

# Nitrogen Generation Packages



# Reliable and efficient solutions

Geveke Pompen provides the process industry with cost effective packages based on customer requirements and specifications. A long term partnership with a large range of manufacturers ensures you a high quality system.

Geveke is a company with vast application know-how and flexible order handling supports you with a team of experienced people, dedicated to your operation.

#### Our activities

- consulting
- engineering and design
- assembly
- supply
- start up and commissioning
- service and maintenance
- support

#### Our characteristics

- located in Amsterdam, The Netherlands
- founded in 1874
- part of Nikkiso Ltd. Co. Tokyo, Japan since 2013
- 185 Employees



### Custom-made nitrogen generation packages

In the oil and gas industry gaseous nitrogen is used in a wide variety of applications to decrease fire or explosion risk or avoiding oxidation. Some of the applications are:

- instrument panel purging
- flare header purging
- pipe line and tank purging
- storage tank blanketing
- dry gas seal
- inerting tubing purging

In many cases the nitrogen is supplied from nitrogen bottles which are easy available. However, these bottles need regular filling. In case large capacities are required, or at remote locations onshore and offshore, the regular transport of nitrogen bottles is not only difficult but also costly and time consuming. In those cases nitrogen generation packages are used instead. Geveke Pompen designs, builds and supplies nitrogen generation packages based on hollow fibre membrane technology.

### Basis of design

In principle the layout of a nitrogen generation package is always the same. The basis of design of a nitrogen generation unit is the customer datasheet and the accompanying specifications. The requirements for nitrogen purity and capacity, but also the available inlet air pressure and inlet air flow rate are main factors for the design of the unit. The basic components are: a filter section, a membrane section and a control section in each unit. Our process and project engineers are in close contact with the draftsman to design the unit according the customers' requirements. A 3-D model is the basis for the production and final assembly of the unit.

### Service

An experienced staff is available 24 hours a day, 7 days a week. Expert service, product support and prompt spare parts supply guarantee operational continuity of your products. All components are individually tested and

certified. A further functional test of the complete package will validate the proper operation of the unit.

### Management structures

Our QA/QC system meets ISO9001:2008 requirements and is Lloyds certified. The HSE system according to VCA\* is for a safe operation on your site.

### Our clients

- oil & gas exploration
- petrochemical industry
- refineries
- chemical industries
- engineering contractors

