

All-electric as a competitive edge

The IntELECT in operation at the Fischer company in Sinsheim / Germany convinces by providing higher levels of process reliability, enhanced ergonomics, and lower energy consumption

When it comes to optimizing tools or processes, Werner Fischer is completely in his element. Whenever his full diary would so allow, the CEO of Fischer GmbH & Co. KG of Sinsheim / Germany would take his time, which in some instances may even be several hours, to observe and

toolmaking shop.” That is where they have enclosed all the noisy equipment with soundproofing housings.

Today’s Fischer GmbH & Co. KG was founded by Werner Fischer as a toolmaking company in Sinsheim in 1973.

was born, among others, from the conviction that tools as complex as we would build them would only be really good if you used them in manufacture yourself”, he explains his motivations. This was supplemented by the changed underlying conditions, adds Fischer. Although the



analyse processes. “After that, I come up with proposals for optimization”, says the skilled toolmaker with a smile. “Tenacity and patience, that’s what I was taught during my apprenticeship days by an experienced teacher”, adds the 61-year-old entrepreneur. But what is equally important is the appropriate environment, meaning the calm and quiet it requires. That may have made Werner Fischer to passionately advocate a low-noise working environment. “I would like to see our production workshop to be as low-noise as our

Toolmaking and injection moulding company

At the time he had to procure a special permit as he had not as yet passed his examination for a master’s certificate. Fischer preferred to attend master school in parallel to day-to-day business. At the beginning the young company produced cutting tools, but also the first injection moulds. After four years, Werner Fischer decided to set up his own manufacturing shop. “This decision

mouldings are by far more complex that they used to be some five or ten years ago, customers are even less willing than ever before to pay adequate prices. Rather, prices are going down while technical or qualitative requirements are going up, which is why I can foresee problems for the future.

Asked about the current situation, Werner Fischer tends to be slightly optimistic. “We are a sound company”, he points out. Although also his company endured losses in the 2009 crisis, it

should still be possible to cope with this after many successful years. "Theoretically speaking, we should have laid people off", he says reflectively, but quickly adds that this would have the last resort only, and the conceivably poorest solution.

In the end, there would be nothing more difficult than to find well trained and committed people when things will go better again. Fischer also made little use of short-time work only. Rather, he used the time to improve operational processes or to optimise toolings. "Bucking the trend, we have invested a lot of money, not least because we

30 trainees in five trades. In 2008, the volume of sales was 33 million Euros, and the company processed 3,600 tonnes of engineering plastics, mainly into small mouldings. This means approximately one million mouldings every day when the company is at full work, part of which is delivered direct to the OEM, but predominantly to their Tier 1.

The medium-sized company is certified to ISO 9001:2000 and ISO/TS 16949, and its customers include many renowned companies from the fields of automotive engineering, mechanical engineering, electrical or electronic engineering, and optical

of 3,500 kN or higher are fitted with an electrical screw drive. This is because parallel dosing will not only reduce the cycle time, but also improve the quality of the melt as there is less load on the material because of the reduced rotational speeds.

The portfolio of the company includes all the process chain from development and tool design to toolmaking, production of plastic components or completion and assembly of assembly groups. In the process, experts selectively search for ways to optimise these processes, for example by simulating or analyzing the feasibility of the



wanted to be prepared for the upcoming economic recovery", amplifies the entrepreneur.

Experienced expert for engineering components

Currently, the Fischer company has a workforce of 200, 50 of which are involved in toolmaking, eight in the design department, 122 in production and installation, plus ten in sales and administration. The training quota of the company is above average. After all, the company trains

engineering. The moulding shop works three shifts, toolmaking one and a half.

Currently, Fischer operates 65 injection moulding machines with clamping forces from 500 to 10,000 kN. More than 80 % of the machines were made by today's Sumitomo (SHI) Demag Plastics Machinery GmbH, nine machines are from the all-electric IntElect series. All machines are fitted with unloading devices made by Getecha or Geiger respectively. Moreover, all hydraulic machines with clamping forces

production of plastic components by means of Moldflow. The portfolio also includes the installation of PU seals (dispensing) or the fitting of mouldings with very small and delicate contacts, for example. Of course, the Kraichgau based company will also print on or weld the components it manufactures upon request.

