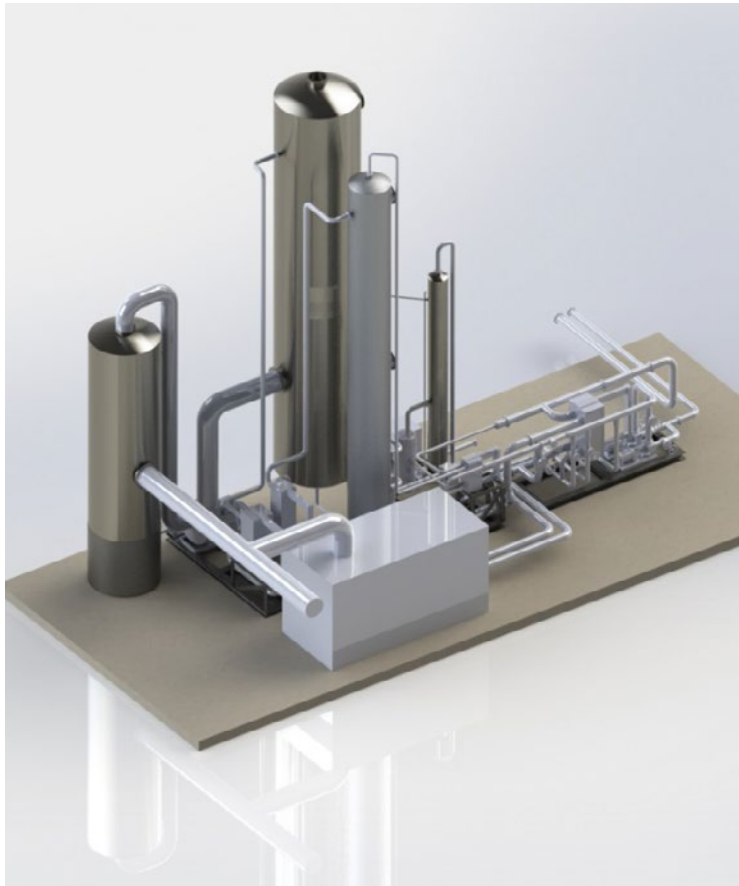


## GALLOXOL®



CO<sub>2</sub> capture and CO<sub>2</sub> processing/quality control gaseous CO<sub>2</sub> delivery

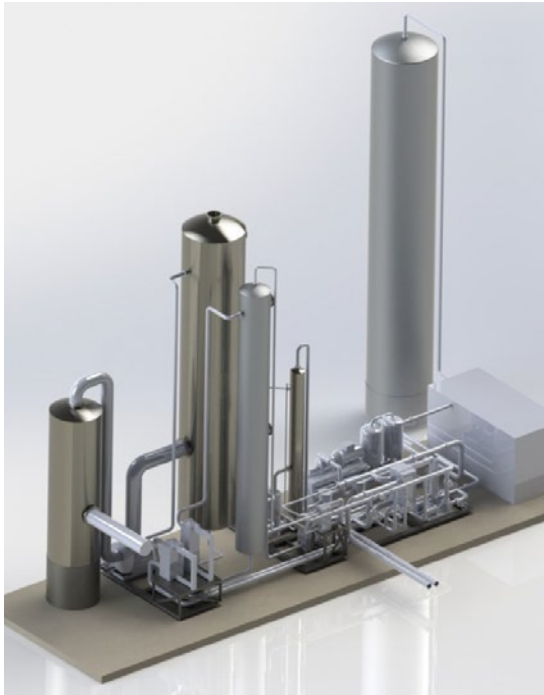
## Product Description

Our mission is to develop innovative technologies and we see it as our responsibility to offer sustainable solutions for energy production to clients all over the world. Removing CO<sub>2</sub> is integral part of our gas upgrading roots. Capturing CO<sub>2</sub> from flue gas and biogas streams is a natural extension of these roots. Separating CO<sub>2</sub> from flue gasses of Industry and biogas production installations into concentrated CO<sub>2</sub> allows for reduction of the carbon footprint but is often also an attractive business propositions.

The challenge in Capturing CO<sub>2</sub> from biogas lies in the low CO<sub>2</sub> partial pressure of the biogas originating from the digester in combination with typical deep CO<sub>2</sub> removal requirement. The low driving forces for CO<sub>2</sub> capture require an inventive and selective capture solution to produce high purity bio methane. At the same time the capture solution should be able to deal with biogas pollutants but stay cost effective. As green technology it should also be assured that the CO<sub>2</sub> capture technology creates no emission of its own.

