

FILL MASCHINENBAU

Optimised tempering process
for gravity casting

We make ideas flow.

bürkert
FLUID CONTROL SYSTEMS

HIGH OVERALL EQUIPMENT EFFECTIVENESS THANKS TO SUSTAINABLE PROCESS RELIABILITY

COOPERATION WITH FILL MASCHINENBAU

Electromobility demands increasingly simpler components with increasingly larger, more complex moulds. Maximum productivity is expected when manufacturing these with casting processes, in order to remain competitive. This means that the requirements for a quickly controllable, reliably reproducible cooling process are also rising. The internationally active machine manufacturer Fill is facing these challenges with solutions by Bürkert: Bürkert motor valves ensure reliably consistent control of the various cooling circuits, with the aid of simple set-point value specifications, for gravity casting machines for the engine bodies of a German pioneer in e-mobility.

The internationally leading machinery and plant engineering company Fill was founded in 1966 in Gurten, Upper Austria. The group supplies a wide range of industries with individual complete solutions. Fill produces complex, turnkey aluminium gravity casting machines with double casting, which possess a sophisticated cooling design with over 60 cooling circuits, for a German automobile manufacturer.

Precise control is the key to success

More and more complex component moulds with increasingly thinner wall thicknesses lead to higher requirements for the casting process. This development must also take the cooling concept into account: various cooling circuits with a wide variety of layouts are present in Fill's modern gravity casting machines. These must always be precisely controlled in order to achieve equal cooling for the mould. For consistently high product quality, it is also important that cooling stays consistent throughout the production process when the temperatures of the mould and cast aluminium change

over the course of the process. The valves for controlling the cooling circuits must also withstand the harsh conditions in the casting process, 365 days a year. And the spaces used here are extremely tight: "We do not install the control elements in a valve cabinet, but directly on our machines. This reduces the space requirements for our systems," says Patrick Dallinger, Fluid Technology Team Leader at Fill. However, the process also requires the cooling solution components to be compact enough and demonstrate the required robustness. For example, this may include an electrical connection made from metal.

Finding solutions together

For the highest possible overall equipment effectiveness, reproducible casting processes and time-saving mould changes are required. With the complexity of today's components, this is no longer possible with manual control of the coolant flow, according to the Team Leader: "Ten years ago, the specialist staff adjusted mechanical ball valves and the like manually until the

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Christian Kreuzhuber, Software Technician and Automation Expert at Fill

quality of the part was high enough. It was therefore left to the caster to find the right set values. This could take up a lot of time for different products with so many different parameters.”

The Fill team therefore joined up with its long-term partner Bürkert to search for an automated cooling solution – a solution with traceable process steps that can be used as a standard for different casting system types. Christian Kreuzhuber, Software Technician and Automation Expert at Fill, recalls: “We started with digital valves and flowmeters. We later changed to valves with Type 6223 analogue amplifiers. This allowed us to set a valve opening percentage. However, we wanted to be able to adjust the flow even better to the varying supply pressure.”

The foundation stone for the technology of today was then found at the Bürkert trade fair stand at Euroguss in Nuremberg in 2016. Bürkert developed a concept based on motor valves with Fill. These precisely control the flow using a prescribed set-point value. “The leap from control to regulation was really significant because ambient conditions change greatly over the course of production – as well as input parameters such as system pressure, the mould temperature also changes,” Patrick Dallinger states



The current flow of all cooling circuits is constantly transmitted to the upstream casting process controller via the Profinet gateway ME43. Downtime can be reduced thanks to reliable process monitoring.

“After three years in the dirty, hot environment, all valves were still functioning properly. It’s proof for us that we chose the right components for these ambient conditions.”

