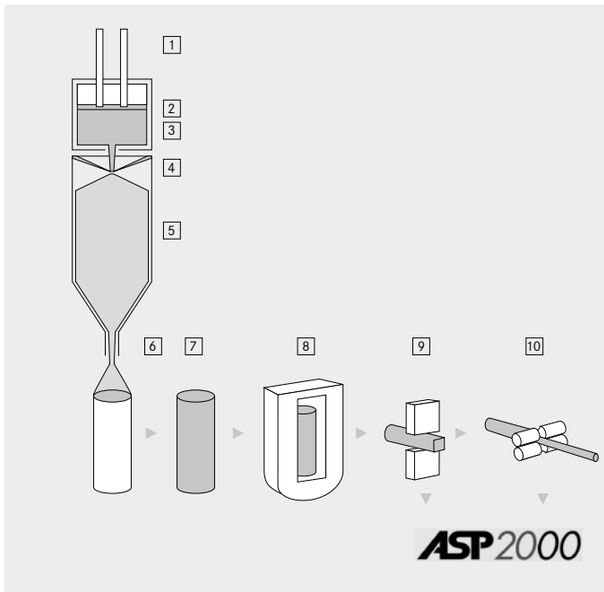
ASP® 2000 STEELS

ASP® 2000: ESH-DVALIN™ PROCESS

The ASP process is a powder metallurgical technique, comprising hot isostatic pressing of rapidly solidified gas atomised powder. A material of homogeneous distribution of the components of the steel is obtained. During gas atomization, the melt is disintegrated by powerful jets of nitrogen gas into small droplets. The powder is collected in a steel capsule which is subsequently evacuated and welded.

After hot isostatic pressing of the ASP-powder the microstructure of this material is fully homogeneous and the mechanical properties are isotropic. Bars, wire rods, strip and sheets are obtained after forging and rolling.

ASP® PROCESS



1. Graphite electrodes for heating and temperature regulation
2. Slag cover
3. Molten steel
4. N_2 gas
5. Atomizing of molten steel with nitrogen gas
6. Encapsulation of powder in steel cylinder
7. Welding of cylinder after vacuum evacuation
8. Hot isostatic pressing
9. Hot forging
10. Hot rolling

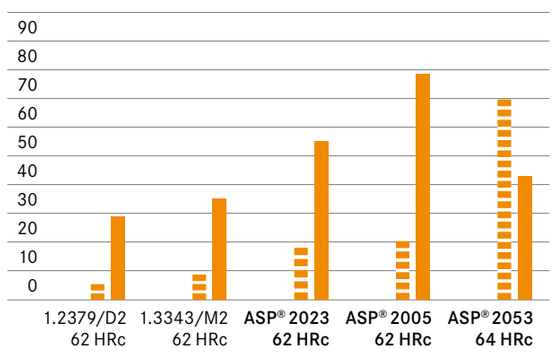
® ASP and ™ DVALIN are registered trademarks of Erasteel, France (Paris).

ANALYSES AND PROPERTIES

Chemical composition (standard values in %)

Steel grade	C	Cr	Mo	W	V	Co	N
ASP® 2005	1.5	4.0	2.5	2.5	4.0	–	–
ASP® 2012	0.6	4.0	2.0	2.1	1.5	–	–
ASP® 2023	1.3	4.2	5.0	6.4	3.1	–	–
ASP® 2030	1.3	4.2	5.0	6.4	3.1	8.5	–
ASP® 2040	1.2	4.0	3.0	3.0	8.0	–	1.5
ASP® 2053	2.5	4.2	3.1	4.2	8.0	–	–
ASP® 2060	2.3	4.0	7.0	6.5	6.5	10.5	–

MECHANICAL PROPERTIES OF ASP® 2000 MATERIALS

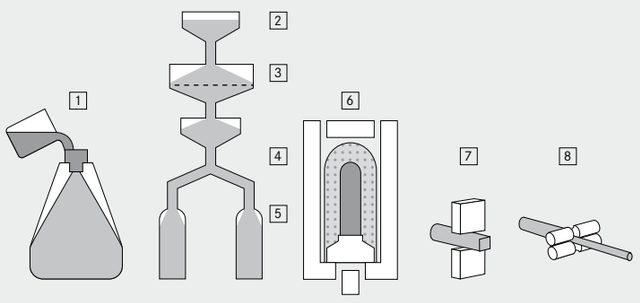


CPM® STEELS

CPM® PROCESS

In its approach to the CPM® processing technique, Crucible has concentrated, among other things, on the production of high alloyed cold-worked steels. These innovative powder metallurgical alloys, which are particularly rich in vanadium, have largely been patented; they fulfill the highest performance requirements.

