



# Alfa Laval Packinox

## Combined feed/effluent heat exchangers

### Introduction

Alfa Laval Packinox combined feed/effluent heat exchangers are ideal for demanding heat recovery duties in processes with high temperatures and pressures.

Thanks to its unique design, a Packinox combines the thermal and hydraulic efficiency of welded plate heat exchangers with the high-temperature and high-pressure resistance of shell-and-tube heat exchangers.

The result is a compact heat exchanger with high capacity, high heat recovery efficiency and minimal pressure drop.

### Applications

Alfa Laval Packinox heat exchangers are used as feed/effluent heat exchangers in:

- Catalytic reforming
- Paraxylene production
- Hydrotreating/hydrodesulfurization
- Paraffin dehydrogenation for LAB Plants

There are currently more than 350 Packinox heat exchangers in operation in refineries and petrochemical plants around the world.

### Benefits

An Alfa Laval Packinox offers many benefits over a shell-and-tube solution:

- High degree of heat recovery – HAT (hot approach temperature) as low as 20°C
- Compact size compared to a comparable shell-and-tube solution
- Low CAPEX and OPEX
- High ROI
- Optimal mixing of the liquid feed and the recycle gas
- Low pressure drop
- Ideal conditions for high yield
- Robust design and reliable operation
- Guaranteed performance
- Fully customized design for optimal performance
- Continuous follow-up from Alfa Laval

### How it works

The core of an Alfa Laval Packinox heat exchanger is a fully welded bundle of heat transfer plates. The counter-current flow of the hot and cold media in combination with the high turbulence maximizes heat transfer between the streams.

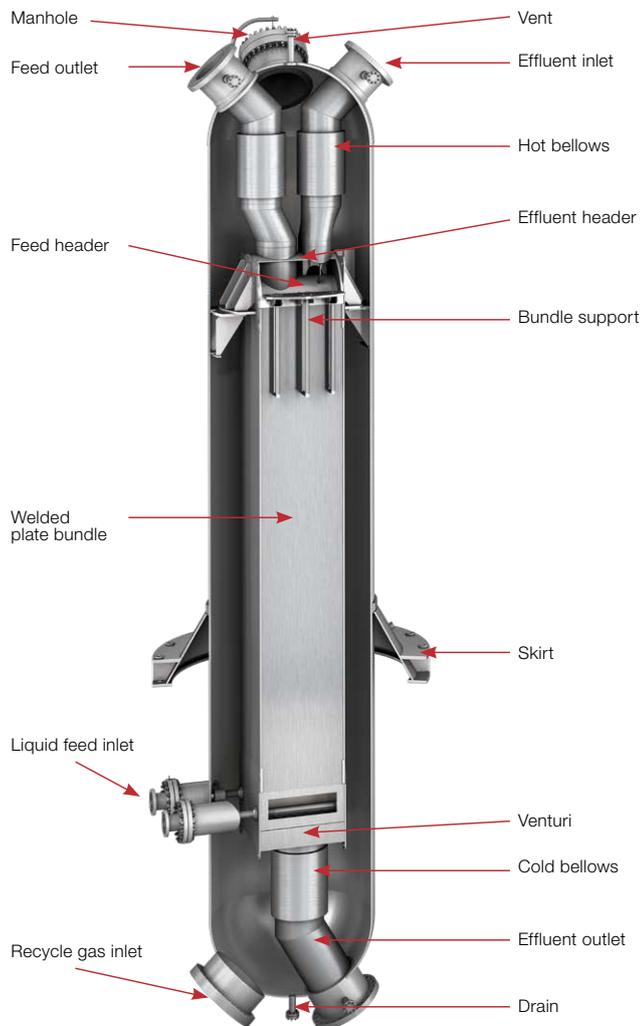


The plate bundle resides inside a pressure vessel filled with the cold-stream gas under high pressure. This means the plate bundle is only exposed to the differential pressure between the hot and cold streams, thereby minimizing the mechanical stress on the plate welds.

### Effective mixing

The liquid feed (naphtha or mixed xylene) enters a Packinox heat exchanger from the side and is mixed with the recycle gas in the mixing chamber. The liquid is sprayed into the recycle gas using Alfa Laval's patented Spray Bars, ensuring a more homogenous liquid/gas mixture compared to traditional mixing in the feed pipe. This optimizes heat transfer in the plate bundle and minimizes mechanical stress.

Thanks to Alfa Laval's Spray Bar technology and the possibility to optimize the plates' corrugation pattern according to operating conditions, Packinox heat exchangers offer greater flexibility than shell-and-tubes when setting the ratio between the liquid feed and the recycle gas, allowing for smaller gas flows without compromising lifting efficiency.



