IGS GeboJagema

Design for Manufacturing: Why, how and when?

By Rob Doorakkers, Chief Innovation Officer, IGS GeboJagema, August, 2017

From Precision to Perfection

Design for Manufacturing: Why, how and when?

Minimized risks, increased production speed and a lower cost price. A toolmaker's Design for Manufacturing (DFM) expertise can have a large impact on your production process. But what is the most effective way to collaborate with a toolmaker? What kind of design changes can you expect and how exactly do those tweaks improve production? Where in the process is the toolmaker best involved? In short: what should you know about working with a toolmaker?

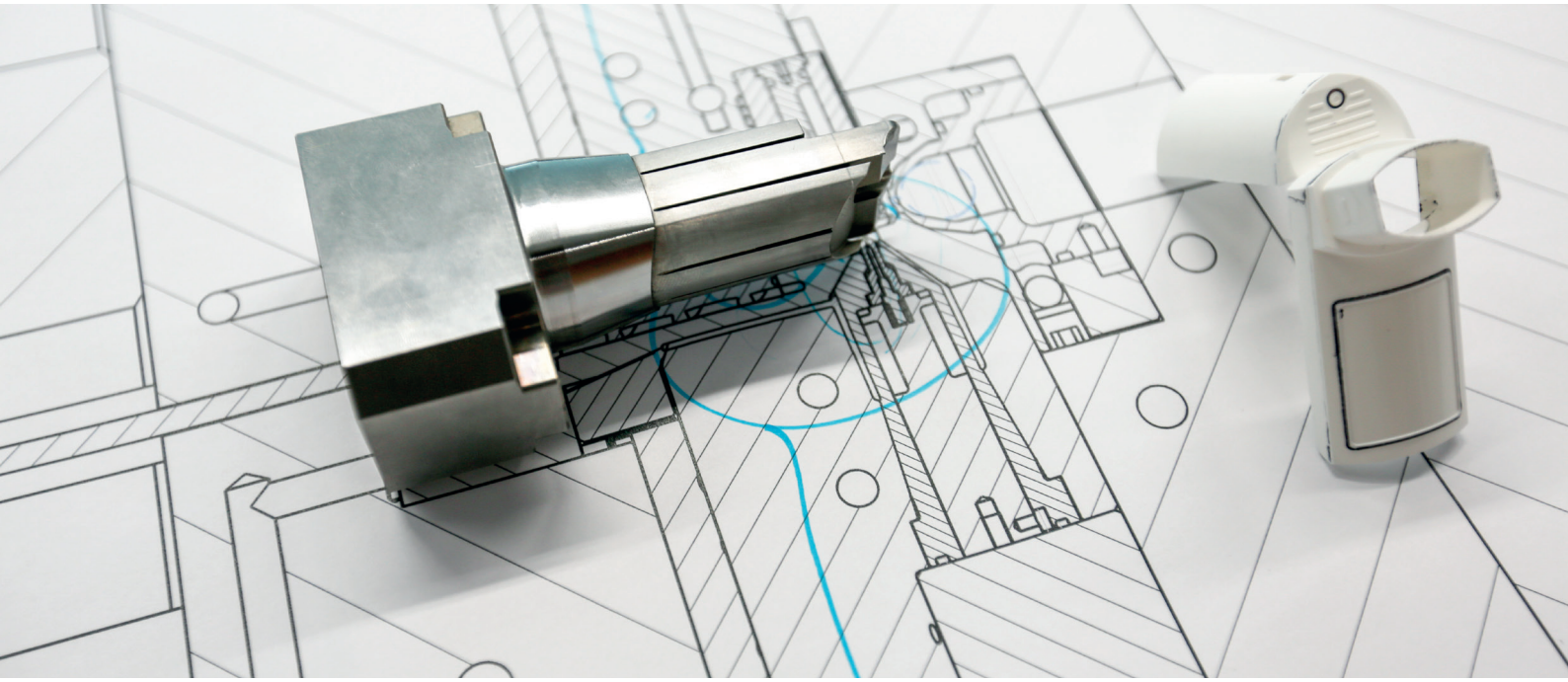
Early involvement of the toolmaker

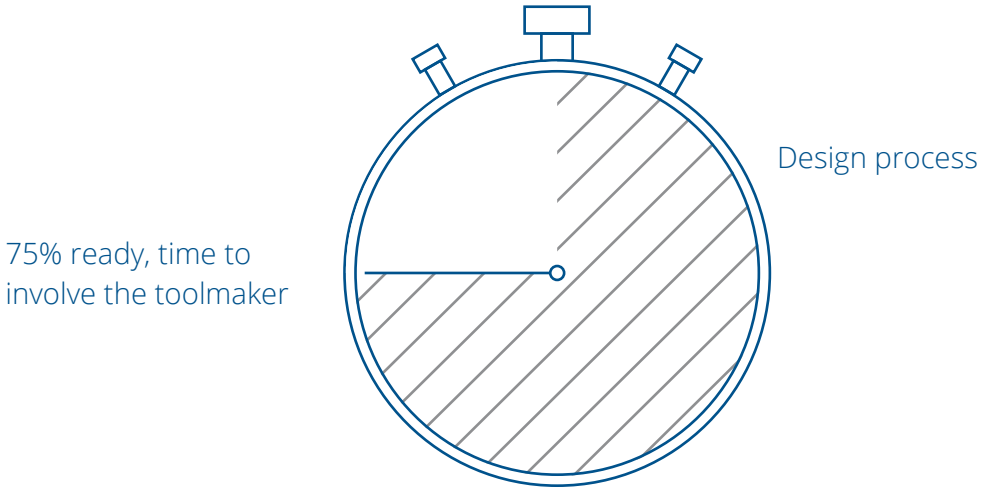
A challenge in the development of a new device in the health care industry or other markets is to involve the toolmaker at the right moment. The development process often looks as follows. Based on their extensive knowledge and experience, the OEM-er and the design agency invest a lot of time and effort in creating a design for their device and its spare components.

After finishing the design, a toolmaker is called upon to create a moulding solution for the product. A mould that ensures long-lasting, high-volume production. Reliability and stability are of course key factors in the project's success.

To meet the customer's requirements, the toolmaker often recommends changes to the component's design. But because the design is all but completed at this stage, implementing these changes will either disrupt the product's development timeline or simply no longer be possible. The customer is left with a choice. Either accept the delays or settle for production equipment that could have been better.

