NITROSource and NITROSource Compact

food and beverage grade nitrogen made simple

Parker

ENGINEERING YOUR SUCCESS.

Contents

Filtration, purification and separation is our business

Parker is a world leader in the filtration, purification and separation of compressed air and gases.

Parker specialises in purification and separation technologies where compressed air and gas purity, product quality, technological excellence and global support are paramount. It designs and manufactures compressed air treatment products, gas generators and ancillary equipment for many key industries where ease of integration, low cost of ownership and energy savings can make a real difference.

Nitrogen gas

Nitrogen gas is used for a wide range of industrial applications, from modified atmosphere packaging for perishable food products, to preventing fire and explosions in chemical plants. However, while nitrogen surrounds us, accounting for up to 78% of the air we breathe, obtaining a ready supply of the gas can be problematic and expensive.

Parker offers an ideal solution to this requirement with a comprehensive range of cost effective nitrogen gas generation systems that enable users to produce their total demand for nitrogen gas on their premises, and under their complete control.

The increasing demand for fresh food produce

In today's global market place, consumers expect to receive maximum quality at minimum cost.

The food industry is no exception with demand for all types of produce to be supplied to every inhabited place on the globe. Regardless of season and location, everything from exotic tropical fruits to the staple diet of bread, rice and potatoes are expected to be available all year round and in "just produced" condition at competitive, affordable prices. Convenience and quick preparation of meals is also a high priority for the fast paced 21st century lifestyle.

Attractively presented fresh or prepared foods and combination meals, in durable hygienic packages that offer useful shelf life under normal refrigeration, have become very popular.

Faced with these consumer preferences and growing demand for an ever wider range of food products, retailers recognise the need for improvements in packaging technology. They need to address the spoilage problem and provide a huge diversity of new prepared foods.

Health concerns continue to drive the insistence on reducing salt, chemicals and preservatives which also places additional pressure on suppliers and manufacturers. They are expected to provide food products that look and taste like they were freshly made or just picked, despite possibly having travelled half way around the world by sea freight.

Operating in a very competitive environment, from the independent retailer to global supermarket chains realise that minimising waste by increasing shelf life, whilst ensuring the product is of prime appearance and taste, is essential to maximising what is often very narrow profit margins. This can be difficult to achieve, but satisfied, loyal, returning customers are key, and both retail and commercial outlets are insisting more and more that their suppliers satisfy these demands with minimal financial impact.


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Extending food shelf life

Many foodstuffs start to deteriorate the moment they are harvested or manufactured and prepared for packaging. The cause is attack from a multitude of spoilage mechanisms such as bacteria, yeast and mould spores, either airborne or naturally occurring within the product. Moisture loss or gain, depending on the food can also be undesirable.

If these spoilage mechanisms can be excluded, prevented or their progress retarded in some way, then the natural process of food decay can be delayed, allowing more time from production to consumer without affecting quality.

This benefits everyone in the supply chain from grower, manufacturer and packer through to logistics, retailer and ultimately, the consumer.

Over the past three decades, a safe, tried, tested and proven method of combating food spoilage mechanisms without the use of (or at least a substantial reduction in) undesirable preservatives, is the use of Modified Atmosphere Packaging. Sometimes referred to as “MAP” or “Gas Flushing”.

MAP is quite literally a process whereby produce is packed or stored in a “modified” form of the Earth’s naturally occurring air.

The normal ratio of gases is modified to significantly reduce or prevent the effects of spoilage mechanisms.

However it must be stressed that MAP is not a solution on its own. The shelf life of food produce is influenced by a number of factors including:

- **Storage temperature**
- **Quality of raw ingredients**
- **Product formulation**
- **Processing method**
- **Hygiene standards**
- **Packaging Material**

If any of these are lacking or substandard, the benefits of MAP can be reduced or even totally compromised.

Type and integrity of packaging

The selection of packaging materials is also of vital importance to ensure that MAP gases are internally retained at the desired level and that the transfer of outside contaminants through the pack are prevented.

