RNA

RNA Robotic Insert Loading and Test System

Introduction

Our customer challenged RNA to design and manufacture a full automated system with minimal operator intervention to enable the manufacture, test and packaging of the Gen Gemma Enclosure.

The system was required to automatically load components into a vertical moulding machine. Each mould tool (2 off mounted to a rotary index table) had 4 mould impressions which required a total of 8 components to each mould tool (e.g. 4 Inserts and 4 Antenna). On completion of the moulding cycle the 4 mouldings were automatically removed, the moulding sprue removed and then placed to a cooling carousel. From the cooling carousel the mouldings are tested, firstly for continuity across the antenna pins and then into a leak decay station. On competition the finished components are either rejected (if failed either test) or automatically packed. The packing area included an automated empty box in-feed and fill box out-feed.

RNA drew upon its extensive experience in component handling, testing and robotic transfer to develop this fully automated solution.

The Challenge

⇒ The automated system must achieve precise repeatability and positional accuracy when placing the inserts and antenna's to the moulding tool.

⇒ The mouldings are at 70°c when removed from the moulding tool, they have to be cooled prior to testing. The enervative cooling process facilitates up to a maximum of 12 minutes cooling time.

⇒ The system must automatically place good mouldings in the appropriate packaging and securely quarantine rejected mouldings for further manual inspection.

Solution

The process flow chart below shows the main functional elements of the solution.

To begin the process 2 types of component parts (Insert & Antenna) are fed and orientated via 2 vibratory bowl and linear feed systems. The components are fed to 2 independent precession shuttle mechanisms so that the Insert and Antenna are always in a known repeatable and accurate positional location. RNA utilised a Fanuc M10iA robot complete with a specifically designed double gripper mechanism to pick 4 Inserts and 4 Antenna from their respective locations. The Inserts and Antennas are then placed in the correct orientation within the 4-cavity moulding tool. Our client RA Labone utilised an Arburg 1200T vertical moulding machine with a 2 position rotary index table, this enables RNA to simultaneously load inserts and antennas whilst the moulding process is taking place.
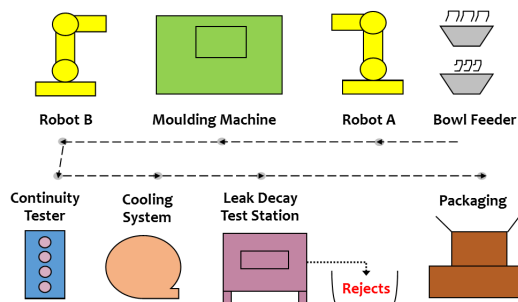
On completion the 2 position rotary index table actuates and presents an open mould tool to a second Fanuc M10iA robot. The robot utilising a double gripper picks the 4 previously moulded components along with the moulding sprue. The robot indexes and drops the sprue material into a recycling bin. The 4 mouldings are now placed to the continuity test station. If all 4 mouldings pass they are then placed within the required cooling area.

One of the critical requirements of this project is that all mouldings go through a decay test cycle. When the mouldings are removed from the mould tool they are at a temperature of 70°c, to ensure that the efficiency and accuracy of the test process is maintained we have to reduce the moulding temperature in a controlled manner. RNA developed a cooling system based on a rotary table and cooling fans.

After the cooling phase the mouldings are placed to the leak decay test station. All 4 mouldings are detected in the station and they are all marked with a simple pin stamp. The leak decay test is based on 3 bar @0.3cc/min. On completion of the leak decay test all 4 components are mark for the second time with the pin stamp. All 4 moulding are now removed automatically and placed with a holding device within the packing area. If they fail they are placed within a second secure quarantine bin.

The packing area consists of an automatic box in-feed and out-feed system along with the escapement mechanism. An empty box is presented and filled with tested moulding, each box has 72 pockets and each pockets holds 2 mouldings. Once the box is filled it is automatically released and transferred to the out-feed conveyor system. The capacity of the in-feed and out-feed conveyors is 10 boxes.

Key features & benefits

- All through the process we use Poke-Yoke design principles for our tooling, location fixtures and grippers.

- Handling processes with extremely high precision and accuracy, multiple sensors monitor part presence at key stations ensuring reliable repeatable positioning of components.

- Cooling system improves cooling time and ensures the integrity of the moulding is maintained.

- Continuity and Leak Decay test stations with positive marking of good and bad mouldings.

- A fully integrated, compact system provides great savings in labour cost, floor space and WIP.

- Improved productivity, consistent product quality and minimal waste.

- Future proof – the system can be programmed to suit new or additional components.

All of these benefits deliver a short payback period and impressive return on investment.