Patrick Dallinger, Fluid Technology Team Leader at Fill



From left to right: Christian Kreuzhuber – Software Technician and Automation Expert at Fill, Stefan Freinthalder – Bürkert Project Supervisor and Patrick Dallinger – Fluid Technology Team Leader at Fill

Decentralised control with process monitoring

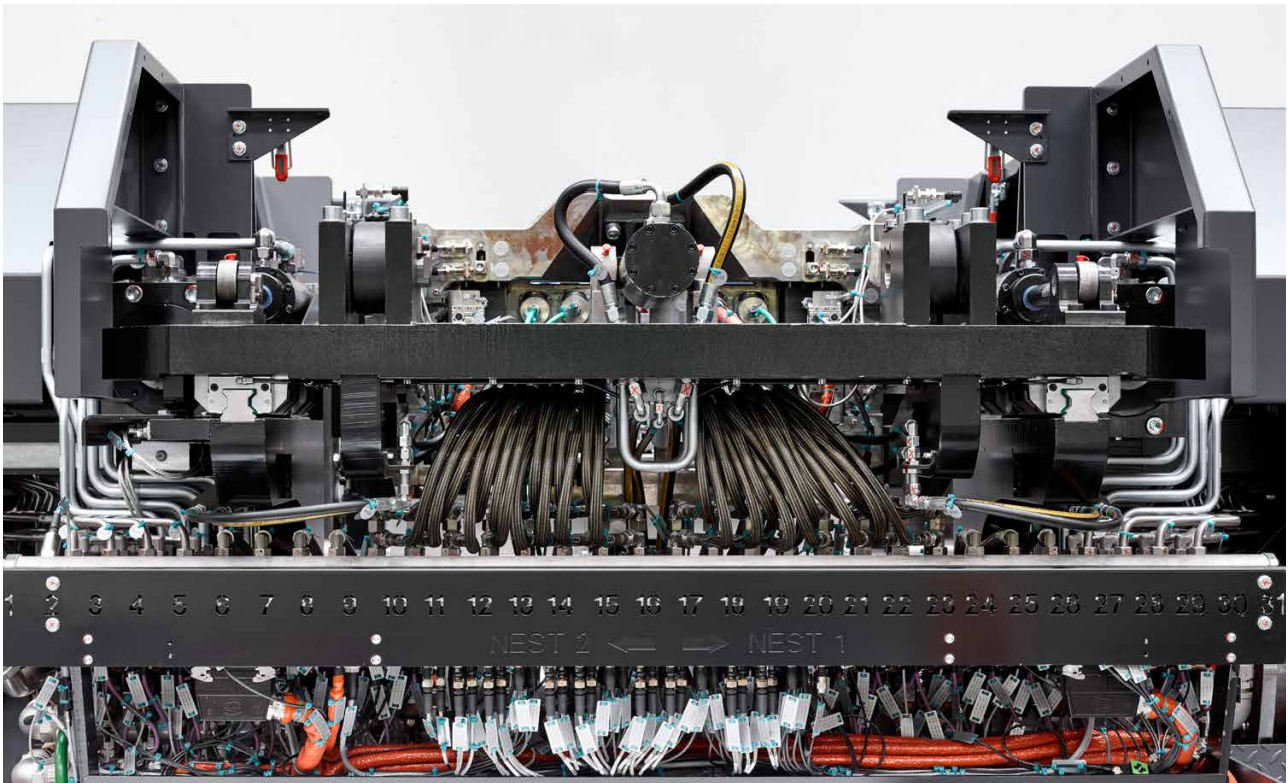
Fill constructs the majority of its machines in order to help its customers to manufacture different products. Depending on the component, up to 62 cooling circuits per casting mould can be activated for the above gravity casting machines. Just as many Type 3280 and 3285 electromotor valves control the temperature of the circuits quickly and with high precision, via the coolant flow. "Control takes place directly at the valve, as the Bürkert valves are already very advanced. They react quickly and well to changes in the supply pressure. We also tried to build a controller ourselves.

But it was nowhere near as dynamic and precise as the Bürkert solution," explains Christian Kreuzhuber.

