



Dalco Nitrogen Systems

**Leaders in Nitrogen Gas Generation Systems
throughout Ireland**

Don't Buy Nitrogen.... Make it!

About us

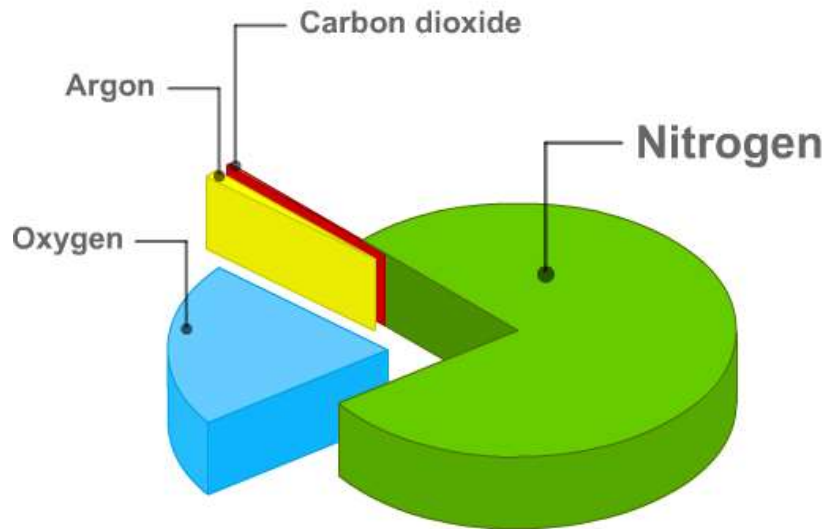
- Dalco Nitrogen Gas Systems was formed in 1993 by its current Managing Director John Daly. The company has grown over that time and developed into a European leader in Nitrogen Gas Generation Systems.
- We are holder of an ISO 9002 Quality Award. In compliance with the ISO structure, Dalco operates to strict quality procedures in every stage of the manufacturing and servicing process.
- Dalco has a dedicated team of professional and friendly staff to guide you through the selection, installation and servicing of your bespoke system.
- Dalco Nitrogen System's head office is based in Co. Meath, Ireland and has offices in the UK and Australia.
- We are increasing our export sales department and we are now available to build and install systems in Eastern European, Middle Eastern and American markets.



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What is Nitrogen?

Nitrogen makes up approximately 78% of the air we breathe at sea level. So there is an abundant supply of inert gas if we can remove the other reactive components of air listed:



The Earth's Atmosphere

- Nitrogen Facts:
- Nitrogen is colourless, odourless, tasteless and mostly inert gas.
- The element nitrogen was discovered as a separable component of air, by Scottish physician Daniel Rutherford in 1772.
- Nitrogen occurs in all living organisms.
- The 7th most abundant element in the universe, nitrogen is created by fusion processes in the stars.
- We each breathe in approximately 8400 litres of nitrogen per day, as it makes up the majority of the Earth's atmosphere.
- Nitrogen has a strong boiling point of -195.8°C.
- The human body is made up of 3% nitrogen.

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Why do we use nitrogen?

Applications use nitrogen because it is a clean, dry gas (dewpoint $<-50^{\circ}\text{C}$) that is inert and removes oxygen from the product or production process. Oxygen is an essential gas for life, but can have very undesirable effects under certain circumstances.

- **Prevent oxidation of materials**

- Removing oxygen prevents metals from oxidising in heat treatment processes.
- The image shows components that have undergone a heat treatment process. The outer 2 components are clean and silver in colour because they have been processed in a nitrogen atmosphere. The middle component has been processed in air where the oxygen has caused a black oxide layer to form on the surface.
- Oxidation doesn't just affect metals in heat treatment processes. It can also cause discolouring of inks, dyes, chemicals, plastics and oil.



