Nitrogen Stations Application

Nitrogen (N_2) is inert, diatomic, colourless, odour-free, tasteless gas. It does not sustaine combustions, protects from oxidation and rotting.

Petrochemical industry

to clean and protect technological capacities, to blow down the pipelines, to pressure-transport the substances.

Oil and gas industry

to ensure the explosion and fire safety, to test and blow down the pipelines.

Metallurgy

to protect metals during annealing, as well as neutral hardening, carburizing and brazing.

Pharmaceutical industry

to package pharmaceuticals and to work with finely divided substances.

Electronic industry

to prevent oxidation, to harden end-products, to blow down and clean.

Food industry

to create inert atmosphere for food storage and packaging

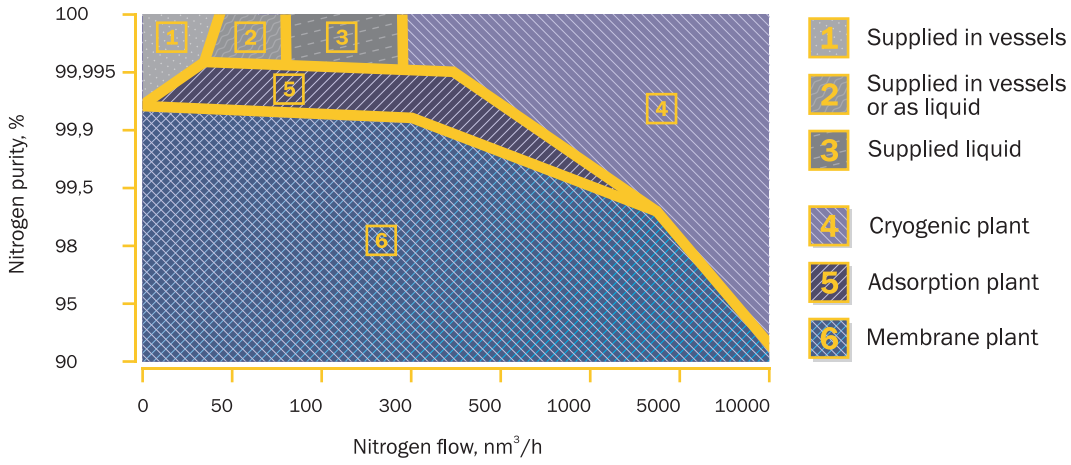
Coal industry

to ensure fire and explosion safety

Paint production

to ensure fire safety and to prevent polymerization of oils

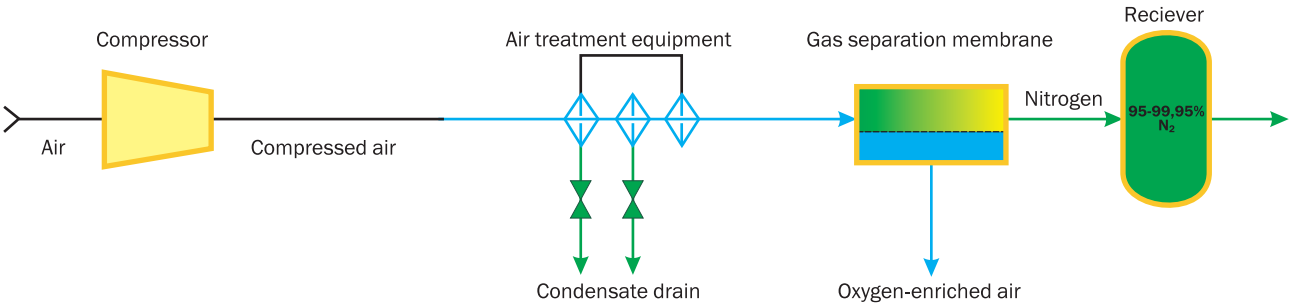
There are several technologies for nitrogen production: membrane, adsorption and cryogenic. Depending on customer requirements for quality and quantity of produced nitrogen, equipment that fully satisfies specified needs can be easily picked up. Usefulness of a particular type of station is shown on the picture:



Scheme 1

Scheme of Nitrogen Production Based on Gas Separation Membranes

Scheme of nitrogen membrane generator



Scheme 2

Compressed in the compressor and heated to the required temperature air is supplied to the gas-separation membrane modules. Oxygen and water vapor in the air, quickly penetrate through the polymer membrane and discharge from the membrane module through one of the outlet pipe to the network or the atmosphere. Nitrogen , as opposed to oxygen and water vapor, slowly permeates through the membrane, and is delivered to the consumer without pressure loss through another outlet of the membrane gas separation unit.

