RDS / VRDS/ OCR / UFR

Chevron Lummus Global

Overview

Chevron Lummus Global (CLG), a joint venture between Chevron and Lummus Technology, licenses a family of residuum conversion technologies and provides premium hydroprocessing catalysts that help refiners optimize product quality, product yield, run length, capital investment, and operating cost.

Fixed-bed residuum desulfurization technologies –RDS for atmospheric residuum and VRDS for vacuum residuum – provide an economical process path to higher-value products from difficult feeds. These hydrogen-efficient processes sufficiently saturate products so that further processing in conversion units is greatly enhanced, ultimately producing more and light products of higher value. For example, by pretreating Residuum Fluid Catalytic Cracking (RFCC) feed in an RDS/VRDS reactor, refiners have more flexibility to choose less expensive crudes or process more residuum, while achieving higher product yields and higher RFCC on-stream performance. Adding an upflow reactor either on a grass roots project or as a revamp enables refiners to increase capacity or process heavier feeds with higher levels of contaminant metals. CLG offers two upflow reactor technologies that can be integrated into the typical RDS reactor train – Onstream Catalyst Replacement (OCR) and Upflow Reactor (UFR). An OCR unit is a countercurrent, moving bed reactor that has the ability to add and withdraw catalyst on-line, considerably increasing cycle lengths as the life of the downstream unit's catalyst is improved.

A UFR is an effective minimum-cost alternative, which is similar in operation to the OCR unit but without the onstream catalyst replacement. Both UFR and OCR make excellent revamp options because they can be added with minimal additional burden to the high pressure loop.

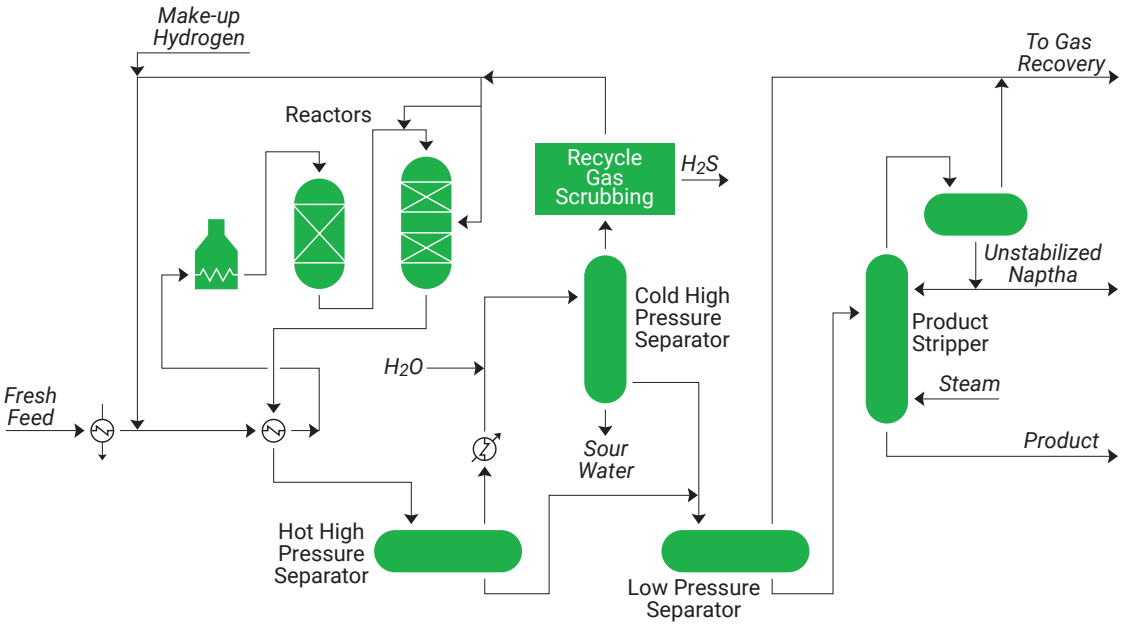
Technical Advantages

Process Features	Process Benefits
Advanced catalyst systems	• Higher product yields • Superior run lengths
Unique, high-quality catalyst grading system maintains good flow distribution and low pressure drop	• Extends run lengths • Trouble-free operation
Patented hydrogen management system	• Efficient hydrogen utilization • Constant product specification • Reduced operating cost
OCR/UFR reactor	• Extend run lengths • Process feedstocks with higher metal concentrations
Optimized two-phase furnace and feed/effluent exchangers	• Minimal fouling • Industry-leading energy savings

Process Experience

- More than 50% of all operating residuum hydroprocessing capacities were designed and licensed by CLG.
- Widest experience in processing various feedstocks, including 100% vacuum residue.
- Only licensor having operating experience with on-stream, moving catalyst bed designs.
- Greatest number of operating and licensed units, including experience with large capacity units (100-300 MBPD).
- The most active R&D program in the industry and continuous feedback from Chevron's operating units and licensees ensure the best designs and catalysts.

Process Flow Diagram



Process Description

RDS/VRDS: After passing through preheat exchangers, the residuum feed is combined with recycle gas and sent through additional exchangers and the feed furnace. After reaching a set inlet temperature, the combined feed enters the reactors from the top. The number of reactors, in parallel or series, is determined by the overall objectives and feed rate.

From the reactor section, heat is recovered in the feed/effluent exchangers and then further cooled and flashed in the separation section. The recycle gas, bleed, and makeup gas are optimized to provide the highest purity hydrogen for the reactor section at minimal cost. The fractionation section draws the liquid from the separation section and separates the lighter components into off-gas, distillates and treated atmospheric residual fractions as required.

OCR: Fresh catalyst is added at the top of the reactor while residuum is fed into the bottom. The catalyst moves through the reactor in countercurrent flow, causing the dirtiest residuum to contact the oldest catalyst first. Spent catalyst is removed at the bottom of the reactor in a batch operation (typically once or twice per week), with no interruption to the process. The equipment moving the fresh and spent catalysts to and from the reactor is automated and requires minimal operator attention.

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