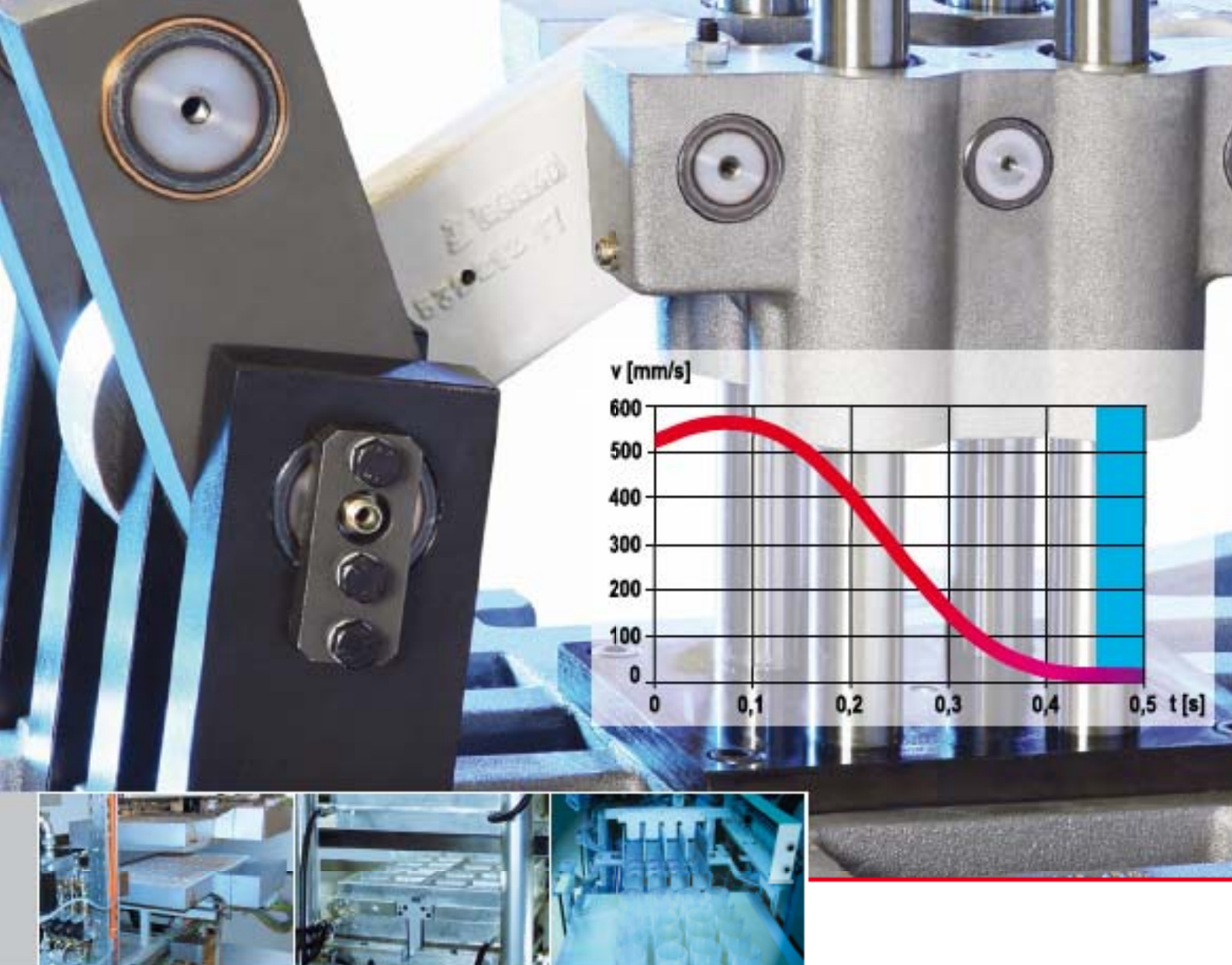


Automatic Pressure Forming Machines

suitable for Use of Forming/Punching
Tools with Steel Rule Cutting Dies

RDK 54, RDK 80

3rd Generation
Thermoformers



ILLIG RDK System – an Innovative pressure forming concept

RDK 54, RDK 80 automatic pressure forming machines were developed as independent machine series to meet market demands in regard to high availability, optimum customer benefits and simple operability.

For decades high product quality and reproducibility of parts have been linked very closely with the so-called forming/punching technology, developed at ILLIG to an industrial standard. Parts can be produced without punching mismatch in the edge area by forming the heated material with pre-stretcher and pressure air and by punching the parts out of the web in that same cycle. This is an essential for automatic processing of parts. The high

demands with respect to forming/punching as well as the findings resulting from high-speed thermoforming on RDM machines were transferred to RDK technology regarding all essential features.

In order to secure long-term success to the processor, the machine must satisfy a broad range of customer requirements. Some of the prerequisites are: simple machine operability, flexible machine concept as well high reproducibility of all functional elements involved in the process.

High rigidity of the forming/punching station and maximum plane parallelism are basic conditions for forming/punching.


Toggle levers, tables and guide pillars were optimized in regard to maximum closing and punching forces to achieve ideal punching results. These forces are transmitted to the tables by double toggle levers and generated by servo motors with satellite roller screws.

Since forces are transmitted centrally to the joint of the double toggle lever no cross forces act upon the pillar guidings of the forming tables. The exact speed profile of the double toggle levers ensures maximum power transmission during punching. Thanks to variable setting options for table strokes and speeds coupled with separately driven upper and lower clamping frames, ten different forming programs are available and this way all part variants can be smoothly realized.