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- **Stop bacteriological growth**
 - Many of the species of bacteria (aerobic) that make food go “bad”, need oxygen to survive. If we remove the life giving oxygen, then the bacteria will die or their reproduction will be retarded. For example, if the air space in a bag of potato chips is replaced with nitrogen gas, the bacteria that normally live on the fats within the chips cannot survive. The result is that the chips will last much longer in the pack, six months in air compared to two years in nitrogen.
 - Some bacteria (anaerobic) can still survive without oxygen. To stop these bacteria from spoiling food, sometimes carbon dioxide is required to be added to the nitrogen to create a ‘mixed gas’.
 - Pharmaceutical packaging also uses nitrogen to package products under aseptic conditions.



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- **Reduce the risk of combustion and explosion**
 - For a fire or explosion to occur, three elements are needed – fuel, oxygen and an ignition source. This is often called the fire triangle.
 - If we remove any one of the three elements, the triangle collapses and a fire or explosion cannot occur.
 - A safe and economical method of “breaking down the triangle” is to replace the oxygen contained within atmospheric air with the nitrogen gas.
 - For most substances, an oxygen level below 10% will prevent fire and explosion.



The Fire Triangle



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Nitrogen applications

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.

Food

- Most food products start to deteriorate from the moment they are harvested or prepared for packaging, being under attack from a multitude of spoilage mechanisms. By flushing, storing or packaging with nitrogen, oxygen that many of these micro-organisms need in order to survive and multiply, is removed and the spoilage process is significantly reduced.
- Prepared salads and vegetables, fresh chilled ready meals, meat, poultry, fish, dairy produce, breads, coffee as well as snack foods such as potato chips and nuts can all benefit from 'modified atmosphere packaging (MAP). By using nitrogen gas from a Parker generator, the product shelf life is increased and the appearance and quite often the taste, is also improved.
- In addition to MAP, nitrogen is also used for 'controlled atmosphere storage' of fresh fruits and vegetables, sparging and blanketing food oils as well as bulk powders, cereals and liquid ingredients



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Beverage

- Alcoholic and non-alcoholic drinks and ingredients can suffer similar spoilage mechanisms to food, however one of the most significant threats to product quality is oxidisation which adversely affects the product taste. Beer and wine can absorb unwanted dissolved oxygen throughout the production process. In addition, oxygen can also reduce the effectiveness of natural or added vitamin C which may be used in fruit juices.
- Parker nitrogen gas generators provide an ideal cost effective solution for all of the processes involved in beverage production and dispense including:
 - Blanketing
 - Sparging
 - Pressure transfer
 - Purging
 - Bottling
 - Kegging
 - Packing
 - Mixed Gas Dispense (MGD)



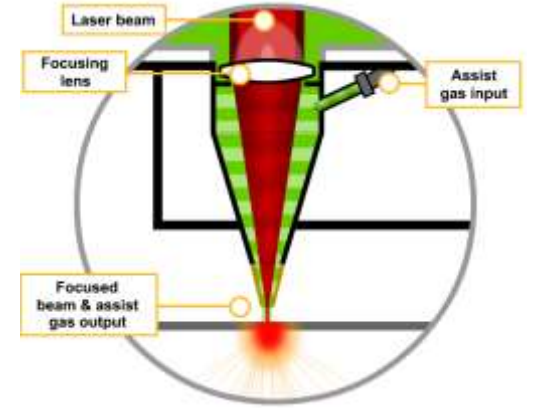
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Laser cutting

- By far the largest use of nitrogen gas within this industry sector is for CO2 laser cutting. Nitrogen gas is used as an 'assist gas' to prevent oxidisation or discolouration and to blow away the molten material from the cut edge.
- It is also used in certain types of laser cutting machines as a 'purge gas' to ensure the laser beam guide path from the resonator (where the beam is generated), to the cutting head, is free from contamination that could otherwise affect the power or alter the shape of the beam.
- **Laser Sintering** – Laser sintering or rapid prototyping uses a laser to form a 3D structure within a plastic powder material. Complex shapes and patterns can be constructed and modelled with ease. Nitrogen is used to blanket and prevent oxidisation of the powder material while it melts and solidifies to shape under the heat generated by the laser beam.
- **Laser Ablation** – Nitrogen is used to expel fumes and blanket delicate electronic circuits where a laser beam is used to erode pathways on micro printed circuit boards.
- **Laser Eye Surgery** – Nitrogen is used as a beam purge and pneumatics gas on Eximer laser machines which are used in the corrective treatment of eyesight defects.



