



ADDITIVE MANUFACTURING
for the plastic injection moulding industry

ADDITIVE MANUFACTURING

The next dimension in Plastic Injection Molding (PIM) tooling

For decades, we have supplied high performance tool steels for the PIM industry, as a result of which we understand the unique production challenges our customers face.

When developing successful additive manufacturing (AM) solutions, customer fulfilment and technical knowledge play a key role, therefore we pay close attention to details beyond 3D printing.

Our expertise in additive manufacturing and materials helps us design custom AM solutions for plastic injection molding in conjunction with our customers.

Powder Optimization

We have spent decades developing materials for the plastic injection molding industry, so you can be sure that the powders you use for your tooling inserts are of top quality that provide superior tool life. The same team behind our tool steels are also responsible for the design and manufacture of our AM powders.

BÖHLER M789 **AMPO**

- » Designed for tooling applications, where corrosion resistance is needed
- » Corrosion resistant
- » Recommended hardness 50 to 54 HRC

BÖHLER W360 **AMPO**

- » Designed for high demanding tooling applications like reinforced plastics and HPDC tools where high wear resistance is needed.
- » Recommended hardness in use 50 – 57 HRC
- » High wear resistance and high toughness

Comparison

Grade	Achievable hardness	Corrosion resistance	Wear resistance	Polishability
BÖHLER M789 AMPO	52 HRC	★★★★★	★★★	★★★★★
1.2083 ESR	52 HRC	★★	★★★	★★★★★
BÖHLER W360 AMPO	57 HRC	/	★★★★★	★★★★★
1.2343 ESR	53 HRC	/	★★★	★★★★★

Chemical Composition

BÖHLER M789
AMPO

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

BÖHLER W360
AMPO

C	Cr	Ni	Mo	Al	Ti	Co
0.50	0.20	0.25	4.5	3.00	0.55	free

Mechanical Properties

Based on our own optimized printing parameters we can ensure superior mechanical properties of the printed parts

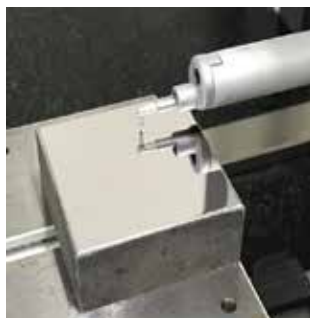
Grade	Properties ¹	Tensile strength ² [MPa]	Yield strength ² [MPa]	Elongation at break ² [%]	Notch impact energy ³ [J]
BÖHLER W360 AMPO	54-56 HRC ⁴	2000 - 2100	1600 - 1800	4 - 6%	★★★
BÖHLER M789 AMPO	52 HRC	1800 - 1900	1700 - 1800	7 - 10%	★★★★★

- All mechanical properties measured were from specimens with a relative density ~99.9%
- Tensile test performed according to method DIN EN ISO 6892-1B, specified by VDI 3405 Part 2 at room temperature, the specimens were built according to DIN EN ISO 50125;
- Charpy V-notch test according to DIN EN ISO 148-1 at 20°C;
- Hardness test performed according to DIN EN ISO 6508-1

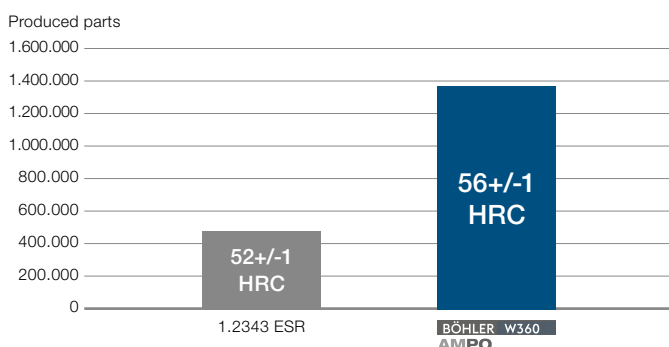
Polishability

The polishability of printed material is a crucial factor in the PIM industry. This depends greatly on several factors, including the quality of the powder, the printing parameters and polishing process.

