

A reliable high tech solution

Martin Grönblad, Product Manager of Process Products at Bucher Emhart Glass, outlines the group's Flexible Pressure System (FPS) and how it has evolved since it was introduced 18 years ago.

Since the Flexible Pressure System (FPS) was first introduced almost 18 years ago, the system has evolved into a standard in the industry. In the Bucher Emhart Glass machine portfolio it is the standard for Plunger Up actuation on all machine types and is a must for customers producing containers in NNPB.

The success of FPS for Plunger Up is based on the dynamics that are required to successfully form a parison. Once the plunger has penetrated the glass and is approaching the end position, the control of the plunger operating air pressure becomes vital to avoid unfilled finishes and over presses.

Blank seams can be caused by the pressing pressure inside the blank moulds, which is a product of the ratio difference between the projected area of the plunger piston and the projected area of the plunger (the opening on the finish). Since the area for the finish is smaller than the piston area, the pressure inside the blank mould will be amplified, and it therefore creates an increased pressing pressure.

This pressure is projected onto the walls of the blank mould and can potentially push the mould equipment apart and consequentially create blank seams. Not only does the operating air pressure need to be kept low, the pressure oscillation must also be kept to a minimum to ensure repeatability in the forming process (**Fig. 1**).

To further complicate the forming process, when the plunger is exposed to stick slip at standstill, the friction coefficient is higher than during movement ($\mu_{\text{Static}} > \mu_{\text{Kinetic}}$).

The required low pressure during pressing is therefore not ideal at the beginning of the plunger motion. In addition, the plunger movement is also

related to the mechanical condition of the mechanism, where factors such as lubrication and dirt also contribute to variations in the movement.

For this reason there is a need for multiple pressure steps with an actuator that offers a quick response to set point changes. With this background it is clear that a directional valve (On/Off) with one defined operational pressure cannot perform this task successfully.

The heart of it

The heart of the FPS technology is the direct proportional solenoid valve (**Fig. 2**). This proportional valve acts on an analogue set point signal coming from the FlexIS control system and outputs the corresponding operational pressure.

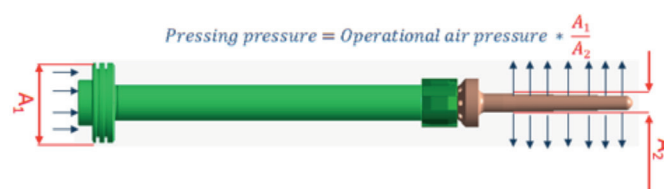
However, if we look under the hood of the proportional valve we understand that it is actually packed with intelligence.

Depending on which function the proportional valve is used for, the characteristics of the underlying control algorithm is tailor-made to suit the intended function and therefore gives optimum functionality in the forming process.

Bucher Emhart Glass's proportional valves are produced in Hannover, Germany. In this high-tech production facility the valves are assembled in a lab environment with each individual valve calibrated against its own mechanical characteristics for optimum performance.

Going from the lab coats and ESD protected environment in Hannover to being mounted on a glass production line may seem from the outside as a big step, but this is a misconception.

Over the years, these valves have built a good reputation in the industry due to



Above - Fig. 1: Pressure on inside a blank mould.

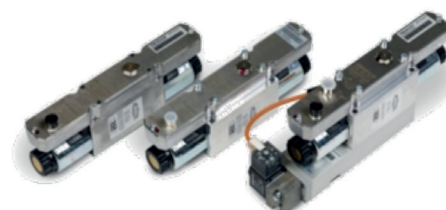


Fig. 2: FPS valves.

their long service lifetime.

Nearly 100% of the annually produced IS machines are equipped with FPS Plunger Up, but this technology is not limited to use for the Plunger Up. Today also a high percentage of the machines are equipped with FPS for Plunger Cooling/Counter Blow as the industry sees the advantage of precise parison forming during B&B, as well as the increased cooling capacity during NNPB and PB due to the valves high flow rate.

The popularity of FPS for Final Blow has also increased over the past few years, with better shaping control being achieved during the final stage of forming. Today, Bucher Emhart Glass promotes new innovations such as the Plunger Up Control, which offers further enhancements and control features for the forming of the parison.

With this control, a defined dwell time can be set and kept at a narrow band through the parison forming process. During recent years, the availability of a repair kit for the valves, repair services as well as an FPS tester has been added to complement the portfolio.

In conjunction with the FlexIS control system, the actual output pressure can be displayed on the User Console by utilising the integrated feedback signal from the valves.

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