Unique solutions for shipboard nitrogen generation
NOXERIOR – Competence and Trust

NOXERIOR focuses on all aspects of the production of dry compressed air and its non-cryogenic separation for on-site generation of nitrogen and oxygen. We help our customers to reduce their costs by offering a customized solution based on either Pressure Swing Adsorption (PSA) or hollow-fibre membrane technology. The unique and patented technology applied for our NITROSWING® and OXYSWING® modular PSA generators has set market standards in terms of flexibility, efficiency, and reliability. Our special packages for instrument air, nitrogen or oxygen generation, designed according to a customer’s specifications and suitable even for operation at extreme ambient conditions, are well known for their high level of engineering and outstanding quality.

Behind all our activities lies trust: the trust our customers have in our ability to meet their specific needs in terms of both quality standards and agreed delivery terms.

Our prime aim is to establish a long-term professional relationship based on transparency and reliability. Our customers appreciate our capacity for smooth project execution and on-time delivery.

NOXERIOR has an export quote of almost 90% with customers located in all corners of the world.
Nitrogen Generation for LNG or Dual Fuel Propulsion

LNG is considered as one of the few fuels capable of meeting ever-tightening emissions regulations in the years ahead. Using LNG as fuel for ship propulsion offers clear environmental benefits compared to the conventional HFO fuelled propulsion solutions, as the elimination of SOX emissions, a significant reduction of NOX and particulate matter as well as a reduction of GHG emissions.

Like other combustible liquids, LNG is not flammable in the liquid phase and cannot ignite, but in the vapour phase it is highly flammable and will readily burn when there is a 5 to 15 percent by volume mixture with air.

Nitrogen is an inert gas and as such can prevent a flammable mixture from occurring. Therefore, the presence of a reliable on-board nitrogen supply source will be mandatory in case of LNG fuelled ship propulsion.

The NITROMEM® Marine Nitrogen Membrane Generators from NOXERIOR are the right solution to meet this stringent condition.

The application of NITROMEM® Marine Nitrogen Membrane Generators from NOXERIOR for LNG or dual fuel propulsion can be divided into two categories:

General LNG Fuelled / Dual-Fuelled Vessels
- Inerting of bunkering station equipment and liquid bunkering lines before and after bunkering,
- Purging and inerting of LNG piping inside the Cold Box (vaporizer & PBU (Pressure Build-up Unit)) after tank outlet valve,
- GVU (Gas Valve Unit) purging,
- Sealing of double wall fuel gas pipes in the E/R (Engine Room),
- Purging of fuel gas pipes and complete fuel gas supply system on the engine, particularly after gas fuel stop or shutdown by the engine’s Gas Injection Control and Safety System,
- Inerting of hold space/gas fuel storage room in case of LNG tank installation inside the ship’s hull,

and specific additional applications for Dual-Fuelled LNG Carriers
- Operation of diaphragm actuators of valve unloaders on the BOG compressors to unload one half of the double-acting cylinders,
- Continuous purging of the insulation spaces of the BOG re-liquefaction system cold box (if such system is installed on the carrier),
- Dry seal inerting of both the compressor and the turbo-expander of the eventual on-board BOG re-liquefaction system,
- Inerting of the hold and inter-barrier spaces between the LNG tanks and the ship’s hull,
- Purging of cargo liquid line, vapour line, gas line, vent masts and related cargo equipment.

On-board installed nitrogen generators are being operated successfully for this specific application on various other types of vessels, like PSVs, bulk carriers, chemical tankers and ferries. The smallest NITROMEM® Marine Nitrogen Membrane Generators are also suitable for LNG bunkering barges.

Nitrogen Generation on Oil & Chemical Tankers and Gas Carriers (non LNG).

The cargo tanks of IMO II & III oil and chemical tankers, either empty or filled, are normally protected against explosion by inert gas blankets. Inert gas is also required for cargo stripping, cargo padding and purging of cargo piping.

As a result of changes to SOLAS, the Fire Safety Systems (FSS) Code and the International Bulk Chemical (IBC) Code, all oil and chemical tankers of 8.000 DWT and above must be provided with a fixed inert gas system. The revised SOLAS allows the application of inert gas to be postponed until after loading but before the commencement of unloading, although only nitrogen is accepted as inert gas medium because of the risk of generating static electricity by using exhaust gas.

