

# Gas Processing Plants.



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Gas processing plants are a group of single process units offered by Linde Engineering. These units include a great deal of proprietary process and component manufacturing know-how in the area of cryogenic separation and purification of gases. They serve for the purification and cryogenic separation of gas mixtures. Cryogenic separation technology and physical or chemical scrubbing processes come into application for these units that frequently are required by engineering companies implementing them as single units within a larger contract plant. Independently endusers may install them as supplement to existing gas generation facilities. Gas processing plants are therefore to a large extent based on Linde's proprietary process and production know-how. The units are tailored to the individual application and requirement of the client. Plant design and scope of supply will typically include several proprietary equipment items produced in Linde workshops like plate-fin heat exchangers, coil-wound heat exchangers or the isothermal reactor. Frequently such equipment will be assembled in the workshop and supplied to site as cold box.

## Partial condensation processes and liquid methane wash

Cryogenic processes for the recovery of pure carbon monoxide and pure hydrogen from gases resulting from partial oxidation or catalytic reforming processes. Carbon monoxide is mainly used for the production of acetic acid, formic acid, polyurethane, poly-carbonates and methylacrylates. The desired purity of carbon monoxide depends on the prevailing requirements and can be adjusted into the ppm range with respect to the residual contents of hydrogen and methane.

## Liquid nitrogen wash

The production of ammonia requires the adjustment of the stoichiometric nitrogen/hydrogen ratio to a value of 1:3. Simultaneously other trace impurities like methane, argon and carbon monoxide (below 5ppm) should be removed to preferentially operate the ammonia synthesis in the absence of inert components. The liquid nitrogen wash is typically arranged downstream of the RECTISOL® scrubbing process, if partial oxidation of coal or residue oil were selected as feedstock basis for ammonia production. The unit is generally supplied as assembled coldbox and includes an upstream adsorber station.

Partial condensation cold box in Clearlake, USA





Gasification complex in Taiwan

#### Separation of hydrogen, olefins and LPG from refinery fuel gas

Refineries may recover hydrogen olefins and/or LPG from off-gases and thus make more profit on these products instead of simply using them as fuel gas. By cryogenic processes such high quality products can be economically recovered. Similarly the dehydrogenation of butanes by the Oleflex or Catofin process within MTBE plants result in a mixture of hydrogen and condensable C<sub>4</sub>/C<sub>8</sub> hydrocarbons. Separation of hydrogen from a bulk quantity of heavy components results in particular adjustments that should be regarded for the heat exchanger design. It has turned out to be of advantage for the design requirements of this cryogenic concept that Linde can offer design and equipment manufacturing in one hand.

#### Rare gas processing

Argon may be recovered from the purge gas of ammonia plants. It can be separated and recovered as liquid argon in a cryogenic process. If suitable feedstock is available, also other rare gases like He, Ne, Kr and Xe can be recovered.

#### Gas liquefaction

Linde offers processes for the production of carbon dioxide with food quality. The main feedstocks are off-gases from ammonia plants or natural gas sources.

Also the liquefaction of SO<sub>2</sub> downstream of flue gas scrubbing plants is a process of this category.

#### Physical and chemical washes

Any cryogenic gas separation process requires the upstream removal of H<sub>2</sub>S, CO<sub>2</sub> and COS as typical sour gas impurities to meet the specification for clean products and prevent their plugging of the process equipment.

RECTISOL<sup>®</sup> is the best known proprietary Linde scrubbing process and can simultaneously remove all above mentioned sour gas components in one process step. RECTISOL<sup>®</sup> is selected for almost all oil and coal gasification projects with chemicals as final product.

Linde can quote other chemical and physical wash processes including various kinds of MDEA type of amine washes, MEA, DEA, Benfield, Sulfinol, Caustic, NMP, Alkacid wash and others. However, due to their number and various applications they are not discussed in this context.

# Collaborate. Innovate. Deliver.

Linde's Engineering Division is a leading player in the international plant engineering business. Across the globe, we have delivered more than 4,000 plants and cover every step in the design, project management and construction of turnkey industrial facilities. Our proven process and technology know-how plays an indispensable role in the success of our customers across multiple industries – from crude oil, natural gas extraction and refining to chemical and metal processing.

At Linde, we value trusted, lasting business relationships with our customers. We listen carefully and collaborate closely with you to meet your needs. This connection inspires us to develop innovative process technologies and equipment at our high-tech R&D centres, labs and pilot plants – designed in close collaboration with our strategic partners and delivered with passion by our employees working in more than 100 countries worldwide.

From the desert to the Arctic, from small- to world-scale, from standardised to customised builds, our specialists develop plant solutions that operate reliably and cost-effectively under all conditions. You can always rely on us to deliver the solutions and services that best fit your needs – anywhere in the world.

Discover how we can contribute to your success at [www.linde-engineering.com](http://www.linde-engineering.com)

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## Core competencies at a glance

### Plant engineering

- Air separation plants
- LNG and natural gas processing plants
- Petrochemical plants
- Hydrogen and synthesis gas plants
- Adsorption plants
- Cryogenic plants
- Carbon capture and utilisation plants
- Furnaces, fired heaters, incinerators

### Component manufacturing

- Coldboxes and modules
- Coil-wound heat exchangers
- Plate-fin heat exchangers
- Cryogenic columns
- Cryogenic storage tanks
- Liquefied helium tanks and containers
- Air-heated vaporisers
- Water bath vaporisers
- Spiral-welded aluminium pipes

### Services

- Revamps and plant modifications
- Plant relocations
- Spare parts
- Operational support, troubleshooting and immediate repairs
- Long-term service contracts
- Expert reviews for plants, operations and spare part inventory
- Operator training