

Engineered Products

ENGINEERED PRODUCTS FOR PLASTIC INJECTION MOLDING

designed for pure performance

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WHO WE ARE AND WHAT WE DO

As a global market leader in tool steel and one of the leading suppliers of high-performance materials, voestalpine High Performance Metals produces technologically advanced products at eight production sites in Europe, North and South America. And with 140 locations in 40 countries on every continent, we provide our customers with outstanding service wherever they may be located. We offer our customers production, sales, and service from a single source. Our core business is defined in two areas:

1. Production

Many of our customers operate in the most technologically challenging industries and rely on our leading brands BÖHLER, UDDEHOLM, EschmannStahl and Villares Metals.

The product portfolio includes:

- » Tool steel & High-speed steel
- » Powder metallurgy-produced steels
- » Powder for additive manufacturing processes
- » Valve steel
- » Engineering steel
- » Special steels

2. Value Added Services

With our Value Added Services, we support our customers with tailored services along the entire value chain – starting with design and engineering, through the selection of the right materials and post-treatment processes, to additive manufacturing and downstream processes.

These services include:

- » Design & Simulation
- » Sawing & Machining
- » Additive Manufacturing (AM)
- » Heat Treatment & Coating
- » Surface Treatment and Texturing

Our sales teams and experts from BÖHLER, UDDEHOLM and EschmannStahl, EschmannTextures and eifeler, as well as from the voestalpine Additive Manufacturing Center, work together with part designers, toolmakers, injection molders and engineers, as well as OEMs, to offer our customers application-specific system solutions. Customer intimacy and effective logistics are an integral part of our commitment to fostering long-term partnerships with our customers.

Engineered Products



ENGINEERED PRODUCTS

designed for pure performance

Engineered Products are ready-to-use, customized parts made from voestalpine premium materials. We design and manufacture our tailor-made Engineered Products with all necessary production steps such as machining, heat treatment and high-quality PVD coating. These tailor-made products are designed using our extensive experience to optimize productivity and increase production efficiency.

We offer Engineered Products for a wide variety of applications – mainly for plastic injection molding, high pressure die casting and food processing. For this purpose, we use innovative production and post-processing technologies from our two core business areas: Production and Value Added Services.

Our Engineered Products include all important features (e.g. conformal cooling) so that our customers can immediately use the finished part in a tool, machine or assembly with little or no final post-processing. voestalpine Engineered Products enable higher productivity and lower total cost of ownership per component produced. Thanks to their high wear resistance and therefore service life - they ensure higher part quality and contribute to a reduction in rejects, maintenance and machine downtime.

Engineered Products



ENGINEERED PRODUCTS

for Plastic Injection Molding

For the plastic injection molding industry we offer tailor-made solutions to address the industrial manufacturing needs of companies such as injection molders and tool makers. The innovation behind our products is driven by our customers' needs to optimize productivity, increase overall equipment efficiency, and minimize their total cost of ownership.

Our Engineered Products for plastic injection molding can optimize productivity through their unique combination of our premium AM powder materials and design features, such as conformal cooling channels (in additively manufactured tool inserts). These cooling channels enable lower cycle times and provide a more homogeneous temperature distribution for reducing scrap rates. AM also allows the creation of venting structures with a microscopic porosity, allowing for a targeted release of compressed air to ensure that the mold remains air free during injection.

These structures help to avoid defects caused by the diesel effect, which is a well-known industrial problem. Other innovative AM design possibilities include the use of sensor channels, which can also be created to allow for data acquisition and real-time production monitoring.

Manufactured using our premium materials by BÖHLER / Uddeholm, these Engineered Products offer outstanding polishing characteristics and high corrosion and wear resistance – ensuring a high product lifetime and less maintenance effort. Behind every product, voestalpine HPM provides the full solution, including post-processing technology such as heat treatment and machining, and our value-added services, which encompass coating and texturing.

Starting from the selection of the right material, voestalpine HPM works with our customers along the entire value chain - from concept to final component.