Laser Cutting Head



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Pharmaceutical, research and academia

- Whether in primary or secondary pharmaceutical product manufacture or as a centralised QA laboratory supply; within research establishments or universities and colleges, Dalco can offer a solution to suit the critical demands of this industry sector.
- For blanketing of pharmaceutical product ingredients and pressure transfer within the reactor vessels, to micronizing powders to prevent oxidisation or explosion, Dalco nitrogen systems can cut costs, reduce risk and improve productivity.
- Centralised laboratory systems remove the need to have high pressure cylinders within the working environment and the possibility of running out of gas during a QA analysis procedure. Nitrogen generators are typically used for analytical equipment such as L/MS, GC, reaction blanketing within fume cupboards, solvent evaporation, ICP, ELSD, NMR and circular dichroism.



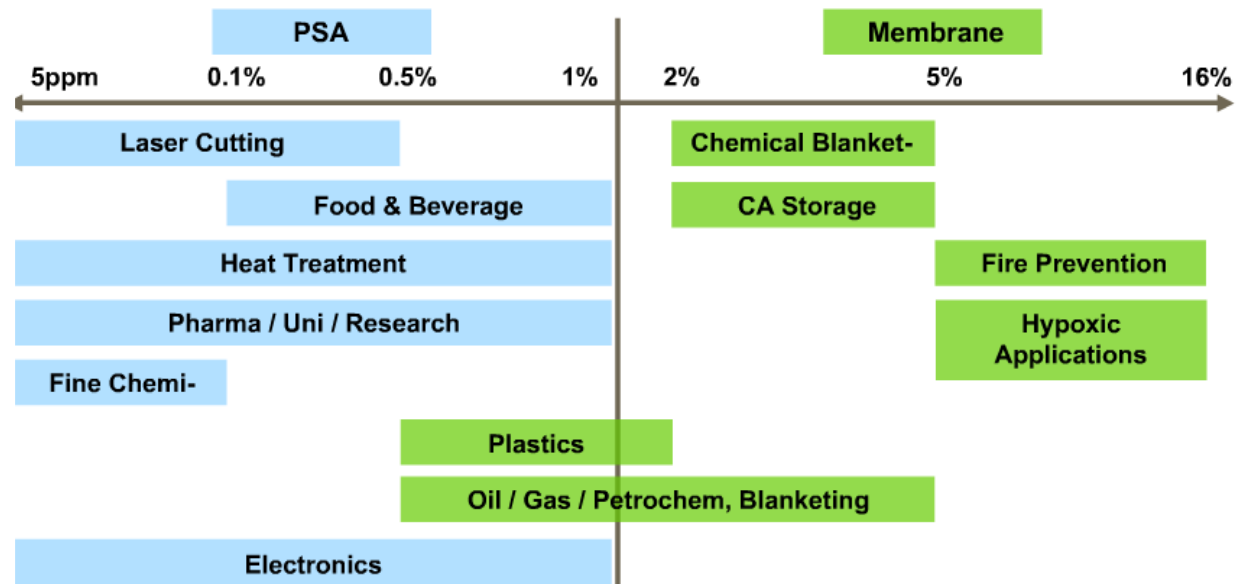
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On-site Nitrogen Gas Generation

On-site nitrogen generation using gas generators allows companies to **take control of their own gas supply**. The generators use air from a standard industrial compressor that is 'sieved' so that oxygen and other trace gases are removed, while nitrogen is allowed to pass through to the application. There are two core technologies that are used in the generation of on-site nitrogen gas: hollow fibre membrane and pressure swing adsorption (PSA).

Nitrogen generation technologies vs application

- In general, membrane technology is suitable for applications with a requirement for between 5% to 2% max remaining oxygen.
- PSA technology is suitable for 1% to 5ppm, maximum remaining oxygen concentration.