Within this range of components, the focus is on connector systems. Currently, the range available from Fischer includes 5,000 different mouldings with

weights ranging from as little as 0.2 g to as much as 1.5 kg. "It's easy to fill straightforward components with a uniform wall thickness all the way through. Rather, it's more of a challenge when you have a moulding with wall thicknesses from 1.2 to 0.2 mm and when the material is a glass-fiber reinforced plastic on top of that", says Fischer.

Boris Linke, who works in the project management and sales department, adds: "When it comes to quality in injection moulding, for us there is no maneuver for compromise. Especially in terms of connector systems, we would have 100 interfaces when a 100-

for in-house production. "Some 99 % of the tools used by us have been manufactured in-house", says Werner Fischer, and he adds that even bought-in tools will be tested at their "in-house test stand", and will usually be optimised by their tool-making shop. What is a problem is when optimised tools are then removed by customers for their own production.

Similar to the quality requirements made by customers, the time and costs spent at Fischer's company before and after serial production are very high. Thus, all new tools would have to pass an elaborate type approval test.

any other department, will be identical in construction and will have the same type of control. Also the fact that practically all of the tools are fitted with intrinsic pressure sensors is owed to pragmatical considerations as Fischer does not use the sensors for injection moulding, but rather for purposes of control: the system would query the various moulding cavities and if the mould internal pressure specified previously is not reached the unloading robot will receive a respective signal to separate the respective moulding or mouldings. "In my view, internal pressure measurement will be the only way in future to reliably pro-



pole multipoint connector must be assembled."

Also, reproducibility is critical because of the high safety and quality requirements made on the components, such as air bag connectors. So, unsurprisingly, Fischer has invested a lot into quality assurance. To even better analyze and further enhance operations and processes, one employee was sent for training in Six Sigma in 2006.

The Fischer toolmaking department almost exclusively works

At the same time, data for quality control and for the quality assurance programs would be collected in the process. To collect or optimise these data, the employees entrusted with this assignment can resort to practically any kind of measuring instruments or devices of which several identical units will be available to them. This principle is resumed by Fischer on other levels, too. So, for example, as a basic principle, all the machines or instruments used in the company, be it in toolmaking, in the moulding department or

duce high quality", says Fischer confidently. In this connection, he refers to practical circumstances: It is especially with small parts produced in millions of pieces that one single reject might result in the full shipment being returned.

All the more important it is to use control systems as optimal as possible. Moreover, it is easier and faster to balance the moulding tools through internal pressure measurement. With a view to quality control, Boris Linke adds that Fischer, upon customer

request, would sort the parts by cavity, pack, supply and deliver the parts fully automatic.

Altogether, the company strongly relies on comprehensive control systems. For example, numerous cameras by Visicontrol inspect the parts or assembly groups in the automatic assembly or testing units many of which have been developed and manufactured in-house. Be it dimensions, variants, the completeness of individual parts or assembly groups, or whether the right part has been provided. There is no other way of handling such huge numbers of pieces. "Of course, we try to avoid errors in the first

working conditions and a comfortable working climate. Indeed, the company's offices and production shops promote a comfortable and cheerful atmosphere.

Continuous control

At the time, Werner Fischer did not anticipate that his curiosity would get him a real "saver" with numerous extras. In addition to the low noise level of the IntElect, two more aspects suggested the purchase of an all-electric machine from Sumitomo (SHI) Demag. Firstly, at the time they needed a clamping force of 1,500 kN which the competitor

to train his operators accordingly. It thus happened to be that an IntElect 150/520-610 of the first generation was installed at the Sinsheim facility in late 2004. "Once the machine had been installed here, we subjected it to comprehensive testing, of course", Fischer recalls.

"Sure, the machine had some teething troubles in the beginning, just like any new system of such complex nature would", he adds with a smile. "But, together with Demag, we soon got over those", he goes on. And Herbert Gegenheimer, sales engineer for Sumitomo (SHI) Demag, still adds that the trustful cooperation built



place", says Robin Kemter who is in charge of Six Sigma. Foresight and curiosity were merely two of the driving forces that made Werner Fischer start the "all-electric injection moulding machine" project in 2004. On the one hand, he was convinced that energy costs would go through the ceiling even then, on the other hand he was interested in that technology. Plus, another major reason was the low noise level of all-electric machines. On this, Boris Linke adds that his boss has always paid much attention to ergonomic

of Sumitomo (SHI) Demag who had also been shortlisted could not offer. Plus, almost even more important, the continuity of the control architecture maintained by Demag. "There is hardly anything worse than having a whole bunch of different control systems involved in your production", Fischer, a pragmatist, puts it in a nutshell.