By integrating our Value Added Services in our Engineered Products, such as Laser Texturing and PVD Coating, we deliver unique solutions across the entire value chain. For example, combining laser texturing with optimized mold temperature control unlocks entirely new possibilities for enhancing the design and functionality of plastic products. The synergy of femto laser technology and conformal cooling allows for the precise and reliable molding of microstructures, thanks to significantly more uniform temperature distribution. Our specially designed PVD coatings provide durable protection against abrasive wear also ensuring long-lasting textures without compromising functionality.



TOOL STEEL PERFORMANCE BEYOND EXPECTATION

voestalpine High Performance Metals focuses on technologically highly specialized product segments and is the global market leader in production and distribution of tool steel and other special steels.

We are fully integrated from production to sales and control the full supply chain. We are globally one of the leading producers of: tool steel, high-speed steel, valve steel, engineering steel, powder metallurgy-produced steels, special steels and nickel-based alloys.

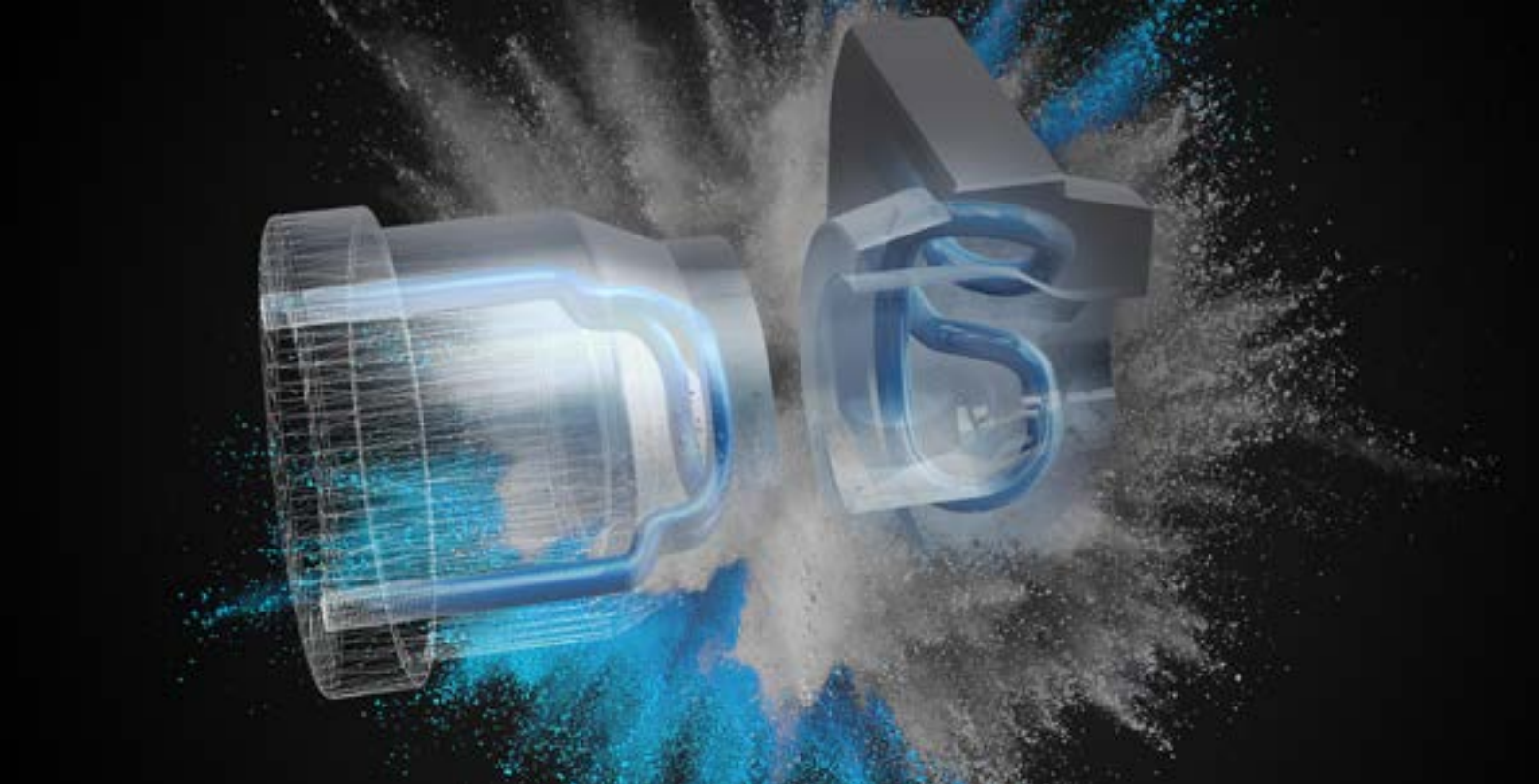
We also manufacture die-forged parts out of titanium alloys, nickel-based alloys and high, medium and low alloy steels.

