

The Best of Two Strong Brands:  
PET-LINE from Netstal and PETForm from KraussMaffei



# High-Quality System Solutions PET Packaging

*Engineering Excellence*



## The Highest Standards of Application and System Expertise

As part of the KraussMaffei Group, Netstal has been producing top-quality injection molding machines and manufacturing systems for the rapid and high-precision production of thin-walled plastic parts for the packaging industry for many decades. Focus on customer applications is paramount here. As a partner for complete system solutions, we have many years of experience and, thanks to our extensive close-knit partner network, we are in a position to offer our customers turnkey systems.

Our high level of flexibility and comprehensive knowledge base distinguish us as the ideal partner for your PET system solution – something which has been strengthened by grouping all PET activities of the KraussMaffei Group together in one place under the overall management of Netstal. This means that our customers can benefit from outstanding support in all key areas by taking advantage of our excellent machine technology, comprehensive customer service and broad-based expertise.

How you benefit: As our customer, you are dealing with specialists who have an in-depth understanding of your application and are able to optimize your system, your machine and accompanying services according to your requirements. Here we make a constant effort to further enhance this outstanding technological standard on an ongoing basis and to offer high-performance production systems with innovative technologies.

## PET Packaging Maximum Output, Minimum Input

We offer our customers a premium product portfolio for PET applications that is tailored to their requirements. The system solutions we develop are geared toward the highest quality, the shortest cycle times and at the lowest material cost.

The benefits in a nutshell:

- Maximum production efficiency
- Minimum material cost
- Shortest cycle times
- Top parts quality
- Optimum energy efficiency
- Specially selected partners to meet exacting requirements
- Decades of experience in the development of system solutions for PET preforms
- Platform strategy: system sizes to match individual customer requirements

# PET Tour Focus on the Application and End Product



## PLA preforms

We have been conducting in-depth research into sustainable and renewable materials for use in PET preforms for several years. PLA is a cereal-based polymer (polylactic acid). It has been demonstrated that there is no notable difference between processing polylactide and processing other PET materials on our production systems. PLA is a safe resource with impressive environmental benefits and has high marketing potential as a result.



## Custom preforms such as wide-neck and pharmaceutical preforms

Vertical technology used in machines from the PETForm series offers clear advantages in the production of custom preforms such as wide-neck and pharmaceutical preforms. In PETForm systems, these are removed in exactly the same way as standard preforms. Additional devices for the demolding of custom preforms are thus rendered redundant and costly system modifications are unnecessary.



#### Standard preforms for beverage packaging

Around 80% of PET packaging is used for carbonated soft drinks (CSD), still water and juices in the beverage industry worldwide. Thanks to our innovative platform strategy for PET production systems, we are able to meet a diverse range of complex market requirements.



#### Hot-fill preforms

There are occasionally manufacturers in the beverage industry who are required to bottle beverages such as tea while hot for sterilization purposes. Special preforms are used for this: These are either designed with a thickened neck area or undergo a special solidification process, which eliminates the risk of neck deformation resulting from the increased process temperature. With an optimized screw design and specialized plasticizing process, we are your ideal partner for hot-fill systems.



#### PRElactia® preforms

Thanks to this innovative and patent-pending technology, we have successfully devised an overmolding process with the necessary barrier properties for light-sensitive products while also creating a design that is cost-efficient and can be reliably reproduced. During this process, an effective UV barrier between two material layers is formed around the PET preform in order to package and protect light-sensitive beverages such as milk and dairy products. In addition to the beverage industry, overmolding can also be used for containers for other applications.

## Calitec® The Smart Way to Reduce Cycle Times

Increased production efficiency with improved product quality thanks to patent-pending Calitec® system.

Reducing cycle time is particularly important when it comes to systems that are used in mass production. This also applies to the PET bottles that are made from preforms. Efforts to shorten cycle time were previously fraught with obstacles. While optimum, intense preform cooling may help shorten the cycle time, it often leads to the molded part being reheated.

