Thermoforming, packaging & mold technology in focus. The ILLIG magazine

thermoformer

ILLIG & INNOVATION
The high-performance 3rd-generation thermoforming machines RDM-K

CUSTOMER FORUM
A visit to Færch Plast: Relying exclusively on ILLIG technology

KNOW-HOW
Energy efficiency in thermoforming depends on many parameters

ILLIG at K
We are looking forward to your visit at our booth
Hall 3 Stand A52
Dear Thermoformers,

We are pleased to present the first issue of our new magazine, thermoformer, to you today. As of now, we will keep you regularly updated on the most recent innovations in thermoforming on these pages. All over the world, this technology has established itself as a key manufacturing route for diverse products which play an indispensable role in many areas of our lives.

New developments and applications of this technology, as well as its implementation by our customers, will therefore be in the focus of our reporting. In addition, we shall be examining practice-related examples to give our readers fresh ideas and insights into the current state of our industry. Energy-efficiency, a sparing use of resources, new thermoplastic materials and methods of processing them – such are the issues we are looking at very hard and which therefore define current engineering trends in thermoforming.

Moreover, as new applications emerge, we are faced with continuously more exacting demands. Machine and mold availability rates and the quality of thermoformed products are becoming ever more important. At ILLIG, ongoing product development is the strategy of choice for prevailing in this environment. Advanced motor and control technologies and optimized MMI solutions can deliver significant performance and efficiency gains today. For our customers to benefit from such advances in their day-to-day operations, highly skilled and motivated personnel is a key prerequisite. Dedicated operator training programs are therefore part of our service offering to enable users to actively design the change process.

By providing extensive information we intend to help build a common discussion platform aimed at the continuous improvement and refinement of thermoforming technology. Our new magazine, thermoformer, seeks to lay the foundation for this exchange. We are looking forward to your suggestions, comments and requests which we will be glad to take up as input for our work.

Yours faithfully,
Karl Schäuble, Managing Director
After the crisis – looking ahead to K 2010

The impact of the gravest economic and financial crisis since the war has been weighing heavily on the mechanical engineering and industrial equipment manufacturing industry. However, with the encouraging uptrend in overall economic activity observed in the last few months, some of the blackest clouds on the economic horizon have dispelled and business has regained confidence.

While producers of thermoforming machinery, molds and packaging equipment were hit with hitherto unknown severity by the crisis, at ILLIG, we never doubted for one moment that our customers, markets and products would regain their strength once it had passed. True to that conviction, we kept staff levels stable and bridged periods of excess capacity by encouraging personnel to deplete their flexitime accounts while introducing short-time work schemes.

At the same time, our company continued with its personnel training programs, optimized production and assembly workflows, refined products and further stabilized quality levels. The successful outcome of these efforts will be presented at the “K” trade fair in Düsseldorf this October. A preview is given in this issue of thermoformer.

Thermoforming – on track for success

New-generation machines delivering increased performance, new energy-saving features and advanced process capabilities are providing thermoformers with highly efficient manufacturing resources today. In conjunction with ILLIG’s radically new ThermoLineControl system, tangible gains in productivity and cost efficiency can thus be achieved, particularly for production lines and integrated equipment environments. The successful IML technology initially launched for thermoforming round cups is currently being adapted to applications involving non-round packaging articles as well. This development is on the verge of completion.

For users to benefit fully from our machines’ improved performance, optimized stacking and discharge technology must be in place and increasingly rapid processes must be effectively visualized to the operator. Suitable optimization aids for running in new molds, a compensation for ambient factors in day-to-day service and the ability to save entire recipes to memory enable users to produce moldings of unvaryingly high quality.

And for the first time ever, ILLIG’s ThermoLineControl system allows all peripheral equipment to be operated, controlled and monitored integrally along with the thermoforming machine. An assist system guides the operator through each mold change, thereby saving valuable set-up time and yielding further plant availability gains.

Communication with a capital ‘C’

For ILLIG, attendance at “K” – our industry’s key trade fair – is a matter of course since it gives us the opportunity to present the state of the art in thermoforming to a wide audience including, first and foremost, customers from all over the world.

The intense market interest in this technology was already very much in evidence during our 10th Open House held at Heilbronn in late September 2009, an occasion which also marked the inauguration of our newly erected ILLIG Customer Center. More than half of the over 300 experts attracted by this event came from abroad, mostly from West and East European markets. However, customers from North and South America, the Asian region and China also came to Heilbronn to take an up-close look at the most recent trends in thermoforming.