Tooling is one of the most challenging steel application. We are the world leader in this area. Among other things, our high quality tool steel is used for the production of high volume and high quality parts in various industries.

Depending on the application, high tensile strength, toughness, working hardness, wear resistance and corrosion resistance are required.

A distinction is made between cold work, hot work and plastic mold steel. Cold work steel is required for the production of stamping, embossing and cutting tools. Hot work steel is used in tools for forging, die casting and extrusion. Molds and matrixes required for the production of plastic products are produced out of plastic mold steel.

Especially with our powder metallurgical and electro slag remelted steels we are pushing the boundaries with regards to the tool life and performance! Each of our market leading brands has a strong value proposition for our customers.



ADDITIVE MANUFACTURING PLASTIC INJECTION MOLDING INDUSTRY

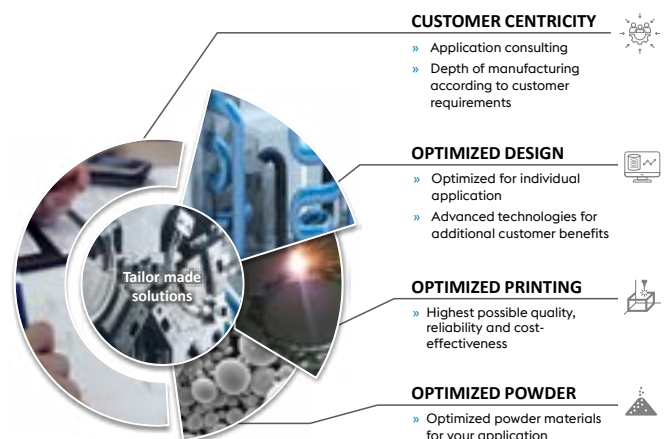
Additive manufacturing offers increased freedom in the design of plastic injection mold inserts. The interaction of powder material, process parameters and heat treatment significantly determines the resulting component properties and the performance of the insert in the injection molding process.

For decades we have been recognized as a global leader for high-performance tool steels for the plastic injection molding (PIM) industry, as a result we understand the unique production challenges our customers face. Shorter cooling times compared to conventional methods is not our only design priority. We optimize our inserts across multiple factors, including uniform wall cavity temperatures, which significantly reduces component distortion in critical areas, and further enhances the service life of the tool insert.

Customer intimacy and technical understanding are essential factors when developing successful additive

manufacturing solutions, as a result our attention to detail goes far beyond 3D printing.

Working together with our customers, using our state-of-the-art additive manufacturing and materials know how, we develop tailor-made AM solutions optimized specifically for the plastic injection molding industry.



POWDER MATERIAL FOR ADDITIVE MANUFACTURING

Our long history of developing materials for the plastic injection molding industry, ensures the powders used to print your tooling inserts are of the highest quality and will deliver superior tool life. Our AM powders are designed and manufactured by the same experts responsible for our class leading tool steels.