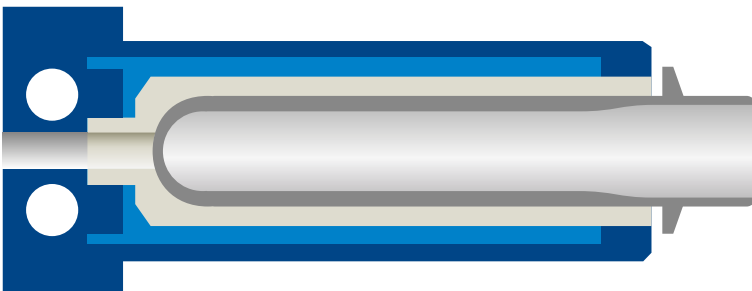
The result is softening of the molded part, which manifests as a reduction in shaping quality. This can be prevented by continuous post-cooling. This is precisely where the Calitec® system comes in with the application of slight pressure to the inside of the preforms during the post-cooling phase.

This property prevents the molded part from shrinking, as it is uniformly pressed onto the cooling sleeve. In addition, cooling is continuous and the preform body is simultaneously subjected to a shaping calibration. The fact that the entire circumference of the preform is now in constant contact with the cooling sleeve

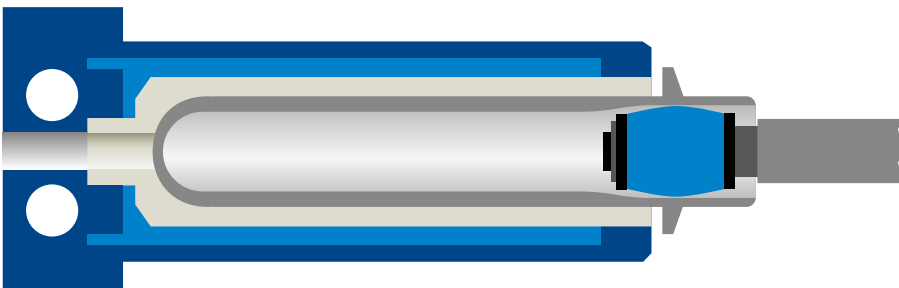
results in considerably more uniform and intensive cooling – with ideal shaping, too!

The necessary internal pressure is generated using a special hollow gripper. The gripper not only grips the preform, but also gently and securely seals it. The gripper then guides compressed air into the preform at low pressure. This outstanding feature allows for calibration, while intense cooling is ensured thanks to increased contact between the preform and the cooling sleeve. Moreover, calibration pressure increases during the cooling phase to counteract the increasing shrinkage of the plastic.

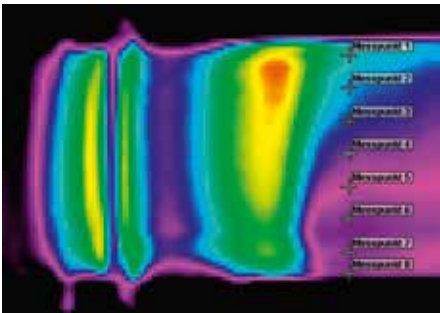
Field tests have demonstrated that this can increase productivity by up to 20%. This equates to a 5% energy saving and significantly improved ovality.



Preform in the cooling sleeve for post-cooling

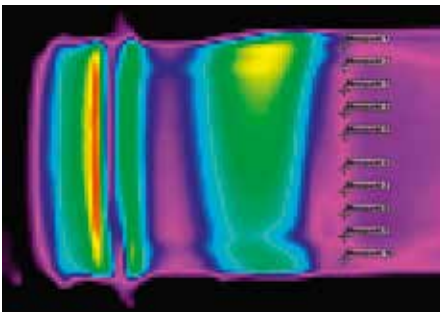


The thermos flask-like function of the special gripper seals and calibrates the preform.



**View through the thermal imaging camera (without Calitec®)**

The post-cooled preform has a temperature difference of 17°C on its circumference following a cycle of 13.5 seconds. An ovality of 0.2mm results.



**Another view through the thermal imaging camera (with Calitec®)**

A preform post-cooled with the Calitec® system is shown here. Following a cycle of 11.5 seconds, the circumference then has a temperature difference of just 3.7°C. The resulting ovality drops to a low 0.05mm. This effectively illustrates that a cycle time reduction of approximately 17% was achieved with Calitec® in this case. In addition, the reduced temperature profile on the circumference (from 17 C to 3.7°C) enabled a decrease in ovalization from 0.2 mm to 0.05 mm.



Thanks to Calitec®, our customer was able to increase productivity by 20%.

