

PLASTVERARBEITER

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Energy efficient drying
of pellets using Vacuum



Photo credit: Ralf Mayer/Redaktion Plstverarbeiter, Maguire

Packaging manufacturer invests in sustainable products and resource-efficient production

Energy efficient drying of pellets using Vacuum

A major **packaging manufacturer** of food and non-food packaging is pursuing a **holistic sustainability strategy**. This includes reusable products with a high **percentage of rPET** as well as an **energy-efficient** and

resource-preserving production process that results in lower CO₂ emissions. For the **drying of PET in injection stretch blow moulding**, the company is currently testing a new **vacuum dryer** as a replacement

for conventional desiccant dryers. The results are promising: The new devices use **less energy** and – in addition to many other benefits – allows **quicker material changes**.

A smaller footprint is one of the advantages of the new vacuum dryers installed at Greiner Packaging.



Photo credit: Ralf Mayer/Redaktion Plstverarbeiter

Greiner Packaging is an internationally operating developer and manufacturer of innovative plastic packaging. The company is widely viewed as Europe's leading provider of dairy packaging. In addition, Greiner Packaging offers custom solutions for plastic bottles and containers that are used both in the food and non-food sectors. At its plant in Kremsmünster, Austria, the head office of Greiner, the company produces ready-to-use packaging by employing different processes, including injection stretch blow moulding, thermoforming and sheet extrusion. Furthermore, the company offers decoration processes, such as IML, printing, labelling or the technology for cardboard-plastic combinations that Greiner developed in-house.

Greiner's production plant in Wartberg focuses on the production of large sized 5-gallon water bottles, containers, and tubes using a single-stage injection stretch blow moulding process. At first a preform is moulded with a mouth piece that has already been fully formed. As a second step the preform is pre-stretched (blow mould) using the remaining residual heat and subsequently blow-moulded into the final product.

The plant runs 24 hours a day, 7 days a week in four shifts.

Sustainability is the order of the day

Greiner Packaging has set ambitious sustainability objectives: By 2025, the company wants to launch fully recyclable, reusable or compostable plastic packaging only. Furthermore, Greiner is aiming to reduce plastic waste significantly and increase the percentage of rPET of their products. The company has recently extended its participation in the New Plastics Economy Initiative. Greiner Packaging joined the initiative back in 2016, as one of the first packaging companies worldwide.

The main objective is „to save as much plastic materials as possible and thereby eliminate waste,“ says Karoline Mossbauer, head of communications at Greiner Packaging, „and to reuse the remaining post-consumer waste in a manner that is as sustainable as possible“. The biggest challenge is to find the right materials and to implement suitable material flows, which is a difficult task – especially in the area of food



Photo credit: Maguire

◀ One of the vacuum dryer's outstanding features is its very low energy consumption.

packaging, which constitutes a big part of Greiner's production.

The European Food Safety Agency (EFSA) mandates that 95 percent of the recycling material has to come from a main flow that had verifiably already been used for good packaging. Only rPET has been approved as the sole recycling material for food packaging. Greiner Packaging is involved in multiple projects concerning the use of rPET in the food sector. rPET, as well as rPO, which Greiner is currently mainly using in pallets and is testing for other applications, is already being used for non-food products. A shampoo bottle made from rHDPE that the company is producing has already been launched.

At Greiner, the notion of sustainability not only encompasses products but rather all of the company's activities. Resource preservation is an important issue. For example, the Greiner Group, which, in addition to packaging, is also active in the extrusion technology, medical technology/diagnostics and foamed materials sectors, has pledged to reduce its specific overall energy consumption by 10 percent by 2025 and by 20 percent by 2030. Using environmentally friendly production processes, CO₂ emissions are

to be reduced by 38 percent (2025) and 53 percent (2030) respectively.

Successful test of ULTRA dryer

An energy-efficient and reliable production is also high on the agenda in Wartberg. An important step in the injection stretch blow moulding process is the drying of materials because residual moisture prevents reliable processes, which results in inconsistent variations in quality.

In the past, Greiner Packaging at Wartberg used conventional desiccant dryers to dry raw materials which has become a challenge. „Our core competence is the development and production of customer-specific products“, explains plant manager Stefan Bürtlmair, „whereas our product portfolio also includes standard products“.



▲ In Wartberg, Greiner Packaging manufactures various types of packaging, including the well-known 5-gallon bottles.

