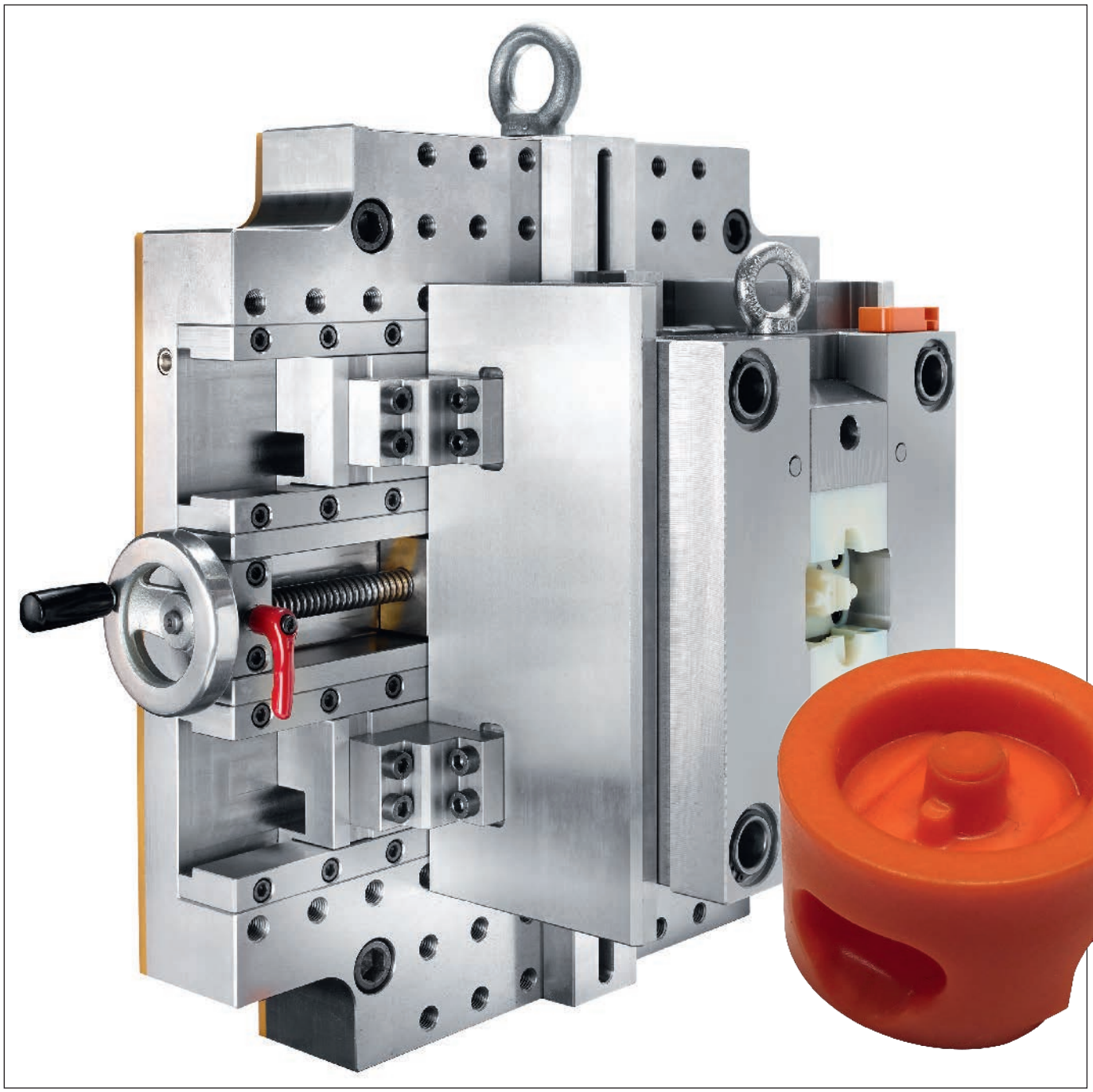
HASCO®

Enabling with System.