# LightBase from the Preblow Process

## Lower Weight, Increased Cost-Effectiveness

Weight-optimized preform geometry thanks to patent-pending preblow process.

The preblow process is designed to improve material distribution on the bottle base and hence lower weight. A patent application has been filed for this process, in which the preform is expanded with air straight after injection. This yields new possibilities in terms of material use and cost-effectiveness. Using this process, for the first time it is no longer just the base contour and, with it, the surface area that can be changed. Enlargement of the base contour in the blowing process simultaneously causes wall thickness in the critical base region to be decreased.

This effect allows for more efficient and accurate heating of the base region in the later blowing process thanks to the lower wall thickness and the larger surface area. The result: LightBase.

### Your benefits:

- Material saving in base area
- Significant energy savings in overall process
- Faster cycle time for injection molding and blowing machine
- Easily blow-moldable
- Lower transport costs

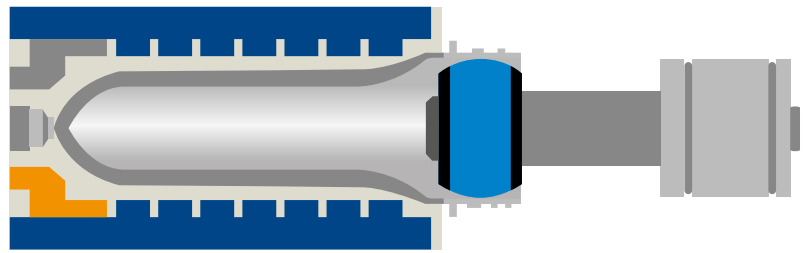


Illustration of the preblow process



Influence of different preform domes on bottle bases

### Example: 0.5 l water bottle

Preform weight OLD (g)	15.85
Preform weight NEW (g)	15.35
Cycle time (s)	7.2
Cavity number	128
Output/year (million pcs) at 8400 h and 95%	510.72
Material consumption/year (t)	8,095
Weight saving (g)	0.5
Weight saving (%)	3.2
Material saving/year (t)	255
Material costs/t	€1,450.00
Material cost saving/year	€370,727.00



## PRElactia® Barrier Technology to Block UV Light Exposure

Material savings thanks to our optimized overmolding process for milk products with necessary light barrier. Cost-effective, reliable and reproducible.

Together with partners, Netstal has succeeded in creating a cost-effective, reliable and reproducible overmolding process. Thanks to this innovative process, double-layer PRElactia® preforms with the necessary light barriers can be produced for milk products.

Since its introduction, PRElactia® has undergone continuous development. The composition of raw materials and additives added in the polymerization phase was optimized further to improve the light barrier.

The preform weight of 28 g selected in the introduction phase for a 1-liter PET bottle was successfully reduced to just 22 g. No negative impact on the barrier properties or the required strength of the product was detected.

The PRElactia® product was awarded the "Oscar de l'emballage" at the Emballage trade fair in Paris in autumn 2008, which highlights the quality of this packaging yet again.



PET-LINE with mold for PRElactia® preforms



Oscar de l'emballage

# High-Quality System Solutions

## A Fascinating Tour of the PET-LINE

### Precise: digital control technology

The clamping unit can reach maximum movement speeds by using servo-hydraulic valve technology, which has made it possible to reduce lock-to-lock time by 15%.



### Optimized machine capacity thanks to platform strategy

The three clamping forces of 2,400, 4,000 and 5,000 kN can be combined with a variety of mold and cavity sizes and offer the ultimate in flexibility.

### Efficient: lowest energy consumption

The PET-LINE's revolutionary drive concept reduces power consumption levels to the bare minimum. The recovery of kinetic energy makes it possible to increase energy efficiency by up to 10%.

