

## LAMINOL®



LAMINOL® installation Groot Zevert Vergisting

## Product Definition

**Hydrogen sulfide (H<sub>2</sub>S) is a very toxic and corrosive gas that causes problems in both the upstream and downstream oil and gas industry as well as biogas plants. H<sub>2</sub>S is a colorless, flammable, and extremely hazardous gas with a characteristic odor similar to “rotten egg”.**

**Frames LAMINOL® H<sub>2</sub>S technology can provide a cost-effective alternative to conventional biogas sweetening processes such as impregnated active carbon or solid dry bed processes to prevent hydrogen sulfide corrosion. The LAMINOL® technology of Frames is capable of selectively removing H<sub>2</sub>S from CO<sub>2</sub> rich gas streams to a few ppm level even at near atmospheric gas pressure.**

## Product Description

Existing sweetening processes such as impregnated active carbon or solid dry bed processes can effectively remove H<sub>2</sub>S to very deep level, but these processes are very expensive in operation especially when high H<sub>2</sub>S concentration are present. Engineered biological H<sub>2</sub>S removal processes are cheaper especially at higher H<sub>2</sub>S concentrations,

however, biological processes experience stability difficulties under fluctuating H<sub>2</sub>S conditions, are susceptible to poisoning by pollutants and are typically not very selective, limiting their use to H<sub>2</sub>S bulk removal. Frames LAMINOL® technology provides a cost-effective alternative for deep H<sub>2</sub>S removal but with high stability based on a selective reaction. Laminol can stable remove high H<sub>2</sub>S peaks. Frames LAMINOL® technology is especially suitable for treating raw biogas with up to 200 ppm (average) of H<sub>2</sub>S up to 5000 ppm. Laminol technology deeply removes H<sub>2</sub>S even at low pressure protecting compressors or other critical biogas upgrading plant parts.

By completely eliminating H<sub>2</sub>S upfront of further biogas handling, corrosion, safety and operational expenditures (e.g. compressor oil) are significantly reduced in the rest of the biogas utilization installation. Laminol technology comes in a liquid scavenger form or in a fully regenerative form in which elementary sulfur is produced. The liquid scavenger is applicable in cases average H<sub>2</sub>S concentrations are low but typical H<sub>2</sub>S peaks can be high. Even at H<sub>2</sub>S concentrations above 5.000 ppm LAMINOL scavenger is able to remove H<sub>2</sub>S below 3 ppm with very high efficiency, making it an ideal solution for biogas with average up to 200 ppm H<sub>2</sub>S content but incidental high H<sub>2</sub>S peaks. The regenerative LAMINOL® version employs a biodegradable and safe scrubbing fluid that selectively react with H<sub>2</sub>S removing H<sub>2</sub>S to below 3 ppm. By regeneration of the fluid with air in a regeneration reactor elementary Sulfur is produced which is separated concentrated and can be employed as Sulfur fertilizer.

## LAMINOL®

### Process Description

In a typical LAMINOL® installation, raw gas contaminated with  $H_2S$  is fed into the top of a packed column, along with LAMINOL® solvent. Both gas and liquid move from the top to the bottom through the column while the  $H_2S$  is being absorbed. The scrubbing liquid is collected and pumped back to the top of the packed column by a pump.

Picture 1 shows the scavenger based LAMINOL® installation. In this installation the scrubbing liquid is collected and mixed with fresh liquid from a buffer vessel. The Laminol is reactivated by the concentrated scavenger from the buffer vessel and pumped back to the top of the packed column by a screw pump. When the LAMINOL® is spent the pH drops slowly indicating that a solvent exchange is imminent. The pH is always higher than 4 which makes the use of normal stainless steels possible.

Picture 2 shows the regenerative LAMINOL® installation. In this installation the scrubbing liquid is collected in a regeneration reactor in which the liquid is regenerated using air. Elementary sulfur is formed which is separated in concentrated form using the included separation section. Regenerated scrubbing liquid being fully restored in absorption capacity is pumped back to the top of the packed column by a pump. The regenerative reactions between oxygen and  $H_2S$  facilitated by the scrubbing liquid is very selective, however, small amounts of liquid make up and some pH correction is automatically applied. The formed sulfur is collected as a sulfur cake which can be used for fertilization purposes.



Picture 1 - Scavenger based LAMINOL® installation



Picture 2 - Regenerative LAMINOL® installation

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## LAMINOL®

### Project Management

Good project management is like being a football manager – you have to direct and coordinate all efforts in order to optimize the results of the team.

At Frames, we work as a coordinated team that focuses on integrated solutions. Our multidisciplinary teams ensure smooth integration of Frames technology unit operations with technologies provided by partners or sub-contractors, in order to create a total biogas processing solution. By combining our project management system with the skills of our project managers, we can punctually deliver equipment for all projects, while paying particular attention to our health, safety, environment and quality requirements, as well as those of our clients.

Thanks to a network of international partners and a worldwide supply chain, our clients benefit from smart services provided by a strong and global project management company.

### Technical Details

- **Constant pH of the LAMINOL® scrubbing liquid**
- **Full regeneration of LAMINOL® scrubbing liquid to elementary sulfur**

### Added Value Frames

- **Cost-effective alternative to conventional gas/liquid sweetening processes**

### References

- **HVC Middenmeer - The Netherlands**
- **Groot Zevert Vergisting - The Netherlands**

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# Frames Family Tree