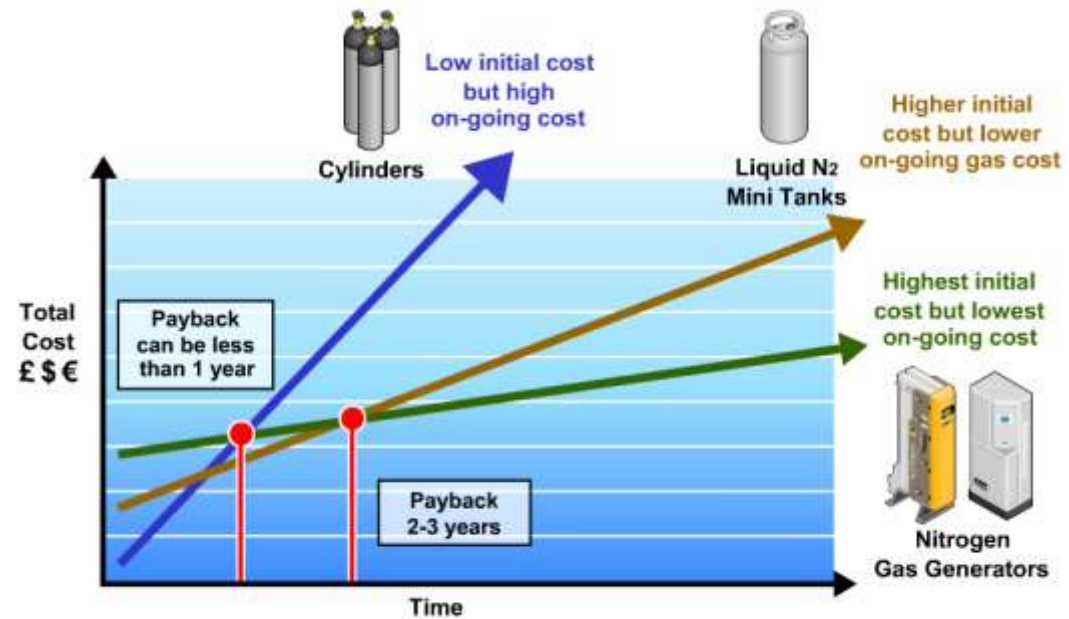


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Nitrogen supply price comparison



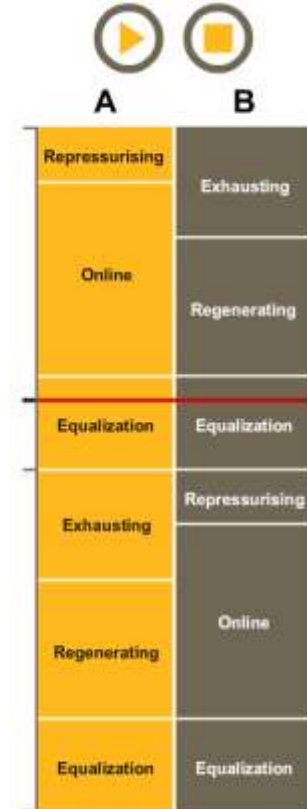
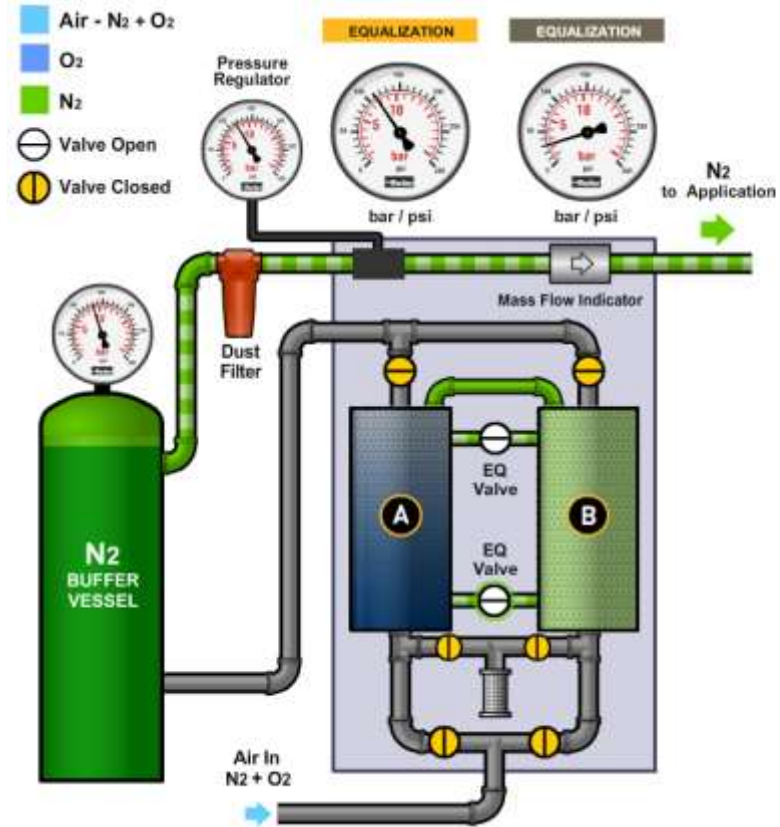
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Nitrogen Gas Technologies

