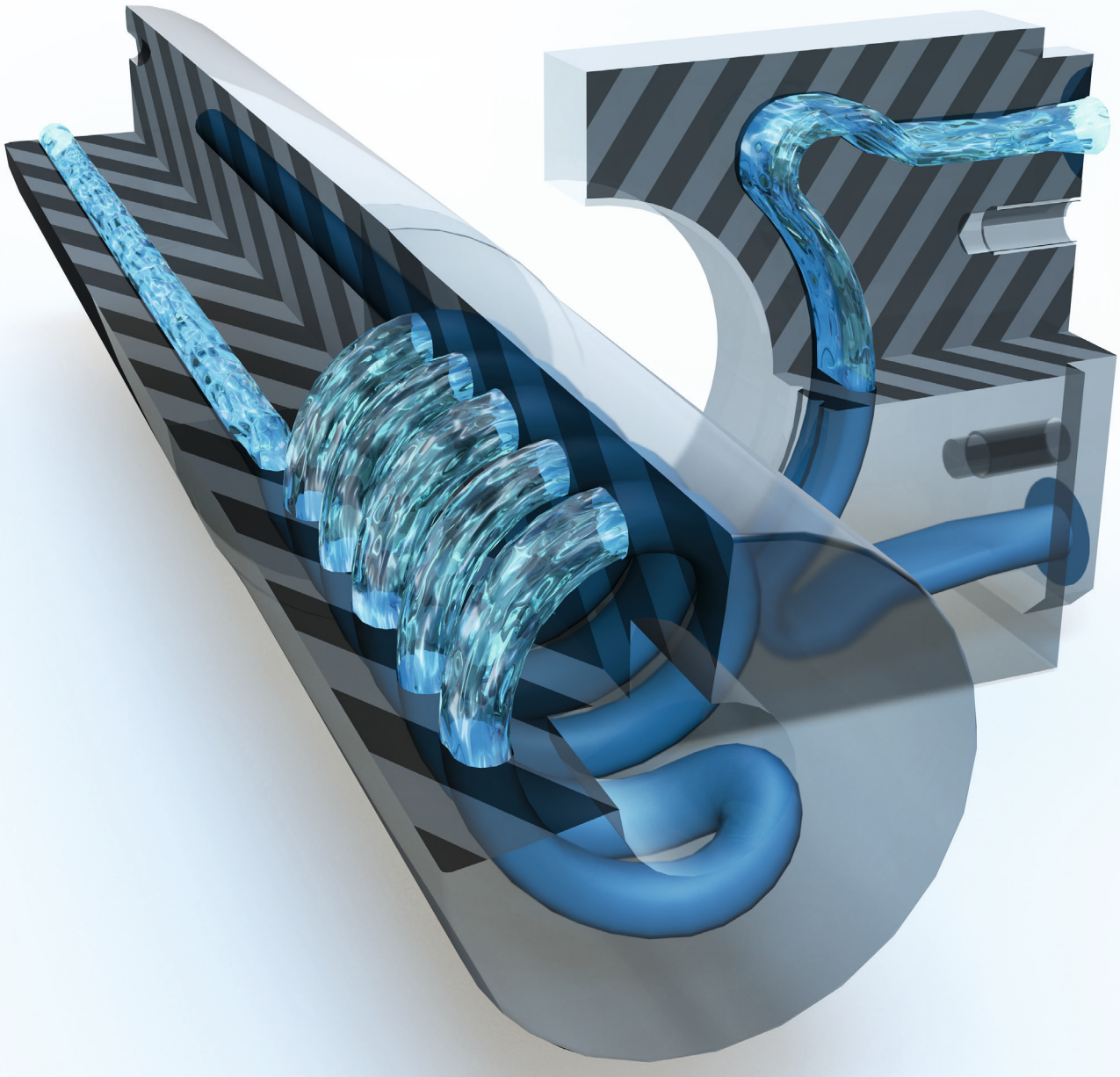
CASE STUDY: MEDICAL CONTAINER

Additive Manufacturing in the tooling industry



voestalpine Additive Manufacturing
www.voestalpine.com/additive

voestalpine
ONE STEP AHEAD.

