

“From beer – for beer”

CO₂ recovery in the brewery and evaporation with GPN CO₂ process evaporators



View of one of the production sheds at Hrch. Huppmann GmbH: CO₂ recovery plants are built in individual sizes depending on the specific power needed by the brewery.

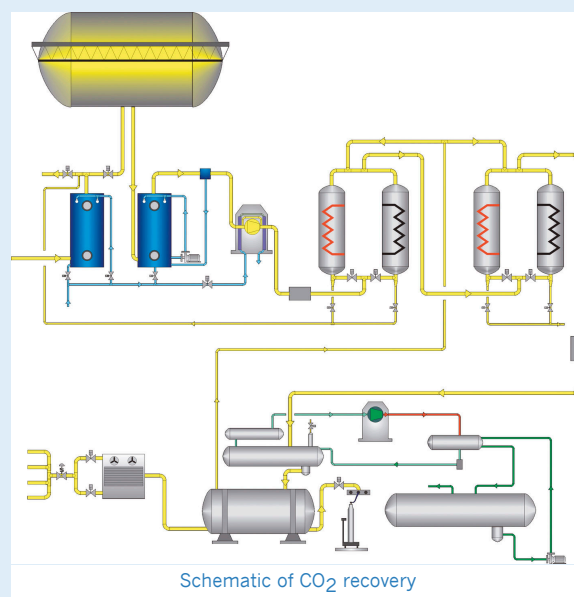
Line of Business:	Industrial Refrigeration
Application:	Beverage Cooling
Country / City:	Germany / Kitzingen
Fluid:	CO ₂
Product:	Process evaporator GPN

CO₂ is a challenging topic for brewers. The fermentation process produces vast quantities of it, which escape and have to be collected. In the further course of production, however, CO₂ in its purest form is needed again. Instead of purchasing it externally, more and more brewers are using the CO₂ recovery plants from Hrch. Huppmann GmbH. In these high-performance systems, the carbon dioxide from the brewery's own fermentation is processed and stored following strict purity principles. Special versions of the Guntner GPN CO₂ process evaporator, developed specifically for Huppmann, ensure optimum performance, quality and hygiene in reusing the processed CO₂.

“From beer – for beer” is the principle of Huppmann’s CO₂ recovery plants in a nutshell. The fully automatic systems carefully process the CO₂ that forms during fermentation. The cleansed CO₂ fulfils all requirements on food-stuffs, and can thus be added to the beer again during the brewing process. There is no longer any need to purchase carbon dioxide from an outside source. Not only do these recovery plants contribute to cost reductions; they also make an active contribution to quality assurance within the brewery, because the beer only comes into contact with carbon dioxide that is produced in-house. Thomas Murschel, head of department and project manager of the refrigeration/CO₂ technology at Huppmann, says: “Meanwhile, more than 50 breweries worldwide are using our CO₂ recovery plants. The systems offer the brewer greatest purity together with lowest oxygen content and maximum yield.” Depending on the original gravity, recovery yields up to three kilograms of CO₂ per hectolitre of green beer, which can be reverted to the needed gaseous form (vapour) with the GPN CO₂ process evaporators after storage in liquid tanks.

Recovery rate of 100 to 2,000 kg per hour

The sizes of the CO₂ recovery plants from Huppmann depend on the performance required by the respective brewery. Depending on the arrangement, recovery rates of 100 kg per hour to 2,000 kg per hour are possible. Systems in the performance range of 100 kg per hour to 500 kg per hour are built as coil systems, which take up little space and are easy to install. In the performance range of 500 kg per hour to 2,000 kg per hour, the plants are available in prefabricated, standardised assemblies, so they can be optimised to the needs of the brewery. For more individual fitting out, Huppmann also offer additional components such as stripper systems, vapour-regeneration cleaners, cascade refrigeration systems and CO₂ cylinder-filling systems, CO₂ tank-filling pumps, inert-gas exhaust controls, and O₂ gas meters. All systems have stored-program controllers with visualisation, and are operated fully automatically.



Careful cleaning

The CO₂ recovery plants from Huppmann clean the carbon dioxide from fermentation in several stages so thoroughly that it meets the brewers’ stringent requirements. To achieve this, the engineers at Huppmann harmonise the cleaning stages precisely with the specific requirements of the respective brewery, taking into account the technological and economic aspects. The functional principle is as follows: first, the gaseous CO₂ is led from the fermentation tanks to the froth separator. In this rough cleaning stage, the gas is separated from the froth that has been sucked out with it. The pre-cleaned gas then passes through a low-pressure gas vessel into the gas washer – a counter-flow washing column which is sprayed with water. This absorbs the water-soluble pollutants and aerosols. The cleansed gas is then compressed. Downstream from the CO₂ compressor is the dryer unit of the CO₂ recovery plant, which consists of two absorption vessels filled with desiccating agent. To remove the residual moisture from the gas, one vessel at a time is flooded with carbon dioxide while the other vessel is regenerating.



