Hop cooling by Güntner

The hop wholesaler Simon H. Steiner „Hopsteiner“ halved the operating costs for his new propane refrigerating plant, compared to the existing plant. Thanks to this efficient technology, the refrigerating plant designed by Schiessl made it to the jury short list in the „Commercial Refrigeration“ category of the Chillventa Award 2016.

Hop is what makes a good beer. It largely determines the touch of spice and the bitter aroma while offering a preservative effect. The sensitive harvest is dried, cooled and subsequently pressed into bales at the growing area for further transport. Until processing, the packages are stored at 2 °C/35.6°F.

The hop wholesaler Hopsteiner, a global player in hop business, is located in Bavaria's Hallertau region which still is the world's largest hop-growing area. Hopsteiner installed a propane refrigerating plant in the new hall and thereby doubled his cold store capacities. The new and the old storage room, both 32 metres/104.59 ft high, are adjacent to one another and have a floor area of each 66 x 25 metres/216.53 ft x 82.02 ft. Both halls have an identical cooling demand of each 120 kW/409.44 BTU/h.

Condenser, subcooler and air coolers from Güntner

The Bavarian company Heilmeier Elektro-, Kälte- und Klimatechnik from Pöttmes installed the refrigerating plant as turnkey solution based on the design by Schiessl GmbH from Oberhaching near Munich and put it into operation. Whereas the existing

Overview

Business line:	Drinks and beverages industry
Application:	Cooling of foodstuffs
Country/Region:	Germany/Au in der Hallertau
Fluid:	Propane / water/glycol mixture
Product:	Güntner floor-mounted brine air cooler FLOOR GSN
	Güntner condenser FLAT Compact GVHX with separate
	Güntner subcooler VERTICAL Compact GSVC

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▲ Two floor-mounted Güntner brine air coolers FLOOR, type GSN, transfer cold to the hop storage that is kept at a constant 2 °C/35.6 °F.

▲ A Güntner condenser FLAT Compact GVHX with separate Güntner subcooler VERTICAL Compact GSVC with microox technology on the roof of the machine room.

semi-hermetic refrigerating plant supplies two floor-mounted R-404A direct evaporators, the new propane refrigerating plant supplies cold for two floor-mounted Güntner FLOOR brine air coolers, type GSN, via a secondary glycol refrigeration circuit. The new floor-mounted Güntner brine coolers are equipped with high-pressure, speed-controlled fans with a nominal capacity of 22 kW/75.06 ft and distribute the air via an air duct system.

The propane refrigerating plant, made up of two semi-hermetic, frequency-controlled 6-cylinder compressors is located in a machine room accessible only to staff with special authorisation. All other components of the plant are installed outside on the roof of the machine room. Due to the place of installation, there is no charge limitation according to EN 378.

The propane is condensed by a Güntner condenser FLAT Compact, type GVHX, with separate subcooler VERTICAL Compact, type GSVC. Also these units' fan motors are frequency-controlled, and an electronic expansion valve is integrated into the circuit. Both Güntner components have a significantly low filling volume thanks to the Güntner microox technology. Expressed in figures, the Güntner FLAT Compact condenser GCHC has a refrigerant charge of less than 30 litres/7.93 gal(US) – with standard finoox technology, it would have been 130 litres/34.35 gal(US). Despite the additional subcooler, the charge of the propane refrigerating plant is only 44 kg/97 lb of propane in total.

Safety concept for propane

As propane is a flammable gas, special consideration was required during installation. All component parts like pressure switches and compressors are approved for flammable refrigerants. As propane is heavier than air, the appropriate gas sensor is to be installed in the lower section of the machine room. This sensor is a two-stage sensor. This means a pre-alarm sounds at which the refrigerating plant can still be operated. It is only when 25 percent of the threshold value in the machine room are reached that the power supply of all non-ATEX components is disconnected, and the

Hop processing

The female flower has a rachid in the middle at which lupulin glands develop. These glands produce essential oils that are required for the process of brewing. There are more than 200 varieties of hops, all of which affect the flavour of beer, and they can of course be combined individually.

Following harvest in late summer, the soft and wet hop cones – separated from leaves and bines – are spread and gently dried on grids in drying towers also referred to as hop kiln. For a period of about five hours, the cones fall down passing several grids until the moisture content drops to about 10 to 11 percent. Drying prevents bitter substances from forming.

The warm and dry cones are heaped up on cooling floors, which retains the valuable essential oils in the fruit and the cones' colour. The cooled hops are then pressed into 60 kg/132.15 lb bales that are, wrapped in canvas, temporarily stored in cold storage rooms. These packages are now ready for transport. They are either processed into pellets or used for extracting crystallisable bitter acid (extract of hops). But the cones are also used directly in the brewing process as cone hops.

Pilsener style beer and extra strong beer are commonly hopped more heavily than the mild and malty export beers. Depending on the sort of beer, the brewer adds 100 to 400 grams/0.13 to 0.88 lb of hop to one hectolitre (100 litres/26.42 gal(US)) of beer.

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emergency ventilation starts to exhaust the room air while a visual and acoustic alarm is triggered. The machine room is operated at low pressure so that the flammable air cannot be forced into adjoining rooms. The control panel has to be installed outside the machine room.

For testing according to PED, the largest vessel of the refrigerating plant is decisive. The largest one at this plant is the 56 litre/14.8 gal(US) receiver. This means the plant is classified acc. to Category IV and has to be tested in accordance with Module G, requiring individual testing by a licensed inspection body.

ROI already reached after two years

As the room to be cooled in both halls is identical in size and layout and as the principle of cold distribution is also the same, both plants can be compared from an economic point of view. The annual operating costs of the propane refrigerating plant are only half of those of the existing plant – €20,000/US$23,340 compared to €40,000/US$46,690 – despite heat transfer losses caused by the indirect system and an additional hydraulic pump. This means that, even though investment costs are higher, the return on investment is reached after two years already.

Assuming a 15-year period of use for both refrigerating plants, the amounts to be invested and the operating costs add up to €700,000/US$817,000 for the existing plant and €440,000/US$513,560 for the propane plant. Given the initial additional investment of about €40,000/US$46,690, the „credit balance“ is €260,000/US$303,465. To achieve this amount on the capital market with an investment of €40,000/US$46,690, the interest rate has to be 12.5 percent.

In addition to these substantial savings, the plant also met the requirements of the market incentive programme by BAFA (Federal Office for Economic Affairs and Export Control) for new, environment-friendly refrigerating plants. The TEWI value illustrates how efficient the new plant is: It is over 60 percent lower than for the existing plant. This calculation value considers direct (leaks and recovery losses) as well as indirect greenhouse effects (power consumption).

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G_REF_097_V1_EN