ACUREMA® Bottle-to-Bottle Food Contact Approved

Choose the Number One.
Uncompromising food contact compliance, IV stability, reliability and top energy efficiency: there are many benefits when you start with the important things first. In bottle-to-bottle recycling this means: decontamination BEFORE extrusion. This is the straightforward but very effective basic principle of the VACUREMA® technology of EREMA. And using this technology you form the perfect basis for a top-quality end product right at the beginning of the process.

In combination with an comprehensive technology package, this basic principle ensures that the quality of your end product not only is but also stays consistently high. Efficient ultrafine filtration, intelligent automation and complete traceability of the quality produced are prime examples of this.

As a result, IV value and further key parameters of your end product remain stable. And they stay stable even if the properties of your input material change all the time – for example in terms of moisture and bulk density or through mixtures of PET material with differing IV values.

**YOUR BENEFITS:**

- Extremely clean rPET pellets
- For direct food contact with IV value on a par with virgin material
- Flexible on input, stable on output:
  Consistent end products in terms of IV value and colour despite varying moisture, IV values, bulk densities and flake wall thicknesses of the input material
- Top resource efficiency:
  Technology saves energy, water and space
- Easy to operate, high degree of automation
- Reliable and proven:
  Overall VACUREMA® capacity worldwide: more than 1.2 million tonnes of rPET per year
Decontamination of the flakes

Unlike conventional bottle-to-bottle processes, with VACUREMA® technology, decontamination takes place already at the PET flake stage—and not until after they are in pellet form. This means that VACUREMA® starts earlier with what is important. Plus: it is also one step ahead in the result, too. Because you reach your target—a stable, extremely clean, food contact compliant and top-quality end product—considerably faster, with lower energy consumption and less space required. Moreover, it gives you a high degree of flexibility as a result, because the technology evens out any differing moisture and IV values in the input material.

Thanks to the pretreatment of the PET flakes at high temperature and vacuum, moisture and migration substances are removed from the material effectively and in a stable process environment already prior to extrusion. This prevents any hydrolytic and oxidative decomposition of the melt in the extruder. A clear bonus for the quality of your end product.

Benefits

- Fast
- Reliable
- Energy saving
- Space saving
- Stable, high IV values
- Top colour values

Clean, food contact compliant rPET pellets after approximately 11 hours
Because efficiency counts.

How the VACUREMA® Prime bottle-to-bottle technology works

Two parallel vacuum crystallisation dryers are filled with amorphous, washed PET flakes. The crystallisation dryers work in proper batch mode. The exceptionally high level of purity of the rPET that is produced is achieved by an exactly defined and guaranteed minimum treatment time for every single thin-walled PET flake in vacuum and at increased temperature. The decontamination requirements specified by authorities and brand owners are fulfilled through the adjustable batch times.

The two identical crystallisation dryers are situated immediately upstream of the continuously operating vacuum reactor. The IV increase of the PET flakes takes place inside the reactor through solid-phase polycondensation which takes it to the required level. The material is melted under vacuum in the directly connected extrusion system.

The benefits of the VACUREMA® extruder: robust single screw technology and compact design for minimum thermal material stress.

1. PET flake pretreatment
   - Highly efficient decontamination
   - The patented pretreatment at elevated temperature and under vacuum before the extrusion process removes moisture and migration materials from the feedstock very effectively and in a stable process environment. The prevention of hydrolytic and oxidative decomposition of the melt in the extruder.

2. IV increase
   - IV value is increased to the required level.

3. Melting under vacuum
   - The very short extruder screw without additional extruder degassing reduces the thermal stress on the material through minimised residence time.

4. Low thermal stress
   - The robust, fully automatic filter removes even the smallest of aluminium, steel and other particles from the melt. The very large active filter areas enable filtration with up to 32 μm fineness with a low pressure level. The result is highly clean pellets.

5. Large area ultrafine filtration
   - The intelligent Smart Start operating concept combines production efficiency with remarkably straightforward operation. The accent is on usability, featuring a high degree of automation, ergonomic touchscreen and practical recipe management.