CORROSION RESISTANT GRADES

- » Designed for tooling applications, where corrosion resistance is needed
- » Corrosion resistant
- » Recommended hardness 45 to 58 HRC

Grade	Achievable hardness ¹	Corrosion resistance	Wear resistance	Polishability	Notch impact energy
1.2083 ESR ²	52 HRC	★★★	★★★	★★★	/
Uddeholm Corrax® for AM	50 HRC	★★★★★	★★★	★★★★	★★★★
Uddeholm Tyrax® for AM	55* (58) HRC	★★★★	★★★★★	★★★★★	★★★★★
BÖHLER M789 AMPO	52 HRC	★★★★★	★★★	★★★★	★★★★

*direct tempering

HOT WORK GRADES

- » Designed for high demanding tooling applications like reinforced plastics
- » Recommended hardness 48 to 57 HRC
- » High toughness

Grade	Achievable hardness ¹	Corrosion resistance	Wear resistance	Polishability	Notch impact energy
1.2343 ESR ²	53 HRC	/	★★★	★★★★★	/
BÖHLER W722 AMPO (~1.2709)	54 HRC	/	★★★	★★★★	/
Uddeholm Dievar® for AM	48 HRC	/	★★★	★★★★★	★★★★★
BÖHLER W360 AMPO	57 HRC	/	★★★★★	★★★★	★★★

CHEMICAL COMPOSITION³

Uddeholm Corrax® for AM

C	Cr	Ni	Mo	Al	Co
0.03	12.0	9.2	1.4	1.6	free

Uddeholm Tyrax® for AM

C	Si	Mn	Cr	Mo	V	N
0.35	0.2	0.5	5.0	2.3	0.6	+

BÖHLER M789 AMPO

C	Cr	Ni	Mo	Al	Ti	Co
0.02	12.2	10	1	0.6	1	free

Uddeholm Dievar® for AM

C	Si	Mn	Cr	Mo	V
0.35	0.2	0.5	5.0	2.3	0.6

BÖHLER W722 AMPO

C	Si	Mn	Mo	Ni	Co	Ti
0.03	0.10	0.15	4.9	18.0	9.3	1.1

BÖHLER W360 AMPO

C	Si	Mn	Cr	Mo	V	Co
0.50	0.20	0.25	4.5	3.0	0.55	free

Footnote

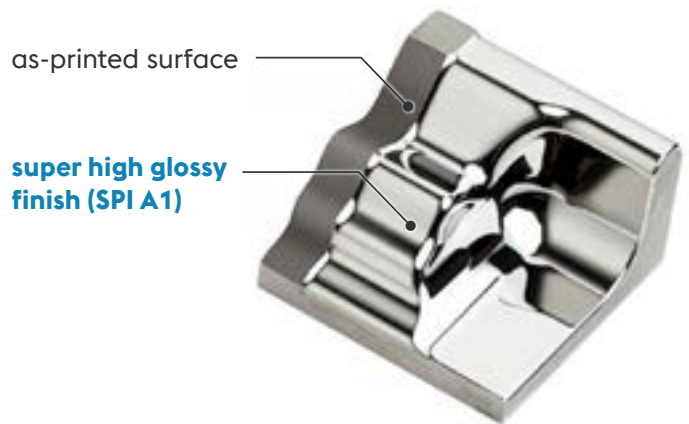
1. Hardness test performed according to DIN EN ISO 6508-1

2. Conventional produced bar material just for comparison;

3. BÖHLER W360 AMPO and BÖHLER M789 AMPO are brands of voestalpine Böhler Edelstahl GmbH & Co KG. Uddeholm Corrax® for AM and Uddeholm Dievar® for AM are brands of Uddeholms AB. The chemical compositions & processing is protected by registered intellectual property rights;

POLISHABILITY

Polishability is a hugely important factor in the Plastic Injection Molding industry. The resulting polishability of the printed material depends on a number of factors such as the printing parameters and the quality of the powder. We have optimised our printing and powder manufacturing processes to ensure our printed inserts can be polished to meet SPI industry standards. The result is our additively manufactured mold inserts for medical technology or lighting applications.