As part of a continuous improvement process, many material tests are required. Long drying times when using conventional drying technology often slow down the process.

That is why, at K 2016, the production experts of Greiner Packaging were looking for an alternative – and found it in the form of the ULTRA-series vacuum dryers from Maguire. „We tested the new vacuum dryers for a year and it was a positive experience“, says Dietmar Aigner, head of technology. Speed is one way in which their advantages are reflected. „A material change takes an average of 40 minutes compared to about three hours with conventional desiccant dryers“.

This means that the injection stretch blow moulding experts in Wartberg can test between six and eight materials each day while, in the past, they could only do two. So far, Greiner has used the vacuum dryers in test series with PET and the copolyester Tritan (brand name).

Drying without desiccant

There is a major difference between vacuum drying technology and a conventional desiccant dryer. Conventional drying methods re-circulate hot air for hours to remove moisture from the pellet.

The saturated air is then being dehumidified using a molecular sieve (a hygroscopic drying desiccant) before being circulated as dry air back into the process.

Since the desiccant needs to be regenerated on a regular basis, modern desiccant dryers require two or more molecular sieve cartridges which are interchangeable.

A vacuum dryer, however, does not require a desiccant. The technology takes advantage of the simple physical principle of the boiling point of water decreasing when the air pressure is reduced. In a vacuum of 90 percent, the boiling point of 100 °C is reduced to 56 °C as a result of atmospheric pressure. When the pre-heated material is

moved to a vacuum, the moisture evaporates from the material quickly and is released into the surrounding vacuum atmosphere. The ULTRA low energy dryer from Maguire operates in a three-step drying process:

► Using a heating unit, a centrifugal fan brings the material to an adjustable target temperature in a heating hopper. That value refers to the temperature at which the material is optimally pre-dried and it varies by the type of plastic. The target temperature for PET is 170 °C. The initial heating process for various materials is about 40 minutes and it takes approximately 60 minutes for PET.

► Once the target value has been reached, the material is moved to the vacuum chamber. The amount of material is monitored by a pair of load cells to know the amount of material and adjust if required. In the vacuum chamber, the air pressure is brought to 700 mmHg (90 percent vacuum) and maintained for a specified period of time. The material remains in the vacuum chamber for 20 to 30 minutes depending on the material type, initial moisture and required throughput.

► In step three of the process the vacuum-dried material is moved to a material retention hopper, which is also monitored by load cells. The load cells monitor usage and signal when to feed from the vacuum hopper. The membrane dry air purge option provides a supply of -40 °F/-40 °C dew point air to purge the vacuum chamber and blanket the retention hopper. Using a slightly positive air pressure, the dried material is kept in a stable, dry environment.

According to information provided by Maguire, the vacuum dryer dries the granulate six times faster on average

Messwerte Wägezelle		Zähler	Durchsatz
Vakuum	Aufbew.	Gewicht	Rate
14 kg	6 kg	9758 kg	32 kg/h
Energieverbrauch			
Wattzahl	M/kg/hr Cur.	/Std. Durchs.	
2384	72.3	65.0	



▲ A simple touchscreen is used for the vacuum dryer settings. Important process information, such as output and energy consumption, is available at any time.



▲ (from left to right) Paul Edmondson (Maguire), Dietmar Aigner (Greiner Packaging), Martin Rühlner (Rühlner/Maguire partner in Austria), Stefan Rürtlmair (Greiner Packaging) and Walter Salzwimmer (Rühlner) in front of a product display at the Wartberg plant.



▲ At its Wartberg plant, Greiner Packaging develops and produces packaging using a single-stage injection stretch blow moulding process.

than a conventional desiccant dryer. Replacing molecular sieve dehumidification with a vacuum process is the reason for the striking amount of time saved.

Vacuum dryer reduces energy consumption

This is also one of the keys to the energy efficiency of the vacuum dryer from Maguire. For example, the process does not require energy to be used for the regeneration of molecular sieves. This is also apparent in the test series Greiner Packaging has conducted. „We determined that the vacuum dryer consumed much less energy than conventional molecular sieve dryers“, states Aigner.

„The energy savings are increased significantly by switching to the energy-saving mode that is integrated into the dryer“, explains Paul Edmondson, the head of sales of Maguire Europe. The software logic ensures that only the required amount of heat is provided to the preheating stage, monitoring temperature at both the beginning and end of the heating hopper, to ensure it's correct for the vacuum drying process requirements.

