Conformal Cooling:
Dimensional Improvements and Shorter Cycle Times

Introduction

Medical device suppliers are under pressure to find process innovations that can meet the demands of more complex and tight-tolerance products. One such innovation is the use of conformal cooling in injection molding, an approach that enables more precise and efficient temperature control during the molding process. Working with a third-party mold designer, Teel can create and utilize conformal cooling molds to improve dimensional accuracy, minimize warping, and reduce cycle times compared to molds using conventional cooling.

Conventional vs. Conformal Cooling

Conventional injection molding relies on straight-line cooling channels within the mold that bring water over more limited areas of the part. The straight channels simplify the mold design, but as they are not designed to a part's unique geometry, they offer less efficient cooling and less dimensional control. This trade-off can lead to greater potential for part warping and create longer cycle times.

In contrast, conformal cooling uses cooling channels that are designed to follow the contours of a part. Water is delivered closer to and across more of a part's surface area, speeding up heat dissipation and cooling the part more evenly, which can prevent warping.

This more customized cooling design allows for more dimensional control, which is especially useful for parts with a complex geometry or various wall thicknesses, as water can be directed around and into a complex shape and different amounts of water can be directed to areas of the part with a thicker or thinner wall.

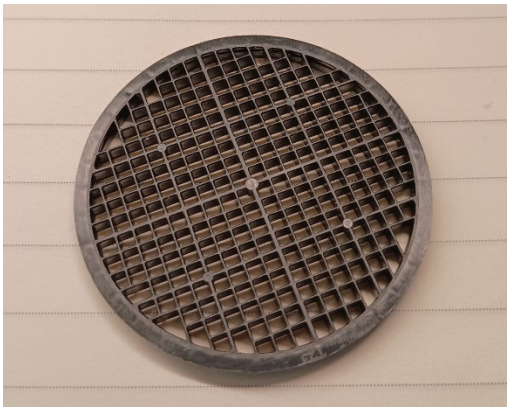
Water flowing over a greater surface area of the part also means the parts cool faster, shortening cycle times and ultimately speeding up time to delivery.

A Conformal Cooling Case Study

One Teel project using a conformal cooling design involved a circular filtration product with a waffled design. A steel core in the mold formed the geometry of the product, which limited where conventional cooling channels could be placed. The most viable option would have been a single cooling channel in the center of the steel core, which would have created uneven heat distribution along the surface. Complicating matters further, having a center ejector pin in the core was critical for this product to ensure any short startup scrap parts were completely ejected from the mold.

As a result, Teel worked with a third-party mold design firm (Dynamic Tool Corporation) who developed a conformal cooling solution. The design was generated by additively manufacturing the top section of the steel core and forming circular channels to run between the ejector pins and closer to the outer diameter, allowing for both better cooling and the addition of the needed ejector pin.

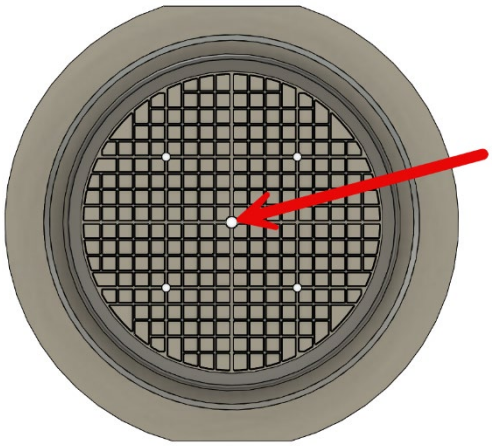
In addition to solving the pin location issue, the use of conformal cooling helps the part to run with faster cycles times and reduced warping compared to conventional cooling.



Water treatment product.

Steel core that forms the part's geometry.

Model showing the two concentric circular conformal cooling channels.



Central ejector pin location.

Conclusion

Teel Plastics recognizes the need for cutting-edge solutions that not only meet stringent regulatory requirements but also enhance the performance and cost-effectiveness of medical devices. Conformal cooling is one example of Teel's commitment to deliver these solutions to our medical partners. Reach out to learn more about our ability to help with your medical device needs from design to production.

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