► In-house engineering and design





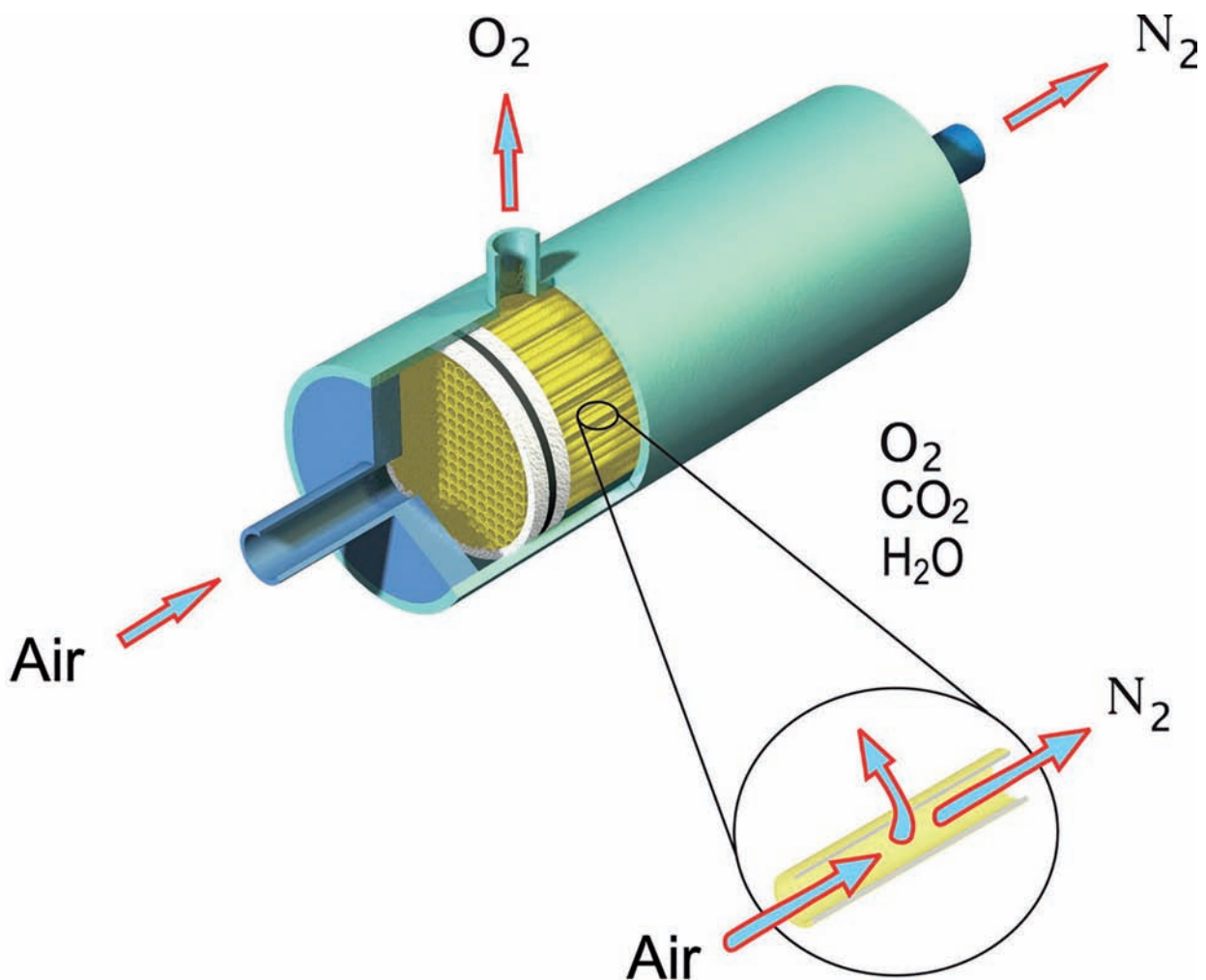
# Working principle

For nitrogen purities between 95 and 99,5% membrane technology is most commonly used. Membrane technology is based on the use of hollow fibers with a permeable structure. Thousands of these small, straw like plastic fibers are packed together in a tube of stainless steel 316 or coated aluminium. The process of gas separation starts when pressurized air is fed to one end of this tube. The quality of compressed air is important in order to maintain the efficiency of the nitrogen membranes and the purity of the nitrogen. Therefore the compressed air will be filtered. Solids, aerosol, liquid and vapour will be removed by coalescing, active carbon and dust filters. The filtration quality complies with customers' requirements. The permeation rates

of water vapour,  $\text{CO}_2$ , and oxygen contained in the air stream are faster than nitrogen and argon and will rapidly diffuse through the fiber walls (permeate). The slower diffused nitrogen molecules remain in the fiber bore and are collected as the nitrogen product gas (retentate). The air flow rate will determine how much undiffused oxygen remains with the nitrogen gas. The membranes act like a filter with no moving parts and continuously generate nitrogen at selected flow and purity. The number of membrane modules, the compressed inlet air pressure and the temperature determine the capacity and purity of the nitrogen produced. The higher the feed-air pressure the higher the nitrogen flow, this increase is more or less linear.

The produced nitrogen at the requested purity is now free for use in various applications or can be stored in a buffer vessel. The enriched oxygen is exhausted via the permeate outlet to a safe location.

The nitrogen generator packages are provided with an oxygen analyzer which measures the quality of the produced nitrogen. In case the produced nitrogen does not meet the requested specification, the off-spec mixture will be vented outside or the package will shut-down completely. Each of our nitrogen generation packages is pre-tested in our workshop to make sure the package meets the requested specification of the client.



### Purities up to 99,5%

Membrane nitrogen generator packages are available for purities from 95% up to 99,5%, different pressures and capacities, including air compressors, filters, instrumentation, automatic valves, control panels, buffer vessels, gas boosters for cylinder charging and nitrogen bottle racks. The packages can be installed in safe areas as well as hazardous areas.

### Highest capacity and lowest feed-air consumption

Parker Smartfluxx membrane modules have a high permeability and operate without heaters, resulting in minimizing energy consumption, minimized aging of the membranes and reducing capital costs.