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FLAKE SUPPLY SYSTEM

PREDRYING

REMOVAL OF EXTERNAL RESIDUAL MOISTURE

REMOVAL OF INTERNAL RESIDUAL MOISTURE

DECONTAMINATION

FOOD CONTACT APPROVED / BRAND OWNER APPROVED

IV INCREASE / IV STABILITY

EXTRUSION (WITH ROBUST SINGLE SCREW TECHNOLOGY)

MELT FILTRATION

PELLETS IN CYLINDRICAL OR SPHERICAL FORM

(INLINE) CRYSTALLISATION

ALL REQUIRED VALUES FULFILLED IN PREFORM (AA, VOC, ETC.)
Food contact compliant
Thanks to highly efficient decontamination the system fulfils and also far exceeds all well-known minimum purity requirements for direct food contact already after the batch process.

With vacuum and top homogenisation for stable IV values
The system achieves stable IV values despite varying moisture levels and different IV values in the input material. The pretreatment in the two crystallisation dryers is essential for this IV stability. This takes place under vacuum and makes for excellent homogenisation of the material.

Top colour values. Stable colour values.
Melting under vacuum and an overall very short residence time of the PET material inside the system – thanks to this particularly sensitive processing, VACUREMA® gives you recycled pellets with top and stable colour values – with a shape and appearance on a par with virgin material!

Clean melt for clean preforms
Thanks to the efficient ultrafine filtration, the smallest of contaminants such as aluminium and steel particles are removed from the PET melt highly effectively and in a material-friendly way.
No compromises when it comes to direct food contact. Trust in the most proven technology. Trust in VACUREMA®. With regard to food contact compliance it is once again the basic VACUREMA® principle which ensures reliability because as the flakes are already decontaminated, any undesired migration substances are removed before extrusion. This means that the materials removed cannot make their way into the polymer either.

As a result, you receive highly clean recycled pellets which are not only approved for direct food contact but also fulfill the criteria of FDA, EFSA and well-known brand owners.

Process stability and traceability through Food Contact Control (FCC)

The parameters for direct food contact compliance are monitored and saved continuously throughout the recycling process. This is handled by the automatic operation mode FCC – Food Contact Control. If levels are not kept, an alarm is triggered automatically and optionally material flow is diverted away from the production line. Data traceability is also guaranteed thanks to archiving with FCC. The result is a reliable process at all times.
The inner values are exemplary.

High IV values, superior stability

Intrinsic viscosity (IV) is one of the central quality criteria in rPET processing. This is because it has a significant impact on the mechanical properties of the end product in terms of tensile strength or stiffness, for example. These are important for the trouble-free further processing of the rPET pellets to make preforms and for subsequent stretch blow moulding. The current trend towards bottle lightweighting solutions, where ever thinner wall thicknesses have to be realised, is increasing the significance of the IV value.

This means, therefore, that the PET recycling system has to reach the exact IV value which is required for the respective bottle application. And: also keep this value constant at the defined level. In other words: maximum process stability.

VACUREMA® stable IV values like virgin material

The VACUREMA® bottle-to-bottle technology fulfils your IV requirements to perfection. And gives you rPET pellets with outstanding IV stability. The intrinsic viscosity is so stable here that the values even lie within the tolerance thresholds for virgin PET material. Besides high product stability, this means that virgin material can be replaced with rPET.

IV stability thanks to vacuum treatment and top homogenisation.

The high IV stability is achieved here through the patented vacuum pretreatment of the flakes prior to extrusion. The strong homogenisation performance which takes place here at the same time is also a key factor. Major differences in input material, such as varying moisture or mixtures of PET flakes with different wall thicknesses and IV values, are thus balanced out and turned into a stable and homogeneous state – until the precise, desired IV level is achieved. Read more about these flexibility benefits on page 18.

