

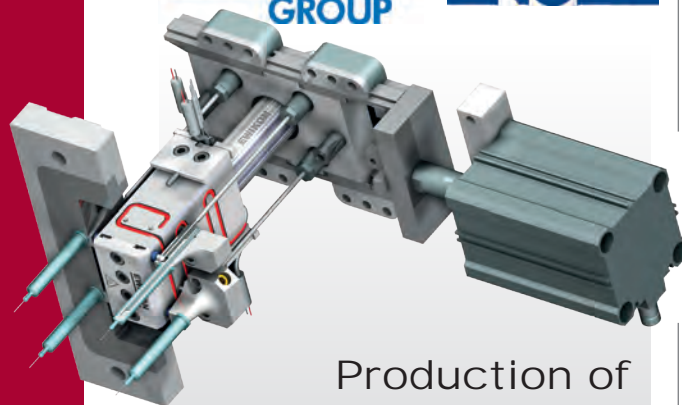
# Hotline **February 2013**



## Shot weights up to 40 grams with direct side gating

Version for large shot weights expands EWIKON range of side gating solutions Page 5

ZAHORANSKY GROUP ENGEL



### Production of disposable syringes

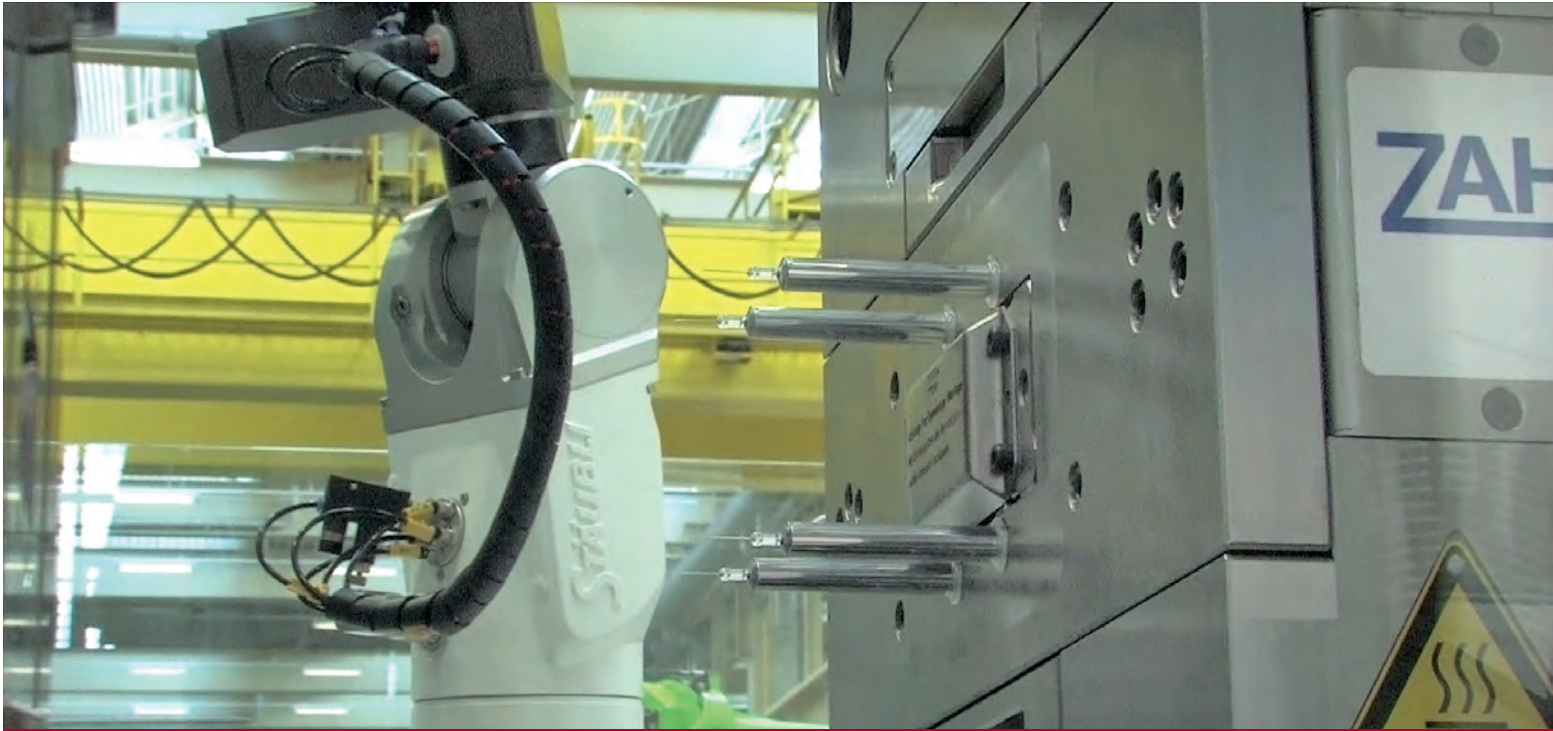
Innovative mould concept with HPS III-MH valve gate technology