Producing prototypes of the HASCO CoolCross

A comparison of three prototype cavity-insert concepts

The standardised HASCO mould system and innovative production processes permit rapid, low-cost prototype production



The idea

Michael Lundbech, a long-standing HASCO customer, from Lundbech A/S intelligent tooling in Ringsted (Denmark), came up with an idea. Wishing to achieve a more homogeneous temperature distribution in injection moulds, avoid hot spots, reduce the installation space and, not least, achieve cost and time savings, he was thinking about a design solution that would allow cooling channels to cross on a single plane. Working together with the team at HASCO, it proved possible to further develop and implement this solution.

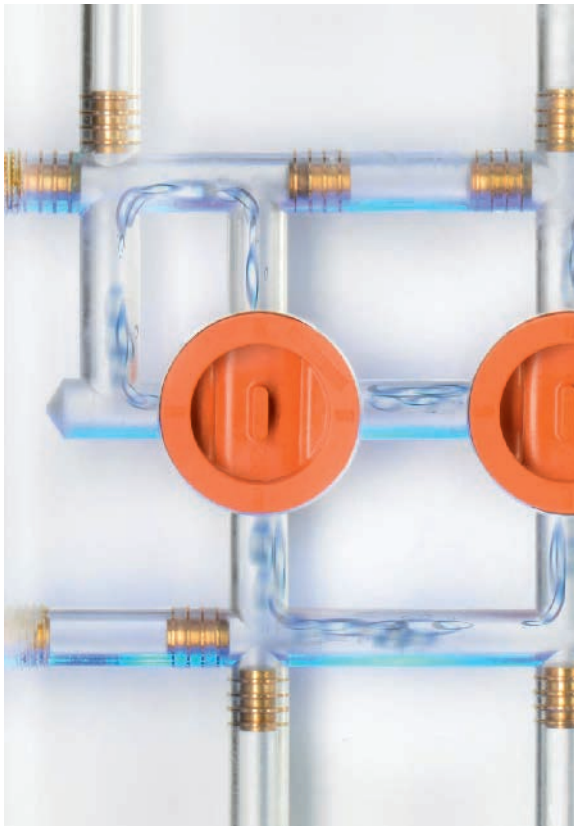
The idea behind the HASCO CoolCross Z99/... had been born. The outcome – a small plastic element that is fitted at the crossing point in the mould – offers the user completely new options for designing the cooling system in the injection mould.

Employing the innovative CoolCross Z99/... it is now possible to have independent cooling channels crossing each other flexibly and inexpensively on the same plane without any major manufacturing outlay. In this way, it is possible to get by with thinner plates and hence fit shorter nozzle, guide and fastening elements, thus achieving cost reductions. And, in addition to this, the HASCO CoolCross allows a combination of transverse and vertical holes.

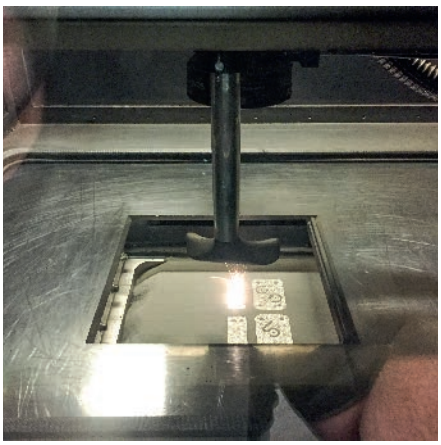
But before this ingenious little part was produced in series and supplied to a large group of customers, the first step was to manufacture and test prototypes.

The Clever Mold System A8500/... and the small-series mould K 3600/... from HASCO in conjunction with interchangeable cavity inserts make it possible to produce prototypes of the HASCO CoolCross Z99/...

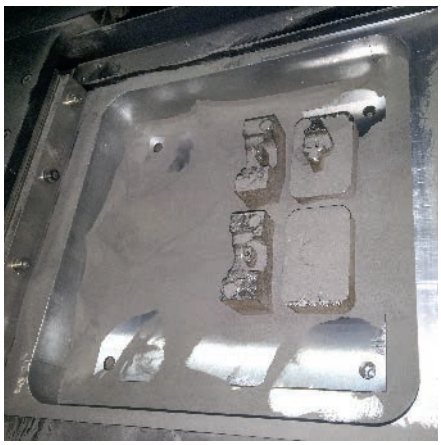
A comparison of three prototype cavity-insert concepts



