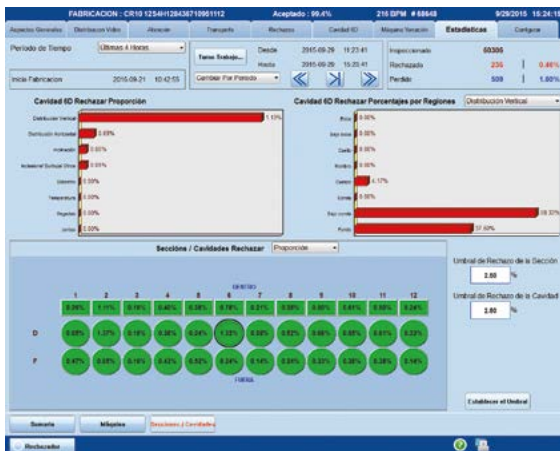


Closing the loop on glass container forming

Since its introduction a little over five years ago, customers have provided valuable feedback for enhancements and extra features to Bucher Emhart Glass FlexRadar. Combined with experience gained in the field, advances in technology and the evolution of the glass container industry, these suggestions have prompted several changes to the equipment, with an eye towards the future of hot end process improvement, as Philippe Spiteri explains.

FlexRadar is a glass container forming process monitor system. It uses two high-resolution infrared cameras, positioned at an angle on opposite sides of the conveyor to capture the thermal signature of glass containers as they travel on the flight conveyor directly after the IS machine.

These thermal images are a direct representation of the glass distribution within the container. They are processed to identify cavities that are producing containers with vertical glass distribution, horizontal glass distribution or dimensions standing out from the overall population, allowing for identification of glass forming process deviations and quality issues. Cavities or sections producing outliers are quickly identified and reported to the hot end operator for immediate corrective action.



FlexRadar statistics screen, showing performance by cavity for the last four hours.



Container spacing with automatic control.

DEFECT DETECTION

FlexRadar was originally designed as a trend analysis tool. It became clear early on that the high resolution infrared technology could also be used to detect a variety of critical glass defects. As a result, the software was modified to take advantage of the latest image analysis technology from Bucher Emhart Glass cold end inspection equipment and algorithms, designed specifically for the inspection of hot containers.

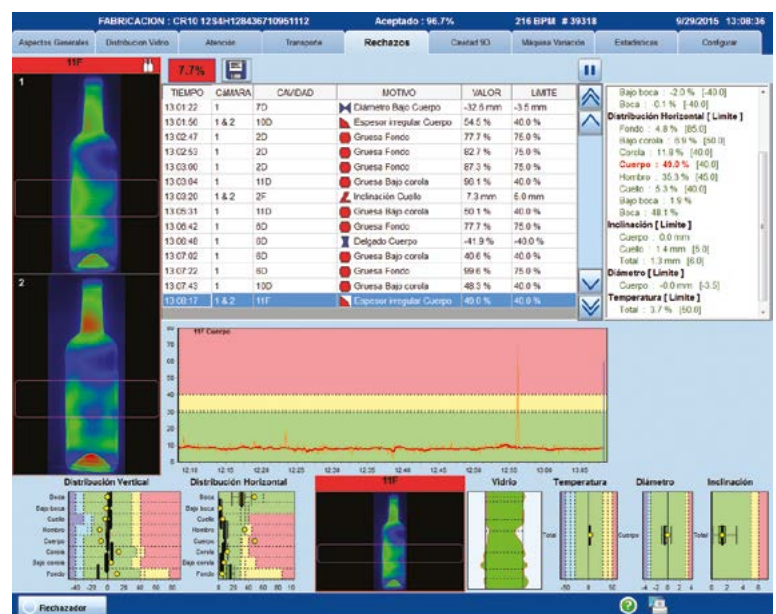
In addition to trend analysis and the identification of outlier containers, FlexRadar now inspects every container, with the ability to classify and reject such defects as stones, blisters, birdswings, mould fins and most importantly, random thin glass. Rejecting these defective containers before thelehr provides for a smooth transition at the ware transfer and protects the cold end equipment from broken containers. Furthermore,

with the new history screen showing images of defective containers by cavity, the operators can perform in-depth root cause analysis to quickly resolve problems and restore production efficiency.

DATA ANALYSIS

No process improvement system would be complete without the proper set of tools to analyse the data. The latest screens and reports were designed in co-operation with customers to show performance and trend by cavity, section or for the entire machine.

Operators and supervisors can analyse performance and review trends for different time slices, allowing for in-depth investigation and finetuning of the forming process. In addition, FlexRadar connects to the factory network for remote monitoring, data collection and integration in custom production reports.



FlexRadar defect history screen, showing the images and quality information for defective containers by cavity.



FlexRadar installed on a Bucher Emhart Glass NIS machine.

CLOSED LOOP

FlexRadar offers valuable benefits as a standalone machine. However, its real value emerges when integrated with the Bucher Emhart Glass FlexIS forming line control system. With FlexIS controlling all settings from the feeder to the stacker, FlexRadar becomes the 'eyes' of the machine.

Using real-time feedback from FlexRadar monitoring the containers on the flight conveyor, FlexIS automatically adjusts the timing of the push-out to maintain proper container spacing, preventing interference on the conveyor and jams at the ware transfer. Even though container spacing is often overlooked, this tedious and time-consuming manual adjustment usually involves highly trained personnel. The self-regulating capability of the automatic container spacing control has significantly reduced demands on the operators.

Automatic container spacing control is only one of the components in the array of closed-loop controls offered by Bucher Emhart Glass to support glassmakers in maintaining important process variables. The FlexIS Plunger Up Control assures optimal pressure and dwell time in press and blow production. Getting the characteristic timing from the Plunger Process Control (PPC) system for every stroke, the closed loop system automatically adjusts the pressure levels to achieve the desired plunger cycle setpoints for each cavity. Furthermore, using data points from the Temperature Control System (TCS), the FlexIS Blank Cooling Control keeps the blank

mould at the desired temperature contributing to the stabilisation of glass distribution in containers.

The closed loop controls are fully integrated in the FlexIS system. Parameters, setpoints and limits are configured at the FlexIS console and automatically restored at job change. Furthermore, machine operators receive feedback through consolidated FlexIS screens and reports, streamlining the skills necessary to gain full benefit from these innovative tools.

OUTLOOK

Piece by piece, Bucher Emhart Glass is building the framework towards an expert system, where all closed loop controls are interacting and the automatic adjustments are directly confirmed against the containers out of the IS machine. With the Plunger

Up Control keeping consistent plunger cycle, the Temperature Control System maintaining constant blank temperature and FlexRadar providing real-time feedback of production, glassmakers can tap the enormous potential for process improvement to raise the competitiveness of glass against other packaging materials. ■

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