There are many types of “barrier” packaging materials available and selection is very much dependent on the type of pack, product and gases to be used.

MAP Gases

The main gases used are nitrogen (N_2), oxygen (O_2) and carbon dioxide (CO_2). All three occur naturally in the air we breathe but by using them individually or combining them in the food packaging process, very beneficial results can be achieved.

Modified Atmosphere Packaging (MAP)

MAP is generally used to control four main types of micro-organisms.

Aerobic Microbes

These need air or oxygen to respire and grow.

Displacing the air in the packaging or storage process with nitrogen gas will cause a reduction in the oxygen level to a point where the bacteria are suppressed and the desired extended produce life is achieved. Some Bacillus, for example.

Anaerobic Microbes

These live without air or oxygen. Some species may even be destroyed or inhibited by very low levels of oxygen. Clostridium, for example.

Microaerophilic Microbes

These need low levels of oxygen to provide an optimum environment for growth. Some also require elevated levels of carbon dioxide, Campylobacter, for example.

Facultative Anaerobic Microbes

These can live and grow with or without air or oxygen. Salmonella species, for example.

For all of these spoilage mechanisms, a single MAP gas or mixture of two or all three will be required depending on the produce to be packaged.

Nitrogen is the most widely used gas. With the exception of raw red meat, raw offal, dark poultry cuts and some hard cheeses, nitrogen is used in some way for every other food that can benefit from MAP.

Benefits of using Parker nitrogen gas generators for MAP

- **Preservation of product flavour, aroma, texture and nutritional value**
- **Increased sales through high product quality**
- **Fewer product returns**
- **Increased production efficiency with longer production runs**
- **Better product colour and texture at point of sale**
- **Extended shelf life**
- **Increased export opportunities to new geographic markets**

Applications

Produce benefiting from MAP:

- Potato chips, corn chips and extruded snacks
- Nuts
- Fresh chilled meats, poultry and fish
- Cooked meats, poultry and fish
- Edible oils - refining of palm and coconut oils
- Coffee and tea
- Powdered milk
- Spices, pasta and other dried products
- Pita Breads, Naan Breads and Pizza bases
- Grated cheese and other dairy products
- Fruit juices and wine
- Salads
- Fruits
- Vegetables

Typical MAP shelf life extension

Product	Gas	Shelf Life In Air	Shelf Life In MAP
Liquid Food & Beverages	N_2	3 – 7 days	1 – 3 weeks
Dried Food Products	N_2	6 months	1 – 2 years
Grated & Soft Cheese	N_2 / CO_2	2 – 3 weeks	2 – 3 months
Fresh Fruit & Vegetables	N_2	3 –6 days	1 – 5 weeks
Fresh Pasta	N_2 / CO_2	1 – 2 weeks	3 – 4 weeks
Chilled & Ready Meals	N_2 / CO_2	1 – 4 days	1 – 2 weeks
Cooked & Chilled Meats	N_2 / CO_2	1 – 2 weeks	1 – 2 months

Packaging equipment often utilising MAP

Image courtesy of HayssenSandiacre Europe

- Vertical Form Fill & Seal, (VFFS)
- Vacuum Chambers
- Thermo Form Fill & Seal
- Snorkel Type

Image courtesy of MULTIVAC

- Horizontal Form Fill & Seal, (HFFS)
- Coffee Podders
- Inerting tunnels
- Tin Can Fillers

Food grade gases

As well as the quality, taste and appearance of food produce, the quality of packaging or blanketing gas is also of paramount importance.

Within the European Union, food gradenitrogen gas used as an additive is subject to European statue contained within

Commission Regulation (EU) No 231/2012 of 09th March 2012 laying down specifications for food additives listed in Annexes II and III to regulation (EC) No 1333/2008 of the European Parliament.

Parker NITROSource PSA has been independently tested by an acredidied UK analytical laboratory to demonstrate full compliance with EU legislation for nitrogen gas used as a food additive, designated E941.