HSC processing



Additive manufacture of the steel inserts

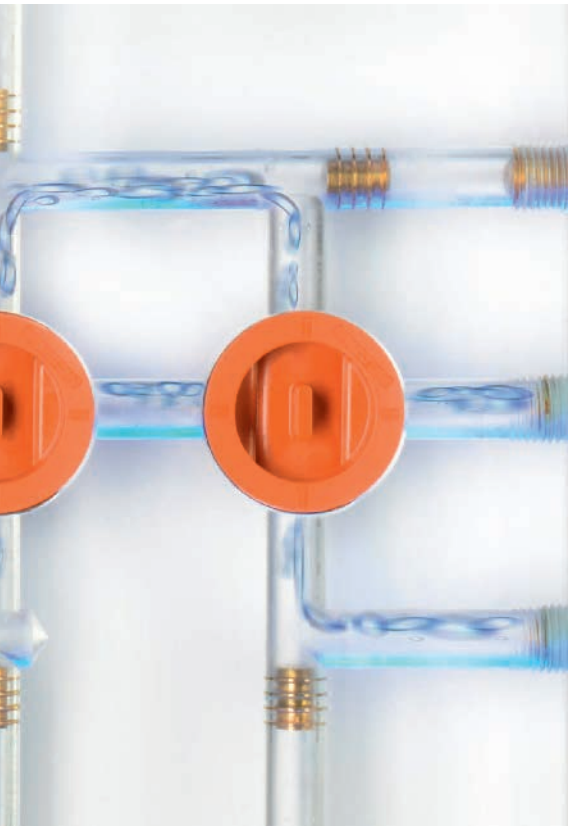


Finished raw parts in the powder bed

Rapid prototyping

Three-phase rapid prototyping processes have currently become established.

A few years ago, it was shown that this 3D technology can also be used to make complete injection moulds for the production of injection moulded, and hence more realistic, prototypes and very small series.

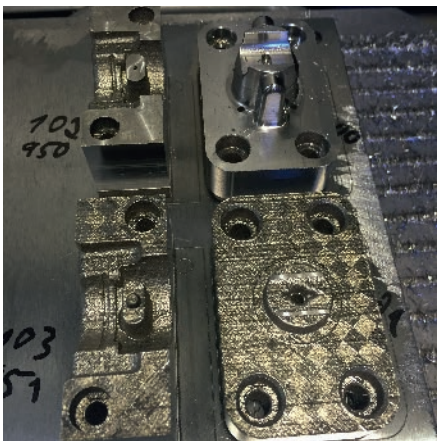


To produce the first CoolCross prototypes, use was made of a combination of the HASCO Clever Mold System A8500/... and the HASCO small-series mould K3600/... in conjunction with interchangeable inserts manufactured by different methods.

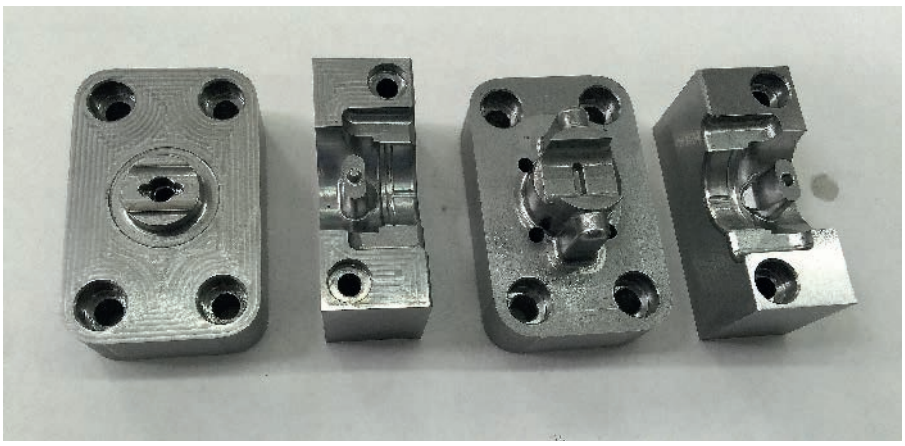
The HASCO small series mould K3600/... was developed for the low-cost production of practical small series. This is a quick-changeable mould, specially coordinated with the HASCO Clever Mold System A8500/..., which permits rapid and efficient mould changing on all the standard injection moulding machines. The Clever Mold System used in conjunction with the small series mould K3600/… reduces both set-up times and mould costs.