The integration of the valves into the entire network via the fieldbus system ensures reliable process monitoring and diagnosis. The current actual flow values for all cooling circuits are constantly transmitted to the upstream casting process controller via a Profinet gateway. As well as precise control, it also helps to recognise when cooling circuits become clogged over time and actuating variables have to be increased even further, Christian Kreuzhuber adds. This enables an early response and reduces downtime.

"With the controllable valves and pre-defined process values, we are taking the adjustment work away from the operating staff and guaranteeing a reproducible, highly repeatable process."

Christian Kreuzhuber, Software Technician and Automation Expert at Fill



The control elements are arranged directly on the machines at Fill. It is therefore not enough for the valves to display a very compact design; they must also be robust enough to withstand the harsh conditions in the casting process, 365 days a year.

Durable solution with low maintenance costs

The compact motor valves also significantly reduce energy consumption, as they do not need any energy to maintain a certain valve opening. The reduced heat development of the valves also has a positive effect on their service life, thereby reducing maintenance costs. The robustness of the Bürkert solution is evident for Patrick Dallinger: “After three years, we performed maintenance on the first machine with this cooling concept. One body or another might have suffered from being used in the dirty, hot environment. But all valves were still functioning properly. It’s proof for us that we chose the right components for these ambient conditions.”

And if a change is needed, it can be done in no time: the device-specific values of the valve to be changed are stored on a SIM card. They can then easily be

transferred to the new valve. “This guarantees the correct functionality for our customers, without needing help from a software technician, and production can continue straight away,” the Team Leader is pleased to say.

The solution developed with Bürkert also manages to function with significantly fewer cables than previously. Instead of each valve being individually cabled, the valves are connected to each other. Now only 2 cables are needed for the 62 cooling circuits, instead of 62 cables. Making “a gigantic difference during regular maintenance” in terms of time for Patrick Dallinger, the spaces or the circuits directly connected to the machine are measured as being extremely tight.

Process reliability despite a lack of specialists

Kreuzhuber explains that today, the machines would be operated less often by specialist staff than previously, which can be traced back to the influences of individual parameters on the casting result, and adds: “With the controllable motor valves, we are taking the adjustment work away from the operators and guaranteeing a reproducible, highly repeatable process. With our machines, a technician defines all process parameters beforehand for each component – and therefore saves

Did you know?

Up to 62 Type 3280* and 3285 electromotor valves control the cooling circuits with high precision, ensuring constant cooling during the production process. Control takes place directly at the valve. This allows a rapid response to the requirements of the casting process.



a sort of visitor's card for the part." The valve set-points, conveniently defined by software, are stored under password protection and can easily be selected by the operating staff at the machine interface. The cooling process can therefore be effortlessly adapted for Fill's customers to meet the requirements of different parts to be produced. There is no need for time-consuming resetting of the flow values, scrap is reduced.

Less effort – even during start-up

Start-up effort is also reduced with the use of Bürkert valves: "A lot of data sets for the different casting

machines are available for us in the meantime. This helps us to prepare the cooling details, and our on-site software technicians only have to upload the data set to the valves. They can then concentrate more on the system cinematics. It has already reduced the time taken significantly".

And Patrick Dallinger is certain that start-up can be speeded up and overall system effectiveness increased with the cooling solution developed, even for special machines from other Fill centres of competence – from plastic technology to machinery for producing skis.

"The Bürkert solution makes a gigantic difference when it comes to cabling work. It makes regular maintenance so much easier."

Patrick Dallinger, Fluid Technology Team Leader at Fill

Benefit

from reproducible processes



Stable processes:

the valves ensure quick and high-precision control, regardless of the supply pressure. The connection to upstream process control provides easy diagnosis and reliable process management.



Reduced energy consumption:

the actuator does not need any energy to maintain a certain valve opening. The low electrical power consumption reduces the energy demand of a system, thus making it more efficient.



Simple maintenance:

the significantly reduced cabling effort creates free space for simplified maintenance. Device-specific values stored on a SIM card and user settings guarantee quick valve changing.



Increased service life:

the robust control valves ensure reliable, long-term operation, even under harsh conditions.

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