



Photos: Harter

The basket bottoms have a special design so that the dry process air may perfectly pass through the bulk items and uniformly absorb any humidity present within three minutes.

Reinhold Specht, Managing Owner of Harter. This is what Harter's engineers experience when they subject prospective customers' products to series of tests in their in-house Test Center. Stunned faces as pins, sleeves, or plugs are freed from any moisture after but a few minutes. "Our Test Center is our powerhouse of ideas. It is the place where we developed the basic solution to bulk material drying, and where we continue to develop solutions for specific applications," explains Specht who co-developed the technology from scratch.

First, the drying tests are used to determine the parameters relevant for successful drying – temperature, time, humidity, airflow rate, and air speed. Then, the second crucial factor is addressed: air routeing. Air routeing is extremely important when it comes to drying bulk material. For bulk material drying in conventional barrels, Harter developed a so-called half-shell provision to force the process air into the barrel and out again. There are other solutions for other containers.

"Air routeing belongs to our outstanding know-how. This is why we will not disclose any details," explains Jonas List of Harter Technical Sales who is responsible for cleaning and paint coating related projects. "In any case," emphasises List, "testing is a solid base for finding a good solution."

### In-barrel Drying

Bulk material drying was initially used successfully in plating barrels. The first project was realised in 1999. The customer was one of the biggest plating contractors in Germany at that time, and has more than 20 Harter in-barrel dryers in operation today. Thanks to Harter's technology, the operator was relieved of the need for the onerous transfer of plated items from the barrel to the centrifuge. Instead, they could

# Fast Drying of Bulk Material in Line

## Air Routeing Concept is Key to Static Drying

Bulk material can be dried completely in a process involving minimal movement or no movement at all. Proof thereof was already given in the 1990's. Still, the opposite view persists. Examples from the field show ways of how such drying may be implemented.

Back in the early 1990's, the German company Harter succeeded in making a major advance in the drying of bulk material by implementing their heat pump based condensation drying. At that time, a manufacturer of bolts and screws centrifugalised their galvanised bulk items. The fasteners were still damp and partly deteriorated upon completion of the process. In the course of

this pioneer project, the technology – which had been unknown a few years ago – was adapted to allow static drying in the centrifuge. This was the starting point for hundreds of bulk material drying projects.

### Air Routeing is Critical

"In-container drying is unimaginable for many people, even today," reports

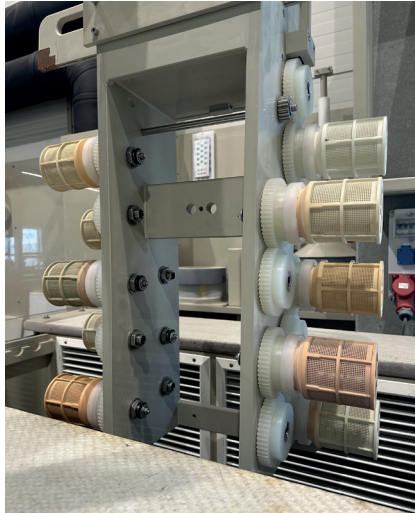
leave their small items in the barrel and get them completely dry therein. Following successful drying tests of small parts for the electronics industry, all fully automatic bulk material processing systems had Harter's heat pump drying installed.

Double barrel carriers supporting two barrels side by side move through the automatic processing systems. Today, the sensitive plated items are rendered completely dry within 12 minutes at a temperature of 70 °C.

Bulk material of complex geometries liable to water entrapment is dried while barrels are slowly rotated at defined intervals to assist in the drying process. The routines for such movement are stored in the control system. This intermittent movement is gentle enough to retain the integrity of the items being dried. So, the plating contractor refurbished all their facilities one at a time. New facilities had Harter technology already in-built. As in any project, the drying tanks and the integrated half-shell provision were modified to match the operators barrel design. Also, each dryer features an automatic lid system that opens only as the barrels are inserted or removed. This is to keep the precious heat inside the system which, in turn, increases the efficiency of the process. The power rating of the said system is about 12 kW.

### 75 Percent Shorter Cycle Time

Drying bulk material in baskets was a new market developed. Another pioneer project involved small parts in baskets with a vibrating unit. Again, the critical feature was air routing. Once developed, the air routing technique paved the way to any type of bulk material in-basket or in-pan drying. A manufacturer of connecting systems learned that their gold plated bulk items were dry in only five minutes instead of the 20 minutes required before. This came as a



To dry minute parts in finely perforated baskets successfully, targeted routing of the unsaturated process air is key. Testing in the in-house Test Center is the pathway to arrive at a viable drying solution for bulk items of various sizes and quantities.

stunner to the persons responsible. Also, the quality was satisfactory at last. But now that drying was much faster, the other processes lagged behind. This opened up an opportunity to expand capacity which the operator appreciated very much. In this application, the plugs and pins are placed in baskets with vibrating units. The baskets have different diameters with resulting different quantities of items to be dried. Harter designed and built two dryers which have their process air supplied by a single heat pump module.

