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CONDENSATION DRYING

# The Drying Trick with the Heat Pump

SPECIAL PRINT

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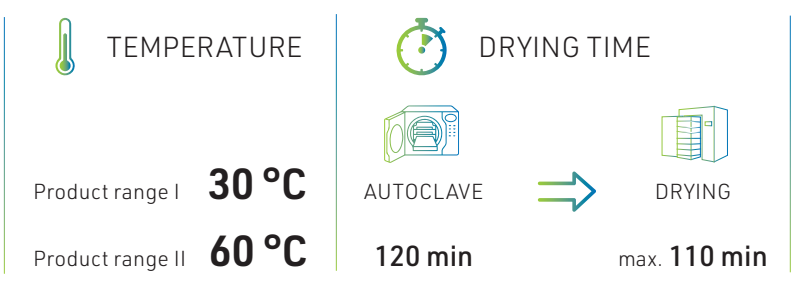
# The Drying Trick with the Heat Pump

Just plain drying has not been enough for the pharmaceutical industry in a long time. Drying processes are supposed to be reliable, gentle on products and energy efficient. Drying with a heat pump has therefore many fans in the pharmaceutical production.




Tests in the Test Center are used to determine the required temperature and drying period. They are indispensable for a viable design of the drying system.

Condensation drying with an integrated heat pump has existed for 30 years. "No one was interested in this drying method back then," says Reinhold Specht, managing owner of Harter, who co-developed the heat pump technology. This has meanwhile changed radically. Besides the food business, the quality-minded and safety-conscious pharmaceutical industry relies on condensation drying. This is shown by the names of renowned pharmaceutical manufacturers on the German company's customer list and successful projects in various sectors. Drying after sterilisation is much sought after. Primary packages from plastics or glass must be completely dry after water spray heating. Harter's experts have also gathered experience with other materials including wet granulates, liquid jellies or collagen foils as well as with the dehumidification of whole cleanrooms or individual workplaces.

## Defined temperature, reliable process

The first example shows which projects the drying experts have already realised. A manufacturer of biotechnological vaccines and pharmaceuticals fills vials and ampoules which are then cleaned or sterilised – a time, space, and cost intensive procedure they wanted to change. The customer wanted Harter to supply a solution customised to the product and process. This was a special challenge because some of the contents of the ampoules and vials decompose unless cooled to a defined temperature within a certain period after autoclaving. Also, the vial and ampoule surfaces must be perfectly dry for subsequent packaging. This may be accomplished using Harter's air recirculation system which does not produce any exhaust air und consequently requires to filter system.

Harter designs systems to meet the specified cycle times in order to ensure a smooth production process. In this application, the autoclaving time is 120 minutes, and the drying period of the new system is 110 minutes maximum. The drying period may also be much shorter, as required for the specific product to be dried. Also, the defined temperatures vary between 30 °C and 60 °C as required for the specific sensitivity of the products. The manufacturer of pharmaceuticals uses a chamber dryer today. It consists of two drying

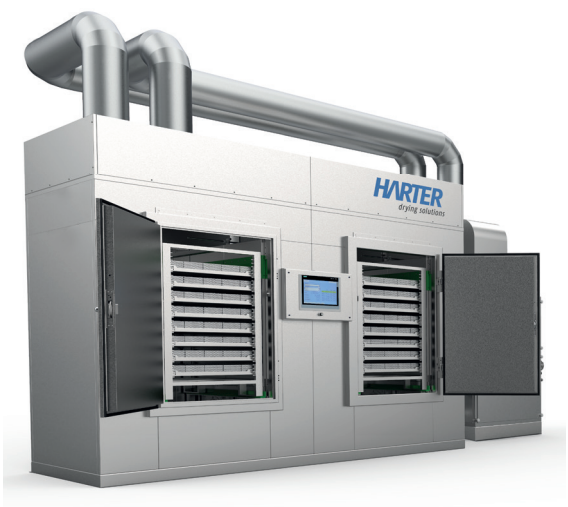



Photo: Harter

Ampoules and vials are cooled and dried in two drying chambers. Low temperature drying maintains the integrity of the sensitive content.

chambers to accommodate the autoclave carriages and one heat pump module. Drying recipes for the individual products are stored in the control system. The drying system is designed for 24/7 operation.

