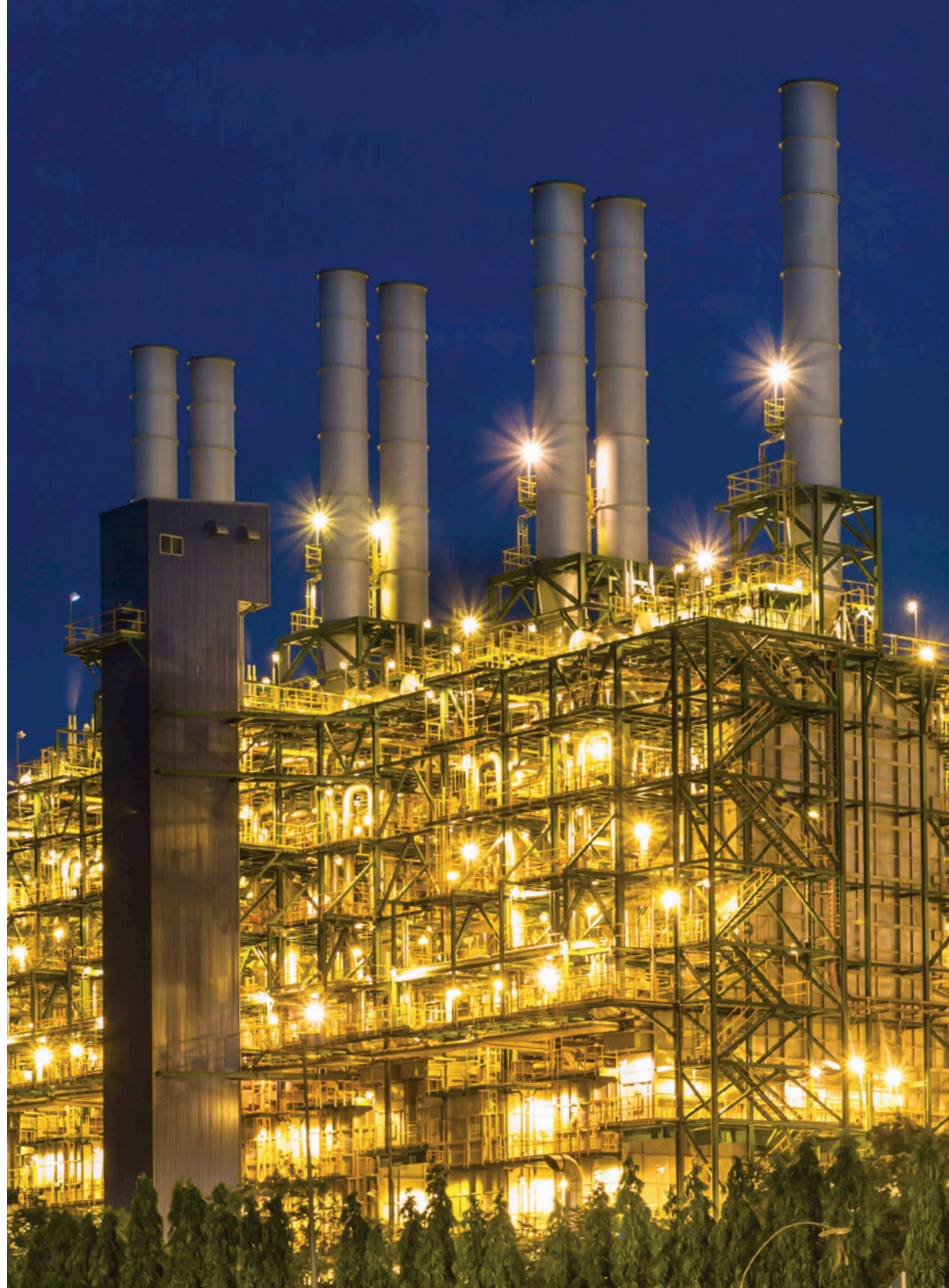




Aerospace
Engineered Materials
Filtration
Fluid Connections
Hydraulics
Instrumentation



Downstream - Petrochemical

Ethylene Process – Cracking and Separation
Filtration Solutions with PECO Products



Oil & Gas
(Downstream)



ENGINEERING YOUR SUCCESS.



When Petrochemical processes presents complex challenges Parker, with its breadth of PECO Brand Oil and Gas Filtration products, presents solutions in response to today's demanding global market, by offering innovative and application specific filtration to ensure integrity and purity throughout the downstream process.

Filtration for process efficiency

From crude to petrochemical production

DOWNSTREAM PETROCHEMICAL DEMANDS

Crude Oil and Natural Gas, processed in Refinery and Gas Processing Plants respectively, produces feedstock for the downstream petrochemical market segment, a critical intermediary in the production of final products like Polyethylene, Polypropylene, etc. and key ingredients for many commonly used finished goods. Effective and reliable separation and filtration of petrochemical raw material, intermediate products, and recycled process fluids, at various points in petrochemical processes, is paramount to improving end product quality as well as extending the life of capital equipment and reducing costly downtime. Parker meets these needs with filtration that gets the job done with minimal maintenance and downtime.

COMMITTED TO PROCESS OPTIMIZATION

Parker recognizes that due to hazards associated with maintenance in petroleum production facilities, along with high disposal costs, minimizing both change-out frequency and process downtime are very important issues. Parker optimizes our filtration products to ensure that the total cost of ownership for contaminant control is balanced, without compromising process efficiency. For over 80 years Parker's PECO Brand products has led the way in Oil and Gas Filtration Solutions. Customers trust the PECO Brand for quality and performance to handle complex contaminant management issues.

