



# Hydrocracking

In today's competitive environment, successfully upgrading heavy feedstocks into valuable products using a hydrocracking process can be the deciding factor in a refinery's profitability. No matter the process used – fixed bed, ebullated bed or slurry hydrocracking, Alfa Laval has the expertise to help refineries increase conversion rates, boost energy efficiency, reduce maintenance and improve profitability.



### Alfa Laval in hydrocracking

Today, Alfa Laval has supplied more than 700 Alfa Laval Olmi high-pressure shell-and-tube heat exchangers and air coolers to the reaction section of hydrocracking units. In addition to this, we have delivered more than 50 Alfa Laval spiral heat exchangers for recovering energy from and cooling of high-fouling unconverted oil fractions. This is on top of the more than 30 Alfa Laval Compabloc heat exchangers that are used in these processes to maximize efficiency in the fractionation section.

To learn how other refineries use Alfa Laval solutions in their hydrocracking processes, visit [alfalaval.com/refinery/experience](https://www.alfalaval.com/refinery/experience).

### Capacity improvement

If throughput in an existing process unit is limited by reactor heater capacity, increasing the preheating of the unit feed can de-bottleneck the process. With Alfa Laval spiral heat exchangers, you can recover energy from the high-fouling unconverted oil into unit feed, thereby off-loading the reactor furnace and making it possible to increase the capacity.

### Product yield improvements

Yield of high-value products depends on the operational conversion rate of the hydrocracking plant. Normally, this parameter is defined by performance of the unconverted oil heat exchangers. Designing the process with Alfa Laval Spiral heat exchangers reduces the fouling tendency in these, normally extremely high-fouling services. This makes it possible to increase the conversion rate of the plant without compromising the plant uptime and availability.

Additionally, during hot summer months, or in regions with high ambient temperature, the ability to cool and condense the stripper or fractionator light vapour can create a substantial yield bottleneck. Cooling the vapours with a temperature approach closer to the cooling media, can enable maximal gasoline production from your process unit. With Alfa Laval Compabloc heat exchangers and wet surface air coolers, you can reach a minimal temperature approach to the supply temperature of the cooling media.



### Energy efficiency improvement

By using Alfa Laval Spiral heat exchangers, you can offload the reactor heater by means of energy recovery from the unconverted oil into unit feed preheating. This will of course reduce the fuel consumption in the heater. Similarly, designing the fractionation section of the process with maximal heat integration from hot fractions into column feed preheating reduces the energy requirement of the column heater or reboiler. Condensing the fractionator overhead vapour at a lower saturation pressure and with lower pressure drop also reduces the pressure in the flash zone of the column, thereby further reducing the energy requirements of the column.

Alfa Laval Compabloc heat exchangers can maximize the energy recovery into feed. With Compabloc heat exchangers and Wet Surface Air Coolers you can also minimize the condensation pressure of fractionator overhead vapours. In total, this means reducing steam or fuel consumption in column reboilers or furnaces by at least 25%. On top of that, with Alfa Laval Compabloc heat exchangers low grade energy from column overhead vapour, pump-arounds or rundown fractions can be recovered, even to generate superheated low-pressure steam directly at source.

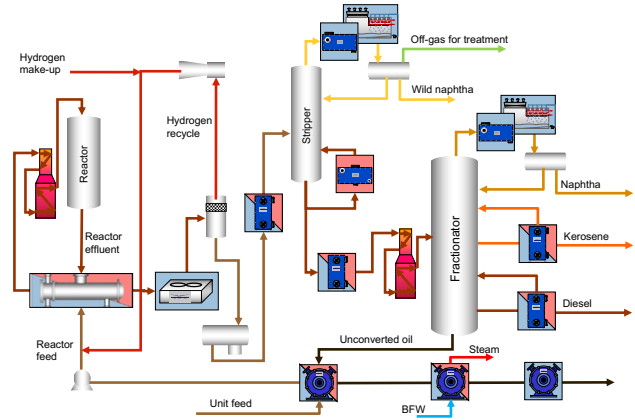
### Improved sustainability

The above energy efficiency solutions enable reduced fuel consumption in the process furnaces. This translates into CO<sub>2</sub> emission reductions. On top of that, reduced steam needs in the column reboilers could lower the capacity of the steam boiler, and CO<sub>2</sub> emissions from these would also be reduced accordingly.

