A journey through time into the future of injection moulding

2,700 guests attend ENGEL Symposium 2012
Maximum output

In a recent survey on our staff, “maximum output” was the characteristic most frequently used in description of ENGEL employees. Maximum output doesn’t just refer to the performance of an individual employee, but also means that his/her whole team is working together professionally and efficiently. The team has a clear goal and each person in the team is working steadfastly towards that goal. This is the only way maximum output is going to result in maximum benefit as well.

In this latest edition of Injection which you’re reading, maximum output plays a special role. It is only through the maximum output and resolute customer focus of our employees that innovations are able to occur. And behind every innovation, there are people whose personal vigour, knowledge and experience have had a major influence in its development, and driven it forward.

Many of our ideas have now become innovations. These include vulcanising silicone at room temperature, detecting environmental changes and compensating for them automatically to keep the weight of moulded parts constant, and integrating the injection moulding and blow moulding processes on one injection moulding machine to produce containers for food and cosmetics.

This edition of Injection contains a multitude of market-ready innovations which provide significant advantages when it comes to integrating individual parts of the production process. These advantages enable our customers to move one step ahead of their rivals, because ultimately, the crucial factor in international competition is the sensible use of innovations – along with the incorporation of innovative employees’ maximum output.

In the area of injection moulding, we are certain that there are many more possibilities for widening the application scope through new technologies, processes and materials, thereby ensuring long-term growth in partnership with our clients.
4 ENGEL worldwide. around the corner.
Fairs, events, projects

8 Opening in January
ENGEL Deutschland Technologieforum Stuttgart

9 A journey through time into the future of injection moulding
2,700 guests attend ENGEL Symposium 2012

10 ENGEL HL-Awards 2012
Innovative applications on tie-bar-less machines

12 New horizons for lightweight construction
Technology Interview: In situ Polymerisation

14 Full modularity with excellent efficiency
ENGEL e-mac: the new all-electric injection moulding machine

14 Highest standards of precision
ENGEL e-duo with electric injection unit

15 Intelligent online process control
iQ weight control, the software for outstanding reproducibility

16 Clean and stable for a lifetime
ENGEL oil maintenance system reduces maintenance costs

17 Into multi-component technology’s big league with UV light
Silicone vulcanisation at low temperatures

18 Injection moulding and blow moulding in one
inject2blow reduces time and costs

20 Efficiency boost through automation
Seletec in Uttendorf goes for system solutions from one single source

22 Lower weight, higher quality
Behr chooses ENGEL foammelt

24 Flexible automation
Highly integrated: ENGEL easix opens up new dimensions to Ensinger

26 LED lamps in a single step
Hella reduces production costs by innovative multi-component technology

28 An effortless new generation
Fiskars maximises production efficiency for long multi-component parts

30 Out with risk, in with efficiency
ENGEL supplies turnkey system and GMP documentation to Helvoet
Production capacity doubled
Opening ceremony in Shanghai

ENGEL’s production plant for large-scale machines officially opened in Shanghai on 20th April 2012, having been considerably expanded. Capacity has been more than doubled to cope more effectively with the rising volume of orders in the region. Local and international clients and partners invited to the opening of the facility were impressed by the high quality of production and ENGEL’s system solutions expertise. “Over the past few years, we have seen significantly higher demands placed on plastic parts made in China,” explains Gero Willmeroth, Sales and Service Manager at ENGEL MACHINERY (SHANGHAI) Co., Ltd. “There is a call for even more sophisticated solutions, which enhance productivity and efficiency in production.”

In fiscal year 2011/2012, ENGEL’s turnover in Asia amounted to €125 million for the first time. The company’s achievement is largely due to continual investment in the region. The ENGEL production plant for small and medium-sized machines in Korea will also be expanded by the spring of 2013.

Meet the experts
Chinaplas in Shanghai

Chinaplas 2012 saw ENGEL present a new exhibition concept. Five leading edge topics were presented with videos and sample parts. “Additionally, we had experts from ENGEL China and from the business units at ENGEL’s headquarters in Austria on site to talk to trade fair visitors about today’s and future challenges“, says Gero Willmeroth. The focus was on the trend topics lightweight construction, automation, LSR processing, process monitoring and glazing.

A practical demonstration was given at the ENGEL trade fair stand courtesy of three manufacturing cells, including a tie-bar-less ENGEL victory 120 machine with ENGEL viper 12 robot, used to produce covers for mobile phones.

“The ENGEL victory machines give plastics processors excellent support when it comes to saving investment costs and energy.”

Gero Willmeroth, Sales and Service Manager at ENGEL MACHINERY (SHANGHAI)

Reducing cost per unit
Medtec Europe in Stuttgart

At Medtec Europe in March 2012 in Stuttgart, Germany, ENGEL AUSTRIA demonstrated how an entire workstep can be removed from the production of disposable syringes, while at the same time saving raw materials. At the heart of a highly integrated and automated manufacturing cell was an all-electric ENGEL e-motion 200/100 T injection moulding machine featuring a clean room design and 100 tonnes of clamping force. The machine was used to produce disposable syringe barrels (including needles) in a single workstep. Needles were inserted into the Zahoransky pilot mould by a linear robot before being overmoulded with COC; the syringe bodies were removed from the mould by an ENGEL easix multi-axis robot.

The integrated procedure differs from the conventional multi-stage process in which needle holders are produced first and the cannulas are subsequently affixed.
Because there is no need for glue, and the COC acts as a barrier, the application is also suitable for manufacturing pre-filled syringes, which have previously been made of glass mainly. "Prefilled syringes are a growth market", emphasises Christoph Lhota, Head of Business Unit Medical with ENGEL AUSTRIA.

20 years in the Czech Republic
200 customers join celebrations

Injection moulding technology was in the spotlight at the Prague conference centre at the end of February 2012 as ENGEL celebrated the 20th anniversary of its Czech sales and service office in the company of 200 guests. “A lot of our customers and friends have been with us for years, so there was almost a family atmosphere at the event”, said a delighted Petr Stibor, Managing Director of ENGEL CZ s.r.o., commenting on the many well-wishers. In the imposing shadow of Prague Castle, the guests enjoyed a unique blend of Austrian and Czech culture, cuisine and music. Thanks to ENGEL’s subsidiary in Prague, the company remains close to its clients in the Czech Republic. Consultancy, sales, service, spare parts and training courses are all offered locally. The company has also operated a production site in the Czech Republic for more than a decade. ENGEL Strojírenská spol. s.r.o. in Kaplice is home to the ENGEL Group’s competence centre for sheet-metal processing. ENGEL has an approximate total of 600 employees in Prague and Kaplice.