### Exhaust-air-free and Highly Versatile Process

One dryer accommodates the single-basket carriers, the other the double-basket ones. In the first dryer, the diameters of the vibrating units vary between 180 and 300 mm. In the second dryer, the two baskets are identical and measure 120 mm in diameter. The applicable carrier is inserted in the dryer, the automatic lid system closes, and the drying process starts. The bulk material is rendered completely and uniformly

dry within five minutes. Stringent continuous quality control confirms this result. The drying temperature is a gentle 50 °C.

Using an engineering trick Harter succeeded in designing the sealing system of the single-basket dryer such that the bulk material baskets of all diameters used become in fact dry. The operator may quickly and easily modify the double-basket dryer for use with a single basket. This provides maximum flexibility to the connecting system specialist. There are systems which work in a similar way except that they emit process air from the system. Harter's systems use a closed air circuit and are thus free from any exhaust air. This does not only save a lot of energy, it also relieves the ambient air and, of course, the environment at large. The power rating of the whole system in production operation is 8.9 kW.

### Baskets in Continuous Dryer

A manufacturer of hard metal rods for producing drills and milling cutters used compressed air blowing

# NO TIME TO DRY?

With our efficient heat pump-based drying systems, you get completely dry, stain-free surfaces within the specified cycle times - and you save a lot of energy!





Combined drying-cooling systems are also supplied to the pharmaceutical industry. In the above application, cooling was used for ground stampings. Following vibratory grinding, 800 kg of stampings are dried at 70 °C, cooled to 30 °C, and subjected to further processing after a total of only seven minutes.

after rinsing to remove water from the rods in their baskets. Subsequently, the rods were subjected to static drying on heating plates at 200 °C. Still, some of the rods were not rendered dry, the noise involved was unsatisfactory, the heat situation required utmost caution.

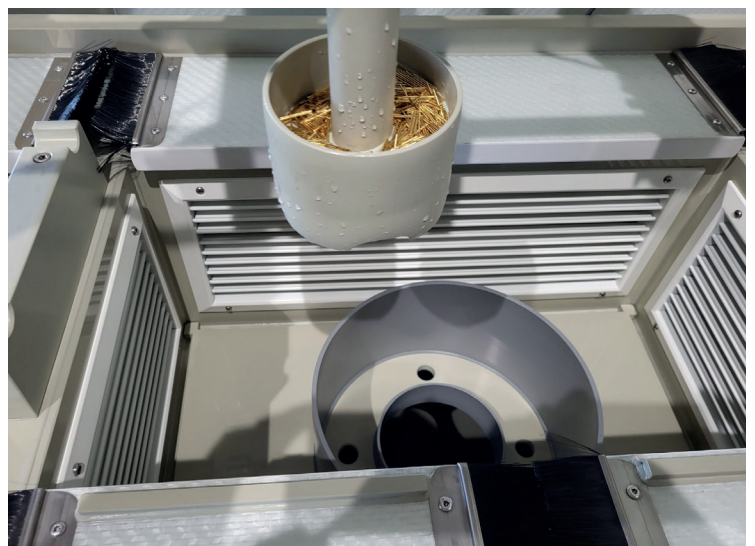
The challenge was to process the rather long rods lying closely packed in their baskets to become completely dry. Besides the regular dryer, Harter installed a special air blow-off provision which is employed before drying proper in such challenging applications. This provision is nor-

mally combined with the dryer and always uses non-compressed air. The combined air blow-off and drying system produces the results specified by the customer, namely complete drying. It was also important that the rods be stain-free. The dryer finally built is a semi-automatic continuous type.

Following rinsing, a worker places the baskets on a roller track for transport to the dryer. The dryer door opens at the push of a button, the basket is inserted, the door closes. The worker starts the product specific programme. First, horizontally movable nozzles blow off the baskets

and the hard metal rods therein. Then, the drying proper commences. The rods are completely dry after processing at 45 °C for only three minutes, and are subjected to immediate further processing.

The German drying system manufacturer also built new baskets for this system. They were customised to the specific product portfolio and have sophisticated features so that process air may flow through them. The power rating of the continuous dryer is 10.4 kW. The customer has meanwhile installed three of these systems.



Bulk items are also surface finished in baskets with vibration units. These integrated vibration units are also supportive in the drying process. Hundreds of gold plated connectors lie in baskets here. Gentle drying is completed after only 5 minutes.

### Perforated Baskets: in Line and Dry

A new challenge to Harter was the drying of minute parts in so-called perforated baskets. The items to be dried are special electronic parts the size of only one millimetre. They are placed in perforated baskets, then plated, rinsed, and finally dried. The customer had massive problems with the last operation. The Harter engineers were fully aware of the need for a special solution because the air recirculation system used so far in the dryer would not work. So, they devised a special solution to pass the air inside the basket and out again at the same time.