To avoid this scenario and realise the best possible moulding solution, it is important to involve the toolmaker in an earlier stage of the design of the device. At this earlier stage, it will still be possible to reap the full benefits of the toolmaker's Design for Manufacturing expertise.





The 75% Ready-Rule

So when exactly is the right moment to involve the toolmaker? At what stage of the design phase? This question is raised often and for good reason. Timing is everything when it comes to the success of DFM.

The most effective moment to involve the toolmaker is when the component design is 75% ready. At that stage, there is still sufficient time to implement improvements without impacting the project's overall timeline.

Involve the toolmaker too late and the suggested changes will often cause delays. When the component design is approaching the design freeze milestone, the project's mounting time pressure might even make it impossible to implement the changes at all, resulting in a suboptimal production solution for the end component.

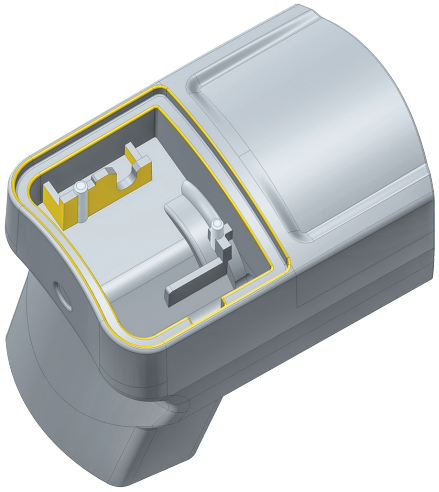
Involve the toolmaker too soon and the toolmaker's input will not be as valuable, as the details of the design will still change frequently and might require a completely different tool concept. While in some cases requesting a toolmaker's input in an early stage can help to choose the right path, generally speaking the tooling concept should not influence the overall device design too much.