Pic 21. Nitrogen station. ORPE «Technologiya», Obninsk

Pic. 22. Nitrogen membrane station with EcoTec Converter

Chelyabinsk Compressor Plant offers the packaged technical solutions with nitrogen membrane stations AMU with the following characteristics range:

Technical characteristics of Nitrogen membrane units

Table 1

Purity nitrogen, %	Delivery, cfm (m^3/min)	Pressure, psig (barg)	Dew point, °F (°C)	Ambient temperature, °F (°C)
90 - 99,95	0,28-3885 (0,008-110)	101,5-580,5 (7-40)	-94 (-70)	37,4-104,0 (3-40)

CHKZ Nitrogen Membrane Stations Series (AMU «Standard»)

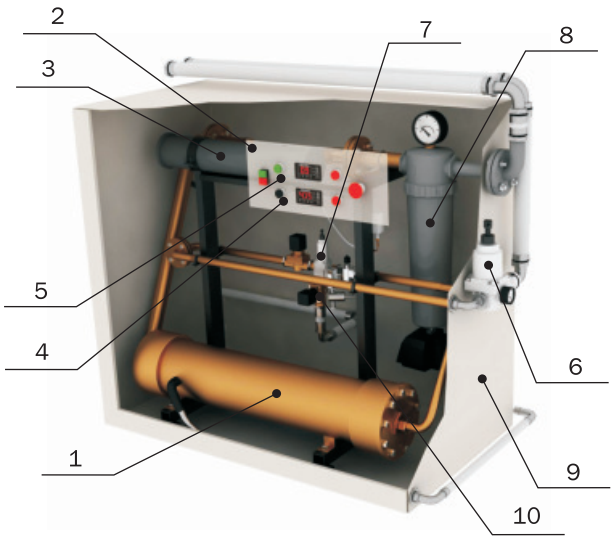
«Standard» series is the best gas separation station version for general industrial application.

The detailed structure of nitrogen membrane station is on Pic.23. Filters unit ensures the purity of the air, which goes to gas separation module (air purification of required class according to Russian Standards; solid particles size less than 0,003mg/m3). Automatic control system ensures the produced nitrogen quality. AMU can be produced in noise insulation hood or without it; the air electric heater is preinstalled.

CHKZ nitrogen membrane stations advantages (AMU «Standard»)

- No special requirements to ambient air quality (filters unit is integrated into the system)
- Low operating cost, easy maintenance
- Flexible nitrogen purity and capacity adjustment
- Handiness, high reliability

Nitrogen membrane stations «Standard» configuration



Pic. 23

Table 2

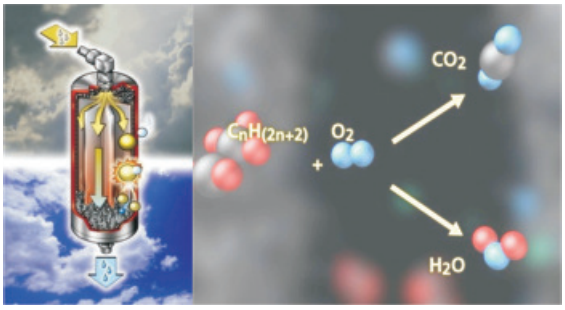
No	Component
1	Membrane module
2	AMU controller
3	Compressed air heating unit
4	Gas analyzer display
5	Temperature sensor display
6	Reducer
7	Pneumatic valve fittings
8	Pre-filter (filter unit)
9	Noise insulation hood
10	Solenoid valve fittings

CHKZ Nitrogen Membrane Stations Series (AMU «Optim»)

«Optim» series is the best gas separation station version for crucial operating procedures.

The detailed structure of nitrogen membrane station is on Pic.25. Filter unit and innovative purifying system **Eco Tec Converter** ensure the purity of the air, which goes to gas separation module (solid particles size less than 0,001 mkm; hydrocarbons concentration less than 0,001 mg/m^3, what is significantly less than it is prescribed for 1 contamination class according to Russian Standards.

