

Case Study

Die-Casting Mold Insert with Conformal Cooling



**Optimizing tool construction and
die-casting processes at Oskar Frech**

3D-Printing Success Story

INCREASED SERVICE LIFE

with optimized tempering



PROCESS OPTIMIZATION
to reduce overall cycle times

60% SHORTER COOLING TIMES
through internal cooling channels

Part Data

Designation:	Core for a die casting mold
Industry:	Tooling
Material:	1.2709
Layer Thickness:	40 µm
Build Time:	1d 7h
Machine:	SLM®280



SLM®280

Current Situation

Almost 70 years of experience from tool construction and pressure die-casting

Oskar Frech GmbH began industrial 3D printing over a decade ago and introduced the first FGS (Frech Gating System) distributors for branch gate die-casting in 2007. Without additive manufacturing technology, this FGS procedure would not be possible. The further development of in-house additive capabilities was the next logical step, and subsequently an SLM®280 machine was procured in 2015.

The main applications of additive procedures in die-casting at Oskar Frech are the aforementioned FGS distributors, prototypes and inserts for die-casting molds with the conformal cooling.

For tempering (heating and cooling) segments special channels inside the insert are produced through additive manufacturing. Their structure and form are optimally adapted to the geometry of the specific insert and its function in the die-casting mold. So that the tempering is efficient, the channels must be close to the surface (the contour) of the component.

Thanks to years of experience in tool construction, specialist expertise and an in-depth understanding of die-casting processes, FRECH is able to create the optimal conformal cooling design to optimize thermal processes in die-casting, shorten the process cycle and improve the quality of the product.

Innovations with Selective Laser Melting

Conformal cooling for mold inserts

Oskar Frech currently processes two materials on their SLM®280 machine – an aluminum alloy and tool steel 1.2709. While the aluminum alloy is primarily used to produce prototypes, inserts for die-casting molds with special, complex internal tempering channels for conformal cooling are produced from tool steel 1.2709 on the selective laser melting machine.

The conformal cooling of die-casting mold inserts creates new opportunities for the efficient tempering of cores, wipers and even anvils. Thus, thanks to the conformal cooling designed by Oskar Frech, significant improvements in the process, as well as the quality of the manufactured parts can be achieved.



Fig. 1
SLM®280 at Oskar Frech

Cooling time is reduced from 12 to five seconds, a reduction of nearly 60% achieved with the help of the cooling channels in the cores, wipers and anvils. Consequently, the total process cycle was shortened by over 12% while the manufactured parts exhibit no material defects, only isolated pores and small cavities.

Alongside the increased profitability of the die-casting process and the higher component quality, additional advantages of conformal cooling are realized. Spray processes can be optimized, for example with “minimal spray,” and service life of the mold is increased.

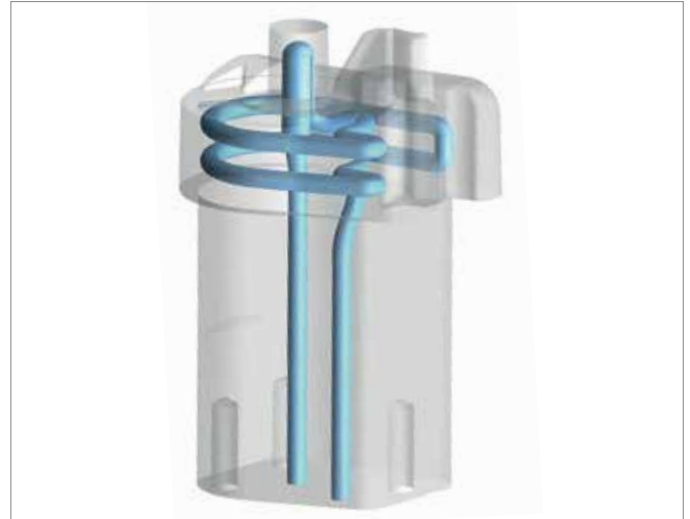


Fig. 2
CAD file of a core with conformal cooling channels inside the insert

Oskar Frech GmbH & Co. KG

Oskar Frech GmbH & Co. KG is a world market leader in die-casting machinery for both hot and cold chamber processes. The company currently employs around 800 people worldwide, with 430 employed in the company headquarters in Schorndorf-Weiler, Germany, with locations in Plüderhausen, Urbach and Velbert.

