

NITROGEN REJECTION UNITS

NATURAL GAS TREATMENT TECHNOLOGIES



Air Liquide Group

A world leader in gases, technologies and services for Industry and Health

Air Liquide is present in 80 countries with approximately 66,000 employees and serves more than 3,6 million customers and patients. Oxygen, nitrogen and hydrogen are essential small molecules for life, matter and energy. They embody Air Liquide's scientific territory and have been at the core of the company's activities since its creation in 1902.

Air Liquide's ambition is to lead its industry, deliver long term performance and contribute to sustainability.

Our full suite of technologies

- Liquefied Natural Gas
- Cryogenics
- Hydrogen
- Syngas
- Petrochemicals
- Natural Gas Treatment
- Sulfur
- Standard Plants
- Oleochemicals

Air Liquide Engineering & Construction

A technology partner of choice

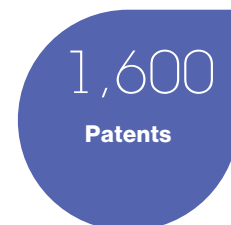
Air Liquide Engineering & Construction builds the Group's production units (mainly air gas separation and hydrogen production units) and provides external customers with efficient, sustainable, customized technology and process solutions.

Our core expertise in industrial gas, energy conversion and gas purification, enables customers to optimize natural resources.

We cover the entire project life-cycle: license engineering services / proprietary equipment, high-end engineering & design capabilities, project management & execution services.

In addition we also offer efficient customer services through our worldwide set-up.

As a technology partner, customers benefit from our research and development to achieve energy transition goals.



Nitrogen Rejection

Air Liquide Engineering & Construction offers a complete portfolio of natural gas treatment technologies, based on Lurgi's renowned expertise in gas treatment and Air Liquide's vast know-how in cryogenic processes and a broad range of membranes for gas separation.

Key proprietary equipment designed and manufactured in-house makes our cryogenic Nitrogen Rejection Units (NRUs) extremely efficient, and enables customers to reduce the costs.

VALUE WE BRING:



Distillation

Distillation column height reduced by half over the past 20 years.

Heat Exchangers

In-house thermal design of brazed aluminum heat exchangers (BAHX).

Membranes

Our Air Liquide Advanced Separation division offers a full range of membrane units for the treatment of natural gas and associated petroleum gases.

Cryogenic Rotating Equipment

Air Liquide Engineering & Construction has designed over 1,000 plants equipped with cryogenic pumps and turbo expanders.

Operational Excellence

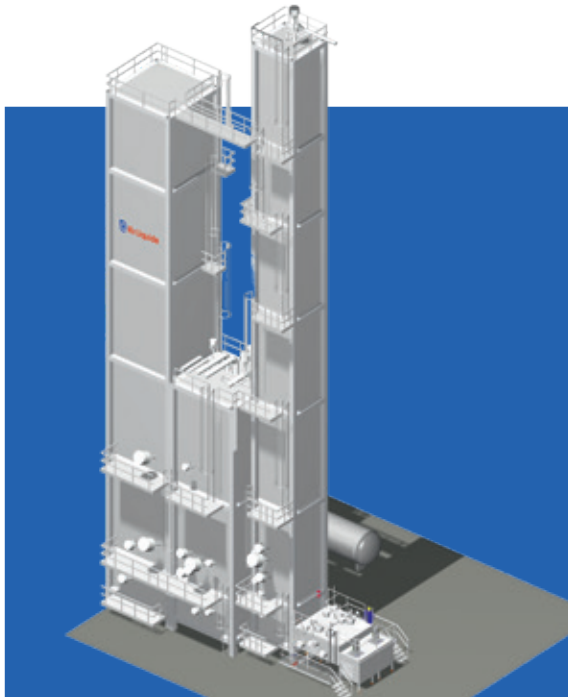
Designs are validated and improved via feedback from our own operations.