Utilising energy savings potential
DKT in Nuremberg/Germany

Energy efficiency was the number one topic at the ENGEL AUSTRIA booth during the Deutsche Kautschuktagung, DKT, (German Rubber Conference) in July in Nuremberg, Germany. With three machines on show, the system supplier for injection moulding technology demonstrated best-in-class approaches to manufacturing premium quality rubber and silicone parts in a sustainable and at the same time economic way using bespoke systems. "Energy saving potentials in elastomer processing are even higher than in thermoplastics", explains Leopold Praher, Head of Sales elast/LIM with ENGEL AUSTRIA. "The long heating times are decisive”. Since the drive unit is only active when the machine is moving, no energy is consumed while the machine is stationary (for example, during the heating phase). This is achieved by eliminating idling in the drive system.

„Ecodrive saves 50 to 70 % energy in elastomer processing.“
Leopold Praher, Head of Sales elast/LIM with ENGEL AUSTRIA
Honoured ENGEL apprentices are among the best

The best mechanical engineering apprentice is a female ENGEL employee. Karin Aigner not only secured first place in the mechanical design engineers category in the 2012 competition for apprentices organised by the Economic Chamber for Upper Austria – she also won a special award for the best overall female trainee in a skilled technical trade. A total of four ENGEL AUSTRIA trainees claimed the coveted awards this year, winning through against 723 competitors from 97 companies. ENGEL AUSTRIA, which has won state awards for its trainee programme, runs apprenticeships in nine technical professions. ENGEL appoints more than 40 new apprentices in Austria every year. An ENGEL subsidiary also became a trainee institution for plastics and rubber process technicians in August 2012. Two apprentices were taken on in Hagen.

Market undergoing radical change

Medical engineering conference in India

ENGEL invited some 50 plastics processing firms to its med.con medical technology conference held in Delhi and Mumbai in March 2012. The attendees learned more about trends and innovative products as well as European expertise in system solutions. The market for medical technology in India is expanding all the time. Alongside the global medical technology groups currently expanding production capacity in India, more and more local plastics processing firms are getting involved in the field. However, many of these companies lack expertise and experience specific to the sector. “The challenge lies in combining high product quality with maximum cost-effectiveness”, emphasises Jitendra Devlia, Managing Director of ENGEL MACHINERY INDIA in Mumbai. “At med.con, we saw how state-of-the-art technologies and a high degree of automation can achieve this balancing act, and exactly what is required for the Indian market in particular.”

Another 6,000 square metres

ENGEL expands Schwertberg site

ENGEL AUSTRIA is investing some €12 million in the expansion of its headquarters at Schwertberg. The manufacturer of injection moulding machines and automation specialist is taking the step to handle the rising volume of orders world-wide, improve working conditions on the site and underline its commitment to company premises in Austria. An additional 6,000 square metres of floor space has been created at the southern end of the factory site. The shipping, incoming goods and storage areas will be the main beneficiaries of the expansion; the assembly area has also increased in size and many workstations have been ergonomically redesigned.

Intelligent process integration

Plast in Milan

Intelligent process integration for maximum efficiency and economy – this was ENGEL’s focus at Plast 2012 in May in Milan. Five highly-integrated and automated production cells at the trade fair stand impressively demonstrated the injection moulding machine manufacturer and automation expert’s system solution and technology competence – and across a wide spectrum of applications, too, from Automotive through Technical Moulding and Packaging to Medical. “Right now, plastics processors in Italy are mainly investing in new technologies, automation, process integration and energy-saving options,” says Maurizio

Preview of 2012/2013

Plast Eurasia, Istanbul/Turkey, 29th November – 2nd December
ENGEL med.con, Kiev/Ukraine, 24th October
ENGEL packaging day, Warsaw/Poland, 15th November, Paris/France, 19th November, Moscow/Russia, 22nd November
ENGEL automotive day, Queretaro/Mexico, 5th-6th December
Arabplast, Dubai/UAE, 7th-10th January
Medtec Europe, Stuttgart/Germany, 26th-28th February
Chinaplas, Guangzhou/China, 20th-23rd May
Ferrari, sales manager with ENGEL ITALIA. At present, the automotive industry is the greatest driver of growth. ENGEL unveiled a lightweight construction application for this target sector in Milan. The MuCell foam injection moulding process was used to produce oil sumps from polyamide on an ENGEL duo 3550/500 pico injection moulding machine with clamping force of 500 tonnes.

**Packing bags of experience**

**New office in Slovenia**

ENGEL’s new representative office in Slovenia is LAKARA d.o.o. – a name that stands for a wealth of experience in injection moulding technology. CEO and head of sales Cvetko Dolenc, who was a production manager in the plastics industry for many years, is deeply familiar with the challenges posed by his new clients. The team also includes Peter Bokal, who has 15 years’ experience in the automotive supply industry (and now takes responsibility for application technology, turnkey projects and training courses), and Milan Kepa, who worked as a maintenance manager for a major ENGEL customer before switching to LAKARA as a service technician. LAKARA plans to establish its own technical centre (with room for two injection moulding machines) on its Škofja Loka premises northwest of Ljubljana by the end of 2012. The company then intends to establish itself steadily as a single-source supplier for the injection moulding market in Slovenia.

**Practical uses of simulation**

**Seminar attracts 40 participants to Schwertberg**

What can simulation contribute to the injection moulding process? Much more than it has so far! That was the message for those who attended ‘From vision to reality’, a seminar organised by ENGEL AUSTRIA this May in Schwertberg. Together with experts from the fields of plastics processing, simulation, test engineering and process technology, ENGEL set out to apply research and development findings to practical situations. Workshops traced an arc from material analysis to simulation and parts measurement.

ENGEL AUSTRIA organised the seminar together with SIGMA Engineering and other partners. It is hoped that the event will not be a one-off. After all, one thing became clear at the seminar: using the results of injection moulding simulation to perform production machine settings is in its early days.

ENGEL ecodrive inside: At Plast, an ENGEL duo 500 pico machine with ecodrive was producing oil sumps in MuCell technology.

ENGEL opened its greatly expanded competence centre in Hagen on 24th May 2012. By enlarging the facility, ENGEL has addressed the rising level of new orders and acknowledged the importance of automation in Germany. The new building adds another 1,000 square metres of floor space, 750 square metres of which will be devoted to the assembly of robots and other automation solutions. Another 250 square metres was given over to new offices for a total of 20 new employees.

ENGEL invested €2 million in the expansion programme, thereby laying the foundations for future growth. “ENGEL’s market share for automation is increasing all the time”, said Jörg Fuhrmann, Managing Director of ENGEL Automatisierungstechnik Deutschland. “The fact that we supply injection moulding machines and robots from a single source is a key reason to purchase for many of our customers”, confirmed Rolf Sass, Managing Director of ENGEL Deutschland in Hagen.

ENGEL celebrated the opening of the extension with customers and partners in Hagen.

Seminar attendees were also able to try out simulation programs for themselves at various workshops.
Opening in January

ENGEL AUSTRIA is about to raise its profile in Germany by opening a fourth subsidiary in Stuttgart. With its sizeable technical centre, the Technologieforum will concentrate on innovations and trends of the future while establishing itself as a communications hub for the plastics industry in the southwest of Germany.

