



IN THE MIX



WHAT'S NEW

SilcoStar e-Flow:
Advancing Injection Moulding
Direct Vacuum Infusion

SILCOSTAR E-FLOW: Advancing Injection Moulding

In 2010, at the K-Trade Fair Dusseldorf, **2KM** drew the silicone market's attention with the newly developed SilcoStar e-Flow. New features allowed better control of the whole process in an efficient and cost effective way.

Servo Electric Driven Metering System

Unlike the usual drive systems, the two metering pumps on the new system were actuated servo-electrically. This new development was led by the rising demand for all-electric injection moulding units with clear advantages when it comes to energy consumption and uncomplicated use in the clean room for medical and pharmaceutical LSR applications.

Total Control

Following several development stages, improving the used actuators, control and layout, the latest version of the SilcoStar e-Flow is now one of most well proven systems for the process of Injection Moulding. One of the most important characteristics which 2KM has been able to develop is complete machine control. Handling the whole process has been made considerably easier, offering the user, besides the familiar volume flow control, the possibility to regulate the mixed material pressure. The mixed material pressure is measured and controlled where it actually matters: at the place of the machine connection onto the injection moulding unit.

Even the smallest fluctuations on the screw speed lead to pressure condition changes and density inconsistency in the metering process. These changes can cause injection errors, especially in the case of multi-cavity tools.

Thanks to the newly developed 2KM mixed material pressure control, the SilcoStar e-Flow automatically adjusts to the dynamic pressure of the injection moulding unit. Time-consuming adjustments carried out by the machine setter are eliminated, ensuring the high quality requirements of the LSR processors.

Optimised Barrel Emptying

Another great advantage of the SilcoStar e-Flow is the integrated roll-in device with drum floor support for an optimized emptying of the drums. Different filling levels or material consumptions of the two components can be taken into consideration. The gravimetric adjustment of

the drum filling levels ensures even emptying. The new, ergonomic characteristic of the basic machine equipment facilitates handling of the drums and can help cutting costs by minimising residues.

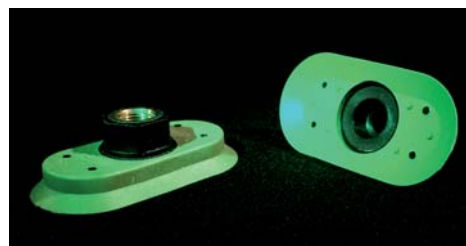
Automatic Deaeration

The optional following plate deaeration is another feature which simplifies the drum changing process. When running the follower plate into the new drum, the air under the follower plate automatically escapes, and the operator does no longer need to open or close the deaeration valve. The new version of the 2KM SilcoStar e-flow will be hosted in a number of industry leading exhibitions throughout the year giving everyone the opportunity to check out the new features.

Pictures below showing items produced with the e-Flow exhibited at NPE show and Technologietage Arburg. All moulds supplied from Rico..



*Magnifying glass surrounded by a special, ultratransparent silicone by Wacker Chemie.
NPE: Booth S28073*



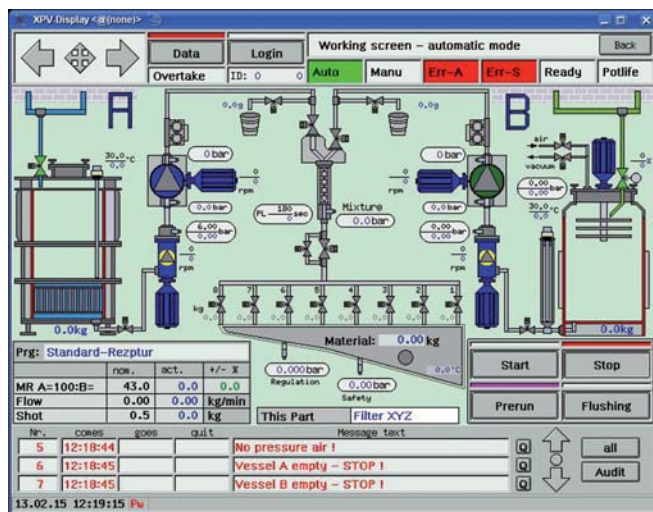
*Two-component injection moulded part for suction. Pads made from PBT and LSR.
NPE: Booth W3729*



Bottle opener manufactured by Arburg using the 2KM e-Flow. The specific design will be presented at Arburg Technologietage 2015.

