

Automation of Filtration and Brand Management maximizes efficiency and cost returns

As competition from craft brewers started to impact national beer sales, a major American brewer increased the number of packaged brands at various brewing plants nationwide. To manage additional brands and maintain or increase production volumes while using existing filtration equipment, the brewing company needed to implement a finishing process that would be automatically managed and resistant to frequent equipment stoppage. Because the brewer's Colorado plant is regarded as a model of leading-edge technology and because it was equipped to be a multiple-brand facility, it was selected to participate in the development of these process enhancements.

SUMMARY:

Automation of Filtration and Brand Change Optimization

GOALS:

- Automate all aspects of the filtration process
- Reduce manual interaction
- Optimize filtration process and brand transition

SYSTEM COMPONENTS:

- Existing and new PLCs
- In-line analyzer
- Existing Human Machine Interface (HMI)

HIGHLIGHTS:

- Filtration process optimized
- Continuous automated brand change realized
- Capacity increase

APPLICATION:

Although its existing filter sequencing was already automatic, the Colorado brewing operations relied on manual filter setup to select source and destination tanks, brand code, volume targets, and finishing control setpoints. Prior to the upgrades, the beer finishing process was controlled ahead of the filter only with single-loop controllers. The finishing control setpoints were manually calculated based on feed beer analysis.

Adding an automatic brand-change process and filter-finishing automation would reduce supervisor and operator management, allow more brands to be produced, and improve the finished product with less run time. The brewing company approached ESC engineering to automate the finishing process because of ESC engineering's long, established relationship with the brewery and extensive process, design and programming background.

REQUIREMENTS:

Filter operation at the brewer's Colorado plant is based on a sequence of steps to start up, prepare the filter, filter the beer and wash down the filter at the completion of the production run. The filtration control system was a vintage Allen-Bradley PLC3.

To provide a single-pass finishing process, ESC engineering planned to install additional finishing control equipment immediately downstream from the filtration equipment. At the end of the filtration and finishing process, an in-line beer analyzer would then sample beer and continuously provide beer quality values to the control system, using a "brand code" to measure the quality of each beer against its tight recipe specifications.

Several specialized engineering, process and control modifications were required to maintain product integrity as ESC engineering implemented the automatic brand changes:

- Continuous-process brand-change implementation
- Beer analyzer to control the finishing process and adhere to tight product specifications
- Brand-recipe interface for control specifications
- Mechanical and electrical design engineering to install new control components
- Substantial control system programming of PLCs and area HMI

CHALLENGE:

Because the filtration and finishing process had to remain in continuous operation, the brand management upgrades would have to be implemented with minimal disruption.

Final product verification had been accomplished using quality assurance lab sampling and manual analysis after the beer was filtered. Occasionally the beer was not in specification, requiring further finishing. ESC engineering was challenged to implement and calibrate a beer analyzer and control system that would outperform these manual assessments.

To do this, brand code information would have to be coordinated with the analyzer, ensuring that the quality specifications matched the product being filtered. Product recipes were required to manage an increased number of control parameters for the finishing process as well as product specification-related alarms.



Filtration and Brand Management Automation



SOLUTION:

ESC engineering recommended adding a new Allen-Bradley PLC-5 to accept the analog beer analysis signals and send the filter's brand code to the beer analyzer. The PLC-5 would provide a modern control platform and be able to directly communicate with the control-area HMI. The PLC-5 would be arranged as a remote IO rack of the filter PLC-3 and exchange data and signals necessary to coordinate filter operation and brand analysis.

The finishing process would be controlled with PLC-based PID functions. These new process variables would be used to control the finishing process with a PID control algorithm.

ESC engineering followed a detailed plan to successfully integrate the necessary control components:

- The new beer analyzer was mechanically added to the finished beer process piping.
- The new PLC-5 was specified, designed and installed into the existing control system communication structure for the HMI and PLC-3.
- The PLC-5 program was developed to receive and scale signals from the beer analyzer and to communicate the brand code to the analyzer.
- The HMI was updated with new and modified screens and filter-setup configuration changes.
- Existing process graphics were modified to indicate the new beer analyzer and PID faceplates.
- New screens were added for filter setup in production runs of multiple brands, brand-change control setup, recipe data display and editing, beer analysis data displays of production run averages and destination tank averages.
- All new process-variable data was added to the HMI-trend database for historical recording.

RESULTS:

The filtration and brand management automation was successful, resulting in minimal downtime and increased production.

Thanks to ESC engineering's multistage plan execution, finished beer was provided continuously throughout the project timeline. The beer analyzer was installed in the process piping during a planned outage, and it started up and tested with the PLC-5 before its control functions were activated. After the HMI trending and sample reporting were complete and functional, lab qualifications were used to tune the beer analyzer to each finished beer product.

Because the finishing-process control and flying brand changes are coordinated functions, they were brought online simultaneously. At the completion of each filter brand run, the finishing brand-code change was timed to the beer analyzer to coincide with the feed beer change in the filter process train. The result is a clean break among finished brands, routed into different destination tanks, without stopping the filtration process.

Production throughput increased without additional filtering equipment, and beer quality was improved as manual filter setup and operation was eliminated. Multiple brands and targeted volumes can now be scheduled for automatic runs. Filter programming responds to a schedule of up to five queued brands and destination tanks. As each defined run nears completion, volumes are computed and tanks are automatically filled and timed with the brand changes.

This automation has been adopted at all of the brewing company's plants and has resulted in process efficiencies, increased production rates and unit-cost savings for the corporation.

FOLLOW-UP:

After these major modifications had been in place for a period of time, further refinements were commissioned, including operator ease-of-use features, additional quality control enhancements, larger brand-queuing capacity, and data logging for better reporting. ESC engineering continued to provide the control system engineering to accomplish these added features.



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