## Product Definition

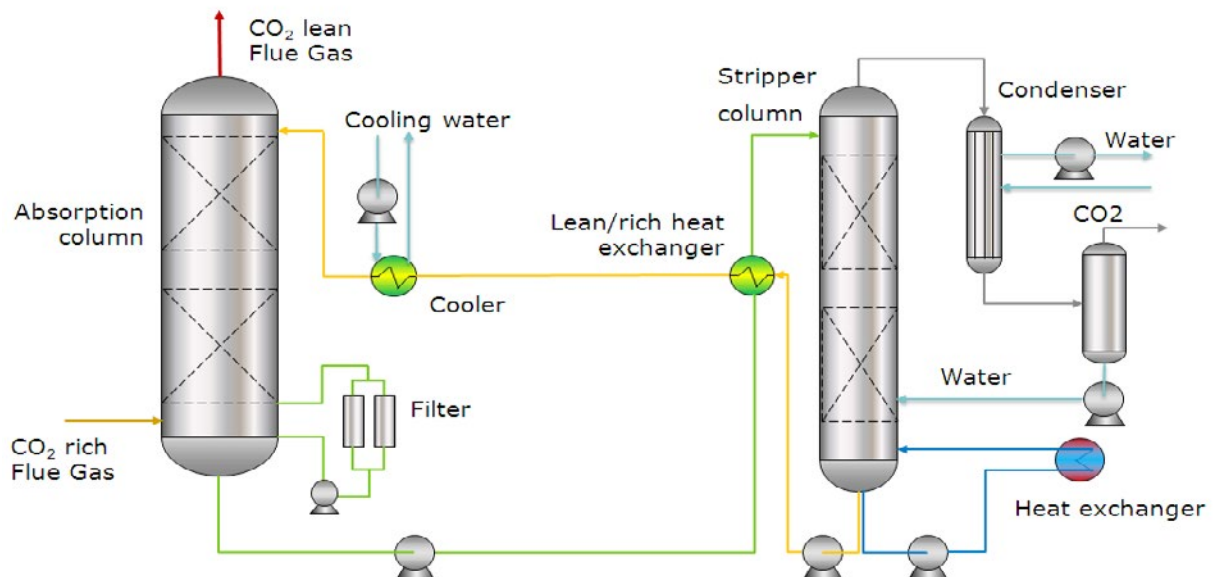
Amine absorption can effectively remove CO<sub>2</sub> from biogas. GALLOXOL® is a second-generation CO<sub>2</sub> removal technology that combines the desirable properties of amine with the neglectable volatility and high stability of a salt. Applicable under oxidizing and reducing gas environment, the GALLOXOL® solvent is biodegradable and safe to handle. Use of GALLOXOL® results in a cost-effective solution, with reduced environmental impact and improved CO<sub>2</sub> quality compared to standard amine solutions.

**GALLOXOL®**

CO<sub>2</sub> capture and CO<sub>2</sub> processing/quality control liquid CO<sub>2</sub> delivery

Frames is able to provide clients with an advanced CO<sub>2</sub> capture solution based on accelerated salt technology. This gas washing technology is based on a family (GALLOXOL®) of environmentally friendly, stable and economical washing liquids which are operated in an optimised absorption-desorption cycle. Our CO<sub>2</sub> capture technology provide solutions matched to customer requirements and markets, including:

- Biogas upgrading
- Greenhouse sector
- Industrial carbonation of brines
- CO<sub>2</sub> capture technology for bicarbonate production
- Pulp and Paper Industries
- Acidification of Industrial streams (CO<sub>2</sub> under pressure)
- Inert gas applications
- Food sector