OPTIMIZED DESIGN MEETS OPTIMIZED PRINTING

At voestalpine, we understand that unique tools demand tailored solutions. Through a comprehensive consultation process, we collaborate closely with our customers to develop the ideal solution for each specific application. We support every stage of the manufacturing journey, from the initial concept to the production of fully functional mold inserts. Where necessary, our plastic injection molding experts work with customers to redesign tools, ensuring they meet the precise requirements of the application.



Our data-driven approach to cooling design allows us to analyze processing parameters and mechanical loads, generating detailed computer models that accurately reflect each customer's process. This advanced thermal management optimization is key to achieving the perfect balance between efficient cooling and optimal tool performance.

Our methodology goes well beyond standard conformal cooling designs, delivering exceptional cooling efficiency and performance tailored to your needs.

The integration of additive manufacturing tool design and process simulation is at the core of our expertise. Our AM specialists create extensive computer models to identify potential failure points and eliminate them, preventing premature tool failure. This ensures that the best possible design solution is implemented before we move to production.

To guarantee the highest levels of quality, reliability, and consistency, we oversee every step of the value chain, from powder production to part delivery. Whether for a single part or series production, our rigorous internal quality systems ensure we meet your requirements, every time.



CONVENTIONAL COOLING



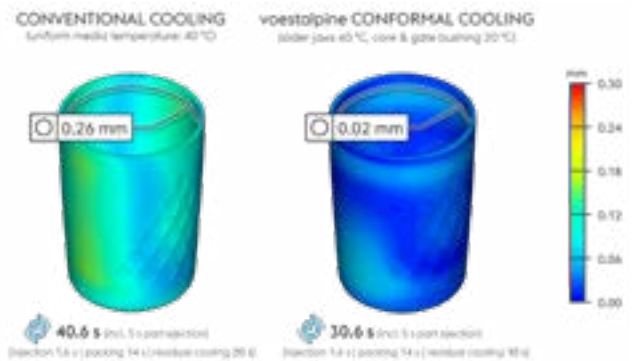
CONFORMAL COOLING

We continuously refine our internal printing processes using advanced tools such as Design of Experiments (DoE), Statistical Process Control (SPC), and Process Monitoring. Ongoing innovation from our AM and materials teams ensures that we deliver superior material properties, even for the most challenging applications. This allows our customers to confidently put their mold inserts into service.

Our deep understanding of the interaction between laser technology and materials, coupled with our expertise in AM and PIM, empowers our customers to enhance their business and gain a competitive advantage.

Unique tools require unique solutions. We support our customers through a detailed consultation process to develop the right solution for the right application. Supporting the manufacturing process from initial concept through to functional parts. Where needed our PIM experts can help our customers re-design tools according to the exact requirements of their application. Our data driven approach to cooling design analyses processing parameters and mechanical loads to develop detailed computer models of the customer process.

This method of optimizing thermal management is essential to ensure the right balance between efficient cooling and the mechanical performance of the tool.



This process goes far beyond regular conformal cooling channel design. We provide you with optimized cooling performance.

AM tool design and process simulation go hand in hand. Our AM experts generate extensive computer models to help identify potential failure modes and remove these problem areas before they can cause premature tool failure. This process ensures the best possible design solution is adopted before we print the part.