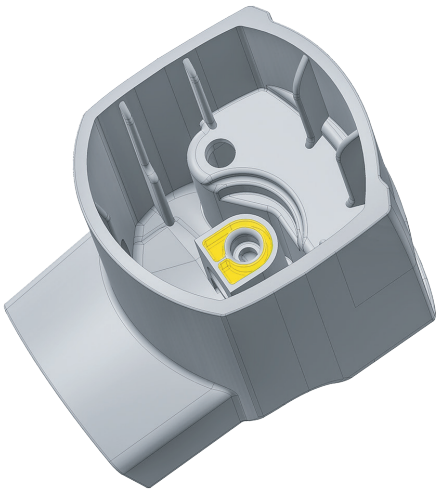
We look for changes that will result in a more reliable and robust tooling concept

A Better Design

There are a number of design aspects that have our attention in every project. Here are some of the most common improvements we make.

Firstly, we look for changes that will result in a more reliable and robust tooling concept. We simplify and/or reduce the number of tool split lines. We make sure the split lines can be made at an optimal angle in order to avoid extensive tool wear during production. We avoid any thin critical steel areas that could weaken cavity details, break during production and damage other cavity details. We also sometimes make minor component changes that can simplify the tool kinetics, slider functions, lifters or multiple ejector stroke, all with the goal of creating a more reliable tool.





By adding adequate draft angles for the used material grade and surface finishes, we avoid scratches or other visual defects and help the part release from the tool. We also foresee potential problems caused by variations in wall thickness in the component in relation to the gating location. Such issues can cause visual problems on the component such as sink marks or filling problems. Overcoming these defects might require high process settings that put unnecessarily high pressure on the tool, which causes quicker tool wear and reduces tool warranty times.

By finding the best ways to get the cooling into the cavities, we avoid weld lines as well as hot and cold spots and achieve optimal filling. This can be done by using a mould flow study, which is usually performed by the component designers or customers. Sharing this mould flow information gives the toolmaker the opportunity to add minor changes that improve tool stability and such.

Lastly, we review the radiuses that tend to be added to all corners nowadays. As features need to be combined, these radiuses often cause issues such as complicated EDM electrodes and affect split lines. Simplifying these radiuses can have a huge effect on tooling costs in the manufacturing phase.