**Fast: removal and post-cooling unit**

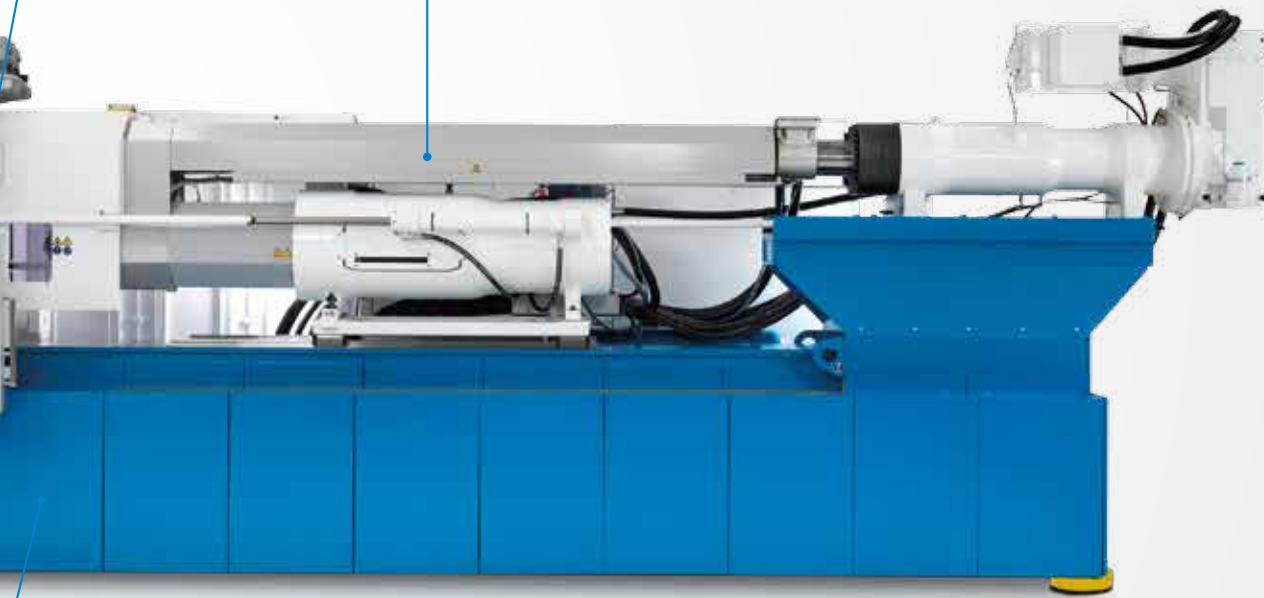
Thanks to synchronized axis movements and improved robot setup options, the preform geometry can be changed quickly. What's more, rapid robot movements allow for the fastest cycle times.

**Innovative: injection unit with melt accumulator**

An optimized screw design enables continuous plasticizing and gentle melting.

