Report

LED lamps in a single step

Production costs reduced dramatically by innovative multi-component technology

State of the art LED products combine a long service life and operating safety with minimal energy consumption. Maximum efficiency – this as well is the focus topic at the global production facilities operated by Hella, the technology leader in the field of automotive LED lighting. In the south west of Finland, Hella produces side marker lamps for caravans and mobile homes. Thanks to a highly-integrated process for a new lamp model, Hella has been able to reduce production costs and the floor space required for the production plant.

The OneLED side marker lamps are produced in three component injection moulding in combination with insert-placing technology. Because this is a fully automated process in an autarchic production cell, Hella has been able to make lamp manufacturing in Europe competitive again. "Cost pressure was the main driver behind the new development", emphasises Sami Yllikäinen, D&D Manager with Hella Lighting Finland Oy in Salo, around 50 kilometres south east of Turku. "But at the same time, we wanted the lamps to be more intelligent than the predecessor models." To this end, the OneLED lamps achieve the legally required lighting distribution with close to 90 % less power consumption thanks to a sophisticated combination of efficient light emitting diodes and precision lenses. Instead of the previous three light sources, the OneLED lamps only contain one; the lens design ensures the distribution of the illumination over the entire lens surface. Another innovation: the use of conductive plastics removes the need for printed circuit boards. In 2010, this innovative lighting design took first prize at the International Society for Plastics Technology's SPE Awards. Beside Hella Lighting, other companies involved in the project were honoured with this award: ENGEL AUSTRIA (injection moulding machine), Sabri Scan (mould) and A. Schulman (raw material).

ENGEL AUSTRIA GmbH, A-4311 Schwertberg/Austria,
Tel.: +43 50 620-0, Fax: +43 50 620-3009
E-mail: susanne.zinckgraf@engel.at, http://www.engelglobal.com

ENGEL be the first.

Redefining multi-component technology

Three different polymer materials are processed. The lower part of the housing and the sealing edge on the lamps is made of ABS; the lens of PMMA and the tracks are injection moulded in an electrically conductive compound. This is not a legacy multi-component application. "Hella has totally redefined multi-component technology," explains Anders Nybäck, Managing Director of ENGEL Finland Oy, the subsidiary of injection moulding machine manufacturer, ENGEL AUSTRIA, in Helsinki. "While the individual materials are traditionally processed one after another, the objective here is to inject three different materials at the same time."

Two steps per processing phase take place in the complex 2+2+2-fold mould with three station rotary plate. The cycle comprises a total of three phases. In the first phase the PMMA lenses and the ABS housing shells are injected at the same time. In phase 2, a multiple-axis robot insert-places LEDs, resistors and metal contacts into the housing shells, after which the tracks are injected. Then, in phase 3, the robot places the lenses on the housing shells; both halves of the component are overlaid with ABS and thus sealed. This process is patented by Hella Lighting Finland Oy (EP 2168748).

After the injection process, the robot takes off the finished parts and feeds them to a test station for 100 percent quality control. The lamps are then deposited on trays before a second, larger multiple-axis robot packs 72 of them each in a cardboard box for transportation. The large multiple-axis robot is also responsible for folding and gluing the boxes. It also places assembly instructions in each box and labels the closed box before stacking the boxes on a pallet.

The following machines, systems and components are involved in the fully-automated process behind the protective fence: an ENGEL victory 180 combi injection moulding machine with rotary plate mould, two multiple-axis industrial robots, a PC-based quality assurance system, a punching machine for on-site manufacturing of the metal contacts to be insert-placed, an inkjet system for labelling the products, two printers for the assembly

instructions and labels, and a complete packing station for folding, gluing and stacking the transport boxes. All told, producing the OneLED lamps takes up a space of 3 by 4 metres.

"In comparison, manufacturing the predecessor products took up a complete production shop," Yllikäinen adds. Additionally, the process took more time, and involved more steps and much manual intervention. The housing shells and lenses were produced independently on two injection moulding machines, and temporarily stored. The housing shells were then populated with PCBs and bonded or welded onto the top part of the lens. Today, we turn out one ready-for-use side marker lamp every 30 seconds," says Yllikäinen. "The injection moulding cycle time defines the cycle of the entire production cell." Due to the high level of process integration and automation production costs have dropped dramatically, "by half", the head of D&D reports. "This means that our products can assert themselves against competitors in Asia. The caravan market in particular is highly sensitive to price, and the volumes are typically low." Batch changes are the order of the day. To reduce the overhead involved, the mould has replaceable cavity sets. To reach maximum flexibility, furthermore the process allows to use either electrically conductive polymers or conventionally inserted printed circuit boards.

