



# Alfa Laval Packinox for hydrotreating

## Feed/effluent heat exchangers and stripper bottoms heat exchangers

### Feed/effluent heat exchangers

The Alfa Laval Packinox Feed/Effluent Heat Exchanger for hydrotreaters is a large heat transfer bundle inside a pressure vessel. All heat transfer takes place inside the bundle, which operates in true counter-current flow. Four bellows compensate for differential thermal expansion between the hot stainless steel bundle and the relatively cool low alloy pressure vessel. Top and bottom end manholes facilitate access for maintenance or repairs.

Because the bundle has no gaskets to soften and leak, the exchanger can operate in temperatures as high as 550°C (1000°F). Maximum operating pressure is the same as for the pressure vessel. The low number of high-pressure flanges in hot hydrogen service such as gasoil hydrodesulfurization greatly reduces combustible vapor leaks and emissions of toxic hydrocarbons and H<sub>2</sub>S.

Refiners see this as a major step forward in plant safety and environmental performance for new units and revamps alike. HDS flue gas emissions of SO<sub>x</sub> and NO<sub>x</sub> are also reduced because charge heater duty is lower – or even zero – with Alfa Laval Packinox technology.

Motivated by cheaper, cleaner, safer operation than offered by other designs, refiners now more than ever find Alfa Laval Packinox heat exchangers an efficient way to optimize their hydrotreaters.

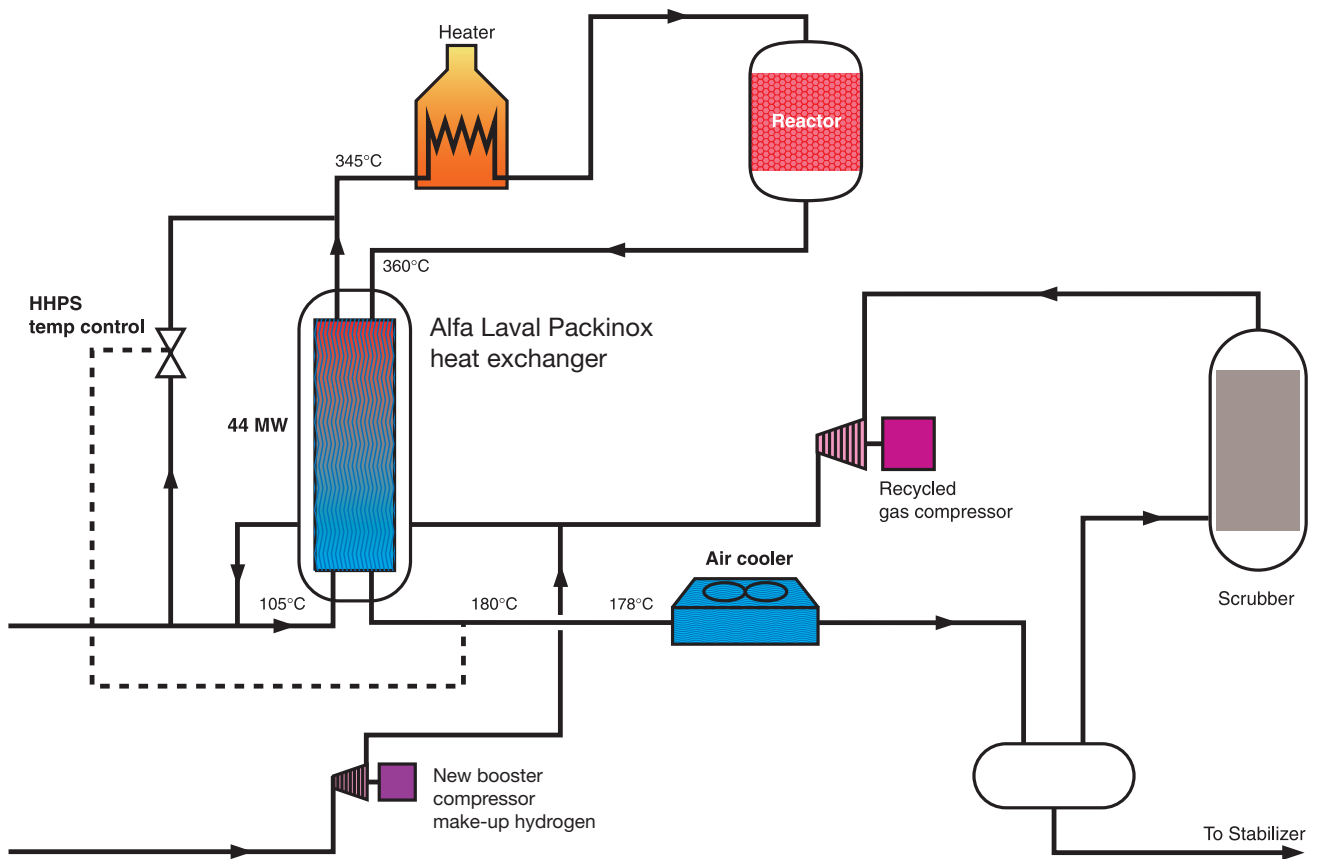
Alfa Laval Packinox devotes considerable resources to research and development of heat exchangers for hydrotreaters in response to the continued interest the refining industry has shown since the first Alfa Laval Packinox Feed/Effluent Heat Exchanger was installed in a hydrotreating unit in 1993.