Steam generated from waste heat recovery can evaporate wastewater from the hydrocracker plant to minimize the amount of waste sent to the wastewater treatment plant. This also generates a condensate that can be recycled back to the process, fully eliminating any need for fresh process water. Alternatively, you can generate process water from seawater or other low grade water sources.

Designing the process to maximize return temperature of the cooling water from the coolers and condensers can reduce cooling water consumption by at least 50%. With Alfa Laval Compabloc heat exchangers, you can achieve this in a highly cost-effective way, using a single heat exchangers on minimum plot space.

### Hydrocracking



### Improved reliability and availability

Process equipment in the reactor section of the hydrocracker process operates under extreme temperature and pressure conditions in the presence of hydrogen at high partial pressure. When effluent vapours are being cooled, salt can also deposit on the heat transfer surfaces and generate underdeposit corrosion. Alfa Laval Olmi shell-and-tube heat exchangers and effluent air coolers are specifically developed to provide the highest reliability in these critical services.

Higher conversion rates of residue hydrocrackers means more unstable unconverted oil (UCO). The precipitation of asphaltenes can cause severe fouling and plugging problems in the UCO equipment, limiting not only the conversion rate of the plant, but also plant uptime & availability. Using Alfa Laval Spiral heat exchangers in all UCO services, such as unit feed preheat, steam generation and final cooling, minimizes fouling tendency. Alfa Laval can also support you with the optimal installation and procedures for on-line chemical cleaning, thereby extending the operating run-lengths in-between mechanical cleanings and maximizing unit performance and availability.

### Minimizing CAPEX

When investing in a new hydrocracker, using cost-efficient heat exchangers installed on minimum plot space is only the start of how you can minimize CAPEX. By optimizing the process design, you can achieve the lowest overall process cost.

- Maximum energy recovery in column feed preheating can reduce the size of the column furnaces or reboilers. Alternatively, it can increase existing process unit capacity without requiring investment in more heater or reboiler capacity.
- Maximizing energy recovery from hot fractions also means less need for cooling capacity, thereby reducing investment in the final run-down coolers. Again, if increasing capacity of an existing process unit, no additional investment in cooling capacity is required.
- Better cooling/condensing of stripper and fractionator overhead vapour can minimize cost in downstream compressor or gas treatment systems. Alternatively, you can increase capacity in an existing plant without investing more in these gas handling systems.
- With wastewater evaporation, you can avoid investment in more water treatment capacity. Running the evaporation plant with steam generated from waste heat recovery in the fractionation process also means no further investment in steam boiler capacity.

- Thanks to minimized cooling water requirements, you can minimize investment cost in the cooling water system. Alternatively, you can increase capacity in an existing plant without investment in this system.

These savings will be much higher than the savings in heat exchangers and their installation cost, but it requires optimizing the process around the efficiency of Alfa Laval heat exchangers. This is why you need to involve Alfa Laval early in the project, before the process design is fixed. We will help you optimize the mass and heat balance of your process to make sure you will get the most efficient design – both for OPEX and CAPEX savings.

For a revamp of your existing process unit, payback can be less than a year with a maximum period of around two years, depending on the complexity of the project and how many of above savings we can implement. For a grassroots unit, you can realize millions of Euros in savings by optimizing the process design based on Alfa Laval solutions.



With Alfa Laval as your partner, you get access to world-leading expertise in process optimization. Together with your process engineers, we create highly efficient and reliable solutions that will take your plant to the next level.

Learn more and see all the facts from real-life customer cases at [www.alfalaval.com/refinery](http://www.alfalaval.com/refinery)

### Our service offerings

Every Alfa Laval solution is backed by the market's only supplier with deep process knowledge and a global network of experienced experts.

Get to know more about our maintenance solutions at [www.alfalaval.com/refinery/service](http://www.alfalaval.com/refinery/service)

### Products and solutions featured

Take a closer look at:

- **Compabloc**
- **Desalination**
- **Niagara Wet Surface Air Coolers**
- **Olmi air**
- **Olmi shell-and-tube**
- **Spiral heat exchangers**
- **Zero Liquid Discharge**