### Robust design

Alfa Laval Packinox heat exchangers are designed and built for maximum operating reliability. The chevron pattern on the heat transfer plates is produced using underwater explosion forming, a technique developed by Alfa Laval, in order to maximize the mechanical strength of plates. Laser welding is used to ensure high weld quality and strength.

We operate under a rigorous quality management system, and thorough inspections are performed at each step of the production process.

### Accessible for service

The plate pack is accessible for service through a manhole at the top of the unit and through one of the bellows from the bottom. All welds can be repaired and channels can be plugged if necessary.

For more information about our service offer, see the Alfa Laval Packinox service leaflet or our website: [www.alfalaval.com/packinox](http://www.alfalaval.com/packinox).

### Customized design

Each Packinox heat exchanger is designed and built to the exact conditions it will operate under. Performance is optimized by the right selection of plate pattern, gap distance, plate dimensions, number of plates,  $\Delta T$  and pressure drop. The result is outstanding performance and high cost efficiency.

### Lifting Controller

Alfa Laval's Lifting Controller software helps operators optimize lifting, and is available for all Packinox heat exchangers. An easy-to-read indicator shows when the liquid feed/recycle gas ratio is optimal, making it easy to set the correct flow rate of the gas.

The combination of Spray Bar technology, plate pattern optimization and the Lifting Controller software gives operators great flexibility and makes it easy to optimize the liquid feed/recycle gas ratio, for example when changing feedstock.

### Low pressure drop with Wide Opening Design

A low operating pressure is key for high yield in catalytic reforming and xylene production processes. Packinox heat exchangers combine excellent heat recovery with low pressure drop, usually within the range of 0.5 to 1.5 bar (total flange-to-flange, both sides).

Thanks to Alfa Laval's unique Wide Opening Design plates, the pressure drop over the distribution area of the plates is very low. This means more of the available pressure drop can be utilized in the heat transfer area of the plate with maximum heat recovery as a result.



Packinox heat exchanger installed in a catalytic reforming unit.

## Installation

Alfa Laval Packinox heat exchangers are installed in an upright position (the pressure vessel is fitted with a skirt or brackets) within minimal footprint.

## Current size range

Shell diameter: 1 m to 6 m (3 to 18 ft.)  
Shell total length: 10 m to 20 m (30 to 65 ft.)  
Total weight: 30 to 400 metric tons (60,000 lb. to 600,000 lb.)  
Equivalent S&T surface area: 1,000 to 35,000 m<sup>2</sup> (10,000 to 375,000 sq. ft.) in a single shell.

## Construction materials

### Bundle

Stainless steel (SS 321, SS 316, SS 304, etc.). Qualified construction materials include all types of austenitic stainless steel, including highly corrosion resistant Alloy 6 Mo.

### Vessel

Qualified construction materials include 1.25 Cr 0.5 Mo, 2.25 Cr 1.0 Mo, stainless steel, carbon steel or other qualities as per customer requirements

### Bellows

Inconel, Incoloy or other, subject to demand.

## Pressure and temperature operating limits

### Temperature

The typical design temperature range is between 300°C (570°F) and 550°C (570 - 1,000°F). Design temperatures as high as 650°C (1,200°F) have been achieved.

Note: internal bellows compensate for thermal differential expansion.

### Pressure

Our reference list includes exchangers with design pressures ranging from 3 bar to 140 bar.

Differential pressure between feed and effluent is the bundle's only mechanical limitation. As a conservative measure, we currently limit this value to 55 bar (depending on the configuration and operating temperature).

## Codes and Standards

Alfa Laval Packinox's quality and environmental management systems are certified according to ISO 9001 and ISO 14001.

We comply with all international standards for pressure vessel manufacturing, for example ASME U, U2, R, NB, as well as all local standards (PED 97/23 EC, ATEX 94/9 EC, AS 12 10, EN standards, CODAP, AD Merkblätter, IS 875 - IS 1893, RACCOLTA VSR-M-S, High Pressure Gas Control Law, Gosgortekhnadzor Permit, Gost R GOST, PD PTM 2615, SNIP II.11, OTY1, etc.)

## Key features



### Lifting Controller

The Lifting Controller software ensures maximum flexibility and makes it easy to set the optimum gas flow.



### Wide Opening Design

With Wide Opening Design plates, as much as possible of the available pressure drop is used for heat recovery.



### Lifetime Follow-Up

We continuously collect operating data, and make recommendations on how to improve performance.



### Spray Bar

Alfa Laval's Spray Bar technology ensures perfect mixing of the liquid feed and the recycle gas, resulting in high heat transfer and reliable operation.



### Explosion Forming

The one-step forming process makes the heat transfer plates strong and maximizes operating reliability.



Alfa Laval's unique Spray Bar technology ensures effective mixing of the liquid feed and the recycle gas. The gas enters from the bottom and passes the Spray Bars where the liquid feed is sprayed into the gas.

## 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)