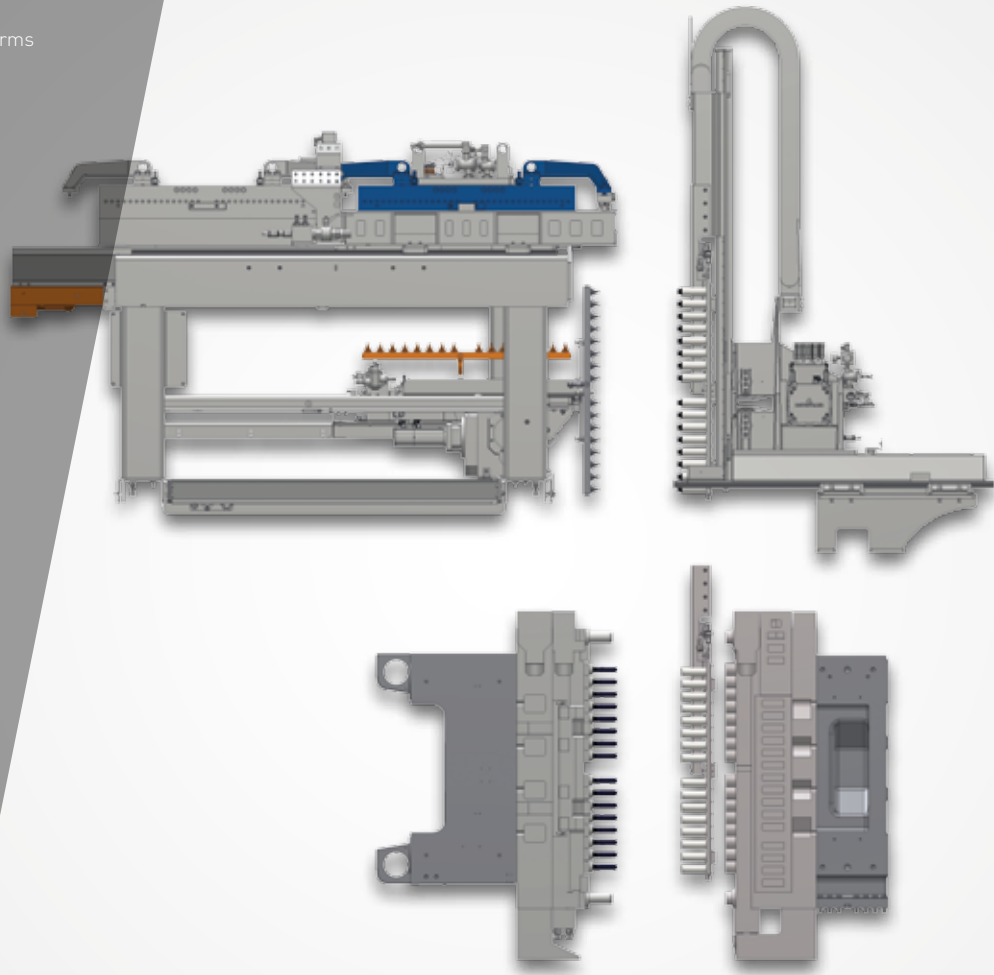
**Your benefits:**

- Maximum parts and production quality
- Lowest energy consumption
- Shortest cycle times
- Platform strategy offers ultimate flexibility
- Parallel and high-precision movements



**Overview of the PET-LINE range**

	24-cav	32-cav	48-cav	60-cav	72-cav	96-cav	128-cav	144-cav
PET-LINE 2400	•	•	•	•	•			
PET-LINE 4000			•	•	•	•	•	
PET-LINE 5000						•	•	•
					Injection unit			
				4000	6000	7300		
				110	135	150		
Clamping unit	2400		•					
	4000		•		•		•	
	5000					•		•



## Top-Quality Preforms Excellent and Flexible

PET-LINE is a state-of-the-art production system and stands for maximum profitability and efficient production. With our PET-LINE series, we are one of the leading providers of injection molding machines for PET preforms worldwide.

### **Robust construction**

The solid construction ensures extremely high preform precision and reproducibility with all mold sizes.

### **Excellent cycle times**

Rapid mechanized operations and optimum coordination of the machine and its peripheral equipment yield the shortest cycle times.

### **High reproducibility**

Absolute weight constancy, first-class surface structures and minimal reject rate: All of these factors contribute to high process reproducibility.



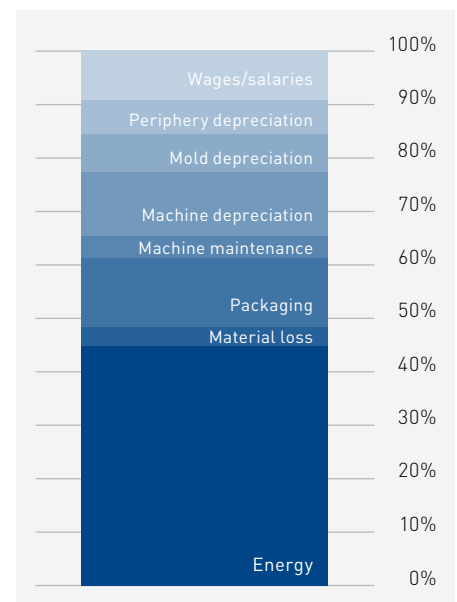
## Less Energy, More Efficiency Efficient and Precise

### Higher injection rate and gentle material processing

The redesigned injection unit now reaches a system pressure of 250 bar, which results in increased injection pressure and significantly shorter injection times. Based on rheological calculations, it was possible to optimize the entire melt flow and ensure very gentle material preparation in order to guarantee improved melt quality.

### Energy efficiency stands for sustainability

It is anticipated that energy costs will continue to rise in the future. In addition to the material costs, the share of energy costs will become the second most important cost factor. Innovative Netstal strives to develop systems and solutions that guarantee optimum energy efficiency teamed with top productivity: true to the motto "less energy, more efficiency".



# Efficient Module Platform

## A Fascinating Tour of the PETForm

### 4-stage post-cooling station

This ensures effective preform cooling in short cycles.

