Perfectly sealed

Laser transmission welding of sensor housing

Sealed plastic sensor housings for new linear range sensors in automatic transmissions are now created with laser transmission welding. In-line process control allows for high weld seam strength, short cycle times, quality control, and an aesthetically fine product. Tyco Electronics introduced a linear range sensor for automatic transmissions. This range sensor is located in the oil tank, together with the gear control, where it is exposed to extreme environmental conditions which require the sensor housing to have a very high durability.

This component wirelessly records the driving mode of an automatic transmission. Thus, special challenges were faced in the choice of sealing technology used for the sensor enclosure, as this housing must operate error-free under the subjected environmental conditions for the life of the vehicle. After a detailed evaluation of all alternative procedures, laser transmission welding was selected as the preferred method. The benefits of laser welding a plastic cover to a plastic housing are short cycle times, the ability for in-line process monitoring, the high strength of the weld seam, and the fact that no welding filler or other dispensable adhesive is required. Furthermore, mechanical stress to the internal electronic components, and release of plastic particulates which are typically caused by ultrasonic or vibration welding, are totally eliminated by using laser transmission welding.

Due to the conditions in the gear box, PA 6/6T with a 25% glass fibre composition was selected, due to its ability to withstand thermal shock and aggressive chemical substances. The housing is pigmented with carbon black for the absorption of laser radiation. The cover, however, consists of ecore coloured PA6/6T in order to allow the transmission of the laser radiation.

Compensation of manufacturing tolerances

With consideration for the functional and manufacturer specified conditions, the construction of the housing was laid out accordingly, with emphasis on the weld path, which can adjust to the manufacturing tolerances of the injection mould during the welding process by monitoring of the melt travel. By simultaneously welding the top edge of the housing in a circular pattern with contact pressure from the clamping device, the melt travel of the cover to the housing (within a specified time frame) can be measured, recorded and evaluated for quality control.

In co-operation with the sensor manufacturer and the laser welding equipment manufacturer, a suitable system was selected for welding the two plastic components of the module. A scanner based laser plastic welding machine was used consisting of a compact welding head and a separate control cabinet. The welding head contains the laser as well as the beam guidance, clamping technology, and all necessary components to guarantee a laser class 1 safety rating.

Due to its compact size, the welding system can be integrated into an existing in-line production chain by using a simple rotary indexing table or conveyor system. The separate control cabinet accommodates the control, the user interface, and the peripheral devices of the laser.

Laser welding system to detect superficial burns

Due to manufacturing logistics, manual loading or the plastic parts to the laser welding system on an eight position rotary indexing table was the first choice. The extraction of the parts after welding is done by a pneumatic Pick&Place robot which sorts the parts on a slide ramp which separates each individual module according to the classification of the quality control feedback loop of the welding system. An upgrade with a handling system for the fully automatic placement and extraction is also possible.