Quality control: the final IV value in real time

Thanks to the practical online viscometer, you are informed about the current IV value at all times during the ongoing process. This continuous online IV measurement, combined with the fully automatic facility control system, enables you to influence a number of important processing parameters such as throughput, processing temperatures, filling levels, etc. The VACUREMA® advantage: the measured value is already the final IV value which the finished pellets will also have. With conventional systems the online viscometer only measures an intermediate value as the final value is not given until after the hours of residence time inside the SSP.

The performance of VACUREMA® technology is also convincing in respect of VOC values (volatile organic compounds, such as AA content). With the new VOClear package the VACUREMA® development team has now achieved further optimisation in this field. The result: the VOC content in the preforms, which was previously already lower than the thresholds of authorities and beverage companies, has been reduced once again by up to 40 per cent.

The new VOClear package features different design and process engineering measures in both prior treatment of the flakes and the subsequent treatment of the pellets.
Looking good. Safe to say!

Bottles which are produced using rPET pellets from a VACUREMA® stand out through their flawless appearance. The key to success here is: highly efficient ultrafine filtration. Even if the material has been thoroughly washed, postconsumer PET flakes contain approx. 20 ppm of aluminium and steel particles. In the case of a plant with output at 1,000 kg/h (24 tonnes/day) this already corresponds to 480 grams of aluminium and steel a day!

THE PROBLEM: if such impurities are not removed from the melt, surface defects may occur in the preforms and bottles which can lead to the end product bursting.

THE REQUIREMENTS: robust extrusion in combination with high-performance ultrafine filtration (e.g. 32 or 64 μm screen mesh size).

THE SOLUTION: VACUREMA® bottle-to-bottle systems are designed precisely for this, with the stable single-screw extrusion unit featuring the highly efficient EREMA SW-RTF® filter.

The highly efficient ultrafine filtration of the PET melt is one of the key strengths of VACUREMA® technology.

Filtration: safety bonus

Safe becomes safer – with the additional filter located immediately after the main SW-RTF® filter. This configuration offers you a permanent quality check of your filtration. The safety filter measures the pressure increase per time unit and detects any sudden, undesired increase in pressure – caused by a defective screen, for example. Any melt contaminants are removed again at once so they are not able to make their way into your end product.

Flakes from cooking oil bottles? No problem.

If a high amount of the PET flakes comes from cooking oil bottles this means much higher maintenance for PET recycling systems, which often raises the question of whether the processing is worthwhile. The VACUREMA® system offers an ideal solution here: the optional condensate separator enables you to process such cooking oil PET flakes very efficiently with minimum maintenance and maximum profitability.

The EREMA SW-RTF® filter is:

• Highly effective: the filter removes even the smallest of aluminium, steel and other particles from the melt.
• Material-friendly: thanks to large active filter areas the system ensures that stress on the polymer is minimised – a crucial measure to avoid black spots in the end product.
• Labour-saving: fully automatic filtration without production interruption thanks to self-cleaning through partial area backflushing.
• High performance: extremely low pressure losses despite very fine filtration, high filtration capacity and long filter service life.

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Stay FLAKEsible

Flexibility is the ability to adapt perfectly to changing conditions. Flexibility is: VACUREMA®.

Because, unlike all other bottle-to-bottle systems, VACUREMA® turns widely varying input into a very stable output. And – when required – you can also change the output to another defined quality level with VACUREMA® technology. For example if you want to change from recycled pellets for water bottles to bottles for hot drinks.

*Very durable bottles, especially for areas with particularly high air humidity.
High input flexibility

Typical input material for bottle recycling systems varies considerably. This is because it consists of a wide variety of flakes which also have different properties. The wall thicknesses and IV values of water bottle flakes are lower than those of carbonated soft drink bottles. Notable deviations are also possible with regard to moisture, for example when the flakes come from different (external) material streams. Storage also has an effect on moisture, as a result of condensation in material silos, for example (especially in spring and autumn) or outdoor big bag storage areas.

The requirement profile for a high-performance bottle recycling system, therefore, is as follows: it has to be able to balance out these fluctuations of the input material and turn it into rPET pellets which fulfill exacting quality criteria. Including maximum process stability.