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### Your benefits:

- Short dry cycle times
  - Quick and easy mold changes
  - Increased mold life
  - Homogeneous temperature distribution within the mold
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### Compact production unit

Reduced footprint thanks to vertical clamping.





**Turnkey**

Complete systems – optimally tailored to customer requirements – including tools and all downstream components.

**Ultra gripper**

Extremely light and can be replaced quickly.

**All-electric injection units**

Equipped with special HPX screws, they guarantee high throughput coupled with minimum energy consumption

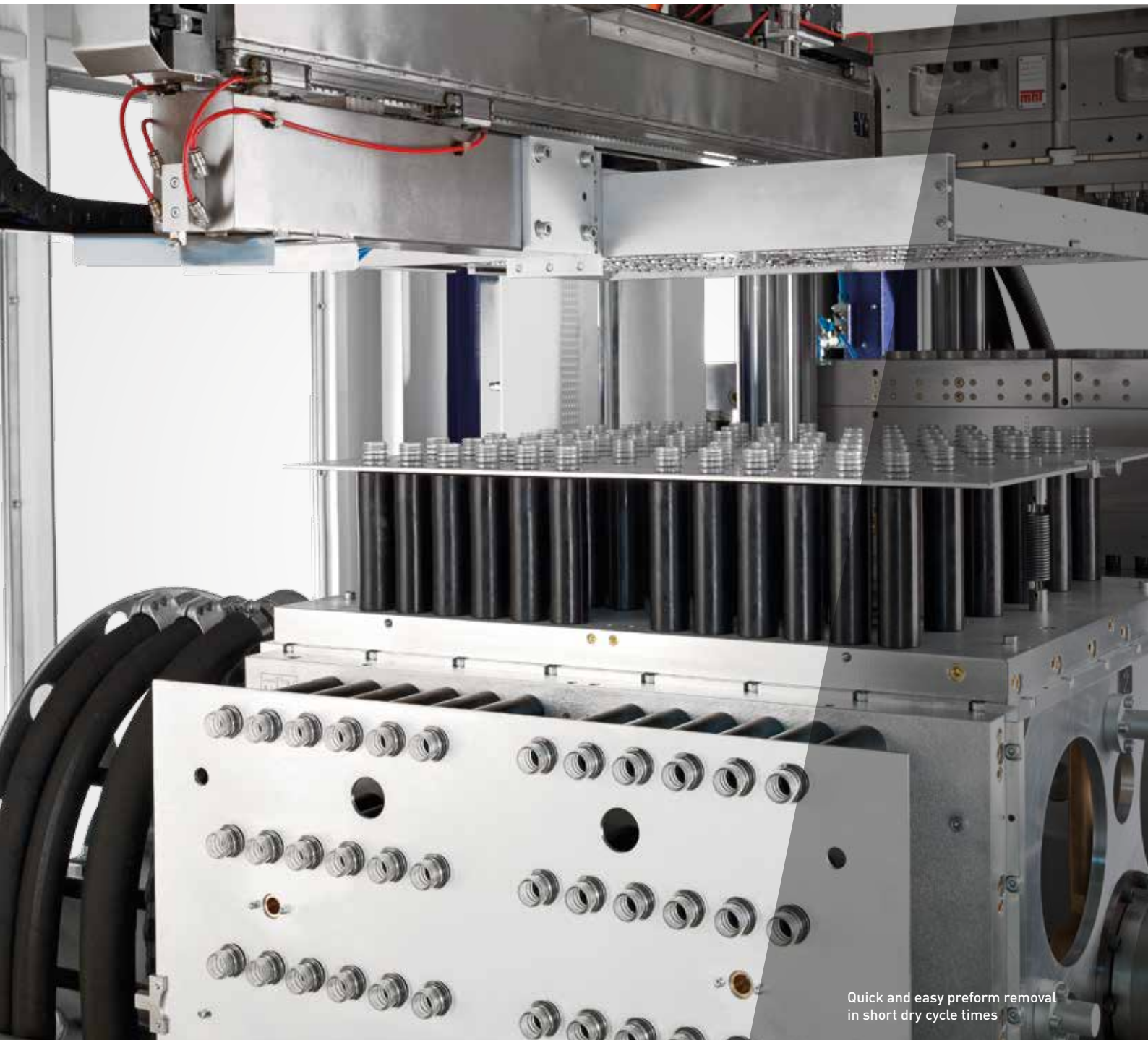
**Vertical clamping unit**

Highly dynamic, gentle on molds and lubricant-free.

