

REFINING

UOP FCC Catalyst Cooler

Maximize high value product from low cost feed

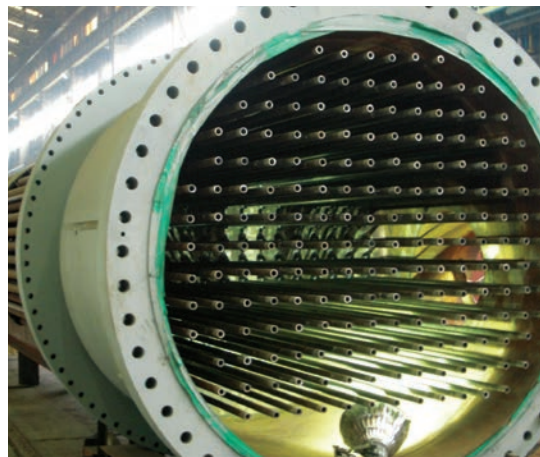
Background

Many refiners are processing low-value atmospheric and vacuum residues in their Fluid Catalytic Cracking (FCC) units as part of their bottoms upgrading strategy. The conversion of these heavy contaminated feeds to lighter, more valuable products results in higher profit margins, but also leads to higher operating temperatures in the regenerator. Removing this heat retains catalyst activity and increases the catalyst-to-oil ratio for better yields, improved product selectivity, and enhanced profitability.

Description

The UOP FCC Catalyst Cooler is an external vertical shell-and-tube heat exchanger. Dense-phase catalyst flows over the entire cross sectional area on the outside of the tubes. UOP's air lance distribution system ensures uniform air distribution within the tube bundle and a uniform heat transfer coefficient. The generation of HP steam from circulating Boiler Feed Water inside the tubes removes heat from the regenerated catalyst. Figure 1 provides a conceptual flow diagram.

Three styles (flow-through, backmix, and hybrid) are available to accommodate a wide range of heat removal duties and physical constraints. UOP catalyst coolers can be included on new FCC/RFCC units, or added to existing units as a revamp.



Proven and reliable technology with unmatched commercial experience

FEATURES & BENEFITS

Benefits

Variable heat removal provides the ability to adjust catalyst-to-oil ratio, reactor temperature, and feed temperature independently of each other. This flexibility allows the refiner to optimize operations and increase profitability from these strategies:

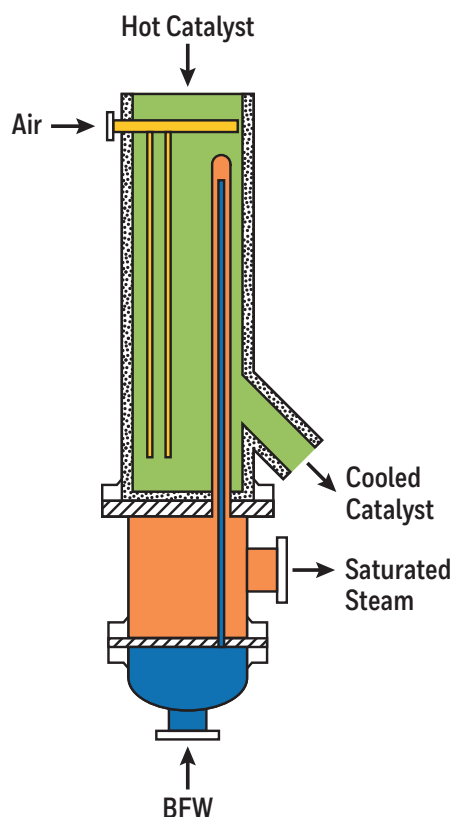
- Ability to process lower-priced feedstock
- Greater feed quality flexibility
- Increased feed throughput
- Improved yield selectivity
- Higher operating margins
- Increased conversion
- High Pressure (HP) steam production

Design Features

UOP Catalyst Coolers are specially designed to:

- Prevent corrosion
- Facilitate easy maintenance and bundle removal
- Use lower grade metallurgy to reduce cost without sacrificing mechanical reliability
- Reduce installation time and cost with a simple but robust design
- Ensure uniform catalyst distribution
- Allow for high operating flexibility
- Achieve a high level of operating reliability
- Minimize erosion from catalyst particles

Figure 1 – UOP Catalyst Cooler Flow Diagram



Technology Delivery

UOP is committed to providing quality products to our worldwide customers in a timely manner. Our Key Mechanical Equipment (KME) division excels at technology transfer via equipment supply. Supplying the UOP Catalyst Cooler equipment from KME provides the customer with:

- Single-point project management
- Fastest project execution
- Superior quality control
- Minimized risk
- Global fabrication capabilities

Feed, Operating, and Design Flexibility

Dual heat transfer control with the standpipe slide valve opening and fluffing air rate provide a wide range of heat removal to maximize feed and operating flexibility. This is shown in the following example where higher conversion is attained with lower quality feed on the same commercial unit.

	Low Duty	High Duty
Feed rate	Base	Base x 1.05
Feed density (°API)	18.1	17.3
Feed Concarbon (Wt%)	6.9	8.7
Catalyst Cooler Duty	Base	Base x 1.43
Conversion (vol%)	77.3	78.2

The highly flexible mechanical design of the UOP Catalyst Cooler makes it adaptable to any Regenerator configuration:

- UOP Combustor style
- UOP 2-stage
- Bubbling bed
- Non-UOP regenerators

Economic Value

UOP recently performed an FCC Revamp study to add a single flow-through Catalyst Cooler to an existing unit. The unit processed 53,000 BPSD of VGO and Atmospheric Residue. The revamp objective was to increase conversion in gasoline mode with the same feed blend. The study showed that the Catalyst Cooler would generate \$7 million/yr of additional product revenue and \$11 million/yr Cash Cost of Production (CCOP) for a total annual benefit of \$18 million. The simple payback for this project is approximately one year.

Commercial Experience

UOP pioneered the dense phase catalyst cooler with development and commercialization in the 1980's. Since that time, 72 UOP Catalyst Coolers have been commissioned on FCC/RFCC units totaling more than 1000 cumulative years of operating experience and 6,500 MM Btu/hr of heat removal. Design duties have ranged from 30 - 200 MMBTU/hr (9 - 60 MW) per catalyst cooler. Twelve UOP Catalyst Coolers have been installed on non-UOP licensed FCC units.

For more information

www.uop.com

UOP LLC, A Honeywell Company

25 East Algonquin Road
Des Plaines, IL 60017-5017, U.S.A.
www.uop.com

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