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Eyes like a Hawk

LiteSentry machine spies defects before glass leaves the production line

By Katy Devlin
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They can happen at any time and turn any piece of glass into scrap. They hold no prejudice to type, and mar laminates, tempered glass and insulating glass units alike, costing fabricators money, causing customers stress and frustrating all.

They are scratches, digs, debris, abrasions, misplaced labels, coating pinholes and other defects that often go unseen by manufacturers and leave the plant undetected; until now, that is.

Officials from LiteSentry of Dundas, Minn., maker of automated inspection systems, introduced the Hawkeye Scratch and Defect Inspection System last February. The system is the first of its kind in North America, company officials say. Hawkeye addresses the subjectivity of human inspection and consistently identifies defective glass before it is shipped to the customer or before more processing.

"There is currently a lot of frustration about quality because of the way the glass industry writes quality [specifications], saying defects are those that can be seen from 6 or 12 feet away," says Mark Abbott, LiteSentry president. "What's the discriminator when you and I look at the same piece of glass and see different things? It's the accuracy of your eye versus my eye, and it creates a lot of arguments over quality."

In addition, defective lites cost manufacturers money if they go unnoticed. The company pays for transportation, labor costs and added-value elements such as lamination, tempering, final window assembly or insulating assembly for glass that they can't sell. These added elements can cost an additional $1 or more per square foot, depending on what fabrication processes the glass goes through, Abbott says.

"The cost of discarding a defective laminate may be $5 per square foot," Abbott says. "The cost of discarding a defective lite of glass that caused a laminate to be defective would have been 20 cents per square foot." Hawkeye is an on-line machine that occupies about 4 feet of line space, depending on the specifications of the particular plant. Glass passes through a darkroom-like enclosure that blocks ambient light, and the movement of the conveyor triggers seven high-resolution cameras spanning 84 inches to capture images of every part of the glass.

"The glass could be coming down a tempering line, IG line or coating line," Abbott says. "It's moving down that line at a high speed, the full line speed, and it comes through the system without slowing. We image that glass, looking at the top and bottom surfaces simultaneously. … The images are stitched together across the line."

The system collects all the information for each piece of glass and analyzes it for defects. Certain thresholds are specifically set for each, determining the sensitivity of the analysis based on the

needs of the customer. For example, some smaller scratches are acceptable for some glass applications but unacceptable for others.

After the system analyzes the glass, the defects are classified and shown on the screen for the workers.

“Scratch, dig, logo misapplication,” Abbott says. “Those are the general categories, and that’s all presented on the screen.” The system logs the defects on the screen as “S” for scratch, “D” for dig and “L” for logo misplacement. “The unloader either makes a secondary judgment or discards the glass,” he says.

Hawkeye’s computer program works through algorithms. The software analyzes the black-and-white digital images of the glass and identifies acceptable and unacceptable scratches and other defects according to the many algorithms. Another program disseminates the information on the screen.

“This is a very data-intensive process,” Abbott says.

All of the information moves into a database that records time, date, size, thickness, coating type and details about the defects. The database allows manufacturers to study their plant performance, Abbott says, looking only, for example, at the productivity of their second shift workers. This recording system also easily identifies reoccurring defects that could be the result of a problem in the line.

However, before the images can even be processed through the complex strain of algorithms, the cameras have to be able to take clear images.

“When you’re trying to detect a scratch or any defect that’s barely visible to the human eye, maybe just 1/10th of a millimeter in width, it requires a high resolution, much higher than things we’ve previously done,” Abbott says.

Hawkeye identifies scratches at least 0.4 millimeter wide and 0.6 millimeter long and digs at least 1 millimeter in diameter via its monochromatic, charge-coupled device industrial cameras paired with light-emitting diode lights.

“This is just a starting point specification that our customers may develop to work with their customers,” Abbott says. “We easily meet this. Our system can see defects half this size. But you have to beat your specs.”

Abbott says that while the motivation to build a machine that addresses the defect detection needs of the glass industry was an important driving force behind creation of Hawkeye, it wasn’t the only motivation.

“Our competitors are primarily in the defect game,” Abbott says of the companies, including Isra Glass Vision of Germany and Image Automation and Sira Group of England, that also make defect inspection machines. “Europeans tended to get into quality inspection ahead of the Americans.”

Demand for Hawkeye in the United States has been quickly growing, says Abbott, and companies such as Cardinal Glass Industries, J.E. Berkowitz L.P., and Northwestern Industries Inc. are in various stages of the looking and buying process.