PRISM® Nitrogen HPN Systems

"Working closely with our customers has allowed us to continually develop our products to match individual requirements. As a result of our key technological advantages and ongoing research and development, we have built a successful product providing our customers with quality product at the right price."

Nigel Lucas,
Global Owner
HPN Product Line

Air Products has designed, engineered, manufactured and operated on-site gas generation systems for over 40 years, which has created an outstanding global product line.

Air Products' ***PRISM®*** Nitrogen HPN Systems, provide gaseous nitrogen at cryogenic purity at flow rates up to 3500Nm³/hr and purities down to ppb levels. These on-site systems provide highly reliable supply at significant cost savings over liquid nitrogen supply, or a standard cryogenic air separation plant. Modular design allows for easy installation and fast start-up times, and microprocessor control permits 24-hour remote monitoring. An integrated liquid nitrogen backup system helps ensure uninterrupted supply.

To generate nitrogen with maximum efficiency, the Nitrogen HPN Systems incorporate a proprietary air separation process. The system's design simplicity reduces maintenance requirements, thus enhancing reliability. Air Products has Nitrogen HPN Systems operating in every major region of the world.

The ***PRISM®*** Nitrogen HPN Systems are available to meet a broad range of customer requirements. Engineered for operation at your site, these systems can also include advanced telemetry capabilities for remote monitoring by Air Products customer service engineers and support personnel.

Features and Benefits

Low Capital Cost	• Standard, pre-engineered plant range • Highly skidded, modular design for low cost site installations • Compact plant design requiring minimal plot space
High Reliability	• Single, integrally geared turbo air compressor • Integrated instrument air system • Full local and remote operation with automatic call-out for 24 hours per day 7 days a week support
Low Operating Cost	• Low pressure with product compression gives low power consumption • Fully automatic controls for unmanned operation resulting in low manning costs
Flexibility	• Load following turndown for power savings at a reduced consumption rate • Customer Specific requirements can be supported due to full inhouse engineering group

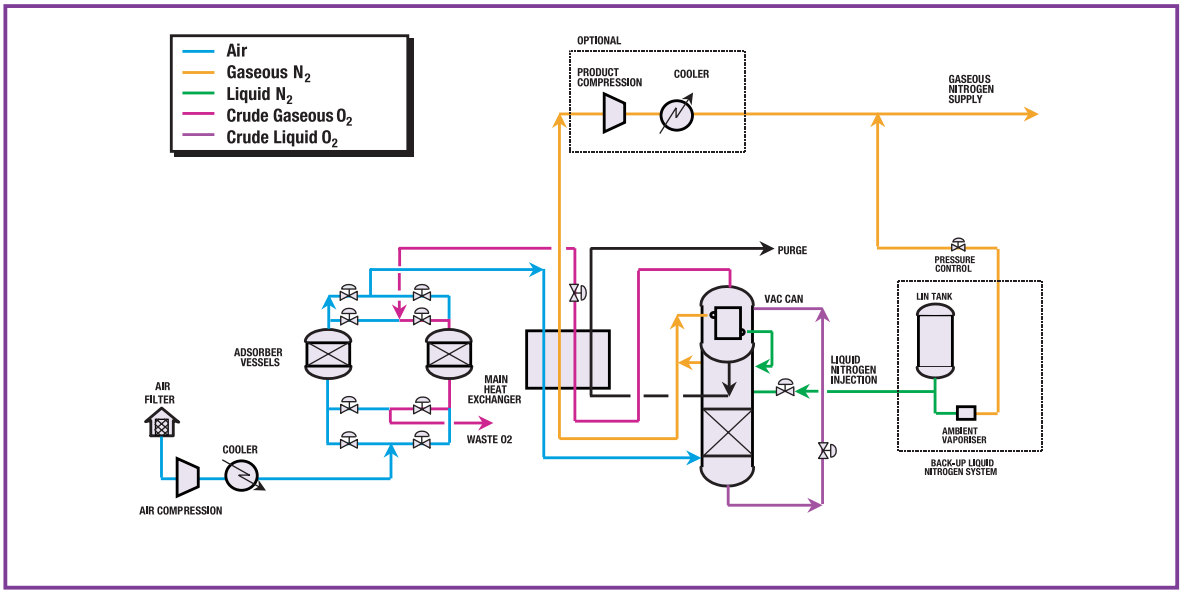
Process Description

The HPN process uses a small stream of liquid nitrogen (LIN) from the storage tank to provide the refrigeration balance required in the nitrogen generator.