Pressure Swing Adsorption (PSA) – technology that uses columns of carbon molecular sieve (CMS) to separate compressed air. Oxygen and other waste gases are selectively adsorbed under pressure by the CMS, allowing nitrogen to pass through to the application.

The technology is called pressure swing adsorption because the operating pressure ‘swings’ from 0 bar up to typically 7 bar to desorb and release the waste gases.

The CMS is regenerated by releasing the pressure in the columns and venting the waste gas to atmosphere.



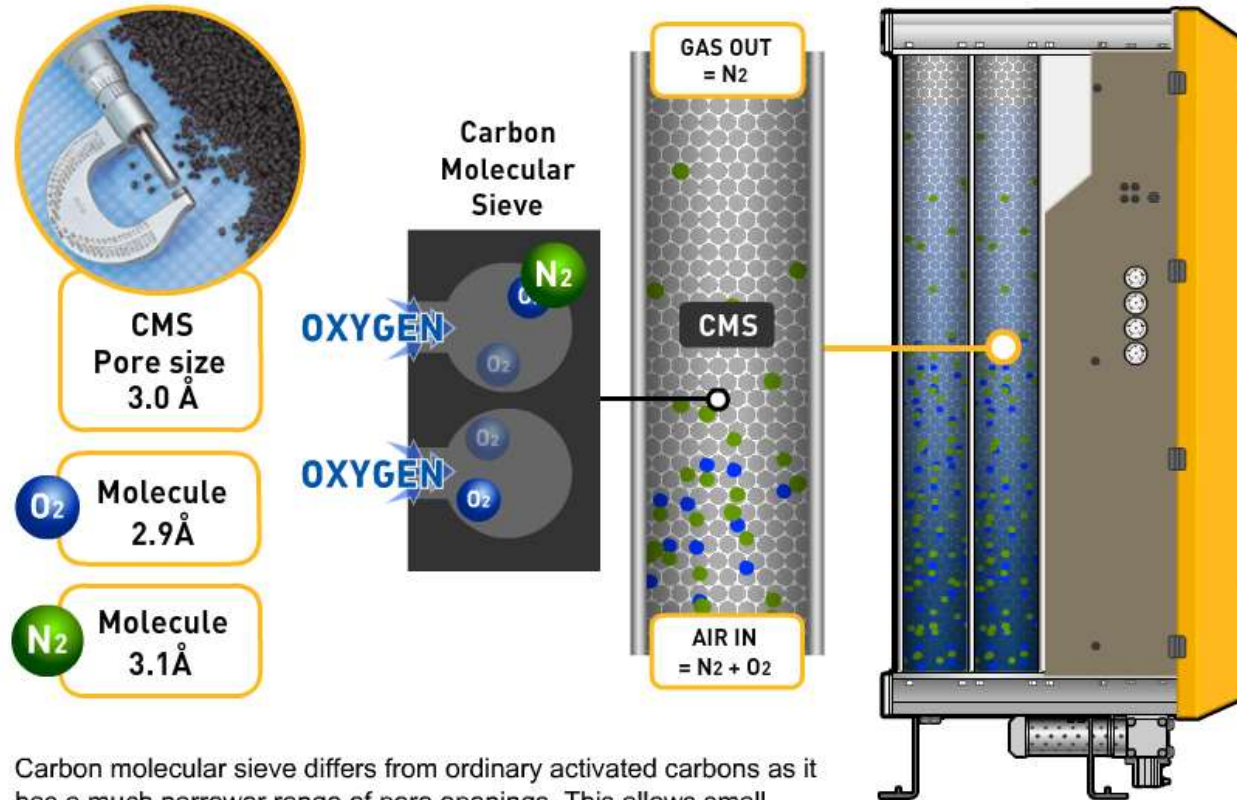
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Nitrogen Gas Technologies