### The benefits

- safe use
- high purity (up to 99,5%)
- small membrane modules
- operating at lower compressed air pressure
- minimum energy consumption
- no heater required
- quick start up and stable N<sub>2</sub> production
- pre-aged: no loss of performance
- simple design
- low investment

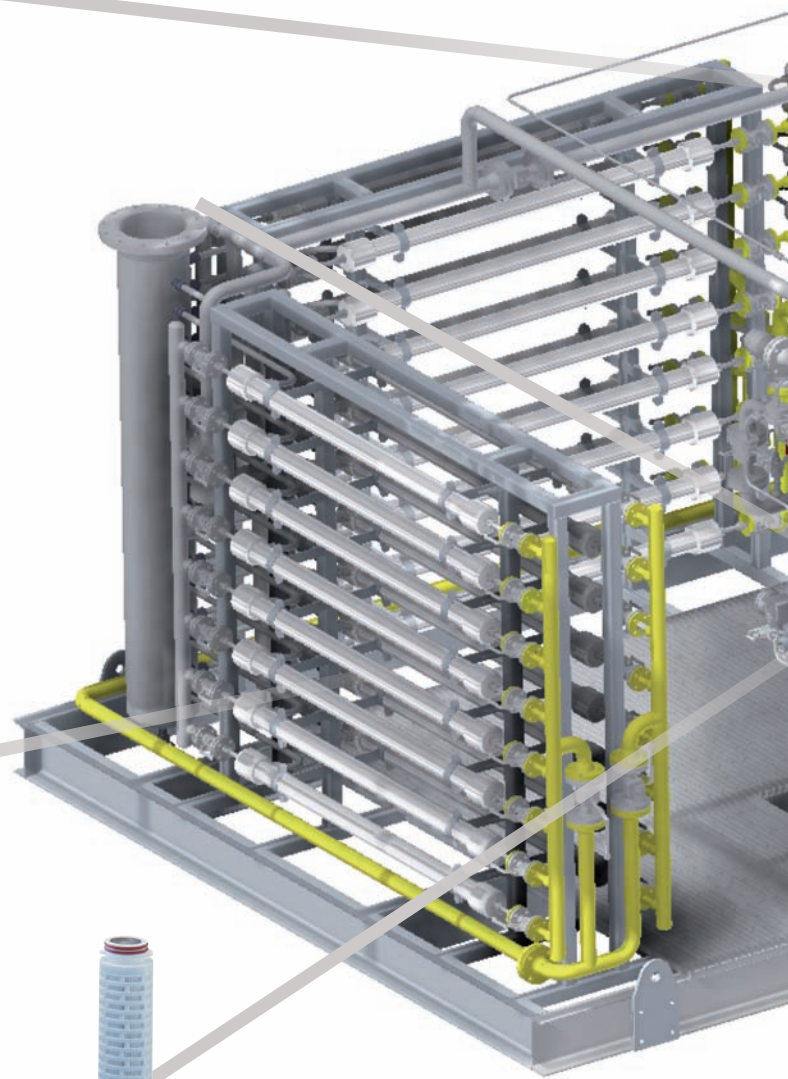


# Details

The nitrogen generation packages are based on instrument air compressors and membranes.



▼ ► **Oxygen analyser:**  
This is an analytical instrument. An electro chemical sensor continuously analyses the gas. Remaining oxygen amount in the produced gas will be measured.



◀ **Nitrogen membrane:**  
This component actually produces the nitrogen. The fibres inside the metal tubes will separate a part of the oxygen from the instrument air, with nitrogen as residue at the outlet of the membranes. The capacity of produced nitrogen is depending on the inlet pressure and the instrument air capacity.



◀ **Dust filter:**  
The filter cartridges determine the filtration grade of the particular filter. A filtration grade of 0,01 micron is common for the filter cartridges used in our nitrogen generators.