Atmospheric air is compressed in the main air compressor (MAC) and cooled in the compressor aftercooler. The air then passes through a 2-bed adsorption system to remove water vapour, carbon dioxide and heavier hydrocarbons. One bed is on-line while the other bed is off-line. The off-line bed is regenerated using dry waste gas from the Vac-Can. The adsorber switching sequence and plant operation is controlled by a programmable logic controller. The air passes through self-cleaning filters as it leaves the on-line adsorber vessel.

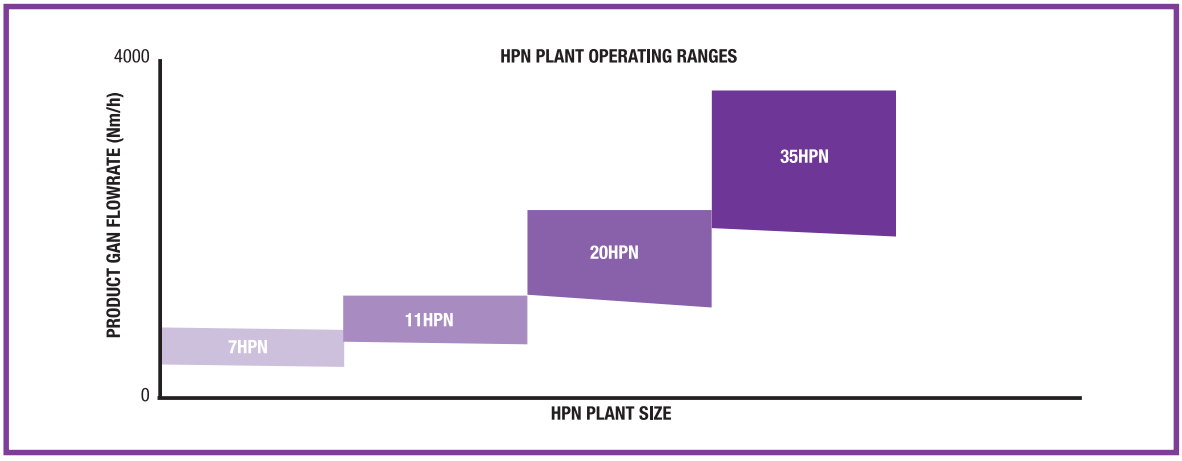
Inside the Vac-Can the air is cooled and partially liquefied by exchange against outgoing process streams in the main heat exchanger.

The cold, partially liquefied air and gas mixture passes into the distillation column. Here the mixture is separated by distillation into nitrogen gas and oxygen enriched liquid. The high purity nitrogen leaves the top of the distillation column as product. Some of the nitrogen passes into the reboiler/condenser where it condenses to provide reflux for the distillation column. Crude LOX from the sump of the distillation column is flashed into the reboiler section to provide refrigeration for condensing the reflux nitrogen. A purge of liquid from the reboiler sump prevents a build-up of hydrocarbons and CO_2. This liquid is introduced to the main heat exchanger to fully vaporise the purge and recover refrigeration. The refrigeration for the overall process is provided by injecting liquid nitrogen from storage. Only a small amount is required to balance the process heat gain, since the column is vacuum insulated and the main heat exchanger is highly efficient.