FILTRATION REQUIREMENTS IN THE ETHYLENE MANUFACTURING PROCESS

Parker Industrial Process Filtration provides optimized engineered solutions to:

- Eliminate fouling of Catalyst, Furnaces and Reactor Beds
- Improve plant capacity, availability, operation efficiency and lower OPEX.
- Meet final product purity and end-customer specifications
- Eliminate Low NOx burner tip plugging and flameouts
- Protect processing equipment and reduce process upsets and downtime

ETHYLENE BY STEAM CRACKING PROCESS

The steam-cracking process for ethylene production from an ethane-propane mixture, can be divided into three main parts: (1) cracking and quenching, (2) compression and drying, (3) separation.

Cracking and Quenching: Initially an ethane-propane mixture or liquid feed like Naphtha or gas oil is fed to furnaces in which, under high severity conditions is cracked, forming ethylene, propylene and other by-products. The furnace outlet stream is subsequently fed to a water-based quench, to prevent further reactions and formation of undesirable by-products. Cracked gas from the quench is then directed to compression and separation.

Compression and Drying: The compression of the cracked gas is performed across five stages. After the third stage of compression, carbon dioxide and sulfur are removed from the cracked gas by caustic soda and water washes in a caustic scrubber. The compressed cracked gas is cooled and subsequently dried by molecular sieves that remove most of the water.

Separation: The dried cracked gas is then fed to a cold box for the removal of hydrogen and light hydrocarbons, while minimizing ethylene losses. At this point, condensates from the chilling train are fed to a series of separation columns. After being processed through the series of separators, Ethylene is obtained as a final product.

ETHYLENE PROCESS CONTAMINANTS

- Corrosion products, water, salts, pipeline scales, coke particles
- Green Oil
- Red Oil
- Yellow Oil
- Mol Sieve Fines
- Lube Oil, aerosols and mist

ETHYLENE MANUFACTURING - KEY ISSUES

Feed: Hydrocarbon feedstock often contains significant levels of corrosion products, water, and salts. Sodium and iron oxides are known to be coke promoters and their presence can reduce the run time of the ethylene furnaces before decoking is required and, in some instances, reduce the life of the furnace tubes by as much as one-third. Unscheduled or frequent decoking cycles lead to a loss in ethylene production, shortened furnace tube life, and create higher maintenance costs.

Fuel Gas: Burner tip plugging is one of the primary performance and maintenance concerns requiring fuel gas filtration. A Fuel Filter / Coalescer is recommended to remove particulate, scale and condensed liquids in the fuels.

QUENCH SYSTEM: QUENCH "PROCESS" WATER AND PYROLYSIS GASOLINE

Quench "Process" Water: The water out of the Quench Water Tower is known as Quench "Process" Water. It contains some C5/C6 oil and coke particles. In an Ethylene Plant, fouling of the Dilution Steam System Heat Exchanger can be a source of high maintenance and operating cost. Common problems include:

- Increased energy consumption as steam usage increase
- High downtime and maintenance cost
- Reduced efficiency due to fouling of heat recovery system

Pyrolysis Gasoline/PyGas is a by-product of the cracking process, used as a blending agent in the gasoline pool, thus the need to be clean and free of any solids/coke particles and water, to ensure quality of the final product.

COMPRESSOR INLET AND OUTLET CRACKED GAS FILTRATION

Compressor Inlet: Cracked Gas from the quench tower may contain solid particles and liquid aerosol contamination, causing mechanical failures in reciprocating and centrifugal compressors.

Compressor Outlet: Lubrication oil from compressors is the source of liquid contamination, which fouls and plugs downstream equipment nozzles, valves, instruments, process streams, heat exchangers, etc.

Protection of Mol Sieve Bed: Hydrocarbon condensates, and/or wash oils from the compressor, can greatly reduce the performance and life of a Molecular Sieve adsorbent bed. Common problems include:

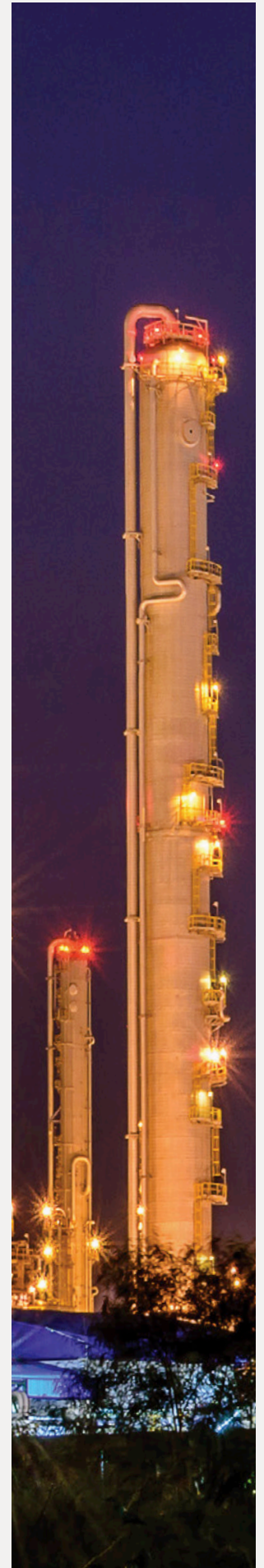
- Frequent regeneration cycles
- Adsorption performance loss
- Premature replacement of the Molecular Sieve material due to attrition

Spent Regeneration Gas Treatment for Burner Protection: The spent regeneration gas, if not treated, will lead to plugging of Low NOx Burners.

