

Labyrinth Editorial-

A new client approached Machine Vision Technology with a request for a fully automated quality control and inspection system to handle and inspect labyrinth plate plastic mouldings. This is for a new UK based production requirement, for a global blue chip customer in the food and beverage industry.

There were several considerations when evaluating the technical aspects prior to putting forward a proposal-

- 1) The system must handle with minimum changeover two labyrinth plates mouldings that are physically different in size and shape.
- 2) The system must not cause any damage to these components, which have a detailed periphery. Damage will result in the components losing their functionality.
- 3) The system must inspect from all three planes-
 - i) Top for damage and OCR (optical character recognition).
 - ii) Bottom for diameter and damage.
 - iii) Side for damage, height and profile.
- 4) The system must be capable of operating at up to a rate of 1200 parts/minute with the labyrinth plates either cold from storage (minimum 10 degrees C) or directly from a moulding machine (maximum 40 degrees C).
- 5) The system must detect and expel 100% of components that are outside the specified limits given in the clients URS, but generate the minimum amount of waste due to either damage caused to the labyrinths by the vision system or rejection that are not outside the limits of the specification.
- 6) It must be designed to meet food and GMP standards.

Machine Vision Technology enlisted the expertise of their automation handling partner, who are leading experts in the field of component handling.

A concept evolved that meant potentially no damage could be caused to the labyrinth plates and enable MVT vision cameras to be mounted to view top, bottom and sides of the components.

It also employed a system where there was no tooling changeover required between the two types of labyrinths, and utilised a menu selection via the HMI.

To enable the system to deliver 1200 parts per minute the design utilised a twin headed system with duplication of rotary feeders, conveyors, disc and reject segregation, with a common good part collection.

This handling solution involved a revolutionary idea of a rotating glass disc.

Continued-

This led MVT to a previously unknown area of expertise in geometry which proved to be both technically interesting and challenging, remembering that the glass disc needed to be flat over 650 mm diameter and capable of being spun at a rate fast enough to pass up to 600 labyrinths per minute beneath the vision system.

The labyrinths are fed from a rotary feeder, onto a conveyor system and fed individually onto the rotating glass disc.

It was at this point it was discovered due to the design of the labyrinths they have a unique tendency to "castle or double up" which then causes problems in the handling and inspection, resulting in false rejects. These problems are one of strengths and were solved with the expert use of gating and air jets, while still ensuring that there was no damage caused to the labyrinths.

An encoder and trigger sensor were fitted. Once a labyrinth has passed through the trigger sensor an encoder count is stored. The PLC then tracks the labyrinths around triggering the appropriate cameras and ejecting reject labyrinths. Good labyrinths continue around being gently swept off down a chute into a collection box.

A PLC monitors a count of all good and reject labyrinths from both heads which maintain correlation over continuous 24/7 production.

During discussions with the customer it also transpired that the labyrinths were to be manufactured from a multi impression mould and it was desirable to segregate labyrinths on demand from any specific mould. These were required both for possible damage from any specific mould and for SPC (statistical) analysis.

To implement this the Vision System had to utilise O.C.R. (optical character recognition) reading the cavity number (alpha numeric) on 3mm high characters that are moulded in the labyrinths at the bottom of a 6 mm diameter hole, 5 mm deep. They are passing the cameras at 600 per minute, but also the position of these characters is anywhere within 360 degrees, and white on white or black on black.

This type of OCR problem is one of Machine Vision Technology strengths with many such systems previously solved in industry.

This feature was to prove of great value to the customer preventing the need for manual sorting of boxes of labyrinths containing thousands of mixed components, and the implementation of SPC.

The cameras used in the MVT vision system utilises the latest technology high resolution cameras with Telecentric lens and lighting.

This was required to achieve repeatability of measured values, with a ONE MICRON resolution, to 20 microns accuracy over 10,000 measured parts.

As part of the trial the rejected labyrinths were segregated and passed through the system 3 times to measure the number of false rejects.

This trial was conducted a total of three times to obtain the required degree of confidence necessary for a 24/7 operation.

Within the scope of supply an automatic indexing boxing system was also included with a count of 3000 pyramids per box.

The customer has now passed stringent preproduction trials required by his customer in preparation for full production.

The customer has congratulated Machine Vision Technology in designing and implementing such a unique system and to confirm their faith an order has now been awarded for another such system for delivery in 2010.

This now gives the customer a huge benefit in supply of these precision labyrinth mouldings in terms of percentage of false rejects, and damage incurred during manufacture, helping them maintain their lead in a hugely competitive market place.