Optimum wall thickness distribution in the side wall of the product is achieved by employing servo drive technology at ILLIG where movements of forming table and pre-stretcher can be precisely synchronized.

Better material distribution in the sidewall of the product means identical product stability with thinner basic material. Product quality is enhanced, features are, e. g., increased rigidity of parts and absolutely exact and plane sealing rims across the whole sealing area thanks to cooled downholders in the tool.



"speed profile" diagram showing closing and punching stroke of forming tables
 punching stroke

System Technology

RDK Customer Benefits

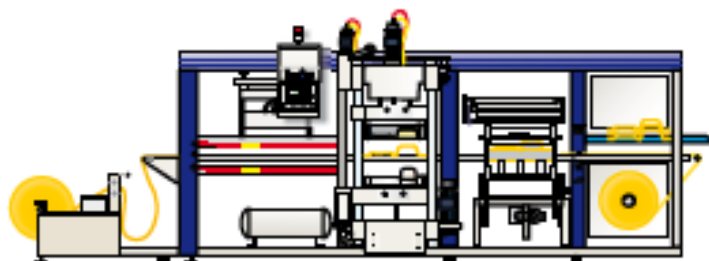
RDK 3rd Generation
Thermoformers

Optimization Strategy

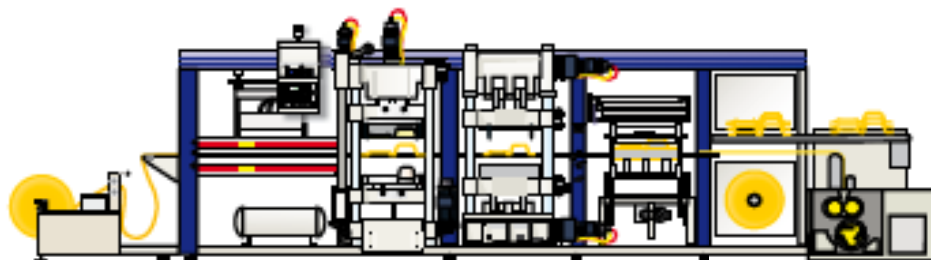
Forming/Punching Station

Processing of Pre-Printed Materials
Steel Rule Punch Press

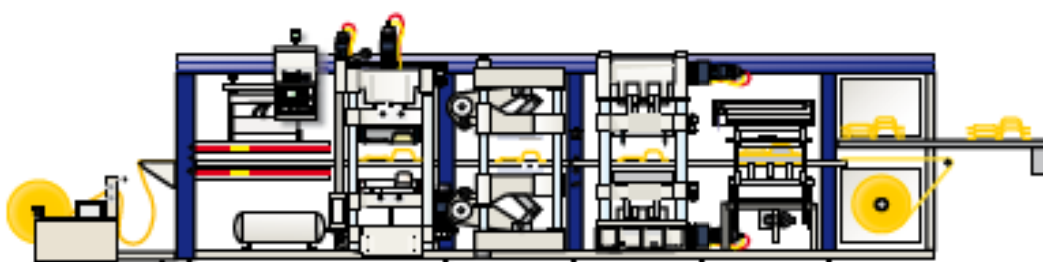
Stacking System Variants



automatic pressure forming machine RDK 54, RDK 80



automatic pressure forming machine RDK 54, RDK 80
with steel rule punch press and skeletal granulator

