IGS INNOVATIVE GAS SYSTEMS

Highest Efficiency Membranes in the market

IGS Innovative Gas Systems

Generon Gas Membrane Technology and Manufacturing Leadership

Over 60 Patents covering membrane and module manufacturing technology and application

20 years of continuous improvement in membrane performance

New breakthroughs and new products ready for introduction

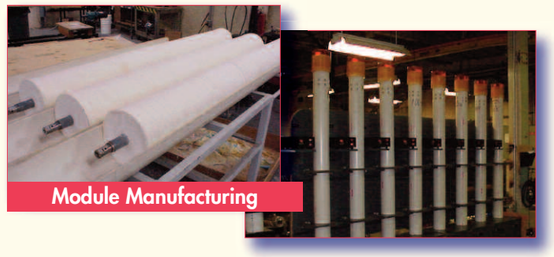
From Concept to Completion, We Provide Solutions!

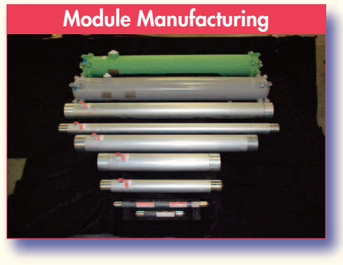
Generon IGS is the leading manufacturer and supplier of state-of-the-art air separation membrane products and technology. Generon has been and continues to be a leader in the application of membrane technology for gas separations through the crafting of innovative products for the most demanding customer needs over the past 25 years.

Cutting Edge Research and Manufacturing at Generon's California Campus


Polymer Science


Hollow Fiber Technology


Module Manufacturing

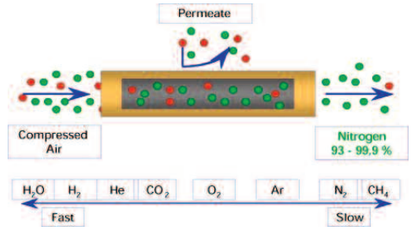

Module Manufacturing

The foundation of Generon's technology stems from Dow Chemical's Polymer Research Group, which screened hundreds of polymers in the 1970's and 1980's before selecting the optimum combination of gas permeability and selectivity. This polymer work has allowed Generon to lead the industry in the delivery of high productivity nitrogen solutions for over 20 years. Generon holds 15 patents covering the process of converting the polymer into hollow fibers about the size of a human hair. Specialized technology is required to balance fiber strength and gas flow characteristics to optimize fiber performance. Generon holds 20 patents covering the technologies used to bundle our polymeric fiber into completed modules. Each module has up to 1-million fibers and it is critical that each fiber be bundled in a way that insures that each fiber contributes to the gas separation process. Generon's technology development over the past twenty years has improved membrane separation effiency by 500%! Generon's R & D efforts are continuing to improve performance into the future.

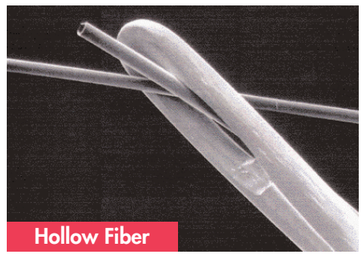
History of Gas Separation Technology

1960	1970	1980	1990	2000+
First Hollow Fiber Membranes Made	First Applications for Liquid Separations	Products for Air Separation Commercialized- Generon Born	Generon Develops Second Generation of Custom Membranes – High Purity N2	Generon Develops Dehydration Membrane and Advanced Air Seperation Polymer

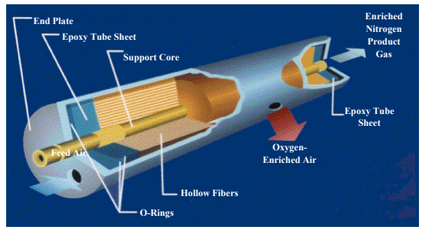
How does a membrane work?



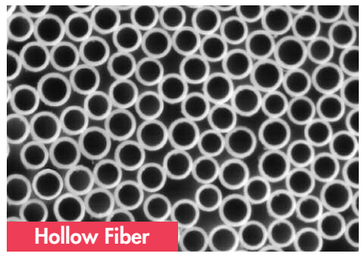
The membrane separation of gases is simple in concept. At the heart of the technology are polymeric membrane materials that allow for the rapid passage of one gas while minimizing the passage of another when applying a pressure gradient across the membrane. This figure demonstrates the relative rates of common gases with the focus on the separation of 02 from compressed air to provide a high purity N2 stream. Generon's polymer has the best properties for allowing the fast gases to permeate the membrane relative to the slow gases, resulting in the most efficient membrane performance and lowest unit power consumption.


Hollow Fiber

Membrane materials are formed into hollow fibers to provide high surface area for high volumetric gas processing rates. Generon holds many patents on the packaging of these hollow fibers into highly efficient modules. The combination of the highest performing polymer and the best fiber bundling techniques, result in Generon having the most efficient modules in the industry. This results in energy savings and space savings for our customers.

