# Process control and flexibility

Increasingly, the stability of the forming process is key to improving pack-to-melt and glass container quality. Currently, variations can only be managed by skilled operators. The magic required to address this situation is the 'closed loop', suggests Andreas Helfenstein.

Plunger Process Control (PPC), Temperature Control System (TCS) and FlexRadar are sophisticated measurement systems. FlexIS can now 'talk' to these systems via a software module called 'FlexTernal', using data to adjust the machine automatically (a closed loop) or just display states, warnings etc.

## PLUNGER-UP CONTROL

FlexIS Plunger-Up Control (figure 1) uses information from the PPC to determine the time needed to move the plunger up to its end pressing position. It then adjusts FPS pressures and timings to maintain this time (figure 2). This also achieves a defined full contact time ('dwell time').

Until now, results in this area depended on friction in the plunger mechanism, glass viscosity, loading situation etc. Even if the plunger was controlled systematically, the single pressure available limited the possibilities.

FlexIS Plunger-Up Control uses multi-pressure pressing for full control. By continually adjusting initial pressure levels and switch points (timing) for stepping between pressure levels, it facilitates multi-pressure pressing, without compromising quality (figure 3).

## COOLING CONTROL

FlexIS Blank Cooling Control is a control loop (still under field test) that uses information from the TCS to maintain blank mould temperature. The TCS sends temperature values from the blank moulds to the FlexTernal, which corrects the appropriate cooling duration.

Since AIS and BIS machines have six on/off valves per section, each cavity half can be controlled by one closed loop (figure 4). On NIS machines, each section half can be controlled individually but it is possible to use the average of all cavity halves per side as input for the closed loop.

Figure 5 shows the successive activation of closed loops for half an AIS DG machine. Generally, temperatures can be kept within a very narrow band.

## INFRARED RADIATION MEASUREMENT

FlexRadar gives machine operators real-time process information so they can maintain quality, without waiting for information from the cold end.

Soon, the FlexIS TS-E machine control will be connected to FlexRadar, which measures the infrared radiation of every finished bottle on the conveyor. This opens up the potential for closed-loop process control, as the system automatically targets highest quality and balances process deviations.


Figure 2: Plunger rise and dwell time between plunger-up and down movement.
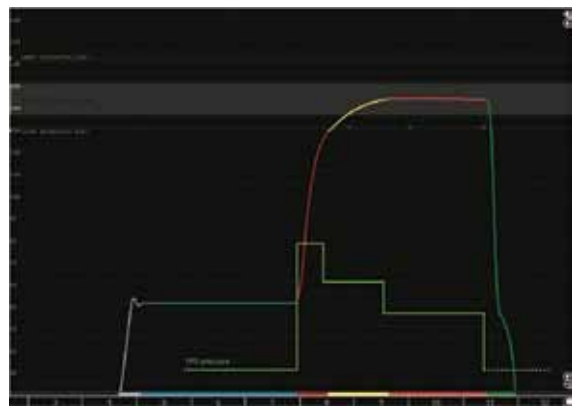

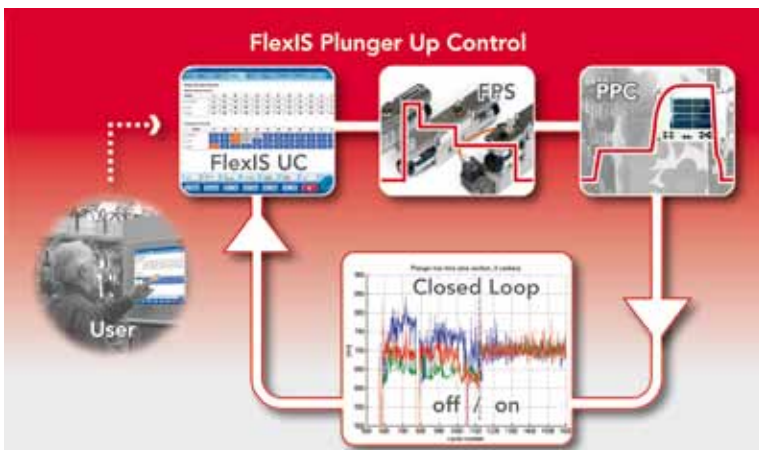Figure 3: Example of pressing curve and FPS pressure sequence.
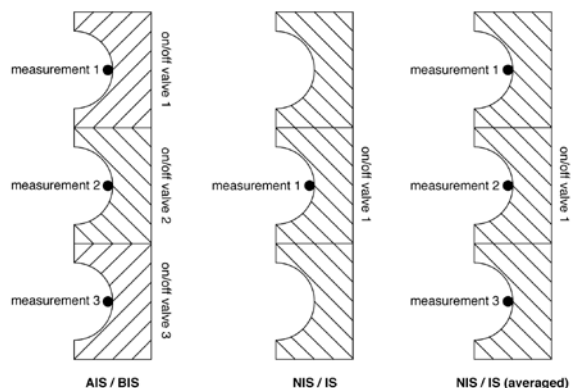

