

Improving production quality

JENS SCHAEFER AND LEO DIEHM DESCRIBE A JOINT PROJECT TO TEST AND VALIDATE A NEW PLUNGER PROCESS CONTROL SYSTEM

Today the glass container industry has limited means to control parison forming. Quite often narrow neck press and blow (NNPB), as well as press and blow (PB) glass container manufacturers are confronted with quality issues, especially finish defects. In many cases these defects originate during the vital parison forming.

This paper describes a joint supply chain partnership project between Rexam and Emhart Glass where Six Sigma tools were used to test and validate a new Plunger Process Control System (PPC). The results show that the new PPC system is a very important tool for container quality improvement in NNPB.

BASE LINE PERFORMANCE

Fillers continue to demand increases in container quality with the elimination of finish defects. The glass container manufacturer has limited means to control the container quality during the NNPB production. Today only limited process visualisation and recording products are available.

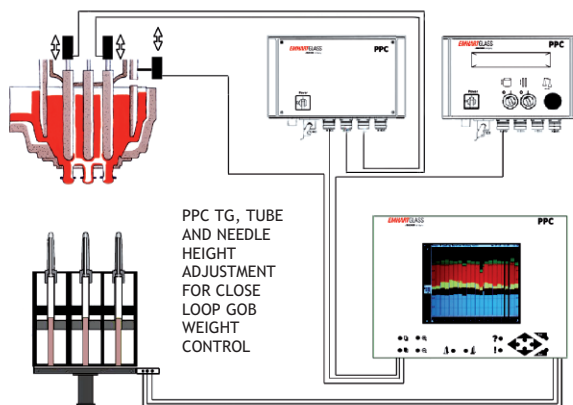
The parison pressing today is done 'blindly'. The final product quality relies on high quality maintenance and operating procedures, experienced operating personnel and the quality of the inspection machines at the cold end. Standard operating procedures dictate that, in certain circumstances, batches of production have to be quarantined and re-inspected – an expensive and time-consuming practice than may impact upon customer service.

This was also the case at Rexam Nienburg, who contacted Emhart Glass. After all key requirements had been identified, it was agreed to establish a joint partnership project. The partnership was done as a Six Sigma Project, a methodology that was well established in both companies. Initial investigations indicated that a better process monitoring system had the highest probability of success.

THE PLUNGER PROCESS CONTROL (PPC)

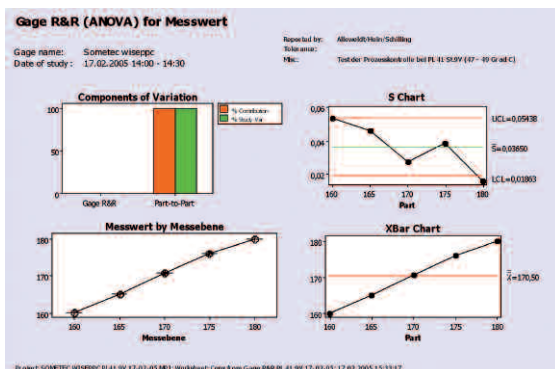
Plunger Process Control (PPC) visualises and continuously records the entire plunger stroke, across all cavities of the machine in real time, as it travels through the glass whilst forming the parison. In theory, this technology could lead to unknown variations in the NNPB and PB production process, with the potential to reduce the incidence of finish defects and hence improve the overall quality.

A ceramic sensor tailored to the Emhart Glass Quick Change plunger mechanism provides the plunger position signal without any wires, cables or connectors to the plunger cylinder mechanism. Wireless transducers are permanently fixed on the base plate, and from there the signals are wired to the master, mounted on the machine upright.



PPC has the following capabilities:

- very precise measurement of the complete plunger stroke (s) (plunger down – loading position – pressing – top position – down position)
- close loop accurate gob weight control through tube and needle height adjustment
- wireless cable connection to Emhart QC Plunger mechanism
- continuously records entire plunger strokes
- analysis of plunger process regarding inconsistency by histograms and other sophisticated software tools
- hot end ware reject of defective containers
- connections to the plant information system.



PPC REPEATABILITY AND REPRODUCIBILITY STUDY

THE JOINT PERFORMANCE VERIFICATION

Rexam and Emhart Glass began the verification and validation in 2005 with the installation of the prototype PPC system to 3 sections, 9 cavities on an AIS 4 1/4" TG 12 Section machine at the Rexam Nienburg plant. Sensor precision was measured by a gauge repeatability and reproducibility study to determine how much of the observed variation was due to the PPC measurement system.