Pages 2 - 4



### Side gating and valve gating: Efficient production of a multi-part medical device

Pages 6 - 8



## Advanced valve gate technology enhances efficiency of syringe production

The integration of subsequent working steps into the injection moulding process is increasingly gaining in importance in the medical sector. Mould making and systems technology specialist Zahoransky, machine manufacturer Engel and hotrunner manufacturer EWIKON have realized a demanding application enabling to produce disposable syringes including needles in one working step. This new technology requires a special valve gate hotrunner solution.



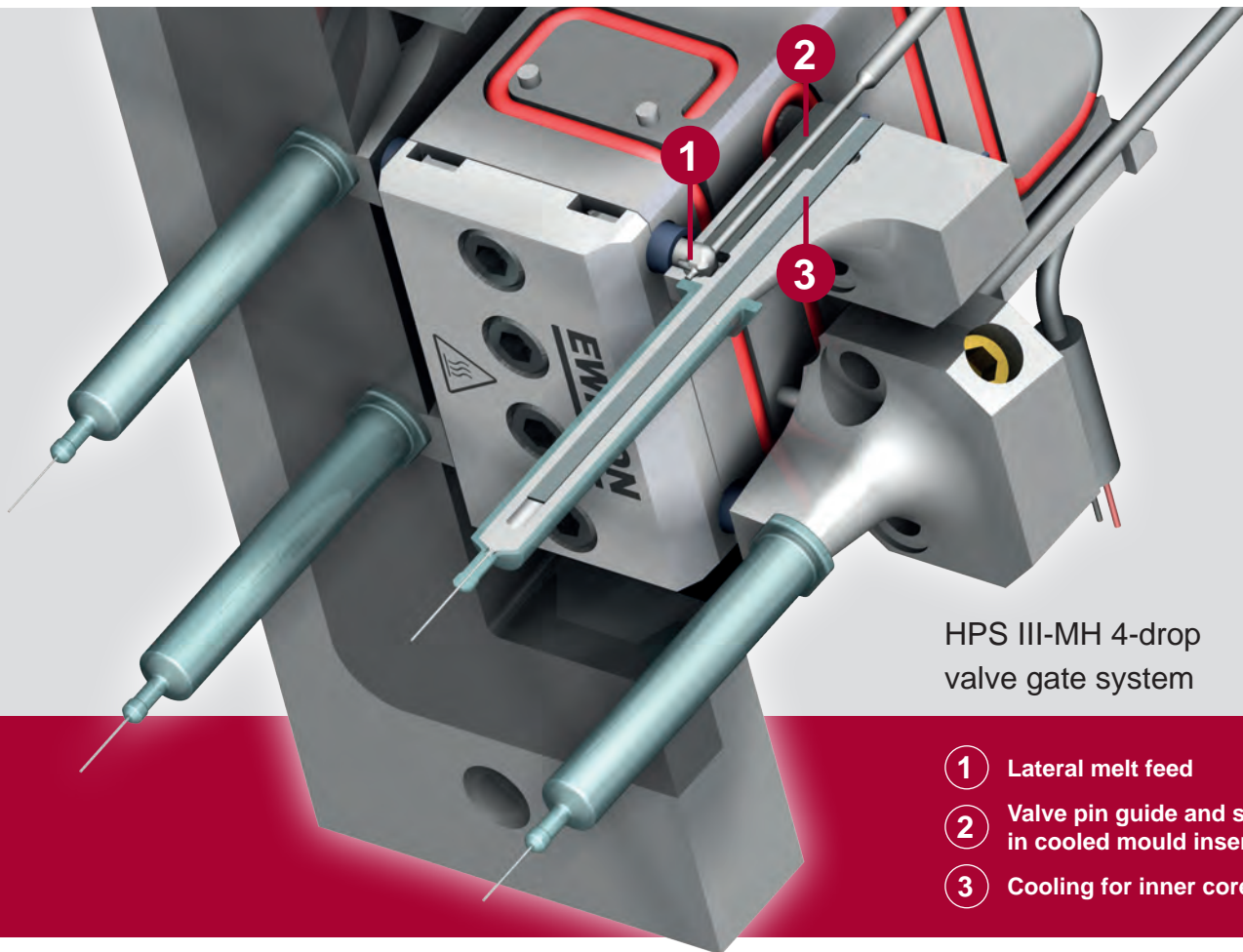
This process is especially suited to make the production of prefilled disposable syringes more efficient. Up to now the syringe bodies have been made of glass and the needles have been glued into the body in a further working step. Using the new technology the needles are separated in a system developed by Zahoransky; a linear robot inserts the needles into the mould where they are overmoulded with a cyclic olefin copolymer (COC) to form the complete disposable syringes. Afterwards they are removed by a handling system. There is no more need to glue the needles in. A 4-drop pilot mould was built for