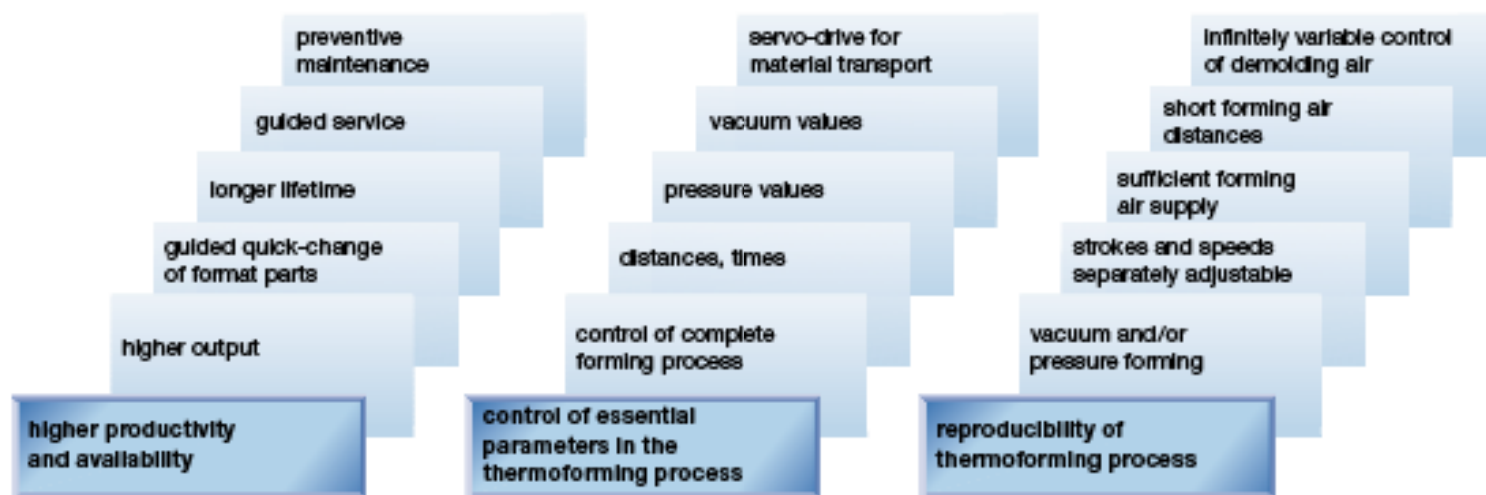
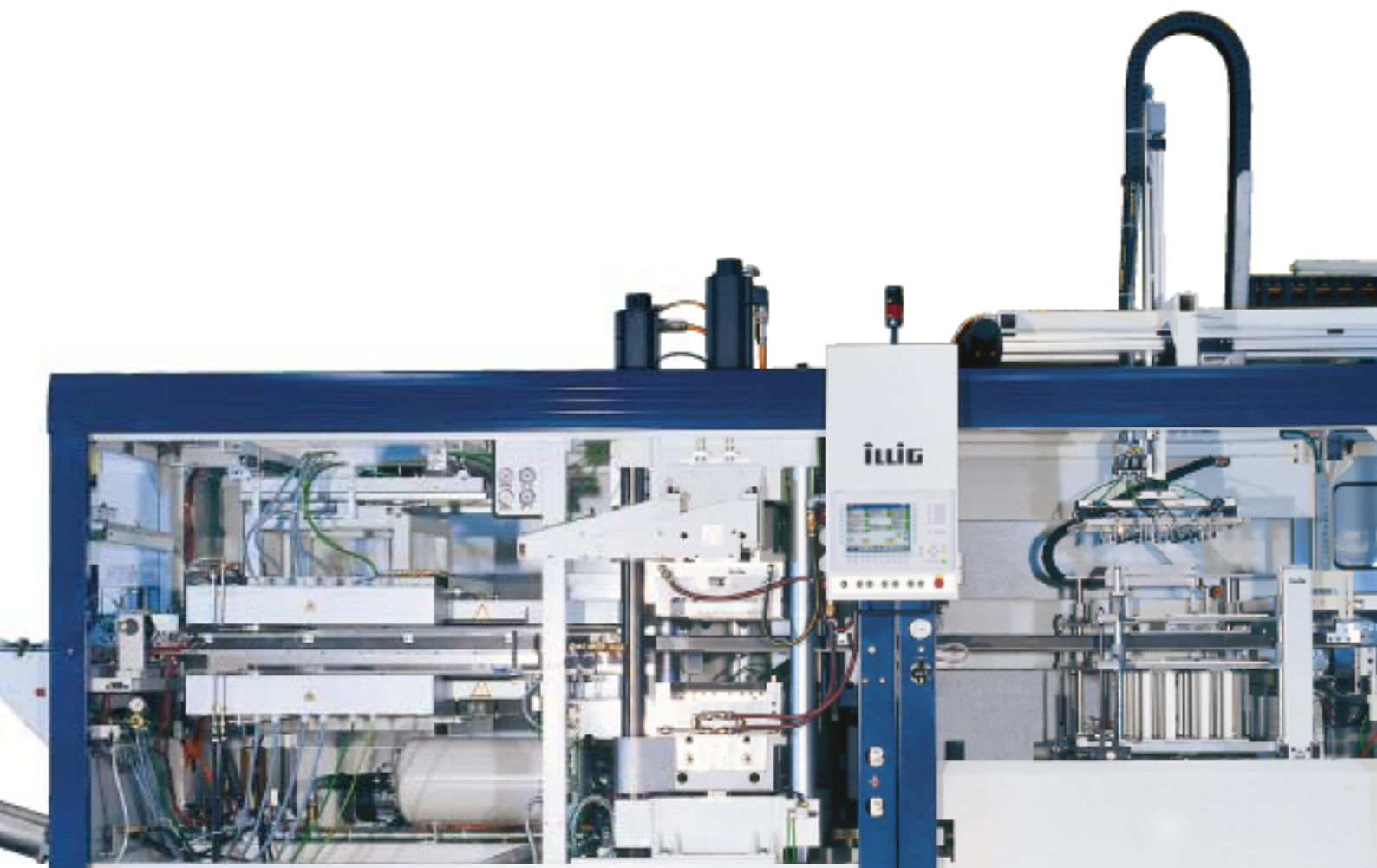


automatic pressure forming machine RDK 54, RDK 80
with hole punch press and steel rule punch press

High flexibility is provided by the modular machine design for forming/punching operations as well as for separate forming and punching. Moreover, a skeletal granulator can be added to complete the machine line.

A stand is used to accommodate devices for positioning fleece inserts, pack decoration or bar code printing.

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Increase in cycle speed and improvement of product quality with 3rd generation thermoformers

Features of RDK 54 and RDK 80: precise mechanical drives, high part quality, performance and reliability. The customer can thus select from two machines with different forming areas and various equipment features.

Free potentials can be optimally used by optimizing the sequencing of the machine during the forming and movement phases. This results in

increased cycle speeds coupled with optimum motion sequences.

The complexity of the process as well as variable overlaps of individual process sections can be utilized in practice by consistent operator guidance.