CPM® PROCESS



1. Atomization
2. Powder
3. Screening
4. Filling
5. Capsulation
6. Hot isostatic pressing
7. Hot forging
8. Hot rolling

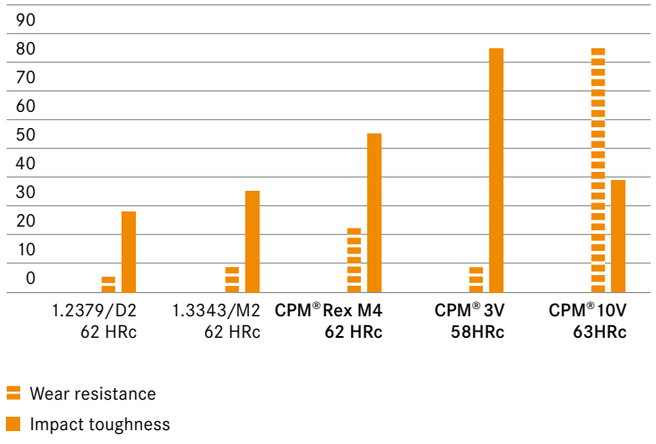
® CPM is a registered trademark of Crucible, U.S.A. (Syracuse, NY).

ANALYSES AND PROPERTIES

Chemical composition (standard values in %)

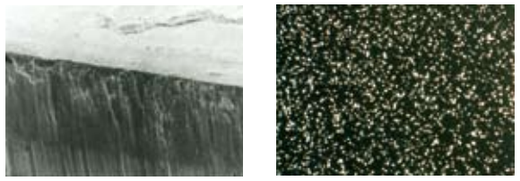
Steel grade	C	Cr	Mo	W	V	Co
CPM® 1 V	0.5	4.5	2.7	2.2	1.0	–
CPM® 3 V	0.8	7.5	1.3	–	2.8	–
CPM® 9 V	1.9	5.2	1.3	–	9.0	–
CPM® 10 V	2.4	5.2	1.3	–	9.7	–
CPM® 15 V	3.4	5.2	1.3	–	15.0	–
CPM® 420 V	2.3	14.0	1.0	–	9.0	–
CPM® S 30 V	1.5	14.0	2.0	–	4.0	–
CPM® Rex M4	1.4	4.2	5.2	5.5	4.0	–
CPM® Rex T15	1.6	4.0	–	12.0	5.0	5.0
CPM® Rex 76	1.5	3.7	5.2	10.0	3.1	9.0
CPM® Rex 121	3.4	4.0	5.0	10.0	9.5	9.0

MECHANICAL PROPERTIES OF CPM® MATERIALS



MAIN ADVANTAGES OF THE POWDER METALLURGICAL HIGH PERFORMANCE STEELS

POWDER METALLURGICAL MICROSTRUCTURE



PM-HIGH PERFORMANCE STEEL
Positive effects of the uniform microstructure for best cutting edge stability.

CONVENTIONAL MICROSTRUCTURE

CONVENTIONAL HIGH SPEED STEEL
Carbide clusters near the cutting edge produce micro- and macro-chipping.

ADVANTAGES

1. ALLOYS
The highest alloy levels can be achieved without any adverse effect on mechanical characteristics.

2. TOUGHNESS
The uniform distribution of carbides and absence of metallurgical defects increase security against fracture and fatigue strength.

3. WEAR RESISTANCE
The volume and hardness of the carbides increase resistance to abrasive and adhesive wear.

4. GRINDABILITY
Machining ability is improved as a result of the small globular carbides.

5. DIMENSIONAL STABILITY
Powder metallurgical steels are free of segregations. This leads to substantially improved dimensional stability. Tools need less remachining.

6. CLEANNESS
Excellent polishing and EDM machining capabilities result from the highest possible degree of purity, known as »Ultra Clean«.