The on-board nitrogen generator shall have a design capacity of 125% of the cargo unloading rate and deliver inert gas with an oxygen content of not more than 5% by volume to the cargo tanks at any required flow rate.

The NITROMEM® Marine Nitrogen Membrane Generators from NOXERIOR meet all requirements for inert gas systems as specified in Chapter 15 of the amended FSS code (IMO – MSC 93(22)/Add.1 – Annex 3) conform IMO resolution MSC.367(93).
NOXERIOR has an experience of more than thirty years with the design and manufacturing of nitrogen generators based on air separation by either Pressure Swing Adsorption (PSA) or hollow-fibre membranes. Having a profound knowledge of both processes, the hollow-fibre membrane technology has been considered the preferred solution for the NITROMEM® Marine Nitrogen Generators.

- Continuous process compared to intermittent PSA process. The absence of moving parts stands for increased reliability and system availability,
- Reduced system footprint, no need for feed air dryer and feed air receiver. Smaller dimensions of the membrane nitrogen generator,
- Stable nitrogen production capacity compared to falling production capacities of PSA generators at increasing feed air temperatures (more than 20% loss of capacity from 20 to 35 °C in comparison to equivalent membrane systems).

**Best Possible Feed Air Conditioning.**

Despite the relatively limited annual operating hours, the NITROMEM® Marine Nitrogen Membrane Generators include an extended feed air filtration and conditioning to remove condensate, oil traces, oil vapours and particles to avoid potential clogging of the permeable hollow-fibre walls. Optimum flow conditions through the air filters are guaranteed over the long exchange intervals in order to ensure a correct air filtration, even immediately after system activation from stand-by mode. All filtration elements are easily accessible from one side of each generator. Maintenance of the integrated activated carbon tower in narrow spaces is extremely easy thanks to the application of NOXERIOR’s patented modular adsorber design.

**Production of Extremely Dry Nitrogen.**

The hollow-fibre membrane modules of the NITROMEM® Marine Nitrogen Membrane Generators also have an outstanding drying capacity as water vapour will be the first component of the incoming feed air to permeate through the membrane wall. A feed air heater will ensure that all remaining water traces will be in the vapour state at module inlet.

This feature allows the NITROMEM® Marine Nitrogen Membrane Generators to produce nitrogen with an unmatched low dew point of less than -70 °C, unreachable by any PSA nitrogen generator without additional adsorption drying. Low dew point values for the produced nitrogen are essential to avoid icing damage in hold- and inter-barrier spaces between the LNG tanks and the ship’s hull or in cold boxes.

**No Need for Back-Purging.**

Unlike other marine nitrogen generators, the NITROMEM® Marine Nitrogen Membrane Generators don’t require any additional back purge line installed between the nitrogen system and the external nitrogen buffer tank for dew point preservation. A NITROMEM® Marine Nitrogen Membrane Generator in stand-by mode will be able to supply on-spec nitrogen within only 3 seconds from start signal.

**Easy Integration with the Vessel’s IAS.**

The control system of the NITROMEM® Marine Nitrogen Membrane Generators allow any direct connection to the vessel’s IAS (Integrated Automation System) through Ethernet connection Modbus TCP/IP, Modbus RTU or Profibus DP for remote monitoring and system start/stop. Remote monitoring is also available for Smartphones or Tablets, eventually by means of an optional Wi-Fi module.

**Certified for Marine Application.**

All NITROMEM® Marine Nitrogen Membrane Generators have a TAC (Type Approval Certificate) released by LR to confirm their suitability for installation in ships machinery spaces in accordance with the requirements of the Rules of the Classification Society, IMO, FSS code and SOLAS. Moreover, the NITROMEM® Marine Nitrogen Membrane Generators are also certified to be compliant with the essential Marine-pollution prevention requirements of the Marine Equipment Directive (MED) 96/18/EC and related successive Commission Directives.
Convenience
Automatic and unattended operation. Fully automatic starting and stopping of the nitrogen production in direct response to demand from the vessel’s downstream nitrogen consumption. Easy, intuitive graphical operator touch-panel. Full integration with the vessel’s IAS.