Flow diagram of the GALLOXOL® process

## GALLOXOL®

### Process Description

In a GALLOXOL® installation, CO<sub>2</sub>-rich but low pressure biogas is washed counter currently with an activated salt solution. The biogas is fed from the bottom of an absorption column, removing CO<sub>2</sub> along its path upwards in the column. CO<sub>2</sub>-lean biogas leaves the top of the absorber. With Galloxol very deep CO<sub>2</sub> removal is already possible at atmospheric gas pressure, but still with compact footprint process equipment. The Galloxol solution is continuously regenerated using heat, which releases concentrated CO<sub>2</sub>. After regeneration, the Galloxol solution is returned to the absorber to be reused. Correct selection of biogas upgrading unit operations makes it possible to produce very pure and concentrated CO<sub>2</sub>, which can have additional value. The heat required for the release of the CO<sub>2</sub> is very efficiently recovered and can typically be fully integrated with the heat demand of a digester. The captured CO<sub>2</sub> is pure and can be directly used or processed into liquid CO<sub>2</sub>. The combination of Galloxol, TEG drying, Laminol Sulphur removal and optional Terpene removal provides an optimized combination for biogas to high purity bio-methane (> 99% CH<sub>4</sub>) production.

### 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

- **Solution based on accelerated salt technology**

### Added Value Frames

- **Environmentally friendly solution**
- **Applicable to customer requirements in various markets**
- **GALLOXOL® creates no emission of its own**

### Contact

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renewableenergy@frames-group.com

# Frames Family Tree

Onshore

Offshore

Floaters

## Renewable Energy



## Oil & Water



## Gas



## Flow Control & Safeguarding



### Turn-key Biogas Installations

- Green Gas Installations (GGI)
- Combined Heat and Power (CHP)
- Compressed bio-methane (CBM)
- Liquefied bio-methane (LBM)

### Biogas and Bio-synthesis Gas Upgrading (CO<sub>2</sub>, H<sub>2</sub>S, VOC, NH<sub>3</sub> & H<sub>2</sub>O)

- Hybriso<sup>®</sup>
- Laminol<sup>®</sup>
- Ammonia Scrubber
- Hydrogen separation

### Bio-methane Grid Injection

- Metering
- Odorizing
- N<sub>2</sub>-injection
- LPG-addition

### Turn-key CO<sub>2</sub> Installations

- Bio-CO<sub>2</sub> for horticulture
- Industrial capture and application of CO<sub>2</sub>
- Carbon Capture and Storage (CCS)

### Flue gas CO<sub>2</sub> capture

- Galloxol<sup>®</sup>
- Liquefied CO<sub>2</sub>

### Multiphase Separation

- Production Separators (High & Low Pressure)
- Test Separator
- Degasser & Knock-Out Drum
- Water Oil Separator (WOSEP)

### Compact Inline Separation

- SwirlSep

### Electrostatic Coalescers

- Dehydrator
- Desalter

### Produced Water Treatment

- Deoiling & Desanding Hydrocyclones
- Gas Flotation
- Media Filtration
- Solids Removal & Cleaning
- Stripping

### Separation Internals

### Heat Exchangers

### Gas Separation

- Demisting
- Scrubbers
- Filters
- SwirlSep

### Heat Exchangers

- Shell & Tube Heat Exchangers

### Air-Cooled Coolers

### Gas Sweetening (H<sub>2</sub>S & CO<sub>2</sub>)

- Amines
- Thiopaq O&G
- Solid Bed Scavenger
- Membrane
- Molecular Sieve

### Gas Dehydration

- Glycol (TEG)
- Molecular Sieve

### Dew Point Control

- Low Temperature Separation (LTS)
- Solid Desiccant

### Hydrate Inhibition

- MEG/DEG Recovery
- Methanol Recovery
- MEG/DEG Desalination

### Light Hydrocarbon Recovery

- Condensate Stabilization
- Fractionation

### Fuel Gas Treatment

### Hydraulic Systems

- Wellhead Control
- Subsea Hydraulic Power Units
- Hydraulic Power Units
- IWOC (Intervention Workover Control Systems)
- TUTU (Topside Umbilical Termination Unit)
- Cargo Ballasting Systems

### Safety Instrumented Systems

- High Integrity Protection Systems (HIPS)

### Chemical Injection

- Chemical & Methanol Injection Systems
- Chemical Distribution Systems
- Seawater Electrochlorination Systems

### Valve Automation Center

- Actuators and Actuated Valve Packages
- Control Systems

### Automation

- Buoy Telemetry
- Tank Farm Control & Safeguarding

### Wellsite Packages

## Services



### Asset Life Cycle Management

### Maintenance & Field Services

### Commissioning & Start-up

### Spare Parts

### Operator Training

### Engineering Studies

- Conceptual
- FEED and Basic

## Integrated Solutions