Our printing and powder manufacturing processes have been optimized so that our printed inserts will be able to be polished to meet SPI industry standards.



Wear resistance comparison household component Gears



Wear and abrasion can be a significant problem when processing glass fibre reinforced plastics. Processing of household component gears made of PA66 + 35GF can be a particular challenge for traditional tool steels. In a recent customer case study BÖHLER W360 AMPO showed superior wear resistance when compared to 1.2343 ESR. The resulting tool life was increased by >300%.

DESIGN OPTIMIZATION

The right tool for the right application requires a custom solution. We offer a detailed consultation process to ensure the right solution is developed. This deep understanding of AM and PIM enables customers to enhance their business operations and achieve a competitive advantage.

Providing manufacturing support from the initial concept to the production of functional parts. Our PIM experts can help our customers re-design tools to fit the needs of their applications when necessary.

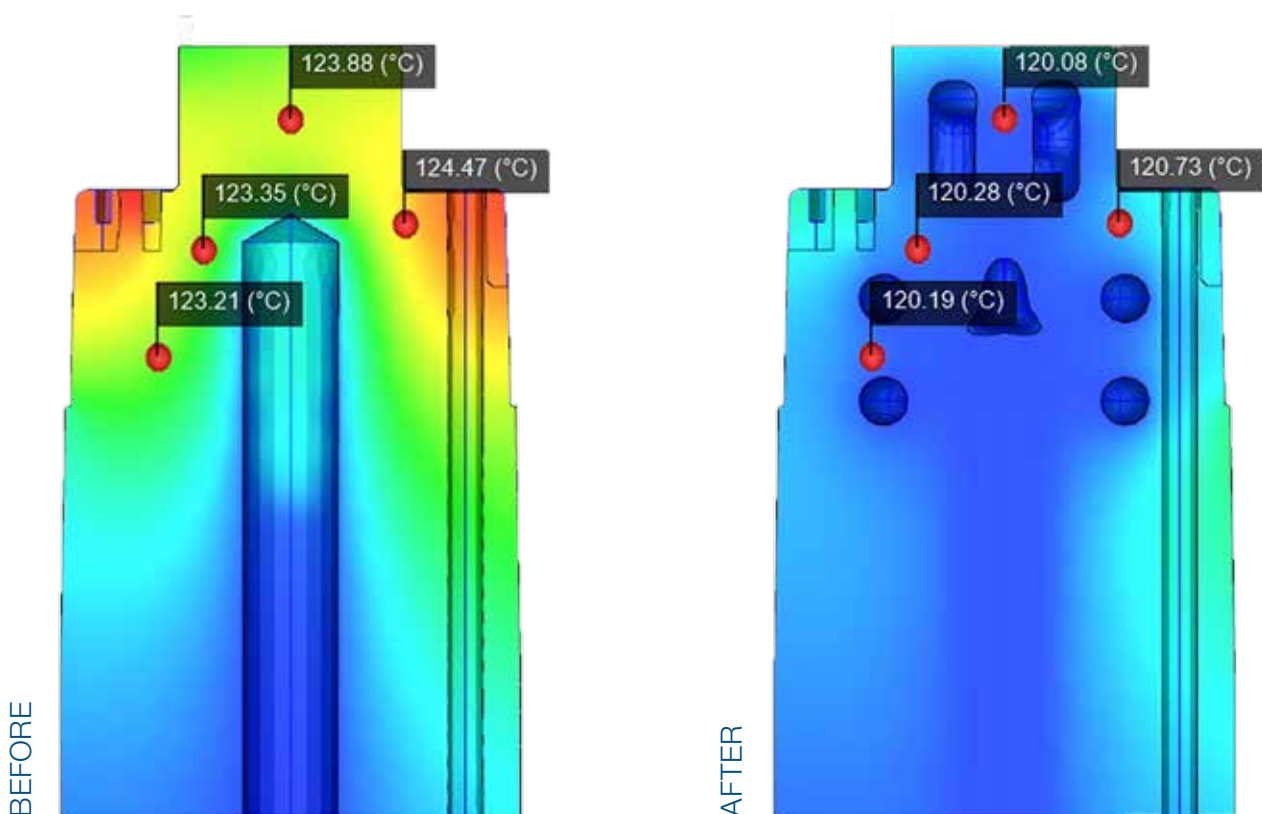
Using data-driven engineering, we develop detailed models of customer processes based on analysis of their processing parameters and mechanical loads. By optimizing thermal management, the right balance is maintained between efficient cooling and the tool's mechanical performance.

