"YOU CARE FOR THE CONTENT.
WE CARE FOR THE FILLING AND PACKAGING."
InnoPET Blomax Series III Stretch blow molding machines – a perfect solution for all filled products

As a technology partner of the beverage industry with 30 years of experience, we know that each decision for a stretch blow molding machine starts with the question about the product to be filled and the correct packaging. This brochure does not therefore start with the features and benefits of our InnoPET Blomax Series III machine types but with the wide variety of filled products and the wide range of PET bottles produced with our machines.

We would like to demonstrate how and at which stage we draw on our comprehensive know-how and the services of our technology center on the matter of «Bottles & Shapes™». This reflects how we develop «your» perfect bottle for the relevant product to be filled. Naturally, all significant details regarding our state-of-the-art InnoPET Blomax Series III stretch blow molding machines are also included. After all, we already consider the best possible further processing methods during the development phase – for example, the downstream filling lines. Implementation of our know-how with regard to PET process, bottle design and construction also play a decisive role for the all important result, that your individual packaging solution will meet all your requirements.
Bottles & Shapes™: The contents determine the bottle

Each filled product requires an appropriate bottle and the PET bottle contributes to the image of your product. At the same time, the bottle should have properties that enable it to «stay in shape» during high-performance production. To make sure that happens, bottles and mold construction as well as the entire production process, must be optimally coordinated.

Our customers begin to benefit at this point from the unique total know-how of KHS Corpoplast.

So, let your imagination rein free. We will make your bottle design fit for production while always taking into account technical and economical feasibility.

Thousands of PET bottle designs have already been developed at our Hamburg technology center. We can therefore assure you with confidence that we will be your competent partner to implement your ideas and wishes.

Our procedure is as follows:

With our 3D CAD system, we will first demonstrate how your idea can be turned into your future product. All conceivable influences on the bottle are determined, analysed and evaluated at this point in order to achieve optimal results.

We then create your initial prototype on our 3D «printer» within just a few hours.

In the next step, the first sample bottle is manufactured using a pilot blow mold. This is then tested under real conditions in our state-of-the-art laboratory, e.g. regarding breaking and stacking strength, wall thickness, bursting pressure and stress cracking.

At this stage we can modify and optimize until all required bottle properties are met. The path is then clear to manufacture the molds – a prerequisite for trouble-free mass production of your PET bottles with the highest guaranteed quality.

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Bottles & Shapes™: From design to the perfect bottle

Work generally commences with the packaging design proposal – an important detail of your marketing concept. The first hurdle to be negotiated is that not every bottle shape can be manufactured using PET with stretch blow technology. But just about!

The KHS Corpoplast CAD archive includes approx. 12,000 bottle designs – a significant benefit for our customers. Thanks to our 30 years of experience, we can advise you precisely and develop a blowable bottle which can be produced exactly to your requirements.

Through the process of evaluating the product to be filled, the PET bottle size and shape, you will get to know our technology center and the KHS Corpoplast core competency – and you will certainly appreciate our definition of the simple concept «Bottles & Shapes™». Because now we will start to develop the appropriate bottle with you – with optimal properties and the lowest possible manufacturing costs. Guaranteed!

Four areas determine bottle development:

- Design
- Weight
- Process
- Laboratory/tests

The design includes:

- Development and construction with state-of-the-art CAD CATIA V5 programs
- 3D prototyping within hours on our 3D printer
- Problem analysis and solutions based on Finite Element Analysis (FEA)
- Sample bottles

The weight is based on:

- Preform design dependent on the stretching ratio
- Light Weighting, based on technical and economical feasibility

Factors influencing the process:

- High speeds
- Low blowing pressure
- Low heat energy
- Alternative materials such as PLA (polylactid) or PP (polypropylenes)

Criteria for laboratory/tests:

11 main points – as demonstrated on the sample bottle shown here.

11 criteria for Laboratory/tests:

- Top Load
- Tolerances
- Thermal Stability
- Shelf Life
- Creep
- Micro-Biology
- Stability of Grip Area
- Burst Pressure
- Impact Resistance
- Stress Cracking
- Stiffness of Base
**Bottles & Shapes™: Light Weighting**

The principle is simple:
Weight reduction in bottle production leads to lower blowing pressure, less PET material and reduced heating input.