You, too, are cordially invited to visit us at Heilbronn for inspiration and to find out about the sheer diversity of thermoforming technology. At our new Customer Center we shall be glad to explain about application-specific solutions to your molding needs and to present our tailor-made operator training programs as well as the maintenance capabilities of our worldwide after-sales organization.
Real-life exhibits

The equipment demonstrations staged at the ILLIG booth reflect real-life manufacturing scenarios. On an RDK 90 automatic pressure forming unit, the largest model in the line-up designed for a 900 mm processable stock width and 700 mm format feed length, APET trays (of the kind sold millions of times over as sales and keep-fresh packaging for food) are produced in a 16-cavity mold at a rate of 55 cycles/minute. Also from APET stock, an RDM 70K automatic thermoformer (molding surface area: 680 x 300 mm²) makes yogurt cups in a 27-cavity mold.

Reliable handling of these high product volumes – more than 50,000 trays and close to 70,000 yogurt cups per hour – is ensured by appropriate downstream equipment. The RDK 90 line includes a dual handling system which takes care of product removal and stacking. The stacker of the RDM-K line has a new turning head capable of rotating through 180 degrees. Designed for up to 45 cycles/minute, the demolded cups can thus cool down for an entire cycle before being safely stacked.

Servomotor-actuated throughout

The consistent use of servomotors for all thermoformer operating sequences is key to the high cycle rates attained. These energy-saving high-speed motors provide elevated accuracy levels and permit a maximum of overlap between operating steps, thanks to their high positioning precision and repeatability. Thus, valuable process time is saved over each sequence. Another key factor contributing to the much-enhanced productivity of these machines compared to the previous generation is their outstanding dynamics in building up and releasing the forming air pressure. In the case of the RDM-K series, this has been achieved essentially by reducing the mold air volume by up to 70% on the new 3rd generation of machines.
generation molds. It has thus become possible to raise cycle rates by over 30%, and sometimes much more (for more details on the performance of the current RDM-K series, refer to page 7 and the following pages).

**Significantly enhanced productivity**
The effect of superior sequence overlap and the resulting process time gains on the productivity of the current process-controlled RDK/RDKP automatic pressure formers is illustrated in Table 2 for machines with existing (2nd generation) mold technology. By way of example, the comparison is shown for three different products. Similar productivity gains have been consistently obtained with customer tooling in many other applications. In most cases the increase amounted to well over 30%. One boundary condition set for the development of the new machines was that existing molds had to remain useable in unchanged form.

Apart from increased productivity, the higher cycle rates had other beneficial effects as well. For one thing, the stock heated to the thermoforming temperature is molded at an earlier point in time, i.e., while still in a more plastic state – and with a much more dynamic build-up of forming pressure. This makes for better contour definition in the mold cavity and hence, increased product quality. In fact, this effect might even be utilized to reduce the stock temperature with existing molds while maintaining the product quality unchanged and still benefiting from faster cycles.

In order to make full use of the potential of its 3rd generation RDK and RDKP thermoformers, ILLIG has also improved the mold technology, and particularly mold cooling. One outstanding feature is the new jacket cooling system (cf. Fig. 1). Compared to conventional solutions, it enlarges the surface area available for heat transfer between the molding and the coolant inside the mold. The new jacket cooling system is particularly beneficial in molding semi-crystalline materials such as polypropylene.

**New control technology:**
ILLIG ThermoLineControl
Developed initially for the large RDK 90 model, the new “ILLIG ThermoLineControl” system is now available for all roll-fed thermoformers including the RDM 70K demon-

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**Table 2:**

<table>
<thead>
<tr>
<th>Product</th>
<th>L x W x H [mm]</th>
<th>Material thickness [mm]</th>
<th>Cycles / min</th>
<th>Increase [%]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>2nd Generation</td>
<td>3rd Generation</td>
</tr>
<tr>
<td>Hinged pack</td>
<td>500 x 250 x 30</td>
<td>APET 0.26</td>
<td>28 (RDKP)</td>
<td>51 (RDKP)</td>
</tr>
<tr>
<td>Meat tray</td>
<td>226 x 180 x 60</td>
<td>PP 0.65</td>
<td>18 (RDK)</td>
<td>25 (RDK)</td>
</tr>
<tr>
<td>Meat tray</td>
<td>230 x 137 x 22</td>
<td>PP 0.40</td>
<td>25 (RDK)</td>
<td>40 (RDK)</td>
</tr>
</tbody>
</table>

Productivity comparison: Molds designed and operated by customers on 2nd generation thermoformers were tested in unchanged form on 3rd generation machines by ILLIG.

**Fig. 1:** High-performance line with RDK 90 automatic pressure forming machines. The mold-change system facilitates rapid format and mold changes (as with the 16-cavity tray mold shown) while the new jacket cooling system (bottom left) provides high molding quality and short cycles through its large-area, contour-following cooling action.

**Fig. 2:** ThermoLineControl – Eliminates traditional paper documentation and the associated errors once and for all. The integrated data record management system supports a full argument-based search among all data for selective retrieval and rapid input upon re-launching production.
demonstrated in a cup molding application at the “K” fair. As a necessary condition for such universality, all add-on equipment and options – from the roll stand to the standalone cooling unit – come with a matching interface as standard.