“We have started on the interior fittings and we’re well on schedule”, confirmed Claus Wilde, head of the new subsidiary, speaking in the run-up to Fakuma 2012. The focus of the Technologieforum will differ from that of the other subsidiaries, with application technology highlighted from the outset. At 700 square metres the technical centre will be the largest of any ENGEL subsidiary, accommodating six or seven automated manufacturing cells. “This will allow us to extend trade shows for our customers and present innovative technologies and applications year-round”, said Claus Wilde.

There will be a strong initial emphasis on energy efficiency as well as the areas of lightweight construction and automation. “A lot of plastics processing firms are moving away from small standard machines in favour of larger, complex and technologically sophisticated plants. That means plastics processing companies and systems suppliers are having to work together more closely all the time”, said Mr. Wilde. “This is precisely what ENGEL is focusing on. The new site will make us more accessible to our clients in the southwest of Germany.”

Training, workshops and conferences

As early as January, the Technologieforum Stuttgart plans to launch a series of events to build on ENGEL’s Fakuma theme of ‘E-novation’. Set-up workshops, multi-component forums and a conference on medical technology are in the pipeline alongside practical training courses on energy efficiency.

The new subsidiary will start out with ten staff members, a workforce that will rapidly increase to 20 in the next few years. It will be based at Wurmberg to the west of Stuttgart. “This is the ideal location for us as every customer in Baden-Württemberg will be able to reach us within two hours”, said Claus Wilde. “We are right on the A8 autobahn, so clients will even be able to drive out for a coffee.”

Germany is the most important market for the Austrian producer of injection moulding machines, accounting for a quarter of ENGEL’s turnover. “In the last few years we have steadily increased our market share in Germany”, revealed Christian Pum, Sales Director at ENGEL. “The new structure will enable us to keep pace with this expansion.”

“As well as providing customers with a technical and training centre in their vicinity, we will aim to act as an information and communications hub for the injection moulding industry in the southwest of Germany.”

Claus Wilde, Branch manager, ENGEL Deutschland Technologieforum Stuttgart
The ENGEL Symposium 2012 was a full house experience. 2,700 guests from 35 countries – more than ever before – experienced ENGEL AUSTRIA's premium system solution competency and innovative drive at first hand on 13 and 14 June 2012.

A journey through time
into the future of injection moulding

With 18 exhibits, ENGEL established another world record at the Symposium 2012: the innovation density was once again greater than at previous events. For example, this was the first time that ENGEL demonstrated the Dolphin process for manufacturing premium automobile interior parts with a ‘Softtouch’ surface at its large-scale machine factory in St. Valentin; the first series production application had not been launched until autumn last year. More than anything else, the size of the ENGEL duo 1500 combi M injection moulding machine and its high degree of automation and process integration impressed the visitors.

No less impressive was the production of extremely thin-walled and at the same time highly decorated laptop covers in a clean room, the high degree of integration offered by a production cell for manufacturing lamp housings including a bead seal on a minimal footprint, and the two-metre tall mould for manufacturing wringing forks for floor mops using the ENGEL gassmelt process, which can be implemented on a comparatively small ENGEL victory injection moulding machine with a clamping force of just 500 tonnes thanks to the use of tie-bar-less technology.

The fact that the exhibits were on display directly next door to ongoing production at the same time gave visitors insights into the production of the ENGEL duo large-scale machines.

World firsts and live development

Two machine types celebrated their first airing at the Symposium: the electrified variant of the ENGEL duo large-scale machine, ENGEL e-duo (P. 14), and the new, all-electric ENGEL e-mac injection moulding machine for maximum precision requirements in technical moulding (P. 14). This was topped off by “development live”: ENGEL gave visitors a peek into the future of automotive lightweight construction in the production of inserts for brake pedals using an innovative in-situ polymerisation technology on a prototype machine (P. 12).

Morning keynote presentations at the Symposium, which was held at the Design Center in Linz, focused on improvements to the injection molding process chain. Topics covered during the talks were process improvements in plasticizing, mixing and cooling, new possibilities in process control, energy efficiency of innovative drive concepts as well as lightweight construction technologies.

40 ENGEL system partners from the fields of raw materials, mould making and temperature control technology, automation, pellet handling, quality assurance and clean room technology backed up the main exhibits with their products and solutions, thus underlining the huge turnkey solution competency that ENGEL guarantees – not just at the tri-annual Symposium, but day by day in demanding customer projects in collaboration with ENGEL partners.
The ENGEL HL Awards 2012 were presented on 13th June against the backdrop of the ENGEL Symposium 2012. This year’s prize winners leverage the benefits of tie-bar-less technology, mainly to achieve greater cost-efficiency in production.

The HL Awards are ENGEL’s acknowledgement of excellent applications with ENGEL tie-bar-less injection moulding machines. 25 contributions from 15 countries gave the jury a very hard job this year. This year’s jury members closely scrutinised the deployed technologies, the progressiveness of the applications, and the economic benefits compared with legacy machines. The jury comprised Prof. Dr. Christian Bonten, the Head of the University of Stuttgart’s Institute of Plastics Technology (IKT), Thomas Bründl, CEO of starlim/sterner in Marchtrenk/Austria, and Joachim Rönisch, the publisher of K Magazine, Hanover.

Multiple use of tie-bar-less benefits
The HL Award 2012 in Gold went to Volkswagen. The Plastics Division at the Group’s head offices in Wolfsburg/Germany perfectly leverages the benefits of tie-bar-less technology in two different ways in the production of components for fuel filler door modules. Firstly, the extremely large moulds utilise the whole of the mould fixing platens’ surfaces. Secondly, the large grippers on the handling robot can reach into the mould space without interference. Both factors ensure that the production cell has a minimal footprint.

The award-winning production cell comprises two tie-bar-less injection moulding machines and two multiple-axis robots. To produce the inserts for the fuel filler doors, first the base body made of 30 % glass fibre reinforced polypropylene is injected. The second machine then adds an EPDM seal. Technologically, a very challenging combination of materials!

Twice as fast as the competitor
It’s not just in the automotive industry, but also in packaging that fast cycle times are a precondition for good competitive ability. Tie-bar-less technology inspired mould maker and injection moulder O.C.S.A. from Creazzo/Italy to create a unique mould design. Thanks
to it, O.C.S.A. produces coffee capsules for espresso machines by illycaffe twice as fast as its competitor. The jury acknowledged this achievement in the form of the HL Award in Silver.

The core of the capsule, the polypropylene and TPE coffee holder, is injected on an ENGEL victory combi machine in a rotary plate mould. The key to reducing cycle times is cooling the hard component. To accelerate this process, in-house mould making replaced the cooling water supply hoses with thicker pipes. They jut out upward through the mould area and are directly connected to the cooling unit. Because there are no tie-bars in the way, the pipes can easily follow the motion of the rotary plate.

