

# Filtration Applications in Hydrotreating



Hydrotreating is an essential refinery process in crude distillation with the goal of removing feed contaminants from downstream processes, as well as converting low-value gas oils into valuable products that meet stringent clean fuels specifications. Hydrotreaters remove sulfur and other impurities from feedstock through catalytic conversion in a hydrogen-rich environment over fixed catalyst beds at high temperatures and pressures.

## Types of Hydrotreating

### • Gasoline Hydrotreating

Removes sulfur from gasoline blending components and reduces the olefins and aromatics content by saturating the double bonds with hydrogen.

### • Jet Fuel Hydrotreating

Improves the burning characteristics of jet fuel by increasing the smoke point at which unburned hydrocarbons are released as smoke.

### • Distillates Hydrotreating

Distillates used for diesel fuel are hydrotreated to reduce sulfur content to meet ultra-low level sulfur mandates. In addition, hydrotreating cracked light oils reduces the amount of aromatics compounds and raises the octane levels.

### • Cat Feed and Reformer Feed Hydrotreating

Cat reformer feeds are almost always hydrotreated prior to entering the catalyst to protect the equipment and maintain optimal operating conditions.

### • Additional Hydrotreating Processes

Pyrolysis Gas, Kerosene, Residual Fuels, etc.

The most common filtration problems include solid and liquid contaminants in the fluid and gas streams originating from upstream equipment, storage tanks and piping. These contaminants will foul the reactor beds resulting in higher differential pressure that leads to reduction in recycle hydrogen compressor performance. This will cause refiners to reduce gas oil throughput in order to maintain the proper hydrogen to gas oil ratio resulting in direct revenue losses. Contamination fouling will also cause catalyst deactivation (coking) requiring refiners to raise temperatures in the reactor to compensate. If elevated long enough, deactivation occurs making it difficult to maintain on-spec product leading to unplanned shutdowns to replace fouled catalyst. In addition, contamination in hydrotreater feed streams will cause problems in heat exchangers and hydrogen compressors leading to costly repairs and downtime.

## Benefits of an Optimized Hydrotreater Filtration System include:

- Maintain stringent clean fuel requirements
- Improve production and operation efficiency
- Extend catalyst bed life
- Protect downstream equipment
- Reduce process upsets and downtime