Professional implementation:
To reduce the weight of your PET bottle, you require a competent partner with comprehensive know-how in PET processing. We have complete know-how in an almost unique combination: Intensive research and development in our technology center and close cooperation with Moldtec for the manufacture of stretch blow molds and injection molding tools.

Because we have 30 years of experience in
- Packaging technology
- Process know-how
- Preform design
- Bottle design
- Stretch blow molding technology

we can guarantee that Light Weight PET bottles produced on InnoPET Blomax machines always meet the defined specifications.

And Light Weighting counts:
With an InnoPET Blomax 10 Series III approx. 78,000,000 PET bottles can be produced annually. If you save just 1 gram of PET material (1 kg = EURO 1.20) per bottle at this production volume you can save up to EUR 93,600!

**Development in Light Weighting**

- 1.5 l CSD: reduced from 44 g to 31 g
- 0.5 l CSD: reduced from 28 g to 15 g
- 0.5 l water: reduced from 18 g to 12 g

**Process stability**

- Pneumatic stretching
- Mechanical stretching

**PET quantity in grams**

- Year 2000: Base weight
- Year 2007: Target weight
  - Pneumatic stretching
  - Mechanical stretching

**Bottles produced**

- 1.5 l CSD: reduced from 44 g to 31 g
- 0.5 l CSD: reduced from 28 g to 15 g
- 0.5 l water: reduced from 18 g to 12 g
InnoPET Blomax Series III: The modular machine concept

The InnoPET Blomax Series III can cover an area of 4 to 24 cavities with the unusually practical module system in the following sequences:

<table>
<thead>
<tr>
<th>InnoPET Blomax Series III compact</th>
<th>InnoPET Blomax Series III standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>4, 6, 8, 10</td>
<td>4, 6, 8</td>
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<tr>
<td>12, 14</td>
<td>10, 12</td>
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<tr>
<td>16, 18</td>
<td>14, 16</td>
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<tr>
<td>20, 24</td>
<td>18, 20</td>
</tr>
</tbody>
</table>

**Room for individual solutions**

The overall InnoPET Blomax Series III construction is modular in design. We use standardised subassemblies for the main machine modules such as the transport module, linear oven and blowing module. The heater boxes, heating train and blow molding stations are also modular. This allows us to offer you cost-effective flexibility when choosing your InnoPET Blomax Series III.

**Always the right module**

Equip your InnoPET Blomax machine with exactly what you need to meet current and future requirements. This is no problem as every module matches each machine. A «special design» simply consists of a different configuration of standard modules. Your benefits:

- No special machine construction
- No additional costs for «special designs»
- Shorter delivery deadlines

**The modular system is economical**

All InnoPET Blomax Series III machine types have identical process engineering. This has enormous advantages for our customers.

**Maximum flexibility:**

Each bottle produced on an InnoPET Blomax can also easily be produced on any other InnoPET Blomax machine type without laborious process adjustments.

**Great familiarity:**

Once trained on an InnoPET Blomax machine, operation and maintenance personnel are familiar with all other InnoPET Blomax machines.

**Simple maintenance:**

The required spare parts stock can be reduced at our customer’s plant. Future modernisation or upgrade packages generally fit each machine size.

**Rapid spare parts service:**

KHS Corpoplast manufactures and assembles most modules regardless of machine size. This means flexible reaction to rapid delivery requirements.

**Flexibility for individual components as well**

The linear oven is available in three sizes based on the number of blow stations. The length of the oven can be altered within certain limits by shifting the dwell point. In order to meet various heating performance requirements, all three linear ovens can be combined with any transport or blowing mechanism. The InnoPET Blomax 4, 6 and 8 have a one-piece machine concept. This means the machine platform is directly connected to the heating module or linear oven. An upgrade is easy thanks to the modular construction. If you plan future expansions with additional heater boxes, you should order a larger oven. The heating train is then adapted to the actual required oven length by mounting the corresponding amount of mandrel carriers. You can also produce bottles with a larger neck (from 36 to 49 mm neck diameter) if required at a later time – just select a larger pitch on the heating train.