Overview of the PETForm range

	24-cav	32-cav	48-cav	60-cav	72-cav	96-cav	112-cav	
PETForm 1750	•	•	•	•				
PETForm 3200			•	•	•	•	•	
					Injection unit			
					1900 CV	3500 CV	4500 CS	6100 CS
	Screw diameter				90	120	120	135
Clamping unit	1750		•		•			
	3200				•	•		•

## PETForm Efficient Module Platform



Quick and easy preform removal  
in short dry cycle times



### Vertical clamping unit delivers long-term precision

The vertical clamping design ensures extremely high plate parallelism and minimizes wear of molds with up to 112 cavities.

### Immediate post-cooling for shorter cycles

With its lock-to-lock time of only 2.0 seconds, the PETForm clamping system is a leading high-performance PET unit. 85% of the required cooling takes place in the separate 4-stage post-cooling station. This results in significantly lowered cycle times and high output performance.

### Optimized removal process – lowered energy consumption

Thanks to the lightweight gripper unit, maximum process speeds can be achieved with minimal clamping movement. This in turn minimizes energy requirements and production costs.

### Ideal for 16 to 112 cavities

The modular design of the two clamping units with clamping forces of 1,750 kN and 3,500 kN, combined with corresponding plasticizing units, make this the optimum system for any application scenario.

### High product quality thanks to screw know-how

Special screw geometries ensure rapid melting. Color pigments, blockers or other blends can be added homogeneously at high throughputs without subjecting the melt to unnecessary shear forces.

### More performance per square meter

Thanks to their vertical design, PETForm systems are extremely compact. More systems can be installed in a given space than with any competitor systems.





## PET Packaging Ecological and Economic Benefits

Sustainable and renewable materials are becoming increasingly important in the modern age, and environmental concerns are now an everyday issue for us all. Netstal is paying particular attention to this global trend.

Replacement products such as PET packaging have significant advantages over both aluminum and glass packaging. PET bottles are convenient for consumers because they are light and yet very robust. This light weight also reduces the energy consumption associated with logistics and transport considerably.

PET packaging meets the highest requirements. In the beverage industry, where approximately 80% of all PET packaging is used, protection of packaged contents (e.g. shelf life of milk), packaging design and, not least, logistics costs are some of the important aspects that need to be addressed. The diversity of modern PET packaging leaves nothing more to be desired – for example, mango juice in the Chinese market is already being sold in mango-shaped bottles. Packaging will play a significant role as a means of communication in the future. In addition, green and sustainable packaging is one of the emerging trends in the beverage industry. The protection of packaged contents is especially important in the case of milk and dairy products – using a special overmolding process, it is possible to manufacture light-impervious PET bottles that increase the shelf life of products such as milk significantly. Innovations such as Calitec®, PRELactia® and the preblow process are key success factors here. PET systems from Netstal meet all requirements so that you can stay one step ahead in the market.

Netstal is your ideal partner and has the right product portfolio to meet extensive market demands. We incorporate current trends and customer requirements into our developments in a manner that is both targeted and solution-oriented. With preform production systems from Netstal, energy-efficient peak performance is guaranteed. This is because system solutions we develop are geared toward the highest quality, the shortest cycle times and at the lowest material cost.

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### Your benefits:

- Minimum production costs and maximum output.
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## PET-LINE and PETForm Customer Benefits

The requirements and needs of globally active injection molders are constantly on the rise. As a result of growing cost pressures and high quality standards in the markets, customers benefit from the early involvement of all partners and suppliers – because it is thanks to their many years of experience and extensive expertise that they are able to offer application-oriented solutions.

All our efforts are geared toward maximum performance. This means that the production process of a plastic part is designed to ensure the following:

- It is extremely easy to reproduce.
- It has the shortest cycle times.
- It achieves the lowest unit costs.

This is guaranteed by our specialist teams, whose task it is to develop the best possible technology to suit your specific application. Our specialists accompany you throughout the production process and are in a position to provide the systems, technology and services that most precisely meet your application needs. We combine the knowledge of sales, applications technology and project management internally so that you, as the customer, can utilize a production system with high performance potential.