COOLING DOWN
EXACTLY WHERE NEEDED

Conformal Cooling designs for the tooling industry show high growth potential for Additive Manufacturing. With this new dimension of producing tooling inserts, the cooling channels can be placed exactly where they are needed. Alongside straight cooling systems used in in-mold drilling channels, Additive Manufacturing can set new standards in the reduction of cooling down periods and reaching a top-level of quality with faster cycle times.

In this case study the advantages of Additive Manufacturing for the production of a Medical Container will be discussed, analyzed and documented as a showcase of the high potential of Additive Manufacturing in this area.
(This case study was developed at the Advanced Remanufacturing and Technology Centre (ARTC) within a cooperation of different partners)

THE DESCRIPTION

With its curved hollow shape, a non-homogenous cooling can result in warpage, thus meaning major losses in quality. By using a linear cooling channel, the curved bottom parts of the container makes some areas difficult to reach.

IN SHORT

The curved forms of this Medical Container may not be reached by traditional linear in-mold drilling channels.

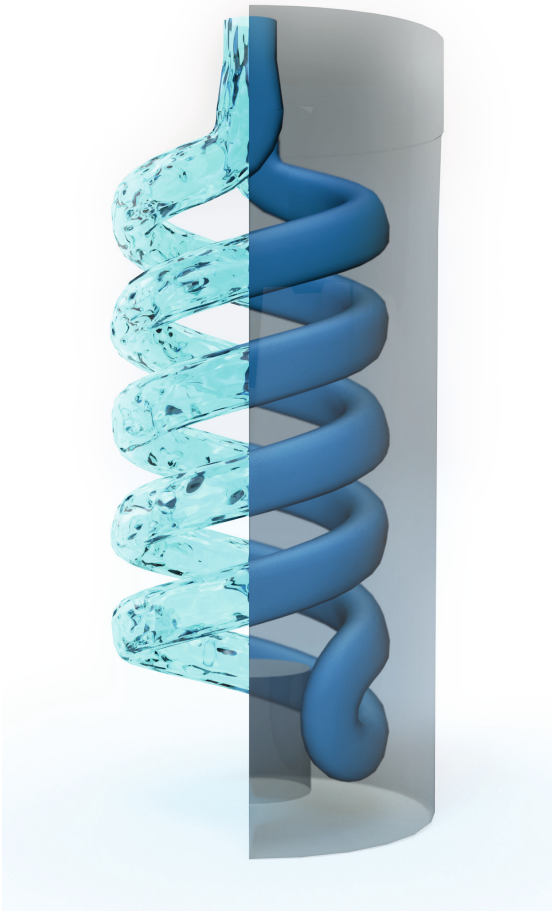
THE AM SOLUTION

A single cavity mold base was specified for the production - cavity, core and slider inserts have been identified as the parts with the potential to be re-designed for conformal channels. Following rules were applied in redesigning the tooling inserts:

- Cooling channels to conform around the product region showing the highest heat
- Cooling channels routed as close to the hot spots as possible
- Cooling channels to be more than 3mm away from the product region, and more than 3mm apart from channel to channel
- Minimal need for support

In order to improve the cooling efficiency, the cross-section shape of the channel was redesigned while the cross-sectional area of the channel was kept unchanged, keeping the conventional circular diameter as a reference to ensure that the flow rate would be similar.

The build orientation was also taken into account when designing the channel shape to ensure that the cooling channels could be self-supporting.



THE ANALYSIS

By using molds constructed with Additive Manufacturing, better results in terms of quality and a reduction of cycle times were achieved.

Injection molded products using the conventional inserts were warmer at the ends of the container than the rest of the container body. This was not observed for the injection mold products using the conformal cooling insert.