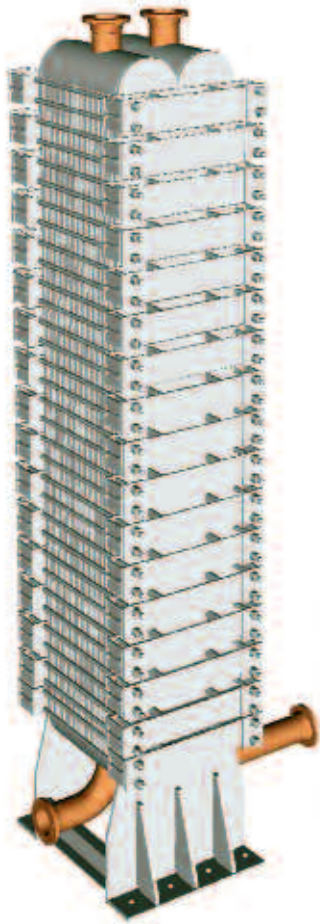
In a project to bring the output of a refinery processing kerosene/diesel/LCO feed into line with ultra low sulfur diesel specifications of 5 ppm, a distillate HDS unit was upgraded with an Alfa Laval Packinox feed/effluent heat exchanger.

**The upgrade includes the following:**

- Single shell Alfa Laval Packinox heat exchanger with a design pressure of 80 bar
- Partial liquid feed by-pass to maintain HHPS temperature
- Small, variable duty at “make up” charge heater



Feed/effluent heat exchanger solution



### Stripper bottoms heat exchangers

The Alfa Laval Packinox Stripper Bottoms Heat Exchanger was developed to recover stripper bottoms heat into stripper feed or reactor feed.

This heat exchanger is suited to medium operating temperatures and pressures. Considerable cost is saved by eliminating the pressure vessel in favor of a simple set of bolted tie rods which securely clamp and compress the all-welded plate bundle. Additional savings are achieved on bellows and mid-bundle water injection system, as the Alfa Laval Packinox Stripper Bottoms Heat Exchanger requires neither.

#### Design information (from a commercial case)

Bundle cross-section:	2.0 m x 2.0 m
Overall length:	15 m
Design pressure:	20 barg
Design temperature:	250°C

The flow diagrams are taken from a cold separator HDS project design (fig. 1) for which Alfa Laval Packinox's solution (fig. 2) called for replacing a train of S&Ts with a Alfa Laval Packinox Feed/Effluent Heat Exchanger for hydrotreating processes and installing a Stripper Bottoms Heat Exchanger replacing of two S&Ts.