**JONELL**<sup>™</sup>  
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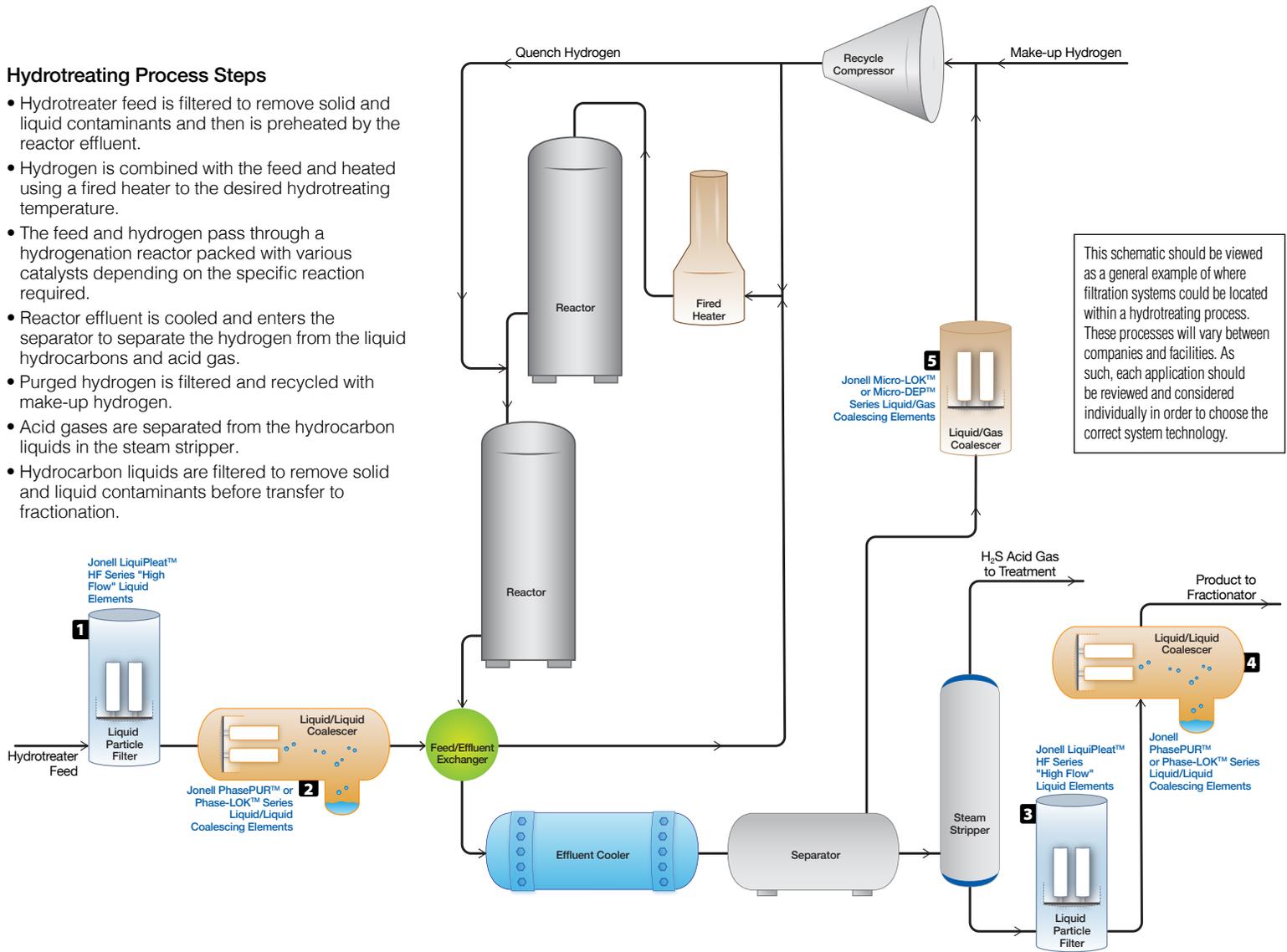
jonellinc.com • sales@jonellinc.com

**254-559-7591**

# Jonell Filtration Applications in Hydrotreating

## Hydrotreating Process Steps

- Hydrotreater feed is filtered to remove solid and liquid contaminants and then is preheated by the reactor effluent.
- Hydrogen is combined with the feed and heated using a fired heater to the desired hydrotreating temperature.
- The feed and hydrogen pass through a hydrogenation reactor packed with various catalysts depending on the specific reaction required.
- Reactor effluent is cooled and enters the separator to separate the hydrogen from the liquid hydrocarbons and acid gas.
- Purged hydrogen is filtered and recycled with make-up hydrogen.
- Acid gases are separated from the hydrocarbon liquids in the steam stripper.
- Hydrocarbon liquids are filtered to remove solid and liquid contaminants before transfer to fractionation.



This schematic should be viewed as a general example of where filtration systems could be located within a hydrotreating process. These processes will vary between companies and facilities. As such, each application should be reviewed and considered individually in order to choose the correct system technology.

## Jonell Filter Solution

## Filter Purpose

## Filter Benefit

1	LiquiPleat™ HF Series (High Flow) filter elements	Hydrotreater feed filtration removes solid contaminants such as scale, rust, and solid particles	Prevents unscheduled reactor downtime; reduced fouling in heat exchangers extending time between maintenance and shutdowns; fewer catalyst change-outs
2	PhasePUR™ or Phase-LOK™ Series coalescing elements	Removal of water from hydrotreater feedstock	Prevents unscheduled reactor downtime, heat exchanger fouling, and extends catalyst bed life
3	LiquiPleat™ HF Series (High Flow) filter elements	Removes solid contaminants such as scale and rust from desulfurized product	Protects downstream equipment, reduces maintenance and labor costs
4	PhasePUR™ or Phase-LOK™ Series coalescing elements	Water removal from stabilized fuel	Maintains liquid fuel specifications, protects downstream equipment, and reduces maintenance costs
5	Micro-LOK™ or Micro-DEP™ Series coalescing elements	Removal of liquids and solids from recycle hydrogen	Efficient hydrogen compressor operation and significantly reduced maintenance costs