The beauty of this approach lies in its simplicity.
A proven quick-change mould, including the cooling system and guides, plus all the necessary connections, is combined with a comparatively small mould insert that can be produced in just a short time.
The time and cost outlay on modifications or variants is then also kept within limits.

It was the big media interest in solutions that had already been presented for both the additive and subtractive manufacture of such cavity inserts that prompted us to study and compare three different processes.



Finishing the blanks



Finished cavity

Steel or plastic? – Additive or subtractive?

If a functional sample of an injection moulded part is required, a number of simple questions essentially have to be clarified to begin with: how quickly is the prototype required, what budget is available, how many prototypes are needed and what quality requirements are placed on the initial sample?

Using the three processes studied, CoolCross prototypes were produced in PE on a 500 kN injection moulding machine. As far as the questions set out above are concerned, each of the three variants has its system-conditioned advantages and drawbacks. The processes were run in cooperation with project partner canto Ing. GmbH of Lüdenscheid. The normal process is the classical chip-cutting (subtractive) process for a cavity insert in a comparatively inexpensive steel or aluminium. In the example investigated, the insert elements were produced in 1.2083 in approximately 40 hours, employing the high-speed cutting (HSC) process.

Since the insert does not have any cooling holes of its own, the cycle time is approximately 69 seconds. Normal series-production volumes of up to 1,000,000 articles can thus be achieved. The quality of the injected parts can be rated as good. The cost can be estimated at approximately EUR 3000 for this version.

The most demanding variant in technical terms, which also delivers the best-quality functional samples, is an additive process. In this case, use was made of an M3 Linear unit from Concept Laser GmbH, and the cavity insert was built up on a layer by layer basis in a bed of powdered metal employing a laser beam. The raw material used (1.2709 steel powder) is comparatively expensive. Generating the elements for the parts to shape the plastic takes a relatively long time, at 88 hours.

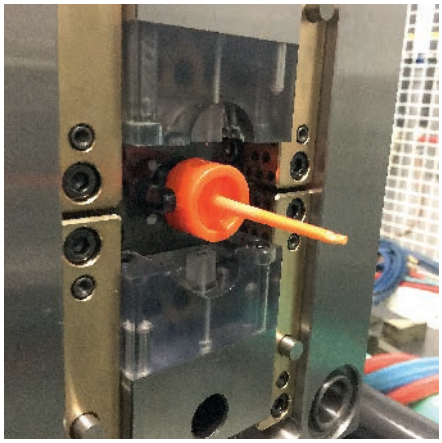
The additive laser sintering process makes it possible to incorporate the corresponding cooling channels, so that cycle times of approximately 26 seconds can be achieved. This insert can similarly be used for series production if it proves to be suitable.
With manufacturing costs of just under EUR 5700, the laser sintering process is thus the most expensive variant.

The fastest method is a special 3D printing process for plastics. VeroClear, a so-called photopolymer, was generated on a Stratasys Objet Connex 500 in a high-resolution printing process. This is comparable with an ink-jet printer and applies the resin in small drops on a layer-by-layer basis. Immediately it has been applied, the resin is hardened by means of UV light (crosslinked).

The elements of the cavity insert are transparent, high-gloss, and similar to PMMA, and can be employed as injection moulding cavities with virtually no finishing work. Since increased flash was to be expected, however, on account of the edge rounding, the sealing zones of the printed components were finished mechanically.

In the example presented here, production

Cavity parts in „Digital ABS“ 3D printed by the Polyjet process!



Sampling the plastic insert

only took about 15 hours. The cost works out at EUR 1100 for a complete cavity insert. Only 15 to 20 shots are possible with an insert, and the quality of the functional samples is no more than mediocre. The quality can, however, be improved by a range of finishing steps.

At 600 seconds, the cycle time is the longest in the comparison. While cooling channels are possible with this process, they do not have any significant advantages, given the thermal conductivity of the plastic.