Clamping force of 400 tonnes instead of 600
The HL Award 2012 in Bronze went to Anton in Zalaegerszeg/Hungary. Thanks to tie-bar-less technology, Anton can now position no less than four injection units on a machine with just 400 tonnes clamping force, while at the same time combining multiple-component injection moulding with insert-placing technology. The ENGEL victory 400 combi is used to produce housings for electric manual tools by Anton’s largest customer, Bosch. Anton requested quotations for various injection moulding machine types for the mould, which measures 1250 x 910 x 900 mm. Legacy machines were planned with clamping forces between 600 and 800 tonnes. With the tie-bar-less 400 tonnes ENGEL victory machine, Anton not only saved on cost of investment, the smaller machine also offers savings in ongoing operations.

Places 4 to 6
The jury awarded prizes to the first six places. The number 4 spot went to Schneegans in Emmerich/Germany. Fifth went to Doctor Zeta in Moscow/Russia, with Okartek in Kaarina/Finland and Fiskars in Billnäs/Finland coming 6th.
New horizons
for lightweight construction

Visitors to the 2012 ENGEL Symposium were able to take a look at a current ENGEL development project. Inserts for brake pedals were being made using in situ polymerisation on a system prototype. What’s special about this process?

Georg Steinbichler: Continuous fibre-reinforced structural components play a major role in high performance applications, but until now economic mass-production of lightweight components functionalised with stiffening ribs and mounting elements using automated injection moulding has failed because of the high viscosity of the polymers. The production cell presented at the symposium is now opening the door to a new level of efficiency, where PA6 is not present before the start of the process but produced directly in the cavity from the monomer ε-Caprolactam. The very low viscosity of ε-Caprolactam lets even the finest fibre filaments infiltrate without damage, opening the door to tailor-made fibrous structures according to load. The relatively high viscosity of PA6 would make mould filling and infiltration impossible.

How does the process work?

Peter Egger: First of all, a pre-mould is produced from several layers of material, and then placed in the heated reactive injection mould. The reactive caprolactam mixture is then injected, and the insert can be shaped once it has been removed from the mould after polymerisation. During the symposium, these steps were integrated and fully automated with the help of an ENGEL viper linear robot and an ENGEL easix multi-axis robot.

To manufacture ready-for-use brake pedals, a conventional injection moulding process would then follow, in which the ribs and other functional elements made from polyamide reinforced with fibreglass are injected. Of course, the aim is to integrate this step in the reactive processing in the production cell as well. This would make it possible to produce a thermoplastic component reinforced with continuous fibres from a dry fabric and ε-Caprolactam using an extremely high degree of automation in one production cell which integrates all the individual processes involved.

What demands does this process place on production engineering?

Peter Egger: Until recently, the in situ process, or rather the production of cast polyamide, was carried out by special reactive systems and presses. From the outset, however, ENGEL’s aim was to utilise standard processing technology as far as possible in order to improve the cost situation in the production of fibre-reinforced components. The system prototype unveiled at the symposium is based on an ENGEL e-victory 120 combi injection moulding machine, with two electric injection units which are inclined at 30° to the horizontal because of the very low viscosity of plasticised caprolactam. The ε-Caprolactam is introduced in the form of hard pellets. There is one injection unit for caprolactam mixed with a catalyst and another for caprolactam mixed with an activator.

Which other factors contribute to the high level of economic efficiency?

Georg Steinbichler: A high degree of energy efficiency sets this direct method apart. The temperature for the in situ polymerisation of ε-Caprolactam should not exceed 170°C, but temperatures of between 240°C and 270°C are required for the large-scale production of PA6, which includes a residence time of 12 to 24
hours for the caprolactam. Using the ENGEL e-victory hybrid machine, which is equipped with the energy-saving servohydraulic system ENGEL ecodrive, also contributes to the high degree of energy efficiency.

Peter Egger: Another factor is the fact that the clamping forces used here are significantly lower than those used in the processing of PA6. The tie-bar-less clamping unit of ENGEL e-victory machines, which offers ample room for the mould as well as the robot, opens up the possibility of using a smaller machine with lower clamping force than the mould size would normally dictate. Investment and operating costs are saved as well.

What’s next development-wise?

Georg Steinbichler: We have demonstrated the new process on a close-to-production system prototype and will now continue to improve the process and adapt it to the requirements of mass production. The cycle time can still be improved, for example. Although cycle times are short compared to the conventional manufacture of fibre-reinforced components, five minutes is still relatively long compared to standard injection moulding applications in the automobile area. Our aim is to continue to raise the efficiency of the process and achieve economically viable cycle times. Amongst other things, the short residence time of caprolactam extends possibilities for reducing the cycle time.

Which role do partners involved in the project play?

Peter Egger: The Fraunhofer Institute ICT has been our development partner from day one. Cooperation with ZF in Friedrichshafen, who made the mould for the prototype machine presented in St. Valentin, was also important with regard to the 2012 ENGEL Symposium. Close collaboration with partners along the value chain is indispensable as far as the future-defining topic of lightweight construction is concerned. Successful lightweight construction concepts will only emerge if the material, the design, and the production process mesh with each other perfectly. We will continue to expand our network of partner firms, universities, and institutes at our Technology Centre for Lightweight Composites in St. Valentin.
ENGEL e-mac: the new all-electric injection moulding machine

Full modularity with excellent efficiency

ENGEL e-mac is the name of ENGEL AUSTRIA’s new solution to demands for the highest possible levels of precision in the manufacture of technical parts. The machines in the new range are all-electric and produce ultra-precise results. They are also fully modular and extremely efficient.

Machines with clamping forces of 50, 75, or 100 tonnes entered the market, while a 180 tonne machine will be added to the series before the end of the year. “The demand for simple, all-electric injection moulding machines for components which need to have very precise dimensions is increasing”, stresses Christian Pum, ENGEL AUSTRIA’s Sales Director. “The new ENGEL e-mac enables us to meet these requirements brilliantly.” The e-mac is equipped with the well-known ENGEL CC 200 machine control. The e-mac therefore offers full modularity and automation technology integration. Thanks to their remarkably compact design, these machines will also save customers production floor space and lower their operating costs. The servo drives are operated by a modern axis system solution involving a stabilised intermediate circuit. The braking energy is recovered and fed directly back into the grid, guaranteeing an unusually high level of energy efficiency. The ENGEL e-mac injection moulding machines work with very high repetition accuracy and, because of the parallel movements of the different drive axes, reduce cycle times. The new ENGEL will supplement the tried and tested ENGEL e-motion series. While the e-motion machines are used primarily in the field of medical technology and for fast-cycling and multi-component applications, the e-mac is a particularly economical alternative for technical injection moulding applications.

ENGEL e-duo with electric injection unit

With the new ENGEL e-duo, ENGEL brings the advantages of electric drive technology to the large-scale machine class too. The e-duo, which has an electric injection unit, is all about providing an outstanding precision and repeatability, as well as high injection performance and maximum energy efficiency. The machine construction specialist unveiled the ENGEL e-duo 500 pico from its new range at the ENGEL Symposium in June 2012. With five clamping forces between 500 and 700 tons available, ENGEL is Europe’s only injection moulding machine manufacturer offering electric dual platen machines in this class.