Additionally, NITROSource PSA has been independently appraised and tested by the same laboratory to demonstrate full compliance with FDA Article 21 materials of construction for food contact applications.

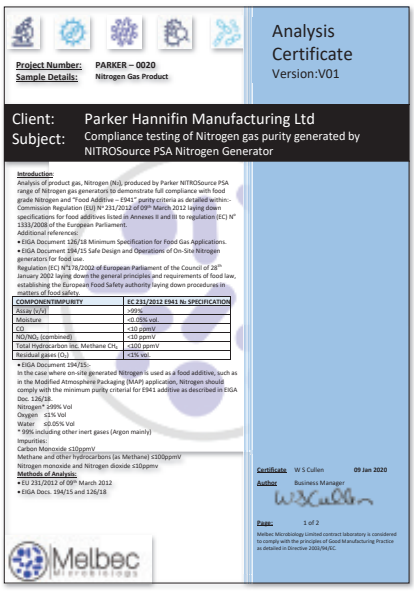
Parker NITROSource and NITROSource Compact – Food Industry Compliant

U.S. Food and Drug Administration
Protecting and Promoting *Your* Health

Materials of construction, independently verified to comply with FDA code of federal regulations title 21 'Food & Dairy'.

EIGA

Meets all criteria specified by EIGA in their document - 194/15 "Safe design and operation of on-site nitrogen generators for food use"



Analysis Certificate
Version:V01

Project Number: PARKER – 0020
Sample Details: Nitrogen Gas Product

Client: Parker Hannifin Manufacturing Ltd
Subject: Compliance testing of Nitrogen gas purity generated by NITROSource PSA Nitrogen Generator

Introduction:
Analysis of product gas, Nitrogen (N_2), produced by Parker NITROSource PSA range of Nitrogen gas generators to demonstrate full compliance with food grade Nitrogen and "Food Additive – E941" purity criteria as detailed within:-
Commission Regulation (EU) N° 231/2012 of 09th March 2012 laying down specifications for food additives listed in Annexes II and III to regulation (EC) N° 1333/2008 of the European Parliament.
Additional references:
• EIGA Document 126/18 Minimum Specification for Food Gas Applications.
• EIGA Document 194/15 Safe Design and Operations of On-Site Nitrogen generators for food use.
Regulation (EC) N°178/2002 of European Parliament of the Council of 28th January 2002 laying down the general principles and requirements of food law, establishing the European Food Safety authority laying down procedures in matters of food safety.

COMPONENT/IMPURITY	EC 231/2012 E941 N2 SPECIFICATION
Assay (v/v)	>99%
Moisture	<0.05% vol.
CO	<10 ppmV
NO/NO_2 (combined)	<10 ppmV
Total Hydrocarbon inc. Methane CH_4	≤100 ppmV
Residual gases (O_2)	<1% vol.

• EIGA Document 194/15:-
In the case where on-site generated Nitrogen is used as a food additive, such as in the Modified Atmosphere Packaging (MAP) application, Nitrogen should comply with the minimum purity criterial for E941 additive as described in EIGA Doc. 126/18.
Nitrogen* ≥99% Vol
Oxygen ≤1% Vol
Water ≤0.05% Vol
* 99% including other inert gases (Argon mainly)
Impurities:
Carbon Monoxide ≤10ppmV
Methane and other hydrocarbons (as Methane) ≤100ppmV
Nitrogen monoxide and Nitrogen dioxide ≤10ppmv
Methods of Analysis:
• EU 231/2012 of 09th March 2012
• EIGA Docs. 194/15 and 126/18