demonstration purposes. The syringe volume is 2.12 cm<sup>3</sup>, the shot weight 1.8 g.

### New approaches to the mould

For the production of syringe bodies cold-runner or semi-hotrunner moulds have been replaced increasingly by advanced full hotrunner solutions in recent years. These offer various advantages as e.g. reduced cycle times and material savings. This is why Zahoransky decided to use a full hotrunner solution. However, changes to the mould were necessary because normally gating is done laterally

on the barrel. The component or rather the mould contour is placed along the nozzle on the fixed half of the mould. But as the needles are inserted on the moving side of the mould the syringe body has been rotated by 180° with the handle plate positioned in the parting line facing the hotrunner side. The contour for the complete syringe barrel is integrated on the moving side of the mould in an insert plate. When the mould opens this insert plate separates from the rest of



HPS III-MH 4-drop  
valve gate system

- ① Lateral melt feed
- ② Valve pin guide and seal in cooled mould insert
- ③ Cooling for inner core

the moving half of the mould and forms a gap. This ensures that the linear robot has enough space to insert the needles when the mould is open. Mould inserts positioned on the hotrunner side contain the cooled inner cores as well as the gating geometry. A stripper plate demoulds the complete parts while, at the same time, the handling system removes them. However, the position of the part in the mould makes it impossible to side-gate on the syringe barrel due to the parting

line which is level with the handle plate. Gating on the lateral edge of the handle plate was considered to be an unfavourable position as well since due to the low height in this area a proper shearing-off cannot be guaranteed, so a gate vestige could be left. Therefore, Zahoransky decided to use valve gating in demoulding direction on the backside of the handle plate. Therefore, on the one hand a perfect gate quality is achieved; on the other hand the gating point could be positioned

in an area where there is absolutely no risk of injury due to accidental contact.