Caustic Wash and Spent Caustic Treatment: The presence of contaminants like Oil/ Gasoline affect the performance of the Wet Air Oxidation Reactor. Polymer formation is the most common cause of fouling in caustic towers. Entrained oils, formed from polymerization, can also upset the WAO operation.

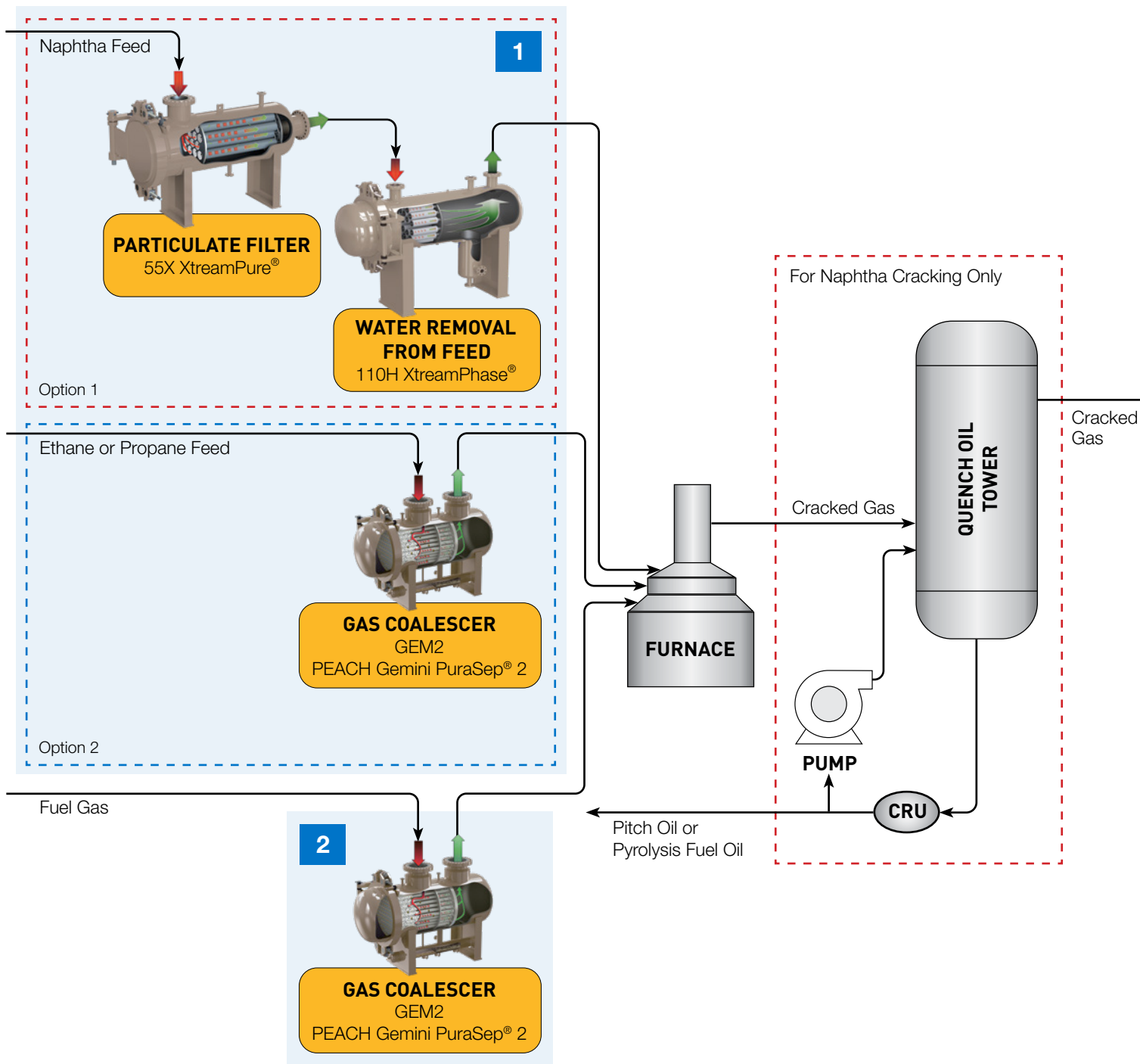
Green Oil Removal: Green Oil carry-over, along with gas, can result in the following issues:

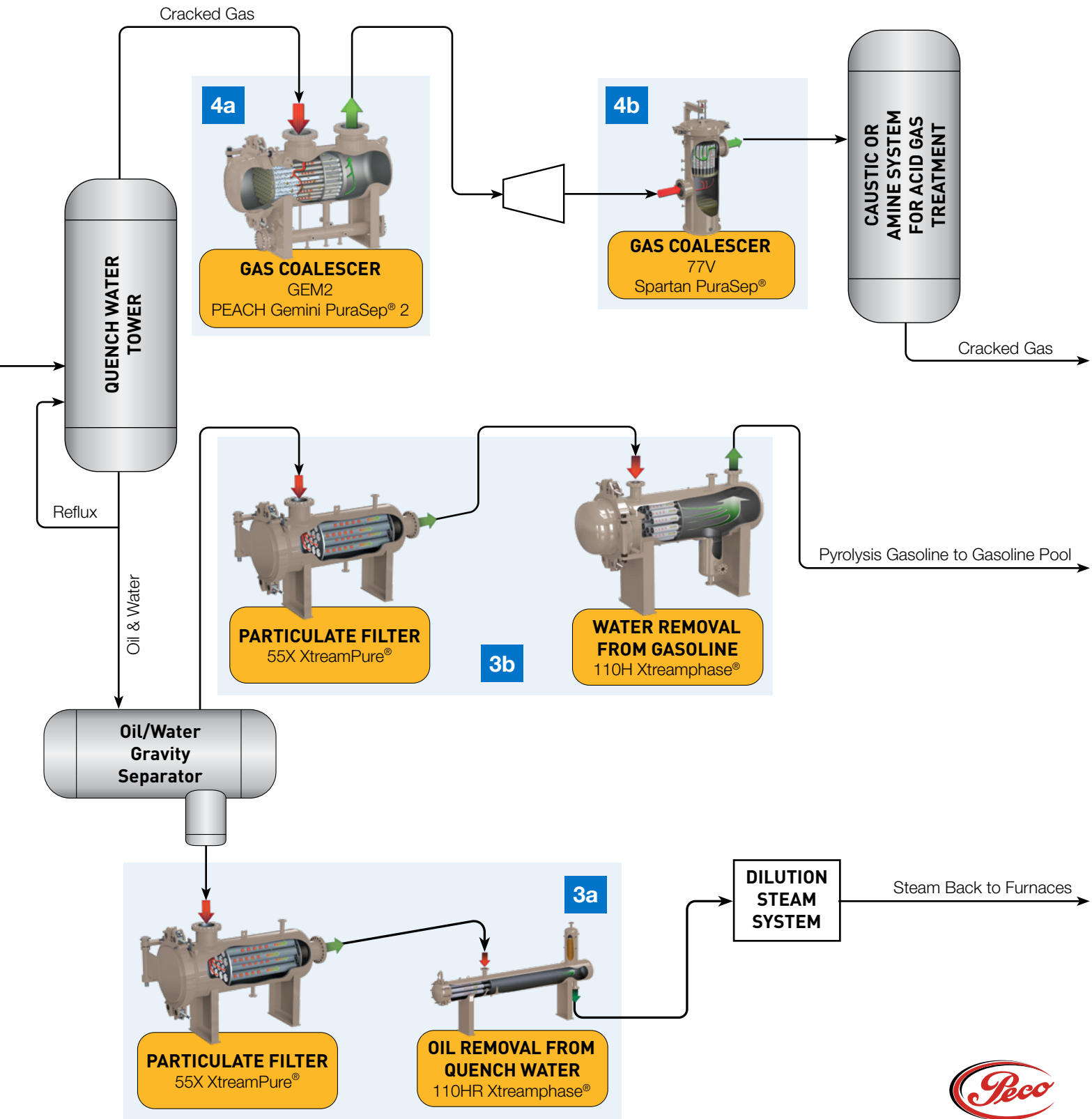
- Reactor bed fouling
- Fouling of heat exchangers, dehydrator beds, fractionators
- Regeneration gas fouling, leading to furnace burner tip plugging