Certificate W S Cullen 09 Jan 2020
Author Business Manager
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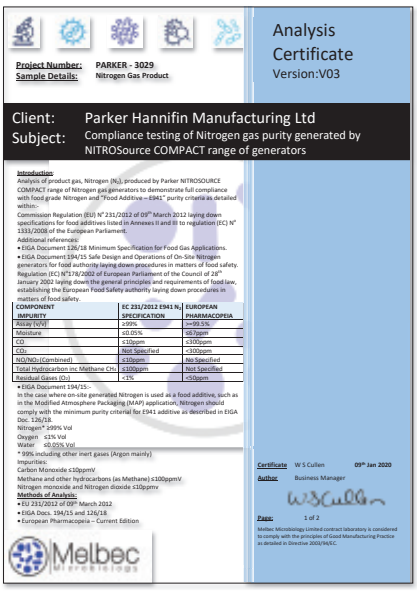
Melbec Microbiology Limited contract laboratory is considered to comply with the principles of Good Manufacturing Practice as detailed in Directive 2003/94/EC.

Melbec Microbiology



Analysis Certificate
Version:V03

Project Number: PARKER - 3029
Sample Details: Nitrogen Gas Product

Client: Parker Hannifin Manufacturing Ltd
Subject: Compliance testing of Nitrogen gas purity generated by NITROSource COMPACT range of generators

Introduction:
Analysis of product gas, Nitrogen (N_2), produced by Parker NITROSOURCE COMPACT range of Nitrogen gas generators to demonstrate full compliance with food grade Nitrogen and "Food Additive – E941" purity criteria as detailed within:-
Commission Regulation (EU) N° 231/2012 of 09th March 2012 laying down specifications for food additives listed in Annexes II and III to regulation (EC) N° 1333/2008 of the European Parliament.
Additional references:
• EIGA Document 126/18 Minimum Specification for Food Gas Applications.
• EIGA Document 194/15 Safe Design and Operations of On-Site Nitrogen generators for food authority laying down procedures in matters of food safety.
Regulation (EC) N°178/2002 of European Parliament of the Council of 28th January 2002 laying down the general principles and requirements of food law, establishing the European Food Safety authority laying down procedures in matters of food safety.

COMPONENT IMPURITY	EC 231/2012 E941 N_2 SPECIFICATION	EUROPEAN PHARMACOPEIA
Assay (v/v)	≥99%	>=99.5%
Moisture	≤0.05%	≤0.1ppm
CO	≤10ppm	≤300ppm
CO_2	Not Specified	<300ppm
NO/NO_2 (Combined)	≤10ppm	No Specified
Total Hydrocarbon inc Methane CH_4	≤100ppm	Not Specified
Residual Gases (O_2)	<1%	<50ppm

• EIGA Document 194/15:-
In the case where on-site generated Nitrogen is used as a food additive, such as in the Modified Atmosphere Packaging (MAP) application, Nitrogen should comply with the minimum purity criterial for E941 additive as described in EIGA Doc. 126/18.
Nitrogen* ≥99% Vol
Oxygen ≤1% Vol
Water ≤0.05% Vol
* 99% including other inert gases (Argon mainly)
Impurities:
Carbon Monoxide ≤10ppmV
Methane and other hydrocarbons (as Methane) ≤100ppmV
Nitrogen monoxide and Nitrogen dioxide ≤10ppmv
Methods of Analysis:
• EU 231/2012 of 09th March 2012
• EIGA Docs. 194/15 and 126/18
• European Pharmacopeia – Current Edition

Certificate W S Cullen 09th Jan 2020
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Melbec Microbiology Limited contract laboratory is considered to comply with the principles of Good Manufacturing Practice as detailed in Directive 2003/94/EC.

Melbec Microbiology

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Problems with typical nitrogen supply methods

Obtaining a ready supply of nitrogen gas can be problematic and expensive. Typical gas supply methods include high pressure cylinders, liquid mini tanks or bulk storage vessels. However, each of these options introduces a range of problems that needs to be solved.

When considering nitrogen supplies, a reliable vendor must be outsourced and valuable space in or outside the company premises needs to be assigned for gas storage. Procedures have to be established to monitor and manage the gas supply and arranging deliveries and payment for the gas must also be considered.