Specific requirements with respect to tool change are considered in the machine design and also the access-

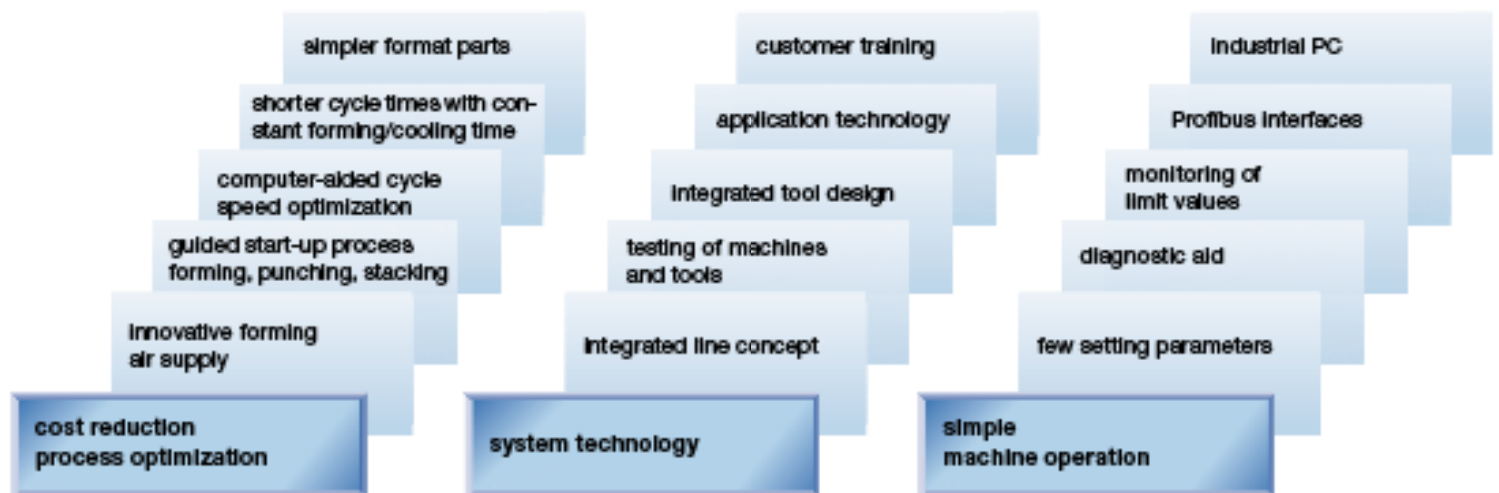
ibility to all machine elements is improved for purposes of service and maintenance.



RDK 80 with stacking device
and handling system



RDK 54
3rd generation thermoformer



Direct arrangement of the vacuum and pressure air valves on the forming station results in shortest filling times of the individual cavities and consequently very short cycle times are achieved. Forming can be carried out alternatively on the upper and lower table using vacuum and/or pressure air.

By pre-selecting the desired forming program on the operating panel, all required settings are carried out automatically.

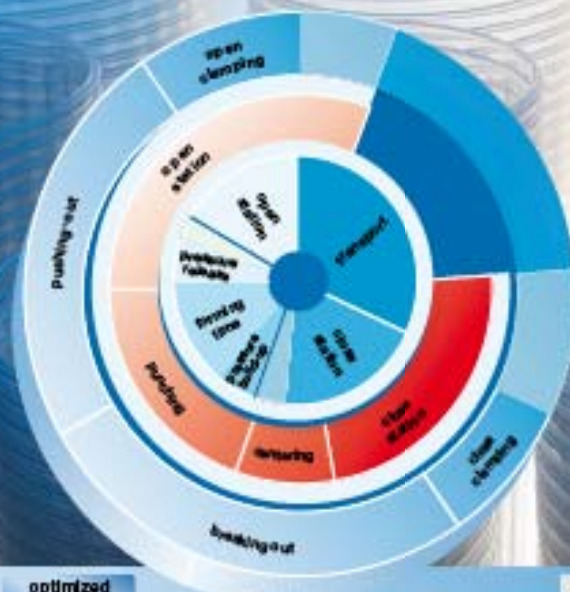
We offer a servo-driven clamping frame drive as optional extra which can be used as pre-stretcher. This way new tool and/or forming techniques can be realized.

Customized equipment for processing the following materials:

- PP materials with roll pre-heater
- Pre-printed materials, e.g. for lid production, with high feed and positioning accuracy due to servo-driven material transport

Further applications due to additional motion sequences:

- Demolding aid for parts with stacking undercuts
- Loose parts control for parts with very pronounced undercuts



optimization product quality

3rd generation optimization of sequencing and performance

3rd Generation thermoforming – optimization strategy

3rd Generation thermoformers feature an optimization strategy due to the innovative, functional program structure. Customers will benefit from that with respect to systematic improvement of performance, product quality and production reliability.

Setting data and process times established by the computer-aided basic setting can be optimized far enough to make controlled overlap of motion sequences possible.

Without altering the thermoforming process, the resulting overlaps have an optimal effect on cycle time, however, without adversely affecting product quality.

The complexity of the process with respect to forming, punching and stacking calls for a new control technology where several individual drives are controlled and optimized.

Newly developed menus provide selective operator guidance through the individual optimization phases. Parameters relevant for performance are provided automatically to the operator in a selective way for optimizing purposes, subject to the forming program of the machine. Consequences of the measures taken are displayed on the screen. The main benefit of this visualization is the selective display of required information and auxiliary functions based on principles of professional industrial design.

Operating mistakes are avoided thanks to a clear and simple menu structure. Easy and comfortable navigation through individual menus can be selected on the operating panel. The dialogue system also features an electronic help function included in the operating system.



