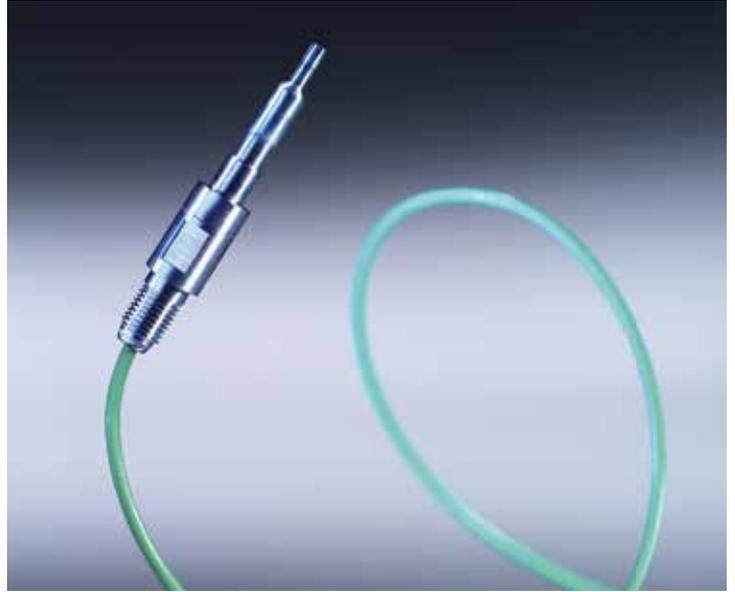


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Spick and span with 100 % quality

How Brose improves the quality of its two-component production and automatically separates defective parts



SPECIAL PRINT

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Brose Group inspects the polyamide (PA) and thermoplastic polyurethane (TPU) rail slider assemblies with complex filling requirements for its window regulator with up to eight cameras. Thanks to a completely new approach, the international automotive components supplier can now safely deliver 100 % quality: the new method stabilizes the process while inspecting the quality – and can even replace optical inspection.

Written by Dipl.-Ing. Markus Lülting, Chefredakteur K-PROFI

Brose Group with headquarters in Coburg/Germany is a leading international automotive components supplier for car parts such as window regulators. The specialist produces several hundred million system components every year, among them about 40 million rail slider assemblies manufactured as hard-soft combinations. The basic design of these parts is the same, only the fastenings differ according to car brand and model. Brose window regulator rail sliders for customers such as Audi, Mercedes and BMW have become best-selling items, which are produced on an injection moulding machine with 4+4 cavities with an output rate of up to eight million parts per machine and year. "Brose inhouse is our customer," says Uwe Truschies, Head of Plastics Preproduction. "We deliver parts to Coburg from twenty-one assembly facilities, which are located all over the world." All standard parts are produced in a three-shift operation. "With the exception of regular maintenance operations, we only change the sliders to accommodate different types and window thickness levels," Truschies explains.

The parts are produced on tie-bar-less Engel victory injection moulding machines. The rail slider's hard component is made from polyamide, while the soft component is made from Elastollan, a TPU grade that was specially adapted to suit Brose's requirements. PA is injected from the main unit into the four bottom cavities of the 4+4-cavity moulds, while the TPU for overmoulding is injected into the top cavities from an ancillary unit. Rotary or indexing plates transfer the preforms to the second injection moulding station.

The most complex mould with a 2+2-cavity in-built indexing plate is used to produce rail gliders for BMW models. The complex flow paths can only be accommodated by means of cascade control. The temperature-sensitive TPU material and many other parameters make reliable filling of the entire cavity challenging, particularly at the end of the flow paths. Brose installed six cameras, which ensure that the critical sections are completely filled with the soft component and fully formed. A removal robot also serves the first inspection point, while all remaining downstream points are serviced by a six-axis robot during machine downtimes.

For Brose, the time-consuming readjustment of the process temperatures is the main drawback. "Formerly, we had to readjust the machine temperatures every day. The temperatures in the four cavities affected each other because of the different distances of the flow paths to the three gating points," process optimization specialist Frank Sauerteig remembers.