Additionally, safety and handling concerns need to be taken into account. The cost of addressing these logistical issues can be high and difficult to budget for, while the price of gas and supplier rates change continually. The environmental impact of truck based deliveries is another important consideration for carbon footprint reduction.

The ideal solution lies in a range of gas generation systems from Parker, which enable users to produce their total demand for food grade nitrogen gas on their premises, under their complete control. As a result, companies can generate as much or as little nitrogen as needed, at a fraction of the cost of having the gas delivered by an external supplier.

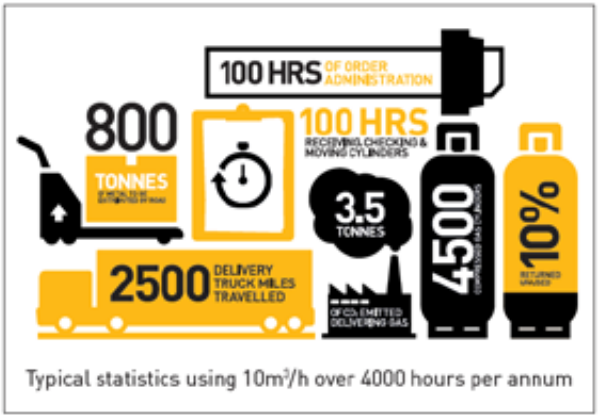
Why gas generation is best

Being able to take control of nitrogen supplies as opposed to having to rely on a third party, can reduce operational costs significantly.

These integrated nitrogen generation systems from Parker use pre-treated air from a standard industrial compressor which is essentially “sieved” so that oxygen and other trace gases are removed while nitrogen is allowed to pass through to the application as the product gas. Air separation is not a new idea, but the radical Pressure Swing Adsorption (PSA) design and control systems employed on the Parker nitrogen generator ranges have maximised gas output and reduced compressed air consumption to achieve even higher levels of efficiency than before.

A nitrogen generation system can reduce costs by up to 90% when compared to traditional methods of supply . If a company using liquid nitrogen was to convert to gas generation technology, the new system could be expected to pay for itself in typically less than two years. For a company using cylinders, the payback period could be even earlier, less than 12 months in many cases.

The new systems can also make the workplace considerably safer for employees, eliminating the safety risks of storage, handling and changing heavy, high pressure cylinders.

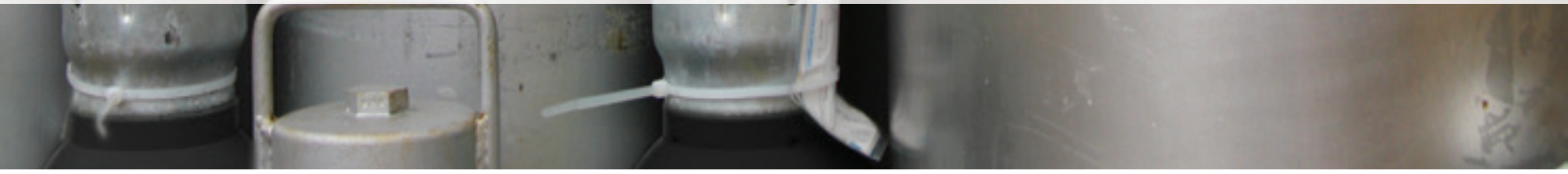


Typical statistics using 10m³/h over 4000 hours per annum

Gas generation is the lowest cost method of supply

Parker nitrogen generators have many advantages over traditional nitrogen supplies:

- Independently certified food grade nitrogen gas to EU statute as a food additive E941
- Complete control over gas supply and costs with savings often exceeding 70%
- No unexpected price rises
- No more expense incurred monitoring gas levels, managing supplies, running out and waiting for deliveries
- No gas wasted through boil-off or part full cylinders sent back to supplier.
- Constant flow and pressure delivered 24/7 ensuring maximum up-time.
- Operates from standard factory air compressor
- Fully automatic operation and control.
- Energy efficient – matches minimum compressed air consumption to meet nitrogen output.
- Sustainable long-life technology, environmentally friendly, reducing CO_2 emissions.
- Very low total cost of ownership with minimal servicing required only once per annum.
- Remote monitoring capability for data logging and traceability.
- MODBUS connection as standard enabling easy BMS integration
- Compact space saving design, fits through a standard doorway
- Increased safety without the need to store or handle high-pressure cylinders.
- Unlike bulk liquid vessels there are no large stored volumes of potentially asphyxiating gas.
- Reduced site vehicle traffic and safety concerns over cryogenic tanker movements
- No manual handling and personnel competence training for very high-pressure cylinder connection.



