



CASE STUDY: TOOLING INSERTS

Additive Manufacturing
in the tooling industry

COOLING EXACTLY WHERE NEEDED

OPTIMIZED DESIGN.

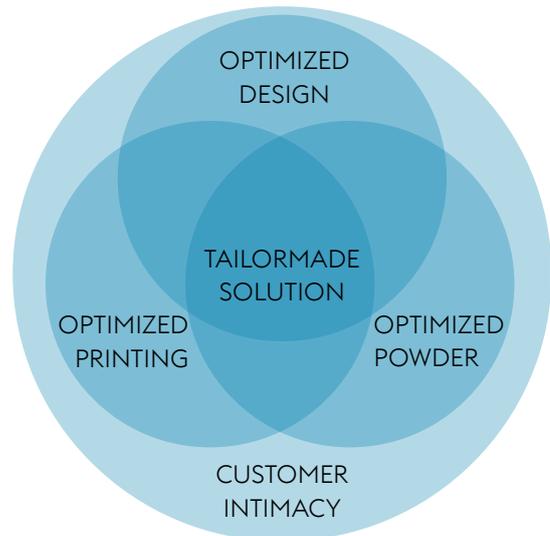
Our data driven approach to cooling channel design analyses processing parameters and mechanical loads to develop a detailed digital twin of your process.

OPTIMIZED PRINTING.

Our long history of developing materials for the Plastic Injection Moulding industry, means the powders we use are of the highest quality and deliver superior tool life.

OPTIMIZED POWDER.

We understand the interactions between laser and material. This deep understanding of AM and the Plastic Injection Moulding industry allows customers to add value to their business.



Three-Pillar Approach: Optimized Powder, Design and Printing.

WHY AM?

Additive Manufacturing can significantly improve the performance of new and existing moulds. Whether, for single cavity or multi cavity tooling, correctly designed and well implemented conformal cooling systems can result in faster cycle times and higher productivity.

DESIGN FREEDOM?

Conformal Cooling allows the tool designer to place cooling channels exactly where need to maximise the cooling efficiency of the tool. Cooling channels can be designed to accommodate tooling hardware such as ejector pins and hot runner systems, allowing existing tooling to be improved with minimum disruption. This level of design freedom is only achievable with Additive Manufacturing and offers superior performance over conventional cooling systems.

Following our philosophy of optimized design, optimized powder and optimized printing this case study discusses the advantages of Additive Manufacturing (Laser Beam Melting) when producing Plastic Injection Mould inserts for the automotive industry.

This case study was developed in co-operation with our partner Eisenhuth.

PROBLEM

Using a conventional “line-of-sight” cooling channel design can result in a non-homogenous cooling profile around the moulded part. This lack of optimized thermal management in specific areas, can lead to part warpage and as a result increased scrap rates.

SOLUTION

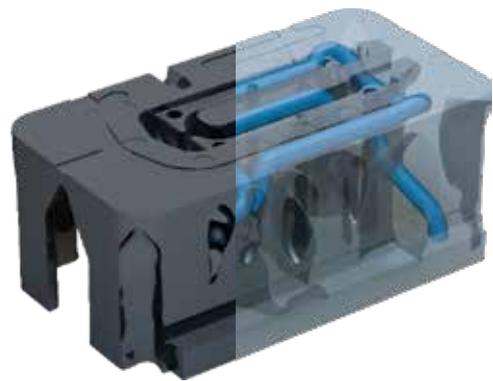
Working closely with Eisenhuth we identified tooling requiring optimization. Employing our three-pillar approach to AM tool design, we applied the following rules:

- » Design a new conformal cooling system to reduce overall cycle time.
- » The new conformal cooling design should address hot spots and reduce part warpage (scrap).
- » The diameter of the cooling channel around the part should be maximised to increase cooling circuit efficiency (5mm diameter).
- » The printing material will be a dedicated Plastic Injection Mould tool steel.
- » Topology optimisation will be used to reduce the overall AM print cost.
- » Use simulation tools to develop a “digital twin” to estimate the potential cycle time improvements and help the customer build a successful business case

COOLING EXACTLY WHERE NEEDED

ANALYSIS

By adopting Additive Manufacturing and implementing conformal cooling Eisenhuth saw significant improvement in both cycle time and product quality. The addition of topology optimisation enhanced the value proposition further, by reducing the printing cost and improving the overall return of investment.

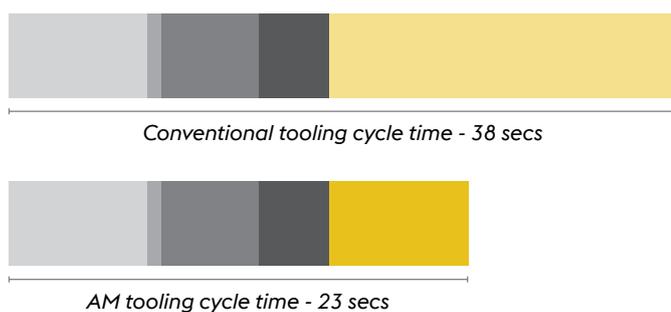


40% CYCLE TIME REDUCTION (38 SECS TO 23 SECS)

60% COOLING PHASE REDUCTION (25 SECS TO 10 SECS)

BENEFITS

In addition to re-designing the cooling system, topology optimisation was used to reduce the overall mass of the tool. This process uses advanced computer modelling to remove unnecessary bulk material from the part and was employed to reduce the overall AM printing time by 30%. The part weight was reduced by 35% (2.3kg to 1.5kg).

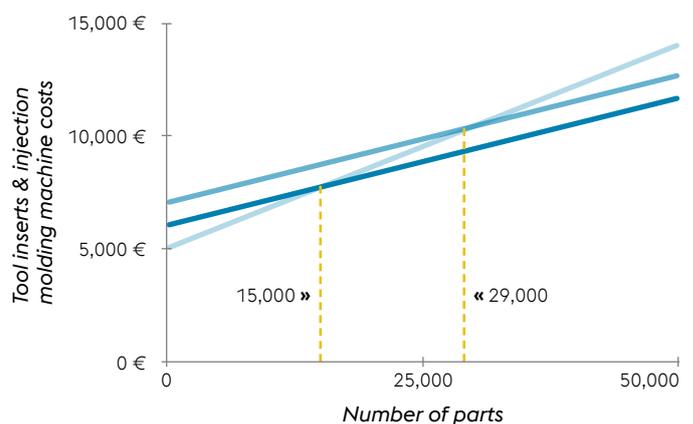


- Tool/machine movement (7s)
- Injection (1s)
- Pack & hold (5s)
- Dosing (10s)
- Part cooling Additive Manufacturing tool inserts (10s)
- Conventional tool inserts* (25s)

*Customer reference part

COSTS

When compared with conventional tooling inserts, the AM tooling with the addition of conformal cooling became cost effective after 15,000 shots (with topology optimisation) or 29,000 shots (without topology optimisation).



- Conventional - Customer reference (cost of tool inserts - 5,000 €)
- Additive Manufacturing (costs of tool inserts - 7,000 €)
- Additive Manufacturing + topology optimization (cost of tool inserts - 6,000 €)

voestalpine Additive Manufacturing Center

Hansaallee 321

40549 Düsseldorf, Germany

+49 211 522 2310

additive@voestalpine.com

www.voestalpine.com/additive

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ONE STEP AHEAD.