

# INCREASING PRODUCTION YIELD THROUGH IMPROVED PROCESS FILTRATION

for the Oil and Gas Industry



Supplying oil and gas products is critical to the global economy. As a process engineer, you understand what your plant needs to run 24/7, you need to rely on the resilience of your process and equipment and any downtime is a serious problem. At John Crane, we understand your needs and have a broad range of process filtration products and services engineered to make your job easier.



John Crane filtration solutions and technologies keep your operation running at peak performance to significantly reduce process contamination and increase the productivity of your operation. Our filter elements and systems are designed to meet global and regional standards.

Selection of filter media is critical to determine filtration performance. We use non-wovens and wire mesh metallic media extensively and a variety of welding processes, as well as reactive adhesives and epoxy-based sealing compounds for bonding metal materials.

Our products are designed to work together in complex systems to ensure optimum system performance and we provide filter elements able to remove liquids and solids within a single unit. Our replacement elements incorporate unique design features, ensuring maximum filter performance.

## Increase Reliability



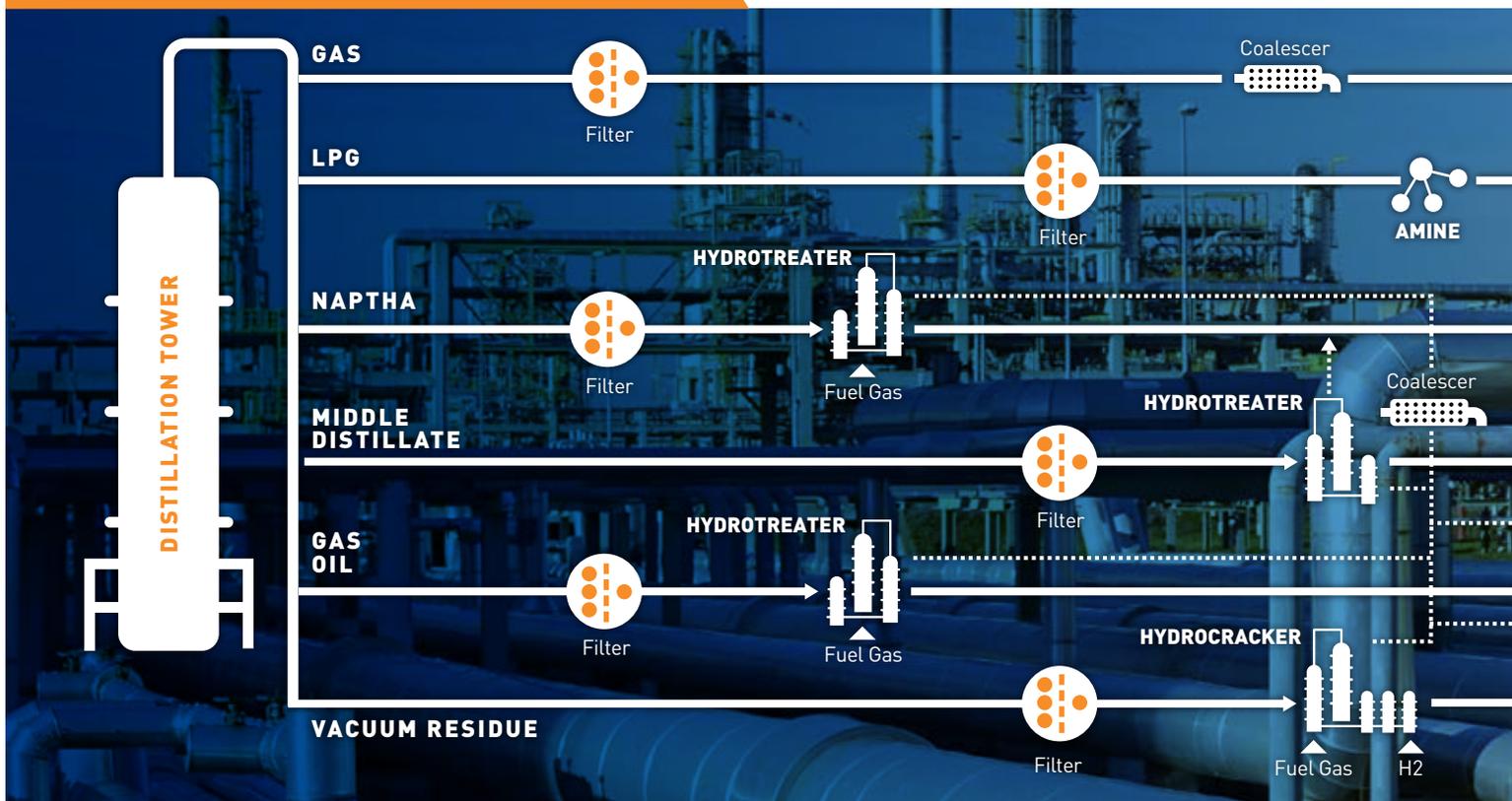
Oil refineries and the petrochemical plants require solutions to prevent process contamination that provide consistent performance.