The electric ENGEL e-duo represents the ultimate in precision and repeatability, high injection performance and maximum energy efficiency.
Producing moulded parts of a consistently high quality shot by shot is the aim of every injection moulder. Simply using a precise injection moulding machine will not achieve this, however. Minor changes in ambient conditions or in raw materials and wear and tear suffered by the mould have an affect too and can mean that parameters need to be readjusted. iQ weight control, ENGEL AUSTRIA’s newly developed software, detects these changes automatically and compensates for them in the same shot.

The widely used monitoring of individual screw positions only supplies information on the quality moulded parts are expected to have under certain conditions. To optimise process consistency, ENGEL AUSTRIA has therefore gone one step further. iQ weight control, for which ENGEL has applied for a patent, analyses the pressure profile at screw positions in real time during the injection process and compares the measured values with a reference cycle online. The system then uses this comparison to calculate a new set of highly significant process parameters which allow changes in melt volume and material viscosity – the two most important factors when it comes to the quality of moulded parts – to be detected immediately. If there are deviations from the set values, the relevant process parameters will be readjusted automatically.

iQ weight control is available for electric machines (ENGEL e-motion, e-mac and e-victory) and is integrated into the CC 200 control unit. As the system automatically analyses and controls the process in real time, changes are counterbalanced before rejects can be produced. The software also reduces the amount of work for the machine operator.

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iQ weight control guarantees moulded parts of a consistent quality. This means that changes in viscosity, for example, are detected and counterbalanced online. Any effects these changes may have had on the mould filling process are therefore prevented.
ENGEL oil maintenance system reduces maintenance costs

 Clean and stable for a lifetime

Soiling causes 80% of all hydraulic system failures. The ENGEL oil maintenance system tackles this problem at its roots. A cellulose cartridge with a 3μm fine filter removes solid dirt particles, condensed water, and oil degradation products (“soft contaminants”) in a single step. The result is up to 55% less downtime and a reduction in maintenance costs of 60%.

GE Industrial Solutions, which is based in Ghent, Belgium, benchmark tested various external filter systems over a period of several months and had the manufacturers’ test results confirmed at an independent laboratory. Production manager Marc van Hassel summarised the findings, saying, “Oil maintenance with a cellulose cartridge was the only method that achieved the promised results. Contamination of the servovalves and the main filters was dealt with.” Four injection moulding machines were set up for the tests, but more machines are expected to be retrofitted with the system now. Mr van Hassel added, “Our aim is reduce downtime and replacement part costs.” After just three months, the cleanliness class of the hydraulic oil in the injection moulding machines equipped with the ENGEL oil maintenance system had improved from 15/14/11 to 14/13/6, and gumming had decreased from 75 to 35%.

Precise hydraulic systems work with clearances in the micrometre range, which means that even the smallest particles of dirt can cause a system to fail, especially during warm-up. There are three risk factors:

- **Dirt particles**: Impact damages the surfaces of hydraulic systems and releases new metal particles.
- **Oil degradation products**: Oxidation and high hydraulic oil temperatures lead to resin build-up and resin deposits (gumming).
- **Water**: The water evaporates, and the microscopically small vapour bubbles can then implode under high pressure and pull particles out of the metallic surfaces. In addition, water in the oil causes corrosion.

The ENGEL oil maintenance system, which ENGEL launched in cooperation with CJC, rules out all three risks reliably. Corrosion residue, resins, and microparticles are filtered, and oxidation, hydrolysis, and acid build-up prevented. This ensures that the viscosity of the hydraulic oil remains constant, that the oil is always clean, and, according to customers’ experiences, that it can last the lifetime of an injection moulding machine. Changing the oil will therefore be a thing of the past. The system also has a positive side effect: Due to less friction, production cells consume considerably less energy.
"Enhancements to silicone rubbers in the past two years have opened the door to new applications in multi-component technology for this material class", reveals Professor Georg Steinbichler, head of research and development technologies at ENGEL AUSTRIA. Whereas conventional silicone rubbers require high temperatures for cross-linking, the new types vulcanise with exposure to light in the ultraviolet wavelength range at room temperature. This enables silicones to be combined with a wide range of thermoplastics via two-component and multi-component injection moulding. Even temperature-sensitive materials such as polypropylene can now be processed with silicone in a single step.

Cavity inserts in the injection mould that are permeable to light are the prerequisite for UV vulcanisation. For this application, ENGEL partner firm Elmet from Oftering in Austria utilises translucent plastic inserts for UV light and integrates UV lamps into the mould for irradiation.

Reducing energy consumption
In June 2012, the new method was unveiled to the world at the ENGEL Symposium in St. Valentin. An ENGEL victory 200/80 LIM injection moulding machine used the UV vulcanisation process to produce wine bottle tops in an Elmet mould. This involved polypropylenes being overmoulded with liquid silicone made by Momentive Performance Materials. The irradiation time for the vulcanisation of the silicone components is around 20 seconds. "In the conventional high-temperature process, silicone parts with a similar wall thickness need more than a minute for cross-linking", said Steinbichler. "UV vulcanisation not only facilitates new applications, therefore, but also reduces the cycle times and energy consumption associated with silicone processing."
**inject2blow reduces time and costs**

**Injection moulding and blow moulding in one**

ENGEL AUSTRIA and CANTONI have set a new standard for process integration. The inject2blow method, which the two companies developed together, combines the injection moulding and blow moulding processes in one mould on one injection moulding machine and significantly reduces time and costs in the manufacture of cosmetic, drug, and food containers by doing so.
With a cycle time of under 14 seconds for the manufacture of cosmetics jars on a 90-tonne clamping force ENGEL victory injection moulding machine in a 2+2-cavity mould produced by CANTONI, which is based in Abbadia Lariana, Italy, traditional methods simply cannot match the production efficiency of inject2blow. Preforms normally have to be made using injection moulding first and then subjected to a second process on a blow moulding machine before they become a final product, but the new method allows small ready-to-use containers to be manufactured in one process. This combination method is the first of its kind available on the market.

Other benefits of integrating the processes include lower system investment costs, a smaller system footprint, higher system availability, simpler quality control, and no maximum clamping force. The inject2blow method can be used to process a wide range of thermoplastics from polyethylene, polypropylene and polycarbonates to PET.

Benefits of no tie bar fully exploited
ENGEL and CANTONI supply the integrated production systems from one source. In addition to the ENGEL injection moulding machine, they include a CANTONI sliding table mould and an ENGEL viper linear robot which removes finished parts from the mould. Both the injection moulding and blow moulding processes are visualised, monitored, and controlled via the ENGEL injection moulding machine CC 200 control unit. This means that injection moulding machine operators don’t have to learn how to use new technology; they will simply be guided intuitively through the integrated injection and blow moulding process by the ENGEL control unit which they are already familiar with.