System Technology

RDK Customer Benefits

**RDK 3rd Generation
Thermoformers**

Optimization Strategy

Forming/Punching Station

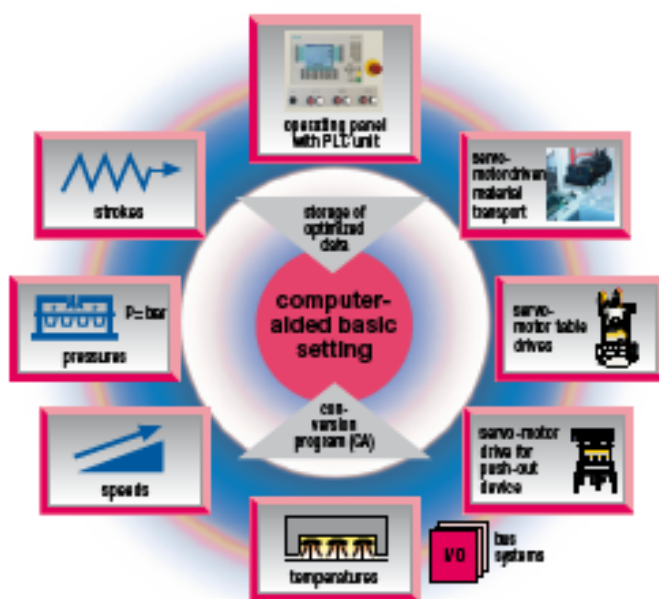
Processing of Pre-Printed Materials

Steel Rule Punch Press

Stacking System Variants



RDK 80
operating panel



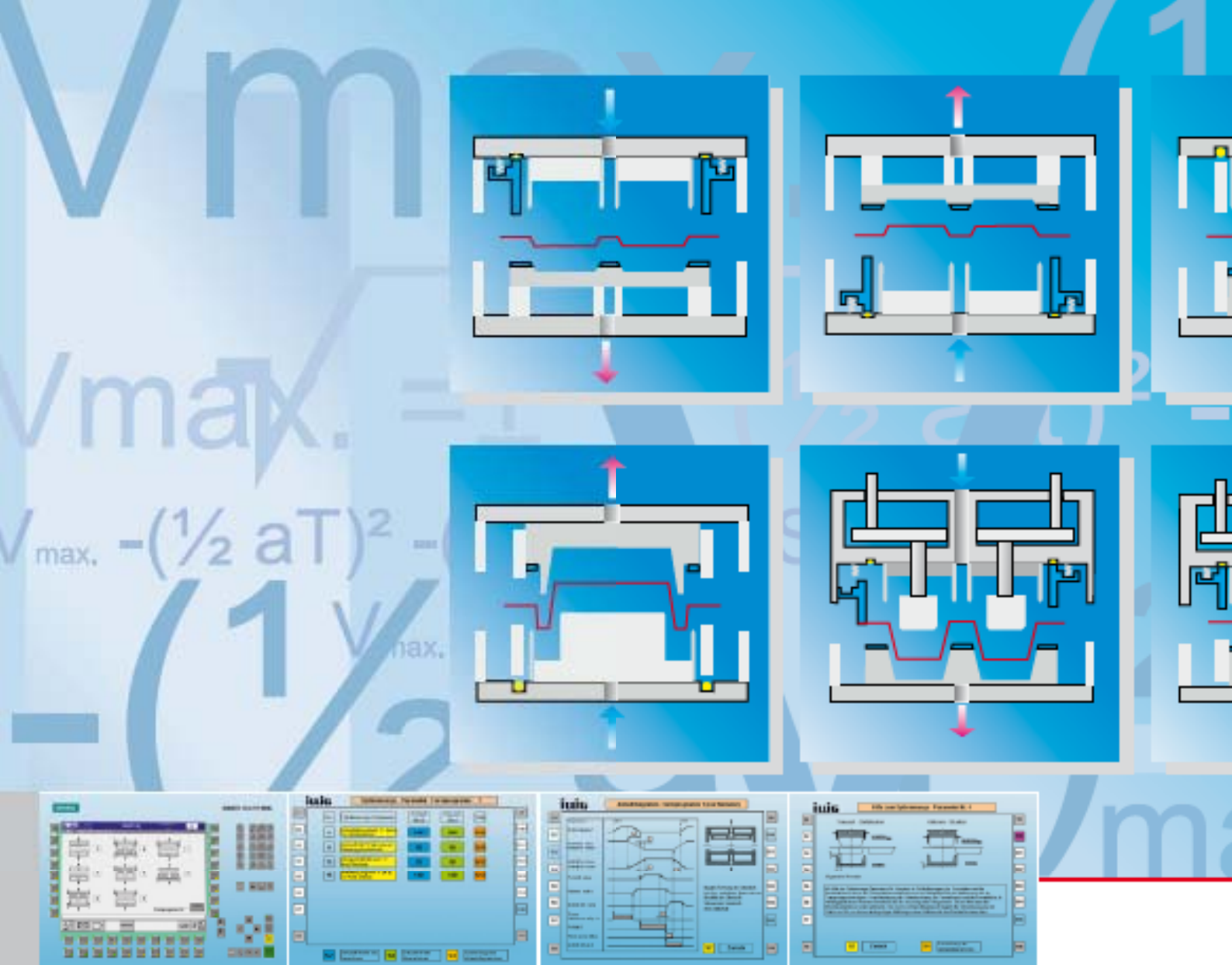
Features of the digitalized machine are: practical operation, computer-aided basic setting of the machine data as well as computer-aided machine conversion.

Control of essential parameters in the thermoforming process

Realization of the requirements calls for a new control concept where all relevant forming, punching and stacking movements are calculated, controlled and optimized.

