



Omron's powerful machine vision technology helps bottled water manufacturer improve product quality and boost customer satisfaction

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Overview

A leading North American bottled water manufacturer was experiencing a variety of problems with its current inspection system that caused faulty product to pass inspection. In particular, the company was seeing issues with downstream contamination and damage to the manufacturing line due to misapplied caps.

Omron helped the manufacturer upgrade its inspection line with the FH Series vision system that provides accurate and affordable 360-degree monitoring of caps, tamper bands and fill levels. Using FH vision, the company can now be confident that its water bottles meet stringent quality standards without incurring additional costs. The entire system is backed by Omron's exceptional 24/7 support.

This solution provides the following benefits:

- Ensures 100% inspection of water bottles from all sides
- Prevents bottles with misaligned caps from damaging downstream equipment
- Strengthens brand reputation by keeping faulty bottles from being sold

The OMRON logo is displayed in a bold, blue, sans-serif font. The letters are evenly spaced and have a consistent thickness, giving it a clean and professional appearance.

Background

Correct application of bottle caps and tamper bands, as well as proper filling and sealing, are crucial for bottled water manufacturers and end users, as these are the primary features that maintain the integrity and hygiene of a bottle's contents. Misapplication and defects create excess waste in the production process, erode profits by incurring costly lot-based recalls, and reduce consumer confidence by signaling a lack of thorough inspection.

Caps can be misapplied for many reasons, including the presence of plastic burrs that haven't been trimmed off prior to application, improper orientation of caps during feeding, malformed bottle necks and other issues. Tamper bands present further opportunities for error, with improper folding and compromised integrity being major issues. Poor seal integrity can also cause leakage on the manufacturing line that leads to contamination of bottle contents, possible contamination of other food products, and malfunctions or damage during marking, casing or carton filling.

High-speed filling machines have complexities as well. For volumetric filling machines, faulty or under-filled equipment such as pistons and augers as well as clogged or restricted supply lines can cause under or overfilling. For level filling machines, problems with the vacuum or pressure are typical causes of improper filling. Timed filling machines can also lead to problems due to clogged or restricted supply lines.

Manufacturers must use an in-line bottle inspection system to continuously monitor the quality of the finished product, minimize product waste, prevent damage to downstream equipment and maintain consumer confidence. Controls must be reliable, accurate, and easy to maintain while also being able to communicate key diagnostic information.

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Cap placement challenges and downstream effects of misapplication

In applications like bottling lines, cap placement is critical. If misapplied caps are allowed to pass inspection, they can damage downstream equipment and lead to wasted product. If they make it to market, they can harm a brand's reputation.

Cap misapplication can occur for the following reasons:

- Plastic burrs that haven't been trimmed off
 - Caps that are fed upside down or at an angle (misaligned)
 - Cap feeder jams
 - Broken caps
 - Malformed bottle necks
 - Caps that are too loose or too tight (mis-threaded)
 - Tilted bottles
 - Changeovers in production runs
 - Tolerances that are out of specification
 - Caps that are missing
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Challenge

One of North America's leading bottled water manufacturers was experiencing problems with its bottled water inspection system, particularly with respect to cap placement, and Omron was called upon to identify a solution. The manufacturer was using a type of bottle cap with a very small trapezoidal top surface that was preventing the existing system from determining correct placement.

The small area on the top of the cap didn't produce enough height irregularity to determine if it had been placed correctly. Since the system couldn't focus on the top edge of the cap, it could only

evaluate placement by calculating the distance from the bottom of the cap to the neck ring. This was leading to unacceptable results.

Blind spots were another challenge. If a cap was tilted toward either of the system's two cameras, the distance between the bottom of the cap and the neck ring would appear equal on both sides, and the bottle would pass inspection even if the cap was tipped from front to back. This was because the system couldn't detect alignment issues that were directly in front of or behind the cap center relative to the camera.

Solution

Omron decided that its FH Series vision system would be the ideal solution for improving accuracy and correcting blind spot problems in the manufacturer's inspection system. The FH Series is a complete, all-in-one system that includes powerful controller options and up to 16 cameras along with menu-driven software and peripheral devices. It also provides real-time manufacturing process monitoring and statistical process control (SPC) data.

The comprehensive solution uses multiple edge detections and profiling to verify the proper placement and seal integrity of the bottle cap and verify consistency and repeatability. Two FZ Series monochrome cameras are installed 90 degrees from each other and at a 45-degree angle to the flow of bottles to provide complete visibility. Each camera has four inspection points at 90-degree intervals around the cap. They inspect bottles for missing caps, high caps, tilted caps, and missing and/or defective caps and tamper bands. The new system can now detect tilted caps in any direction, which is a major advantage over the previous one.

The system measures the gap between the cap and the neck ring and compares the result to preset thresholds. All four gap measurements must be within specifications for a bottle to pass inspection. If one or two measurements are greater than specification, the cap will be considered tilted. If three gap measurements are greater than specification, the cap will be considered high. The vision system will also inspect the tamper band, confirm its presence, and verify that it's not broken.

The Raw Material Distribution Control Panel and multiple remote I/O sub-control panels were added to control the flow of raw material to the mixer machines. These control panels were fabricated by Omron's authorized control panel partner and installed at various locations within the facility. The Raw Material Distribution Control Panel was designed using the NJ Controller and NA HMI, and NX-IO remote modules were used for the I/O. The system's controller is also responsible for opening and closing the automated valves, eliminating the need for operators to manually remove and reconnect the air hoses.

Technology spotlight: FH Series vision system

Omron's FH Series vision system is a complete, all-in-one system that includes powerful controller options and up to 16 cameras along with menu-driven software and peripheral devices. It can be easily installed as a package on PC-based systems and has compatibility with a number of different GigE Vision cameras. The FH Series also provides real-time manufacturing process monitoring and statistical process control data.

Results

The FH Series vision system has been continually improving the bottled water manufacturer’s product quality and end user satisfaction by guaranteeing proper cap placement, tamper band integrity and proper fill level. It also lowers costs by minimizing product waste due to malfunctioning capping and filling processes or defective raw materials. This has led to a reduction in customer rejection and product returns.

In addition, the improved system helps prevent downstream contamination and damage to the manufacturing line due to misapplied caps. Cap, tamper band and fill level inspection are automatic and 100% verifiable, which eliminates the need for audit checking or manual sight verification. The customer is highly satisfied with the results and the easy installation and has purchased additional systems for seven other plants nationwide.



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