For the operator, ThermoLineControl provides a broad range of auxiliary functions, beginning with a basic start-up setting for each new product or mold. Once the material type, stock thickness and a few product and mold data have been entered, the program will automatically determine a basic setting – including a cycle rate and matching stock heating program. The machine is then ready for production, with all settings geared for optimum product quality.

**Fast retrieval and activation – productivity restored in no time**

The control system not only provides a continuous supervision and graphic visualization of the machine’s operating sequences but also saves all settings and process parameters to memory. Thus, the laborious manual documentation routines practiced for so long become a thing of the past. For all molds ever used and all products made to date on a given thermoformer, parameters can be stored in the new data record and recipe management system which provides search options for easy retrieval so that all data can be instantly used in production (Fig. 2).

Beyond these thermoformer control features, the new ILLIG ThermoLineControl system conceived specifically for full-scale production lines provides several additional efficiency-enhancing benefits. As demonstrated on the RDK-90 line at the “K” fair, all operations of the individual machines making up the production line can be centrally managed, optimized and process-controlled via the MMI station on the thermoformer (Fig. 3). This capability will save much time during format or mold changes, apart from providing enhanced operator convenience. Given the additional advantage of the thermoformer’s mold quick-change system, formerly non-productive periods are thus converted into precious value-adding time (Fig. 4).

Moreover, the new ThermoLineControl system makes fault analysis and troubleshooting tasks easier, faster and, above all, more focused. These advantages will be appreciated especially when a production line is remotely monitored via the Internet using ILLIG’s Net Service.

**Dramatically improved energy efficiency**

The actuation of all thermoformer movements by servomotors not merely translates into superior efficiency but also improves the equipment’s energy balance. Thus, depending on the machine type and drive system, up to 20% of the total power input can be saved by recovering braking energy.

For all that, there are clearly more sides to a thermoformer’s energy efficiency. The latter is further influenced, e.g., by the type and use of the infrared heaters pre-heating the material, the power demand of the temperature control devices, and – quite a critical energy factor on roll-fed machines – the power required to provide the forming air.

Comparative measurements have shown that today’s much more powerful 3rd generation thermoformers save up to 50% power over older-generation ILLIG machines. The underlying causes and effects will be clearly illustrated on practical examples at ILLIG’s booth at the “K” fair (see also the article on page 14).

> All further details will be presented at the ILLIG booth, Stand A52 in Hall 3
In developing its new range of RDM-K automatic pressure thermoformers employed chiefly in cup-making applications, ILLIG had set itself two overriding goals. The 3rd generation machines should provide higher outputs while delivering improved product quality at the same time. While there was not much to be changed about the thermo-forming principle in general, an analysis of past practices nevertheless revealed scope for process improvement in the forming air application step.

With the current machine and mold generation, forming air is supplied to each cavity directly via the respective pre-stretcher (refer to the article on p. 9). This technology ensures a controlled repeatability between cycles, which in turn has a direct effect on the uniformity of cups made in multi-cavity molds.

**Increased dynamics for shorter cycles**

Another innovation resulting in both increased molding quality and shorter cycle times lies in the reduced forming air volume used for molding each cup. Compared to the prior state of technology, 3rd generation RDM-K molds now need 50 to 70% less forming air per cavity. As a result, the forming pressure will build up at a much steeper rate (p. 9), which not only makes for much faster molding but also gives a substantially improved contour definition to the product.

The time gains obtained by reducing the forming air volume, in conjunction with the new individual-cavity control process, can be exploited directly by the operator to increase the cycle rate. This productivity enhancement is supported by a new, optimized mold cooling system (p. 9).

**Uniform wall thickness**

The performance of these machines in terms of quality and productivity also benefits from another innovative solution, i.e., the downholder pressure level control system which adapts the force applied according to the specific thermoforming process stage (see p. 9). Until now, applying the full clamping force had invariably resulted in the formation of a permanent bead along the top edge of the cup (cf. Case 1 in Fig. 1).

Systematic investigations revealed that this bead deposit, which accounts for approx. 10% of the molded article weight, can be “shifted” by varying the downholder pressure (Case 2). With the new pressure...
level control system, the downholder force is matched perfectly to the time curve of the thermoforming process, so that the undesirable material deposit is drawn completely into the side wall as the cup is formed. The result is a highly uniform wall thickness distribution (Case 1 in Fig. 1).

Moreover, the “additional” material thus drawn into the side wall gives added strength to the cup, i.e., the top load rating is increased. Conversely, a thinner web material (10% less basis weight) would suffice to produce a molding of the same strength. This corresponds to a direct reduction in material costs.