The blowing wheel consists of a ring to which the blow molding stations are bolted; the ring is connected to the machine platform via a ball bearing. This ring construction is identical for each «machine pair» in the InnoPET Blomax Series III and has all connection points for each type. This not only provides flexibility when assembling the machines at the KHS Corpoplast plant, but also enables you to expand your InnoPET Blomax 4, 10, 14 or 18 by a further two blow molding stations – at your plant and without disassembling the machine.

**Unlimited modularity**

Most machines are suitable for air cargo transport because of their transfer, heating and blow molding module construction. The maximum dimensions of the modules have been deliberately designed up to the InnoPET Blomax 16 for transport in a 747 cargo plane.

The machine is wired up with connectors between the modules and the integrated control cabinet (except InnoPET Blomax 4, 6 and 8 which are based on a one-piece machine concept).

This enables simple re-connection on site – a genuine «Plug-and-Play» installation rapidly completed including commissioning and start-up. The modular construction is also economical with regards to maintenance. Some components can simply be removed from the machine for adjustment, maintenance or repair.

The changeover times are:

- 1 min for a heater box
- 3 min for a turning wheel
- 30 min for a complete blow molding station

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InnoPET Blomax 12 Series III

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**SchematicDiagram:**

- Turning wheel
- Linear oven (smallest machine)
- Linear oven (largest machine)
- Transfer station III
- Loading and unloading wheel
- Transfer station II
- Linear oven (both machines)
- Blowing wheel (both machines)
- Electrical cabinet
Our customers benefit from KHS Corpoplast’s decades of PET process experience and from the construction and design of stretch blow molding machines that meet the requirements for the cost-effective, reliable and precise production of high-tech PET bottles with top output and machine availability.

We call this «Value Added Bottle Blowing» – a high demand which is met by the key features of our InnoPET Blomax Series III machines.

1. Transport mandrels
Mandrels and their circulation through the machine are standard components in the InnoPET Blomax Series III. Through continuous development of this reliable and highly efficient component with regard to dimensional accuracy and repeatability during process, the transport mandrel principle supports a minimum process time particularly for high speed production. Impurities in preforms and bottles are avoided by the neck-down principle.

2. Low energy consumption
The low heating and compressed air consumption in the InnoPET Blomax machines is a tradition – the lowest energy consumption in this industry.

   a) Heating
   - Mandrel pitch only 38 mm
   - High heat penetration of preforms
   - Optimal use of heating energy
   - Flexibility of heating modules
   - Core cooling

   b) Compressed air
   - Lowest dead air volume through valve block directly installed at the station
   - Air recycling from P2 to P1 directly into the production process without compromising the process
   - Reduced blowing pressure < 10 bar is possible

3. Stretching system
The mechanical, cam-controlled stretching enables high precision and repeatability compared to pneumatic stretching. This is a significant prerequisite for material savings in light weighting and cost reduction in air consumption. Changeover times can be reduced by 25 percent because the stretching rod is only adjusted during product changes and no longer exchanged.

4. Blow molding station
Blow molding stations are also a modular element in the InnoPET Blomax Series III machines with their mold holders, outer and inner shells. They are available for all machine sizes and are therefore exchangeable and cost-effective. The compact new generation blow molding stations operate with a support wheel and cam-controlled opening and closing mechanisms for increased stability and consistent bottle quality in high speed production. The pre-installed air recycling system AIRBACK automatically saves up to 100 percent of the air required for pre-blowing (recirculation from P2 to P1). The compact construction of the valve block directly at the blow molding station reduces the dead air volume and also saves air energy costs.
5. Quality assurance systems
We offer numerous quality controls for maintaining machine availability at the highest level.

a) Preform testing
Only impeccable preforms guarantee precise heating and stretch blow molding processes. We provide testing devices installed at the perform infeed or transfer station 1 to sort out damaged preforms. The systems are video-supported and eliminate preforms with irregular necks.

b) Bottle testing (Off centre measuring)
Testing systems detecting non-axial, irregular bottles are either installed upstream of the air conveying line or at the rotating wheel. Damaged bottles are eliminated.

c) Bottle testing (wall thickness measuring)
For process testing we offer a video-supported inline testing system for measuring the wall thicknesses of blown bottles, in particular after product change and for Light Weighting.