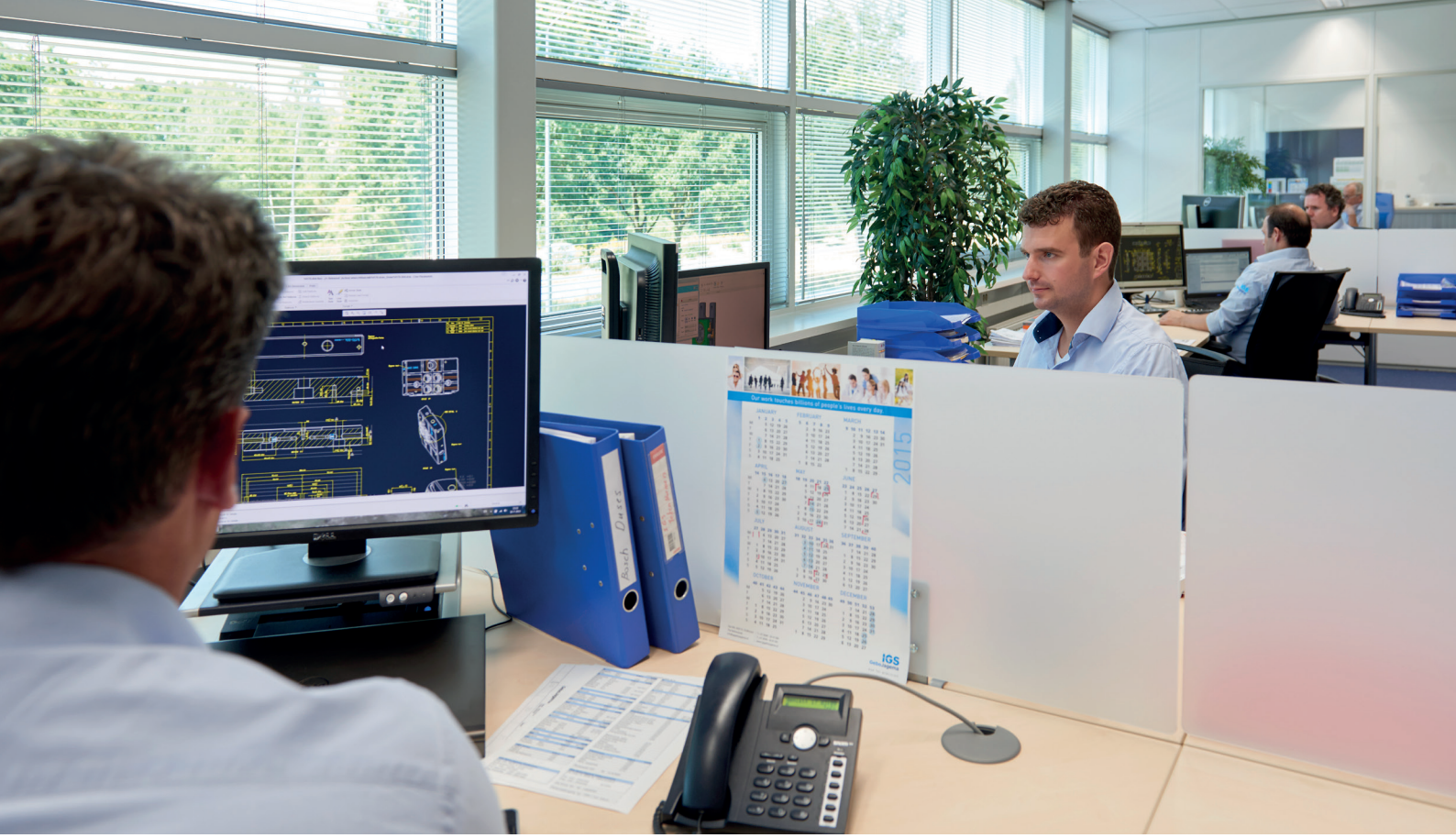
A Toolmaker's Expertise

Involving a toolmaker in the Design for Manufacturing phase has numerous advantages. Using a toolmaker's knowledge allows for an optimal team effort between component and tool designers. It results in the best possible solution from the perspective of both disciplines.

Production stability is the most important driver for DFM involvement. If more robust production equipment can be realized through DFM, that means fewer production stops, more output and improved yield. Tool wear is reduced, meaning fewer spare parts and less preventive maintenance are required.

Secondly, cycle times can be improved. We ensure the visual quality of the component by avoiding strange wall thicknesses and filling problems etc., which allows us to run the tool at an optimum process and achieve the best possible cycle time. Reducing unnecessary hold pressures, hold times and filling speeds brings the pressure down on the entire tool and increases the tool's lifetime.

Lastly, starting DFM work at the right time saves extra design work during the tool design phase and keeps the project's timeline on track.



Design for Manufacturing with IGS GeboJagema

At IGS GeboJagema, we can and want to offer you our DFM capabilities. Our expertise is based on over 70 years of injection moulding tooling experience. We have seen the impact of DFM activities that are well executed and performed at the right time. We have also seen what can happen without DFM...

These decades of tool design experience allow us to identify critical areas in your component design in an early stage. We then improve the design based on our know-how on plastics as well as the expertise that we have grown through our extensive validation process.