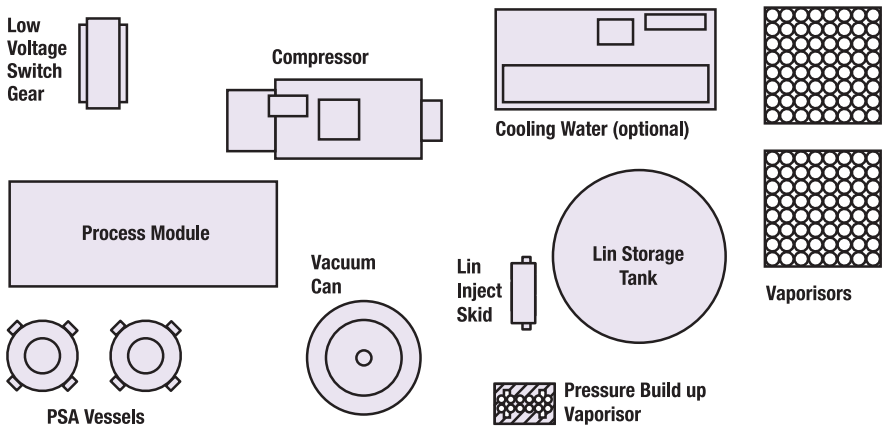


PRISM® HPN Performance

The ***PRISM®*** Nitrogen HPN System covers a range of gaseous nitrogen duties. The map below outlines the general performance capabilities of the various plants in the range. The LHS of plotted range represent 3 bar g product pressure, RHS represents 9 bar g product pressure.



Typical Plant Layout



Typical Dimensions

Model	L (m)	W (m)
7 HPN	14.5	10.5
11 HPN	14.5	11.0
20 HPN	16.0	13.0
35 HPN	21.0	14.5

Standards and Specifications

Safety, Health & Environment

Air Products believes that nothing is more important than safety.

We have extensive Safety Management systems, procedures (including HAZOP analysis) and detailed engineering standards, as well as 50 years of Air Separation plant operation experience. This expertise is applied to all plant and equipment that Air Products operates and sells, to ensure the safety of employees, customers and the general community. As a result Air Products is widely acknowledged to be the safety leader in the industrial gas industry and also has one of the leading performances in the chemical industry as a whole.

Quality

Air Products PLC engineering and manufacturing operates under QA procedures, certified under ISO9001 since 1983.

Pressure vessels

These are normally manufactured to ASME VIII (with U-stamp) or to European PED, but other codes can be accommodated where necessary.

Piping

ASME B31.3 as standard, DIN where required.

Electrics

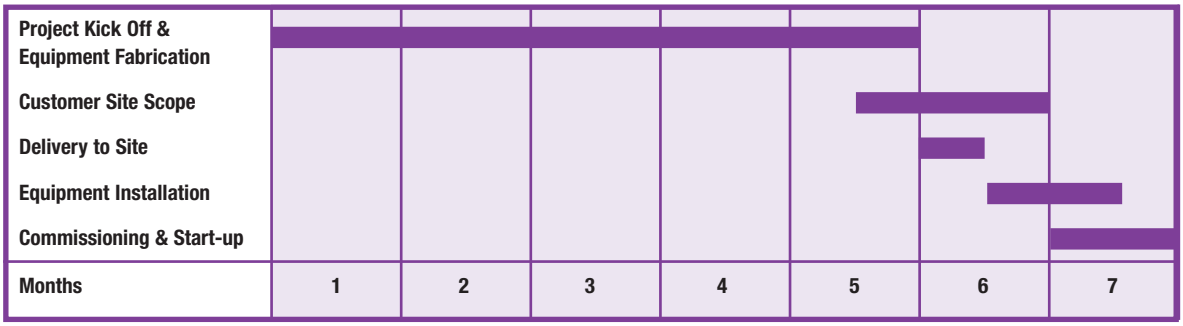
IEC, CE plated as standard, NEMA where required.

Noise level

85 dB(A) at 1 metre as standard, in a “free field” area with no other noise sources considered. Lower levels can be achieved where required.

Typical Project Schedule

A typical milestone schedule for an HPN Plant. All times are in months from the date of formal commitment. Project schedule is dependent on equipment lead times and is subject to change.



Scope of Supply

Descriptions:

Air Products ***PRISM®*** System products have been designed to meet a wide range of applications in order to satisfy the requirements of each Customer. The scope of supply of each plant can also be tailored to best address the interests of the Customer. As well as supplying the generation system, Air Products offers a broad complement of service options. These service options build on the base equipment package to provide a full product supply system, complete with ongoing operation, maintenance, and ownership of the equipment. An Air Products Commercial Manager would work directly with the Customer to identify the optimum level of service options.

Available service options:

- Licence and Permit Assistance
- Foundation Design and Construction
- Product Compression
- Equipment Delivery and Full Installation
- Utilities Design and Supply
- Startup and Commissioning of System
- Plant Overview and Safety Training
- Ongoing Operation and Maintenance
- Liquid Supply System for Backup & Peakshaving
- Product Pipe Line to Point of Use
- Application Testing & Optimisation
- Product Validation

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