Miele: Sprayed Güntner dry coolers in an adsorption refrigeration cycle

A reorganisation at Miele in Bünde, North Rhine-Westphalia, Germany, had increased the plant's cooling requirements meaning that the cooling equipment being used to date had reached its capacity limit. Having compared various processes, Miele, which is a family-run company, decided that adsorption chillers would be the best option to cover these requirements. Two sprayed Güntner GFD-type V-SHAPE Vario dry coolers act as evaporators and condensers in equal measure as part of the cooling process and also efficiently dissipate any unusable heat from the process.

Miele's Bünde site is its Competence Centre for the development and manufacturing of cooker hobs, steam ovens and warming drawers (for warming crockery, keeping food warm and low-temperature cooking). Around 600 employees work there. Cutting-edge laser welding equipment, press lines for sheet metal, laboratories, server rooms and office buildings had all pushed the site's previous technology to the limit in terms of cooling requirements. Two separate boiler houses supplied the plant with cold until 2015.

Overview

Business line:	EPC, air conditioning
Application:	Machine cooling, air conditioning
Country/Region:	Germany, Bünde
Fluid:	Water / 34 % glycol/water mixture
Product:	Güntner V-SHAPE Vario GFD dry cooler

Güntner GmbH & Co. KG
Hans-Güntner-Straße 2 – 6
82256 FÜRSTENFELDBRUCK
GERMANY
www.guentner.eu

▲ The machine room with five adsorption chillers provides air conditioning at the Miele plant in Bünde.

The family-run company's requirements for the new cooling equipment were ambitious: In addition to working efficiently, it also had to be designed so as to enable a long period of use. The principle that has now been implemented of using waste heat almost as an "environmental source of energy" more than covers the requirements and will result in considerably reduced operating costs.

Savings of around EUR 240,000 per annum could be achieved in terms of the overall energy costs for ten buildings including the production and server rooms. Incidentally, the new technology will also help to improve the site's carbon footprint. The existing refrigeration machines now have to be used only as back-up in the event of sporadic load peaks.

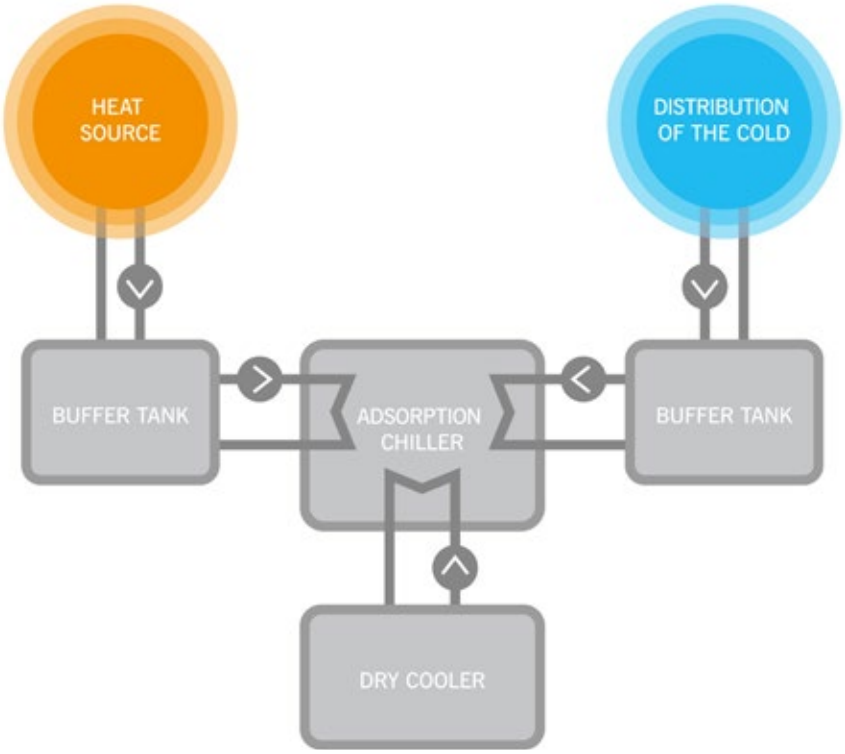
Combined cooling, heating and power generation

Miele is now using a combined cooling, heating and power (CCHP) generation at its approx. 82,600 m² plant. It consists of two cogeneration units and 11 InvenSor adsorption chillers, which together provide a cooling capacity of 110 kW. The two cogeneration units provide a total of 480 kW of electric power and 720 kW of thermal capacity from the primary energy source natural gas.

The waste heat generated by these units in turn serves as "primary energy" for the cooling with the adsorption chillers. In winter, the heating circuit is also supplied with the waste heat from the cogeneration units.

The thermally driven adsorption chillers convert waste heat into cold and use clean water as a refrigerant. They have no moving wear parts and are therefore durable and reliable. They were set up in two locations near to the cold consumers to keep routes short and minimise energy losses. In order to further optimise the operation of the refrigeration system and eliminate any performance fluctuations, a heat buffer tank and a cold buffer tank were also integrated into the system.

Initially, the adsorption cold was supposed to be used only for cooling the laser equipment and sheet metal press lines and for air-conditioning the additional rooms in the Quality Management Department. However, since the refrigerating installations had spare capacity, the server room and the laboratories have also been included in the InvenSor refrigeration system.



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Adsorption chiller with Güntner V-SHAPE Vario GFD dry coolers

An adsorption chiller carries out two sub-processes alternately, whereby hot water regenerates the adsorbers and the regenerated adsorbers then drive the evaporator for the cooling. The heat absorption from the drive circuit and the cooling circuit is controlled by the dry cooler.

Heat is used for the heating in line with demand and when it is not required, for example in the summer months, it is dissipated into the environment with the help of the two Güntner V-SHAPE Vario GFD dry coolers. One of the two dry coolers (140 kW) is located on the roof of the plant and the second (110 kW) next to the production hall.

Free cooling alone is sufficient for the process up to an ambient temperature of 15 °C. At higher temperatures, the humidification pads can be sprayed section by section and the Güntner Motor Management GMM as well as the Güntner HydroSpray Professional regulate the most economical operating mode for the speed of the EC fans and the spraying respectively.

Adsorption chillers with silica gel – the principle:

An adsorption chiller is an intermittent refrigerating machine and, in order to ensure continuous operations, consists of two adsorbers and one dry cooler, which also functions both as an evaporator and a condenser in the process. The refrigerant (water) adsorbs onto and desorbs from the solid and porous sorbent (silica gel). The entire system is placed under vacuum to lower the boiling point of the water. Both adsorbers switch counter-cyclically into the operating statuses of adsorption and regeneration as part of this process.

The refrigerant's vapour generated in the evaporator is sucked in and taken up by the adsorbent of the regenerated (dried) adsorber and hence continues the cooling process. As part of the subsequent desorption (regeneration) process, the silica gel is dried by means of the heat supply. The heat releases the water molecules from the silica gel and pushes them into the condenser. The condenser (dry cooler) extracts the heat from the vapour so that it condenses and the condensate is directed back into the evaporator and then loads the second adsorber that has been regenerated in the meantime.

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