Technological excellence

Using the latest technology, Parker designs and manufactures Energy Saving Technology Pressure Swing Adsorption (PSA) nitrogen gas generators to provide a solution for every food application.

The Parker range of generators include:

NITROSOURCE PSA
nitrogen gas generators

NITROSource Compact PSA
nitrogen gas generators

Please consult with your local Parker representative to ensure selection of the correct solution tailored exactly to your requirements.

Committed to environmental Responsibility

ENERGY
SAVING
TECHNOLOGY

Prerequisite in everything Parker does is environmental responsibility. Certified to ISO14001, Parker is continuously making investments for the future, aiming to minimise environmental impact by how it conducts business and with the solutions it provides.

Nitrogen gas generation offers a real low carbon alternative to traditional methods of supply and one that environmentally aware nitrogen gas users will appreciate and want to be a part of.

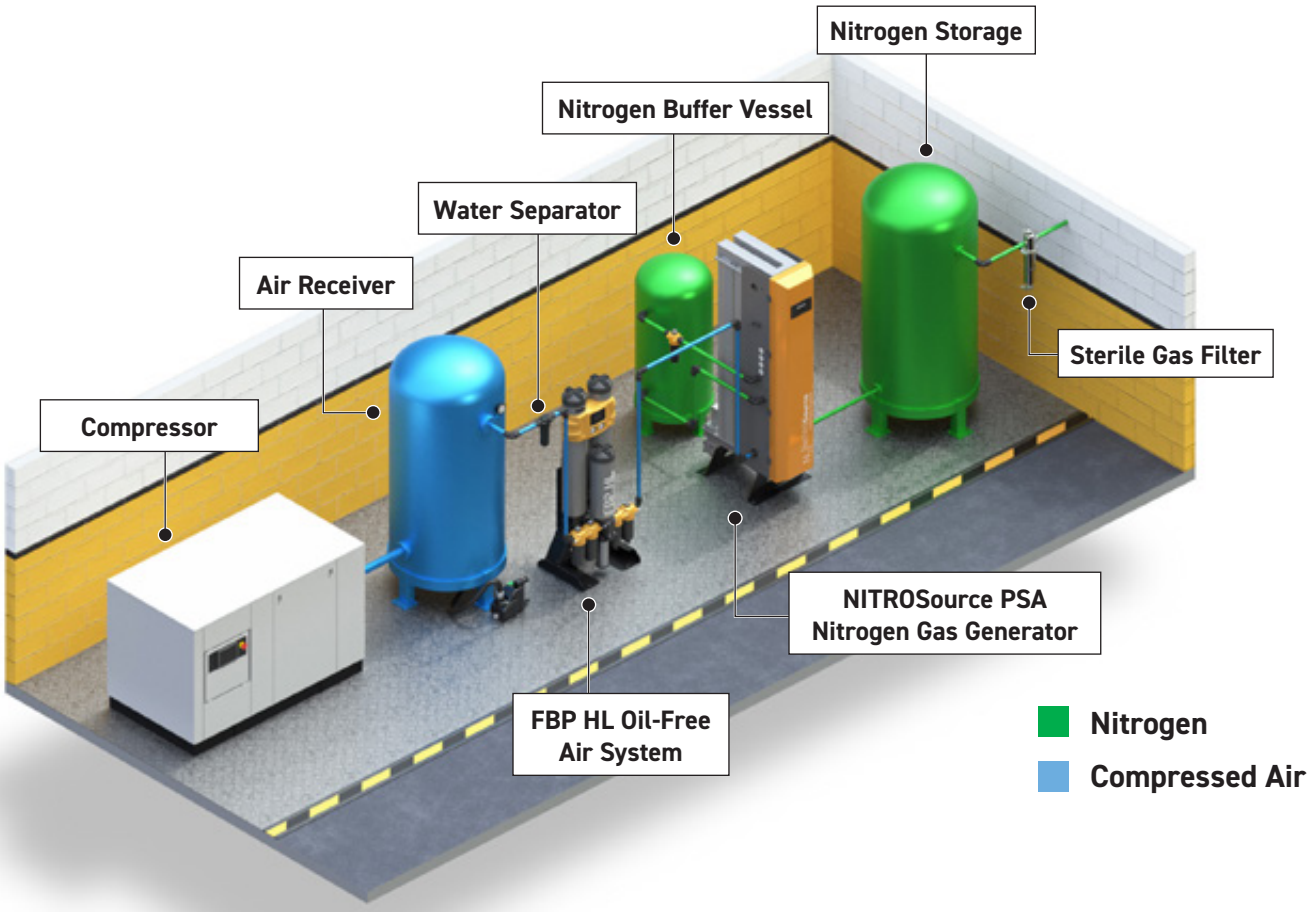
A significant amount of energy is wasted through process inefficiencies when considering traditional supplies, such as turning air into liquid at very low temperatures, or compressing gas to high pressures, and of course, the CO^2 emitted from delivery trucks.