AMU can be produced in noise insulation hood or without it. Automatic control system ensures the produced nitrogen quality.



«Eco Tec Converter» system

Eco Tec Converter (ETC) operation principle is to transform with the help of special catalyst the oil and other hydrocarbons during physical and chemical process into water and carbon dioxide.

This is a revolutionary process for removal oil from the compressed air, which states new standards for reliability, price, condensate cleaning and environmental protection.

Pic. 24

Flow chart

1. Compressed air
2. Controller
3. Additional velocity change unit
4. Minimum pressure valve
5. Heat exchanger
6. Converter chamber
7. Heating element
8. Catalyst
9. Outlet into compressed air system

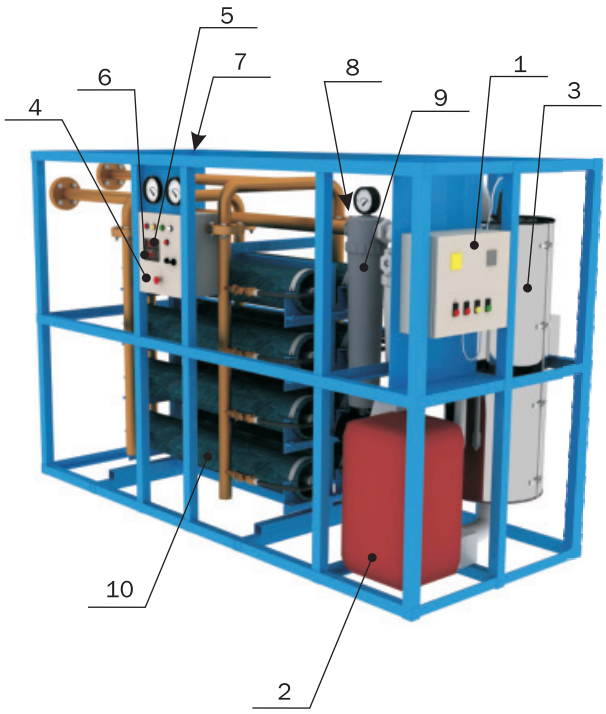
«Eco Tec Converter» advantaged

- Guaranteed oil-free compressed air, oil/carbohydrates concentration less 0.001 mg/m^3 (compressed air);
- Condensate generated in Eco Tec Converter compressed air network elements requires no further purification, consequently there is no need to install oil separator for condensate.;
- Low power consumption (~ 5 W/m^3);
- Long operation period (20 000 hours) before cartridge – catalyst replacement;
- Efficiency 100% during whole life time, because Eco Tec Converter productivity does not depend on:
  - inlet oil concentration (wide range);
  - air humidity;
  - inlet air temperature.

CHKZ nitrogen membrane stations advantages (AMU «Optim»)

- Long operational life of the station – membrane module operational life is twice longer
- High quality of produced nitrogen, no particles and oil
- No special requirements to ambient air quality
- Flexible nitrogen purity and capacity adjustment
- Handiness, high reliability

Nitrogen membrane stations «Optim» configuration



Pic. 25

Table 3

No	Component
1	Eco Tec Converter controller
2	Eco Tec Converter heat exchanger
3	Catalyst-module with a heater
4	AMU controller
5	Gas analyzer display
6	Temperature sensor display
7	Solenoid valves unit
8	Nitrogen sampling and analyzing unit
9	Filter unit
10	Membrane module

Nitrogen Compressor Station

Nitrogen compressor station designed for reliable operation of oil products underground storage «Podzemneftegaz» OJSC is a bright example of high-quality design and production of gas separation station based on BKK.

This compressor block-modular station is portable. To make the transportation easier It consists of four sections which can be disassembled and conserved after the testing at the plant, and the station can be transported by auto or railway transport.

The station is designed to meet the customers requirements. «Podzemneftegaz» OJSC storage is remote from main power supply, it results in lack of energy. Chelyabinsk Compressor Plant proposed the following solution: first stage compressor voltage 6kV – new compressors series DEN «Volt», other equipment (such as EcoTec Converter, boosting compressor stations), which consumes less energy, are designed for 0,4kV.

To ensure required compressed air purity (hydrocarbons residual concentration – less than 0,0025 mg/m^3) two hydrocarbons catalytic decomposition system Eco Tec Converter are integrated into the station.