Tangible increase in product quality and productivity
Compared to the previous series, these 3rd generation automatic pressure forming machines consistently achieve around 30% shorter operating cycles in drink cup thermoforming service, depending on the material type and shape of the cup. In some cases, much higher gains are achieved (cf. Table). The same applies to product quality parameters.

For economic reasons, cup walls are kept as thin as possible (reduced material cost) while on the other hand, the thermoformed product is expected to withstand a certain minimum top load. In the case of a yogurt cup, for instance, which must be securely sealed after filling, the flatness of the sealing rim becomes crucial over and beyond the given thickness of the material. A maximum rim angle variation of 5 deg. is not to be exceeded since the cup will otherwise not be positively sealable in a volume production line.

The RDM-K automatic pressure forming machines and 3rd generation mold technology remain far below the tolerance limits specified for the above criteria. Notwithstanding the major increase in cycle speeds achieved, the cups are consistently less susceptible to rim angle deviations – even when measured across all cavities of a multi-cavity mold.

Process reliability in stacking
In order to cope reliably with the enhanced output of the new thermoformers, stacker technology has been advanced as well (Fig. 3). Even short, bulging cups which are difficult to keep properly aligned are reliably transferred to downstream equipment in unattended operation, whether for packing counted cup stacks into a transport container or for direct filling, sealing and packing on integrated lines.

All stacker components are made of wear-resistant materials throughout. Contamination of the cups with foreign particles – as can never be fully avoided, e.g., with stacking cages comprising brushes, rubber or similar stack holder materials – is thus prevented. Freedom from contamination is an important criterion not only if the cups are to be subsequently filled with food products.

The high precision and repeatability of 3rd generation RDM-K automatic pressure forming machines also becomes evident when they are started up in production. As soon as the mold has reached operating temperature the first true-to-specification cups emerge, ready to be stacked. The new RDM-K generation is suitable both for off-line roll-fed operation and for in-line use downstream of a flat-film extruder. The standard range comprises four machine sizes addressing various requirements in industrial practice, with the RDM 54K (mold surface area: 520 x 300 mm²), RDM 70K (680 x 280 mm²) and RDM 78K (760 x 420 mm²) having now been joined by the most recent RDM 75K (735 x 465 mm²) model.

<table>
<thead>
<tr>
<th>Product</th>
<th>Cycles /min</th>
<th>Increase [%]</th>
</tr>
</thead>
<tbody>
<tr>
<td>2nd Generation</td>
<td>3rd Generation</td>
<td></td>
</tr>
<tr>
<td>Jogurt cup, PS 73 mm dia., 1.25 mm wall thickness</td>
<td>22</td>
<td>36</td>
</tr>
<tr>
<td>Drink cup, PS 73 mm dia., 0.8 mm wall thickness</td>
<td>25</td>
<td>37</td>
</tr>
<tr>
<td>Jogurt cup, PS 75 mm dia., 1.15 mm wall thickness</td>
<td>28</td>
<td>36</td>
</tr>
<tr>
<td>Drink cup, PP 75 mm dia., 1.2 mm wall thickness</td>
<td>28</td>
<td>36</td>
</tr>
</tbody>
</table>

Numerous innovations on the 3rd generation RDM-K automatic pressure forming machines (exemplified by an RDM 70K with a 24-cavity mold in this case) have yielded marked productivity gains (increased cycle rate).
The 3rd generation of RDM-K molds
High dynamics and product uniformity at one stroke

Synchronous pressure build-up – in all cavities
Second-generation RDM-K molds reflect the state of the art of their time, with central valves handling the supply of forming air to all cavities. In the development of 3rd generation thermoformers, lateral valves – integrated into the mold – were used as a first step. Each of these valves controlled the supply of forming pressure to one single row of cavities. Although this method already constituted an improvement over the prior-generation, an absolutely synchronous airflow to the cavities could not yet be ensured in this manner. The task of forcing the material into conformance with the cavity contours and pressing it against the cooled mold wall (thereby initiating cooling) was completed within a given inter-cavity “time window”, resulting in non-uniform product characteristics.

In the current 3rd generation molds, forming air is separately supplied to each cavity directly via the pre-stretcher (Fig. 1). Compressed air is thus gated directly into each cavity. To this end, a solenoid valve assigned to each cavity is fitted in the upper mold part for a defined, synchronous build-up of forming air pressure.

The synchronous admission of forming air is all the more important in view of the severely reduced forming air input per cavity which is achieved through improved design (see p. 7). Even with this diminished air demand, a dynamic (steep) build-up and release of forming air pressure (Fig. 2) occurring simultaneously in all cup-forming cavities can thus be ensured.