Costly equipment modifications or filtration system replacement are not typically required. Simply replacing existing filter elements with proven John Crane alternatives increases the reliability of your filter system, improving uptime and maximizing operational availability.

### Examples:

- » Better filter media and advanced welding technology
- » Improved filter element strength and rigidity
- » Local service centers and site support personnel; swift communication with dedicated staff

### PROCESS FILTRATION FOR THE OIL & GAS INDUSTRY



## Reduce Costs



Take advantage of our filtration expertise to optimize your equipment performance and reduce operational costs. We have designed and developed high quality filter elements capable of eliminating contaminants down to, and below a fineness of, 1 micron and proven to exceed efficiencies of 99.8% on both particles and aerosols.

Significant contaminant-holding capacity is made possible with the use of pleated filter material, extending the period between filter element change out by up to 5 times when compared to a cylindrical element design.

### Examples:

- » Increases in filter cycle time
- » Improved filter element cleanability

## Optimize Yield Performance

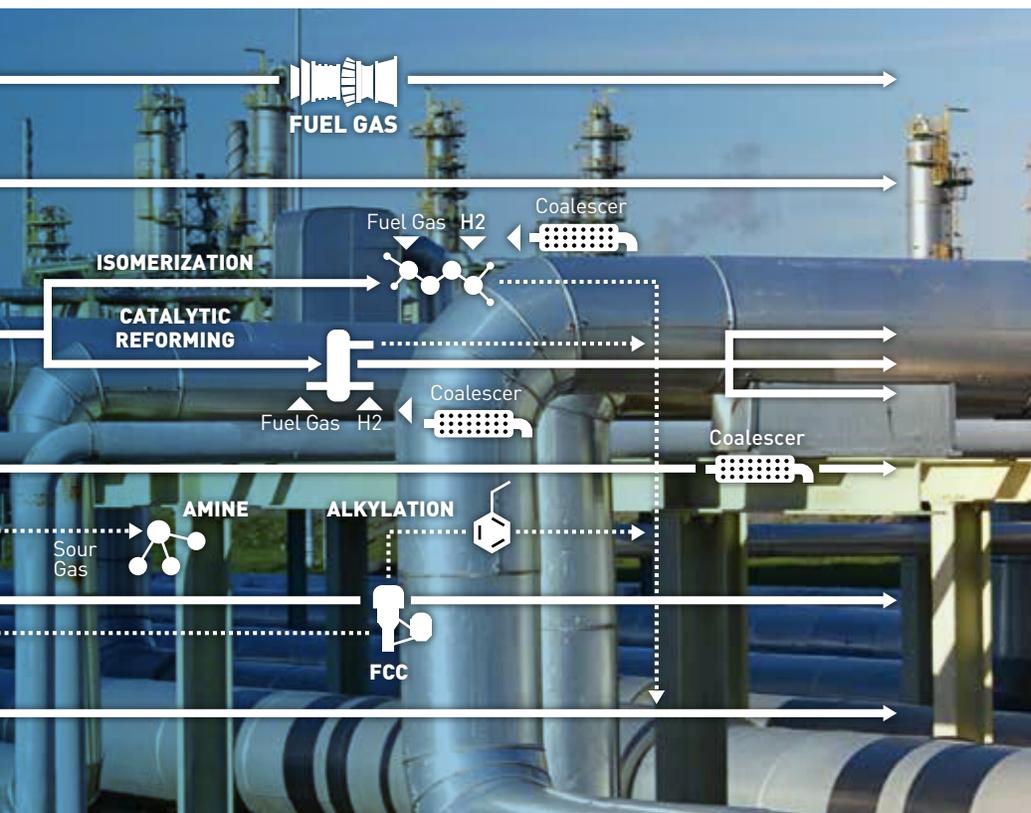


We can identify opportunities for application improvement, on all types of equipment. Component upgrades, refurbishments and retrofits can enhance process equipment reliability and efficiency. We can handle every aspect from initial review to final connections — including ongoing site support.

To optimize your process, we will collect system and mechanical filter data, inspect and analyze components and report accordingly. If required, elements can be re-engineered to add extra functionality and cleanability. Filter material selection will be based on most appropriate change scheduling.

