

Process control with closed loops

Andreas Helfenstein describes recent advances at Bucher Emhart Glass in the field of process control and closed loops for the glass container production process.

In recent years, such measurement systems as Plunger Process Control (PPC) and Temperature Control System (TCS) have provided a valuable insight to the glass container production process. Via these systems, important process variables like temperatures on the blank side and the trajectories of plunger strokes can be monitored precisely. This is especially useful - and for NNPB, almost inevitable - to set up production properly and to conduct meaningful troubleshooting.

It is a tough job, however, to monitor these critical parameters systematically and perform all appropriate manual readjustments. Imagine a current AIS or BIS machine producing in 12-section triple gob; 72 mould half temperatures and related cooling valves can be adjusted. Measurements show that it is already a true challenge for an operator to keep temperatures within $\pm 15^{\circ}\text{C}$ over a 24h time span. It also requires some experience because with the time constants in the system, there is a chance of unintended overreaction.

CLOSED LOOP BENEFITS

This is where a closed loop like FlexIS Blank Cooling Control provides an important benefit. Blank mould temperatures are kept automatically within a band of typically $\pm 8^{\circ}\text{C}$, day and night. And after startup of a new production, cooling is adjusted to match the desired mould temperatures as well. The operator has more time

to focus on other tasks. It becomes easier to maintain good product quality because the variation of critical parameters is reduced.

Controlling the pressing in P&B or NNPB is no less demanding, especially when the advantages of multi pressure pressing is used. FlexIS Plunger Up Control provides ideal support in this instance. Getting the characteristic timing values from the PPC system for every plunger stroke, the closed loop adjusts the initial pressure levels to achieve the desired setpoint for the plunger rise time/dwell time.

FlexIS Plunger Up Control uses four pressure levels (including zero bar), the first and second of which are adjusted by the closed loop. The third pressure level is applied during the dwell time and always stays as defined by the machine operator. Using more than one pressure level (multi pressure pressing) permits users to influence the initial up motion and the distribution of the glass independently from the applied pressure during dwell time. This is a major advantage for controlling the parison characteristics and defect prevention. It is important, however, to switch from one pressure level to the next at the correct moment. FlexIS Plunger Up Control also takes care of this task, determining the correct moments based on the last few press curves, individually for each cavity.

FULLY INTEGRATED

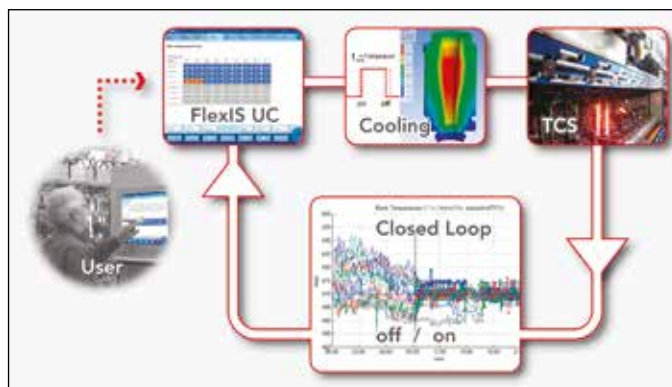
Both of the closed loops described are fully integrated into the FlexIS controls system. This means that the machine operator can set up and adjust all parameters on the FlexIS User Console (UC). All settings are stored with the job and are therefore immediately ready after a job change. Furthermore, the machine operator also receives feedback directly on the FlexIS UC, seeing at a glance if a cavity operates at the adjustment limit. He also recognises easily which settings are adjusted by a closed loop (greyed out/read only in all views). This facility helps the operator to cope with these innovative tools and to take real advantage of them.

FIELD EXPERIENCE

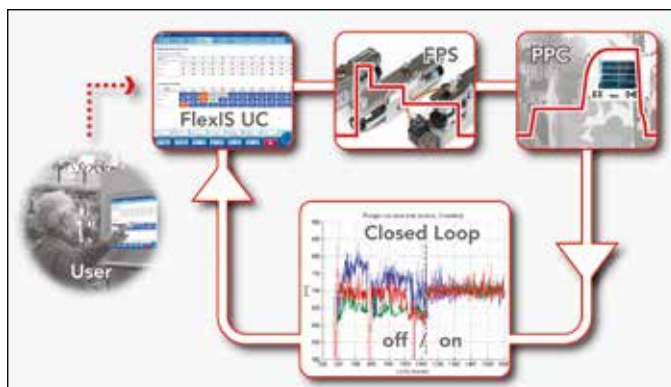
In the meantime, FlexIS Plunger Up Control and FlexIS Blank Cooling Control are both commercially available and installed at various glass plants in Europe and South Africa. Some installations were undertaken during the development phase to obtain early feedback from customers. This led to refinements even before the equipment's commercial release.

Feedback generated from customers is very positive. For example, Vidrala SA's Carlos Barranha comments: "The TCS gives us finer control over heat exchange on the blank side. Mounted on an AIS machine, the Blank Cooling Control closed loop can take advantage of separate valves for each mould half in the section, compensating for imbalances that may exist in the cooling process." According to Mr Barranha, this contributes, for example, to greater stability of vertical glass distribution and the mitigation of the settle blow wave. "Furthermore, the possibility of measuring neckring and plunger temperatures automatically and systematically allows us to detect problems more quickly and thus prevent or minimise the generation of defects, eg from broken plunger cooling tubes."

Wiegand-Glas has used Plunger Up Control for more than a year and Karl-Heinz Mann is also impressed with the equipment's performance. "Through the use of



Schematic of FlexIS Blank Cooling Control and Plunger Up Control.





Overview page of the FlexIS Plunger Up Control, showing setpoint and measured values. The background colour indicates all cavities switched on and cavity one of section five operating at the allowed pressure limit.

constantly adjusted multi pressure pressing, we can avoid blank seams and better achieve reasonable dwell times, even for plungers having more friction" he confirms. "The fact that the dwell time is kept so constant also reduces sugary finish. We could

stretch the intervals for changing the moulds and starting up after a job change is faster and smoother!"

OUTLOOK

Bucher Emhart Glass will continue to make further developments in the



Machine operators can set up and adjust all parameters on the FlexIS User Console (UC).

field of process control and closed loops. Together with its customers, the company believes that the currently available measurement systems still have untapped potential, especially when they can be linked to the machine controls. ■

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