The investigation concluded that the PPC system accurately exceeded the defined requirements.

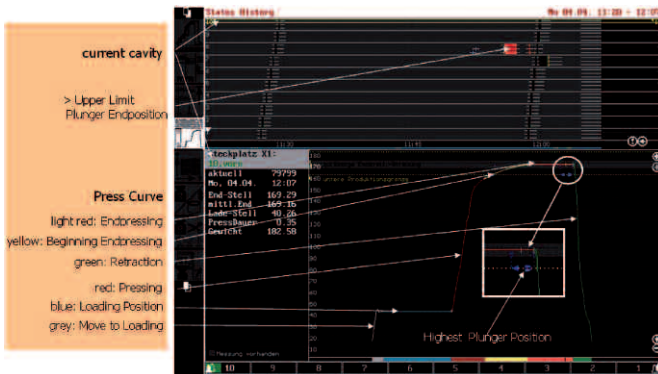
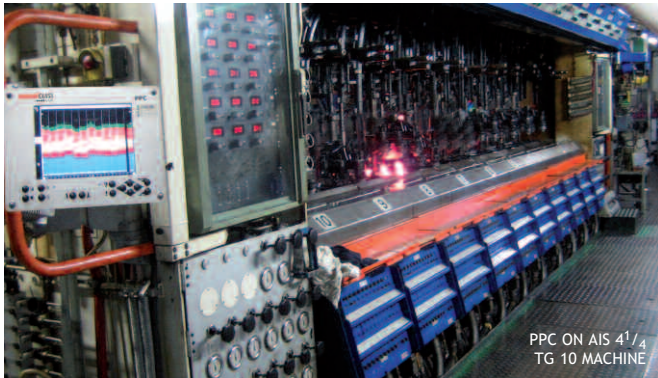
The PPC system acceptance by the machine operator was also closely investigated. The findings highlighted a high level of acceptance. Production personnel started to use the 3 section prototype trial to improve the production quality. As a consequence of the trials, Rexam decided to equip a complete AIS 4 1/4" TG 10 section machine with the system.

RESULT OF THE MACHINE TRIAL

In April 2005 a new AIS 10 Section 4 1/4" TG machine was fully equipped with the Plunger Process Control system.

The performance of the PPC gob weight control function, when automatically adjusting the feeder tube height and independently the two feeder needles, outperformed existing systems. The example shows a gob weight performance history over an hour: the upper part of the PPC chart displays the TG cavity gob weight performance and the lower part of the chart recorded the feeder tube (blue, green) height correction.

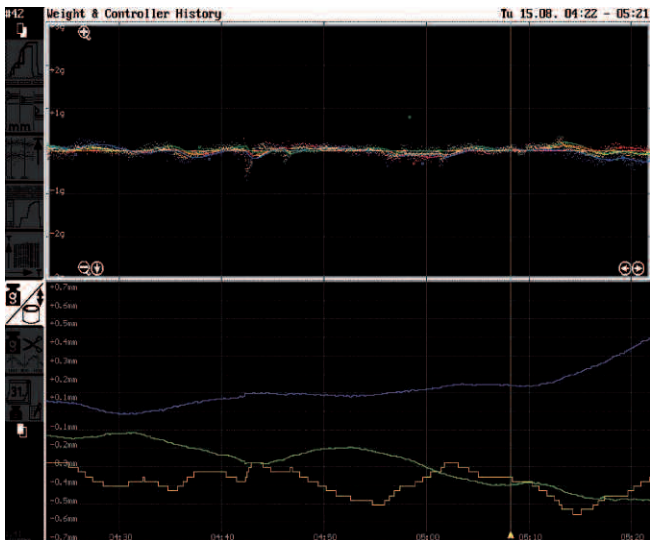
The production quality improvement and the opportunity to detect critical finish defects early at the hot end resulted in a favourable return on investment. Rexam decided to equip all five NNPB production lines at Nienburg with PPC systems. Other Rexam locations have subsequently upgraded NNPB machines with Plunger Process Control systems.



EXAMPLE: RECORDED PLUNGER STROKE SECT. 10 FRONT

CONCLUSION

The PPC system proved to be very successful. The project achievements and experience on the partnership approach between the two companies have been very positive, and the methods and concepts determined by their cooperation are being extended to other projects within the two organisations. ■



PPC GOB WEIGHT HISTORY SEQUENCE ON THE AIS TG MACHINE

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