### Examples:

- » Increases in filtration efficiency
- » Less and better weld seams = increase in filter area



### Filter Systems

Complete solutions consisting of a filter housing, associated filter elements and optional control technology and piping. Essentially, filter systems ensure that our customers' products achieve the desired specification. Water treatment is a common application for such systems.



### Back-Flush Filters

Back flush filters are self-cleaning systems where a cleaning of the filter elements with the filtrate is generated by flow reversal. Depending on the type, a distinction is made between manual (hand-operated) and automatic back-flushing filters which are integrated into a higher level controller.



### Multiple Filter Housings

Filter systems can comprise multiple filter housing, associated filter elements and optional control technology and piping. Multiple filter systems enable filter switching for continued operation while individual filters are replaced.



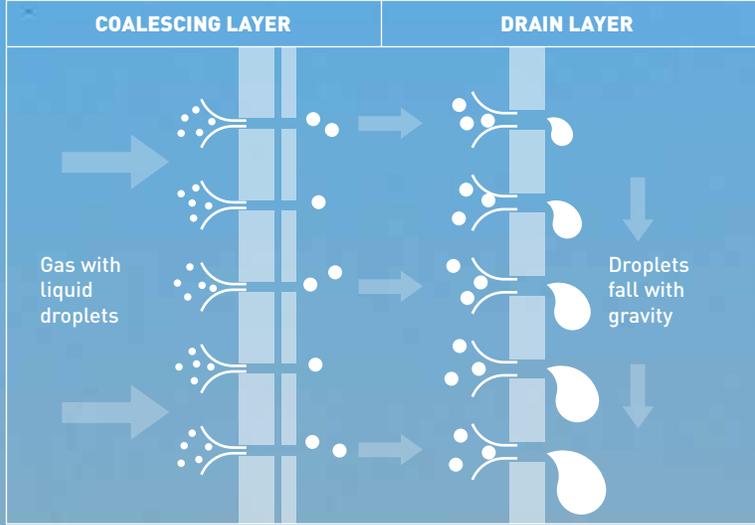
### Filter Candles and Filter Cartridges

Cylindrical filter elements are produced flat or pleated (for enhancing the filter surface area). Suitable connection techniques include gluing, welding and crimping. Filter candles and filter cartridges are used in almost all applications in the oil and gas industry.



### Filter Baskets

Filter baskets are cylindrical filter elements which are flushed from the inside to the outside. This technique is used to hold back high amounts of dirt in the basket so that the remaining solids can be easily emptied. They are typically used for coarse filtration to remove a majority of solids.