This process extends well beyond the regular design of conventional cooling channels.

Designing AM tools and simulating processes go hand in hand. Our AM experts create detailed computer models to aid in the identification of potential failure mechanisms and the elimination of problem areas before they lead to premature tool failure.

From powder production to delivery, we control every step of the value chain to ensure the highest possible part quality, reliability and consistency - regardless of how many parts are ordered or how many series we produce.

The design of experiments, statistical process control, and process monitoring constitute our method of continually improving and refining our internal printing processes.



PROVEN CUSTOMER SUCCESS



APPLICATION: PACKAGING

- » warpage reduction
- » Replace Be-Cu (similar temperature was the goal)
- » Cycle time : -6% when compared to conventional cooled design



APPLICATION: WHITE GOODS

- » Replace Be-Cu
- » When compared to conventional cooled design
 - » Cooling time : - 40%
 - » Cycle time: - 8s



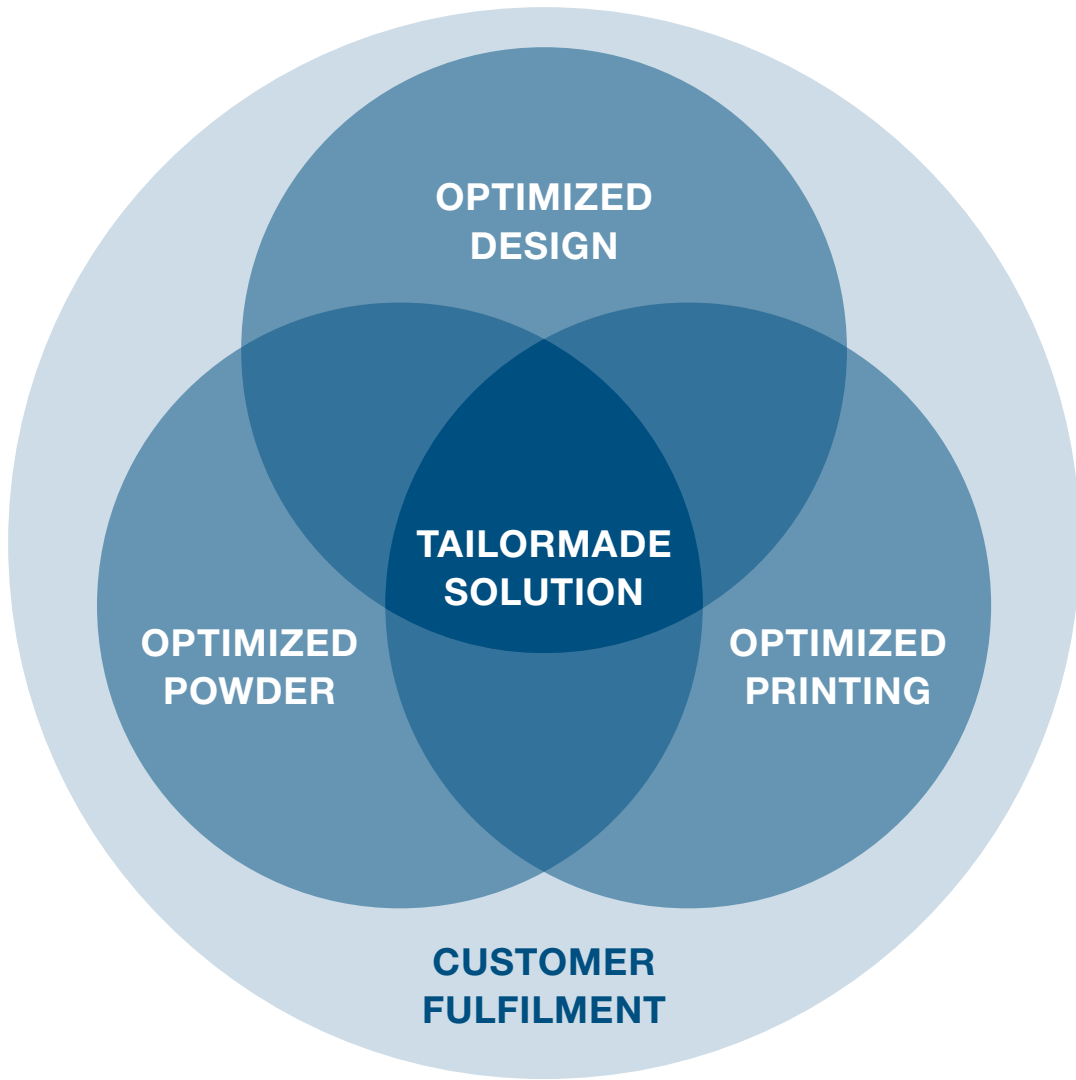
APPLICATION: CORE PIN FOR WINDOW HINGES

- » When compared to conventional cooled design
 - » Cooling time: -20%
 - » Cycle time: - 5.5s



APPLICATION: CORE PIN FOR FAUCET STRUCTURE

- » When compared to conventional cooled design
 - » Cooling time: -30%
 - » Cycle time: - 9s

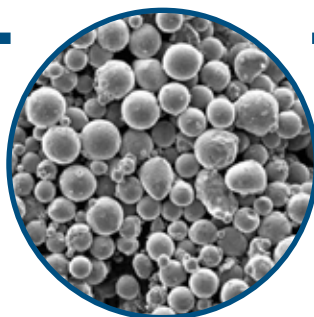


TAILORMADE SOLUTIONS



