Shell Thermal Gasoil

Overview

The Shell Thermal Gasoil process, jointly licensed by Shell and CB&I Lummus, upgrades atmospheric residue and waxy distillate. Originally developed in the 1960s, continued improvement in the Shell-designed soaker drum and heater designs resulted in the present Thermal Gasoil technology, a combination of three mature, well-proven Shell technologies:

- Soaker Visbreaking
- Vacuum Flashing
- Thermal Cracking

Shell was the first to develop and employ soaker visbreaking technology. The soaker drum, with patented internals, achieves higher conversion and improved viscosity reduction compared to other visbreaking technologies. Over 80 units have been designed and built worldwide.

The Shell Vacuum Flashing technology was developed to recover distillates from thermal conversion residue. The specially designed transfer line and vacuum flasher internals maximize the flashed distillate yield and quality, and assure a run-length comparable to that of the rest of the Thermal Gasoil unit despite the severe fouling tendencies of the residue feed.

The design of the distillate Thermal Cracking heater is based on Shell's experience and know-how in the field of thermal cracking in general.

CB&I Lummus and Shell have extensive experience in the design of thermal conversion processes. With continual feedback from operating units, we are able to provide advanced designs and practical advice on operational matters. Shell's ongoing research and development in thermal cracking technology and equipment design assures the availability of the most up-to-date know-how in this field.

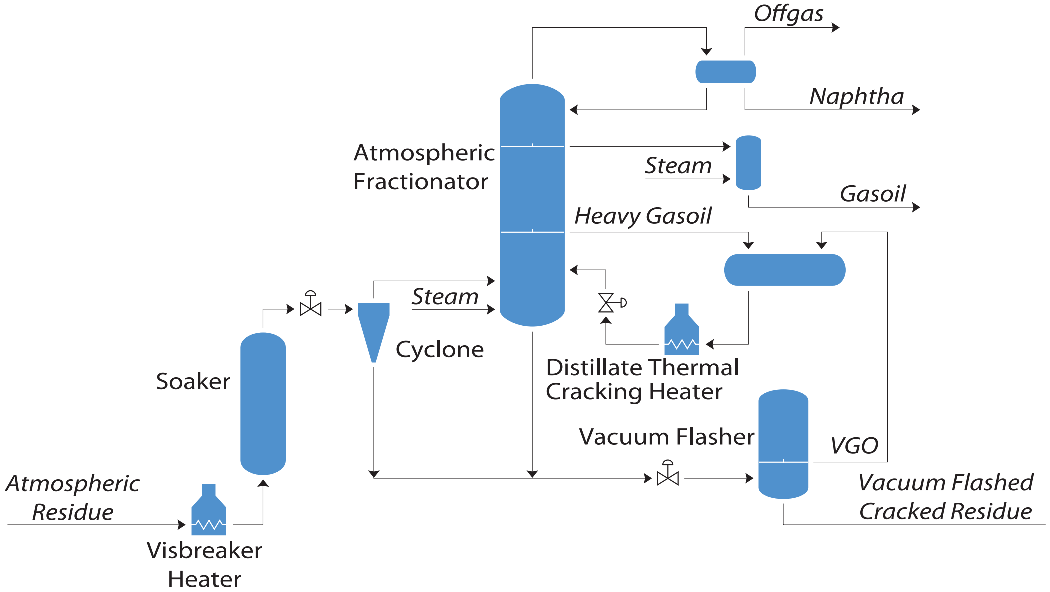
Advantages

Process Features	Process Benefits
Lower cracking temperatures and longer residence time	Selective cracking to distillate product • Less sensitive to operational and feedstock fluctuations • Better process control • Longer run-lengths and less down time
Use of soaker drum with special internals minimizes back-mixing	Higher conversion for the same fuel oil stability • More distillate production • Less cutter stock usage
Distillate cracking heater	Maximum naphtha yield • Maximum gasoil yield
Smaller visbreaker heater	Lower investment cost • Less waste heat recovery equipment • Lower fuel consumption
Lower visbreaker heater pressure drop	Less power consumption

Performance Characteristics

Typical Feedstocks		Typical Product	
			% wt on feed
Atmospheric residue	Middle East	Gas	6.4
Viscosity, cst @ 100°C	31	Gasoline ECP 165°C	12.9
		Gasoil ECP 350°C	38.6
		Residue ECP 520°C+	42.1
		Viscosity 165°C plus, cst @ 100°C	7.7

Process Flow Diagram



Process Description

Atmospheric residue is pumped through feed preheat exchangers, where the feed is heated against cracked residue, to the visbreaker heater. The feed is heated to the required cracking temperature and routed to the soaker where the majority of the thermal cracking occurs under controlled conditions. The soaker effluent is routed to a cyclone and the cyclone overheads are charged to the flash zone of the atmospheric fractionator.

In the top section of the fractionator, the soaker effluent is split into four fractions: heavy gasoil, gasoil, naphtha, and offgas. The gasoil is taken from the fractionator as a draw-off, steam stripped in a side stripper to improve the flash point, and sent to the battery limit. The overhead vapors are condensed in a two-stage condensing system: in the first stage, only the reflux is condensed; in the second stage, the naphtha product is condensed. From the overhead system, the offgas and naphtha are sent to the battery limit.

Inside the fractionator, the liquid is quenched to prevent further cracking and then steam-stripped. The hot fractionator bottoms, together with the cyclone bottoms, are routed to the vacuum flasher where the vacuum gasoil (VGO) is recovered. The VGO is sent, together with the heavy gasoil from the atmospheric fractionator, to a distillate thermal cracking heater where it is partly converted into lower boiling fractions. The heater effluent is routed to the flash zone of the atmospheric fractionator. The unconverted heavy gasoil is recovered in the fractionator and vacuum flasher and is recycled back to the distillate thermal cracking heater to maximize the gasoil yield.

The vacuum-flashed residue is cooled against the VGO and then by steam generation. The cooled residue is sent to fuel oil blending where it is blended with gasoil product and/or other cutter-stocks to meet the specified fuel oil viscosity.