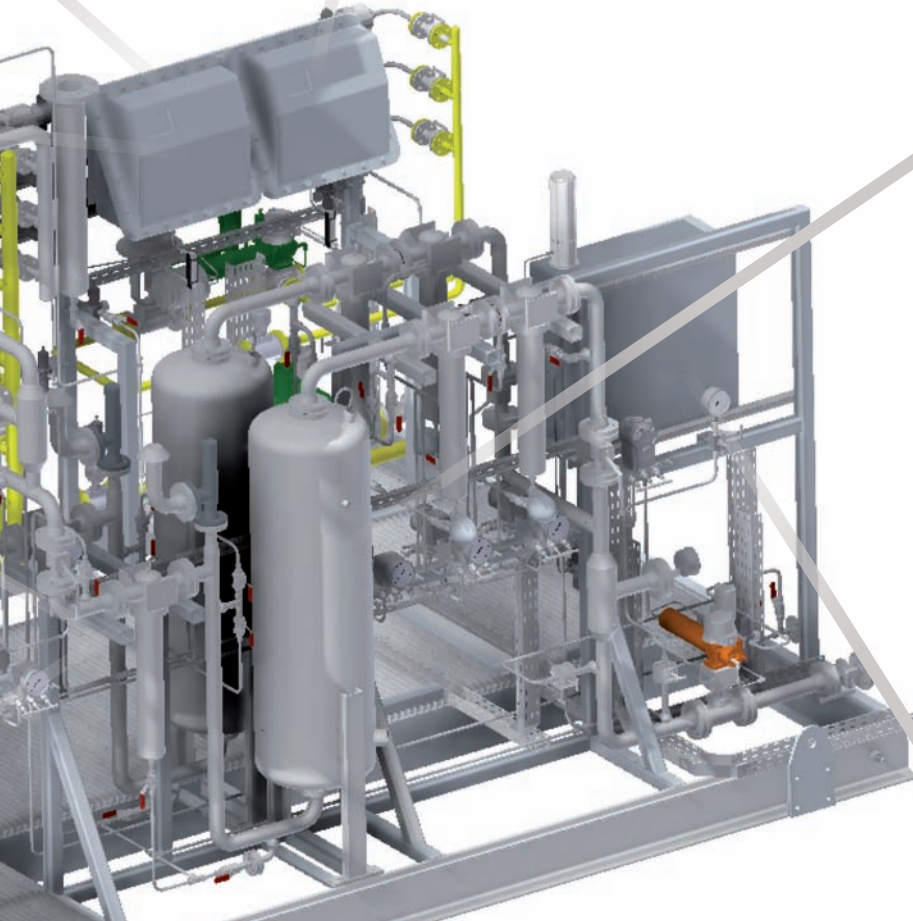




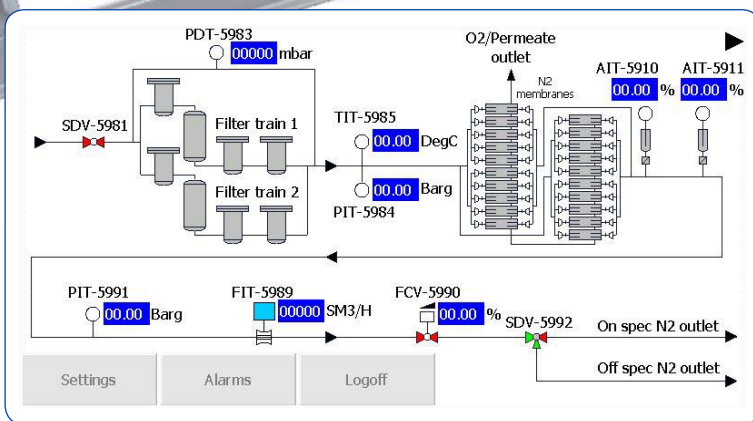
◀ **Flow control valve:**  
Downstream the nitrogen membranes, a flow control valve is placed to control the nitrogen purity. It is able to adjust the pressure in the nitrogen membranes by throttling the gas flow.



◀ **Active carbon filter:**  
The active carbon filter is an essential item of the nitrogen unit. This filter absorbs oil moisture and ozone to prevent aging and contamination of the nitrogen membranes. Any remaining oil-aerosols and oil-vapours, including odours and tastes, are removed by the active surface area of the highly-porous activated carbon to produce high-quality, clean compressed air.



▲ **Local control panel:**  
The local control panel contains a PLC with touch screen panel. All transmitters and controls are connected to this LCP. With this unit the nitrogen generator will work as a stand alone unit; only signals for monitoring are shown in the ICSS. The unit will run fully automatic. Local start and stop functions are included.



▲ **Screen shot:**  
The touch screen panel contains a graphic display showing the complete unit, all functions can be controlled and monitored from this display.