TYPICAL APPLICATIONS

Type of tool	Production material	Steel grade	Hardness [HRc]	Performance
Punch	Cu-Be, s = 0.28 mm	1.2379/D2 **CPM® 10 V**	61 62	75000 parts per regrind 1500000 parts per regrind
Sinter pressing punch (calibration)	Iron powder D 7 Density 7.1 kg/dm³	1.3207 PM **CPM® 10 V**	64 63	54000 parts 75000 parts
Fineblanking	St 52, s = 8 mm 550 MPa	1.2379/D2 **CPM® Rex M4**	58 59	20000 parts per regrind 60000 parts per regrind
Forming punch	St 2k, s = 1.2 mm 500 MPa	1.3343/M2 **CPM® 3V**	59 59	25000 parts per regrind 300000 parts per regrind
Sinter pressing tool	Iron powder Density 6.85 kg/dm³	1.2767 1.3207 PM **CPM® 9V**	53 61 55	5000 parts 10000 parts 310000 parts
Punching tool	QStE 460 TM, s = 2.0 mm 800 MPa	1.2379/D2+TICN ASP® 2053	61 61	150000 parts per regrind 500000 parts per regrind
Fineblanking	16MnCr 5, s = 4.5 mm 550 MPa	1.2379/D2 ASP® 2005	60 60	80000 parts per regrind 190000 parts per regrind

ECONOMY CALCULATION

Tool	Die	
Machine	Stamping press	
Production material	St 37 thickness 0.5 mm	
Value of production run	8000000	
Steel grade	1.3343/M2	**CPM® 10 V**
Material costs	€ 80	€ 360
Total tool costs	€ 4000	€ 4280
Material cost proportion	2.00%	8.41%
Quantities per regrind	approx. 150000	approx. 500000
Number of regrinds	15	15
Costs per regrind	€ 150	€ 150
Max. number of parts per tool	approx. 2250000	8000000
Two further tools required	€ 8000	€ 0
Additional regrinding costs (30 x € 150)	€ 4500	€ 0
Costs of production run	€ 18750	€ 6530

It must be admitted that, at first sight, powder metallurgical high performance materials are relatively expensive. But often only at first sight. A detailed price/performance comparison between powder metallurgical and conventional tool steels often produces some surprising results.
An example of a cost-effectiveness study has revealed a saving of EUR 12220 by the use of CPM® 10V material.

TOOL STEELS

COLD WORKING

Chemical composition (standard values in %)

Material no. DIN 17350	Zapp-brand name	DIN EN ISO 4957	C	Mn	Cr	Mo	V	W	Ni	Co
1.2080	C 120	X210Cr12	2.10	0.30	12.00	–	–	–	–	–
1.2363	LVC 50	–	1.00	0.50	5.30	1.00	0.20	–	–	–
1.2379	LC 120 S	X153CrMoV12	1.55	0.30	12.00	0.70	1.00	–	–	–
1.2436	WC 120	X210CrW12	2.20	0.30	12.00	–	–	0.80	–	–
1.2550	SCW 20 H	60WCrV8	0.60	0.30	1.10	–	0.20	2.00	–	–
1.2714	LCN Extra	55NiCrMoV7	0.55	0.70	1.20	0.50	0.10	–	1.80	–
1.2767	LCN 45	45NiCrMo16	0.45	0.25	0.30	–	–	–	4.00	–
1.2842	VM 20	90MnCrV8	0.90	0.25	0.50	–	0.10	–	–	–

HOT WORKING

Chemical composition (standard values in %)

Material no. DIN 17350	Zapp-brand name	DIN EN ISO 4957	C	Mn	Cr	Mo	V	W	Ni	Co
1.2343	CVL 10	X37CrMoV5-1	0.38	0.40	5.30	1.30	0.35	–	–	–
1.2344	CVL 10 V	X40CrMoV5-1	0.40	0.40	5.30	1.40	1.00	–	–	–
1.2365	CVL 30	–	0.32	0.30	3.00	2.80	0.50	–	–	–
1.2367	LC 50	–	0.40	0.40	5.00	3.00	0.50	–	–	–

PLASTIC MOULDING

Chemical composition (standard values in %)

Material no. DIN 17350	Zapp-brand name	DIN EN ISO 4957	C	Mn	Cr	Mo	V	W	Ni	Co
1.2083	C 135 M	–	0.42	0.30	13.00	–	–	–	–	–
1.2311	MCL 3	–	0.40	1.50	2.00	0.20	–	–	–	–
1.2312	MCL S	–	0.40	1.50	1.90	0.20	–	–	–	+ S
1.2316	LC 160	X 38CrMo16	0.36	0.80	16.00	1.20	–	–	–	–
1.2738	MCL 4	–	0.40	1.50	1.90	0.20	–	–	1.00	–
1.4112	K 90 L	–	0.90	0.60	18.00	1.20	–	–	–	–
1.4122	K 35 L	–	0.40	0.60	17.00	1.20	–	–	0.80	–
1.8550	N 35	–	0.34	0.50	1.70	0.20	–	–	1.00	+ Al