Injection moulding machines from the ENGEL victory and ENGEL e-victory series, which are adapted to the individual requirements of the application, can be used in the manufacturing cells. These machines offer plenty of free space for the sliding table mould because their clamping unit does not have a tie bar. As the mould clamping platens of tie-bar-less machines can be used up to their edges or even beyond, large moulds can fit on comparatively small injection moulding machines.

Machine size can therefore now be decided according to the required clamping force instead of the size and movement radius of the mould, which keeps investment and operating costs low. The barrier-free mould area also simplifies the automation process, because the robot can access the mould from the side without being hindered.

Minimal consumption, maximum flexibility
A high degree of energy efficiency sets this new integrated process apart from older methods. There are two main factors responsible for this. Firstly, unlike traditional two-stage methods, preforms do not have to be heated up again before the blow moulding part of the process, and secondly, ecodrive – the energy saving option for hydraulic ENGEL machines, which is offered by the ENGEL victory and e-victory machines – matches consumption levels achieved by fully electric machines. Hydraulic injection moulding machines equipped with the servo-hydraulic system ecodrive consume between 30 and 70% less energy than comparable machines which don’t have this energy saving option, depending on the specific machine and use. Despite the high degree of process integration and automation, manufacturing cells are very flexible when they are in operation. Cavity inserts make it easier to change from one product to another, and the production of small batches economical. As the inject2blow process is based on standard injection moulding machines, the system can be used with moulds for classic injection moulding products too.
"In Western Europe we can no longer afford to work without automation," says Gerald Rauch, Head of Sales and Development at Seletec Plastic Products, which is based in Uttendorf, Austria. "Cost pressure is getting greater and greater, while the quality standards demanded by our customers are increasing at the same time." Seletec, which belongs to the Pinzgau-based Klepsch Group, has been developing and making high-quality injection moulding products for technical use for over 50 years. The company's customers come from the machine construction, farming, logistics, advertising, furniture, and electronics industries, while it is also starting to receive more and more orders from medical engineering enterprises. Amongst other things, Seletec specialises in hybrid components which are produced by overmoulding metal inserts. The production hall contains nine injection moulding machines, with their clamping forces ranging from 25 to 650 tonnes. The 650-tonne machine, an ENGEL duo which was recently added to Seletec's production armoury, has increased its maximum clamping force. It was supplied as a complete system and came with an ENGEL viper 40 linear robot. "We always order new machines with a robot," Mr Rauch stresses. "It is important to us that the machine and the robot come from the same place. Past experience has shown us that this reduces time and expenses considerably. It is faster and cheaper to CE certify the whole system this way, for example. Of course, having the machine and robot delivered together also speeds up the start-up process."

Complete control unit integration
"After just two days, our machine operators felt very comfortable on the new system," Mr Rauch continues. The fact that the robot is very easy to programme and control via the display on the injection moulding machine made a crucial contribution here. Instead of mirroring the robot's control unit display on the monitor of the injection moulding machine, ENGEL's system solutions really do integrate the two. The RC 200 control unit in ENGEL viper linear devices is part of the CC 200 control unit in ENGEL injection moulding machines. "The robots can be operated with the usual machine control unit commands as well," stresses Johannes Brandstötter, Head of Sales for Automation at ENGEL AUSTRIA.

Twelve different products run on the new large-scale machine, and it is also equipped for high-temperature applications. ABS seat shells for office swivel chairs are what the machine is currently used most for, and the manufacture of these allows users to benefit from another advantage of the viper robot: its highly precise movements. "The four vacuum grippers have to work..."
in exact parallel to each other to prevent the component, which is relatively heavy at 2400 grammes, from becoming distorted," Mr Rauch explains.

Process integration increases
ENGEL’s high degree of system expertise and many years of experience in the construction of large-scale machines were the two main factors which persuaded Seletec to purchase another IMM from ENGEL. Mr Rauch says, "Mr Mittmannsgruber also showed great commitment in providing us with technical process support even before we had accepted the offer." "ENGEL analysed all the details we gave them and were therefore able to sell us a system which meets our needs perfectly."

As a service provider, Seletec covers every part of the value chain for its customers. It develops and constructs products, makes its own tools, and also takes care of the mass production and installation of machines. With the involvement of more and more automation, the degree of process integration will continue to rise. "We are complying with the wishes of our customers and becoming more of a system supplier," stresses Mr Rauch. "We see our future in the assembly of complete units, which means that we will have to overcome quite a few more challenges in cooperation with ENGEL in the next few years."

A thousand ENGEL viper robots now in use
The ENGEL viper 40 linear robot which primarily handles large parts like components for office chairs or casings at Seletec is a very special one. It is the thousandth viper robot supplied by ENGEL since the introduction of its new robot generation. Since the launch of the new generation, ENGEL has increased its sales in the field of linear robots significantly. This is partly due to the fact that the viper linear machines are not just sold in a package with injection moulding machines, but also as replacements for old equipment or for use with injection moulding machines from other brands. ENGEL viper robots are now available in seven sizes, with nominal load-bearing capacities ranging from 6 to 120kg.
Behr GmbH & Co. KG specialises in air conditioning for vehicles and engine cooling. With numerous plastic components injection moulded using more than 100 injection moulding machines around the world, the company’s vertical range of manufacture is high. A range of technologies are used in the process, with the current emphasis on ENGEL foammelt, which utilises MuCell foam injection moulding. Behr invested in its first system more than a decade ago; now the company has 10 manufacturing cells helping to make vehicles lighter.

The manufacturing cells are at different locations: Neustadt an der Donau in Bavaria, Rouffach in Alsace, Montblanc in northern Spain (near to Tarragona) and Mošnov in the east of the Czech Republic, close to Ostrava. Housings for air conditioning units are produced from talc-filled polypropylene in Germany and France, while the sites in Spain and the Czech Republic specialise in fan cases and frames for engine cooling made of polyamide reinforced with fibreglass. ENGEL victory injection moulding machines with clamping force of 300 and 600 tons are used to manufacture fan components under the MuCell process. “Switching from compact to MuCell foam injection moulding has allowed us to reduce the weight of components by eight percent”, says Katia Hendrickx, head of the specialist plastics division at Behr in Stuttgart.

Maximum reproducibility
The MuCell process involves the injection of pressurised nitrogen or carbon dioxide in a supercritical state into the plastic melt during plastification, where the gas is distributed uniformly. After injection into the mould it separates again from the melt, producing a fine-cell foam structure. As a result, less raw material is required and the weight of the components is reduced. “The parts have very high dimensional stability”, emphasises Michael Fischer, Sales Manager (Technologies) at ENGEL AUSTRIA in the Austrian town of Schwertberg. “They don’t have any distortion or sink marks and it’s
possible to achieve extremely thin wall thicknesses of 1mm, which you can’t do with compact injection moulding.” Under the ENGEL foammelt label, ENGEL AUSTRIA offers complete turnkey systems with integrated foam units through its cooperation with Trexel of Wilmington, Massachusetts, the company that invented MuCell technology.