Rail glider assembly for window regulators made from a polyamide hard component and a TPU soft component

Fotos: Brose

This is why Brose decided to equip the first mould with Kistler pressure sensors, which record the cavity filling levels. A sensor for the hard component is installed in each cavity and three sensors for the soft component are installed along the flow path, i.e. a typical 2+2-cavity mould will be equipped with a total of 16 sensors. The sensor signals provide information on the pressure profile during the filling and holding pressure phases and transmit this data to the Kistler's CoMo Injection process monitoring system with MultiFlow hot-runner balancing function.

This function records differences in the filling levels of the four cavities containing TPU. These differences are balanced out by adjusting the temperatures of the individual hot runner tips. "In the beginning, balancing of the soft component filling levels was not fine enough, but together with the Kistler team we managed to hone the adjustment increments and to optimize the system for the material. The adjustment now works impressively well," Frank Sauerteig reports.

The automotive components supplier has extended the scope of the process monitoring system: in addition to monitoring the TPU hot runner, it now also assesses the process and determines which parts meet the quality standards. Optimum pressure profiles were taken from the production of immaculate parts, which also passed the automatic image evaluation. If the process monitoring system detects a part that failed to reach the minimum or exceeded the maximum tolerances, it will trigger a signal for the robot to separate this particular defective part. "The Kistler system helps us separate critical parts immediately. Even if we run the balancing function without the quality monitoring system, we manage to reduce the defect rate to a minimum," Frank Sauerteig explains.

Since Brose introduced the pressure-based hot-runner balancing and process monitoring system, the manufacturer's defect rate has dropped significantly. The balancing function dispenses with the need to adjust the temperatures at regular intervals – not even after mould changes, which slightly change the flow path.

Uwe Truschies, Head of Plastics Preproduction
on the production floor at Brose in Coburg



In addition to automatic hot-runner balancing and end-to-end monitoring, the mechatronics specialist also uses an automatic cavity-pressure based switchover from injection pressure to holding pressure. Process optimization expert Sauerteig explains: "As soon as the first cavity has reached the set filling level, the system will trigger the switchover process." The trigger signal is sent from the monitoring system to the machine. This has not only improved the defect rate but also had a positive effect on the processing quality. Even in cases of filling delays in one cavity, the other cavities are not overfilled. This protects the mould, as it prevents pressure peaks during the switchover phase and subsequent overloading. Cavity-pressure based technology also accelerates the production start-up.

"We are seriously considering the introduction of sensors right at the start of other complex projects," Truschies explains his company's response to increasingly more exacting quality requirements. "Pressure monitoring is an important factor in our endeavour of meeting ever more stringent quality requirements. This technology provides us with an inside view of the mould – we can actually 'see' what happens inside the cavity. It allows us to effectively pre-empt the production of defective parts." The Head of Plastics Pre-Production is also thinking of the future: "This year, we will acquire a machine for the production of transmission gear housings with inserted pins. These housings must adhere to strict dimensional tolerances. Any deviations would cause major noise emissions. These tight tolerances can only be adhered to if we make sure that our processes are spick and span, which means that we definitely need sensors." ❏

Brose Group in profile

As a partner for the international automotive industry, Brose supplies about 80 vehicle brands and more than 30 suppliers with electric motors and drives and mechatronic systems for vehicle doors and seats. About 23,000 employees are working at 58 locations in 23 countries generating a turnover of EUR 5bn.

The company ranks among the Top 40 automotive suppliers worldwide and is fifth-largest family-owned company in this segment.

One in three new cars driven all over the world is equipped with at least one Brose product. At present, the mechatronics specialist is the leading the international market for window regulators, door systems, closure systems, drives for electric braking systems (EBS), drive train actuators, HVAC blowers and cooling fan control modules.

Brose is the leading supplier of electric seat adjustment systems in Europe; one of the company's medium-term objectives is market leadership in this segment.

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