The company was founded in 1949 by Oskar Frech in Schorndorf near Stuttgart as a manufacturer of casting and injection molds. In 1965, the mechanical engineer Wolfgang Frech took over the company. A driving force of the company, Wolfgang Frech was responsible for the expansion of the product range to cold chamber die-casting machinery as well as the international focus of the company and its 20 subsidiaries.

Summary

Die-casting mold insert with conformal cooling channels

- 60% reduction in cooling time
- 12% shorter cycle times through shorter spraying and cooling
- Improvement of the surface structure of die-casting components through 3D-Printing
- Reduction of mold separating agent
- Increased mold service life
- Highest quality and perfection in the production of die-casting machinery and tools

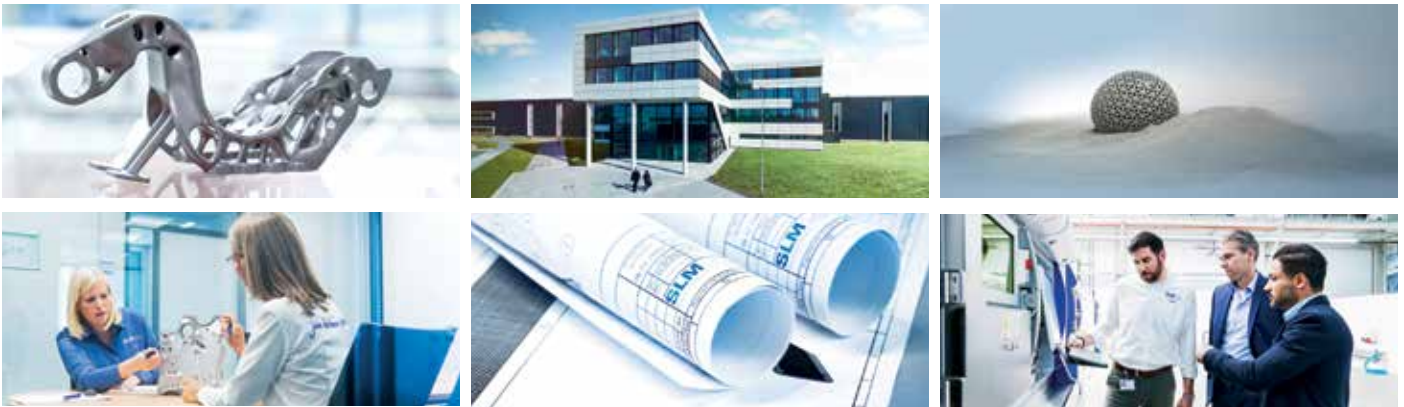


Since then, Oskar Frech GmbH & Co. KG has distinguished itself through the highest quality and perfection in the production of die-casting machinery and tools. Wherever reliability and safety are a priority, the latest technology, the worldwide dedicated customer support and comprehensive service program guarantee customer satisfaction.

SLM Solutions - Technology Pioneers, Innovation Leaders

SLM Solutions helped invent the laser powder bed fusion process, was the first to offer multi-laser systems and all selective laser melting machines offer patented quality, safety and productivity features. Taking a vested interest in customers' long-term success in metal additive manufacturing, SLM Solutions' experts work with customers at each stage of the process to provide support and knowledge-sharing that elevate use of the technology and ensure customers' return on investment is maximized. Optimal paired with SLM Solutions' software, powder and quality assurance products, the SLM® technology opens new geometric freedoms that can enable lightweight construction, integrate internal cooling channels or decrease time to market.

A publicly traded company, SLM Solutions Group AG focuses exclusively on metal additive manufacturing and is headquartered in Germany with offices in China, France, India, Italy, Russia, Singapore and the United States and a network of global sales partners.



SLM Solutions Group AG | Estlandring 4 | 23560 Lübeck | Germany
+49 451 4060 - 3000 | info@slm-solutions.com | slm-solutions.com

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