

Turbine condensers for propylene production



Propylene is one of the most important compounds in the chemical industry. It's primarily used to make the plastic polypropylene, but also in many other processes. A propylene factory in Ningbo, China set Körting Hannover AG an exceptional process-engineering challenge. It appointed the company to design special turbine condensers to produce 600,000 tonnes of propylene per year.



The bigger turbine condenser being manufactured in China. The vast dimensions indicate the magnitude of the project.

The production process chosen for Ningbo Haiyue New Material Co. Ltd. is called Catofin and was developed by Lummus Technology in the US. Two hydrogen atoms are removed from liquid propane through catalytic dehydration. This produces propylene (C₃H₆) and hydrogen (H₂). The machinery is operated all year round and uses two steam turbines, driven by compressors, to condense air and product gas. The goal was to condense the waste steam from the turbines as effectively as possible. The first task was to condense the steam from the turbines.

Furthermore, the waste steam from the turbines was to be used for another important role. The turbine condenser is designed to perform the function of a tube and shell heat exchanger and propane is its cooling medium. This is fed in into the tube bundle in a liquid

state. Due to the heat transferred from the condensing turbine steam, some of the propane evaporates and some of it stays in a liquid state. As a result, this mixture of liquid and steam, emitted in two phases from the condenser, has a lower density when it leaves the condenser than when it entered. This difference in density produces a natural flow which allows the propane to circulate without any other form of propulsion. Therefore, the energy generated from the waste steam doesn't just provide natural flow, but also increases the effectiveness of the process as a whole.

The turbine condensers had to be designed in such a way that in addition to condensing the turbine steam, they were also able to produce and maintain natural circulation. The contents of the splitter vessel are heated from the waste heat of the turbine steam and this

is where the end product propylene is separated while in a vapour state from the circulating liquid (propane).

Exceptional turbine condensers were designed, which as well as condensing the waste steam from the turbines, also ensure that natural circulation takes place. During day-to-day operation, the machinery fully satisfies the customer's expectations.

More than 122 kilometres of pipe

Körting engineers designed two turbine condensers for the two propulsion turbines. The condensers were made on site in China because of their vast dimensions. Over 122 kilometres of pipe were added to the two condensers. The sizes of the vessels speak for themselves. While the smaller condenser is already 2.8 metres in diameter at a length of over ten metres, with a condensation area of 3,500 m², it has to condense a total of 76 tonnes of steam per hour. Consequently, 4,400 pipes each 10 metres in length were put into this condenser alone. The second condenser surpasses these dimensions. At a diameter of 3.8 metres and with a condensation area of 6,300 m², this one has to condense 120 tonnes of steam per hour. The huge condensation area was achieved by over 7,100 pipes, each 11 metres in length. At 270 tonnes, the larger condenser weighs as much as a fully loaded Airbus A340.

As well as the turbine condensers, two evacuation units were supplied to maintain the vacuum required. The condensate pumps also required were included in the order. Even if designing and manufacturing turbine condensers and venting products are familiar fields for Körting Hannover AG, this project presented an unusual challenge. The fact that the machinery was produced and operates perfectly is a clear indication of the quality of the engineering from Hanover.



Loading the two condensers for the complex job of transporting them.

< > At a glance

Supplied with	Two turbine condensers, two evacuation units, condensate pumps
Process	Catofin, PDH-propane dehydrogenation process, production of propylene
Installation site	Ningbo, China
Production quantities	600,000 tonnes of propylene per year



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