Controlled pressure profile
On 2nd generation molds, the full downholder force was commonly applied upon closing of the mold. This practice invariably resulted in the formation of a bead along the upper cup rim, as described in detail on page 7. However, in terms of process technology, the maximum downholder force is needed only during application of the full forming air pressure. During pre-stretching of the material and punching of the molded product the downholder force may be lower.

With the new pressure level control system, the downholder contract pressure is adapted to the specific phase of the thermoforming process. The full downholder force is not exercised until the main forming air pressure sets in; it is then reduced toward the end of the molding cycle (Fig. 3). Another innovation is that the downholders are cooled directly to support short cycle times.

Optimized mold cooling
The mold now comprises up to four cooling circuits. Individually controllable, these supply coolant separately to the upper mold part, the downholders, the lower mold part and the ejectors. In order to accelerate the dissipation of heat from the cavities, the molds have contour-following cooling passages of adequately sized cross-section.

It is not necessary to reduce the coolant temperature – quite the opposite is true. While previously the coolant had to be at 12 °C, the new molds can be cooled with water in the 16 …18 °C range. This saves energy but also reduces the risk of moisture condensation in the mold, which is always extant at elevated air humidity levels.
A visit to Færch Plast, Holstebro/Denmark

Food packaging made in Denmark

“Danish Food Packaging” by Færch Plast has become a brand name with reputation extending far beyond Denmark. With over 500 office and production staff employed today at its headquarters site in Holstebro, sales offices in England and France and a manufacturing facility in the Czech Republic, the company produces high-grade food packaging systems – and puts faith in ILLIG thermoforming equipment.
Food is a valuable product. Protecting it along the value-adding chain from the producer to the retailer and on to the consumer, thus allowing it to be brought to the table fresh and appetizing, is the stated ambition of Færch Plast A/S (www.faerchplast.com), the Danish packaging specialist. The company is headquartered at Holstebro, a town of 34,000 situated in picturesque north-western Jutland, close to the North Sea and the Limfjord – the long stretch of water which links the North Sea to the west with the Kattegat in the east and has been dividing Vendsyssel-Thy, Denmark’s second largest island, from southern Jutland since the flood of 1825.

Since its formation in 1969, Færch Plast has built a name for itself as a leading developer and manufacturer of high-quality food packaging. Working around the clock, the company produces plastic packaging for diverse applications by thermoforming. The bulk of its products consists of trays of different shape, color and functionality for primary ready meals and fresh meat, but also for salads, snacks and other cold food products. These trays are made of sheets consisting of polyethylene terephthalate (PET) – more specifically, semi-crystalline CPET and amorphous APET – even polypropylene (PP), polystyrene (PS) and even polyactic acid (PLA), a so-called biopolymer.

The company supplies its products to the food processing and retail industry, with exports – destined mainly for the entire European market – accounting for around 80% of its output.

Attractive jobs – ambitious corporate policy

A job with Færch Plast is considered highly attractive employment in the region. “To us, our employees are our most important resource. With their skills and commitment, they are key to our ability to keep on increasing our competitiveness and to remain on a constant growth path”, acknowledges Lars Gade Hansen, the company’s managing director.

As a manufacturer catering to the foodstuffs industry, Færch Plast has always been convinced that its foodstuff packaging should meet the same high hygiene standard as the food itself. Thus, specific headgear or protective clothing must be worn in all production areas, depending on the individual job activity. All production employees are issued fresh work wear every day.

Similarly, production technologies and processes at Færch Plast have been required to comply with hygiene, product safety and quality standards from the start. Thanks to this approach, the company quickly won hygiene certification by ADAS, the British research and consulting organization, in 1998. Today its certification conforms to the internationally recognized BRC/IoP standard developed by the British Retail Consortium (BRC) and the Institute of Packaging (IoP).

Environmental and energy management are likewise key themes in the company’s policy. “In 1996, at the request of the public authorities, we started to measure our climate impact. But we did not stop at measuring – instead, we initiated and implemented environmental improvement steps systematically”, explains Lars Gade Hansen. The company has thus managed to cut its annual energy consumption by 29% since 1996. In terms of kilowatt hours, this figure corresponds to the annual power demand of 4,400 households. As its next goal, Færch Plast is determined to meet its entire energy requirement from renewable resources as of 2012. “Our objective for 2009 was to get 40% of our energy from renewable sources, and this we have achieved. For this year we have now raised the bar to 53%, and we are going to meet that target as well”, Hansen adds. This will mean that Færch Plast has cut its impact on the global climate (expressed in so-called CO2 equivalents) by more than one-half since 1996.
Prizewinner: “Hot soup in the air”

The company’s integrated energy and environmental management policy – documented by its ISO 14001 certification – is rounded out by a labor safety improvement program. Faerch Plast was among the first ten companies in Denmark to receive certification in accordance with OHSAS 19001 and the Danish Ministry of Labor’s ordinance No. 923 (2003). OHSAS 18001 (Occupational Health and Safety Assessment Series) is an international occupational health and safety management system specification. – Such are the conditions in which the Holstebro-based company continues to develop ever new and improved packaging solutions for the protection, storage, handling and use of foodstuffs – always in close cooperation with the customer. Time and again over the years, the company has won awards such as the “Scanstar” and the even more prestigious “WorldStar” for its innovative achievements.