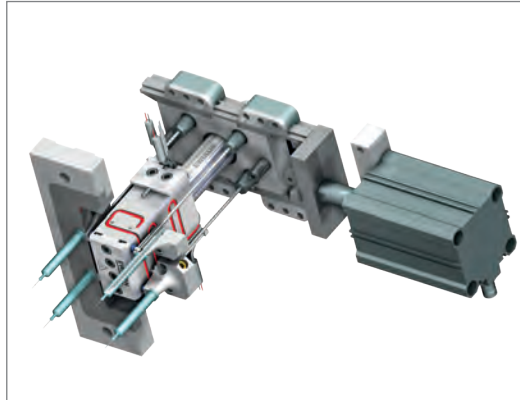
#### Gating point difficult to reach

However, space for gating is very limited in this area because of the cooling cores and the stripper mechanism. It was not possible to use a conventional valve gate system as even with a very slim conventional nozzle the gating point could not have been reached without interfering with the core cooling. With its HPS III-MH valve gate system EWIKON offered the suitable technology for the new solution. Because of its lateral melt feed and the gate positioned in demoulding direction the concept allows very compact valve gating in hard-to-reach areas. A linear nozzle body is the centre of the system. Each long side of the



Mould with lifting contour plate and cores with stripper plate on hotrunner side (left). Laser scanning is used to check whether each cavity is fed when inserting the needles (far left).

nozzle body has two lateral melt outlets with heat conductive elements protruding into the gate area of the mould insert. The melt channels inside the nozzle are fully balanced and streamlined without sharp corners or dead spots. A melt seal directly at the gate is realized by sealing sleeves around the heat conductive elements. The nozzle body itself is not



surrounded by melt. The valve pins run parallel to the nozzle body. In the gate area they are enclosed by the ring-shaped contour of the heat conductive elements but without contact. A special feature of the system is the position of the valve pin guide and seals. They are not integrated in a hot section of the system but screwed into the cooled mould insert. This makes the system absolutely leakproof. In general, the valve pins are not in direct contact with any hotrunner component and are exposed to melt only over a short distance resulting in enhanced wear resistance. All valve pins are opened and closed simultaneously via a synchronous plate system operated by pull rail actuation with pneumatic actuation.

### Automated production

An automated manufacturing cell is used for production. It consists of a Zahoransky Needle Feeding System (NFS), combined with a fully electric Engel e-motion injection



Synchronous plate actuation of valve pins (left). Automated manufacturing cell equipped with a Zahoransky NFS unit (Needle Feeding System) and fully electric Engel e-motion injection moulding machine (right).

tion moulding machine for cleanroom use with 100 t clamping force. In this application the NFS unit separates 4 needles and inserts them into the injection mould using a linear handling system. An Engel easix multiaxial industrial robot is used to remove the complete parts from the mould. This robot is equipped with a grab head that has been especially developed for this application by Zahoransky. Removal and insertion of a new set of needles take place simultaneously resulting in very short cycle times and the syringes are positioned correctly for the next processing step.

The hotrunner concept can be used in future multi-cavity production moulds without problems, as it is possible to realise a most compact nozzle arrangement in line. Another advantage is that a part of the melt distribution is integrated in the nozzle

body, f. ex. only a relatively simple 8-drop manifold is required for a 32-drop mould with 4 cavity rows. This reduces the residence time of the plastic material in the hotrunner and also simplifies the mould layout. To further increase efficiency it is also possible to integrate additional processing stations, from filling up to packing the ready-to-use syringes.

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## HPS III-MH200

# EWIKON expands nozzle range for side gating with version for large shot weights

With the HPS III-MH200 nozzle EWIKON offers a new version for direct side gating which has been designed for larger shot weights. The new development targets the growing field of potential side gating applications which – beside the typical target market medical – arise in other industries as the HPS III-MH nozzle concept offers various benefits. It enables a very compact mould design with utmost ease of maintenance. Standard polyolefines as well as technical resins and filled materials can be processed easily. Thus, in many cases as

for example in the electronics industry or when producing technical parts side gating proves to be a more cost-effective solution than conventional gating. Examples are filled polycarbonate cover frames for light switches, socket housings or technical functional components.

