

## Refineries: Application Focus

### Hydrotreating (HDT)

#### Process Description

Hydrotreating is a catalytic chemical process to remove Sulfur (S), Nitrogen (N), Oxygen (O), and metals from straight run and cracked products. This “clean-up” also saturates olefins to yield easier-to-process intermediates. Removing the S reduces SO<sub>x</sub> emissions when fuels are combusted. Sulfur also poisons downstream noble metal reformer catalysts and must be removed from reformer feeds (<0.5 ppm S is a typical naphtha feed spec).

The reaction is carried out in a hydrogen rich environment over a fixed catalyst bed. The process replaces sulfur or nitrogen contaminants in the hydrocarbon chains with hydrogen, making the process a consumer of hydrogen. Protection of the catalyst beds from fouling is critical to maintaining long term hydrotreating efficiency.

Treated products are then stabilized with heat to remove H<sub>2</sub>S and light ends. Use of direct steam injection is common, especially on diesel.

Ensure your hydrotreater reliably supports your daily production quotas and environmental protection needs.



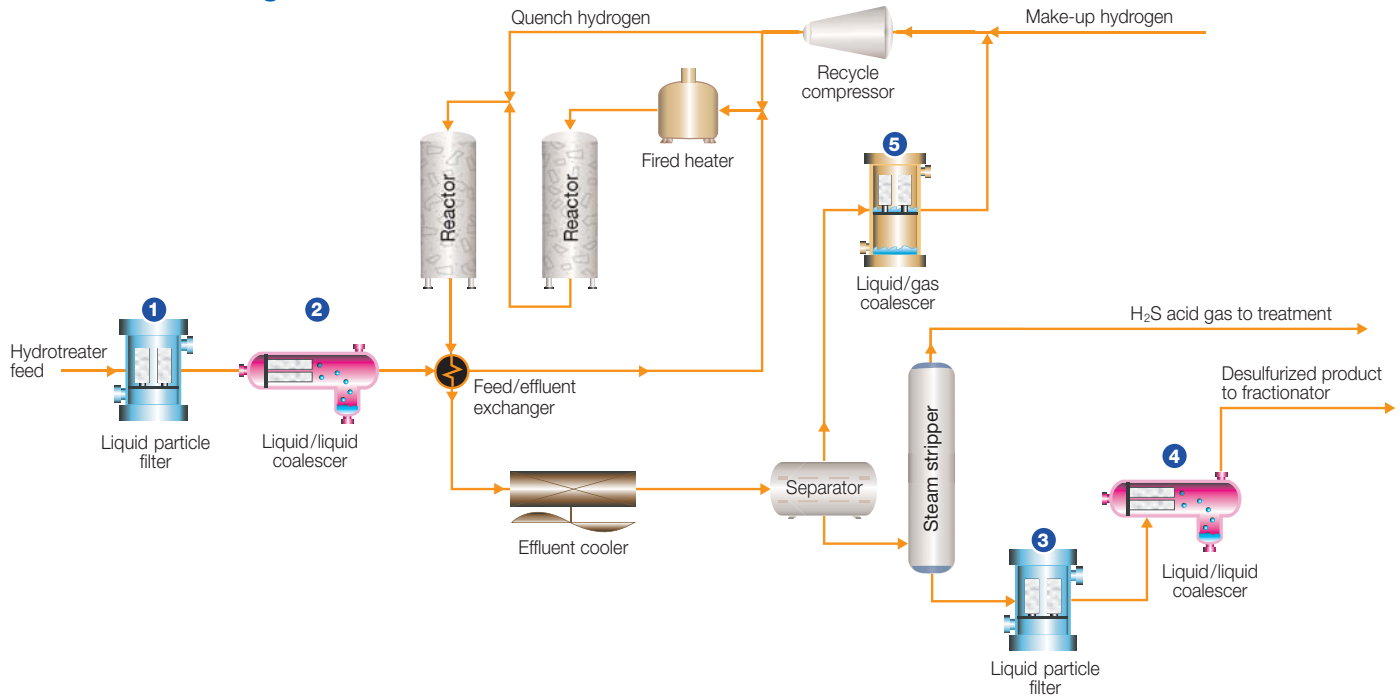
#### Refinery Needs

- Achieve production quotas of low sulfur gasolines and diesels via reliable hydrotreatment of straight run and cracked products that otherwise become a bottleneck
- Provide consistent transportation fuel quality
- Protect against fouling of the feed/effluent heat exchanger
- Protect against premature loss of catalyst activity
- Meet steadily increasing clean fuels specifications