Separate optimization of all process parameters is thus possible as well as their precise allocation to the individual phases of the forming process. Starting and ending points as well as absolute values for pressure and/or vacuum can be precisely determined and documented, thus they are available for repeat orders.

Absolutely exact and flat sealing rims are required for a long shelf life of the packs' contents. This is achieved by cooled downholders and clamping frames in the tool.



In the course of process optimization, the basic machine was extended by the following features:

- Material transport with pneumatic chain tightening system
- Upper and lower clamping frame system with cascade control
- Highly dynamic valves for build-up and release of forming pressure
- Infinitely variable air control for demolding
- Optimized drive technology and sequencing for forming, punching and stacking station

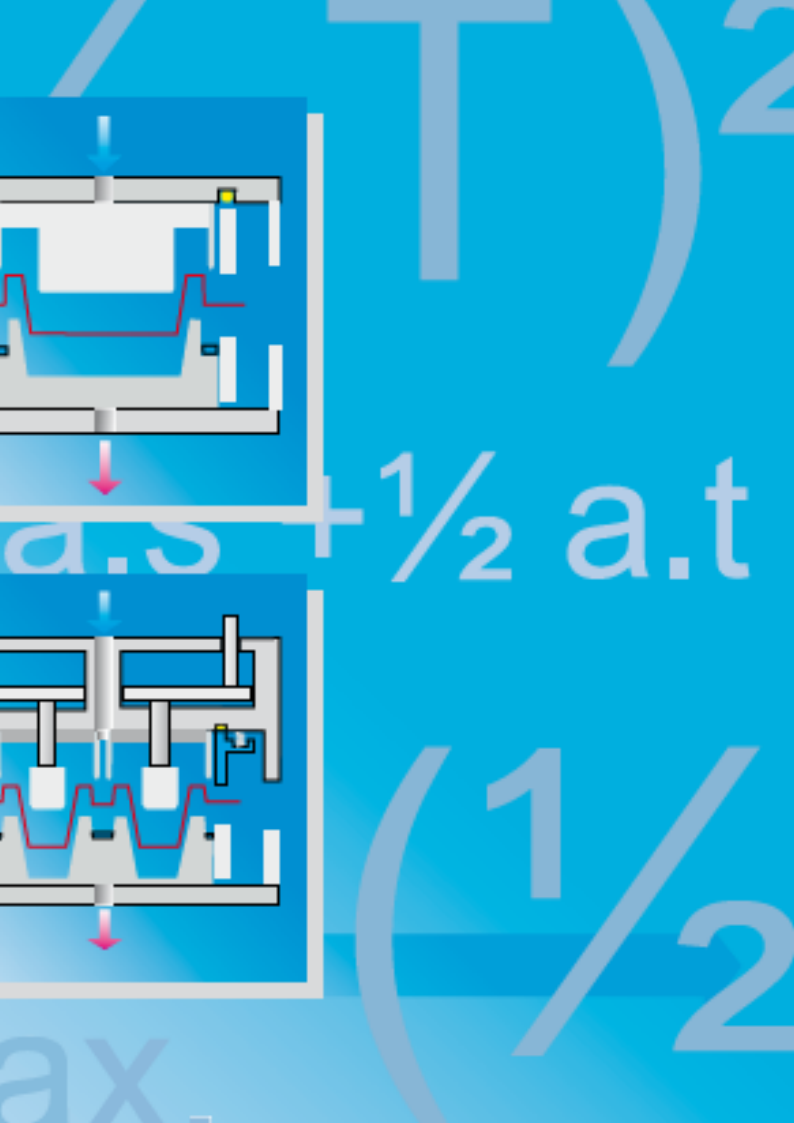
Requirements with respect to formed parts can be systematically improved by integrated optimization of machine and tool. At the same time machine specifications were realized, such as:

- Control of parameters relevant to the thermoforming process
- Reproducibility of thermoforming process
- Reduction of energy consumption
- Short tool changing times
- Guided service and preventive maintenance
- Higher availability and productivity

operator guidance for 3rd generation process optimization



material transport



System Technology

RDK Customer Benefits

RDK 3rd Generation
Thermoformers

Optimization Strategy

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Processing of Pre-Printed Materials
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1st generation
pneumatic
machine



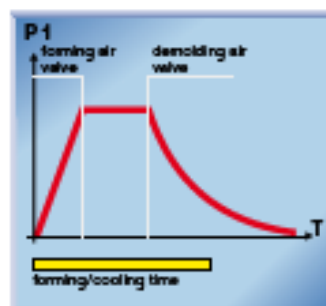
2nd generation
servo-motor
machine



3rd generation
process
optimized
machine

development levels

Based on the 2nd generation, an increase in cycle speed of up to 60% coupled with enhanced product quality can be achieved with the 3rd machine generation



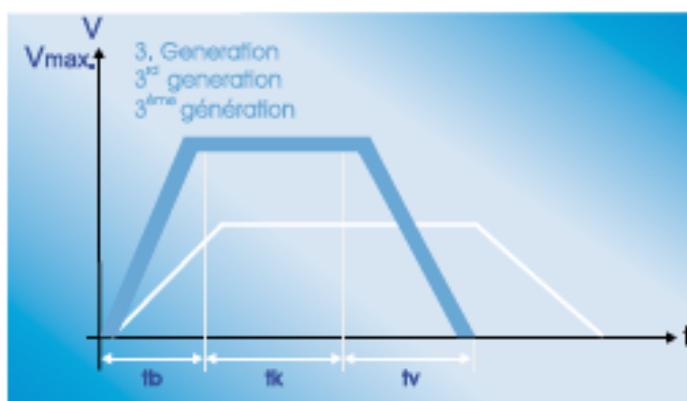
schematic drawing: build-up and/or release of forming pressure



forming air valve

Reproducible forming of sealing rim, stacking edge and thickness distribution of the side wall thanks to interaction of all parameters relevant to the process.