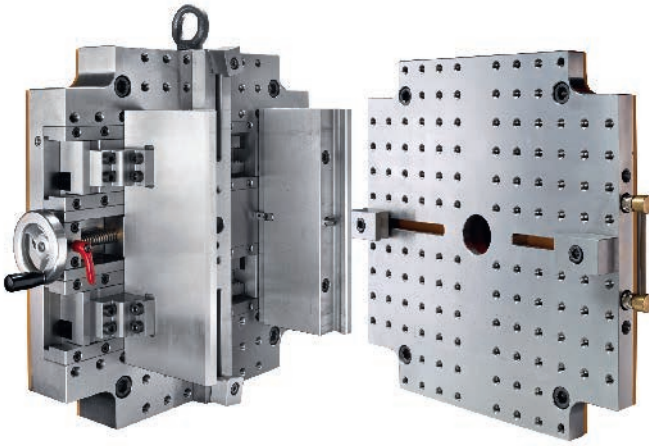
Conclusion

The HASCO Clever Mold System A8500/... in conjunction with the HASCO small series mould K3600/... reduces both set-up times and mould costs.
To produce prototypes of the HASCO CoolCross Z99/... mould inserts were produced by three different methods and compared.

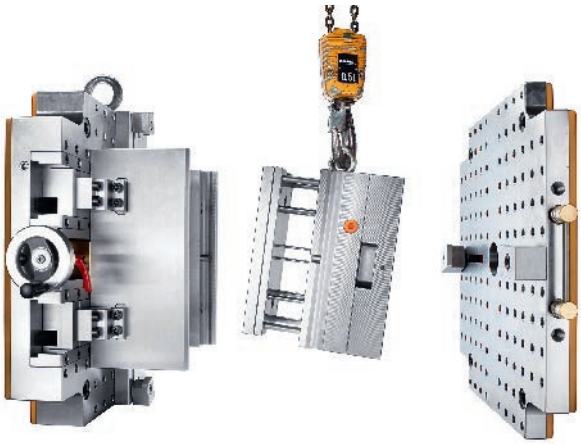
A milled variant without cooling channels is inexpensive and allows prototypes to be produced with medium-length cycle times, in bigger quantities if required. With the laser sintering process, short cycle times can be achieved through cooling channels. The cavity insert is comparatively expensive, it takes correspondingly longer to produce but can then be fitted in a subsequent series mould.

While the 3D printing of acrylic resin can be performed rapidly and is comparatively inexpensive, long cycle times are required and only a few prototypes can be produced. True to HASCO‘s motto of „Enabling with System“, it has been shown once again for this application that the latest technologies coupled with HASCO standard components enable customers to achieve technological advances.

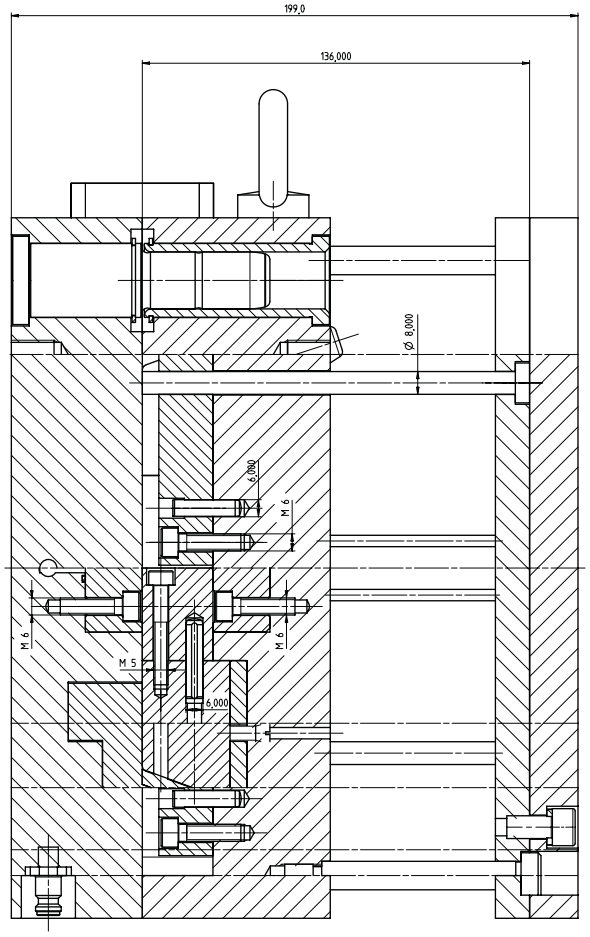
All three processes have their advantages and drawbacks which must be individually assessed for the application in question and used as appropriate.