Each carrier accommodates ten baskets with an extremely fine perforation. Each basket features a provision for slow rotation at defined intervals during the drying cycle. The drying temperature is 50 °C and the drying period about 15 minutes. The power rating of the system is 10.4 kW. The customer has meanwhile acquired several such systems to dry their minute parts comfortably in line, processed in a gentle way to become completely dry at last.

### Belt Drying Including Cooling

“We are very excited to work out new solutions,” reports Stephan Ortmann. He is also a member of Harter Sales and responsible for liaison with international customers, such as with a project to design a belt dryer with integrated cooling zone. A belt dryer was required because the customer produces in continuous operation and wished the dryer to fit in. The system they originally used was a hot air type drying steel stampings at 100 °C after vibratory finishing.

“This situation was deemed utterly unsatisfactory because the parts could not be subjected to immediate further processing owing to their hot condition,” says Ortmann. The customer wanted an up-to-date drying solution for a new vibratory finishing system. The series of tests run showed best results at 70 °C. As this temperature was still too high for immediate subsequent packaging, Harter proposed to integrate a cooling zone. This is done, as Ortmann explains, by slightly modifying the heat pump drying system such that it starts cooling once dehumidifica-

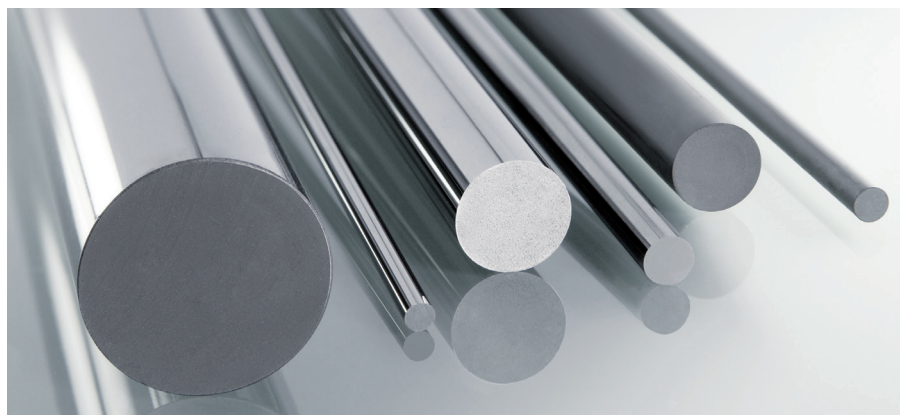
tion is completed. As the customer used a ventilation system, Harter’s idea was to employ this system for cooling. This way, not only drying but also subsequent processing was ensured. After cleaning, 800 kg of stamped, vibratory ground parts are placed on the conveyor belt of the dryer. The drying zone in the tunnel is two metres long. This is where the stampings undergo complete and uniform drying at 70 °C. Then, they are cooled to 30 °C on the following two metres of tunnel passage. The belt speed is 0.58 m/min. So, the products leave the belt dryer – dried and cooled – after seven minutes. The power rating of the system in production operation is about 25 kW.

### Air, Reliability, and Government Subsidy

Harter’s drying systems always include a drying chamber of most varied design, as required for the specific application, and a heat pump module. The latter conditions the required process air and is also responsible for the condensation process. For in-line bulk material solutions, the heat pump module is installed separately. The two components are then connected through air ducting. Some of the heat pump modules are even installed on another floor or a platform as space provides. Continuous drying systems often have the heat pump module integrated to form a compact system. Harter uses extremely dry air for their alternative process. Such air is passed over or through the items to be dried. Being unsaturated this air absorbs humidity readily. The air is cooled, in two stages, in the heat pump module. The humidity

condenses to form water. Subsequently, the air is reheated and recirculated to the drying chamber. “Air routing is critical for drying to be reliable and uniform,” explains Jonas List. “The air, by its very nature, follows the path of least resistance.” So, appropriate air routing is important to direct the unsaturated air over or through the items to be dried. Such technical success is only possible by perfectly combining air dehumidification with air routing. The drying temperature may be varied between 20 °C and 70 °C as required for the specific product or process. Temperature equalisation and cooling operations may be easily integrated in the system. The drying period is as required to reach the specified residual humidity. For many products, the drying period is often in the order of minutes to meet the specified cycle time. Harter’s systems feature a completely closed air circuit. Exhaust-air-free drying enables filtering to be omitted and results in very high process reliability owing to the fact that impact by the climate or the seasons is precluded. Harter’s low temperature process is very energy-efficient and leaves a small carbon footprint – it was classified eligible for government subsidy in Germany, Austria, and Switzerland in 2017. Customers may apply for government assistance ever since. “The customers get high quality bulk items, a reproducible process, high energy efficiency, and government subsidy for using heat pump technology is an on-top bonus” summarises Reinhold Specht.

**i** Harter GmbH  
www.harter-gmbh.de



Hard metal rods are processed to produce drills and milling cutters. Earlier problems – compressed air and heat – have been overcome by a temperature of only 45 °C and high energy efficiency.