

Oil and Gas: Application Focus

Mercury Removal from Natural Gas

Process Description

Mercury is present in most natural gas fields in concentrations from <10 ppb to >1 ppm as elemental (metallic), organic, and also inorganic compounds. Removal of mercury to non-detectable levels is important since it is toxic, can poison catalysts used in downstream process units, and can damage downstream equipment through liquid-metal embrittlement (LME), a form of corrosion leading to crack initiation and propagation primarily in equipment constructed from aluminum. It has resulted in numerous equipment failures, unscheduled shutdowns, and in some cases fires.

Mercury can be removed using either non-regenerative or regenerative adsorbents. In both cases hydrocarbon gas enters the top of an adsorption tower and flows downward through the adsorbent where the mercury is adsorbed, exiting the bottom for further processing or sale. Regenerable systems have two or more adsorption towers enabling one to be regenerated while the remaining tower(s) are in operation. Bed regeneration is accomplished by flowing heated regeneration gas upward so that contaminants adsorbed near the inlet can be removed without flushing them through the entire bed. Protection of the beds from liquid water contamination is critical to ensure effective mercury removal and long, reliable bed life.

Ensure your mercury removal reliably meets your daily production quotas and environmental protection needs.



Gas Plant Needs

- Achieve or exceed natural gas or LNG production quotas via reliable treatment of raw natural gases
- Provide consistent gas quality for mercury content, typically <10ng/Nm³ (approx. 1 pptv)
- Protect downstream cryogenic equipment against LME
- Minimize adsorption bed degradation or capacity loss resulting in premature bed replacement

Production Challenge/Pall Solution

Challenge	Solution
<p>Protection of downstream aluminum equipment from LME failure due to adsorption bed degradation that reduces mercury removal due to foreign material, such as glycol, amine, lube oil, corrosion inhibitors and solids, coating and plugging the pores of the adsorbent, typically leading to the need for expensive premature bed replacement</p>	<p>Improve your equipment reliability, productivity and safety via assured mercury removal efficiency and bed life with effective liquid and solid removal upstream of the adsorption beds. Bed life extensions of a year or more may be possible from improved protection.</p> <ul style="list-style-type: none"> • 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.
<p>Bed damage due to continuous low level or slug ingress of liquid water, causing the bed to “explode” from thermal shock</p>	<p>Protect against introduction of traces or slugs of liquid by capturing the water upstream of the desiccant beds.</p> <ul style="list-style-type: none"> • The SepraSol Plus liquid/gas coalescer assembly has a dual sump provision that accepts most slugs without bypass or loss of removal efficiency. • Pall’s proprietary oleophobic treated coalescers provide superior continuous liquid removal performance, and also recovers quickly from most short-term liquid overloads, minimizing the pressure drop across the assembly and chance of liquid carryover.

Challenge

Damage to downstream process equipment due to entrainment of desiccant fines in the mercury-free gas stream

Solution

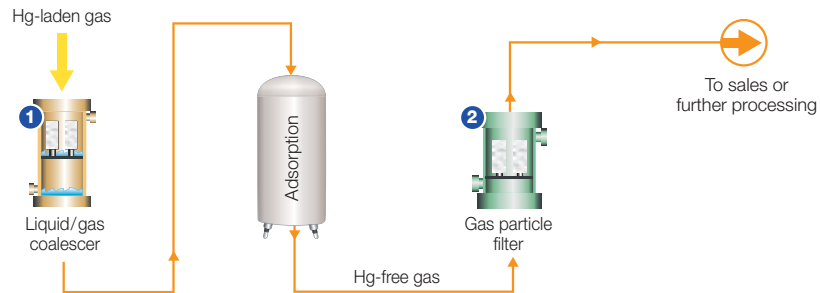
Ensure productivity and reliability by protecting downstream equipment such as cryogenic heat exchangers, compressors and catalyst beds through effective solids control downstream of the adsorption beds.

- The DGF Dry Gas Particulate Filter removes desiccant fines and other contaminants from the dry hydrocarbon gas stream before it enters the cryogenic unit, pipeline, compressor, or catalyst bed.

Process Flow Diagram

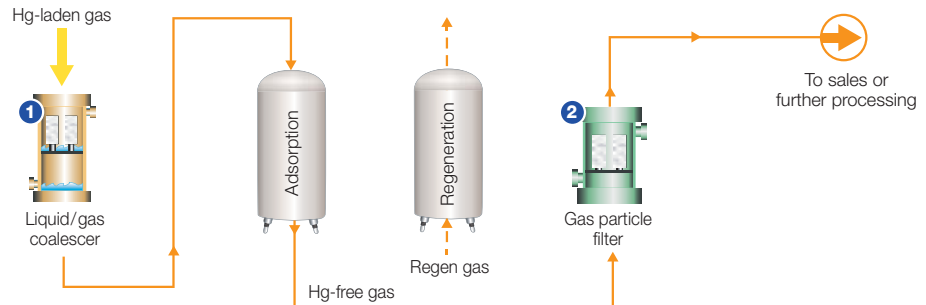
Non-regenerative adsorption

- Activated carbon
- Sulfur or halide—impregnated activated carbon
- Mixed or metal sulfide on alumina or activated carbon



Regenerative adsorption

- Silver on molecular sieve (can be a layer in a molecular sieve dehydration bed)



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

	Application	Pall Product	Advantages	Customer Benefits
1	Adsorption bed protection	SepraSol Plus liquid/gas coalescer Medallion HP liquid/gas coalescer	Remove liquid water and hydrocarbons that shorten adsorbent life	Productivity, process and equipment reliability and on-spec mercury content via maintained adsorber efficiency and capacity
2	Downstream protection	MCC1401 style dry gas filter Profile® Coreless dry gas filter	Protect metering, downstream processes and other instrumentation from abrasive adsorbent fines	Downstream process reliability by elimination of adsorbent dust



Fuels and Chemicals

25 Harbor Park Drive
Port Washington, New York 11050
+1 516 484 3600 telephone
+1 888 873 7255 toll free US

Visit us on the Web at www.pall.com

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