There were times when his machine operators had to cope with seven different control systems on the machines. So, it was also very costly and time-consuming

up over a number of years has also contributed to this success. "We want to get to know new technologies and processes as early as possible", explains Robin Kemter.

The reason is obvious. The sooner you gain firsthand experience, just like here with a new generation machine, the more confident operators will be in using these machines. This is an understandable and important aspect when faced with high quality requirements. Plus, the use of modern, powerful machinery adds to

the motivation of your people. In this regard, the willingness to innovate and to invest of the entrepreneur is exemplary, adds Kemter.

Convincing precision

The production features of the new machine came as a surprise to the Fischer team. Even the first results suggested the extraordinary repeatability and positioning accuracy of the all-electric injection moulding machine. But none of those involved knew at the time how precise this machine would really be. It is not out of the usual, comments Linke, that manufacturers would praise their new products to the skies.

But, the positive experience gained with the IntElect came totally unexpectedly, even at that time, five years ago. Consequently, in early 2005, it was suggested to compare the production data of the new machine with those of a hydraulic machine of similar frame size. An Ergotech Extra 150-430 with a DFE control that had been procured not even one year earlier was selected for that purpose. At the time, the result was that the average input power of the IntElect was lower than that of the hydraulic machine by approximately 40 %. But, the benefits of the all-electric injection moulding machine were also obvious in

normal operation. The machine's precision and process reliability were undisputed. Also, it was soon found out that also the amount of maintenance required was clearly lower as compared to the hydraulic machines. Thus, Werner Fischer procured another eight electric machines within a short period of time.

Mid-2009, Fischer decided to do another test on the same two machines, but with much more comprehensive measurements this time. "We wanted to obtain a statistically supported pool of data", Robin Kemter explains the motivation behind this exercise. Here, an eight-cavity moulding tool for a 15-pole connector housing of PBT-GF20 (weight of the moulding: 4.8 g; cycle time: 16 seconds) was used. This mould was fitted with two hot runner sub-distributors and four hot runner nozzles, and each cavity had 2.5 sliding cores. Just like virtually all moulding tools at Fischer, this one, too, was fitted with sensors to collect the mould internal pressure in the cavities.

For the field test, the tool was first clamped onto the hydraulic Ergotech Extra and then on the all-electric IntElect, and operated with identical parameters. Energy measurement was begun after approximately 30 shots, and production data were logged for the next 50 shots. Energy measurement was performed by the

local utility of EnBW. The mouldings were marked and deposited separately with a view to accurately measure and weight them later on. To anticipate the upshot: Not only were the results from the first test confirmed, but they were clearly surpassed this time. "At similar cycle time, similar peripherals and identical unloading system, the all-electric machine is more stable in operation as opposed to a hydraulic one", points out Werner Fischer.

40 % less energy

At the same time, the IntElect requires approximately 40 % less energy, which results in an annual saving of more than 3,000 Euros for each electric machine based on three shifts and 250 working days. Something not taken into consideration here is the reduced energy requirement of the centralised cooling system as generally fewer components have to be cooled.

"Moreover, we also noted enhanced process stability", comments Robin Kemter regarding these results. As opposed to the hydraulic machine, the electric machine is significantly more consistent and has higher positioning accuracy in terms of both, cycle time and other machine parameters such as dosing time. Thus, the reproducibility of the IntElect would considerably contribute to securing and main-

Ergotech Extra 150-430		IntElect 150/520-610	
Ø Average power requirement	11.42 kW	Ø Average power requirement	7.21 kW
Consumption / hr.	11.42 kWh	Consumption / hr.	7.21 kWh
Costs	0.12 €/kWh	Costs	0.12 €/kWh
Operating costs	1.3704 €/h	Operating costs	0.8652 €/h
250 days, one shift	2740.80 €	250 days, one shift	1730.40 €
250 days, three shifts	8222.40 €	250 days, three shifts	5191.20 €

taining the high level of quality. The machine's precision was also obvious when the shot weight or critical dimensions of the component parts were examined. All in all, according to Kemter, the process capability in these tests was improved through the IntElect by approximately 0.9 (Cpk).

