

Vorsprung durch Technik – Audi Uses Innovative Drying

Harter Low Energy Condensation Drying System Installed in a New Decker Anlagenbau Pickling Line for Car Manufacturer Audi AG

At their new Münchsmünster, Germany, manufacturing site Audi AG installed a pickling line for which they had specified very high quality standards and maximum energy efficiency. The order covering the pickling line was awarded to Decker Anlagenbau GmbH. They, in turn, got their long-time business partner on board - Harter Oberflächen- und Umwelttechnik GmbH of Stiefenhofen, Germany, with their alternative dehumidification technology. The Decker system provided for a 90 °C dryer with an adjoining cooling zone. Harter, with their special low temperature process, was able to achieve the specified drying result at a temperature as low as 75 °C. This result was verified by several series of tests conducted in conjunction with Audi.

Saving Energy in the Drying Process

Harter GmbH drying systems operate at low temperatures. They might also be run at temperatures as high as 90 °C, if specified. Such high temperature, however, is often not required for Harter's condensation drying systems. And many an operator willingly refrained from using such high temperature considering its many well-known drawbacks. So, Harter proposed a 75 °C drying system while suggesting to run drying tests on Audi components in Harter's pilot plant station to demonstrate successful drying at a lower temperature level.

Audi was open to this suggestion and gave Harter some of their parts and body components, thus living up to their slogan "Vorsprung durch Technik" (headstart through technology). Harter conducted an extensive series of tests in a real size test dryer. From the onset, all parties involved were aware that successful drying of aluminium parts with complex geometries posed much of a challenge. Little wonder that the series of tests showed that good drying results could not be achieved unless additional air knives were used. The desired 75 °C were complied with.

Optimization Through Customization

The design of the drying system built is as follows. Eight stainless steel dryers and two so-called Airgenex® dehumidification modules were installed. One dehumidification module each provides the dry air required by four dryers. Four dryers were required each to meet the specified three minute cycle time per basket of items to be dried. There is also an air knife with a special medium pressure fan integrated in each dryer. So, the racked items have water blown off upon entry into the dryer. Then, they are completely dried inside the drying chamber. The total drying time is 11 minutes.

There are many positive effects of low temperature condensation drying for the car manufacturer. The fans used at 75 °C or lower require much less space than the ones for 90 °C drying. The dryer traverse length may thus be reduced and the whole

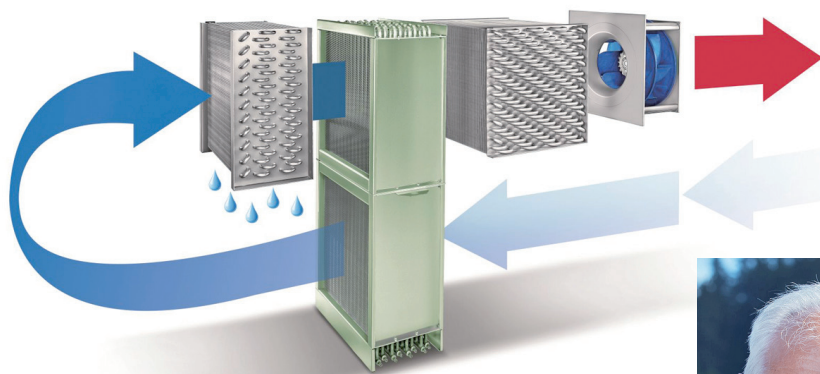


View of dryer in production operation

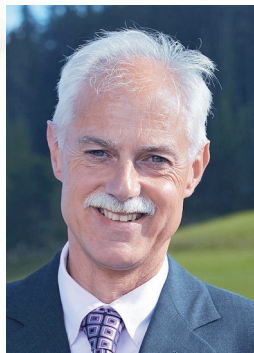
dryer downsized. Another benefit is explained by Reinhold Specht, Harter's managing owner: *Using low temperature drying, we are the only drying system manufacturer to use fans with internal motors. This is not possible with hot air drying.* Another benefit of the internal motors in these special fans is that their waste heat is retained and reused in the drying system. Otherwise such heat energy would be lost beyond retrieval.



Airgenex® dryer and medium pressure fans



Airgenex® functional diagram



Reinhold Specht,
managing owner,
Harter

Balance of Successful Co-operation

The three parties involved made up a thoroughly positive balance of this project states Bernhard Hilliges of Decker. As far as drying is concerned, the conclusion to be drawn is that heat pump based condensation drying tremendously increases the economic efficiency of a given system. The heat recuperated in the closed system reduces cost of operation. The low connected loads of the dehumidification modules result in further cost reduction. The low temperatures used for drying prevent undesired product heat-up. The drying system, which is closed in terms of energy, renders processes independent of the seasons and of varying ambient conditions in manufacturing areas. Weather impacts are essentially precluded.

The system developed by Harter provides highest efficiency for the drying process. This heat pump technology closes an economically and ecologically reasonable cycle.

Airgenex® - Operation and Special Features

How does the above-mentioned dehumidification technology work and what is special about it? The condensation drying method developed by Harter follows an alternative physical approach. In the Airgenex® dehumidification module, the air is largely dehumidified and heated. The unsaturated, extremely dry air is then passed over the material to be dried and absorbs moisture in this process. The now moist air is returned to the Airgenex® dehumidification module and subjected to dual stage cooling. This strips moisture from the air, the moisture condensates, and the condensate is drained off the system. Subsequently, the cooled air is reheated and recirculated over the items to be dried in a closed circuit.

The drying process is essentially emission-free and independent of changes in environmental conditions. Airgenex® drying may be adapted for use in any kind of process, whether batch (racks, barrels, baskets or in the chamber) or continuous (suspended, in upright or lying position). The second factor ensuring successful drying is adequate air routing. The driest air is of no avail unless passed directly onto or through the items to be dried. This is where Harter brings their full know-how to bear by reconciling

drying parameters such as temperature, air flowrate, air speed and air routing – customized to meet the requirements of the applicable process or components to the dried.

On taking stock of the energy used we can also see the benefits of this drying method. The Airgenex® modules have a connected load of 15 kW each. There are ten 1.2 kW fans installed in each dryer totalling 48 kW for each set of dryers. The connected load of the medium pressure fan for the air knife is also only 15 kW. Additionally, all dryers include an automatic lid system that ensures even better energy efficiency – altogether a drying method that saves a lot of energy.

Auxiliary heaters are often installed in dryers on customer request. These heaters are used to rapidly boost the temperature as the dryer is run up. Once the desired temperature is achieved, the auxiliary heater is powered down automatically. In Audi's application – as in many other companies recently – there was excess hot water available for boost heating. Finally, there was another benefit for Audi. The cooling zone originally planned, which would have been required for 90 °C drying, could be dropped. Components that have completed drying for some time are gripped by a robot, at which time their temperature must not exceed 45 °C.

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