ETHYLENE - CRACKING

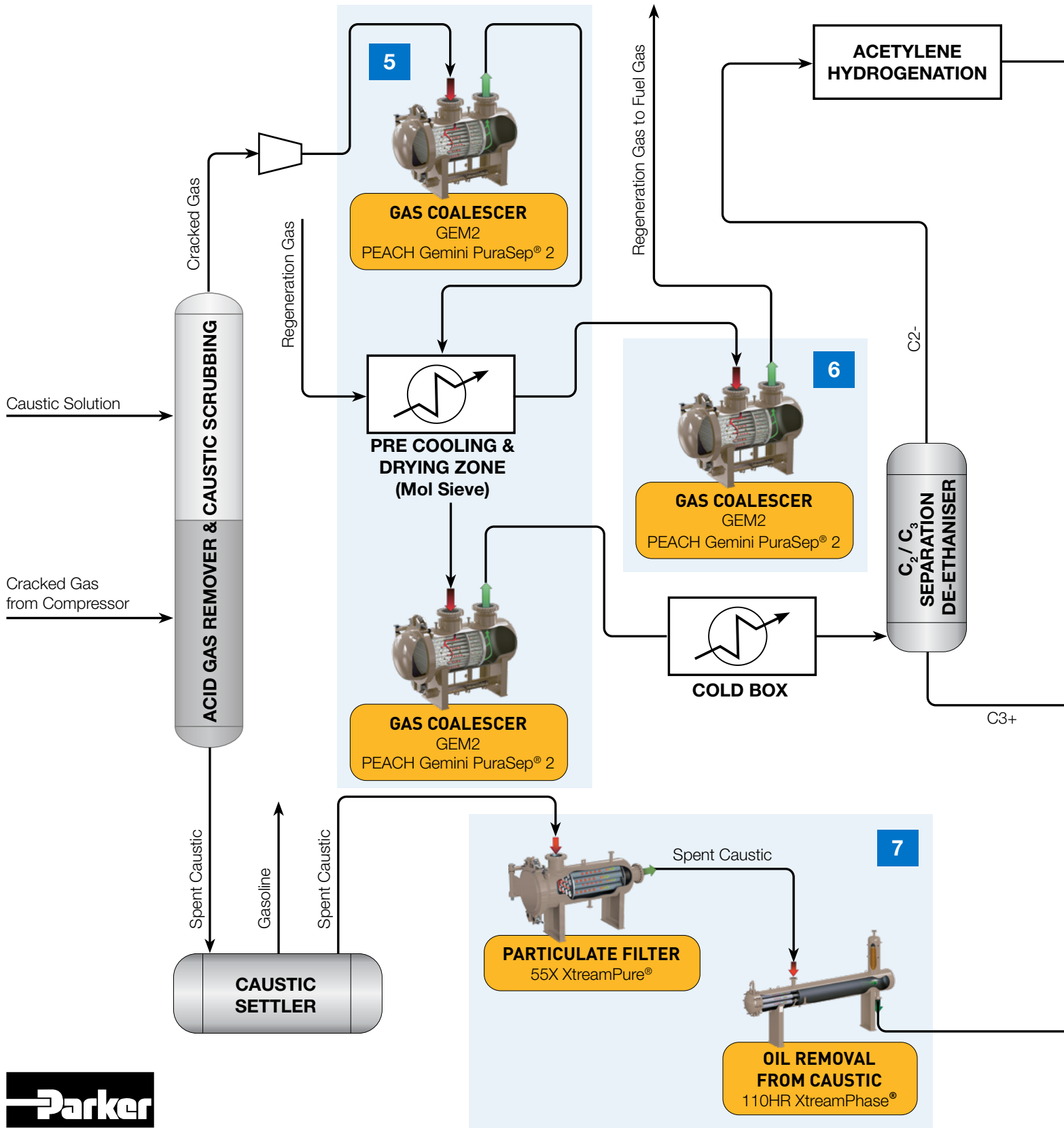
FILTRATION & SEPARATION EQUIPMENT



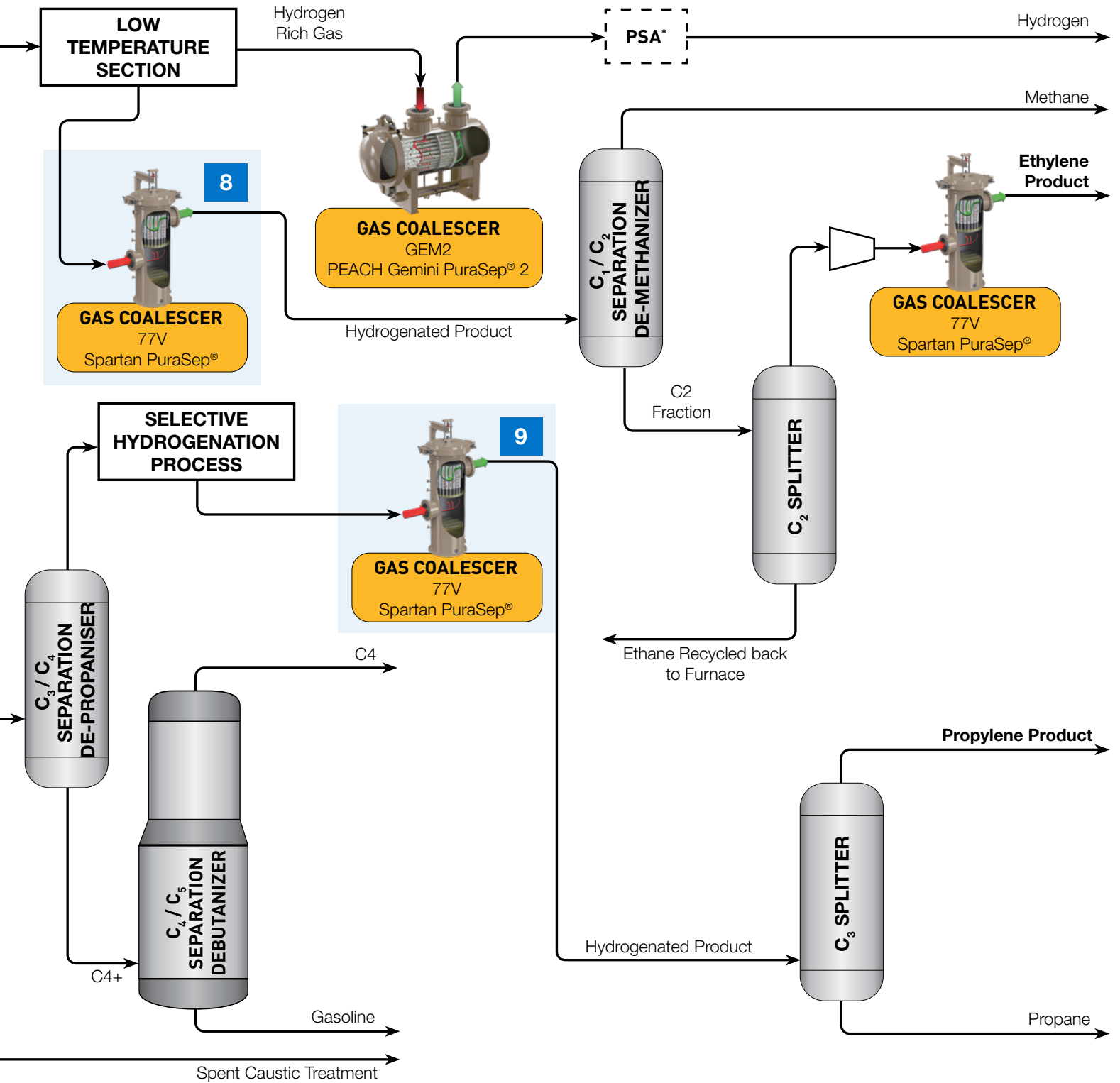


ETHYLENE - SEPARATION SECTION FRONT

FILTRATION & SEPARATION EQUIPMENT

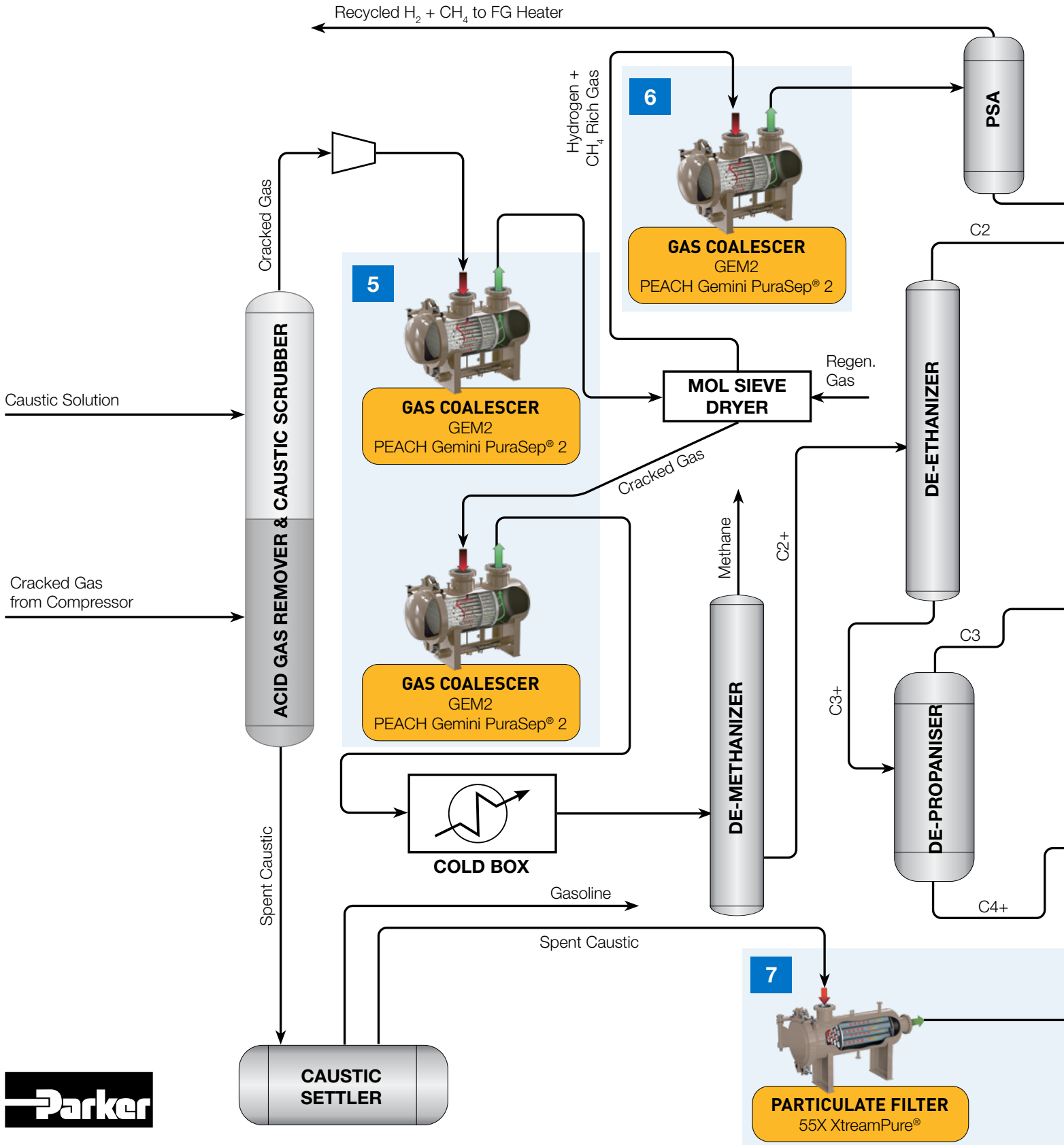


END HYDROGENATION

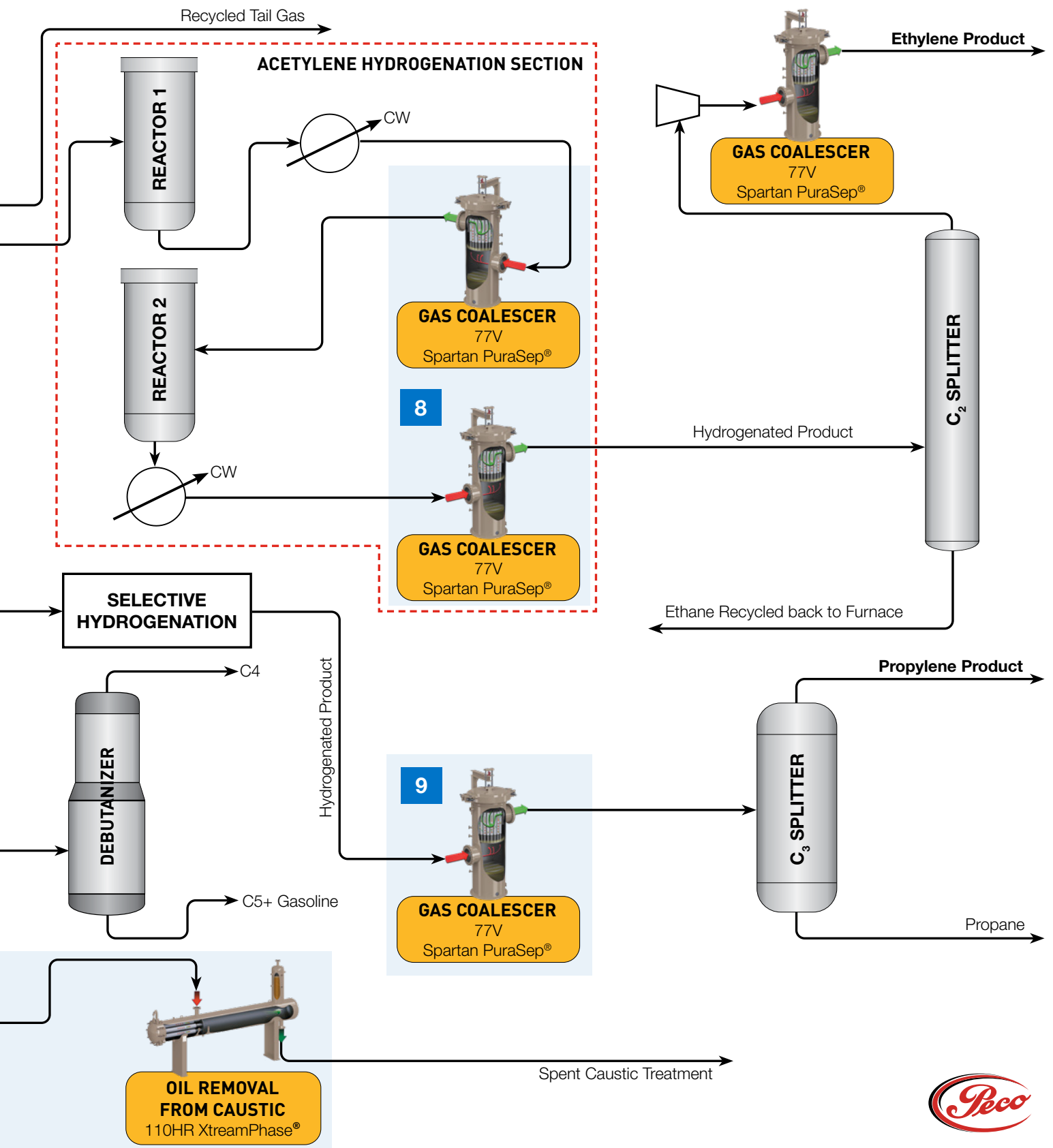


ETHYLENE - SEPARATION SECTION BACK

FILTRATION & SEPARATION EQUIPMENT



END HYDROGENATION



FILTRATION SOLUTIONS

1. FEED FILTRATION

a. Gas (Ethane, Ethane – Propane mix) Feed:

Gas Filter-Coalescer

(PECO, PEACH Gemini PuraSep® 2, Series GEM2 horizontal coalescer with PGC cartridges)

- High efficiency 0.3 micron coalescer
- Removes solid and liquid contaminants
- Prevents fouling of furnace tubes.

b. Liquid (Naphtha, Gas Oil) Feed:

Liquid Filter Pre Filter

PECO, XtreamPure®, Series 55X filter with 6" diameter XP cartridges

- Removes corrosion products and particulates
- Prevents clogged furnace tubes
- Prevents particulate deposits steam cracker

Liquid-Liquid Phase Coalescer

PECO, XtreamPhase®, Series 110H coalescer

- Protects fouling of furnace by removing water down to 8-10 ppmv in the feed stream

2. FUEL GAS FILTRATION

Gas Filter-Coalescer

PECO, PEACH Gemini PuraSep® 2, Series GEM2 horizontal coalescer with PGC cartridges

- High efficiency 0.3 micron coalescer
- Removes solid and liquid contaminants
- Protects burner tips

3A. QUENCH "PROCESS" WATER FILTRATION

Liquid Filter

PECO, XtreamPure®, Series 55X filter with 6" diameter XP cartridges

- Removes particulates from the Quench "Process" water stream

Liquid-Liquid Phase Coalescer

PECO, XtreamPhase®, Series 110HR coalescer

- Removes hydrocarbon (oil) carryover down to 8-10 ppmv in the Quench "Process" water stream.
- Prevents fouling in downstream equipment such as dilution steam generators
- Helps maintain good water quality and steam balance
- Reduces loss of water or requirement of fresh water make-up

3B. PYROLYSIS GASOLINE/PYGAS FILTRATION

Liquid Filter

PECO, XtreamPure®, Series 55X filter with 6" diameter XP cartridges

- Removes particulates from the Pyrolysis Gasoline/PyGas stream

Liquid-Liquid Phase Coalescer

PECO, XtreamPhase®, Series 110H coalescer

- Removes water/mist from the PyGas stream down to 8 – 10 ppmv, which helps in improving its purity.