Design optimised to fit your requirements

+



Powder optimised for your application

+



Printing optimised for superior quality, reliability and efficiency

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- » **Tailormade solution**
- » **Application consulting**
- » **Failure analysis**

FROM CONCEPT TO COMPONENT

With our global positioning as a leader in steel and technology, we offer a full range of production technologies and services across the value chain. We are experienced and equipped to handle from alloy and powder production to design, printing,

heat treatment, PVD coatings and other post-processing. We strive to be your trusted and reliable business partner by offering end-to-end solutions. We deliver tailor-made solutions from concept to component.



Metal Powder



Parameter Development



Design / Simulation



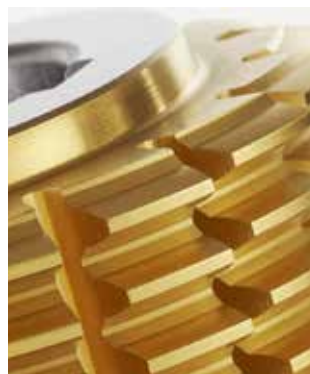
Additive Manufacturing



Heat Treatment



Machining



PVD Coating



Inspection / Testing

The data contained in this brochure is merely for general information and therefore shall not be binding on the company. We may be bound only through a contract explicitly stipulating such data as binding. Measurement data are laboratory values and can deviate from practical analyses. The manufacture of our products does not involve the use of substances detrimental to health or to the ozone layer.



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