High System Reliability & Quality
First-class components, stainless steel process piping, valves and regulators, heavy-duty PLC. Extended feed air filtration, including activated carbon tower, and feed air condition monitoring. It should work. Always.

Guaranteed Stable Nitrogen Purity
Real-time purity monitoring in combination with an automatic blow-off system and a nitrogen discharge flow regulation guarantees you that your produced nitrogen always corresponds with the defined specifications, even in case temporary nitrogen demand would exceed the rated production capacity of your NITROMEM® Marine Nitrogen Membrane Generator.

Ultra-Fast Reaction Time
The fastest marine nitrogen generator on the market: from stand-by mode to the supply of on-spec nitrogen within only 3 seconds after start signal. Fast reaction times allow the installation of significant smaller shipboard nitrogen receivers compared to any other marine nitrogen generator.

Compact
All NITROMEM® Marine Nitrogen Membrane Generators represent the most compact shipboard nitrogen generators currently available on the market. At similar performance data, 30 to 40% less installed volume than competing products despite the integration of a more extensive feed air conditioning system.

Easy Fleet Management
Modular design and identical components for the entire model range mean limited spare part management, fast supplies and easy maintenance.
Technical Specifications

Residual Oxygen Content

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Standard Components

- **Feed Air Filtration**: incl. Modular Activated Carbon Tower to patented NOXERIOR design
- **Electric Feed Air Heater**
- **Process Piping & Fittings in Stainless Steel**
- **Feed Air & Nitrogen Pressure Transmitters**
- **Feed Air Temperature Transmitter**
- **Feed Air Moisture Analyser**
- **Oxygen Analyser with Zirconium-Oxide Sensor**
- **Electronic Nitrogen Flow Meter**
- **Automatic Off-spec Nitrogen Blow-off System**
- **Nitrogen Pressure Regulation**
- **Control System with Siemens PLC**
- **Siemens Interactive 7” Touch Screen HMI**
- **Ethernet Connection Modbus TCP/IP**
- **App for Remote Monitoring by Smartphone or Tablet**
- **Marine Painted Carbon Steel Cabnet**
- **TAC and MED Certificate from LR**

Options

- **Nitrogen Moisture Analyser**
- **Modbus RTU or Profibus DP Data Connection**
- **WiFi or GSM Communication Module**
- **Analogue Output Signals Module (4~20 mA)**
- **ANSI / DIN / JIS Flanged Connections**
- **External Nitrogen Booster with Cylinder Filling Manifold**
- **Class Approval by Major Classification Society**

Special Products

Due to the unique design features of the NITROMEM® Marine Nitrogen Membrane Generators, NOXERIOR can supply you the most compact units on the market for the on-board production of nitrogen.

Our systems, including air compressors, can be supplied turn-key installed either on a single skid or inside a top deck container and will be suitable for operation under harsh marine or offshore ambient conditions.

NOXERIOR also has experience with the supply of specially designed nitrogen generation plants for offshore platforms. Please contact us directly in case you would be interested in one of our special products.

Health, Safety & Environment

According to our environmental management system certified to ISO14001:2004 and EMAS we constantly verify and correct our consumption of utilities and our waste disposal and we pay special attention to the material selected for our products and services.

Our Health & Safety system is implemented and applied according to national Italian legislation with periodic external verification by local authorities.

References

Please ask for the latest version of our reference list.

After-Sales Service

A reliable and responsive after-sales service is an integral part of NOXERIOR's business philosophy. Our technicians or our local partners for the NITROMEM® Marine Nitrogen Membrane Generators are able to assist you with correct installation and maintenance of your system.

Critical spare parts are always available on stock and can be supplied immediately to any location in the world.

Quality

All activities within our company strictly comply with the procedures of our certified quality management system to both ISO 9001:2008 and ISO 19485:2012, which are regularly updated and optimised.

Before packing and shipment each NITROMEM® Marine Nitrogen Membrane Generator will be thoroughly tested.

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