The new nozzle is available in linear or radial version for up to 4 gating points per nozzle. When processing low-viscosity materials 40 g per gate can be injected. For high-viscosity resins up to 10 g per gate are possible. To handle the higher shot



weights the flow channels in the nozzle are enlarged and the heat conductive tip inserts have been re-designed in size and shape. In general the HPS III-MH nozzle body with its relatively large mass features a high thermal stability. However, by enlarging the heat conductive tip inserts the temperature profile especially in the gate area has been further improved. The result is a very broad processing window which makes the nozzle suitable for even critical materials. For reinforced materials wear-resistant molybdenum tips are available.

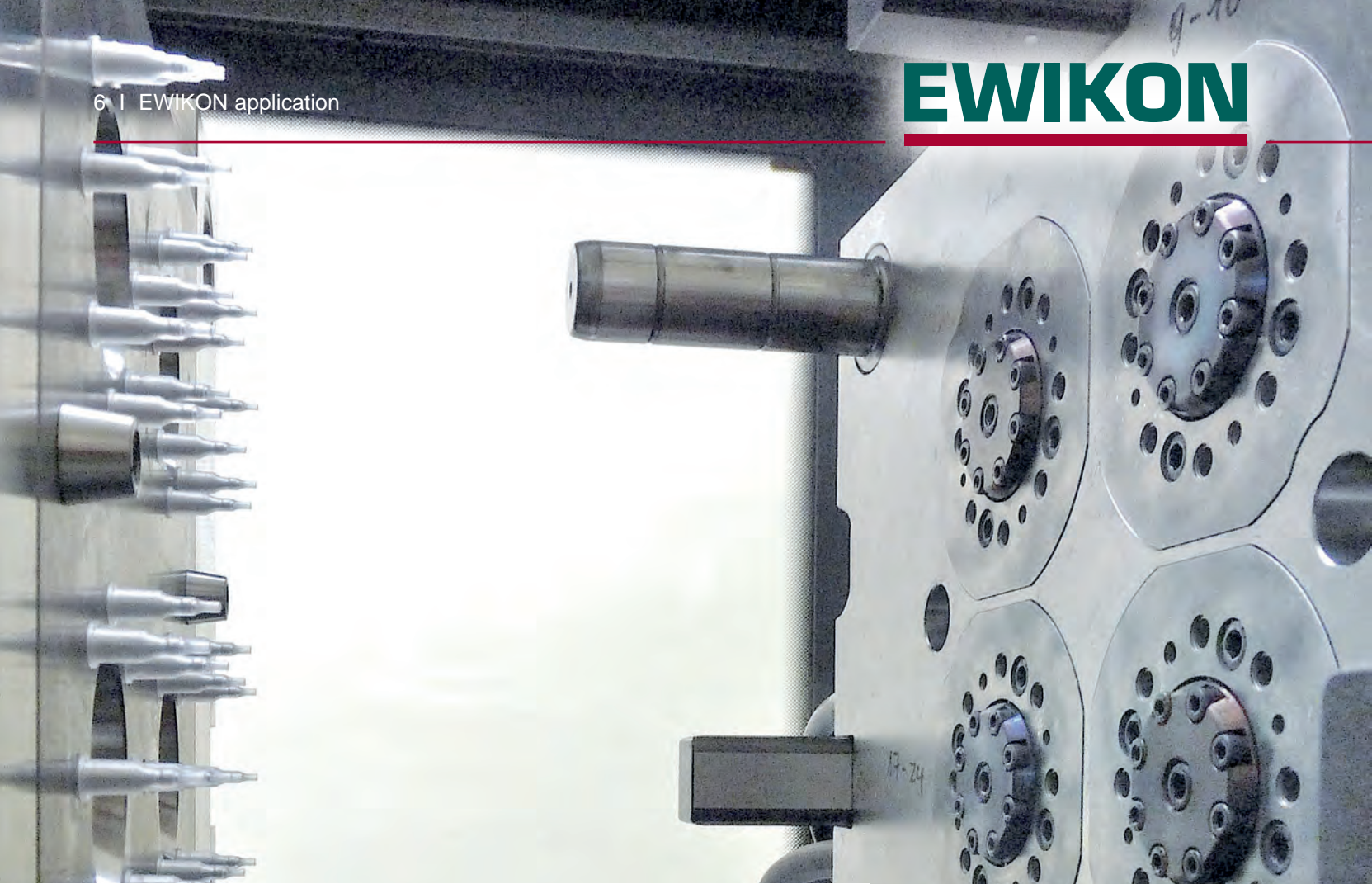
### HPS III-MH100



### HPS III-MH112/122



**More EWIKON side gating solutions:** The HPS III-MH100 is the standard nozzle for shot weights up to 10 g, the HPS III-MH112/122 is a slim version for deep immersion applications and split moulds.