CONFORMAL COOLING SOLUTIONS INSERTS FOR TEST TUBES



[Here](#) you can find out more about voestalpine inserts for test tubes

DETAILS:

- » Optimized conformal cooling structures that enable our customers to perform stable & highly efficient production with a minimized cost per plastic part produced.
- » Reduce overall cycle time when compared to conventionally manufactured drilled cooling channels.
- » Improved part tolerances are also achieved through homogeneous and conformal cooling design, leading to decreased scrap rates

CUSTOMER VALUE:

- » Improved cycle time up to 30%
- » Improved part tolerances
- » High gloss polishability with state-of-the-art surface quality (similar to 1.2083)
- » Higher wear resistance compared to copper beryllium inserts
- » Corrosion resistant material with improved crack resistance

INSERTS FOR SYRINGES



[Here](#) you can find out more about voestalpine inserts for syringes

DETAILS:

- » Reduce overall cycle time by up to 15% compared to sprinkler cooling by using conformal cooling
- » Increased profitability by using our corrosion-resistant AM Inserts for Syringes

CUSTOMER VALUE:

- » Improved cycle time up to 15%
- » Improved part tolerances
- » High gloss polishability
- » Improved crack resistance

INSERTS FOR PET PREFORMS



[Here](#) you can find out more about voestalpine inserts for PET-preforms

DETAILS:

- » Single part design resulting in minimized production risk compared to other technologies
- » Improved part tolerances due to more homogenous temperature distribution

CUSTOMER VALUE:

- » High gloss polishability (similar to 1.2083)
- » Improved crack resistance

INSERTS FOR FOOD CONTAINER LIDS



[Here](#) you can find out more about voestalpine inserts for food container lids

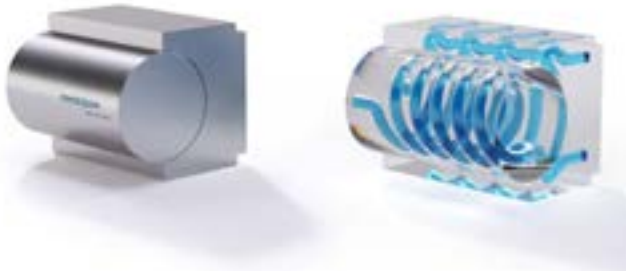
DETAILS:

- » Homogeneous temperature distribution leveraging conformal cooling can reduce the overall cycle time by up to 15% compared to conventionally manufactured products
- » Increased wear resistance in gate area due to our high hardness material grades (56 HRC)

CUSTOMER VALUE:

- » Less warpage due to homogeneous temperature distribution due to (conformal cooling)
- » High ductility
- » Improved crack resistance
- » Corrosion resistant material

INSERTS FOR CYLINDRICAL CONTAINERS



[Here](#) you can find out more about voestalpine inserts for cylindrical containers

DETAILS:

- » Optimized conformal cooling solutions, enabling a stable and highly efficient production with a minimized cost per plastic part produced.
- » Homogeneous temperature distribution can reduce the overall cycle time by up to 26% compared to conventionally manufactured products.
- » Our AM solutions increase profitability by using our corrosion-resistant Inserts for Food Container Lids.

CUSTOMER VALUE:

- » 26 % reduction of cycle time
- » Improved part quality due to conformal cooling
- » Improved crack resistance

INSERTS FOR BOTTLE CAPS



[Here](#) you can find out more about voestalpine inserts for bottle caps

DETAILS:

- » Optimized conformal cooling solutions, enabling a stable and highly efficient production with a minimized cost per plastic part produced.
- » Made from premium steel, inserts do not contain copper beryllium - a potentially toxic element in standard inserts.
- » PIM companies confirmed premium functionality & profitability of our corrosion-resistant inserts for bottle caps.

CUSTOMER VALUE:

- » Higher wear resistance compared to copper beryllium inserts
- » Reduced cycle times
- » Single part design minimizing production risk due to leakage
- » Improved crack resistance



STANDARDS FOR INJECTION MOLDS

In addition to our custom solutions, such as additively manufactured mold inserts with conformal cooling, we provide ready-to-install components designed to enhance part quality while reducing rejects, maintenance, and machine downtime.