When the air that reaches the top of the heating hopper reaches a value that is 30 °C below the set point of the target material temperature, the heater and the blower are switched off automatically. They remain in standby mode until the end of the vacuum cycle or until the expiration of a set time. Only then will they turn themselves on again. This operation can be repeated any number of times during a process. „When drying all polymer materials, the ULTRA low energy dryers verifiably consume 50 percent less energy than conventional desiccant dryers“, Edmondson emphasises.

The vertical design of the dryers makes an efficient gravimetric system possible. At the start of processing a batch, the granulate is heated in the heating hopper and then a defined amount of the material is moved to the vacuum chamber. After the first vacuum cycle, the content of the vacuum hopper is emptied into the retention hopper. From there the material is continuously fed into

the manufacturing process. The heating hopper is automatically refilled for the subsequent vacuum cycles. Weighing cells in two critical spots allow the entire drying process to be automatically adapted to the manufacturing process integrated with the software control of the dryer. In addition, the output rates are continuously monitored and recorded due to the use of load cells.

Small footprint

The vertical design of the vacuum dryers offers another advantage: the machines take up less space. „The new vacuum dryers only take up about half of the space of our other dryers, for which the heat hopper has to be placed separately“, explains Aigner. In addition, ULTRA low energy dryers are very slim overall because the size of the heating hopper could be reduced as the granulate remains in it for a comparatively brief amount of time.

„We are excited that energy-conscious companies like Greiner Packaging use Maguire technologies to implement sustainable processes“, emphasises Paul Edmondson. „We are making good progress in positioning the vacuum dryer technology on the market – even against a desiccant drying process that still dominates the mainstream“. Greiner Packaging in Wartberg has tested the ULTRA low energy dryers for a year and has already replaced multiple molecular sieve dryers with new machines in its production department. „Our experiences so far have been positive“, says plant manager Stefan Rürtlmair in conclusion. ■

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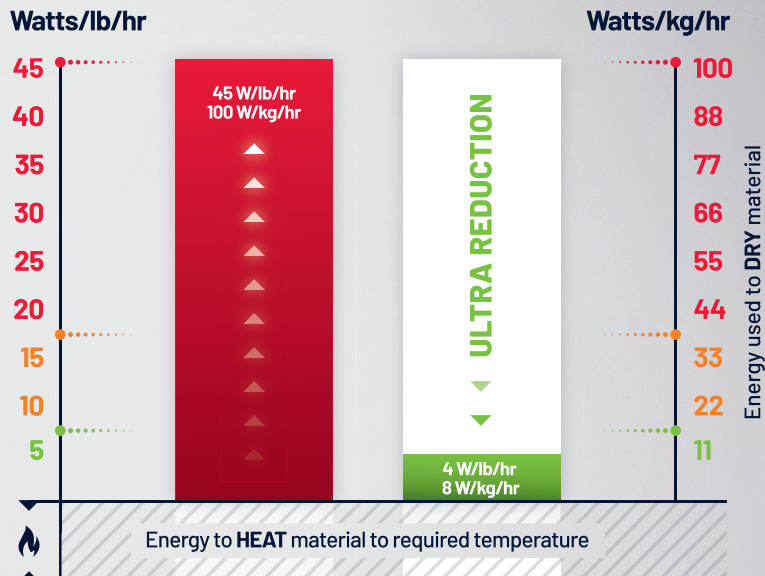
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INTRODUCING...

THE FIRST ULTRA LOW ENERGY DRYER.



Desiccant

ULTRA

\$7,128*

\$634*

ANNUAL COST TO DRY MATERIAL*

DESICCANT dryers recirculate hot air for hours, which is energy intensive and slow. Regeneration then wastes even more energy.

ULTRA uses Vacuum to lower the boiling point of water to 133°F / 56°C. Moisture boils off quickly with **NO ADDITIONAL ENERGY**.

Unlike Desiccant dryers, **ULTRA** dryers remain energy efficient at reduced throughputs.

#DryerULTRA |

ULTRA - The Only ULTRA Low Energy Dryer

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*Based on 220 lb/hr (100 kg/hr), 6000 hours per year, kW cost at national average of \$0.12 per kW. This chart shows the **EXCESS ENERGY** required to **DRY** the material. **Savings calculated based on pounds/hr.**

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