HASCO Clever Mold System A8500/...



HASCO small series mould K3600/... with A8500/...



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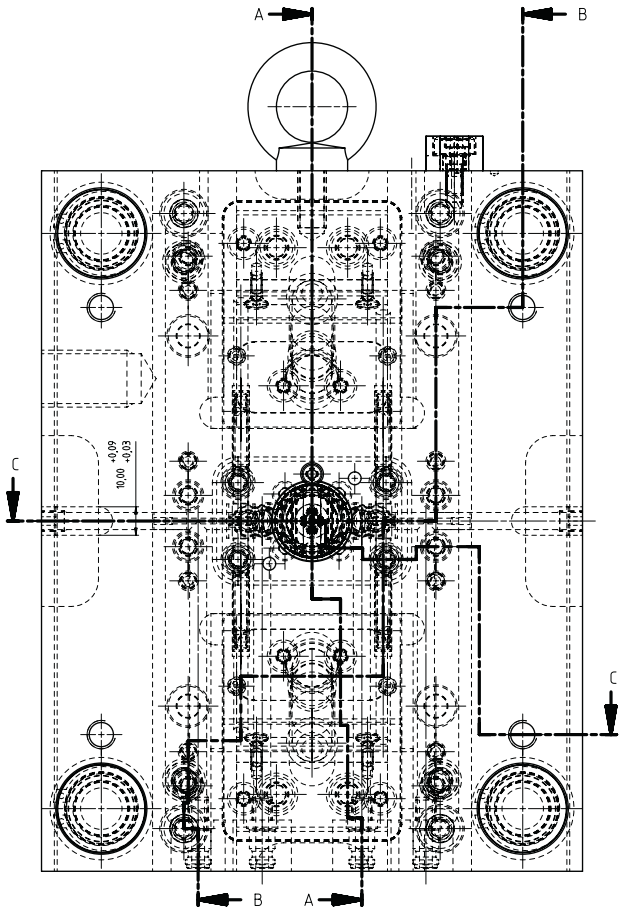