VACUREMA® masters this requirement because the system has perfect control over the severe input material fluctuations and can turn it into a very stable output. Thanks to the patented vacuum pretreatment at elevated temperature it achieves stable IV values despite varying moisture levels and different IV values in the input material.

FLAKESIBILITY BY VACUREMA®:
The intelligent VACUREMA® system makes use of a particular characteristic of the rPET flakes: varying IV value growth rates with varying IV value levels and wall thicknesses.

PET flakes with relatively thin wall thicknesses, such as water bottles for example, have a relatively low IV value (often around 0.74 dl/g) at the beginning of the process. However, the IV value increases relatively rapidly. The opposite is true of rPET flakes with relatively thick walls, for example from bottles for carbonated soft drinks. These enter the process with a relatively high IV value (often around 0.78 dl/g) and the further growth of this figure is considerably slower than that of the thin flakes. In the course of the residence time inside the vacuum reactor, the IV values which differ to begin with then move closer to each other until they finally reach the required, application-specific IV value (e.g. 0.82 dl/g). The further homogenisation subsequently takes place inside the extruder.

This means that with the VACUREMA® system it is possible to raise flake mixtures with varying IV values in the input material to the desired IV level already prior to extrusion. For more efficiency, productivity and flexibility in PET processing.

How VACUREMA® balances out IV value differences in the input material

VACUREMA® rPET process
01:30
Extrusion/pelletising
Dry air predrying
Dry air predrying
Inline crystallisation
Crystallisation dryer 1 / 2
Vacuum reactor
Vacuum reactor
Inline crystallisation
SPP
Extrusion/pelletising

STANDARD rPET process
01:30
01:30
01:33
02:33
11:20

01:30
01:33
02:30

100% rPET
Pellets
Operating mode 1
Operating mode 2
100% rPET Pellets
100% rPET Flakes

High output flexibility

With the flexible and versatile VACUREMA® technology it is particularly easy to change from one defined end product grade (in terms of the required IV value or colour, for example) to another. This is possible because the entire process from the PET flake to the decontaminated, food contact compliant rPET pellets takes place notably quickly and efficiently.

The VACUREMA® system handles this task up to five times faster than other bottle-to-bottle technologies which use SSP solutions, for example.

Your benefit: you save time, gain flexibility and increase your productivity!

The right recipe for every application – thanks to the practical recipe management you can handle such product changeovers remarkably easily and quickly: simply press a button and you have all the saved process parameters of the new recycled pellets and can start with production.
SUSTAINABLY BETTER.

Conserving resources.
This central idea is one of the key driving forces behind recycling in general and, of course, also for the bottle-to-bottle loop in particular. This is because both the environment and the public benefit equally when waste is avoided and used PET bottles are transformed into new ones.

Conserving resources.
This also has to be a guiding principle for the technical process of the bottle-to-bottle recycling itself. Because if you bear in mind that electrical energy accounts for 38 per cent of the costs in this area, those technologies which address this specific issue have a clear edge.

Conserving resources.
VACUREMA® technology fulfils this requirement in every respect. Thanks to its basic principle of “decontamination before extrusion” and a series of additional ecological measures, it is programmed through and through for energy efficiency and saving both water and space.

SAVE ENERGY
SAVE WATER
SAVE SPACE
SAVE COSTS
REDUCE CO₂
SUSTAINABILITY

ENERGY SAVING
CHAMPION

Saving energy means saving costs.

High performance yet still highly energy efficient. This is the challenging performance profile of modern bottle-to-bottle recycling systems. VACUREMA® systems master this challenge to perfection and in doing so set the standard for energy efficiency in the marketplace. Not only the environment but also you benefit. Because if you reduce energy consumption, you likewise reduce production costs considerably. Hour after hour.

The basis for energy efficiency: decontamination before extrusion

The basic VACUREMA® principle means dramatic savings in the energy consumption of the entire process. Because, unlike conventional solutions which require hours of energy-intensive residence time in the SSP for decontamination and IV increase, VACUREMA® handles these tasks in a very energy-saving way already prior to extrusion. The result: the total energy consumption of the VACUREMA® system is considerably lower.