With lightweight construction currently in vogue, commodity prices are rising steadily. Various factors are behind the huge increase in the importance of foam technologies. One advantage of MuCell is the fact that material savings do not adversely affect component stability. “For us, the high level of form stability in the components was central to our decision to invest in this technology”, says Fritz Mundigl, process specialist for plastics at Behr. “The precision of cases and frames is critical in terms of the functionality of fans, for example.” The overall quality of parts increased more than expected following the changeover to MuCell technology. “Today, we are producing parts that are absolutely uniform”, says Katia Hendrickx. “The cost of balancing has fallen significantly and reproducibility is much better. We didn’t expect the improvements to be so far-reaching.” Hendrickx offers an explanation, however: “The gas practically explodes from the melt, evenly distributing polymer around the entire cavity, including the corners and undercuts. The holding pressure control in compact injection moulding cannot achieve such a high level of process stability.”

Cutting costs with smaller machines
Another plus point of ENGEL foammelt is the high efficiency of the process, the result of the excellent rheological properties of a gas-charged melt (and other factors). At Behr, this has led to a reduction in cycle times of 15 percent.

As far as Behr is concerned, the efficiency of production processes is a key parameter subject to continuous monitoring. Processes are analysed regularly in order to identify and exploit further room for improvement and quantify the success of measures already enacted. The last big analysis took place last year; as Hendrickx reports, “One of our main findings was that the machines now are smaller on average than they were just a few years back.” Smaller machines are cheaper to acquire and consume less energy and so have a major influence on an efficiency analysis. “We put this positive outcome down to the tie-bar-less technology of ENGEL, which has enabled us to downsize our production systems”, continues Hendrickx.

Since the clamping units on ENGEL victory machines operate without tie-bars, the mould fixing platens can be utilised more effectively and relatively small machines can accommodate larger moulds. As far as investing in new injection moulding machines is concerned, the most important factor for Behr is invariably the size of the mould in relation to the clamping force required – and foammelt technology normally requires less clamping force than compact injection moulding.
Ensinger is synonymous with high performance in the business areas of compounds and semi-finished products as well as injection moulding. The company took up residence in a new injection moulding factory in the Ergenzingen district of Rottenburg in 2009. At the planning stage of the new facility, flows of goods, internal processes and communication channels were optimised to ensure the efficient series production of sophisticated precision parts from high-performance plastics. The automation level of the manufacturing cells is high as the trend towards greater process integration clearly gains pace.

The latest manufacturing cell, which went into operation in August 2012, combines injection moulding with a milling process. By the end of the year, it will be expanded to include a camera system for in-line quality control and a packing station. The cell is designed to produce housings for use in vehicle powertrains from polyamide reinforced with fibreglass. Ensinger has developed an optimised and highly automated production process in partnership with its client, an international automotive supplier. “It soon became clear that we wouldn’t be able to realise this product through consecutive production steps because of its complex geometry and high dimensional accuracy requirements”, revealed Reimar Olderog, who heads the injection moulding division at Ensinger. The snag was that the batch sizes for the housing components were too small in themselves to utilise a highly integrated and automated plant to full capacity and thus ensure competitive unit costs. As the customer wanted to be loyal to its long-standing supplier, the scope of delivery was expanded to include the manufacture of five more automobile components with similar requirements as regards the injection moulding machine, post-production and automation.

The manufacturing cell saves space by combining an ENGEL e-victory injection moulding machine with 200 tonnes of clamping force with a cooling station, CNC milling machine, component cleaning machine, multi-level conveyor belt and an ENGEL easix multi-axis robot that performs all handling of components between the injection moulding machine, post-production stations and discharge belt. When the manufacturing cell is complete by the end of this year, the robot will independently perform a total of seven work steps, adapting itself to the exact cycle time of the injection moulding process. “Because of this we are speeding up our handling processes at the moment”, said Michael Werner, head of technical services at Ensinger.

Flexible automation

To maximise the efficiency potential of a highly integrated injection moulding process, a manufacturing cell must work at high capacity. Since planned quantities of a new product are insufficient to ensure this, Ensinger is producing six different components with similar moulds on one machine. An ENGEL easix multi-axis robot and a tie-barless ENGEL e-victory injection moulding machine provide the necessary flexibility.
Machine and robot share operating logic
ENGEL easix has enabled Ensinger to expand its automation horizons. The multi-axis robot supplied by ENGEL with the injection moulding machine as part of a complete package is fully integrated into the CC 200 control unit of the injection moulding machine. This produces a number of advantages for the user: “Anyone who can operate the injection moulding machine can also operate the robot”, says Roland Materne, putting his finger on the most important point. Mr. Materne is a sales engineer at the ENGEL Deutschland Technologieforum Stuttgart, ENGEL AUSTRIA’s new subsidiary for southwestern Germany based in Wurmberg. In the ENGEL solution, the movement instructions for the robot are incorporated into the graphical interface of the machine control unit. Many tasks that previously required the involvement of a programmer can now be performed by the setter, which saves time and costs and increases system availability. “For us, the fact that our setters can program and operate the robot themselves is a definite precondition for using jointed arm robots in series operation”, emphasised Dr. Dirk Weydandt, the production manager at the Ensinger injection moulding factory who sent two fitters to Fakuma last year to take a close look at the new ENGEL easix (an order was placed shortly afterwards).
For Dr. Weydandt, involving staff at an early stage is a key success factor when deploying new technologies. Ensinger purchased its first multi-axis robot three years ago, for training purposes rather than any particular customer order. “We wanted to familiarise our staff with the machine and get used to the way it functions, and the approach worked out very well”, said Dr. Weydandt. “Since then we’ve made big strides in multi-axis automation with the ENGEL easix. Our setters have already written programs for the new manufacturing cell.” Those at Ensinger have no doubt that given rising demands on efficiency and the increasing integration of process steps, more multi-axis robots will follow.
The procurement process will also be more efficient in future. “You’ll be seeing me in Wurmberg more often”, announced Reimar Olderog, speaking in the run-up to the opening of the ENGEL Deutschland Technologieforum Stuttgart. “We are very pleased that ENGEL will soon be right on our doorstep.”
LED lamps in a single step

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. "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.

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 Franz Pressl, product manager for the ENGEL victory range at ENGEL Austria in Schwertberg. "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. After the injection process, the robots take off the finished parts, feed them to a test station and pack them for transportation.

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.
Market share extended

“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.

“Today, we turn out one ready-for-use side marker lamp every 30 seconds,” says Yllikäinen. “Due to the high level of process integration and automation production costs have dropped dramatically, by half. 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.”

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. 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.”
An effortless **new generation**

Aching arms and beads of sweat on the forehead – even for experienced lumberjacks, chopping wood can be very hard work. That’s why a totally new type of axe has been developed in the middle of (where else?) the endless forests of Finland. The axe features a lightweight plastic handle, non-slip grip and non-stick coated blade that cuts through wood almost like butter. Also, with the production of the new axe, Fiskars Brands Finland is finding new ways to make life easier for their workers.

