A test passed with flying colours

How eight Alfa Laval spiral heat exchangers saved €1,647,000 a year

Case story

When a Russian oil company acquired a new refinery in 1999, modernization and cost control topped the agenda. A key concern was the high cost of maintenance for the heat exchangers used in the visbreaking process at the new plant. Alfa Laval was asked to prove that their spiral heat exchangers could solve the problem. Alfa Laval delivered that proof – along with some impressive savings.

It's well known that in oil refineries, many processes are subject to problems with heavy fouling that affect overall plant performance and profitability. Operating costs associated with fouling in refinery heat exchangers include increased fuel needs and pumping power, increased CO_2 emissions, and excessive maintenance costs and downtime.

Since 2002, spiral heat exchangers from Alfa Laval have handled the entire visbreaking bottom cooling duty at the refinery.

Fast Facts:

The challenge

- The customer acquired a new refinery in 1999
- The new refinery was plagued by extremely high maintenance costs – €1,650,000 yearly – for the shell and tube heat exchangers used in heavily fouling visbreaking bottom cooling duties

The solution

- Two spiral heat exchangers installed in 2001
- Six more spiral heat exchangers installed in 2002
- In all, eight spiral heat exchangers replaced 12 shell and tube heat exchangers
- The entire visbreaking bottom cooling duty is now handled by spiral heat exchangers

The benefits

- Maintenance costs dropped from €1,650,000 yearly to €3000
- One year payback period
- Insignificant fouling since commissioning
- More stable and profitable throughput and production
- Better heat-transfer efficiency
- Increased safety

The new refinery was no exception. In particular, maintenance costs in connection with the heavily fouling visbreaking bottom cooling duties reached a whopping €1,650,000.

Tailor-made for fouling applications

With its single-channel flow, uniform velocity profile, self-cleaning effect and lack of dead zones, Alfa Laval's spiral heat exchanger is tailor-made for heavily fouling applications. In addition, the spiral flow and counter-current design make the spiral heat exchanger more efficient for heat recovery than traditional shell-and-tube heat exchangers.

The company to Alfa Laval: Prove it

The parent company had already installed a number of Alfa Laval's Compabloc compact heat exchangers in other plants during revamps. These Compablocs had proven to be both robust and economical, and Alfa Laval had shown itself to be a reliable partner. So it was a short step for the company to contact Alfa Laval about alternatives to the high-maintenance shell-and-tube heat exchangers in the new plant.

Table 1

Visbreaking unit	Shell-and-tube heat exchangers	Spiral heat exchangers
No. of heat exchangers	12	8
Operating period	Before 2002	Since 2002
No. of cleaning interventions	Always ongoing cleaning	1 per year for inspection
Duration per intervention	4 days	1 day
Cost per intervention (EUR)	4,500	3,000
Yearly cost maintenance (EUR)	1,650,000	3,000
SHE payback period based on cleaning costs		12 months

Nevertheless, spiral heat exchangers were new for the company. So in 2001 when Alfa Laval presented their proposal for replacing the 12 shell-and-tube heat exchangers at the new plant with eight spiral heat exchangers, the company wanted proof that their investment would payoff.

Proof positive: Payback in just one year

Just two of the eight spiral heat exchangers in Alfa Laval's proposal were commissioned in January 2001 as a pilot project. A year later, the company was convinced.

The company saved enough money in the first year on maintenance costs alone to pay for the new heat exchangers (see table 1). Before the spiral heat exchangers were installed, the company was constantly doing maintenance work on their shell-and-tube heat exchangers. The cost was enormous – in both money and downtime. The spiral heat exchangers on the other hand were opened for inspection once during the first year – and no cleaning was needed.

Insignificant fouling

In 2002, the new plant's 12 shell-and-tube heat exchangers were entirely replaced by the original spiral heat exchangers plus six more. Today, the eight spiral heat exchangers handle the entire visbreaking bottom cooling duty at the new plant. They're opened once a year for routine inspection and preventative cleaning. So far fouling has been insignificant.

Two of the eight spiral heat exchangers.

And that's not all ...

The company saved €1,647,000 per year on maintenance alone thanks to Alfa Laval's spiral heat exchangers. But there are other savings as well. For example, heat-transfer efficiency is up to four times higher now, safety has increased and throughput and production are more stable and more profitable.

The process

Visbreaking reduces the pour point and the viscosity of waxy residues used for blending with lighter fuel oils. Middle distillates may also be produced, depending on product demand.

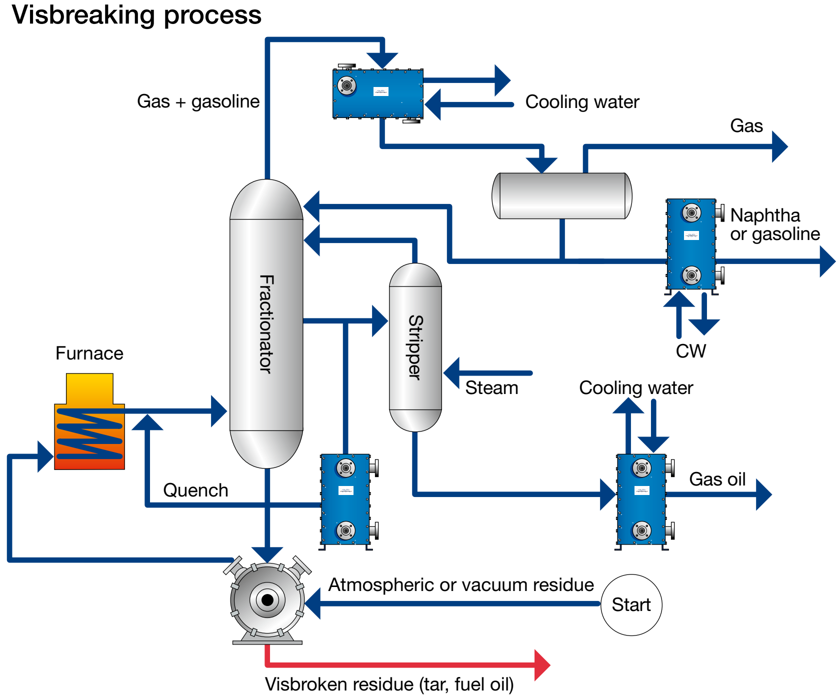
The process is a mild form of thermal cracking that significantly lowers the viscosity of heavy crude-oil residue without affecting the boiling point range. The feed, which is made up of residues from the atmospheric or vacuum distillation towers, is heated to 425 – 500°C (800 – 950°F) at atmospheric pressure and mildly cracked in a furnace.

The time in the furnace is carefully limited to prevent much of the reaction from taking place and clogging the furnace tubes. The heated feed is then charged to a reaction chamber, which is kept at a pressure high enough to permit cracking of the large molecules but restrict coke formation.

After the reaction chamber, the process fluid is cooled by means of quenching with cool gas oil to inhibit further cracking and then charged to a distillation column for separation into components. Visbreaking units typically convert about 15 percent of the feedstock to naphtha and diesel oils and produce a lower-viscosity residual fuel

The role of spiral heat exchangers in the process is to preheat the feed entering the visbreaking unit by cooling the visbroken residue:

Visbreaking process



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.