## Process/Fuel Gas Treatment

Throughout the oil and gas industry, natural gas has become the preferred fuel for providing motive power, but feed gas is normally contaminated with aerosols and solids, which require removal before it is used in downstream equipment such as gas turbine injectors and furnaces. This issue is particularly evident in low NO<sub>x</sub> burners. The nozzles can foul with deposits, leading to poor furnace performance. In extreme cases, they can damage the convection section of furnaces. Maintenance can become an expensive task, requiring burner tip cleaning or replacement at regular frequencies.

Contaminants in gas supply range from fine solids created from pipeline corrosion to lube oil from compressors. These contaminants create fouling deposits in gas turbine injectors, burner nozzles and on molecular sieve adsorbent beds, thereby impeding heat transfer and affect the efficiency of turbine operation. Feed natural gas contains pipeline rouge (black powder), glycol and other contaminants that need to be removed. Green oil present in hot fuel gas used to regenerate molecular sieve beds can also cause extensive fouling, especially in ethylene plants.

These problems can be mitigated by using our efficient liquid/gas coalescers on the equipment fuel gas feed. By installing the liquid/gas coalescer in line, 99.9% of the liquid aerosols and solids above 0.3 micron are removed. Fuel gas conditioning systems of various sizes are available. Our team has a lengthy history of supplying liquid/gas coalescer housing and elements to the oil and gas market.

### Gas sweetening

Process filtration is also critical for the treatment of sour gas during amine filtration in refineries. Gas sweetening processes using amine solvents are often challenged to meet productivity and reliability targets due to the impact of solid/ liquid contaminants in the sour gas. Commonly seen issues are foaming in the amine contactors, high solids content in the rich amine and corrosion. This results in production loss from unscheduled downtime and reduced flow capabilities. Installation of liquid/gas coalescers in the sour gas before the amine contactors can minimize these issues by removing the hydrocarbon and other liquid droplets.

### Liquid contamination

Other applications include protection of molecular sieve dryer beds from excessive liquid ingress. If the process gases are loaded with excessive free and dissolved liquids, the contaminants will overwhelm the molecular sieve dryers (dehydrators) installed to remove them. This will result in frequent regeneration of the beds and short life for the adsorbent material. The expensive losses from the fouling of these beds and material replacement can be reduced by using our efficient liquid/gas coalescers to remove free liquids from the process gas.

- » Lower operating costs through extended filter element lifetime by reducing pressure drop.
- » Eliminated re-entrainment of droplets at high gas velocities, resulting in improved gas quality.
- » Special design features provide the lowest pressure drop and increase filter lifetime resulting in lower operating cost



**Contaminants in gas supply range from fine solids created from pipeline corrosion to lube oil from compressors. These contaminants create fouling deposits in gas turbine injectors, thereby impeding heat transfer and affect the efficiency of turbine operation.**

## Fluid Catalytic Cracking (FCC)

Fluid catalytic cracking is used to convert low value gas oils to valuable products. FCC produces high octane gasoline, C3/C4 olefins and isobutene by catalytic cracking in a fluid bed reactor. This reactor is fed with steam to vaporize "fresh" oil, recycled slurry oil and catalyst.

After reaction, the catalyst is separated from the hydrocarbon vapor in the disengaging drum by use of multi-cyclones and the hydrocarbons are treated in the fractionation unit. In the bottom of this fractionation unit, catalyst fines and coke, not collected by the cyclones accumulate forming slurry oil.

By removing catalyst fines from slurry oil, or main column bottoms, product fuel oils can be upgraded, or feedstock can be provided for production of carbon black or other products. The installed particulate filter elements (typically 5 to 20 micron mesh stainless steel) will address the fouling caused by catalyst particles from the reactor. The operating conditions dictate the type, number, selectivity and cleaning mechanism/process of the filter elements.

The solid (particle) characteristics and quantity may result in several filtration and cleaning challenges.

## Feed Filter

The feed filter is a process critical particulate filter, typically located between the process unit feed pumps and the first stage heat exchangers to address the fouling and reactor plugging problems. The capacity and type of hydrocarbon dictate the type of filter element, the selectivity and cleaning mechanism.