## Stainless steel barrels under test in the Test Center

Another tricky job was the drying of stainless steel barrels used by a pharmaceutical company for internal transport of their pharmaceutical ingredients. The barrels must be cleaned and dried after transport to prevent cross-contamination. The company had acquired a cleaning system with integrated drying provision. The latter, unfortunately, did not keep what it promised. Using compressed air, the barrels had to be manually blown dry after cleaning which cost time and money. „Many of our customers have a problem with their existing drying process because they failed to adequately delve into this operation," explains Specht.

Photo: Harter

The customer specified an exact residual humidity to be met by the internal and external surfaces of the barrels. The barrels have volumes of between 10 and 30 litres and dissimilar geometries: While some are tapered, others feature a seam that was much of a challenge for drying. Also, the different wall thicknesses of the barrels have an impact on the drying process. The biggest challenge, however, was the small opening of the barrels. Harter conducts tests in their in-house Test Center to identify the response to drying of the specific item to be dried – which for Specht forms the basis for any approach to designing a drying system. For the pharmaceutical supplier in question, very extensive series of tests with largely varying parameters were conducted to arrive at the final solution: a drying-cooling station. The drying chamber accommodates a carrier with barrels of various sizes suspended with their mouths facing down. As for air routeing, Harter developed an engineering trick to get the process air inside the barrels and out again. This air routeing technique ensures that the inner and outer surfaces of the stainless steel barrels are dehumidified by the dry process air.


Photo: Harter

## Specialist for tricky problems

An equally complex project was the drying of hoses under cleanroom conditions. A major pharmaceutical company has a research site where they develop liquid agents among other things. Hosing is used to pump liquids in test systems. The hoses must be cleaned and dried subsequently for storage and reuse. „In this case, too, the drying quality was insufficient," says Specht. The challenge for Harter was as follows. The hoses have diameters between 32 mm and 110 mm, and lengths between three and ten metres. Some are plain while some are corrugated which entails dissimilar response to drying. The tests were run at the customer specified maximum temperature of 75 °C. This temperature was required to ensure that the ten metre long spiral coiled hoses, too, were completely dehumidified. The highlight of the

Photo: Harter

Figures top left and right: Extensive series of tests were necessary to find a technical solution for drying the inside of these stainless steel drums.


Photo: Harter

**Compared with conventional drying, energy and carbon savings of up to 85 percent may be achieved using the integrated heat pump technology.**

project is that the heat pump module is located at the equipment floor above the cleanroom. Pipes run from there into the cleanroom where they hook up through various adapters.

## Air routeing, process reliability and govern ment subsidy

Heat pump assisted condensation drying is a sophisticated system using extremely dry air and adequate air routeing. By its very nature, unsaturated air readily absorbs any humidity present on the products to be dried. The air is then cooled, in two stages, in the heat pump module, then reheated, in two stages, and returned to the drying chamber. While the humidity condenses to form water, which leaves the system, there is a constant flow of air through the energetically closed system. Targeted air routeing is what turns the scales towards condensation drying success. The integrated heat pump technology is instrumental in obtaining enormous energy and carbon savings. And, exhaust-air-free drying has even more advantages. Constant parameters make the process independent of any climatic conditions. Systems are always designed in accordance with hygienic design requirements, and GMP requirements are always reflected and complied with in the design of the drying systems. Harter dryers were classified as future fit technology in 2017 and are eligible for government subsidy in Germany, Austria and Switzerland. Energy savings of up to 85 percent have been demonstrated. *(agk)*

Picture above and previous page bottom right: In the clean room, hoses of different lengths and geometries are completely are completely dried at 75 °C within 30 minutes. They are docked onto air ducts for drying. The air circuit is closed.