Food Grade Quality Statement for Air Products PRISM® Gas Generation

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Air Products and our subsidiaries have been providing gas based equipment, services and products to the food and beverage industry globally for more than 40 years.

PRISM on-site gas generators are often used to provide gaseous nitrogen for processes such as modified atmosphere packaging and beverage applications. The quality of nitrogen produced by our PRISM on-site generators meets and typically exceeds national and European requirements for food quality and hygiene, provided that the generators are correctly installed, operated and maintained.

This document provides information on the specification of our food grade generated gases. Details of our quality management policies, including food legislation and other external requirements, are summarized in the document *"Air Products' statement of quality conformance for supply of gases and equipment into European food and beverage processing industries."*

1. General

PRISM on-site generators produce nitrogen for food using three principal technologies:

- Membrane
- PSA (Pressure Swing Adsorption)
- Cryogenic

These technologies use a similar overall process. Air from the surrounding area is pressurised using an air compressor, and then passed through a series of filters to remove key contaminants such as water and hydrocarbons. Membranes use a semi-permeable plastic polymer membrane to separate the nitrogen from the oxygen and other gases. PSAs use a Carbon Molecular Sieve to remove the oxygen and other gases, and Cryogenic generators use a heat exchanger and Cryogenic (low temperature) separation column to provide high purity nitrogen. In addition, Cryogenic generators will often use a PSA to ensure the air entering the cryogenic separation column is clean enough to prevent impurities from freezing and blocking up the column.

2. Regulatory requirements

For any food use, on-site generated nitrogen must follow the general principles described in EC Regulations 178/2002 and 852/2004 (food safety and hygiene).

In the case of modified atmosphere packaging applications nitrogen is defined as an additive (E941) and on-site generated nitrogen must also meet the following purity criteria:

- Nitrogen ≥ 99% Vol
- Oxygen ≤ 1%Vol
- Water ≤ 0.05% Vol
- Carbon monoxide ≤ 10 ppmV
- Methane and other hydrocarbons (as methane) ≤ 100 ppmV
- Nitrogen monoxide and nitrogen dioxide ≤ 10 ppmV

Note: the PRISM generator will be designed to supply nitrogen to meet the user's specification, which may be lower (or higher) than 99% purity. In such cases, the oxygen content will also vary, typically forming the balance of the gas supplied, e.g. 98% nitrogen will contain up to 2% oxygen. Other impurities will be within the specification above.

3. Generated gas quality statement

Provided they are correctly specified, installed, operated and maintained, our PRISM on-site generators are capable of supplying nitrogen at purities which exceed the European regulatory requirements. The following table indicates typical concentrations of the key impurities within the nitrogen produced from the three main technologies, for a given set of inlet air concentrations:

Impurity	Typical max concentration in air (ppmv)	Typical max N_2 PSA outlet concentration (ppmv)	Typical max N_2 Membrane outlet concentration (ppmv)	Typical max Cryogenic N_2 outlet concentration (ppmv)
Water	Varies	<500 (0.05%)	<500 (0.05%)	1
Carbon Monoxide	20	6	10	10 (with front-end PSA)
Methane	10	15	>10	0.1
Other Hydrocarbons	1	3	>1	0.1
NO and NO_2	0.05	0.08	0.05	1

Note: Although the production process will remove some gaseous contaminants, it will concentrate others. The quality of air supplied to the compressor cannot be controlled by Air Products as the production process takes place on the user's site. While the required air inlet specification is not normally difficult to achieve and Air Products engineers will advise on compressor siting, the responsibility is on the user to ensure that the day-to-day operation of the plant, inlet air quality, and the area surrounding the generator are not compromised by other permanent or temporary installations or emissions

4. Hazard Analysis of Critical Control Points (HACCP)

A documented HACCP forms the basis for ensuring that the quality of the nitrogen produced by PRISM on-site generators meets the required standards. Air Products maintains up-to-date HACCP documentation for all of our PRISM generators. Note that the HACCP covers the generation of the gas only, not the delivery into the user's system nor the use of the gas in the production processes. The HACCP may be used by the food producer when completing their own Risk Assessment.

5. Monitoring and analysis

The purity of on-site generated nitrogen is controlled by analysis of oxygen content in the outlet gas, with adjustable alarm and plant trip points to ensure that non-conforming / out-of-specification gas is not supplied into the user's process. When the oxygen level exceeds the specified limit, the plant will vent the out-of-specification product. If a back-up liquid nitrogen system is installed then this will take over supply to the user until the generator is back within specified limits. Remote signals can be supplied in order to provide duplication of key quality data within the user's control system.

Where specified, moisture analysis may be supplied as an option. Checks and controls on other impurities and on microbiological contamination will require sampling and testing of the Nitrogen by the user.

6. Preventative Maintenance

Preventative maintenance is extremely important to maintain the PRISM generator reliability, and also to ensure that product quality and purity is not compromised. Removal of hydrocarbons and water from inlet air is achieved primarily using water separators, filters and adsorbent beds, before the air enters the generator. These items must be maintained in accordance with manufacturer's or Air Products' instructions.

Air Products takes responsibility for preventative maintenance of generators owned and operated by Air Products. The user has responsibility to ensure that site conditions around the generator do not adversely affect the air quality supplied into the generator, nor the operation of the generator itself. While the PRISM generators are designed to operate without supervision, Air Products can monitor and operate the generator remotely via a user-supplied telephone/internet connection.

Maintenance operations must be carried out by trained personnel in such a way as to avoid contaminating the PRISM generator equipment and the supplied gas..

7. Traceability and recall

The generator control system continually logs the performance of the plant, and maintains a record of key data including pressure, purity and flow rate over time. Traceability for site-generated gases is limited to matching the data from the PRISM generator against the user's records of production of finished goods.

Air Products supplies industrial gases through a comprehensive range of supply modes. Additionally we provide variety of applications tailored for food industry. If you require further information, please contact us at:

Air Products PLC
2 Millennium Gate, Westmere Drive
Crewe CW1 6AP
T 0800 389 0202
email apukinfo@airproducts.com

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airproducts.co.uk/food