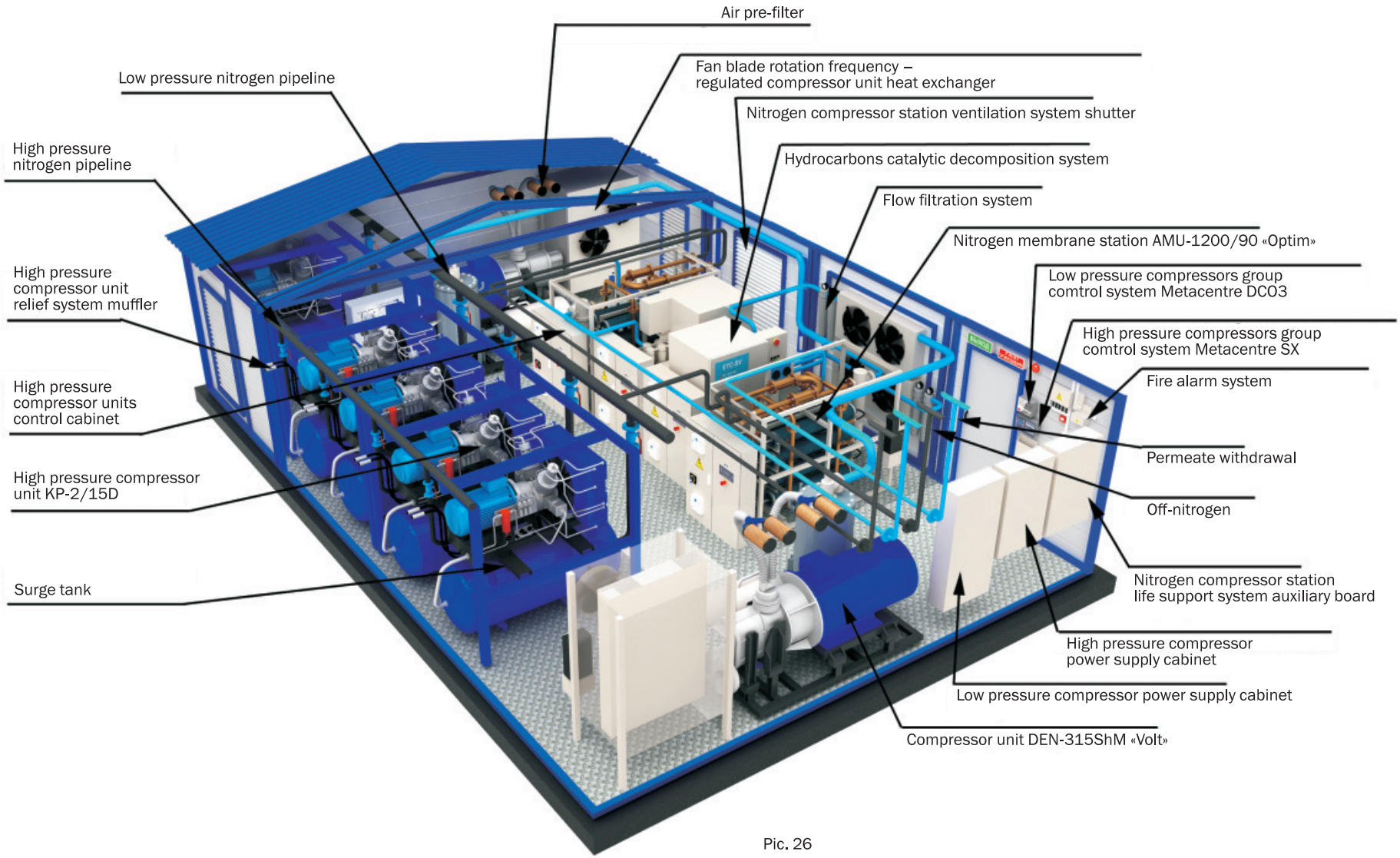
Central element of designed especially for «Podzemneftegaz» OJSC compressor block-modular station is gas separation membrane system.