Cold Box Manufacturing

Expertise in cold box design plus competitive cryogenic equipment manufacturing in the United Arab Emirates and China.

Nitrogen Rejection Technologies

Whether naturally occurring in gas reservoirs or resulting from injection into the gas cap for pressure maintenance, nitrogen is frequently present in natural gas at levels that decrease its quality and restrict its marketability. Air Liquide Engineering & Construction offers a comprehensive suite of processes to remove this nitrogen that includes cryogenic and permeation technologies for all feed gas conditions and removal requirements.



Nitrogen Rejection Unit (2017)

Cryogenic Nitrogen Rejection

Cryogenic distillation is a highly efficient and cost-effective solution to remove nitrogen. Air Liquide Engineering & Construction optimizes NRU design to address specific feed conditions and product specifications.

Capacity	from 10 to 1000 MMSCFD
Feed nitrogen content	from 5 mol% to 90 mol%
Nitrogen vent purity	down to ppm

We offer the optimum configuration and the most efficient process considering tolerance of feed gas impurities, such as CO₂, H₂S, mercaptans or heavy hydrocarbons.

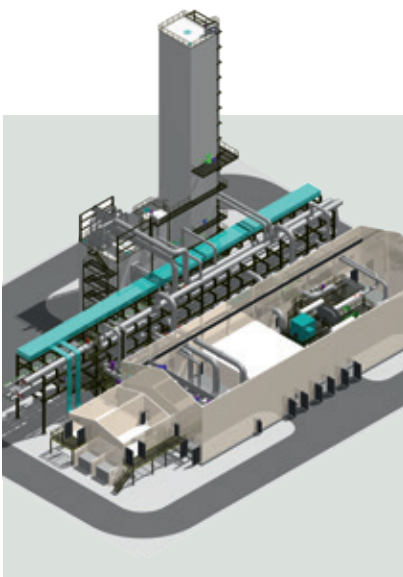
Customer requirements	Typical schemes	Specific	Air Liquide Value Proposition
Feed gas composition Feed pressure Sales gas specification Nitrogen vent specification Variable feedstock CO ₂ content	Single column Double column Three columns Two columns	External refrigeration Expansion turbine Liquid nitrogen injection CO ₂ tolerance	Optimised TCO High reliability Flexible operations

Nitrogen Rejection Offer



Cryogenic nitrogen rejection units

- **Conceptual studies** stand-alone or combined with Natural Gas Liquids recovery, Enhanced Oil Recovery applications or LNG.
- **Basic engineering** and **FEED** packages.
- **Proprietary cryogenic equipment** (columns, heat exchangers and cold boxes).
- **Modularized** engineering and procurement solutions.
- **Site services** including commissioning and start-up, training for NRU operators and retrofit of existing units.



Combined and integrated cryogenic solutions

- **NRU & NGL recovery:** Various levels of integration between NRU and NGL recovery sections can be achieved. Air Liquide has developed proprietary designs that are well suited to multi-train NGL / NRU / He. Having a single technology provider maximizes the benefit of the integration and streamlines project execution.
- **NRU & Helium:** With its extensive expertise in both nitrogen and helium cryogenic processes, Air Liquide offers integrated solutions of helium recovery with nitrogen rejection. Even small amounts of helium can add significant value to a project.
- **NRU & the full portfolio of LNG products (Turbofin™, Smartfin™ and Liquefin™).**
- **Syngas purification:** When high-purity CO is required, syngas purification units designed and operated by Air Liquide often include nitrogen removal using cryogenic distillation.

Membrane solutions

PoroGen™ PEEK-SEP: a cost-effective technology for fuel gas conditioning and biogas applications

- Best-in-class thermo-mechanical properties and chemical resistance.
- Cost-effective solution for fuel gas conditioning and biogas applications of limited capacity.



● Operating Centers and front-end offices ● Manufacturing centers



Contact us

gas-treatment@airliquide.com

www.engineering-airliquide.com