#### Production Challenge/Pall Solution

Challenge	Solution
<b>Reduced catalyst bed activity and shortened life between shutdowns</b> due to bed fouling and associated channeling	<b>Improve refinery productivity and extend hydrotreater bed life</b> by removing solids from the feed to protect the feed/effluent heat exchanger and/or catalyst bed. <ul style="list-style-type: none"> <li>• A range of absolute and nominal rated filter elements is available to <b>reduce suspended solids levels in the feed, to protect the exchanger and/or catalyst bed from fouling.</b></li> </ul>
<b>Products failing to meet specifications</b> due to solids and water carryover from direct injection steam stripping	<b>Improve product quality making it easier to meet ‘clear and bright’ clean fuels standards</b> by removal of water and solids carried over from steam stripper. <ul style="list-style-type: none"> <li>• A range of absolute and nominal rated filter elements is available to <b>reduce suspended solids to &lt;5 ppmw, and extend the coalescer life.</b></li> <li>• High efficiency AquaSep® Plus liquid/liquid coalescers reliably meet <b>the ‘clear and bright’ product specification and/or reduce the cost for downstream dehydration.</b></li> </ul>
<b>Hydrogen recycle and make-up gas compressors requiring excessive maintenance (rebuids and downtime)</b> due to liquid and solid carryover from separator causing severe fouling and erosion of compressor internals	<b>Reduced maintenance of the recycle and make-up gas compressors</b> by removal of liquids and solids in the hydrogen recycle stream from separator. <ul style="list-style-type: none"> <li>• KO pots, mesh pads, cyclonic devices and conventional filter-separators may not effectively remove aerosol-sized liquid hydrocarbon droplets or fine solids.</li> <li>• High efficiency SepraSol™ Plus liquid/gas coalescers and Medallion™ HP liquid/gas coalescers provide 99.999% removal at 0.3 microns per the DOP test and 1 ppb downstream per the modified ANSI/CAGI-400-1999 test procedure. <b>Both provide excellent compressor protection.</b></li> </ul>

## Process Flow Diagram



### Key Applications/Filter Recommendations (*other applications not shown*)

Application	Pall Product	Advantages	Customer Benefits
1 Hydrotreater feed filtration	Ultipleat® High Flow filters: <sup>1</sup> <ul style="list-style-type: none"> <li>• 10 µm beta 5000 to protect exchanger</li> <li>• 20 µm beta 5000 to protect bed</li> </ul>	Removes scale, rust, and solid particles	Assured HDT profitability by protection from unscheduled reactor downtime or off-spec product due to exchanger fouling, catalyst bed activity loss or high delta P due to bed fouling
2 Hydrotreater feed water removal	AquaSep XS liquid/liquid coalescer	Consistent water removal without disarming	
3 Liquid/liquid coalescer protection	Ultipleat High Flow filters	Removes scale, rust, and solid particles	Low operating costs by ensuring long coalescer life while meeting particulate specifications for final products
4 Water removal from stabilized fuel	AquaSep XS or Plus liquid/liquid coalescer	Removes emulsions of direct steam injection stripping	Reliably meet 'clear and bright' final product specification, and/or reduce costs for downstream salt dryers or desiccant dehydration units
5 Hydrogen recycle and make-up gas compressors protection	SepraSol Plus and Medallion HP liquid/gas coalescers	Removes liquids and solids from recycle hydrogen	Eliminate cost and revenue losses due to compressor rebuilds and unscheduled downtime due to fouling

<sup>1</sup> The test procedure used is an adaptation of ISO 4572, modified to determine the micron size above which particles are quantitatively removed.



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