

UOP HYDROPROCESSING SOLUTIONS

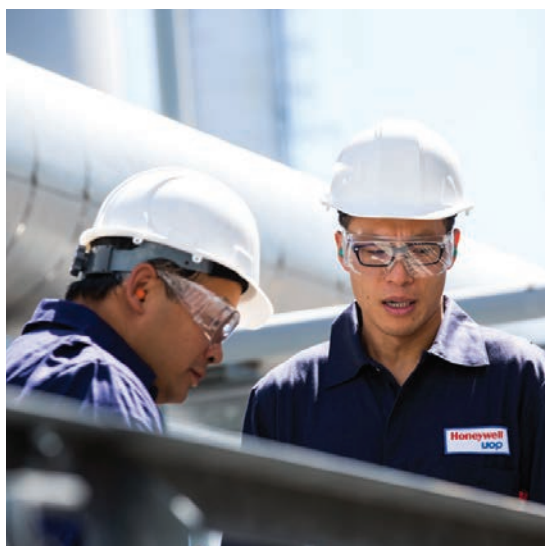
Innovative Flow Schemes to Maximize Profitability

Case Study





With growing demand and more stringent specifications for fuel, hydroprocessing technologies will be key to meeting refinery conversion capacity and quality needs.



Honeywell UOP has explored synergies between multiple hydroprocessing units to develop integrated flow schemes that:

- Lower capital and operating costs
- Increase desired product yields
- Provide flexible product slates
- Process tougher feed

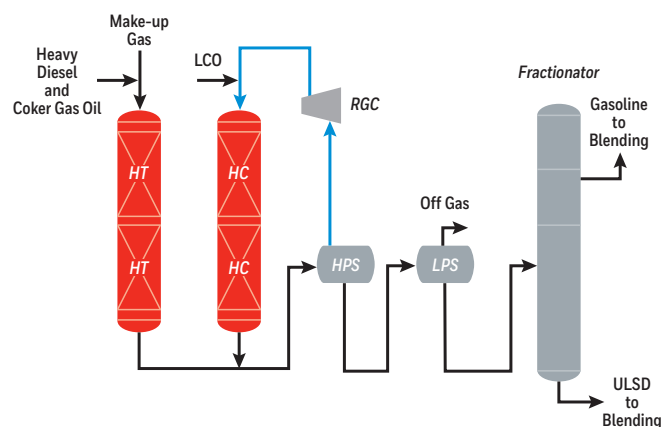
Typical Single Stage and Two-Stage UOP Unicracking™ Process Flow Schemes

- Once Through
- Single Stage Recycle
- Separate Hydrotreat
- Two-Stage

Innovative Hydroprocessing Configurations

UOP has developed many integrated hydrocracking processing schemes and catalyst solutions to meet our customers' operating objectives.

Figure 1 – Integrating LCO Unicracking Process with Unionfining



Parallel Flow Integrated LCO Unicracking and Distillate Unionfining Unit

Figure 1 highlights the UOP LCO Unicracking process integrated with UOP Unionfining unit. The first reactor uses makeup hydrogen to hydrotreat distillate blend. The second reactor is an LCO Unicracking reactor with its own recycle gas system. The downstream equipment is common for both stages. By integrating these operations, refiners can save up to 30-40% compared to constructing two independent units. Some key features of the unit include:

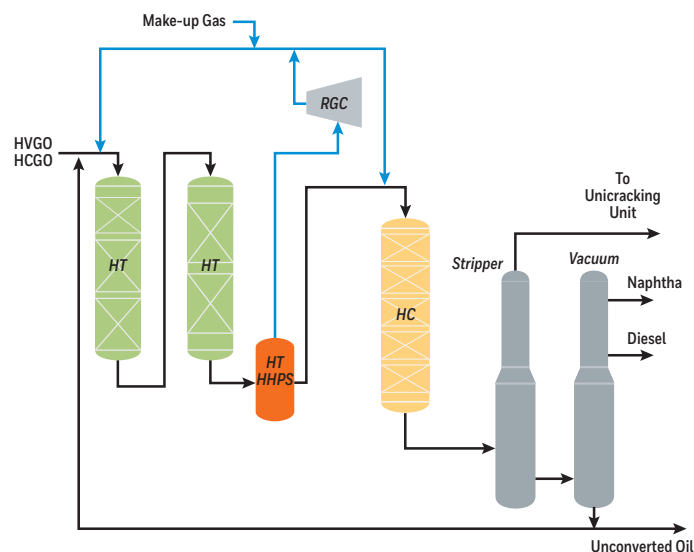
- Production of ultra-low sulfur diesel (ULSD) and high octane gasoline with 36 months cycle length
- Ability to vary conversion to meet product flexibility