No additional predrying necessary

Thanks to the multi-functionality of the vacuum reactors, the PET input material is not only decontaminated, homogenised, compacted, buffered and dosed inside them, it is also automatically heated and predried. The benefit: additional predrying is not necessary. Materials with an input moisture of up to 1% can be processed as standard (up to 1.5% with special option).

Needs less. Gives you more. ecoSAVE®

VACUREMA® systems conserve your resources: thanks to ecoSAVE® technology with up to a 12% less energy consumption, reduced CO₂ emissions and lower production costs. Standard with every system, ecoSAVE® is a complete package of design and process engineering measures which increase energy efficiency. High-quality, energy-saving components such as high-performance motors, for example, and very robust insulation material in the pelletising section are used especially for this purpose.

VACUREMA® saves water

The optional utility-free vacuum pump requires no water to create the vacuum. You save not only operating but also maintenance costs. Compared to other pump systems, you can achieve considerable cost benefits after just one year.

Pelletising system with crystallisation

Immediately after pelletising the surface moisture is removed in the centrifuge. The amorphous pellets are crystallised in the crystallisation unit using the residual core energy and without needing any external energy.

Only 0.295 kWh/kg – this is how low the specific total energy consumption of the VACUREMA® Prime bottle-to-bottle system is. This outstanding figure regarding energy efficiency was achieved in impressive style by the EREMA system in an independent comparison* with eight other PET processing lines. Besides VACUREMA® only one other supplier managed to be below the magic threshold of 0.30 kWh/kg. VACUREMA®. Saving energy the intelligent way. The comparison shows you are safe and sound.

* Source: SKZ – Das Kunststoff-Zentrum, specific total energy consumption of 0.29 kWh/kg measured without material conveyance and without cooling.
Stable, high performance, energy saving and reliable. There are many reasons why you should count on VACUREMA®. And there are many companies which count on VACUREMA® day after day. Together, these companies process more than 1.2 million tonnes of PET to make rPET every year in the segments bottle-to-bottle, inline application and pelleting. The majority of them produce rPET for direct food contact. In Europe the VACUREMA® market share is 30% whereas in the USA it is already 50%. In global terms, therefore, VACUREMA® is the most proven technology in the production of direct food contact grade rPET.

Remote maintenance and data traceability

The practical remote maintenance tool is an additional reliability bonus. This means that should it be required, support from EREMA experts is available fast and if you wish, they can connect to your system from Austria and assist you in remedying any trouble. Thanks to extensive archiving software you are also in safe hands with regard to the traceability of valuable production data – an important feature in order to document your quality reliably. And, with the new remote diagnosis tool, you can also call up analyses and data evaluations extremely conveniently online at any time.

VACUREMA®. A technology you can rely on.

Amauri dos Santos, General Manager of M&G Fibras in Brazil:

We decided in favour of VACUREMA® technology because the system is known in Brazil for its operational reliability and there are already numerous EREMA reference systems here which fulfil the stringent criteria of the ANVISA Agency for National Health Surveillance in Brazil.
### Technical Data

**Systems available**

<table>
<thead>
<tr>
<th>System</th>
<th>Capacity</th>
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<tbody>
<tr>
<td>VACUREMA® Prime 1310 T</td>
<td>500 kg/h</td>
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<tr>
<td>VACUREMA® Prime 1512 T</td>
<td>700 kg/h</td>
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<td>VACUREMA® Prime 1714 T</td>
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*IV values attainable in repellets – variable according to chosen throughput*

*IV increase according to plant type and set throughput; example based on VACUREMA® 2018 T:*
More questions?
We would be pleased to answer them!
Your EREMA advisor will be pleased to attend to your request personally and quickly. If you are interested in a demonstration or a test run with your specific material it would be a pleasure for us to make an appointment and welcome you to our EREMA Customer Centre at the headquarters in Ansfelden, near Linz in Austria.

We look forward to seeing you at EREMA!

For worldwide representatives please visit www.erema.at

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