Long-standing and mutually beneficial partnership

As one enters the production building at Holstebro, two observations literally leap to the eye: the “clinical” cleanliness of all surfaces in view and the uniformity of the company’s machine pool. Indeed, Faerch Plast relies exclusively on ILLIG thermoforming machines in its production of packaging products.

The cornerstone for this cooperation, which has grown and evolved over the years, was laid in 1969 by Jørgen Faerch himself when he purchased six pre-owned ILLIG RDM 37/10 to launch his production operation. These were followed, in 1971, by the first new machine of the same type which was specially adapted for molding cup-shaped products. Other machines were added in the course of the company’s rapid and continuous growth which, in 1973, called for the construction of a new factory. The first RDK type ILLIG machine, designed for the production of PP trays, was acquired by Faerch Plast in 1994.

Today, 40 years from its founding date, the company commands a total production, storage and office area of over 46,000 m² at Holstebro, following a series of inevitable expansions over the years. Along with this growth, the number of ILLIG machines in use has increased substantially. In the majority of cases, RDK type thermoformers with combined molding and punching action were added.

This long-standing customer/supplier partnership is certainly based on trust. Faerch Plast has confidence in the technology leadership and broad process expertise of its Heilbronn-based specialty manufacturer of thermoforming equipment. Aside from the high productivity and reliability of ILLIG’s machines, after-sales benefits such as rapid spare part supplies and technical

The sheet warehouse at Holstebro, with a surface area of more than 1,700 m², contains over 2,000 tonnes of sheet in various grades and colors on an average day. This provides enough production flexibility to complete the most diverse orders with a minimum turn-around time.

One of the most recent examples of Faerch Plast’s innovative force is a new packaging solution which allows soup to be safely heated and served aboard airplanes. This product scooped up no less than two prestigious prizes in 2009: the much-coveted “Scanstar” (although to Faerch Plast, this is already the fifth) as well as the “WorldStar” award conferred by the WPO (World Packaging Organisation).

The new packaging consists of a soup bowl with a lid which seals off the container tightly enough to keep liquid inside, but is permeable to vapors. Specially formed valves along the edge of the bowl ensure that the steam will escape from the pack during heating so that no hazardous overpressure can form. A filling line in the bowl indicates how much soup it may contain without fluid exiting through the valves upon heating.
field service contribute equally to a stable business partnership. In this regard, the Danish ILLIG representative, Activteam APS in Dragør – headed by Henrik Sundby – has been playing an important role.

“It is a partnership that works – and continues to work – to our mutual benefit”, says Reiner Albrecht, Head of Sales at ILLIG, and goes on to explain: “Færch Plast has often presented us with ambitiously defined specifications, which we have met by adapting our equipment in one special way or other. Some of these modifications have then found their way into series-produced machines as part of our ongoing effort to improve our machine technology.”

The trust accumulated over the years went so far as to prompt the management of Færch Plast to entrust ILLIG with the training of its personnel for a projected new production plant at Liberec/Czech Republic. Well in advance of the March 2008 start-up date for this 13,500 m² facility, the workforce was given on-site instruction on two thermoformers and received comprehensive support in the run-up to the launch of production at Liberec. By now, food packaging is manufactured on a substantial number of ILLIG thermoformers at this site.

Extrusion competence

In 1991, Færch Plast at Holstebro additionally commissioned its first PET extruder equipped for the production of multilayer sheets. This decision was motivated not only by economic reasoning but rather by technology and quality aspects. As process owner the company would be able to influence, and selectively control, the production of sheet at one stage upstream of its packaging production. Not least significantly, this approach enabled the company to pursue the intended replacement of raw materials with recyclate, thus further reducing the environmental impact of its operations. One current aim is to meet part of the PET requirement from post-consumer bottle waste, which – once thoroughly cleaned – meets exacting hygiene standards no less fully than new material. The PET recyclate is processed into multilayer sheets having a cover layer made of new stock.

Today, Færch Plast produces both mono and multilayer PP and PET sheets on several extrusion lines. The new plant at Liberec likewise runs its own PP extrusion line by now.

The name of Færch has been a household word at Holstebro for well over 140 years. It all started in 1869 with the establishment of “R. Færch’s Cigar- og Tobaksfabrikker A/S”, which was later merged with two other Danish tobacco companies to form “Skandinavisk Tobakskompagni A/S”. When, in 1968, the proprietors’ families withdrew from the business after 100 years, Jørgen Færch launched a new corporate era by founding “R. Færch Plast A/S”.