Our product range features advanced filters that effectively prevent clogging in small cooling channels. Leveraging the full potential of additive manufacturing, we also offer melt filters that minimize pressure loss, ensuring optimal performance and efficiency. Additionally, we utilize premium materials from Böhler/Uddeholm to produce corrosion-resistant, porous venting inserts that facilitate efficient gas release from the mold.

We continually expand our standard portfolio to introduce new possibilities for customer molds and enhance the overall efficiency of your processes.

SOLUTIONS FOR MOLD VENTING

VENTING STRUCTURES



DETAILS:

- » Microscopic porosity allows for a targeted release of trapped air & ensures the mold venting during the injection phase
- » Additive manufacturing allows for application specific geometry
- » Easy and customized integration into the mold.
- » Corrosion-resistant high part quality allows stable venting quality throughout mold lifetime.
- » Improved overall equipment effectiveness

Technical data

Surface quality	Ra from 2.4 to 3.4 μm
Recommendation for machining	EDM (recommended) or High-Speed Cutting
Maintenance	<ul style="list-style-type: none"> » Back flushing via channel using compressed air » Ultrasonic cleaning with plastic solvent

CUSTOMER VALUE:

- » Defect prevention by targeted air release to minimize scrap rates
- » Improved part quality
- » High venting performance
- » Porosity depending on the required venting



SOLUTIONS FOR MELTING PROCESS

FLOW FILTER X AND V



DETAILS:

- » Nozzle filters prevent contaminations in the plastic melt from entering the mold
- » Flow Filter X combines filtration and mixing properties reducing masterbatch consumption
- » Flow Filter V provides extremely low pressure drop (up to 65% compared to comb filter)
- » Corrosion-resistant throughout mold lifetime.
- » Tailored and standard sizes dimensions available

Technical data

Material	Premium Materials from BÖHLER/Uddeholm
Hardness	49 – 51 HRC

CUSTOMER VALUE:

- » Trouble-free injection molding
- » Minimal increase in injection pressure compared to no filter
- » Lower maintenance and downtime costs
- » Better part quality
- » Easy cleaning
- » Long lifetime due to premium material composition



GENERAL MOLD COMPONENTS

COOLING LIQUID FILTER CLF-100



Technical data

Material	Stainless-steel 1.4305
Temperature range	-10 to 260 °C
Nominal pressure	PN16
Heat Treatment	customized
Conformal cooling	customized, conformal

DETAILS:

- » Star-shaped stainless-steel sieve offers exceptional filtration performance preventing particles larger than 100 µm from entering the cooling channel
- » Engineered for water-/oil based coolants
- » Maximal coolant flow with an impressive flow rate of up to 80 liters per minute
- » Filter can be flanged to the mold or operated directly with a temperature control unit

CUSTOMER VALUE:

- » Prevents clogging of conformal cooling channels
- » Pressure-loss optimized design for high volume flows
- » High filtration capacity
- » Cost effective and easy maintenance and cleaning
- » Operates within wide temperature range





PVD-COATINGS FOR PLASTIC INJECTION MOLDS

PVD coatings are created in a high vacuum by converting metal into a vaporous state and simultaneously adding a reaction gas. With different temperatures (starting from 200 °C) we can deposit layers of 2-8 µm.

Our in-house research and development department has developed numerous successful PVD coatings in recent years and presented them to the market. With several centuries of experience in the tooling industry, we have a deep insight into the entire value chain, which extends from the material selection to the finished tool.

- » Combination with friction-reducing layers possible
- » Variable layer structure (nanostructures, multilayer, monolayer)
- » Chemical and mechanical decoating possible
- » Very good adhesion to the substrate
- » Very good impression of textured and polished surfaces
- » Very good dimensional accuracy and contour accuracy
- » No hardness drop
- » No influence on the microstructure with suitable material selection