Figure 1: Plunger-Up control.


Figure 4: Configuration examples having a different number of on/off valves and measurement points.
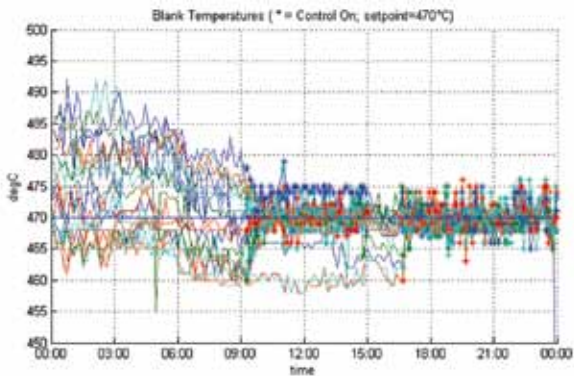
Figure 5: Successive activation of closed loops for half an AIS DG machine.

### FLEXIBLE MULTI GOB WEIGHT SYSTEM

The glass container industry is facing a contradiction. On the one hand, IS machines are becoming larger while on the other, packaging trends favour individual ware shapes,
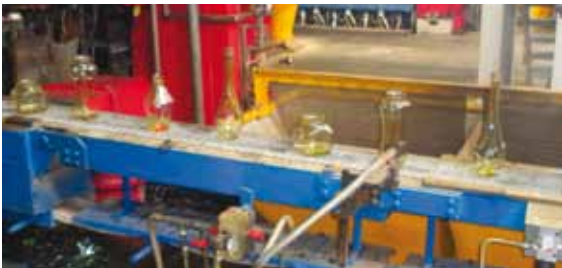


Figure 6: By operating the 555 feeder and 565 shear with the latest Emhart Glass FlexIS Multi Gob Weight System software, each section of an IS, AIS, NIS or BIS machine can produce with different gob weights and shapes.

which means smaller lot sizes. This challenge is met by the Multi Gob Weight System, which effectively splits a machine into sub-machines, each being able to produce different containers. It also allows for sampling a glass container on one section, without affecting production on the others.

By operating the 555 feeder and 565 shear with the latest Emhart Glass FlexIS Multi Gob Weight System software, each section of an IS, AIS, NIS or BIS machine can produce with different gob weights and shapes (figure 6). There are many advantages:

- Production can be matched with demand, optimising machine utilisation and minimising stock.
- It is no longer necessary to halt an existing run to accommodate a short-notice job. Some sections can continue, while the rest are changed.
- For low quantity production runs, it is not necessary to equip the entire machine with moulds.
- Single sections can test new moulds or make sampling runs without interrupting production.

Emhart Glass is dedicated to investing in the future of glass container production. Innovations such as these will reduce dependency on the skill of the specialist in favour of a fully controlled process. ■

### TERMS USED IN THIS ARTICLE
FlexIS: FlexIS Forming Line Control, which controls all settings from the feeder to the stacker.
FPS (Flex Pressure System): Proportional valves for precise and fast pressure control.
PPC (Plunger Process Control): Measures the full stroke of each plunger over time.
TCS (Temperature Control System): Measures the surface temperature of various points in each cavity.
FlexRadar: Measures the infrared radiation of every finished bottle on the conveyor.

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