4A. COMPRESSOR INLET CRACKED GAS FILTRATION

Gas Filter-Coalescer (PECO, PEACH Gemini PuraSep® 2, Series GEM2 horizontal coalescer with PGC cartridges)

- High efficiency 0.3 micron coalescer
- Removes solid and liquid contaminants
- Prevents mechanical damage of compressors.

4B. COMPRESSOR OUTLET CRACKED GAS FILTRATION

Gas Coalescer

PECO, Spartan PuraSep®, Series 77V vertical coalescer with NGGC cartridges

- High efficiency 0.3 micron liquid coalescing
- Prevents lube oil carryover in the compressed Cracked Gas

5. PROTECTION OF MOL SIEVE BED

Gas Filter-Coalescer

PECO, PEACH Gemini PuraSep® 2, Series GEM2 horizontal coalescer with PGC cartridges

- High efficiency 0.3 micron coalescer
- Removes solid and liquid contaminants
- Prevents Molecular Sieve fouling
- Prevents Solid and Oil carryover to cold box

6. SPENT REGENERATION GAS TREATMENT FOR BURNER PROTECTION

PECO, PEACH Gemini PuraSep® 2, Series GEM2 horizontal coalescer with PGC cartridges

- High efficiency 0.3 micron coalescer
- Removes solid and liquid contaminants
- Protects burner tips

7. CAUSTIC WASH AND SPENT CAUSTIC TREATMENT

Liquid Filter

PECO, XtreamPure®, Series 55X filter with 6" diameter XP cartridges

- Removes particulates from the Caustic stream

Liquid-Liquid Phase Coalescer

PECO, XtreamPhase®, Series 110HR coalescer

- Removes hydrocarbon (oil) carryover down to 8-10 ppmv in the Caustic stream.
- Helps protect the Thermal Oxidizers (WAO) from failures by removing oil from the caustic stream

8. GREEN OIL REMOVAL

Gas Coalescer

PECO, Spartan PuraSep®, Series 77V vertical coalescer with NGGC cartridges

- High efficiency 0.3 micron liquid coalescing
- Prevents fouling of critical equipment's like acetylene reactor, furnace tubes.

9. OIL REMOVAL

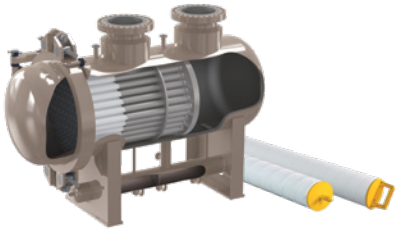
Gas Coalescer

PECO, Spartan PuraSep®, Series 77V vertical coalescer with NGGC cartridges

- High efficiency 0.3 micron liquid coalescing
- Prevents oil carryover and fouling of critical equipment

PECO Filtration Products

SERIES GEM2, PEACH GEMINI PURASEP 2 HORIZONTAL GAS FILTER-COALESCER



The PEACH Gemini PuraSep is an innovative product in gas coalescing technology which provides the solids loading capabilities of a filter-separator with the liquid removal efficiency of a vertical coalescer. This patented design provides ultra-clean gas with high efficiency removal of solid and liquid contaminants down to 0.3 microns. It can effectively handle higher inlet solids and liquid loads versus conventional vertical coalescing equipment and is designed to remove a wide range of liquid contaminants such as lubricating oils, low surface tension liquids and aerosol mists.

SERIES 77V, SPARTAN PURASEP VERTICAL GAS COALESCER



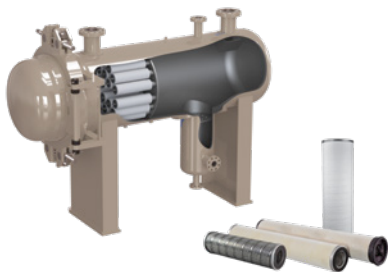
The Spartan PuraSep gas coalescer is a highly efficient mist and aerosol remover down to the 0.3 micron level. Series 77V coalescers work best with minimal solids and low surface tension liquids such as lube oil and NGL with minimal liquid loading.

SERIES 55X, XTREAMPURE HIGH FLOW RATE, LIQUID FILTER



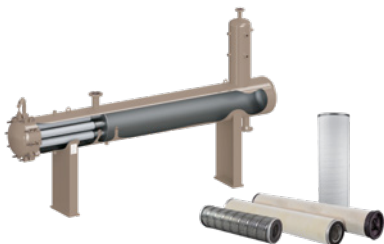
The XtreamPure vessel and cartridge line removes particulate in liquid applications with flow rates over 200 gpm. It provides high capacity filtration for virtually any liquid application by utilizing large 6" diameter cartridges in 40", 60" and 80" lengths with a variety of material choices for compatibility and performance needs. The inside-to-outside flow through the cartridge ensures contaminant is captured within the cartridge allowing a cleaner cartridge extraction during change-outs.

SERIES 110H, XTREAMPHASE HORIZONTAL LIQUID-LIQUID PHASE COALESCER



The Series 110H vessel is used to separate and remove a discontinuous phase fluid, such as water from a continuous phase fluid, such as a product stream. Removal of the discontinuous phase fluid down to 8-10 ppm can be achieved.

SERIES 110HR, XTREAMPHASE HORIZONTAL LIQUID-LIQUID PHASE COALESCER



The Series 110HR vessel is used to separate and remove a discontinuous phase fluid, such as a hydrocarbon from a continuous phase fluid, such as water. Removal of the discontinuous phase fluid down to 8-10 ppm can be achieved.

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