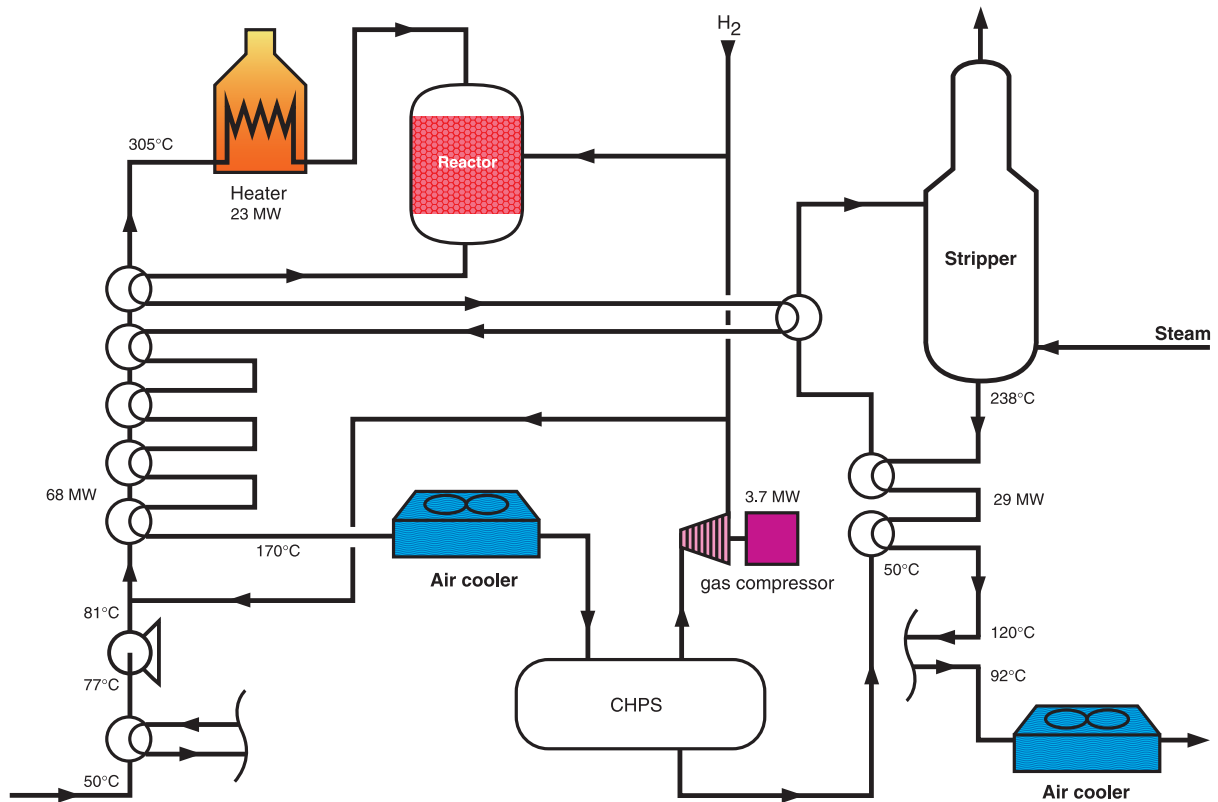


fig. 1

Because Alfa Laval Packinox provides much lower approach temperatures, the combined effect of the Feed/Effluent Heat Exchanger and the Stripper Bottoms Heat Exchanger increased charge heater inlet temperature from 305°C to 350°C, thus lowering heater operating duty by about 80% (18 MW\*) for annual savings of US\$ 2.6 million.

In addition, the Alfa Laval Packinox Feed/Effluent Heat Exchanger offers lower pressure drop than the train of five S&Ts. As a result, total pressure drop in the overall reactor

circuit falls from 18 bar to 11 bar. For the same total flow of recycle gas, the compressor's power consumption decreases from 3.7 MW to 2.2 MW from, thus economizing another US\$ 0.7 million per year\*\*.

Total energy savings resulting from the replacement of seven S&Ts with a Alfa Laval Packinox Feed/Effluent Heat Exchanger for hydrotreating processes and a Alfa Laval Packinox Stripper Bottoms Heat Exchanger is US\$ 3.3 million per year.