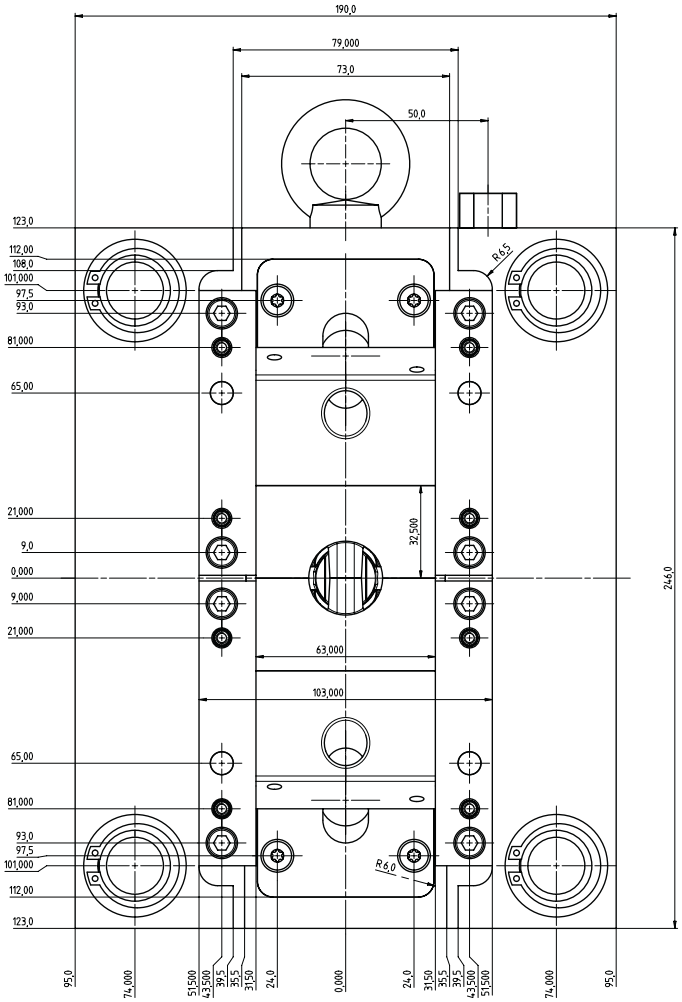

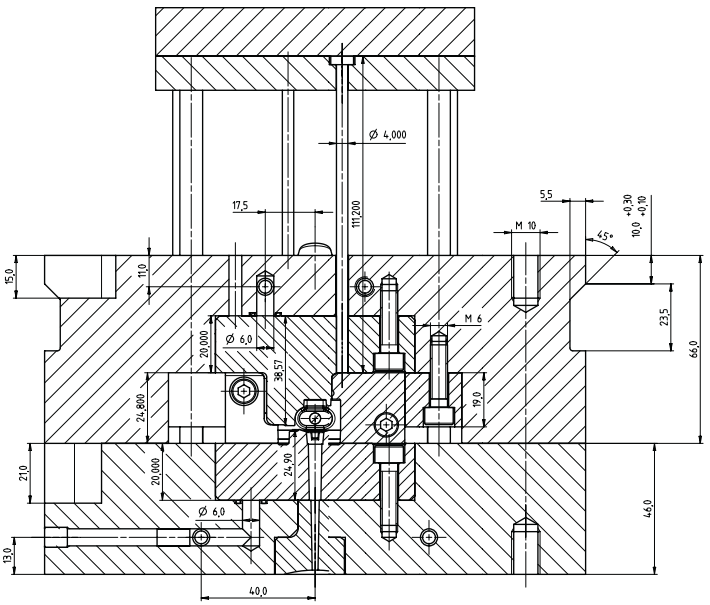

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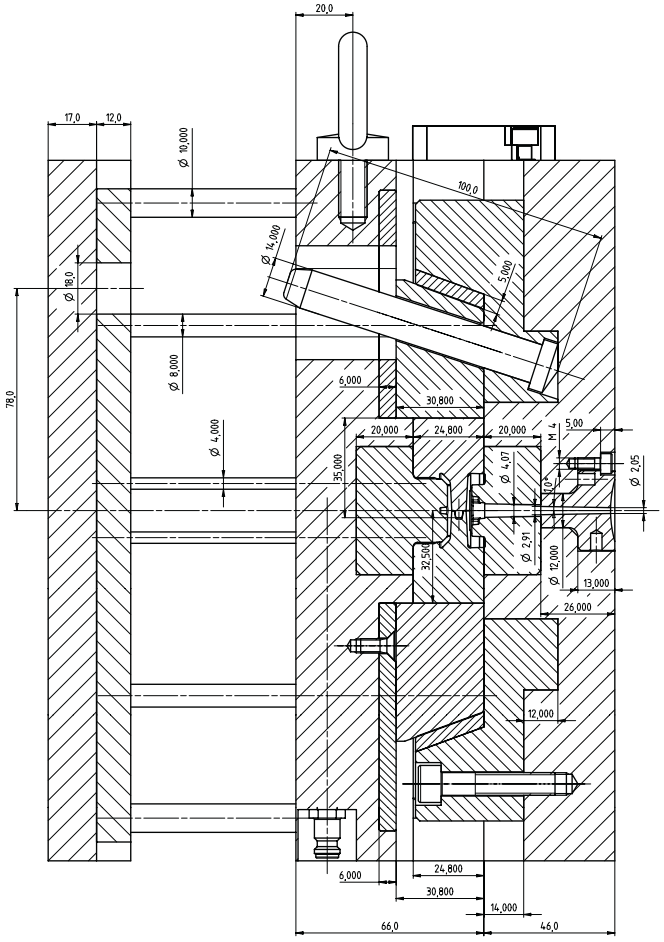
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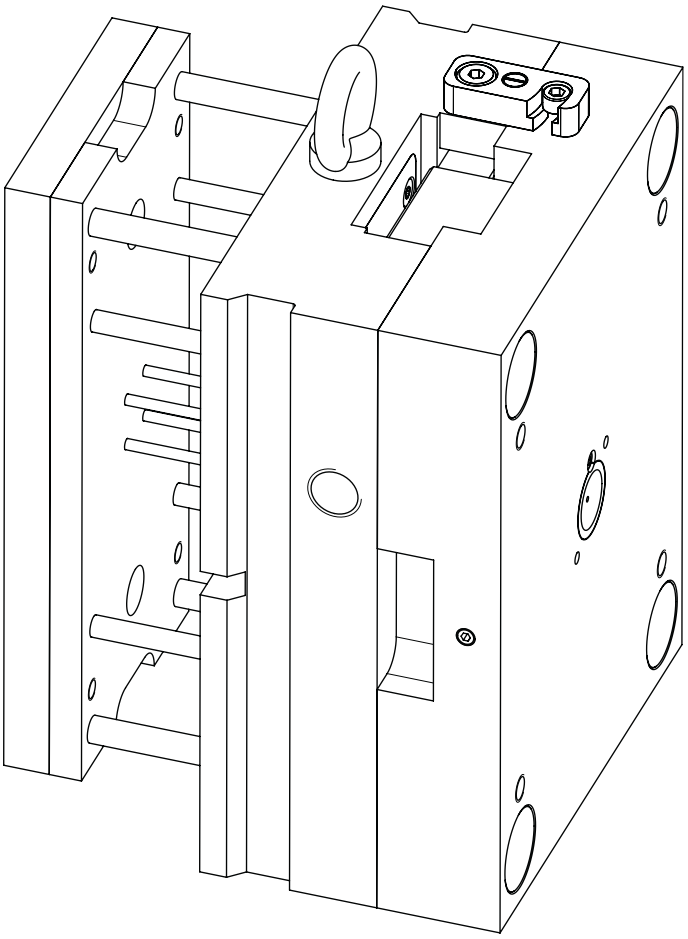