6. Modification
Modifications during product changes should not influence precision or reliability of the machines. Implementation must be simple and above all rapid. As the rapid exchange systems are continuously under development, the modification times are significantly reduced. The KHS Corpoplast Speed-Loc system with its rapid exchange components for
- Mold section
- Base molds
- Stretching rod
ensures the shortest possible product change-over.

The base molds (multi-coupling) and the mold shells can be easily removed, screws and hose connections do not have to be undone. The new generation stretching system does not need any stretching rod exchanges. Adjustment during product change is sufficient. The Speed-Loc components reduce modification times to a minimum.
The costs for PET bottle production are roughly divided as follows:

- 70 percent material (PET)
- 15 percent preform production
- 15 percent bottle production

Optimal bottle design is a significant prerequisite for cost-effective production. The decision for a KHS Corpoplast stretch blow molding machine pays right from the start of production. InnoPET Blomax Series III machines traditionally feature the lowest energy consumption compared to the competitors.

We can directly influence the 15 percent production costs. These consist of:
- Investment
- Heating energy consumption
- Air consumption
- Reliability

**Investment**
Our InnoPET Blomax machines are distinguished by their modular construction and high standardisation. The transport mandrel is a standard feature in all InnoPET Blomax machines. The neck-down transport of the preform prevents contamination in preforms and bottles. The mandrel circulation is wear-resistant and supports the high outputs by absolute dimensional accuracy and constant, precise repeatability of the entire process. A decisive factor for Light Weighting.

**Heating energy consumption**
The very low mandrel distance (pitch) of just 38 mm enable InnoPET Blomax machines to achieve highly efficient heat penetration of the preforms and top industrial values in heating energy consumption. Individually adjustable heating modules and an efficient mandrel cooling also reduce energy and time costs.

**Air consumption**
The KHS Corpoplast AIRBACK system enables lowest dead air volume and up to 100 percent recycled air from P2 for the pre-blow process P1. In addition, the reduced blowing pressure in Light Weighting results in very low compressed air consumption. Costs for generating compressed air requirements and air consumption are the lowest in this industry.

**Reliability**
The availability of KHS Corpoplast stretch blow molding machines is traditionally excellent and a benchmark for the competition. It is our PET process know-how that enables us to offer the best stretch blow molding machines with the InnoPET Blomax Series III. In addition, our service is available around the world so that we can respond to your queries rapidly and provide support.

InnoPET Blomax Series III: Best of its class for production costs

![Preform on mandrel circulation](image)

![Mandrel distance (pitch)](image)

![KHS Corpoplast AIRBACK/AIR RECYCLING](image)
InnoPET Blomax HR Series III: Hotfill

Hotfill is a suitable alternative to cold aseptic filling if temperature and sensitivity of the product during PET bottle filling plays a role. The requirements for PET bottle filling with heat treated products are mainly dependent on the product, market requirements and shelf life.

The design elements and the process parameters must be selected carefully to optimise the cost-effectiveness of a machine.

Highest demands for Hotfill processes

Juices and teas are filled into PET bottles at a temperature of 92 °C. A high crystallinity is required to prevent moisture affecting the bottle quality during temporary storage.

A bottle for Hotfill no longer has a uniform, classical «appearance». Even unusual bottle designs are possible and can hardly be distinguished from traditional PET bottles.

Viscous products require a wider bottle neck and a design that enables better absorption of the vacuum produced during cooling down from the bottling temperature (96 °C). These properties can be included by means of special solutions in machine construction.

In order to pasteurise a bottle at 75 °C for 30 minutes, the bottle must be totally stress-free and geometrically designed to withstand the process.

InnoPET Blomax HR Series III: Optimal results

InnoPET Blomax HR Series III machines can easily be adapted to Hotfill processes from relax or standard blow molding processes. Maximum output is guaranteed for each process thanks to the modular construction with exchangeable components.

In Hotfill, the temporary storage time for a bottle between blow molding and filling is a decisive factor as to whether maximum output for a defined container size can be met. The reason is that the bottle absorbs moisture during storage, affecting thermal stability. If bottles are filled directly after blow molding, the so-called inline process leads to a production capacity of 1,400 bottles per hour. The capacity for the same bottles is reduced to 1,000 per hour if filled after temporary storage.

Our table overview includes normal values, dependent on container size and filling process. Please refer to the overview on pages 26, 27 and 28 in this brochure for machine speed data and other process types.