Why? The temperature distribution was not as uniform for the conventional insert as for the conformal cooling insert, and that the re-designed conformal cooling channels for the slider inserts helped to improve the cooling of the thread area.

Result: more homogenous part properties and a reduced cycle time of about 25%

DIMENSIONS

The form of the products produced by the conformal cooling insert were slightly better: The outer and inner radius at 20mm from the top of the container seems to display a lower discrepancy from the CAD data for products produced by the conformal cooling inserts than those produced by conventional cooling inserts.

FORM

Looking at the spread of the dimensions measured along the container (at 20mm, 35mm and 50mm from the top of the cylinder), it was observed that the products produced by the conformal cooling inserts appeared to have better form. This is due to the walls of the containers seeming to deviate more from the target.

COSTS

Based on the cycle time, the cost benefits were investigated. The table shows the tool cost for each type of tool (the insert tool-life was assumed to be around 5 million shots). In all cases the higher costs in producing Additive Manufacturing tools were easily outperformed by better part quality and especially by the reduced cycle time.

	Mould tool of		
Costs	1-cavity	4-cavity	8-cavity
with conventional inserts	23,525 USD	70,201 USD	120,209 USD
with conformal cooling inserts	28,025 USD	86,992 USD	146,282 USD
Tooling cost difference	-4,500 USD	-16,791 USD	-26,073 USD
Overall no. of parts	1,500,000	6,000,000	12,000,000
Cycle time difference	25.6%	25.6%	25.6%
Opportunity gain	19,052 USD	76,207 USD	152,414 USD
Overall gain (+) / loss (-)	**14,552 USD**	**59,416 USD**	**126,341 USD**

This dataset was created in cooperation with ARTC

CONTACT US

Our team supports you with consulting, application development, design and manufacturing of parts with additive manufacturing technologies.

Global website:

www.voestalpine.com/additive

Centers of Excellence:

Düsseldorf, Germany
voestalpine Additive Manufacturing Center
Hansaallee 321
40549 Düsseldorf, Germany
Phone: +49 (211) 522-2304
E-Mail: additivemanufacturing@voestalpine.com

Singapore
voestalpine Additive Manufacturing Center
25 Pioneer Crescent
628554 Singapore
Phone: +65 6303 8787
E-Mail: am-sales.singapore@voestalpine.com

Mississauga, Canada
voestalpine Additive Manufacturing Center
2595 Meadowvale Blvd.
Mississauga, Ontario, Canada L5N 7Y3
Phone: +1 (800) 665 8335
E-Mail: am-sales.northamerica@voestalpine.com

Salzgitter, Germany
voestalpine eifeler Lasertechnik
Gottfried-Linke-Straße 205
38239 Salzgitter, Germany
Phone: +49 5341 18863-0
E-Mail: Info-ELT@voestalpine.com

Houston, USA
voestalpine Additive Manufacturing Center
11869 Cutten Road
Houston, Texas, USA 77066
Phone: +1 (800) 665 8335
E-Mail: am-sales.northamerica@voestalpine.com

Kapfenberg, Austria
voestalpine Böhler Edelstahl
Mariazellerstraße 25
8605 Kapfenberg, Austria
Phone: +43 50304 20 - 0
E-Mail: info@bohler-edelstahl.com

Taiwan
voestalpine Technology Institute Asia
Room B105, No. 2 Wenxian Road
Nantou City, Nantou County, 54041 Taiwan, R.O.C.
Phone: +886 49 2332116
E-Mail: info.vti@voestalpine.com

Hagfors, Sweden
Uddeholm
Uvedsvägen
SE-683 33 Hagfors, Sweden
Phone: +46 563 170-00
E-Mail: info@uddeholm.com

voestalpine High Performance Metals GmbH
Donau-City-Straße 7
1220 Vienna, Austria
www.voestalpine.com/additive

voestalpine
ONE STEP AHEAD.