Güntner GPN CO₂ process evaporator in use at Paulaner brewery

There is a further cleansing system installed after the dryer unit. Here, in another two-vessel system, substances that affect smell and taste are removed. Though identical in construction, the cleanser differs from the dryer in being filled with active charcoal. The CO₂ gas is then liquefied in a bank of tubes, and freed of extraneous gases such as O₂ and N₂. Optionally, the Huppmann engineers can extend their CO₂ recovery plants to include a stripper system, so as to fulfil even the highest requirements with respect to the purity of the CO₂.

Reduced storage volume

Through compression and liquefaction, the storage volume is so reduced that even larger quantities of carbon dioxide can be buffered cheaply in a very small space. The first stage in the reduction of the volume is two-stage compression. A dry-running piston compressor compresses the carbon dioxide from fermentation to a sixteenth of its original volume. The compressed gas is then condensed in the condenser, and filled into the storage tank in liquid form. This allows the brewer to collect the carbon dioxide from fermentation as it occurs, and to reintroduce it into production when required.

GPN CO₂ process evaporator



CO₂

Entnahme von CO₂ 150 Kg/Std. bis 6000kg/Std.
Effektives Verfahren und
Konstruktion spart Geld und ist wartungsarm

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Data sheet for Güntner CO₂ process evaporator GPN

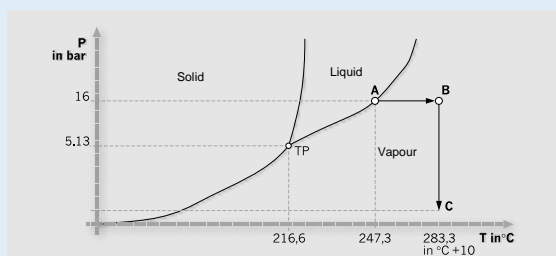
The CO₂ process evaporators that the Huppmann engineers use are specially made units from the Güntner GPN series, which Güntner have standardised specifically for the recovery plants. The evaporators take the liquid CO₂ from the storage tank, and restore it to the needed vaporous form (gas) by means of evaporation warmth. Because of the low evaporation temperature of CO₂ at approx. -26 °C, it is necessary to defrost the process evaporator regularly. To maintain continuous operation during the defrosting phases, Huppmann use only units with two separate circuits in the CO₂ recovery plants. After every eight hours of operation at a rate of 2 x 300 kilograms per hour, the Huppmann system controls automatically switch evaporation to the parallel circuit. "The Güntner process evaporators, with their optimum performance, have already thoroughly proved themselves in our CO₂ high-performance systems. The specially made units with stainless steel housing and tubes, together with

the hygienic design, have all the characteristics needed to preserve the quality of the product,” says Huppmann manager Thomas Murschel. Huppmann regard the reliability and longevity of the GPN CO₂ process evaporators as a further important criterion for the use of the units, which are characterised by high resistance to thermal and mechanical stress. Because Güntner have standardised the special versions for Huppmann, short, flexible delivery times and comprehensive technical support are also available for them. “This is a case in which you can really talk about high performance at attractive prices,” is how Huppmann manager Thomas Murschel sums it up.



The Güntner CO₂ process evaporator GPN with two-part evaporator coil: Optimum performance, highest quality, hygienic design.

Highest demands on purity and quality



CO₂ evaporation to win gaseous CO₂
A to B Evaporation and superheating in the Güntner GPN process evaporator
B to C Pressure reduction through the pressure-reduction valve mounted on the evaporator outlet

In beer brewing, the process of fermentation produces not only alcohol through the degeneration of the sugar in the malt, but also considerable quantities of carbon dioxide. Two grams of malt sugar yield roughly one gram of

alcohol and 0.96 of a gram of carbon dioxide. So more than 60 litres of CO₂ escape from one litre of beer wort. At the same time, the use of extremely pure CO₂ is indispensable after the fermentation and maturing of the beer. The quality and durability of the finished beer depend on it. It is particularly important to have as small a residual oxygen content as possible, because oxygen greatly accelerates the ageing process in the beer.

Technical maturity and system reliability

“All that a good brewer needs.” Even the slogan of the Huppmann group of companies shows their close affinity to the brewing business. Founded in 1874, the group with its headquarters in Kitzingen is today one of the world’s leading suppliers of global solutions for the brewing and foodstuffs sector. A whole series of technical developments and patents, such as the soft pelleting process with the Lenz Millstar system, have set standards worldwide. Huppmann manufacture energy storage systems for water heating, industrial refrigeration technology and CO₂ processing plants in mature technology with a high degree of system reliability. Combining this with modern process-control technology, the development of which Huppmann strongly influences through co-operation, the firm has comprehensive solution competence in all sectors of industry in which batch processing is practised. The Huppmann group of companies currently employs 400 people, and has its own development department as well as 60 experienced fitters and supervisors, who are in action worldwide. The group’s annual turnover is 290 million, of which 90 % is made in the international market.