HIGH SPEED STEELS

Chemical composition (standard values in %)

Material no. DIN 17350	Zapp-brand name	DIN EN ISO 4957	C	Mn	Cr	Mo	V	W	Ni	Co
1.3202	SSVB 50	–	1.40	0.30	4.20	0.90	4.00	12.00	–	5.00
1.3207	SSB 120	HS 10-4-3-10	1.30	0.30	4.20	3.80	3.20	10.50	–	10.50
1.3243	SSLB 50	HS 6-5-2-5	0.92	0.30	4.20	5.00	2.00	6.50	–	5.00
1.3343	SSWL 50	HS 6-5-2C	0.90	0.30	4.30	5.00	1.90	6.50	–	–

ZAPP-SPECIAL STEELS

Zapp-brand name	Characteristic	Typical application areas
VC 800, US 1000, US 2000	Cold working steel	Blanking and forming thick sheets. Blanking and forming tools. Stamping, cold forging
Vacumar	Hot working maraging steel	Aluminum die casting
CSM 21	Plastic moulding maraging steel	Plastic moulding, corrosion-resistant parts
LC 200 N	High corrosion-resistance up to 60 HRc with a good toughness	Cutter blades, high gloss polished plastic moulds

SERVICES AND SPECIAL OPTIONS

OUR PRODUCTS ARE SHIPPED TO YOU IN A MINIMUM OF TIME...

1. thanks to a large, well organized warehouse, and
2. a comprehensive range of modern machines for processing.

In total, our Service Center stocks around 400 tonnes of CPM® powder metallurgical high performance steels, together with approximately 1000 tonnes of conventionally manufactured tool steels for immediate delivery. These include precision flat and square profile steels, ground tool steels and pre-machined PM steels, as well as hardened EDM blocks. Our Processing Center performs services in accordance with your requirements. A range of modern machines, which includes 14 high performance bandsaws, can process materials for you in various dimensions from 1.8 mm to 500 mm in round steel and 650 mm thickness in flat/square profile steels.

PRE-MACHINED TOOL STEEL
annealed, fine-finished contact faces, sides milled, sawed to length, stocked as standard in lengths of 1030 mm

TOLERANCES IN MM:

Width	Thickness	Lengths
+0.40/0	+0.25/0	+5.00/0

PRECISION FLAT AND SQUARE PROFILE STEEL
annealed, finely ground contact faces, fine-finished stopped end, stocked as standard in lengths of 500 mm and 1000 mm

TOLERANCES IN MM:

Width	Thickness	Lengths
+0.20/0	+0.05/0	+5.00/0

NITRIDING AND SPECIAL CONSTRUCTION STEELS
special steels featuring high resistance to corrosion, wear and thermal fatigue

ALUMINUM ALLOYS
finely milled aluminum panels in cast and rolled form – also available with greater strength

HARDENED EDM BLOCKS
When ordering, please specify the desired quality grade, dimensions, hardness and, if necessary, the position of the starting drill hole.

LOGISTICS AND QUALITY

CERTIFIED QUALITY WITHIN 24 HOURS
With the largest inventory of powder metallurgical materials in Europe, we guarantee dependable supplies and the shortest possible lead times. Our material will reach you within 24 hours of receipt of order, as standard. Our Service Center stocks countless types of material of every shape and size in readiness for you. This brochure contains information on the materials and characteristics most commonly in demand, together with a number of typical applications. Detailed material data sheets and inventories can be found on our website: www.zapp.com. High standards of product quality are essential for the successful use of tool alloys. To this end, materials from world market leaders are used exclusively which comply with demanding requirements and have qualified for all the requisite approvals.

ISO 9001
All our processes are subject to a quality management system certified in accordance with ISO 9001. During incoming and outgoing inspections, all goods undergo a dimensional check, a visual inspection and a check for conformity with purchase order details. We continually introduce new quality standards appropriate to the development of our business.

ZAPP MATERIALS ENGINEERING

TOOL ALLOYS

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