

Traditionally the very latest equipment

The Ottenbräu brewery in Abensberg has installed a completely new brewing plant which uses the refrigerant R723.



Line of Business:	Industrial Refrigeration
Application:	Beverage Cooling
Country / City:	Germany / Abensberg
Fluid:	R723
Product:	Condenser AGV

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You don't know Abensberg? Then you should. Abensberg is a traditional brewing centre in the hop-growing area Hallertau. The local Ottenbräu brewery is by no means the largest in the town, but that doesn't detract from the quality of its beer, on the contrary: At the "European Beer Star Award" competition in 2008, Ottenbräu's "1348 Dunkel Lager" was awarded the gold medal in the category "European style dark".

Experience does tell after all: The brewery has been in existence since 1609 which makes it one of the oldest breweries in Germany, and the Neumaier family has been brewing here for almost 200 years. To continue being able to manufacture outstanding beer the current owner, Robert Neumaier, who is a seventh generation brewer, decided to build a completely

new brewing plant. His great-grandfather had already carried out a general refurbishment of the brewery in 1906, after which it was one of the most modern brewing installations in the world. Pioneer spirit seems to run in the family.

Admittedly, various parts of the equipment have been replaced since then, but for the most part the technology was 1900 vintage. For Robert Neumaier, who likes to describe the old brewery as a “productive museum”, it was clear that only an entirely new building would enable him to bring the technology properly up to date. But even here he was unconventional. Ammonia is the refrigerant of choice for brewery applications, but it is unusual to use the equally natural mixture of ammonia with dimethylether (refrigerant R723) in the power range 3 to 15kW, with direct expansion at 8°C and an air-cooled condenser.

For the professional implementation of the refrigeration plant Robert Neumaier turned to Karl Huber from HKT Huber-Kälte-Technik GmbH in Halfing, who has many years’ experience in the construction of special units, including those for natural refrigerants, and especially when the requirements are as specific as these. Mr Huber has this to say about the implementation: “The order from the Ottenbräu brewery was a welcome opportunity for us to demonstrate the performance of R723, if only because of the great success that HKT has had with the R723 cold-water chiller that has been cooling our own production facility since 2002. And the numerous installations that are now running in the field tell the same story. The requirements for efficiency, sustainability and quiet running led to this customised brine chiller that was tailor-made for the customer.”



The Hundertwasser Tower has become one of Abensberg’s famous landmarks.

New brewery with the very latest technology

The mash house and malt store were completely rebuilt and equipped with the latest plant technology. The new brewery can process two mashes per day, together that makes 4000 litres. Around 2000 litres are made up for each mashing, and a complete mashing cycle takes about eight hours. A plate heat-exchanger has the task of cooling the hot wort from boiling point (95°C) to the proper temperature for the fermentation tanks (7°C). There yeast is added to begin the fermentation process; the main fermentation at 7 to 9°C takes eight days. The beer is then stored for 8 to 10 weeks to mature. The grains are used as livestock feed for dairy cattle.



External view of the old Ottenbräu brewery; the wooden building (on the right-hand edge of the picture) contains the "coolship", which can hold 4000 litres of beer.

New R723 refrigeration system: quiet and efficient

For the design of the new brewery the focus was on energy efficiency and sustainability. Naturally, this also applied to the refrigeration system and was the basis for the decision to use R723 as refrigerant.

R723 is a mixture of the two natural refrigerants NH₃ and dimethylether (DME) in the proportions 60% to 40%. The addition of DME reduces the discharge temperature by up to 25K and renders the refrigerant oil-soluble. This makes it possible to construct reliable directly expanding chillers with air-cooled compressors, even where the ambient temperature is as high as 35°C. Conventional cooling systems for breweries often need to use water-cooled condensers or evaporative cooling towers, which gives rise to very high operating costs. The higher suction gas density of R723 also produces 3% better efficiency than pure ammonia.

This circulation model is also able to dispense with costly components such as ammonia separators and secondary pumps. In this way, refrigeration systems drawing less than 20kW can realistically be operated with a natural refrigerant.

The brewer Robert Neumaier has this to say about it: "We can already quantify our energy savings due to the new technology. Switching from masonry fermentation vats to free-standing directly-cooled stainless-steel tanks, converting the storage tanks' air-conditioning to direct glycol cooling, converting ice bank storage to single-stage plate heat exchangers circulating precooled brewing water, plus converting to R723, together produces energy savings of ca. 40%."

The new brine chiller cools a 750 litre buffer tank (15% glycol brine) to within the range 2°C to +3°C. This is then used to cool the brewing process via the plate heat-exchangers and the storage tanks via their jackets.

Due to the difficult structural situation the chiller not only had to be modified to fit in the available space, it also had to be designed to be extremely quiet. They decided to use an AGVV series condenser made entirely of stainless steel, with a sound pressure level of 36dB (A) at 10m, which was mounted on a special base frame above the compressor on the suction side. The design of the frame was governed by the second major factor affecting the refrigeration plant: sound emissions. Since the brewery is situated in the city with its nearest neighbour living only a few feet away, every effort was made to keep the plant as quiet as possible.



Brewery owner Robert Neumaier (left) and chiller manufacturer Karl Huber (right) assessing the quietness of the glycol brine chiller. To improve the air flow and further reduce noise, the space between the condenser and the opening in the outer wall was also enclosed.

Separate frame construction for compressors

That is why the compressor was mounted on a separate frame that itself rested on shock-absorbers on the base frame of the motor unit. The frame construction for the condenser and compressor prevents vibration from the compressor being transferred to the condenser and other components; the pressure and suction tubes of the compressor each included an additional anaconda (a pipe section that functions as a vibration damper). Care was also taken to use fans that were as quiet as possible, and in addition, the condenser was housed in a wooden casing to prevent the installation room functioning as an additional resonance chamber.



The wooden barrels in the brewery cellar are used to this day for festive processions.

The energy-efficient approach also includes the small CHP plant that not only makes the brewery 100% self-supporting but also generates excess power to feed into the grid. The CHP runs on natural gas and is in operation for a total of 8700 hours per year. Its electrical power rating is 20kW, with a thermal rating of 43kW. The subsequent installation of a second flue gas heat exchanger brings the temperature of the exhaust gas down below 60°C, giving the unit an overall efficiency rating of over 97%. The generated heat is stored in a 10,000

litre buffer tank which feeds the brewery's own district heating network. An additional 400kW wood chip boiler is operated during the heating period, providing the neighbouring primary and secondary school complex, a kindergarten, an old people's home operated by the Red Cross and a bank with heating energy all the year round.

Around 2000 hectolitres of beer per annum are now brewed in Abensberg on this principle.

	Ammonia	Azeotropic mixture	Dimethylether (DME)
Chemical formula	NH ₃	60 / 40	CH ₃ -O-CH ₃
Designation	R717	Schick R723	RE170
Molar mass g/mol	17	23	46
Boiling point °C	-33,4	-36,6	-24,9
Melting point °C	-77,9	< -90	-141
Critical temp. °C	132	131	227
Critical pressure in bar	113	110	50

Physical and chemical properties of R723 compared to NH₃ and pure DME (Source: ILK Dresden)