His company’s success story has by now been unfolding for 40 years. ILLIG has been there from day one to assist in writing it – and will be glad to keep on contributing, with commitment and expertise, now and in the future.

By relying on “large” 3rd generation RDK 90 type thermoformers, Færch Plast has taken a further step towards optimized performance and quality improvement.
Energy efficiency – how can it be compared?

An everyday example
In thermoforming, preheating the stock (i.e., sheet or film material) at a dedicated station upstream of the thermoforming machine is recommended practice. It ensures a reproducible and uniform stock temperature at the inlet into the machine’s heating zone, a superior and more homogeneous temperature distribution over the entire process and hence, constant process conditions which are key to high product quality. But how does this “extra” heating step affect the machine’s energy balance?

The table across shows the results of energy consumption measurements carried out on a sheet-fed forming machine with pneumatic and servomotor drives with and without stock preheating. It emerges that the specific energy consumption (SEC) of a machine equipped with stock preheating is higher in all cases (cf. Fig. 1). The additional power requirement amounts to approx. 25–26% on a pneumatically driven unit, as distinct from approx. 22% on a servomotor version. In other words, the additional energy input per processed kilogram of stock is quite significant. So does the operator have to pay “a high price” for the process uniformity obtained?

It is further evident from the table that stock preheating yields a significant reduction in cycle times which translates into a substantial rise in machine productivity (PR). On a pneumatically driven machine this productivity gain exceeds 40%, while on a servomotor version it may amount to over 50%. It becomes clear at this point that in thermoforming, specific energy consumption alone is not the overriding criterion for assessing energy efficiency.

Objective energy efficiency assessment: “energy-related productivity”
In order to judge the impact and effectiveness of a given measure in thermoforming, the associated specific energy consumption and the resulting productivity of the thermoforming machine must always be viewed in conjunction. It is therefore recommended to consider machine productivity as related to specific energy consumption (PR/SEC) as a reference standard. This is, by itself, a parameter of little information value.

Ensuring energy efficiency – or even a reduction in energy input – is an economically rewarding objective in every value-adding process. But how can differently equipped thermoformers be objectively evaluated in terms of their energy efficiency?

<table>
<thead>
<tr>
<th>Machine version</th>
<th>Cycle time [s]</th>
<th>PR [kg/h]</th>
<th>SEC [KWh/kg]</th>
<th>PR/SEC [(kg/h)/(KWh/kg)]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 UA 155g pneum + BE, without VH</td>
<td>81,2</td>
<td>337</td>
<td>0,237</td>
<td>1 420</td>
</tr>
<tr>
<td>2 UA 155g pneum + BE, with VH</td>
<td>57,6</td>
<td>474</td>
<td>0,298</td>
<td>1 592</td>
</tr>
<tr>
<td>3 UA 155g servo + BE, without VH</td>
<td>68,4</td>
<td>399</td>
<td>0,193</td>
<td>2 069</td>
</tr>
<tr>
<td>4 UA155g servo + BE, with VH</td>
<td>44,8</td>
<td>610</td>
<td>0,235</td>
<td>2 595</td>
</tr>
</tbody>
</table>

Productivity (PR), specific energy consumption (SEC) and energy-related productivity (PR/SEC) of a sheet-fed thermoforming machine with sheet feeder (BE) and different actuating systems, determined for 4mm HIPS sheets, without and with stock preheating (VH).

“energy-related” productivity of a machine (or of different machine settings) indicates the productivity achievable by the machine per kWh/kg of available energy, i.e., it is a measure of how efficiently the machine can convert its power input into productivity (output).

If we apply this principle to the machine versions examined, a clear picture emerges (cf. the table and Fig. 2). Stock preheating yields a substantially higher energy-related productivity in all cases. The PR/SEC value rises by approx. 12% for pneumatically driven machines and by over 25% on servomotor versions. Consequently, stock preheating is not, in energy consumption terms, a luxury: it definitely pays off because of the superior “yield” obtained from the energy expended. The installation of a stock preheating station can therefore be recommended unreservedly, since it not only provides superior process and product uniformity but also enhances the energy efficiency of a thermoforming line.

This energy yield situation is graphically illustrated in Fig. 2. It is therefore expedient to rely on the energy-related productivity (PR/SEC) in general whenever the energy efficiency of a thermoforming machine or equipment configuration is to be evaluated. This observation not only holds true for sheet-fed thermoforming machines – indeed, energy consumption measurements on automatic roll-fed systems have confirmed the rule. Here, too, the PR/SEC value provides an unambiguous and accurate measure for assessing different equipment configurations in terms of their energy efficiency.

Fig. 1: Specific energy consumption SEC is, by itself, a parameter of little information value.