Technical characteristics

Table 4

Model	Nitrogen capacity, cfm (m^3/min)	Pressure, psig (barg)	Nitrogen Purity, %
BKK 67/13-2	1413 (40)	2175 (150)	90

3D-model BKK-67/13-2 «Podzemneftegaz» OJSC



Pic. 26

Adsorption Nitrogen Plants

Adsorption gas separation technology is applied when it is necessary to produce the nitrogen with purity more than 99,95%. Adsorption technology is based on the absorption of certain substances with molecular sieves, which guarantees the separation of air mixture. The operation principle is based on the different adsorption rate of certain gas mixture components depending on pressure and temperature.

The process scheme is based on regulation of the air mixture adsorption speed and adsorbent regeneration through changing the pressure in two vessels (adsorbers), which are filled with adsorbent. At the adsorption stage the adsorbent captures mainly one of the air mixture components and the nitrogen is left. At the regeneration stage captured component is generated from the adsorbent and vented to atmosphere.

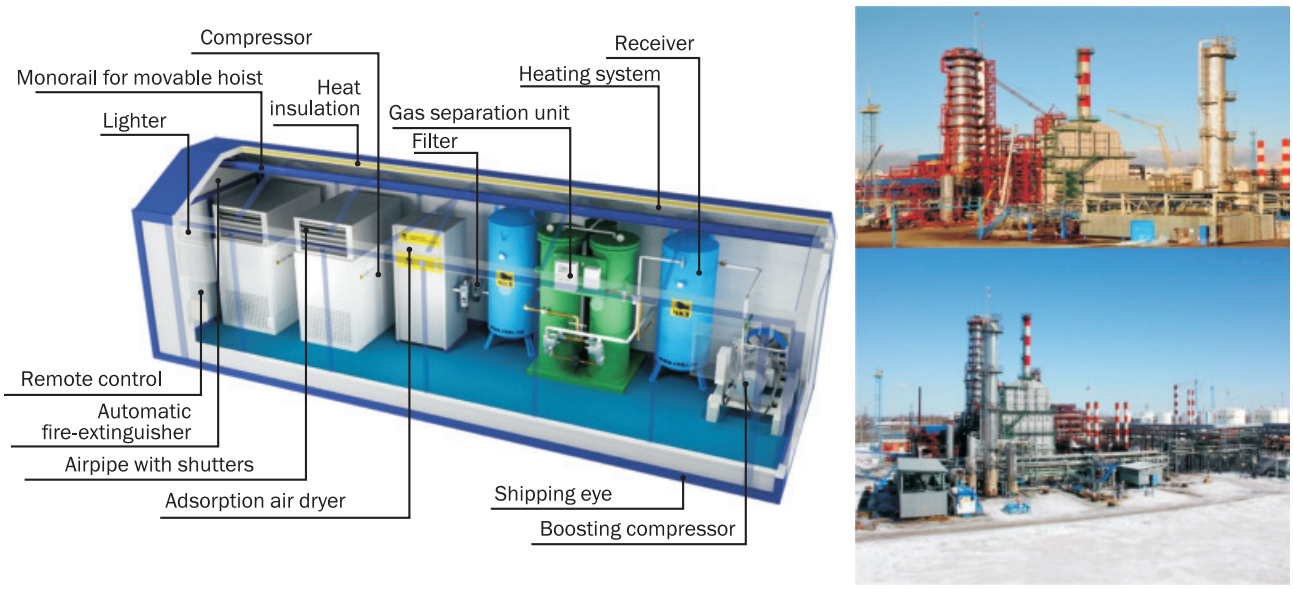
«Chelyabinsk Compressor Plant» CJSC offers comprehensive technical solution with the nitrogen adsorption stations with the following characteristics range:

Technical characteristics of Adsorption nitrogen units

Table 5

Nitrogen purity, %	Delivery, cfm (m^3/min)	Pressure, psig (barg)	Dew point, °F (°C)	Ambient temperature, °F (°C)
99,5- 99,9999	0,6-323.48 (0,017-9.2)	101,5-507.6 (7-35)	-94 (-70)	37,4-104,0 (3-40)

On the Pic. 27 the comprehensive technical solution: mobile gas separation station based on BKK, designed especially for Antipinsky Oil Refinery CJSC is presented. Compressed air supply system (for control and instrumentation equipment) and nitrogen with purity 99,9 supply system (for supply to technological processes connected with oil products) are combined together in a single modular.



Pic. 27