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Heat Pump Based Condensation Drying

Reliable Drying and Cooling in One Go

The globally operating pharmaceutical group B. Braun Avitum formally opened a new production facility at their Glandorf, Germany, site last autumn following an investment of some 50 million Euros. The facility uses an energy-saving drying process: heat pump based condensation drying by the German drying system manufacturer Harter.

Two cooling and drying tunnels installed in parallel with a closed cooling circuit (independent of external supply air to be conditioned) ensure optimum economy. The very compact design featuring control cabinets on the platform requires minimum space. Photographs: courtesy of B. Braun

The globally operating pharmaceutical group B. Braun Avitum formally opened a new production facility at their Glandorf, Germany, site last autumn following an investment of some 50 million Euros. The facility uses an energy-saving drying process: heat pump based condensation drying by the German drying system manufacturer Harter. Production processes of pharmaceuticals are complex and intricate. The see-

ingly minor drying stage is more than often not fully appreciated. If drying turns out to be unsatisfactory or utterly failing it becomes a needle's eye in the overall process. It should be considered that quality and reproducible drying improves the quality of the products while, at the same time, optimising the production process. This is the way followed, for some years now, by a renowned pharmaceutical

company in that they use heat pump based condensation drying. B. Braun operates their new production facility to produce Ecoflac Plus infusion and rinsing solutions for dialysis. Drying and cooling had been an issue considered early on at the planning stage. The company knew heat pump based condensation drying well. B. Braun had made positive experience with this alternative drying method at many of their sites. The method





B. Braun Ecoflac Plus infusion and rinsing solution for use in dialysis

is not quite new but still unknown to many operators.

Gentle and Reliable

The German drying system manufacturer Harter developed this energy-saving drying method more than 25 years ago. The technology reconciles the seemingly conflicting features low temperature and short drying time. Airgenex® condensation drying systems and their variants AIRGENEX®med and AIRGENEX®food are capable of drying - in a gentle and stress-free way at temperatures between 20 °C and 90 °C - primary and secondary packages, any product made from metal, glass or plastic, metal bands, plastic foils and thin superficial liquid films as well as organic products such as wood, food and pet food.

Extremely dry air and customised air routeing enable quality drying results to be achieved within very short times. Plus, the heat pump technology integrated in the system provides highest efficiency of the drying process. Drying is always accomplished in a closed system so that it is unaffected by environmental conditions. It also does not affect clean room and production environments. AIRGENEX®food dryers meet hygienic design requirements, AIRGENEX®med systems also comply with GMP and GAMP requirements. With minor modification, Airgenex® condensation drying systems may also be used for cooling as desired or required by the process.

The responsible project manager, Manfred Klass, knew from experience with a dozen or so Harter dryers installed at various B. Braun sites in Germany and abroad how efficient this drying technology is. Nevertheless, drying tests were scheduled to be run at the Harter premises to see if the proposed drying solution

was able to meet the specific requirements of the Ecoflac Plus line.

Drying and Cooling after Sterilisation Series of tests in the Harter pilot plant station are generally included in the services offered by the drying system manufacturer. This approach appears to be reasonable to determine the parameters relevant for successful drying such as temperature, time, humidity, air speed and airflow rate. These parameters form the basis for system layout and design, which was also applied to B Braun of Glandorf.

The results of extensive and ultimately successful tests were implemented in the final drying system as follows. Two drying-cooling tunnels matching with the two sterilisers were installed in parallel. The tunnels have a capacity of nine racks each. An insulated, low noise air ducting system connects to the AIRGENEX®med dehumidification module controlling the environmental condi-



"Adequate air routeing is essential for condensation to take full effect. Air, by nature, takes the path of least resistance. To force the air to take the right path is Harter's speciality and takes much know-how", explains Jochen Schumacher of Harter Technical Sales.



ons inside the drying-cooling space. The packages to be dried - said polyethylene infusion containers - are filled with 1000 ml of solution. After sterilisation, the plastic bottles must be dried externally, and the solution inside cooled subsequently. B. Braun's requirement was to synchronize the drying-cooling tunnel operation with the cycle time of the upstream autoclaves. The Ecoflac containers are placed on trays stacked, six at a time, to form racks. The racks leaving the steriliser are automatically loaded into the tunnel. The man-sized tunnels have two automatically controlled gates, one at the entrance and one at the exit end. The PE bottles are dried for 25 to 55 minutes, as required for the specific formulation and fill quantity. The drying temperature is about 60 °C. Upon completion of the drying process, the tunnel is automatically changed to cooling mode. The subsequent cooling process takes 60 to 90 minutes, again as required for the specific formulation and fill. The cooling temperature is 5 °C. The infusion solutions have a temperature of 55 °C before and 42 °C after cooling. The drying and cooling processes are storage programmable controlled, visualized on a touch panel and slave to the company-wide system. As required by B. Braun, full or partial loads of all products are dried and cooled completely, reliably and gently within the time desired.

A Perfect Match: Air Dehumidification and Air Routeing

The extreme efficiency of heat pump based condensation drying is attributable to its alternative physical approach. Extremely dry and, thus, unsaturated air is passed over the items to be dried - which are trays filled with infusion containers and piled atop each other in the case of B. Braun - to absorb humidity. Subsequently, the air is stripped of the moisture it carries in the AIRGENEX®med dehumidification module. The humidity is condensed and the condensate drained off the system. Then, the cooled air is reheated and recirculated. The circuit is closed. This makes the drying cycle almost emission-free. In cooling mode, the air cooler is operative only. It cools the air from the drying-cooling tunnel. The waste heat produced is drained off the



Cooling and drying tunnels are located downstream the sterilisers and operate alternately.

system through an additional condenser. The AIRGENEX®med module controlling air dehumidification is either attached to or integrated in the drying space, as desired by the customer or as required where space restrictions apply. B. Braun's dehumidification modules are placed on top of the tunnels as separate packs. Basically, AIRGENEX® drying systems may be used in continuous or batch operation. The drying chamber has a customised recirculation system installed to provide individual air routeing. For it is the perfect combination of air dehumidification and air routeing, plus air speed and airflow rate inside the drying chamber, that makes

condensation drying successful for the specific product. B. Braun's drying-cooling tunnels have nine frequency converter controlled recirculation fans installed each. They provide optimum air distribution within one rack space each and are controlled to meet the air requirement for the specific load. The recirculation system and the air routeing inside the dryer are always customised. Harter may not disclose details for confidentiality reasons. "What counts for the customer, at the end of the day, is a smooth drying-cooling process for both full and partial loads" says Jochen Schumacher.