

ECOVAR® – Standard on-site solutions

ECOVAR® systems

CRYOSS® plants

Process and technology

CRYOSS®

Nitrogen generation plants based on the cryogenic process

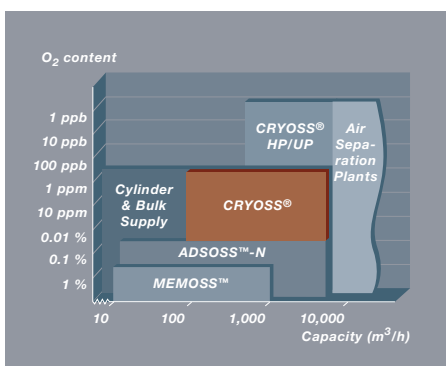
ECOVAR® supply systems enable on-site production of industrial gases. The CRYOSS® product line is part of the Linde ECOVAR® portfolio. The standardized and modularized set-up assures maximum cost efficiencies and reliability. Linde puts emphasis on applying state-of-the-art technology and maximized flexibility for customized solutions. All ECOVAR® systems include a back-up unit to ensure continuous supply.

CRYOSS® plants are highly compact and modular. This enables easy transport and rapid installation. All parts are fully pre-engineered to accelerate delivery and start-up. A unit typically consists of two factory assembled modules, the warm end container and a cold-box. The container is usually equipped with an air compressor, an air pre-treatment unit, a control system and electrical devices. The coldbox mainly contains heat exchangers, a condenser and the rectification column. CRYOSS® plants are modularized in 7 size ranges resulting in more than 20 specific plant sizes.

Typical specifications for a CRYOSS® plants (without additional purification and compression)

- ▶ Capacity 100-7,000 m³/h
- ▶ Purity 1-100 ppm oxygen
- ▶ Pressure up to 10 bar

The cryogenic process separates air by means of rectification, which utilizes the different evaporation temperatures of the components in the air. A cryogenic plant mainly consists of a warm end (with an air compressor and a molecular sieve station) and a cold part (coldbox) with the rectification column where the actual air separation process takes place. Inlet filters remove dust and other mechanical impurities from the air before it enters the air compressor, where it is compressed to the required process pressure. It is then pre-cooled in the after-cooler or in a refrigeration drier. After passing through a moisture separator, the air enters one of two molecular adsorbers, where impurities (such as water,



Nitrogen supply solutions



CRYOSS® 250

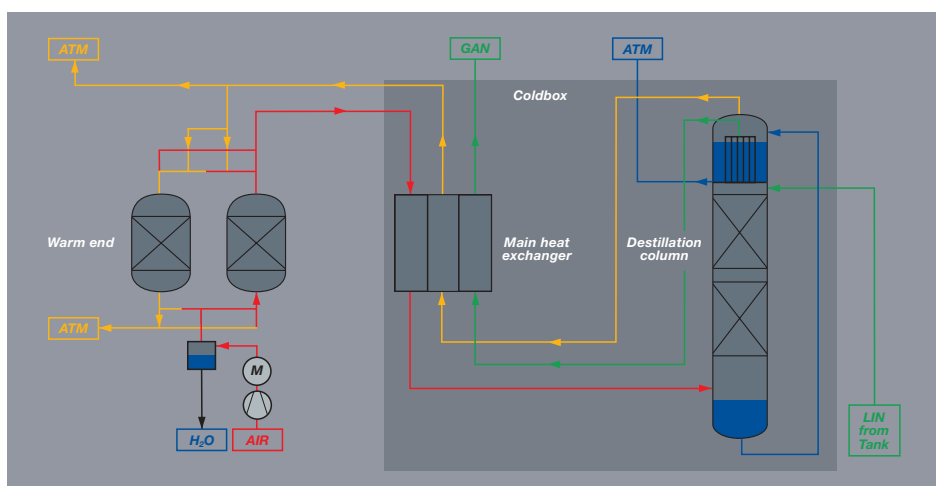
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carbon dioxide, most hydrocarbons etc.) are removed. One of the two adsorbers is always in operation while the other is being regenerated by residual gas from the separation process. The process air is cooled down to almost liquefaction temperature in the main heat exchanger in counter-flow with the cold separation products and then fed into the bottom of the rectification column. There, the feed air is rectified. The pure nitrogen fraction is withdrawn at the top of the column, heated up in counter-flow in the main heat exchanger and then fed into the product line. Cold is supplied in the form of liquid nitrogen (LIN) from the back-up system or is generated with an expansion turbine.



ECOVAR® system based on a CRYOSS® plant

Cost-efficient, reliable solution



Typical flow diagram for a cryogenic nitrogen plant

The modularized design of the CRYOSS® plants, combined with the back-up system, ensures best possible reliability and continuous gas supply. CRYOSS® plants reflect many years of experience and are designed to the highest quality standards using state-of-the-art technology. All plant sizes are equipped as standard with PLC and a modem to enable remote monitoring and control. The nearest Linde operational center can thus keep the entire ECOVAR® system under 24-hour surveillance.

Applications

ECOVAR® systems based on CRYOSS® plants are typically used for the following applications in the industries below:

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| <p>Chemical and petrochemical industry</p> <ul style="list-style-type: none"> ▶ Inerting/purging ▶ Blanketing ▶ Catalyst regeneration | <p>Electronic industry</p> <ul style="list-style-type: none"> ▶ Inerting ▶ Purging |
| <p>Metallurgy/Glass industry</p> <ul style="list-style-type: none"> ▶ Heat treatment ▶ Inerting ▶ Purging ▶ Refining | <p>Pharmaceutical industry</p> <ul style="list-style-type: none"> ▶ Inerting ▶ Purging |
| | <p>Food industry</p> <ul style="list-style-type: none"> ▶ Packaging ▶ Inerting |