InnoPET Blomax HR Series III: Mode of operation

The preform is heated to maximum temperature and blown in a hot blow mold. The material is aligned in the blow mold during the blow molding process. Due to the high blow mold temperatures, the material is stress relieved, alignment stress is neutralised and thermal crystallisation is increased. PET material deformation at higher temperatures is reduced by the increase in thermal crystallisation. The so-called glass temperature of the material rises and enables Hotfill or pasteurisation without significant bottle deformation.

The bottle is flushed with cooling air prior to extraction to stabilise the bottle in the blow mold. This cools the product sufficiently and prevents deformation during extraction.

Special features of InnoPET Blomax HR Series III

Optional features of InnoPET Blomax HR Series III enable high process precision at maximum speeds.

Three different temperatures are possible with the three-stage cooling/heating system:

• One temperature for neck cooling
• A medium temperature to insulate the mold carrier from the hot mold
• A hot oil circulation to bring the mold to the operating temperature

This three-stage cooling/heating system is distributed to the various mold components via a ring distributor.

The valve block contains a blowing valve and air cooling valves. They optimise the reaction time and are installed adjacent to the bottle. The cooling air is transported into the bottle using a hollow stretching rod. The steel blow molds are heated individually for optimal control of temperature.

InnoPET Blomax HR Series III – a profitable investment

The use of InnoPET Blomax HR Series III machines increases the cost-effectiveness and reliability of Hotfill lines. They also contribute to the reduction in costs for packaging units:

• Optimal use of material through mechanical, cam-controlled stretching. Specifications for wall thickness are precisely complied with and the weight of the product is reduced.
• Optimal post-heating of preforms via heating control, which maintains short wavelengths and enables ideal heat penetration.
• Flexible configuration of the oven ensures perfect temperature profiles.
• Optimal blowing air supply directly by the bottle via valve blocks and optimised layout of stretching rod for cooling air.

Maximum output during production (Machine availability: InnoPET Blomax 4, 6, 8, 10, 12, 14, 16, 18, 20, 24)

According to application and bottle size

<table>
<thead>
<tr>
<th>Bottle size</th>
<th>Hotfill, inline fill (btl./hr)</th>
<th>Hotfill, offline fill (btl./hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 0.60 l</td>
<td>&lt; 0.60 l</td>
<td>&lt; 0.60 l</td>
</tr>
<tr>
<td>Cylindrical mold, max. temperature 88 °C, standard neck</td>
<td>1,400</td>
<td>1,400</td>
</tr>
<tr>
<td>Cylindrical mold, max. temperature 92 °C, crystallised neck</td>
<td>1,200</td>
<td>1,200</td>
</tr>
<tr>
<td>Cylindrical mold, max. temperature 88 °C, standard neck</td>
<td>1,000</td>
<td>1,000</td>
</tr>
<tr>
<td>Cylindrical mold, max. temperature 90 °C, crystallised neck</td>
<td>950</td>
<td>950</td>
</tr>
</tbody>
</table>

InnoPET Blomax HR Series III – Costs per thousand bottles (EUR)

<table>
<thead>
<tr>
<th>Bottle size</th>
<th>Preform</th>
<th>Neck crystallisation</th>
<th>Blow molding of bottle</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 0.60 l</td>
<td>&lt; 0.60 l</td>
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</tr>
</tbody>
</table>
Customised bottles for special applications. These are, for example, oval PET bottles for packaging of food, cosmetics and cleaning agents.

«Exotic» bottles are frequently required for cosmetics – the highest-grade products offered in PET bottles until now.

The combination of unusual shapes and optimised quality presents technical challenges. However, it is by no means impossible, as KHS Corpoplast engineers have demonstrated with the development of the InnoPET Blomax PH. The suffix PH stands for the selective preform heating (Preferences Heating) process developed by KHS Corpoplast. The orientated preform is heated in a pre-defined manner from two sides on a mandrel which can be locked into position with a guide. This results in a controlled, optimised and uniform material distribution. Cost-effective, light weight oval bottles with perfect appearance and geometry can be produced which precisely comply with the stipulated specifications.

Using this technology, bottle designs which are aesthetic as well as technically demanding can be realised.