## Clever Combination

To ensure the problem-free introduction of blood samples for analysis systems the medical technology specialist PAYER developed a new device which combines a venting adapter with a clot trap to filter out contaminants. The components are produced in multi cavity moulds equipped with EWIKON hotrunner technology.

When whole blood samples are introduced into the analysis system directly from the syringe a clot trap is attached to the syringe tip and removes clots and tissue particles to prevent the system from clogging. Up to now this process could only take place in a special operating mode which uses a strong vacuum to

move the syringe plunger. However, not all analysis systems have this function included. At the request of a well-known manufacturer of pharmaceutical products and diagnostic equipment PAYER searched for a way to realize a device for independent sample introduction. The solution was to combine an existing clot trap

with a newly developed venting adapter – this new functional device named "Clot Catcher" is a world first. It makes sure that during sample introduction air can enter the syringe and replace the removed blood volume. Thus, there is no need to apply a vacuum. At the same time the device ensures that no air can enter the analysis system and falsify the test result and that no blood leaks out.

### Side gating enhances efficiency

The clot trap itself is an existing and proven PAYER part made of TPE with a shore

## Clot trap: Side gating



HPS III-MH nozzle for side gating with 8 tip inserts with 60° angle. (above). View into the open 48-drop production mould for the clot trap with parts on the ejector side (left page).

## 50% more energy-efficient

The total energy consumption of a hotrunner system depends on the heat loss during the process, mainly at the contact points between hotrunner components and mould. To realise an energy-efficient process the number of contact points must be minimised. Especially the manifold is a decisive factor. The larger it is the more pressure pads are needed to guarantee a leakproof system. A 48-drop side gating system as used here needs only 8 nozzles which have a part of the melt distribution already integrated. Thus, the manifold can be kept small and compact with a low number of pressure pads and therefore contact points. The energy consumption is up to 50% lower compared to a conventional system.

hardness of 85. The blood is filtered by an integrated mesh. Up to now the part has been produced in a 32-drop coldrunner mould. For a more efficient production PAYER designed a new 48-drop hotrunner mould for direct side gating. Six radial HPS III-MH nozzles with 8 tips each are arranged in two rows and fed by a 6-drop manifold. The flow channels in the manifold as well as in the nozzle body are fully balanced. This enables a very compact and cost-efficient multi cavity mould design. The costs per cavity are considerably lower than for a comparable system with standard nozzles because only six nozzles are needed therefore the mani-

fold system is less complicated. At the same time the cost of control equipment is reduced because for 48 cavities only 15 control zones are required.

The nozzles have heat conductive tips which are angled by 60°. Thus, they can be installed in a way that the required gating point can be reached while the parting line of the mould remains plane. This enables a simple stripper plate on the ejector side to demould the part.

Another advantage is the maintenance-friendly nozzle design. Due to the patent pending tip exchange technology the tip inserts can be easily exchanged from the parting line without disassembling the

mould. To access the tip inserts only the cover flange of the nozzle needs to be removed. In practical use the hotrunner solution achieves a convincing cycle time reduction of 40% compared with the coldrunner solution and at the same time allows material savings of 50%.