- » Typical feedstocks are residual oil, gas oil, de-asphalted oil, middle distillate (VGO, HVG0, HGO, LGO etc.) and naphtha.
- » Particle filtration upgrades the feedstocks for further processing elsewhere in the plant.
- » Typically 20 to 80 micron wedge wire or mesh stainless steel filter elements are installed.

### Operational problems

- » Heat exchanger fouling
- » Reactor bed plugging or blinding
- » Hydrogen contamination
- » Final product contamination

These operational problems degrade hydrocracking or hydrotreating performance and can lead to off-spec product, premature unit shutdown and significant increased operating cost for the process unit.

## Amine/Glycol Filtration

Natural gas sweetening (and drying) is a chemical process to remove acid gas (water), hydrogen sulfide and other sour gases from gas blends. An additional process step to recirculate the amine by heat treatment is necessary.

### Key filtration issues

- » Amine quality (cleanliness)
- » Reduce foaming
- » Efficient mass transfer
- » Reduce operating costs (process efficiency)
- » Prevent contamination related downtime
- » Nozzle plugging
- » Heat exchanger plugging
- » Reboiler plugging
- » Pump seal failures

### Filtration benefits

- » Minimize amine (glycol) loss
- » Reduce corrosion
- » Minimize injection of anti-foaming agents
- » Maintain processing capacity
- » Optimize power consumption
- » Recirculation rate (reflux rate)
- » Heat exchanger

This procedure is used in refineries, natural gas and petrochemical plants. Filter elements made from stainless steel and special alloys like Hastelloy, are chemically resistant and can help to extend maintenance intervals and reduce operating cost.



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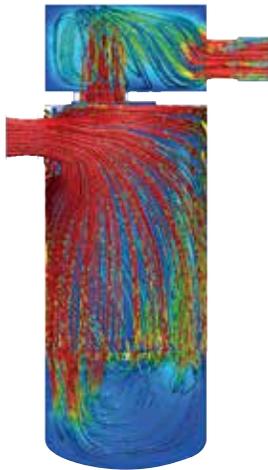
## Flow Simulation

### Fluid Dynamic Analysis

We have extensive experience in the simulation of fluid and media flow characteristics. Utilizing simulation, we can optimize existing systems or design new systems, optimized for specific applications. We routinely upgrade elements and systems for classical fluids, such as gases and liquids, but also for non-classical fluids such as polymers and resins.

#### Typical results will include:

- » Expected start pressure loss
- » Velocity profile within the filter
- » Temperature gradient



## John Crane Services

### Maintenance and Repair Services

To reduce unplanned maintenance and avoid unnecessary replacement costs, John Crane Maintenance and Repair Services oversees critical systems checks and plant equipment maintenance.

Assistance can be provided during unplanned shutdowns to get equipment back up and running quickly, or during planned maintenance to optimize your process and achieve your shutdown window.



**John Crane offers on-call, on-site service support for installation and inspection, repair and troubleshooting of filtration.**



## John Crane Knowhow

Well-designed filtration systems play an important role in maximizing rotating equipment reliability and safety, which is why John Crane developed its series of specially designed liquid and gas filtration products. Since 1990, our Indufil oil and gas filtration products have significantly

reduced contamination and increased the efficiency in thousands of mission-critical operations. With decades of experience and facilities in more than 50 countries, we can provide support and guidance for all your filtration applications.



### Global Service Network

- » Over 200 facilities in more than 50 countries
- » Close proximity to customers' operations
- » Local service and expert global support

**North America**  
United States of America  
Tel: 1-847-967-2400  
Fax: 1-847-967-3915

**Europe**  
United Kingdom  
Tel: 44-1753-224000  
Fax: 44-1753-224224

**Latin America**  
Brazil  
Tel: 55-11-3371-2500  
Fax: 55-11-3371-2599

**Middle East & Africa**  
United Arab Emirates  
Tel: 971-481-27800  
Fax: 971-488-62830

**Asia Pacific**  
Singapore  
Tel: 65-6518-1800  
Fax: 65-6518-1803

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