



## Spiral Heat Exchanger solves costly fouling problems

Crude oil refinery, USA

A major US refinery was experiencing severe fouling and plugging problems in two shell-and-tube (S&T) heat exchangers installed to cool desalter effluent using cooling water. In 2008, on Alfa Laval's recommendation, the refinery replaced the two S&Ts with a fouling-resistant Spiral Heat Exchanger (SHE). The result exceeded expectations.

The SHE gives continuous problem-free operation, higher process reliability and more consistent wastewater treatment temperatures than the S&Ts. Best of all, there has been no plugging and, based on savings in maintenance and cleaning costs alone, the payback time was less than 18 months. The on-site engineers were delighted! As one remarked: "I think the technology is great!"

### Cooling the effluent water

In the desalting process crude oil is contacted with hot water to remove impurities such as chloride salts and particulate matter before continuing through the crude preheat train into the refinery. The solids and salts collect in the process and must be flushed out with the effluent water.

In a process called "mudwashing", solids are mixed with the effluent water and removed. The effluent water, now contaminated with oil, suspended solids, and dissolved solids, needs to be cooled before travelling downstream to wastewater treatment.

### Heat transfer specialists consulted

The process of cooling the effluent water has caused fouling headaches in



As this report from a US oil refinery shows, due to their self-cleaning effect, spiral heat exchangers from Alfa Laval can virtually eliminate heat exchanger fouling in critical refinery processes.

refineries for years, as was the case in the refinery in this report. Due to continuous, costly fouling and plugging problems, it was necessary to shut down the S&Ts cooling the desalter effluent water on average once a month.

The unplanned downtime caused problems for the wastewater treatment plant, since the effluent temperature was poorly regulated and frequently out of specification. Finally, the refinery contacted Alfa Laval seeking a solution to the problem.

### SHE recommended

Alfa Laval recommended and supplied an SHE – well-proven technology for fouling applications. Its single-channel design resists plugging while the fully counter-current flow paths allow for effective heat recovery in a compact space. It copes easily with the solids in the stream and can handle process interruptions. Due to the efficiency of the design, it was possible to install just one SHE. This had only 50 percent of the surface area of the S&Ts yet still outperformed them in the long term.

### Continuous problem-free operation

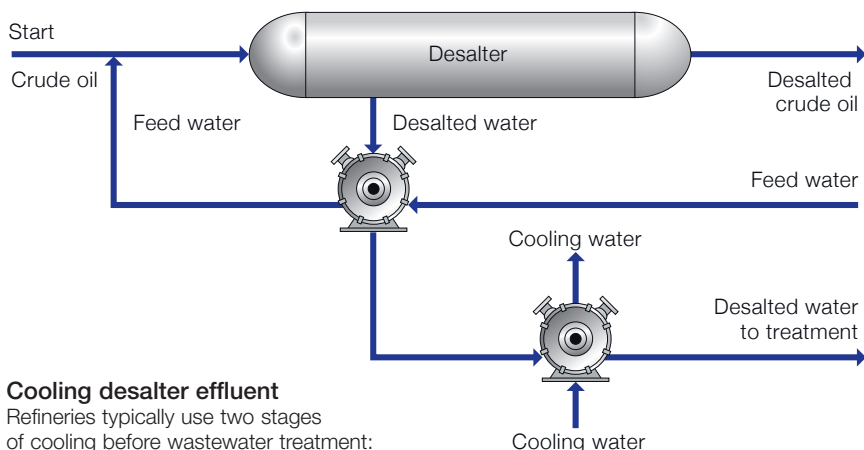
Shortly after start-up of the SHE, the refinery noticed with satisfaction that the pressure drop through the unit remained stable. Increasing pressure drop had frequently been one of the reasons the refinery needed to shut the S&Ts down for cleaning. The SHE continued to provide trouble-free operation and, over an extended period, only a moderate reduction in thermal performance was measured.

### Cleaned once since start-up

In June 2009, after 14 months of operation, the refinery opened the SHE for the first time to check for fouling – an operation made easy by the option of integral davits on each cover. To their surprise, the engineers found only a thin greasy coating on the effluent side and minor scale on the cooling water side. The unit was mechanically hydroblasted and placed back in service the next day.

By July 2010, it could be noted that the SHE had only been cleaned once since start-up and was still operating efficiently. According to an on-site engineer: "It's doing well – I've heard no complaints."

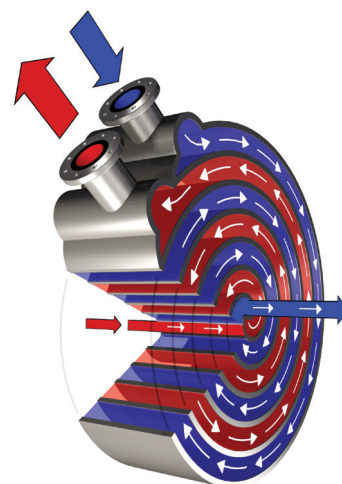
For more information on how spiral heat exchangers can eliminate fouling in desalting and other critical refinery processes, please contact an Alfa Laval refinery specialist.



### Cooling desalter effluent

Refineries typically use two stages of cooling before wastewater treatment:

1. Effluent cooling by preheating feed water
2. Effluent cooling with cooling water



The spiral flow pattern in a spiral heat exchanger ensures a continuous, ultra-efficient self-cleaning effect.

### Impressive savings for the refinery

Unit	Service	Cleaning frequency, times per year	Cost per cleaning*	Total cleaning costs per year
2 Shell-and-tubes	Desalter effluent cooling	12	USD 6,000	USD 72,000
1 Spiral Heat Exchanger	Desalter effluent cooling	0.86	USD 3,250	USD 2,786

\*S&T Cleaning costs calculated as \$2,500 (disassembly/assembly tube side, 2 units) + \$2,500 (cleaning rig: day 1 + \$1,000 cleaning rig: day 2)  
Spiral Cleaning Costs calculated as \$1,250 (disassembly/assembly 1 unit) + \$2,000 (cleaning rig: 5.5 hours)

#### SpiralPro

##### Design temperature

-100°C (-148°F) to 400°C (752°F)

##### Design pressure

Full vacuum to 100 barg (1450 psig)

##### Maximum heat transfer area

900 m<sup>2</sup> (9,688 ft<sup>2</sup>)

##### Material of construction

Carbon steel, 316L/304/316Ti, 2205 Duplex, Titanium, Nickel alloys

##### Duties

Liquid-to-liquid or steam heater



#### SpiralCond

##### Design temperature

-100°C (-148°F) to 400°C (752°F)

##### Design pressure

Full vacuum to 100 barg (1450 psig)

##### Maximum heat transfer area

2,500 m<sup>2</sup> (26,910 ft<sup>2</sup>) (for stacked columns)

##### Material of construction

Carbon steel, 316L/304/316Ti, 2205 Duplex, Titanium, Nickel alloys

##### Duties

Vacuum condensation or evaporation



#### Unique features

Built with unique features that prevent fouling, Alfa Laval spiral heat exchangers ensure efficient, reliable performance with high uptime and low maintenance requirements.



##### SelfClean

Design that prevents fouling



##### RollWeld

Automated, reliable channel closures



##### HighP

A custom solution for high-pressure duties



##### ALOnsite

Qualified support at your facility

Learn more at [www.alfalaval.com/spirals](http://www.alfalaval.com/spirals)

#### 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).