# Completed projects

## ▶ High purity nitrogen production

Location: FPSO, offshore Brazil

- Nitrogen purity: 99,5%
- Capacity: 30 Nm<sup>3</sup>/hr



## ▶ Unit for the production of high and low purity nitrogen

Location: FPSO, offshore Brazil

- Nitrogen purity: 95 and 99,5%
- Capacity: 400 and 15 Nm<sup>3</sup>/hr

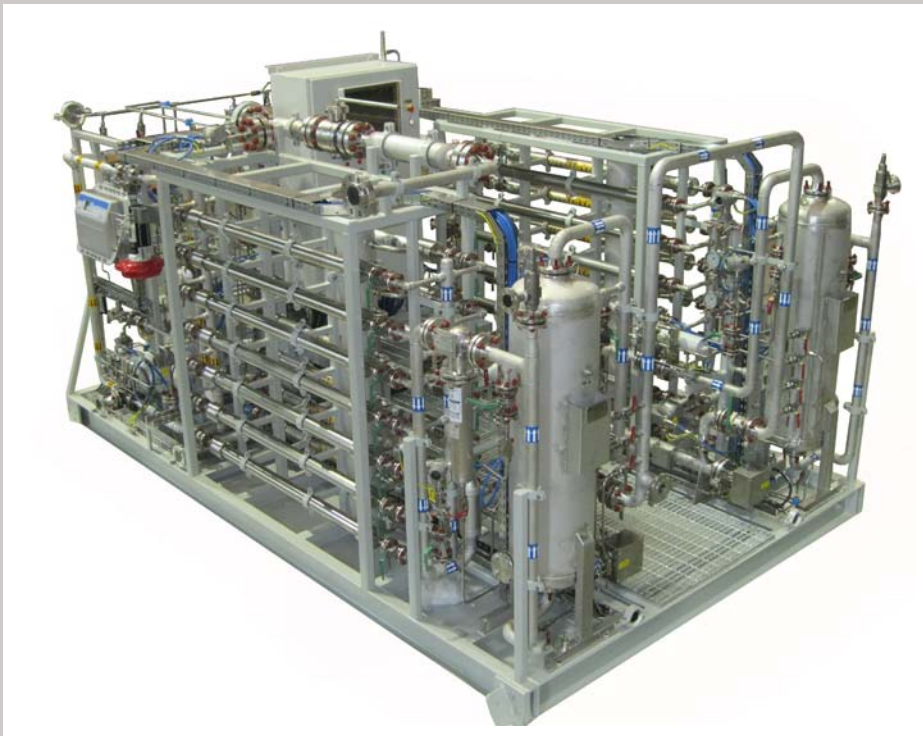




- ▼ Location: FPSO, offshore Australia
- Nitrogen purity: 97%
- Capacity: 250 Sm<sup>3</sup>/hr



- ◀ Unit for the production of nitrogen, including membrane type booster compressor for high pressure duties
- Location: FPSO, offshore Ghana
- Nitrogen purity: 95,5%
  - Capacity: 2x 236 Nm<sup>3</sup>/hr



- ▶ Location: offshore Brazil
- Nitrogen purity: 98%
- Capacity: 130 Nm<sup>3</sup>/hr



- ▶ Unit for production of nitrogen including a 3m<sup>3</sup> nitrogen receiver vessel and air driven booster compressor
- Location: FPSO, offshore Angola
- Nitrogen purity: 95%
- Capacity: 100 Nm<sup>3</sup>/hr





# Options

- receiver vessels
- bottle racks
- booster compressors
- dryers
- instrument air compressors



▲ Receiver vessel



▲ Bottle rack



▲ Membrane type booster compressor, electric motor driven



▲ Piston type booster compressor, air driven





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 **geveke**  
pompen

 **NIKKISO** Group

#### Geveke Pompen

- Is specialized in chemical injection packages, methanol injection packages, (IRCD) distribution packages (racks and panels), nitrogen generation packages, vacuum pump packages, produced water packages, well head service pump packages, instrument air packages.
- Can give an answer to your specific requirements with custom-made delivery of A-brand products, specialized know-how and experience of many years.
- Can offer you 24/7 service, inspection and maintenance, tuned to your requirements, for any product.
- Is at your service for advice, to send you detailed documentation or a quotation.