Customisation kings

Hot runner systems providers are going to ever-greater lengths to meet the demands of the market. **Noli Dinkovski** reports

As with many buoyant manufacturing sectors, customisation goes a long way in the hot runners market.

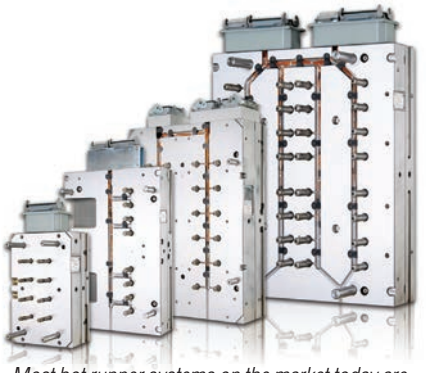
A case in point is how Husky Injection Molding Systems handles its customers' needs. According to the Canadian firm, every hot runner system sold is specified to meet the requirements of the end application. From resin type, drop locations and shot size, to processing temperatures and cycle time – Husky says any variable that has an impact on hot runner design and suitability is taken into account.

By its very nature, a good hot runner system is meant to reduce resin usage, cycle-times, and post-processing costs – so it makes sense for them to be customised to meet the end-user's needs.

However, with modern injection mould makers facing increasingly complex demands, hot runner manufacturers are having to be ever more adaptable in their approach. Whether it concerns gating options, temperature-control monitoring, or the use of bio-resins, those involved in the hot runner market are now being challenged to go the extra mile to enable their customers to operate as efficiently and cost-effectively as possible.

Husky says its customers are primarily focused on precision-part needs, high cavitation, and scale-up production requirements, with risk reduction also key. But there are other trends to consider.

"Now more than ever, moulders and brand owners are looking at gate quality," says Pierre Tassel, sales support and service manager for hot runners and controllers at Husky. "Topics like bio-resin moulding, resin waste reduction and general system sustainability are also very important. We are often asked to take part in bio-resin test applications, and we are constantly evaluating market needs to ensure we have the right type of hot runner product for these advancing requirements."



Most hot runner systems on the market today are customised to meet the needs of the end application

Tassel notes that in the high-end packaging and medical markets in particular, there is currently a strong focus on reducing risk while addressing scaling options.

"We've addressed this need with our new UltraShot product," he explains. "Through extreme resin- and pressure-control at the gate, this technology enables customers to essentially scale up from low-cavity systems to high-cavity production tools immediately."

Specialising in multi-drop systems for high-volume packaging, and caps and closures, Thermoplay's current focus is on medium-to-large customers that require a high number of cavities for large-scale production. As a business unit of Barnes Molding Solutions, the company claims to offer synergies across the whole spectrum of mould-making and hot runner technology.

Around half of the hot runners it sells are customised to meet special process or injection requirements, and filling analysis, mechanical and thermal balance testing is included.

Gate quality is also a leading consideration for Andrea Carelli, who works in applications at the Italian-headquartered firm. In addition to customised special gating options, Carelli says Thermoplay is able to provide direct gating for moulding parts where a good injection-point appearance is required. These systems are recommended for all polymers, including those with abrasive fillers.

"They can be fitted with a tip extension that can inject the part in areas with limited space – the heating area is distant from the part to limit haloing and imperfections, so they are recommended for moulding thin parts that require fast cycles," Carelli explains. "The particular GLT nozzle tip allows for a uniform material distribution, reducing flow paths."

In contrast, Günther UK sales director Reiner Heendeniya has spotted a "definite move" towards servo-driven electric valve gate systems. This is usually via a synchronous plate, although the company also offers an electric stepper motor option. "These systems are especially suitable for the clean room requirements of the medical and food packaging industries," he says.

As with so many hot runner components, Heendeniya suggests the best gating option is very much dependent on the application, and this is always discussed at the initial proposal stage with the customer.

Co-injection allows two different resins to be combined into a single melt stream

Mold-Masters says its brazed heater technology can lower operational costs

An F5 32x100mm special nozzle supplied by Thermoplay

"For optimum gate quality we will always recommend a valve gate or, where suitable, a side gate solution," Heendeniya advises. "We have different gating solutions for all applications – it is important to discuss this with your hot runner supplier at the beginning of a project."