		TiN*	TiCN*	CrN/CrN-Multilayer	EXXTRAL®-Plus	DLC
THERMO-PLASTICS	Polyolefine - PE, PP, PB	+		++		+++
	Styrene polymerisates - PS, SB, SAB, ABS, ASA	+++		++		
	Chlorine-containing polymerisates - PVC			++		
	Fluorine-containing polymerisates - PTFE, PVDF			++		
	Acetan resins - POM	++		++		
	Polyamide - PA	+++		+++	++	++
	Linear polyester - PC, PBT(B), PET(P)	+++		+++		++
	Polyarylenethene - "PEEK, PPS, PSU, PES, PPE, PPO"	+	++	+++	+++	
	Polyimide - PI	+++				
	Cellulose ester - CA, CP, CAP	+++				
	Polyacrylates - PMMA	+++				
	Polyurethane - TPU			+++		
THERMOSETS	Polyurethanes - PUR			+		
	Aminoplastics - MF, UF, MP	++		+++		
ELASTOMERS	Polyurethanes - PUR			+		
	Synthetic rubber - NBR, EPDM, SI			++		
	Fluorinated elastomers - Multipolymer-TPF, FPM			++		
WEAR TYPES	Abrasion	++	+++	++	+++	+
	Adhesion	+	+	++	+	+++
	Corrosion		+	+++	++	++

+ = suitable

++ = well suitable

+++ = very well suitable

*Ultrafine on request



HEAT TREATMENT

To achieve higher material strength, better wear resistance and improved corrosion behavior of a tool or component, the heat treatment process is essential. It is our goal to provide you with a one-stop shop solution, from the initial stages of material selection to the final steps of post-treatment recommendations.

We offer a wide range of heat treatments through our worldwide distribution network. This allows us to optimize our products for your individual requirements.

We currently offer heat treatment for tool steels such as, high alloy cold work steels, hot work steels, plastic mold steels, high speed steels, PM steels and special materials in 58 locations around the globe.

Our main services are:

» Vacuum Hardening

Our vacuum heat treatment process helps you achieve higher strength of material, better wear resistance and improved corrosive behavior of the components.

» Gas Nitriding

In the gas nitriding process, nitrogen diffuses into the component surface and builds up the so-called connection layer on it.

» Plasma Nitriding

This process enables partial nitriding to be carried out in the same way as in the gas nitriding process. Furthermore, in addition to the covering by means of paste, this process offers the possibility of mechanical covering.

» Induction hardening

The induction hardening process is suitable for steels with a carbon content of at least 0.3%. Here the component surface is brought to hardening temperature by means of an inductor.

SUSTAINABILITY

THE LATEST TECHNOLOGY AND NEWEST ENVIRONMENTAL STANDARDS

At our production sites – in Hagfors in Sweden and Kapfenberg as well Mürzzuschlag in Austria – we set new standards for production quality, process reproducibility, and environmental impact. In addition to using resources responsibly, we are constantly implementing new measures for environmentally friendly processes and production.

Sustainable production processes and the use of the best possible environmentally friendly technologies have been an essential part of our environmental philosophy for decades.

With our integration of products, services and technical advisory we create a profound impact on our business area.



HIGHEST PRODUCTION QUALITY

As the world's leading manufacturer of tool steel, our high-performance materials are specially developed for the tooling industry.

Safe, efficient production lines with minimum downtime are of great importance in the injection molding industry around the world. Our state-of-the-art production processes such as protective gas electroslag remelting or powder metallurgy enable us to fulfil the highest quality standards.

Through our unique service network, we create long-lasting performance that meets the needs of our planet and future generations. We work closely with our customers on these demanding applications.

Leading by example, we enable our customers to engage in sustainable initiatives while also driving our suppliers and partners to be at the cutting edge of essential transformation processes for tomorrow.

Together, we inspire the change in our industries by always thinking and walking one step ahead.



Reducing **CO₂ emissions** by **50 %** in our operations by 2029



Using **over 90% of recycled** scrap and secondary raw materials in our production processes by 2030



Contributing to the voestalpine group target of reducing **CO₂ emissions by 25% in our supply chain** by 2029

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OCTOBER_2024_EN

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ONE STEP AHEAD.