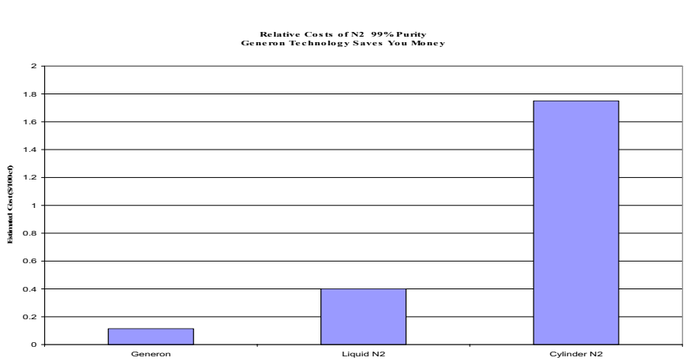


The membrane module may contain millions of fibers. Compressed feed air is passed down the bores of the fibers at one end of the module with the enriched nitrogen product gas exiting from the opposing end. Oxygen and water vapor are selectively removed and vented away from the feed air as it flows to the other end of the module. The Generon high performance membrane maximizes the passage of waste gases while keeping the nitrogen loss to a minimum while maintaining a history of reliability unmatched in the industry!!!


Hollow Fiber

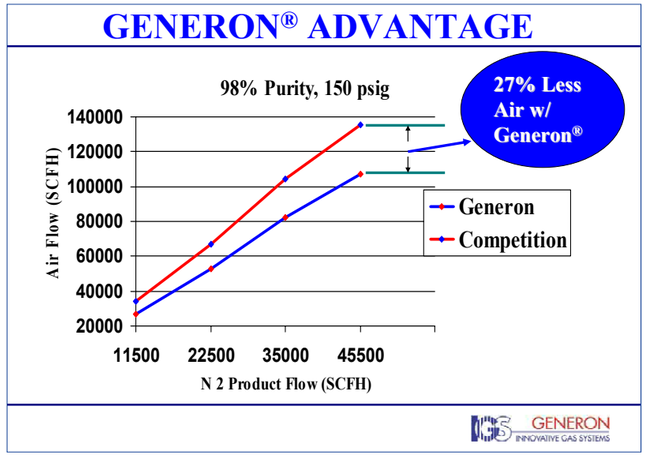
Generon IGS combines the best available membrane materials with state-of-the-art fiber bundling and the optimum module fabrication methods to provide the most cost effective solution for on-site nitrogen production.....and we have over 60 patents to prove it!

Generon is the Best Choice for Your Nitrogen Needs

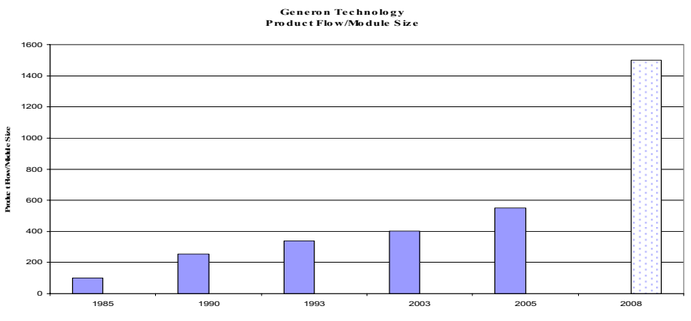


Generon Produced N2 can be 25% the cost of Liquid N2 and 5% of cylinder N2 cost

Membrane N2 Generators are not only cost effective, but are compact, light weight, portable and tunable to your exact purity needs. Even greater savings can be achieved at lower nitrogen purities.



The intrinsic properties of Generon polymer make it the most energy efficient membrane on the market. The power efficiency of Generon membrane products alone can save the average customer thousands of dollars over the life of a system.



Over a 500% Productivity Improvement since Generon's Commercialization in 1984 through 2005 with more advances on the horizon.

New Polymer will yield a dramatic jump in membrane efficiency. Value shown is an estimate which is being confirmed in field trials.

GENERON IS AN ISO-9000 COMPANY FOR ONGOING PROCESS CONTROL AND PRODUCT RELIABILITY. 100% OF GENERON MODULES ARE PERFORMANCE TESTED AND CERTIFIED PRIOR TO SHIPMENT.

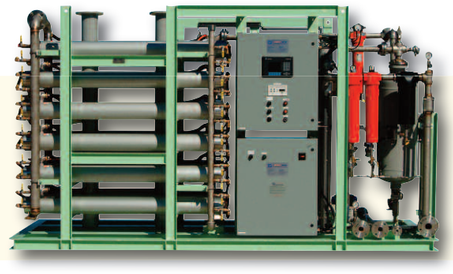
Generon IGS Membrane Systems Provide Solutions for Industrial Applications

- Over 20 years of membrane and system design experience
- State-of-the-art manufacturing sites-Texas, California, China, Italy
- Supplier of standard and custom engineered systems for.....