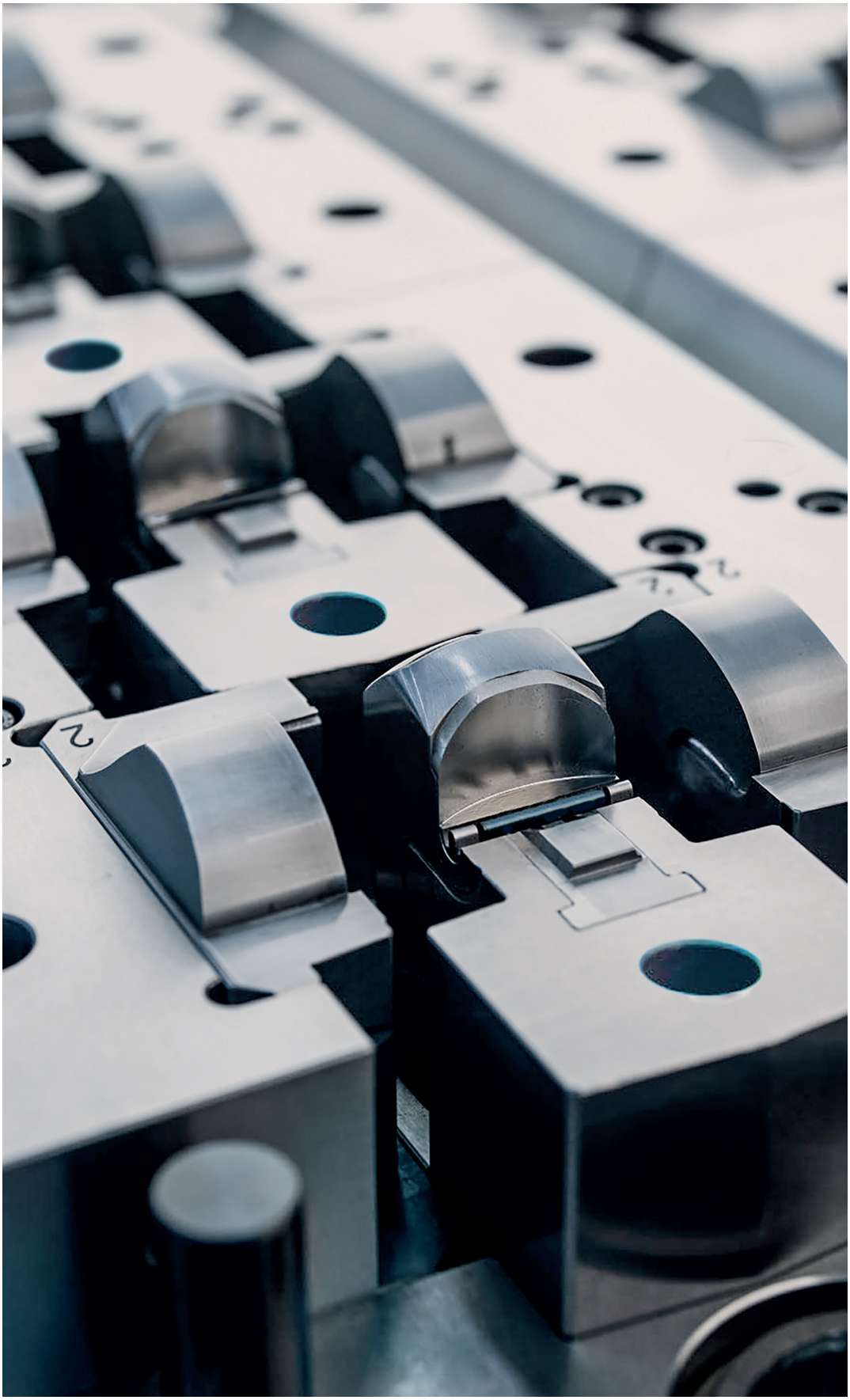
By reviewing 2D drawings upfront, we can make improvements by avoiding unmeasurable or conflicting dimensions. And by reviewing the metrology methods in advance, we avoid problems or discussion by the time the first parts are measured.

DFM in Our Tool Shop

In addition to the DFM work we do for our customers, our team is also constantly working on our internal DFM strategy. Our main goal is to optimise our workflow throughout the tool shop by removing handwork as much as possible and getting closer and closer to fully machined parts. This allows all parts, copy tools and spare parts to be made according to a completely reproducible process that uses the same strategy, equipment and programs. This reproducible process ensures full accordance with the 3D model and drawing as well as 100% interchangeability between the moulds.

The Difference DFM Can Make

Involving the toolmaker at an early stage for DFM leads to more robust production equipment. This saves the system integrator and the end customer time and money and leads to a more relaxed and profitable project for all parties. A few tenths or hundreds of a millimetre can make the difference between a project turning into a nightmare or a resounding success.



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