Separate Hydrotreat Unit

Figure 2 depicts a separate hydrotreat unit processing heavy, high nitrogen feed, with a large portion of coker derived material. Built alongside an existing UOP Two-Stage Unicracking Unit with a common fractionation system, the unit utilizes existing assets for reduced capital cost. Key features of this unit include:

- Complex configuration combining two-stage Unicracking and separate hydrotreating units with common fractionation
- One of the highest severity hydrotreating units in the world to process a feedstock with a >6000 wppm nitrogen
- Cycle length of 3 years with a difficult high-end point feed >675°C (1250°F)

Figure 2 – Separate Hydrotreating Unit

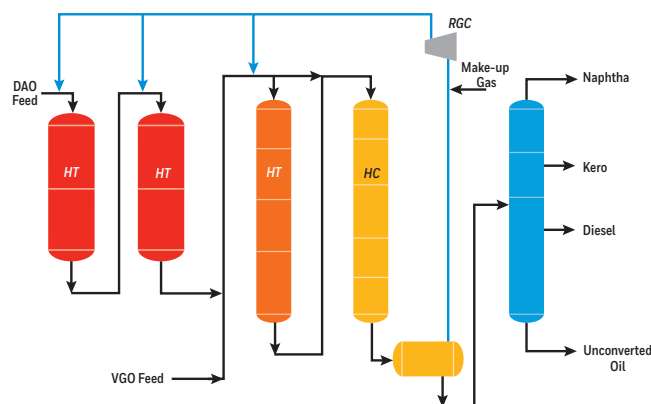


Integrated DAO Unionfining and Unicracking Units

UOP collaborated with a North American refiner to successfully revamp a hydrocracking unit to meet Tier III regulatory mandates, while positioning the refinery for future profitability. The main challenge was short cycles due to high severity feeds while operating at lower conversion. The refiner engaged UOP to successfully revamp the unit (Figure 3) to better utilize existing hydroprocessing assets. Key features of this project include:

- Increased capacity of existing unit revamp with the to increase the feed rate
- Cycle length over 24 months despite tougher feed
- Achieve product specifications of 51 min cetane
- Successfully demonstrated DAO processing with higher conversion

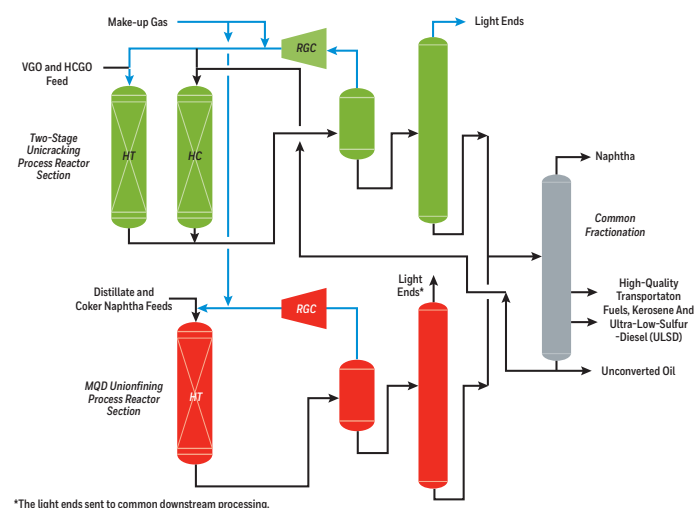
Figure 3 – Integrated DAO Unionfining and Unicracking Units



Integrated Residue Upgrading and UOP Unionfining Units

A customer selected UOP process technology and catalyst systems to improve yields and boost refinery performance. UOP developed an innovative approach by integrating the refiner's process units (Figure 4), delivering \$30 million in

Figure 4 – Integrated UOP Unicracking and Unionfining Units



*The light ends sent to common downstream processing.

capital expenditure savings and more than \$20 million per year in yield improvement benefits. The solution resulted in the highest yield of kerosene and diesel from the available feedstock while meeting the product quality requirements for current and anticipated environmental regulations. Key features of this unit include:

- Integrated two-stage Unicracking unit (98Wt% conversion) with a Unionfining unit
- Ability to process difficult crude (60% coker gas oil) with high nitrogen, sulfur and metal impurities
- Integrated UOP Pressure Swing Adsorption (PSA) unit to recover hydrogen from flash drum off gases
- Common fractionation section for Unicracking and Unionfining section with the flexibility to operate Unionfining and Unicracking units independently

Summary

For 100 years, Honeywell UOP has provided complete solutions to refiners and petrochemical producers worldwide. As a provider of hydroprocessing solutions, our goal is to minimize costs and maximize returns for our customers. UOP continues to innovate its catalyst and process technology offerings to maximize refinery profitability when processing challenging feedstocks.

For more information

For more information please contact your UOP representative or visit us online at www.uop.com.

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