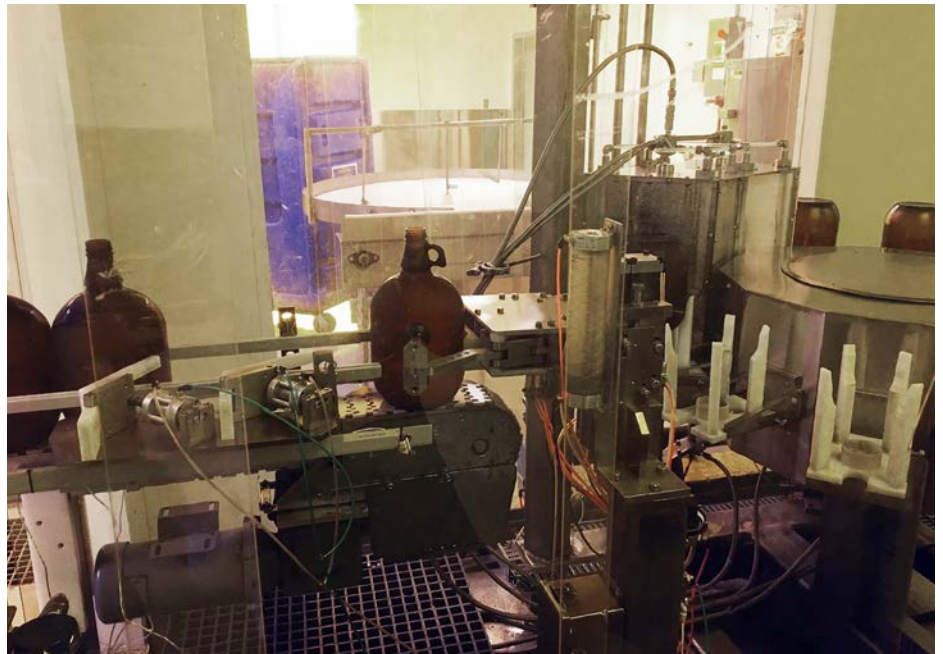


Fortune 100 Chemical Company Relied on The Hope Group For PLC Control Solution to Replace Pneumatic Logic System

Persistent shutdown issues at a critical bottle washing facility sent a major Fortune 100 U.S. chemical manufacturer looking for a diagnosis and solution to an aging pneumatic logic system. Under stringent requirements from its customer, the chemical company must clean the bottles to a cleanliness standard they set using deionized water that is heated to a minimum of 140 degrees. The bottles are presented to the machine via an automatic conveyor belt and then are automatically loaded into the washing table via a pneumatic rotary actuator that has a pneumatically operated claw for grabbing the bottle.

According to **Ray McCann**, Fluid Power Sales Engineer at The Hope Group, during the initial meeting with the customer about the challenge they were facing, it was outlined to him how many times the operation was down the previous year. There was a continuing concern that operators had no quick way to identify what part of the system had failed, thus making the repair cycle even longer. Ray explained that downtime was the issue and for the customer it was a costly issue.

Chuck Keyes, Senior Project Engineer, described that the problem of persistent breakdowns was caused by an old and complex pneumatic logic control system.



Pneumatic-Electrical Enclosure

A new pneumatic-electrical enclosure was designed, fabricated, and tested by The Hope Group and then delivered to the customer along with all the associated devices for installation. Once The Hope Group technicians completed the installation, the engineer and technician performed the start-up. Actuator speeds were set and the system control sequencing was tested during hundreds of bottle-washing runs.

The washing line was experiencing multiple breakdowns each month and sometimes more than one breakdown per week. As a result of lack of feedback from the control system, maintenance personnel frequently had no immediate idea of what part of the machine had failed. Many hours were being spent troubleshooting the cause of the shutdown.

Isolating the Problem

An assessment conducted by the chemical company proved that the major mechanisms of the washing line such as the indexing table, wash can, conveyer belts, and pneumatic actuators, were all in good working order and that it was the pneumatic logic control system that was causing the machine failures. It became apparent that a new control system

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was required to solve the problem and improve operational efficiency.

The engineering department at The Hope Group elected to introduce a system design that incorporated an Allen Bradley Compact Logix PLC to direct the control functions for the upgraded system. Chuck Keyes described the system as including electrical limit switches on all actuated components for the purpose of control sequencing and operator feedback. Chuck said, "The PLC would energize Parker pneumatic directional control valves to actuate the system cylinders and rotary actuators to perform the required washing sequence."

Design Challenges

Chuck pointed out that in order to design the new system and then create a PLC program, the machine operation sequence needed to be fully understood and documented. The first engineering challenge was understanding the system actuator sequence. Not only was this an important step to ensure that the bottle washing sequence was correct but also to recognize all safety

features and interlocks that would be required to protect equipment and personnel.

The next design challenge was one of the most important features of the new system; how to create the important operator feedback that the current pneumatic logic system could not. Chuck said that the PLC code was written as a series of steps that required the previous step be confirmed in order to proceed. Step validation is positively confirmed by the limit switches on the actuators, photo eyes and vacuum switches. If the permissive feedback needed to proceed with the next step is not received in the predetermined time period the PLC will trigger an alarm and display the device signal that has not been received. This feedback can be used by the operator or maintenance personnel to resolve the issue.

System Integration

The Hope Group designed a system that could integrate smoothly with the customer's existing control system, which was responsible for the conveyer belts, bottle feeding system,

and water/nitrogen monitoring system. The existing system closely monitors the DI water and nitrogen and will not allow the bottle washing machine to proceed with the washing sequence unless temperature and other parameters are within limits.

The Hope Group developed HMI (Human Machine Interface) screens that command the system and provide the customer with system feedback. The HMI screens can also be useful for monitoring the system during normal operation as helpful messages will pop up indicating which washing step the machine is performing and the status of all feedback devices. The screen will also indicate when a washing sequence has been paused by the control system as a result of the water or nitrogen parameters falling outside their appropriate ranges.

The new system was housed in a single pneumatic/electrical enclosure that replaced the existing control enclosure. The new enclosure was designed, fabricated and tested in Northborough, MA. After installation, the engineer and technician performed the start-up. Actuator speeds were set and the system control sequencing was tested during hundreds of bottle washing runs.

Ray McCann reports that the customer has greatly reduced the line stoppages and the few that occur are identified and quickly repaired. The issue of downtime has become more manageable thanks to the efforts of The Hope Group.



Monitoring System Processes

The Hope Group developed HMI screens that indicate which washing step the machine nearby is performing and monitors the control systems for the conveyer belts and bottle feeding system. The screen will also indicate when a washing sequence has been paused by the control system as a result of the water or nitrogen parameters falling outside their appropriate ranges.

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