Shorter changing times for tools and format parts, simplified operation and higher availability are further benefits of ILLIG 3rd generation thermoformers. Rectangular trays, e.g., can be produced at a speed of 55 cycles/min due to the above-mentioned features.



higher cycle speeds thanks to faster closing movements

illig



Customer benefits / Focus of development

Higher productivity and availability

At ILLIG synergies between customer benefits and development of thermoformers have resulted in considerably higher outputs.

Substantially higher cycle speeds can be achieved thanks to an optimized and accelerated forming process. The machines feature forming areas within tested limits.

Different process steps are carried out during the actual forming process (forming table movements, building-up of forming pressure, punching, stacking, etc.). The quality of the formed part is subject to the precision of these process steps.

Acceleration of the individual process steps can be used to extend the cooling time or for further improvement in performance.

Servo-driven material transport system for exact positioning during high speeds

Width and index length of the material transport are set by computer-aided basic setting via operating panel.

The servo-mechanical positioning drive reduces index length tolerances to ± 0.2 mm. In the area of the forming station the material transport is moved apart pneumatically by the spreading device. The material is stretched thus

webbing is prevented during forming which is especially beneficial for PP processing.

The pneumatic chain tensioning system is supplied with adjustable pressure and separately keeps the transport chains under optimal tension. This way the play between the individual chain links and the tolerances occurring in an expanding chain can be offset.

Benefits:

- Checking and readjustment of chain tension no longer required
- Higher transport accuracy and longer service life of chains since chain tension is always optimally set and identical in both chains
- Reduction of wear and tear due to integrated cooling channels



*RDK 80 forming/
punching station*



*machine feed
side with forming/
punching
tool*

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ILLIG heating technology provides optimum thermoforming conditions

Upper and lower heater are part of the basic equipment. The individual rows of heater elements can be controlled by pilots. Rows of heater elements which are not needed are automatically switched off subject to index length and material width.

Four rows of heater elements on the feed side can be switched off to adjust the effective length of upper and lower heater optimally to the index length.

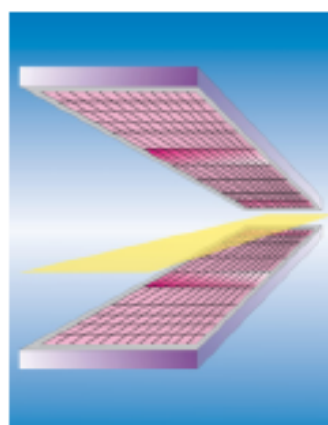
Moreover, the heater length can be adjusted exactly to the index length by using water cooled heater covers.

A heating profile is calculated by the control via computer-aided basic setting subject to the rows of heater elements. It is possible, e.g., to increase

or decrease the temperature level as a whole e.g. to achieve higher cycle speeds.

Excessive sagging due to material overheating is detected by a light barrier. Upper and lower heater move back and the machine stops. This way no material will fall into the lower heater.

All thermoforming possibilities can be optimally utilized thanks to this optimized heater equipment.



Upper and lower heater are equipped with longitudinal row control. The effective heating length can be adjusted to the index length by switching off the cross rows of heater elements on the feed side.



Constant product quality when processing pre-printed materials

A control device with photo cell is available for processing pre-printed materials, e. g. for lid production. The servo-driven material transport coupled with the photo cell, ensures exact positioning of the printed material in the forming tool.

Depending on the application, the photo cell is located on the material transport in the center of the forming tool and/or on the feed side of the machine.

There must be print marks on the material at intervals of the printing images.

After reaching the set index length at high speed, the print mark is searched at an additional creep speed. When the print mark has been detected, the search run ends. The material is transported further by the correctional value to ensure precise positioning of the print.

Benefits provided by RDK technology in lid production:

- Better material distribution in the rim area since material is drawn in from skeletal area
- Less maintenance effort required for tool repairs
- Short stand-still times due to fast change of steel rule dies
- Optimum punching results on product due to new punching technology in the range of the holding studs
- Longer lifetimes due to cutter stop on forming/punching tool



different stacking system variants can be used for lid stacking



photo cell for positioning pre-printed materials



RDK 54 equipped for processing pre-printed materials



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Steel rule punch press (option)

A steel rule punch press equipped with movable upper and lower table is offered for product punching. In the automatic mode the station starts working as soon as the first parts reach the punch press.

The whole station can be moved in longitudinal direction by servo drive. The correct position is determined by the computer-aided basic setting and stored. Precision corrections are possible during operation.

The toggle lever drive – an essential element of the steel rule punch press – is very rigid thanks to its mechanical force transmission. In the dynamic phase of the closing and opening movement force is transmitted centrally to the joint of the double toggle lever which prevents development of transverse forces on the pillar guidings of the forming tables.

The steel rule cutter is positioned by motor-driven adjustment devices. It thus can be moved in all degrees of freedom on the punching table. The selected positions can be changed during operation and stored after optimization.

A steel rule die heating is optionally available for reduction of cutting forces.

