

## Solid Bed Scavengers



### Product Definition

**Frames Solid Bed Scavengers efficiently sweeten natural gas by chemically removing hydrogen sulfide. Thanks to close collaboration with our clients and use of the latest technology, our Solid Bed Scavengers are a specialist solution ideal for small gas flows and polishing applications. They also work extremely well in demanding applications, such as floating production, storage and offloading (FPSO) facilities.**

### Product Description

Solid bed scavengers are an important component of our solutions for production of clean, high-value gas streams, ready for downstream applications. The solid bed scavenger technology efficiently removes hydrogen sulfide by chemically bonding it to non-regenerable adsorbent granules. This effectively sweetens the gas stream while forming water and a harmless residual product which can easily be disposed of or repurposed.

#### Customized for your unique operating conditions

At Frames, we focus on helping our clients implement the best possible processes in their business with maximum value from natural resources. Our team of in-house engineers cooperates closely with carefully selected, specialized adsorbent suppliers delivering fully integrated sweetening solutions, including pre-treatment systems. Our combined expertise and industry know-how enable us to deliver a complete package for which Frames provides both the process and mechanical guarantee, ensuring continuous, trouble-free operation.

Early involvement ensures that we are able to design optimized solutions with respect to the project's specific needs. During the early stages of a project, we support our clients by calculating the consequences of different technical options with regard to both CAPEX and OPEX.

Based on an extensive analysis of a client's situation and requirements, we will select the best possible mix of technology. Besides technical parameters such as gas flow and composition, our analysis also takes into account general requirements such as customer specifications and integration into overall process design.

## Solid Bed Scavengers



Solid Bed Scavenger Vessel Prepared for Transport

### Robust and reliable units

Frames Solid Bed Scavengers are extremely robust and require minimal operator involvement, even when working under the most demanding of conditions. The entire chemical process is exothermic, meaning no energy is required for proper operation. This makes Frames Solid Bed Scavengers the ideal gas sweetening solution for remote locations and challenging circumstances.

### Quick-and-easy loading system

Sharp design with smart ergonomics minimizes on-site handling of the scavenger material, with quick and easy loading and unloading of the vessels. Vessels are normally refilled without any plant downtime, while maintaining the required H<sub>2</sub>S specification of the product gas. This is achieved by employing a lead/lag configuration which has the additional benefit of maximizing bed lifetime, thus optimizing operational costs.



Solid Bed Scavenger Technology and Pre-treatment Combined in One Optimized Package

## Process Description

Frames Solid Bed Scavengers are housed in modular vessels with the gas stream flowing through the vessels. The type of chemical adsorbent used depends on the gas composition and operating conditions. Two main types of chemicals are used: iron oxide-based and mixed metal oxide-based.

The reaction process is similar for both types of chemicals: hydrogen sulfide contained in the feed gas selectively bonds with the iron or metal oxides in a process commonly referred to as chemisorption. To optimize the sweetening process, the scavenger materials are granular and highly porous, creating a large, reactive surface area.

Processes using mixed metal oxides generally have faster reaction rates, higher capacities and lower pressure drops compared to iron oxide-based processes. Spent mixed-metal-oxide material is disposed of through the metal reclamation industry, while spent iron oxides are generally handled as a waste stream.

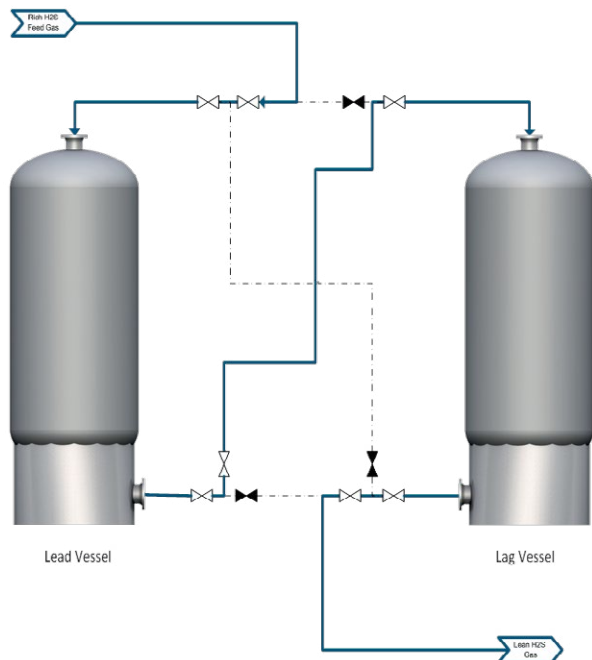
# Solid Bed Scavengers

## Project Management

At Frames, we look at the bigger picture. Our team of in-house experts works with our clients to understand their business, and challenge them to examine better solutions that give them the competitive edge.

From optimizing production to cutting operating costs, we work to fully integrate our Frames solutions into your production system within budget, on time, and in spec for years of trouble-free operation.

We understand your expectations for high performance, and use industry-leading project management and document control to design, construct, and commission quality products where and when you need them. Our centralized engineering and construction teams in the Netherlands work together to find effective answers to each unique project, with our global network of offices, suppliers, and trusted service providers giving us the global reach to fully accomplish the most challenging projects.



Process flow scheme of two vessels in lead/lag configuration

## Technical Details

- Simple, straightforward technology and operation
- Selective H<sub>2</sub>S removal to very low levels in product gas
- Easily disposable and harmless residual product
- Suitable for unmanned operation
- Operating flexibility; able to handle fluctuating inlet conditions without operator involvement
- Minimal downtime
- No energy required
- Quick and easy material change-out
- Highly reliables

## Added Value Frames

- Design according to your system's unique requirements, ranging from general project requirements, equipment and materials, to gas composition, contaminant levels, flow rates, etc.
- Collaboration with leading suppliers of solid bed scavenger materials
- Design by our in-house engineering team using smart 3D-modelling technology for a perfect fit with your production system
- Thorough review of requirements and suitable technology with objective advice in terms of optimum CAPEX/OPEX
- Worldwide service with full, expert support

## References

- P-75/P-77 FPSO Petrobras – QGI, Brasil
- GC-16 Kuwait Oil Company – Alkhorayef Group

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# Frames Family Tree