Heendeniya is a believer in the design of a hot runner system being every bit as important as its assembly. He says Günther offers front-loading nozzles as an option, which means mould maintenance can often be done without removing the tool from the press.

"During assembly, gate and nozzle geometry in the tool are always checked by our engineers and the correct pre-load needs to be calculated to ensure there is no material leakage due to incorrect expansion rates," Heendeniya explains. "Gate diameters, pressure losses and residence times are calculated at the time of order to ensure the system is compatible with the application."

At Mastip Technology, each hot runner system is designed to suit the specific order, and an approval package will be supplied giving 2D and 3D designs. Marketing manager Steven Mckinlay says that all tolerances must be followed and checked during assembly to ensure the system functions correctly the first time and that there is no chance of leakage.

"While we have catalogue-standard layouts, we will often work with customers to develop custom solutions, particularly with family tools where the moulder is looking to balance for different part weights within the hot runner system," Mckinlay says. "In these cases, advanced mould flow analysis is used as part of the design process to determine the layout of runners and their sizing within the manifold."

There is a consensus among hot runner suppliers that the engineering that goes into a system is highly dependent on the application. However, in addition to the importance of getting the assembly right, careful consideration should also be given to the process of disassembling any hot runner system.

"There may be different procedures, tools and even bolt torques to consider," suggests Sudheer Thrissileri, technical director at Mold-Masters. "Failure to follow the proper directions could lead to leakage or damage, which could cost thousands [of dollars] to repair. If you are not familiar with the hot runner system at hand, it is always recommended to take the training courses offered by manufacturers, or let the manufacturer handle the servicing for you."

While acknowledging that customisation is an important element of hot runner design, as it provides customers with greater design flexibility, Thrissileri says the customisation of standard parts (such as gate seals) are not necessary for them to be effective.

He adds that Mold-Masters products incorporate a variety of technologies engineered to improve part quality, increase productivity and lower part costs. Most significant is the company's iFlow manifold and brazed heater system.

"Manufactured from two separate pieces of steel where runners are carefully milled and ▶

The bio-resin challenge

With the clamour for greater sustainability in plastics production at an all-time high, injection moulders are increasingly looking at bio-resins to boost their environmental credentials.

However, Mold-Masters technical director Sudheer Thrissileri cautions that applications utilising bio-resins are still uncommon, and as a result, many moulders lack experience in processing the novel materials.

"Bio-resins can be very challenging to process compared to the common resins they typically aim to replace," says Thrissileri. "This can make producing good parts very difficult and, sometimes, impossible. Some can be easier to process than others, but it is common for many to have narrow process windows due to thermal or shear sensitivities."

If the hot runner design is not optimised for bio-resins, this can compound the issue, Thrissileri suggests. Taking into consideration the flow pattern, eliminating hang-up spots and other design requirements are critical elements that need to be considered, he adds.

"We have spent extensive time testing a wide selection of these materials in our R&D facility and through our partnership with the University of Massachusetts [USA]. In addition, we worked with leading converters and brand-owners to select resins and to define a priority test sequence. This has allowed us to evaluate and understand their unique properties and effective processing requirements."

polished into each half, iFlow manifolds have the flexibility to incorporate a range of patented melt flow geometries, flow path options and runner shapes that just aren't possible with conventional gun-drilled manifolds," Thrissileri explains. "Once brazed together, they have the same strength as if it was made from a single solid piece of steel."

In the field, iFlow has been found to improve fill balance by up to 60 per cent, Thrissileri says. Weight variation can be minimised too, he adds, which is critical to part quality and controlling resin costs. "Even on small, technical components like 0.35g medical rear barrels, a 1.7 per cent total variation was achieved on a customer application. Another customer was able to lower injection pressure by 11 per cent, which allowed them to lower energy consumption by 7 per cent."

For temperature control, Mold-Masters has recently introduced the TempMaster M3, which features TC-Connect technology that, it says, eliminates the need for conventional temperature-control mould cables, saving significant cost, weight and clutter from the moulding cell.

"TC-Connect Technology has a new eBox design that attaches to the mould," says Thrissileri. "A single, lightweight data communication cable connects from the back of the M3 controller to the eBox – it's as simple as that."