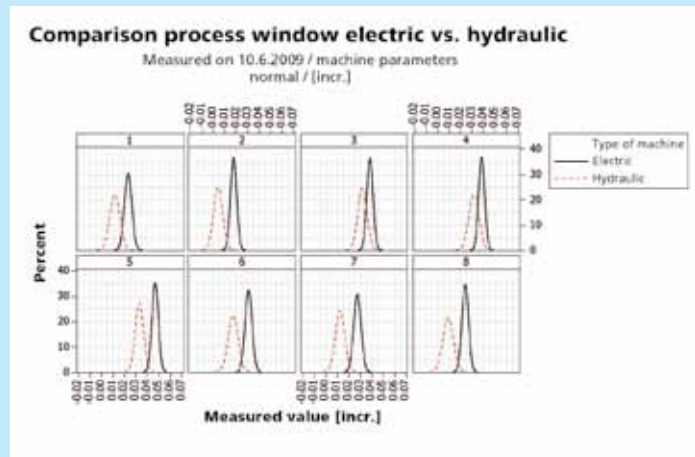
Noise cut by one half

As expected, also the noise measurements conducted yielded the results hoped for. On the operator side of the Ergotech, the measured value was 74 dB(A), whereas for the IntElect it was only 61 dB(A). Thus, the IntElect emits less than one half of the noise as compared to its hydraulic counterparts – a reduction by as little as 10 dB is perceived as only half the noise level. All in all, Werner Fischer is very satisfied with the test results.

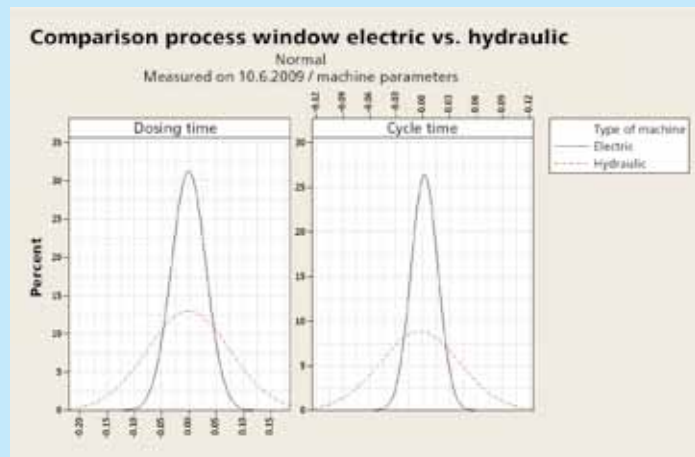
Apart from the investment costs, which are still higher, the IntElect has come up to expectations. "Lower consumption, higher process reliability, more reserves, significantly enhanced ergonomics – plus it does not require any oil, so it's clean, too", he enumerates some of the advantages.

Author

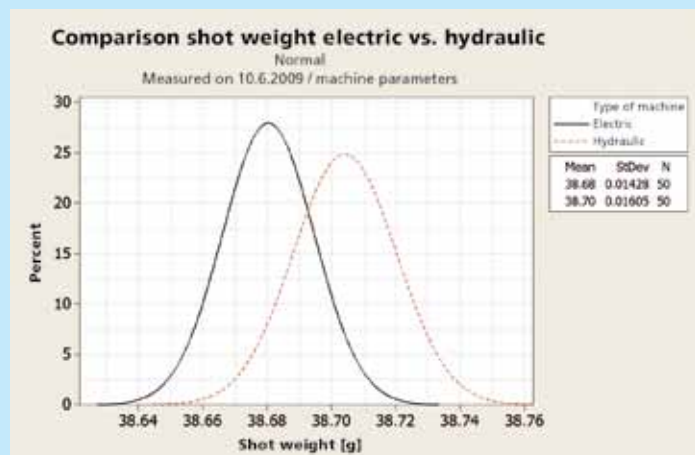
Dipl.-Ing. Thomas Schwachulla,
Freelance Specialised Journalist



Tightest tolerances: The electric machine especially convinces in terms of the dimensional stability of the mouldings



Precise control: The repeatability of the set parameters (screen shown dosing time and cycle time) is clearly better with the electric machine as opposed to the hydraulic one



Constant shot weight: With the all-electric machine, the variance of the shot weight is clearly less