Producing just the right amount of gas at low pressure and ambient temperature, at the site of the application, with nitrogen gas generators from Parker, is the most convenient and energy efficient option.

Energy Saving Technology, (EST), developed especially for the NITROSource PSA, goes one step further in reducing energy consumption and compressed air wastage.

Unlike most fixed timing cycle PSA nitrogen gas generators, the NITROSource PSA is available with an integral system that matches inlet compressed air flow to exact nitrogen demand by constantly monitoring the generator performance and adjusting the timing cycle accordingly. Dramatically lowering energy consumption and running costs.

Typical Parker food grade NITROSource Installation –



Parker nitrogen gas generators- food applications other than MAP

Image courtesy of ICA

Controlled Atmosphere (CA) storage

Large gas tight temperature and oxygen controlled bulk stores are typically used for fruit, vegetables and salads.

Purging with nitrogen gas removes oxygen and CO_2 which will slow product deterioration from weeks to many months.

In addition to land based CA stores, marine units provide the same level of benefit on-board specially modified cargo holds within ships, allowing the most economical transportation of perishable foods from all areas of the world.

Sparging

Nitrogen gas is passed through liquids such as cooking oils to help reduce dissolved oxygen. Diffusers are used within the oil storage vessels to ensure small bubbles of nitrogen gas are produced to achieve the best results.

Pressure transfer

Nitrogen gas is used as an inert, non oxidizing motive force to convey powders and liquids where it is undesirable or not possible to employ traditional pumping methods.

Using nitrogen gas gives the additional benefit of fire and explosion suppression, often associated with powders, dust and flammable liquids.

Silo and bulk storage blanketing

Providing an inert nitrogen gas “blanket” at minimal overpressure, above food produce contained in bulk storage silos or vessels will help prevent oxidisation and contamination from possible external atmospheric sources.

Insect and larvae reduction

Storage of produce such as cereals and grains can be purged and blanketed with nitrogen gas to eradicate insects or the development of their larvae. While the vast majority of these pests are totally harmless to consumers, minimisation of their presence is often desirable.

Nitrogen injection

Nitrogen gas is often used to create micro bubbles in products such as cream and certain desserts to improve texture and mouth feel. Nitrogen is used in preference to air as it is less likely to be absorbed into the product, therefore maintaining the bulk for longer, and as it is inert, it is less likely to oxidise the product and affect the taste.

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