Success: You can benefit from outstanding support in all key areas by taking advantage of our excellent machine technology, comprehensive customer service and broad-based expertise.

### The path to success with PET-LINE and PETForm

Top productivity and efficiency are key factors in the manufacture of bottle preforms. The PET-Line and PETForm production systems for the manufacture of PET preforms enjoy a high market share, which can be attributed to their high performance capacity and the outstanding reproducibility of the applications produced. You are optimized for maximum performance and have the latest and most innovative technology at your disposal. The result is top reproducibility with the shortest cycle times and efficient energy consumption that leads to the lowest production costs.

Thanks to in-depth training at our training centers, you and your employees will be able to operate our machines both optimally and efficiently. Individually tailored training courses are ideal for this. The content of our courses is designed to meet the needs of our customers and can be adapted according to the knowledge of participants involved.

Customer preferences are constantly changing – but the need for quality remains the same. That is why our customers continue to rely on our high-quality machines.





## Life Cycle Services – A Partnership to Last a Machine's Lifetime



Customer service from Netstal and KraussMaffei provides you with optimum support throughout the entire life of your machine. Our solution-oriented services and products such as commissioning support, troubleshooting, spare parts supply and customer training optimize your production efficiency and secure your investment to create a lifelong partnership that works to your advantage.

### Start-up phase

- Commissioning
- Training
- Maintenance consultation
- Parts finder

### Optimization phase

- Upgrades
- Energy optimization
- Production optimization
- Remote support

### Utilization phase

- 24-hour spare parts hotline
- Inspection
- Calibration
- Hotline – technical customer service

### End phase

- Relocation of production
- Overhaul
- Rental and lease machines
- Used machines

### Contact:

- Service for PET-LINE:  
service\_pet@netstal.com
- Service for PETForm:  
IMM-BoardofService@kraussmaffei.com

## Netstal

# A strong brand in a unique global group

### Premium high-performance and high-precision injection molding technology and system solutions

Netstal is an international provider of premium high-performance and high-precision injection molding technology and system solutions. Our customers are always impressed by the innovations and services that we provide, as well as by our efficient and performance-driven technological approaches for the beverage, packaging and medical technology sectors in particular. Our production systems are all characterized by the same attributes: speed, precision, reli-

ability, user friendliness and operational efficiency. We are constantly refining our technological standard of excellence and, thanks to our innovative technologies, we are able to offer high-performance production systems to our customers.

### There for you around the world

With eight subsidiaries and around 30 distributors, our global presence guarantees optimum customer proximity. This means that we are able to address your individual needs as quickly as possible and provide you with a comprehensive and customer-oriented service.

### Individualized service

While our customer service supports you with a range of solution-oriented services and products, it also excels as a provider of "classic" services thanks to its high reliability and quality standards. Be it commissioning, troubleshooting or customer training – make the most of our first-class services.

## KraussMaffei Group

# Comprehensive expertise

### Unique selling proposition Technology<sup>3</sup>

The KraussMaffei Group is the only provider in the world to possess the essential machine technologies for plastics and rubber processing with its KraussMaffei, KraussMaffei Berstorff and Netstal brands: Injection Molding Machinery, Automation, Reaction Process Machinery and Extrusion Technology.

The group is represented internationally with more than 30 subsidiaries and over ten production plants as well as about 570 sales and service partners. This is what makes us your highly skilled and integrated partner. Use our comprehensive expertise, which is unique in the industry.

You can find additional information at:  
[www.kraussmaffei.com](http://www.kraussmaffei.com)



The KraussMaffei Group has a global presence. Countries with subsidiaries are marked in light blue. In the white-colored regions, the Group is represented by over 570 sales and service partners.

## High-Quality System Solutions PET Packaging

Focus on the applications of our customers is paramount here at Netstal. We have extensive expertise when it comes to the manufacture of preforms for PET packaging and, with our high-performance PET-LINE and PETForm series, we have a wide product portfolio on offer. Our technical specialists are well placed to advise you on specific regulations and can provide you with the best possible support in the face of growing requirements in the beverage industry. The solutions we develop are geared toward the highest quality, the shortest cycle times and the lowest material cost, so it's no wonder Netstal is your first port of call for highly advanced PET packaging solutions.