Direct Vacuum Infusion

Process Control of Large Parts in the Highest Quality



Epoxy Resin Treatment: Then and Now

Vacuum Infusion is the standard technique used for the production of rotor blades for several years. The rotor blade mould is lined with glass fibre mats and then saturated with liquid Epoxy Resin under vacuum. The two-component Epoxy Resin is premixed in the required mixing ratio and stored in buffer vessels before moving to the next stage. The vessels with the Epoxy Resin mixture are positioned next to the blade mould. The number of vessels used depends on the final size of the rotor blade. Depending on the size of the rotor blade, several of those intermediate vessels might have to be used. Following that, the vacuum generated allows the resin mixture to get sucked into the mould. The resin flow is controlled mainly by ball valves which are switched on and off manually. Once the glass fibre mats are sufficiently saturated, the resin supply is stopped.

Treatment of the resin, mixing and material consistency issues have changes since the process was first introduced. In the beginning, the two-component resin was mixed manually according to the required mixing ratio, (stirred) and then intermediately stored in the buffer

vessels. The amount of resin mixed was larger than required, to avoid mixing more material while disrupting the process. Consequently, surplus was unavoidable and increased the amount of wastage. Consistency could not be guaranteed and the quality of the mixture always depended on the person mixing the resin material.

As the wind energy market invested in R&D, the size of the rotor blades therefore the amount of resin required grew drastically, opening the way for the development of the first mixing and metering units for resin processing. These units meter and mix the resin online with appropriate metering pumps according to the required mixing ratio and supply the resin mixture into the buffer vessels. The development of systems customised to the specific process was rapid allowing a repeatable and controllable resin mixture to be produced.

Challenges Linked to the Modern Process

Infusion via buffer tanks is the present standard for most blade manufacturers. Unfortunately, the process is far from perfect. The premixed Epoxy Resin in the intermediate vessels is a reactive material meaning that the chemical reaction takes place as soon as the two components are mixed. The exothermicity caused by the reaction leads to temperature rise and the resin might start boiling while in the intermediate vessels. Additionally, the chemical reaction changes the mixture's viscosity therefore the flow's characteristics. Therefore, it becomes rather difficult to control the flow front in the rotor blade mould.

The process requires that there is always sufficient quantity of premixed resin available, to ensure that no air is sucked into the mould. To avoid that, more resin than necessary is premixed leaving, in most cases, significant surplus. The solution was given by the introduction of a filling-level control mechanism which keeps the amount of mixed resin in the buffer as small as possible.

New Dimensions of Vacuum Infusion Eliminating Risk

Motivated by the motto "Standing still is moving backwards", 2KM always responds to the continuously growing requirements for quality, efficiency and repeatability in the production of rotor blades.

Having sound knowledge of the 'Vacuum Infusion in a blade mould' process, being very well aware of the challenges and pain points, 2KM continues the development of the machine range 'ResinMix'. The systems 'ResinMix' are trusted by the world's best blade manufacturers making them the most established machines in their category. The latest version of the range called 'ResinMix DI' (Direct Infusion) allows to open new paths in the infusion process. This highly intelligent production unit allows injection of the resin from the

metering unit directly into the vacuum mould. This breakthrough of the process has eliminated the need to have buffer tanks around the blade mould. The resin flow is controlled dynamically through a vacuum sensor system positioned directly at the distribution points of the sprues. There is no longer danger of under-saturation or over-saturation, as the unit meters the required amount of resin into the vacuum mould. The resin does not react prematurely avoiding relevant complications and surplus residue. An additional vacuum sensor secures the vacuum foil from 'lifting off' in case of overpressure.



To produce the rather large dynamic range of the requested resin quantities for the infusion process, the metering pumps are not operated with the commonly used frequency-controlled asynchronous motors. Using direct-current servo drives instead, allows coverage of the complete range of requested resin quantities with the usual precision.

The high level of automation now allows injection into the vacuum moulds to be controlled automatically via the metering unit, depending on the respective filling level. By feeding the relevant parameters on the system it is possible to actively optimize, control and replicate the specific infusion process.



2KM The Technology Partner

Since 1976, 2KM has been working on the development, construction and manufacturing of mixing and metering units for the processing of liquid Polymers. For the last 15 years, the production units for vacuum infusion have been an integral part of our portfolio. We are among the global leaders in supplying machines for the production of rotor blades for wind energy plants.

Moreover, our steady market presence, the close contact and regular partnership and with rotor blade manufacturers make us a reliable technology partner - **your reliable technology partner!**

During March, you can visit 2KM at the **JEC Paris Composites Show** – stand C39, **NPE International Plastics Showcase** – booths S20094, Arburg W3729 and Wacker S28073, **Arburg's Technology Days** in Loßburg and the **Chinaplas Guangzhou** – Stand E51 in Hall 10.1.



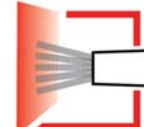
Bonding



Coating



Composite



Spraying



Moulding