ISOCRACKING®

MCDERMOTT TECHNOLOGY

Overview

Chevron Lummus Global (CLG), a joint venture between McDermott and Chevron, offers ISOCRACKING® technology to efficiently convert heavy opportunity feedstocks into premium, high quality middle distillates and lube oil basestocks. Building upon more than 50 years of operating experience including Chevron's pioneering efforts to commercialize modern hydrocracking, CLG has continued to invest in the development of best practices, new and unique hydrocracking schemes and catalyst systems. As a result of our continued innovation, today we are the leading hydrocracking technology licensor with more than 60 units licensed since 2000. ISOCRACKING technology today incorporates new design features that significantly reduce plant investment and operating costs while offering 98%+ operating factor.

CLG is highly experienced as a licensor with more than 285 hydroprocessing units licensed since the 1960s, a refiner and a world-class engineering company enabling us to offer unparalleled expertise in hydrocracking. We offer our clients expertise through active research and development programs, pilot plant studies and a full range of engineering and technical support services.

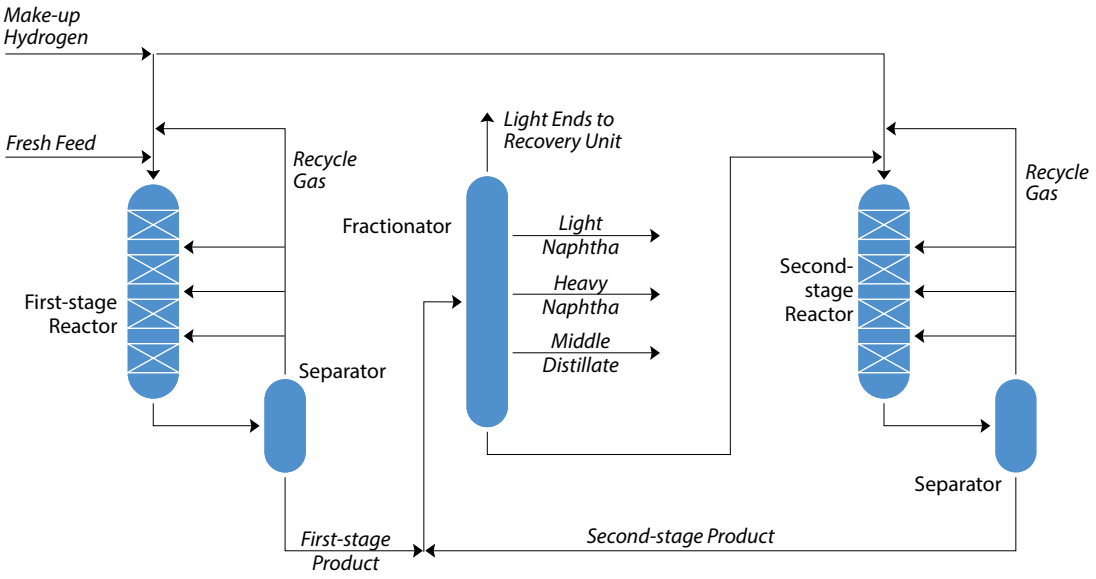
CLG has been propelled toward an aggressive catalyst development program, especially over the last decade by ongoing market growth, increasing operating severities and the design of very large units (75,000 – 140,000 BPSD). With improvements to catalyst formulations and raw material quality (both amorphous and zeolitic), CLG's latest line of ISOCRACKING catalysts have proven not only to enhance selectivity for a full range of applications, but also to exhibit increased activity and stability for processing increasingly difficult feedstocks. The process employs a family of unique catalyst systems to maximize middle distillate or naphtha yields, tailored to meet a particular unit's requirements.

Along with optimum catalyst design, catalyst life cycles can be extended by improving reactor operation. CLG's latest ISOMIX®-e reactor internals offer enhanced reactor operation by thoroughly mixing and uniformly distributing gas and liquid across the reactor bed. These internals have demonstrated even temperature distribution (low radial ΔT's < 3° C), which results in maximum catalyst utilization across the reactor bed, ultimately improving cycle length, and operating stability.

Advantages

Process Features	Process Benefits
Produces diesel fuels with very high cetane number and low pour point	Can be blended with poorer quality streams and still meet refiner's diesel pool cetane specs
Produces kerosenes with low freeze points and high smoke points	Results in optimum fuel combustion characteristics
Produces hydrogen-rich heavy products	Excellent feedstock for downstream processing (e.g., FCC, ethylene or lube oil), providing better yields and product properties in these units
Unique catalyst systems result in maximum yield of middle distillate products and lube oil base stocks	Optimum catalyst selection will produce about 3% more higher-value distillate product yield than competing hydrocracking technologies
Minimizes formation of polynuclear aromatic (PNA) compounds in the reaction system	Achieves high unit on-stream factor by avoiding deposit of solids on process equipment
Catalysts with superior stability result in long catalyst cycle length and ultimate life	Low catalyst replacement costs permits design of lower pressure hydrocrackers with lower investment cost
Extensive family of amorphous and zeolitic catalysts available for any application	Selection of optimum reactor/catalyst configuration gives refiners greater flexibility in processing a wide range of feedstocks from different crudes

Process Flow Diagram



Process Description

The hydrocracker is a high-pressure, moderate temperature conversion unit. ISOCRACKING hydrocracker designs include single-stage once through, single-stage recycle and two-stage recycle processes. A two-stage hydrocracker with intermediate distillation represents the most common process configuration for maximizing middle distillates.

The feed, which is typically a blend of HCGO and VGO and in certain cases includes residue hydrocracker VGO, is sent to the first stage of the hydrocracker and is severely hydrotreated. Most of the sulfur and nitrogen compounds are removed from the oil and many of the aromatics are saturated. In addition, significant conversion to light products occurs in the first stage.

The liquid product from the first stage is sent to a common fractionation section. To prevent overcracking, lighter products are removed by distillation.

The unconverted oil from the bottom of the fractionator is routed to the second stage reactor section.

The second reaction stage saturates almost all of the aromatics and cracks the oil feed to light products. Due to the aromatics saturation, the second stage produces excellent quality products. The liquid product from the second stage is then sent to the common fractionator, where light products are distilled. The second stage operates in a recycle to extinction mode with per pass conversions ranging from 50 to 80%.

The overhead liquid and vapor from the hydrocracker fractionator is further processed in a light ends recovery unit where fuel gas and liquefied petroleum gas (LPG) and naphtha are separated. The hydrogen supplied to the reactor sections of the hydrocracker comes from reformers or steam-reformers. The hydrogen is compressed in stages until it reaches system pressure of the reactor sections.

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