X Range universal and splitting axes are tools to span generations. Not only does the extreme strong polyamide handle reinforced with fibreglass give every axe a lifespan roughly 20 times longer than a conventional wooden-handled variety, but the solid connection between the axe head and the handle guarantees extremely high stability.

The axes comprise three components in total: a steel head, polyamide handle reinforced with fibreglass and thermoplastic elastomer grip. The steel head and the grip are fused with the polyamide handle in a single injection moulding step. The axes are produced in the manufacturing hall at the Fiskars site in Billnäs, 85 km west of Helsinki, using a pair of ENGEL victory injection moulding machines, each delivering 300 tons of clamping force. The machines utilise single-cavity moulds with insert technology.

**Ergonomics through tie-bar-less technology**

Whereas the ends of the axe parts were lacquered in earlier models in the X Range, the new two-component solution promises greater comfort and grip during use; switching from one version to another in the production process is also easier. The new manufacturing process has not changed the colour scheme, with grips of orange – the Fiskars corporate colour – contrasting against the anthracite handle.

There are eight different models and sizes in the range. The smallest version, the X5 hatchet, is 23 cm in length; the largest, the X27 splitting axe, measures...
The new generation of Fiskars axes makes chopping wood easier. The axe has a handle of polyamide reinforced with fibreglass and a non-slip TPE-V grip.

92 cm. “From our point of view, it was important to handle the whole size range with one and the same injection moulding machine”, emphasises Fiskars process developer Harri Engström. “That’s why we opted for the tie-bar-less ENGEL victory. Ease of access to the mould room makes the removal of big, lengthy axes a simple matter, and our staff don’t need to bend over the tie-bars.”

While the injection moulding process is working, the person operating the machine imprints the axe handles at the finishing station next to the injection moulding machine and packs axes for export around the world.

Process development in partnership

Although Fiskars has been using machines made by ENGEL since 1981, the axe project represents something special for both partners. “We collaborated during the product and process development phase, which meant we could tailor the processing technology to the precise requirements of our product”, says Anders Nybäck, Managing Director of ENGEL FINLAND. “We knew ENGEL has a wealth of expertise and experience in the field of multi-component technology”, continues Jouni Riikonen, Technical Manager at Fiskars. “This meant we could minimise the risk to ourselves.”

Pre-production took place at ENGEL’s base in Schwertberg, Austria, before the system – optimised and ready for series production – was transferred to Finland. The fact that ENGEL’s Helsinki branch is about one hour from Billnäs by road saved a great deal of time at the commissioning stage on site. “Whenever we need help, someone always gets to us quickly”, says Harri Engström. “ENGEL has got the biggest service team in the region.”

The team doesn’t only turn out to start up new systems or deal with malfunctions; ENGEL and Fiskars are working together continually as partners in process optimisation, with the issue of energy efficiency currently high on the agenda. The new ENGEL victory machine installed to manufacture axes is fitted with a servohydraulic ENGEL ecodrive and realise energy savings of more than 35 percent compared to a conventional hydraulic 300-ton machine. “We did several test series with both machines – the victory without ecodrive and the new one with the servohydraulic system – using the same moulds and exactly the same process parameters”, says Engström. „The results are clear-cut."

The machine park in Billnäs contains a total of 35 injection moulding machines delivering clamping force of 50 to 350 tons. Apart from low levels of energy consumption, the ENGEL servohydraulic offers another advantage: greatly reduced noise emissions compared to standard machines. “It’s made a massive difference”, says Engström. “Staff using the machine with the ecodrive only wear headphones to listen to the radio now, not to block out noise.”
The market for diagnostics is changing. Rising demands on product convenience are driving a stream of new product designs and enhanced functionality while raising the efficiency of production processes. For many years Helvoet, based in Tilburg, has specialised in this dynamic market segment. Amongst other things, the Dutch company produces test cassettes via two-component injection moulding in its capacity as sole supplier to a global pharmaceutical organisation. Helvoet acts as a development partner as well as a producer. “To turn an idea into a successful product, we need to combine a wide range of technologies”, said Bas Schuurs, Managing Director of Helvoet in Tilburg. “Our expertise lies in finding the right partners and suppliers for our customers and working out the best possible manufacturing solutions in partnership.” Helvoet decided in favour of ENGEL AUSTRIA as a partner for injection moulding technology for the test cassettes. Its system solution competency tipped the balance. “From the outset, it was clear that we would be able to cut our time-to-market”, underlined Helvoet project manager Jeroen Molenschot. ENGEL therefore supplied the complete production cell including automation from the same place, and also took care of the GMP documentation for the whole system.

Minimise risks
GMP (good manufacturing practice) is designed to ensure that products are manufactured to a consistent standard of quality in accordance with their intended usage; GMP guidelines define a code of conduct and regulations that must be observed in the manufacture and utilisation of relevant products. The aim is to minimise risks while ensuring observance of rules can be demonstrated at all times. For every system used to produce pharmaceutical or medical products, documentation is drawn up setting out the process and the decision-making procedures that resulted in that process. Whereas GMP rules define what must be done and observed, they do not describe how this should be achieved – and therein lies the challenge.

FMEA: the backbone of development
Failure mode and effects analysis (FMEA) is an important element of GMP documentation. According to Jeroen Molenschot, FMEA amounts to “the backbone of all process development”. Proceeding sequentially is the key. In this way, the intended production process is talked through step by step, underlined Helvoet project manager Jeroen Molenschot. ENGEL therefore supplied the complete production cell including automation from the same place, and also took care of the GMP documentation for the whole system.

Out with risk, in with efficiency
Systems business is on the rise: procuring injection moulding machine and automation from a single source saves costs and speeds up commissioning. Now, for the first time, ENGEL has also supplied GMP documentation as part of the turnkey package. The advantage for Helvoet, the client? Even more efficient processing of projects and a fully optimised manufacturing cell.
As a plastics processing business, what does GMP mean to you?
Jeroen Molenschot: We have to make sure our products are in perfect order and function reliably. In the event that one of our products causes a problem, we must be able to verify that we did everything technically possible to prevent that problem ever arising. To do that as a plastics processing firm, we need experience and good partners. After all, the standards don’t define clear guidelines.

In your view, what is the ideal procedure?
Jeroen Molenschot: It’s essential that documentation is compiled in tandem with the planning and building of the system. The most important thing is to start with the risk analysis and proceed step by step.
Bas Schuurs: Now, though, we realise that the success of the project was actually down to this very intensive early phase. Given the complexity of the process, the start-up time for the plant was extremely quick thanks to good preparatory work.

What other advice would you give to plastics processing companies addressing this area for the first time?
Bas Schuurs: GMP guidelines were originally developed for the manufacture of pharmaceutical products, and the requirements of the pharmaceuticals industry cannot be compared to those of the plastics processing sector. In other words, you have to weigh up everything in the light of the practical reality of your own business and not lose sight of the product requirements. Specifications, time and costs are in a three-way relationship; if the relationship is unbalanced, the process becomes either too risky or uneconomical. Pragmatism is needed, but the number one priority is always safety and the elimination of risk.