Tie-bar-less benefit saves investment costs

Hella Lighting Finland produces around 900,000 sidemarkers per year and the aim is to increase volume to over 1 million in the near future. Production takes place in two-shift operation, with three shifts at peak times. The Finns attribute today's trouble-free production to their exhaustive and far-sighted planning up front. "We were aware at all times that this was a very risky project," says Yllikäinen. "We were entering new terrain and invested in a completely new technology to do so. This made it all the more important for us that our partners were able to guarantee a high level of assurance from the outset."

Besides the mould, the injection moulding machine was the focus of attention. "We needed a machine with a control unit that was designed to inject different materials at the same time", Yllikäinen explains. "This has always been possible with the CC 200 control unit on the

ENGEL injection moulding machines", Anders Nybäck adds. "Apart from Hella, none of our customers has ever used this option, so far. Thus, the project was a first for ENGEL Finland, too, and an exciting challenge." The numerous references in the field of multi-component technology, and the positive experience that Hella had made up to this point with ENGEL on-site service, were equally important factors in choosing an injection moulding manufacturer as the ENGEL victory machine's tie-bar-less design. "Thanks to tie-bar-less technology we were able to deploy a machine with a clamping force of 180 tonnes," Sami Yllikäinen reports. "Based on the mould size, we would normally have needed at least a 300 tonne machine. Our budget was limited, and this aspect obviously played into our hands."

Because the clamping unit on the ENGEL victory machines does not use tie-bars, the mould mounting platens can be used right up to their edges, and in many cases even beyond. This proves to be a benefit, especially in multi-component technology. "The mould is usually relatively large in multi-component applications, whereas a comparatively low clamping force is required on account of the fairly small projected part surfaces," explains Franz Pressl, Product Manager for the ENGEL victory machine range at ENGEL's head quarters in Schwertberg, Austria. In addition to this, tie-bar-less technology offers benefits in terms of automation. The robot has maximum freedom to move; the robot arm can reach into the mould space in any direction without any obstacles. This results in shorter cycle times, smaller footprints and lower plant heights.

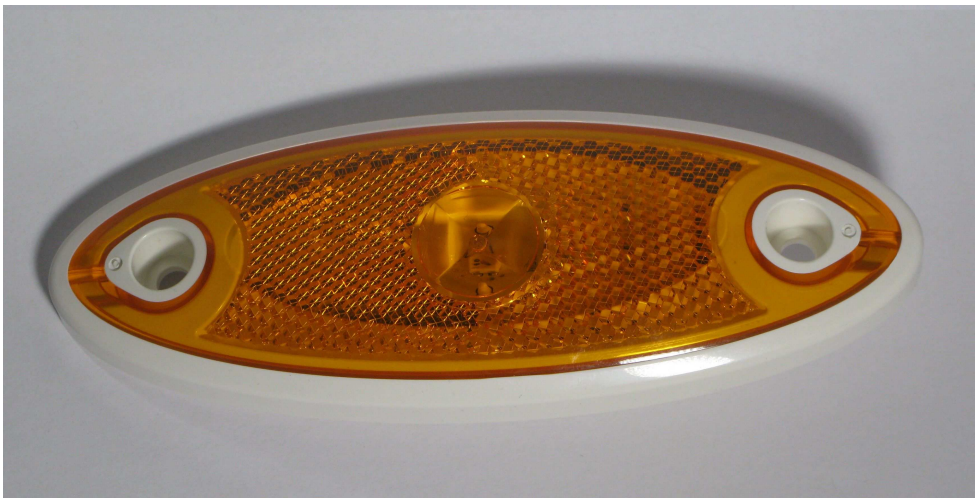
Market share extended

Hella achieved market penetration with its OneLED lamps in a very short time. Hobby Caravans started the trend, but now many other caravan and mobile home manufacturers order their side marker lamps from Hella in Salo. "This new development has enabled us to extend our market share in Europe," as Sami Yllikäinen points out. "At the same time, we are even getting enquiries from HGV manufacturers." Hella produces the OneLED lamps exclusively in South Finland. To increase output, Yllikäinen and his team are planning to increase the mould's cavity count next. ▪

<<Box:>>

At a glance

With a turnover of 4.4 billion euros (2010/2011), Hella – whose head quarters are in Lippstadt/Germany – is one of the top 50 automotive suppliers, and one of Germany's 100 largest industrial companies. At 70 locations in more than 30 countries, Hella employs some 25,000 staff who develop and produce lighting technology and electronics components and systems mainly for the automobile industry.