The Oil and Gas Industry-

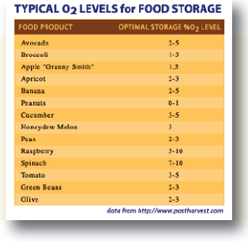
Providing engineered systems since 1993 to the oil and gas industry- containerized or skid mounted system which are portable, compact, light-weight and reliable. These systems are perfect for offshore applications.

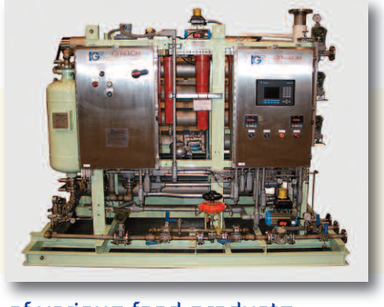
The Shipping Industry-



Membranes are increasingly used for shipboard system taking advantage of their light weight, compact size

The Food Industry-





Membrane system can make "tailored" purity N2 for the storage of various food products.

The Tire Filling Industry-

Membranes have become the tool of choice for filling car and truck tires to extend tire life and improve road safety. Generon serves this industry segment through highly-qualified market specialists.

Membranes are perfectly suited for removal of water vapor from Compressed Air streams.....

Membrane Operational Dynamics

This illustration shows how fast gases like oxygen and moisture permeate the surface of the individual membrane fibers while nitrogen molecules remain inside and are delivered as the product gas.

Model Number	100psi 0°F dp	100psi -40°F dp	200psi -20°F dp	200psi -40°F dp
GMD 210	6.3	2.5	23	9.2
GMD 4100	63	26	235	92
GMD 6150	135	55	505	198

Technology Summary

- ▲ Custom high performance polymer
- ▲ Patented fiber spinning process used
- ▲ Dew point of -70°F achievable
- ▲ Feed air up to 200 psig and 131°F

Convenient Packaging

- ▲ Point source modules in 3 sizes for flows from 6 scfm to 500 scfm
- ▲ Cabinet-mounted units for flows from 25 scfm to 4000 scfm
- ▲ Dew point of -70°F achievable
- ▲ Custom engineered systems for higher flow rates

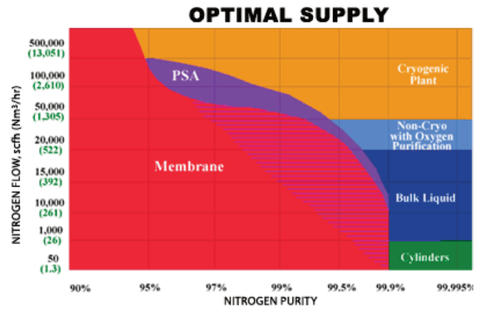
Product Features

- ▲ No moving parts
- ▲ Small, light-weight units
- ▲ Low maintenance system
- ▲ High efficiency modules
- ▲ No condensate disposal
- ▲ Noiseless operation

Future Membrane Gas Separation Developments.....

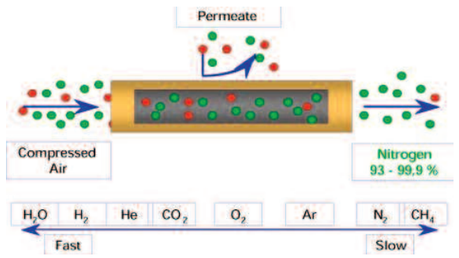
Higher Purity Nitrogen

Generon continuously improves the efficiency of producing high purity nitrogen with membranes. Industrial applications historically served by LN2 are moving to membrane nitrogen as purity improvements are introduced and new oxygen removal technologies are perfected. Membranes will greatly reduce the overall energy consumption to meet industry needs as membrane N2 purity continues to improve over time.



Natural Gas Cleanup using Membranes

Membranes are well-suited for the cleanup of natural gas (methane) because the main contaminants are water vapor and CO2. Both of these contaminants easily permeate through membrane material while membrane material resists the permeation of methane. This allows the CO2 and water contaminants to be discarded while the clean CH4 is contained as clean product.



Custom Gas Separations

Generon's R&D group in Pittsburg, California stands ready to work with customers to solve their gas separation challenges. Whether it be CO2 separations for sequestration; hydrogen/CO separations for process optimization or helium/air separation for product recovery, our experienced staff is ready to help.

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Highlights of Generon Technology

- Highest efficiency, custom designed polymer
- Patented fiber spinning and module technology
- 20+ year history of improving N2 purity output
- Dramatic new development now in field trials
- Future membrane separations in development

Reference List:

- Oil and Gas: Chevron. BP, Shell, Conoco-Phillips
- O&G Services: Halliburton, Weatherford, BJ Services
- Shipping: Unitor, DSME, Pe-Gu
- General Industrial: Atlas-Copco, Southtek, AMD-Metron
- Industry Standards- ASME/CE
- Generon Production History: Over 28,000 membranes sold around the world.

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