Increased plant capacity and reduced maintenance at fertilizer plant

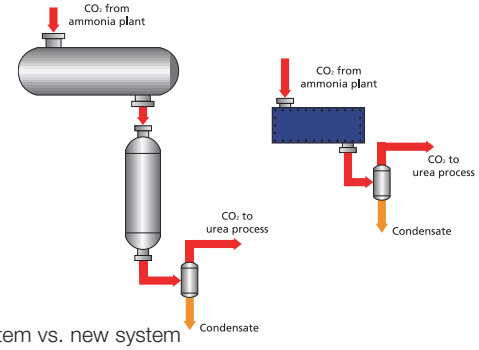
One Compabloc replaced 2 shell-and-tubes

Case story

In order to increase production capacity, DneproAZOT – a Ukrainian fertilizer manufacturer – replaced its old shell-and-tube technology with a fully welded Alfa Laval Compabloc heat exchanger.

Production of ammonia first started when the plant was brand new, right back in 1934. Set in the Ukrainian city of Dneprodzerzhinsk, DneproAZOT manufactures urea at its ammonia plant and two separate urea plants. The ammonia plant uses the "Kellogg" process with an annual capacity of approximately 450,000 tonnes, and the two urea plants have a combined annual capacity of 660,000 tonnes. In addition to producing ammonia and urea, DneproAZOT produces caustic soda and nitric acid.

At DneproAZOT, the ammonia plant feeds ammonia and carbon dioxide to the urea manufacturing facility. Production of urea, a highly efficient fertilizer, is based on the well-established "Stamicarbon" process. Carbon dioxide from the ammonia plant must be cooled before it is conveyed to the urea plant. This reduces the moisture content in the gas in order to optimize capacity in the urea production process. Once it has reached the urea plant, the carbon dioxide (CO_2) enters a compressor in order to build up pressure. This compressor requires inter-stage cooling of the CO_2 gas.



Old System vs. new system

CO_2 cooling

Originally, the carbon dioxide from the ammonia plant was cooled in two steps by means of shell-and-tube heat exchangers. In 1999, DneproAZOT turned to Alfa Laval for assistance in replacing the old shell-and-tube system. Alfa Laval suggested installation of a single Compabloc welded compact plate heat exchanger to replace the two shell-and-tube heat exchangers.

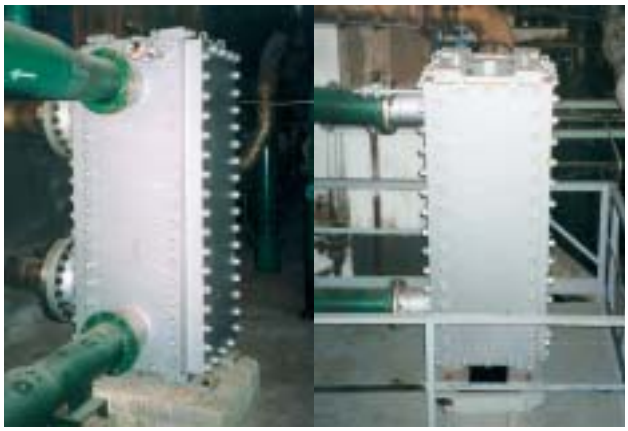
Vladislav Levchenko, production manager at the DneproAZOT ammonia department, says "We decided to try Compabloc for gas cooling applications and I must say that we are very pleased with the result. With the old shell-and-tube system, it was only possible to cool the gas down to 65°C during the summer. With Compabloc, we can now reach temperatures as low as 35°C using the same cooling water, which is taken from the Dnieper river. This means that more water can be removed from the gas, resulting in increased urea production. Compabloc not only solved our cooling requirements, but also helped us to increase profit."

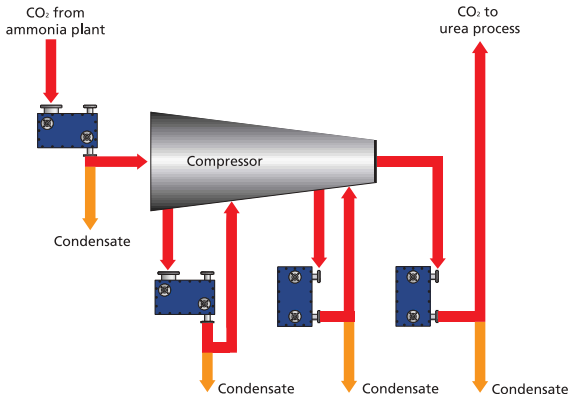
The Alfa Laval Compabloc heat exchanger has operated perfectly since it was installed in 2000. Regular inspections are carried out once a year, compared with frequent opening and cleaning of the old shell-and-tube system, which led to severe production losses.

Another advantage in replacing the two bulky shell-and-tube heat exchangers with Compabloc is its compactness. The Compabloc heat exchanger need only one third of the space required by the old installation.

Inter-stage cooling of CO_2 gas

After successfully installing the CO_2 cooler in the ammonia plant, DneproAZOT also investigated opportunities for increasing efficiency in other parts of the process, such as inter-stage cooling in the compressor stage of the urea process. This led to replacing the shell-and-tube heat exchangers, with their carbon steel shell and stainless steel tubes, with stainless steel Compabloc heat exchangers in three steps of inter-stage cooling.





Efficient, reliable compressor cooling

The old shell-and-tube heat exchangers were three times the size of the new Compabloc replacement, and they required massive foundations, stretching over two floors of the plant. Alexander Sudak, production manager at one of the DneproAZOT urea plants, says “The old shell-and-tube units were very difficult to clean, often suffered from interleakage, and had a very low heat transfer rate. Today, we are satisfied with the temperature programme, the compressor is stable in operation, we have decreased the amount of cooling water needed and we have increased urea production capacity to 1300 tonnes per day!”

The three Compabloc heat exchangers have been in operation for more than a year, without any problems whatsoever. The compactness of the Compabloc units also means extremely short response times following adjustments to the process.

Features of Compabloc

The Compabloc welded plate heat exchanger from Alfa Laval is designed for operation in aggressive environments or in connection with hazardous processes. It is available in six different models, with heat transfer areas ranging between 0.7 to 320 m^2 (7 to 3450 ft^2). The heat transfer area is made up of a stack of corrugated plates alternately welded to form channels. The plate pack is supported by an upper and lower head and four side panels, which accommodate the connections. The 100% welded plate pack extends design limits and provides improved reliability. With no gaskets between the plates, compatibility concerns are eliminated, and maintenance costs are reduced. Access for inspection and cleaning is both rapid and easy.

Plate materials

Stainless steel 316L, 304L, 317L, 904L
Avesta 254 SMO, AL6XN
Titanium, Pd-stabilized titanium
Alloy C276, C22, B2
Hastelloy™ 2000

Specifications

Design pressure min/max:	Vacuum/32 barg (460 psig)
Design temperature min/max:	-40/350°C (-20/660°F)
Connections:	ANSI or DIN flange
Construction codes:	ASME (with or without U-stamp), or ADM (code used for PED and CE marking)

PPI00026EN 0304