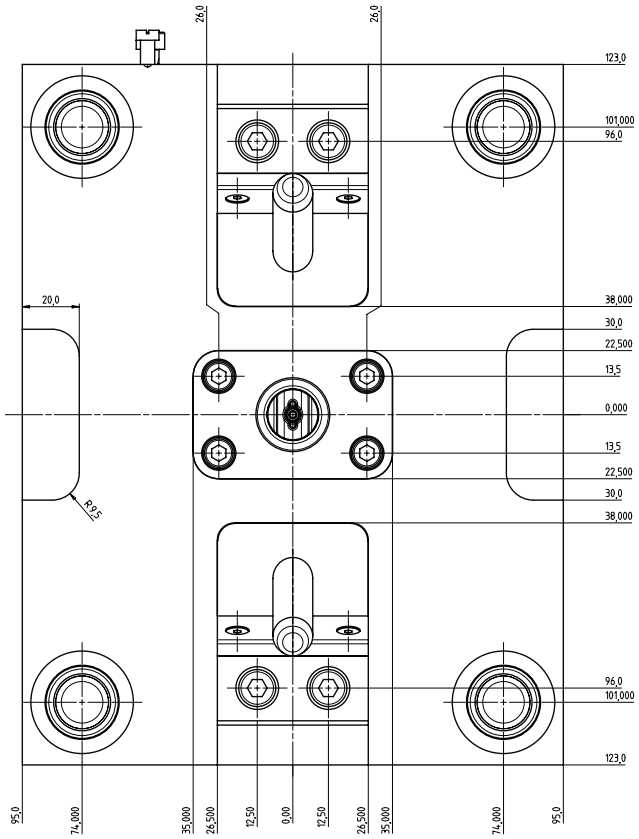
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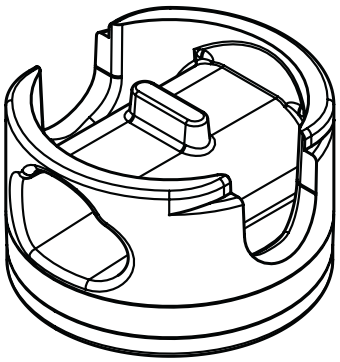

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