Adjustment of cutter, height adjustment, floating cutter

There are certain production tolerances on the part if the heated material is formed by pre-stretcher and pressure air and punched by steel rule cutting dies in a separate process step.

In order to limit this tolerance range, the punching tools are designed as so-called "floating cutters".

Cutting contours are supported in a freely moveable way within the holding plate so the centering aids can center the cutting dies with respect to the forming contour shortly before punching.

This process is supported by the movement profile of the table drives since the speed is reduced in the decisive phase and thus there is sufficient time for centering. The benefits provided by heated dies are fully maintained in floating cutters, too.



floating cutter



Process optimization by different stacking system variants

Finally, product properties are also subject to quality and reliability of the different production steps. ILLIG therefore offers a reliable range of stacking systems and downstream equipment for RDK machines, adjusted to:

- automation level
- output
- further processing

Safe and reliable product stacking at any speed is ensured by employing the predominantly used servo drive technology suitable for synchronization and precision adjustment of stacking movements.

Admissible depths of draw are considered in the layout of the stacking station. Positive or negative parts can be stacked. In the automatic mode the stacking station starts as soon as the first cycle output of punched parts has arrived.

In the standard version, clamping mask and stacking chute are moved together simultaneously by a pneumatic cylinder and fix the skeletal in which the formed parts are held by holding studs.

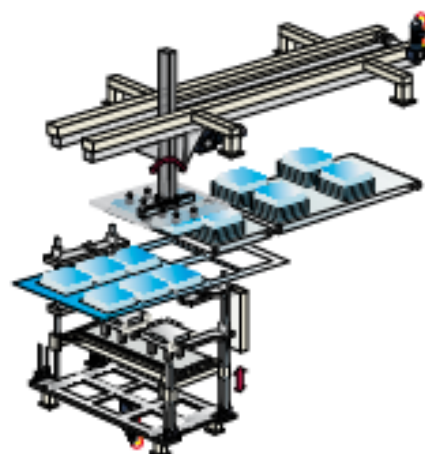
The format-dependent break-out unit removes the parts from the skeletal and positions them in the stacking chute.

As soon as the set number of parts has been reached in the stacking cage, the formed stacks are moved to a buffer sheet and/or a conveyor (in case of optional equipment) by servo motor.

The stacking station is automatically positioned exactly via the pre-setting program, however, precision corrections are possible during operation.

Optionally, the clamping mask can be servo-driven for reproducible synchronous stacking movements regardless of part weight. Synchronized movements result in reliable stacking movements and thus in an improved stacking process.

The setting parameters of the servo-driven stacking movements are programmed and stored in the teach-in method.



stacking station with handling system, stacks of counted cups are formed on a conveyor



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stacking station with handling system

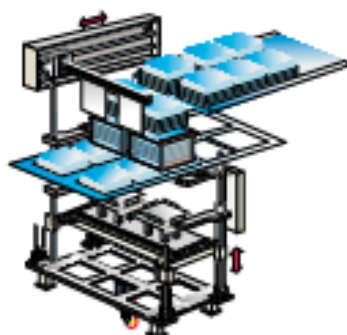
- no limitation of machine output
- ergonomic part removal
- long discharge conveyor as storage range

Extended push-out time is required for formed parts formed with high cycle speeds. For this purpose a fixed stacking cage is used in addition to the movable one.

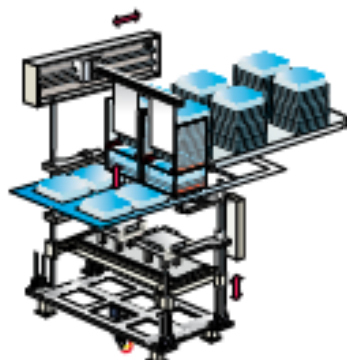
Parts can be stored in the movable stacking chute with the servo-driven clamping mask, thus parts can be pushed out regardless of machine cycles.

Handling system

The handling system is operated via the operating panel of the forming machine. Integration of the control ensures exact synchronization of the movements of the entire stacking system. A/B/C stacking is possible. Moreover, stacking of parts formed in W-configuration is possible. Format parts can be changed very fast by means



stacking station with counting device and servo-driven pushing-out device, parts are pushed onto storage sheet and/or conveyor



version with divided stacking cage for higher cycle speeds

of quick-change technology. Conventional stacking format parts can be used.

In the stacking station the products are separated from the web by a break-out plug and transferred to the suction plate of the handling system. It works with two linear units and positions the formed parts on a conveyor.

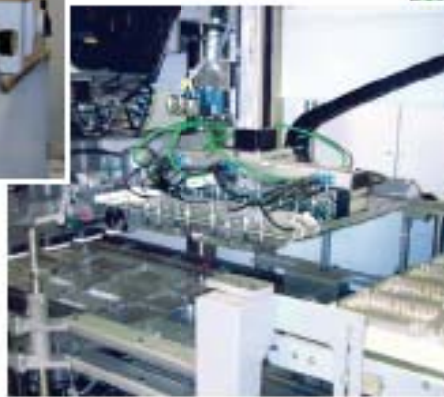
Optionally, a divided conveyor is available for facilitated product removal should the operator take care of more than one machine.

Control for shuttle stacking in stacking station

Stacking studs in multiple-row tools can be designed differently and arranged in different ways. In the stacking station the product rows are then pushed on top of each other and stacked in one row.

The parts are kept apart from each since the positions of the stacking studs differ from part to part. This way part jamming within the stack is prevented and the parts can also be easily destacked.

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