Fig. 2: Energy-related productivity PR/SEC – a precise and unambiguous indicator.
EXPERTISE UP TO DATE

New ILLIG training concept
Geared to the practical needs of its target group

The growing use of complex electronic control systems and a host of process parameters is a characterizing feature of today’s thermoforming machines, whether of the sheet-fed or roll-fed variety. As with all modern production systems, such complexity has become the key to fast and cost-efficient automatic manufacturing. On the other hand, it imposes ever more exacting demands in the day-to-day operation of the equipment. A sound base of skills and know-how is therefore required and must broadly encompass anything from setting up and operating the machine to maintenance and troubleshooting tasks. Without target-oriented personnel training it would be difficult to keep up with the pace of technological progress.

Practical value as a guide
In response to this trend, ILLIG has newly added a set of practical courses for machine operators and setters to its training program this year. Spanning the entire equipment range, the scheme comprises a course on UA Series sheet-fed machines, one on RDM-K automatic roll-fed machines with tilting mold system and shear cutting action, and one on RDK/RDKP roll-fed machines with steel rule cutting system. A feature common to all courses is a theory block focused on direct practical value, but ample scope is also given to practical exercises aimed at repeated training of key skills on the equipment. The training courses are designed for attendance in small groups of up to eight participants.

At the ILLIG Training Center in Heilbronn, a new set of personnel training courses combines focused, practically relevant theory with hands-on exercises on a variety of machine types. Thanks to their ambitious content, these programs not only give a sound background to the thermoforming novice but also enable experienced hands to upgrade their expertise.

Course overview
The practical courses dealing with the individual machine types are scheduled to last four days each. In the initial 2-day theory block, thermoforming fundamentals such as film/sheet material characteristics, forming processes and heating techniques are addressed. This is followed by an introduction to the machine and its components, the man/machine interface and the operating philosophy. Each participant has access to interactive learning software reflecting the practical operation and functions of the machine in realistic terms.

Days 3 and 4 of the course are dedicated to “hands-on” practice. Supervised by an experienced instructor, the participants learn about basic machine settings (controls, computer-aided basic setting features) and other operating tasks such as how to insert the film roll (on roll-fed machines), carry out a mold-change, optimize product quality and cycle times and, ultimately, conduct requisite maintenance steps.

The modern interactive teaching documentation comprises illustrations, films and graphics: as in this “heating system” example (partial screen view) from an UA course, the student can leap to any chapter of the material by the simple click of a mouse.

The “hands-on” practice block carried out on the machine with a small group of participants provides ample scope for exercises, repetition and in-depth instruction.
Dear Reader,

You are holding the first issue of thermoformer, the ILLIG magazine due to be published twice yearly as of now. We hope that its content and design will appeal to you. Please do not hold back with praise, criticism, suggestions for improvement or any requests for subjects you would like to see covered on these pages.

Likewise, we would be grateful for contribution proposals dealing with your company’s own experience. Needless to say, the research and actual writing will be handled for you by our professionals. Thank you in advance for your input!

We would also be glad to forward each new thermoformer issue to your personal e-mail address to keep you updated at all times (of course, your data will be kept private and not disclosed to any third parties). You can reach us easily by e-mail at thermoformer@illig.de

Your editorial team thermoformer

Preview: ILLIG at Interpack 2011

The next leading trade fair for the packaging industry will be Interpack 2011, due to be held at Düsseldorf next year. Needless to say, ILLIG will be present at this event. The focus of our exhibits in Hall 11, Stand C54 will be on innovations in decorating technology. Moreover, a new concept for the FS Series of molding, filling and closing lines will be presented – we shall keep you posted in advance through the pages of thermoformer.

Interpack 2011
12-18 May 2011
Düsseldorf

Current ILLIG training offers

The practical training courses presented in this issue of thermoformer are run regularly at our Heilbronn training center. Thermoforming technology is currently covered in the following courses, lasting 4 days each:

- Roll-fed RDM-K Series thermoforming machines
- Roll-fed RDKP Series thermoforming machines
- Sheet-fed UA Series thermoforming machines

In addition, two courses addressing packaging technology issues are available upon request:

- Blister film technology (two days)
- Skin film technology (one day)

Our course program is geared toward machine operators, set-up and maintenance personnel. – The quickest way to find out about time schedules and start dates is to consult the ILLIG web site at www.illig.de. Under the Technical Training heading you will find the relevant information and may also register for courses online.

Impressive Variety for individual requirements

Whatever you may need, ILLIG can offer it. We provide a full spectrum of future-oriented, high-quality thermoforming and packaging machines as well as suitable tools: Cost-effective, long-lasting, worldwide available and suitable for your requirements. In addition, we offer a comprehensive service kit to ensure utmost production reliability for decades. Buy now – and get lasting benefit.