All TempMaster controllers feature APS (Adaptive Process System) technology, a heat-control algorithm that continuously monitors and adjusts system temperature. APS makes micro adjustments every 20 milliseconds, meaning mould temperatures are maintained with the highest degree of precision.

According to Pierre Tassel at Husky, most new developments in temperature control systems are related to connectivity. Tassel says the focus is very much on the implementation of modern OPC UA-based interfaces that provide the flexibility to exchange process data and parameters between the controller and the injection moulding machine or process control and manufacturing execution systems.

"Two other connectivity aspects are remote access for more effective technical support and VNC screen sharing, enabling the machine to be the central point of control for the entire injection moulding cell," he says. "Exchanging data between equipment on the shop-floor and upstream systems enables faster and better decision-making, resulting in more effective and efficient manufacturing processes that save time and money."

Connectivity is also the watchword for French temperature control maker SISE (Société Industrielle de Service Électrique). Chief executive and marketing manager Philippe Monnet says his company's main focus is enabling customers greater traceability through data capture.

In-mould labelling packaging produced with the help of a Günther hot runner system

Case study: Günther on point with valve gate technology

German toolmaker Roth Werkzeugbau manufactures moulds for a number of industries, including packaging. The company claims special significance is always given to the hot runner technology, as customers in the packaging sector in particular expect optimum injection-point quality with the shortest possible cycle time, coupled with high-level service and maintenance support.

Through an innovative in-mould labelling process where the plastics for the container are injected directly into the printed film, Roth is able to produce fully printed plastics packages in a single step, eliminating additional labelling.

Production is made more efficient with the use of valve gate nozzle technology provided by Günther. Taking the example of curd cheese cups made of a low-viscosity PP, where the wall thickness of the cup lies between 0.4mm and 0.5mm and the injection point is 2mm in diameter, Günther used a 4x valve gate system with an 8NHT1-200 nozzle and LA needle guide.

According to Günther, the quality of the injection point on the finished item completely fulfilled the customer's requirements. This was thanks to the high production tolerances of the cylindrical portion and the precise needle guidance in the µ (micrometre) range. Meanwhile, a pneumatic single-needle valve of type ENV3/10/L/G handles the drive function.

The needle guide is highly durable thanks to the material used, and can easily be replaced when worn, Günther says. The elimination of insert reworking saves time and reduces expenses, the company adds.

"Our cooperation with Günther was extremely successful," says Roth managing director Marco Roth. "Our customers demand a visually perfect product for a saleable price. The only way this can be made possible is with high process reliability and minimal cycle time. Thanks to the Günther hot runner system, we were able to reduce the cycle time to less than five seconds. This enables high production volumes within a short time."

For this to be possible, Monnet says the hot runner system and its components must be able to communicate with each other. "For example, we save the data of the hot runner system for temperature, but we can say with our process control system what the pressure is in the tool, and save that data in the same place," he explains. "Put simply, we can save the data from the tool, from the hot runner system, and from the machine at the same time."

This "multivariable statistical analysis", as Monnet calls it, can save the manufacturer crucial production time in the event of mechanical failure. "If there is thermocouple breakage, for example, we are able to identify and isolate the problem by looking at deviations in data. By doing so, we are better-equipped to keep the production going."

When it comes to the wider hot runner manufacturing market, Monnet is noticing a degree of segmentation unfolding, with more businesses choosing to specialise in particular sectors.

This way, he suggests, they are better able to organise service support around the hot runner systems, and in turn increase the value of their offer. "By doing this they sell value, because they sell a total package for the hot runner system to the client, including services, guarantee, spare parts, and so on."

Whichever way the market may evolve, there seems little doubt that hot runners will continue to play a leading role in plastics injection, and their designs will keep evolving to meet the processing challenges of new materials and even more complex part designs.

And from the manufacturers' point of view at least, there is still plenty of opportunity for growth.

"While new innovations are introduced regularly, there are still many components, equipment and processes that utilise decades-old technology, which can still be optimised," says Thrissileri at Mold-Masters. "There are also many cold runner moulds still in production that we expect to convert to hot runners over time." P

More information from:

Günther UK	*gunther.co.uk*
Husky Injection Molding Systems	*husky.co*
Mastip	*mastip.com*
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SISE	*en.sise-plastics.com*
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