InnoPET Blomax PH Series III: Preferential heating

- Quality of appearance
- Optimisation of capacity
- Weight reduction
- Possible use of preform for larger diameters

**Limits of the standard processes**

- Insufficient material distribution
- Results: thickening and sections with low resistance

**Symmetric development of blown material**

Rapid contact between mold and bubble at the narrowest point

**Preferred cooling at contact point between material and mold:** Material not stretched; thickening visible

**In the preferential process:**

Blown material develops towards the coolest areas

**Development of blown material according to mold profile:** Uniform stretching of material through all profile areas

**Application of Preferential Heating**

- PH: Mandrel orientation
- PH: Thread orientation in the mold
- PH: Heating configuration

**Rotating preforms in front of heating**

**Preferred heating on orientated preforms**
InnoPET Blomax stretch blow molding machines are held in high esteem globally thanks to their durability, availability and reliable productivity with the lowest energy consumption.

But over the long-term a machine is only as good as the service. And we are convinced that service starts with the initial contact. Therefore, at KHS Corpoplast we do not talk about After Sales Service but First Minute Service: We give you our complete know-how right from the first minutes! This close cooperation and service is generally available over the entire useful life of our machines.

Service not only refers to maintenance and repairs. KHS Corpoplast service also includes a complete range of products such as training, spare parts, molds, retrofits, Secondhand machines, consultation and support from our technicians – including on site.

We are also proactively informing you about new developments, retrofits, energy saving and maintenance concepts.

The market demands product solutions which can be implemented quickly. Thanks to carefully synchronised timing, KHS Corpoplast can provide you with operational InnoPET Blomax machines at very short notice. Minimum assembly time using prefabricated subassemblies and modules plays an important role here. Efficient logistics and EDP-supported project management round off the process.

Personal support from your KHS Corpoplast contact person guarantees maximum efficiency in all order phases. Our company philosophy is based on not supplying any machines until they have produced top class bottles conforming to specifications during the pre-delivery tests – and then only with the promised production performance. Because of these thorough tests, all of our machines can be rapidly installed, set up and put into operation after delivery. All electrical connections are designed as plug connectors – as easy as «Plug and Play».

We offer training before and after commissioning for all the operating and maintenance personnel and all operating and maintenance requirements. This intensive training programme based on the C.O.A.C.H. principle (Content, Organisation, Approach, Clients, Headlines) is an important part of our overall support. We do not regard training as an auxiliary service to accompany the machine delivery, but rather as an essential element to ensure the successful operation of your InnoPET Blomax machines. Training encompasses all relevant areas of technical process procedure, control programmes, the control variables for bottle quality and production speed as well as process and error analysis, and the requirements for efficient preventive machine maintenance. Our training center in Hamburg has an excellent reputation.

The participation of your operating and service personnel during in-house acceptance, commissioning and test runs of machines in KHS Corpoplast’s assembly hall is particularly effective. As a result, customers are highly familiar with the process technology and machine hardware. This leads to a high degree of identification between the customer’s personnel and «their» machine – an important requirement for trouble-free high-performance production of first-class PET bottles.

Easy To Work With – the KHS Corpoplast Service
If necessary, we will accompany you throughout a KHS Corpoplast machine’s entire lifetime. We inspect the machine at regular intervals and recommend improvements as part of our preventive maintenance. We check operating and quality data and discuss changes in process data with you – measures which can improve product quality and the productivity of the machine. Refresher training ensures that new personnel quickly become accustomed to the machine, and that personnel who have already received training are constantly up-to-date with the latest technological developments. Machine overhauls and upgrades are carried out at your premises. Even older machines can be modernised by the replacement of components or assemblies, increasing their productivity or reducing energy consumption.

Your satisfaction is our main priority – irrespective of the scope of services you require. You can therefore always expect rapid, reliable, cost-effective service from us – tailored to meet your on-site requirements.

In short, if you need us, we will be there. With over 90 service technicians worldwide. 24 hours – 7 days a week!

We place utmost value on top precision, quality and reliability of spare and wear parts for our InnoPET Blomax machines.

Always look for the symbol displayed here when using spare parts for your InnoPET Blomax machine. It is on every spare parts delivery from our company. Premium Quality Parts from KHS Corpoplast for your Premium Quality Production.
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