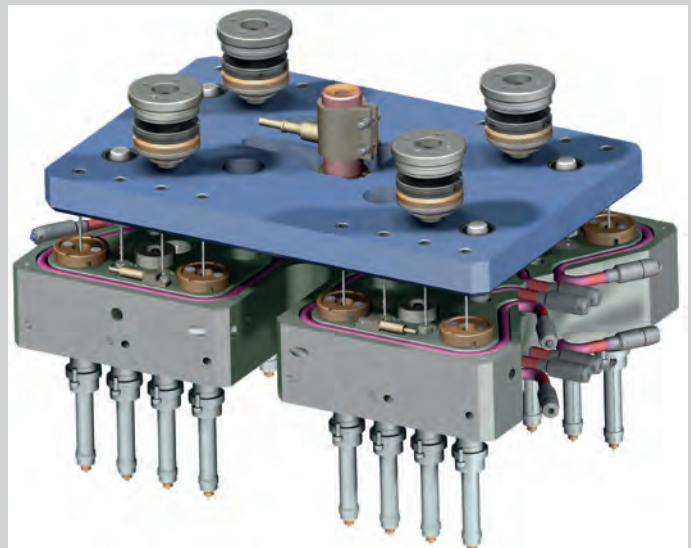
## Valve gating ensures process reliability

The second component of the device, the venting adapter, is made of SAN. The venting adapter and clot trap are assembled with a non-detachable snap fit. Its essential component is the intake tube for the blood with a length of 25 mm, an inner diameter of 0.5 mm and a wall thickness of 0.25 mm. Such a demanding part design is a challenge for mould making and production. In a first step the general producibility of the part was tested with a prototype mould. After validation PAYER started to design the 16-drop production mould in close cooperation with EWIKON. With a required quantity of several million pieces per year, maximum process reliability had to be achieved. Because of the part weight of less than 0.5 gram and the thin wall thicknesses an even filling of all cavities is essential. Considering these requirements it was decided to gate the part directly with valve gate technology. The ideal position of the gate as well as the finally gate diameter of 1.5 mm were determined by fill simulations which were also used to further optimise the part geometry regarding the filling behaviour.

## Venting adapter: Valve gating



Part "venting adapter" in the moving mould half with slide units (above). Valve gate hotrunner system with slim nozzles and compact manifold for production of the venting adapter (right).



The slightest deviations in the opening time of the valve pins can lead to an imbalance of the filling and packing of the cavities with such small shot weights, PAYER decided against the use of single valve pin drive units. Instead, all valve pins are actuated absolutely simultaneously by a synchronous plate mechanism which is operated by four pneumatic pistons in the clamping plate.

The nozzles used have a slim design with a flow channel diameter of 4.5 mm and were delivered with front installation technology. This means they are easily accessible for maintenance and replacement by just removing the cavity plate from the fixed half. There is no need to disassemble the manifold. The nozzles are installed in four groups each with four nozzles aligned in a row. On both sides of each nozzle group the slide units with the intricate inner core inserts are arranged. The distance between cavities within a group is 35 mm. Despite this rather tight cavity spacing the system of course

features full natural balancing. This is made possible by the manifold technology with distribution elements which EWIKON uses as a standard. It allows a very compact manifold design with streamlined flow channels arranged at different levels within one manifold.

EWIKON delivered a complete hot half with the hotrunner system, electric wiring, bores and connectors for the pneumatic supply of the drive units already integrated. PAYER completed the mould by manufacturing the fixed half cavity plate and the complete moving half with slides and ejector mechanism. The final assembly of the "Clot Catcher" device consisting of clot trap and venting adapter takes place on an automated assembly and packaging line which was developed under the aegis of PAYER. After assembly the Clot Catchers are packed in quantities of 100 and labelled with batch identification and expiry date. More than 8 million devices per year are produced.

#### About PAYER / Contact



Established in 1946 PAYER today is one of the leading contract manufacturers for complex, innovative product solutions and develops and manufactures complete devices, systems and single components for different industry sectors. The customers are well-known international and domestic companies. The PAYER group headquarters is located in St. Bartholomä in Austria. With more than 1200 people employed worldwide

and subsidiaries in Central and Eastern Europe and Asia PAYER offers full service for customers. The service range includes development and conceptual design as well as mould making and volume production on more than 100 injection moulding machines. The activities of the business unit "Health Care Solutions" focus on the development and production of parts and devices for in-vitro diagnostics and homecare diagnostics.

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