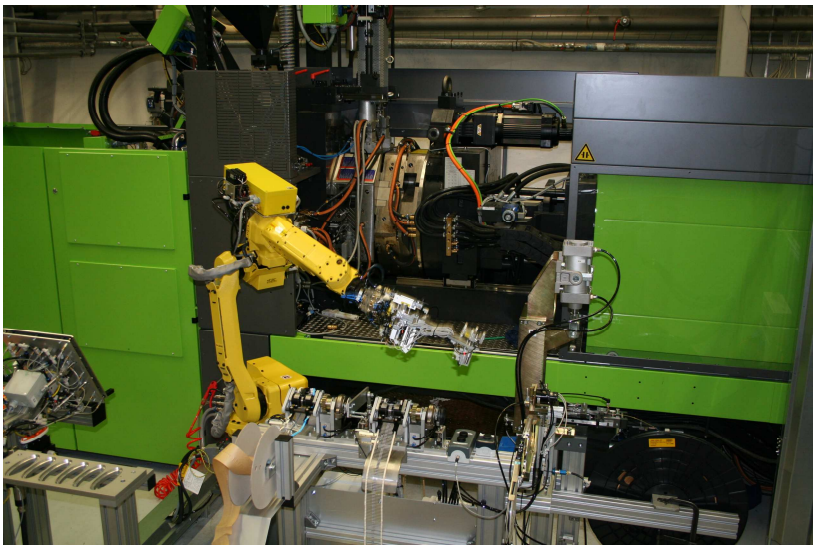
The OneLED lamps are manufactured in a single production step. This is made possible by a combination of three component injection moulding, insert-placing technology and the use of innovative, conductive materials. (Fig.: Hella)

Hella Lighting Finland in Salo produces around 900,000 sidemarkers per year and the aim is to increase volume to over 1 million in the near future. (Fig.: ENGEL)

Conquering new territories together (from left to right): Sami Yllikäinen (Hella), Anders Nybäck (ENGEL Finland) and Franz Pressl (ENGEL AUSTRIA). (Fig.: ENGEL)

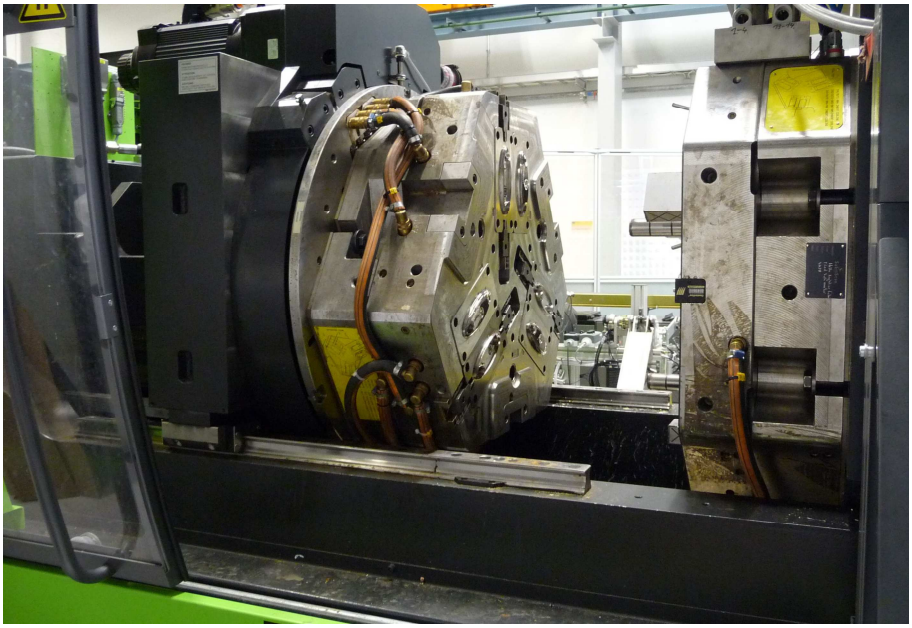
ENGEL AUSTRIA GmbH, A-4311 Schwertberg/Austria,
Tel.: +43 50 620-0, Fax: +43 50 620-3009
E-mail: susanne.zinckgraf@engel.at, http://www.engelglobal.com

The production cell for manufacturing the OneLED lamps works autarchically on a minimal footprint. (Fig.: Hella)



The components are set to the mould from the feeders by multiple-axis robot. (Fig.: Hella)

ENGEL AUSTRIA GmbH, A-4311 Schwertberg/Austria,
Tel.: +43 50 620-0, Fax: +43 50 620-3009
E-mail: susanne.zinckgraf@engel.at, http://www.engelglobal.com



Tie-bar-less technology allows for the use of large moulds on a relatively small injection moulding machine. (Fig.: ENGEL)

ENGEL AUSTRIA GmbH, A-4311 Schwertberg/Austria,
Tel.: +43 50 620-0, Fax: +43 50 620-3009
E-mail: susanne.zinckgraf@engel.at, http://www.engelglobal.com