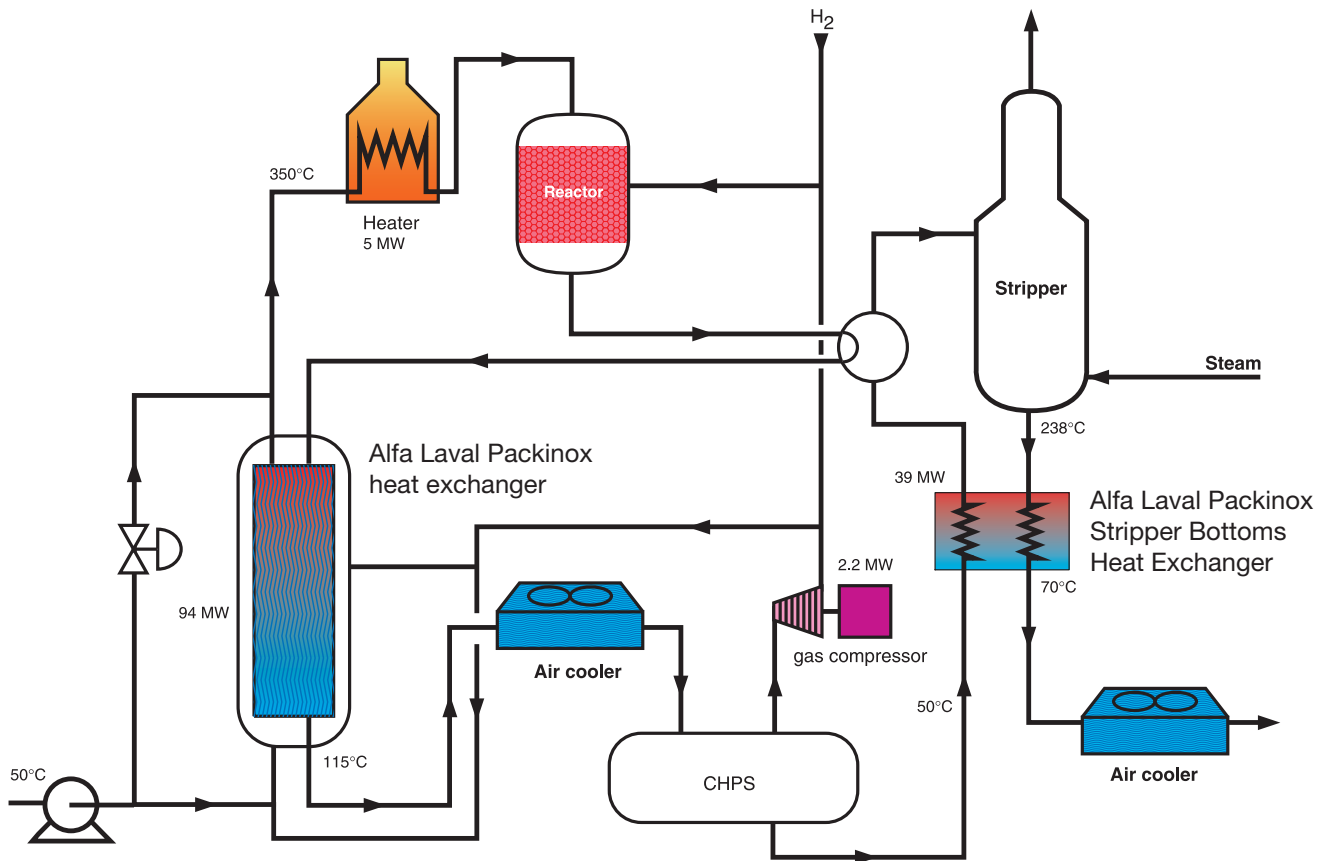


fig. 2

\* saving about 48 ton/day of fuel gas, with charge heater process duty based on gasoil heating in a radiant cell at typical furnace efficiency of 65% (or less), gas prices at US\$ 160/ton and 340 stream days/year.

\*\* assuming US\$ 60 per MWh.

#### How to contact Alfa Laval

Up-to-date Alfa Laval contact details for all countries are always available on our website at [www.alfalaval.com](http://www.alfalaval.com)