Carbon Molecular Sieve



Carbon Molecular Sieve Material



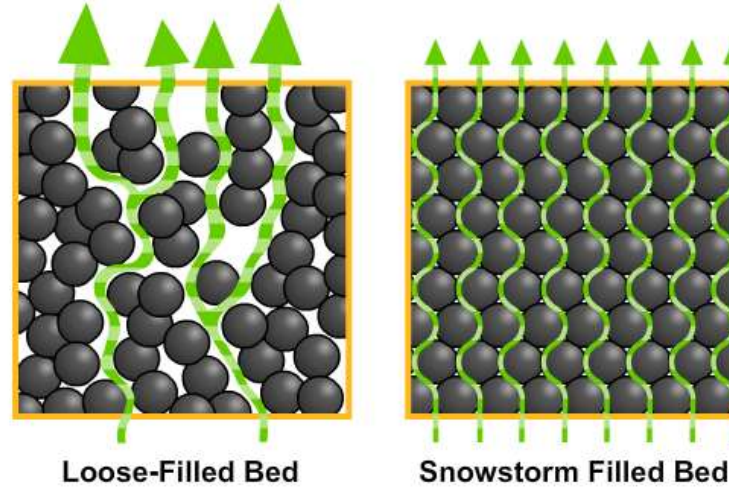
Carbon molecular sieve differs from ordinary activated carbons as it has a much narrower range of pore openings. This allows small molecules such as oxygen to penetrate the pores and separate from nitrogen molecule that are too large to enter the CMS. The larger nitrogen molecules by-pass the CMS and emerge as the product gas.

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Nitrogen Gas Technologies

Snowstorm Filling technique

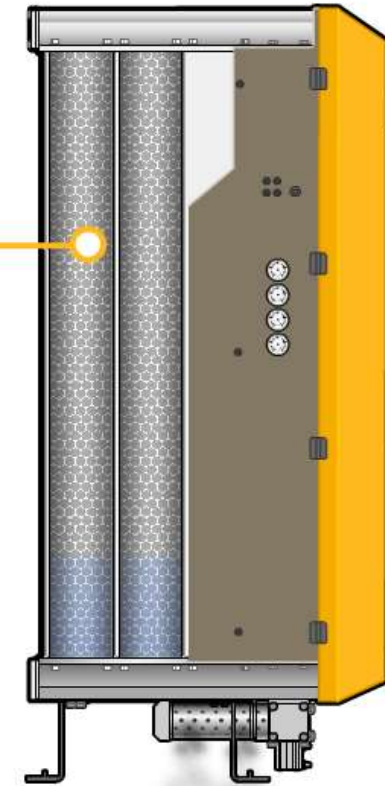
Snowstorm Filling



The design of the columns enable a filling process for the CMS called snow storm filling. This ensures maximum packing density to prevent the sieve bed moving and leaving leakage paths.

The advantages gained by using snow storm filling are:

- The CMS bed cannot move or settle. This prevents CMS granules from rubbing together and wearing away, (attrition), which reduces the life of the CMS and requires constant topping up.
- There are no leakage paths for the compressed air to find, so all of the CMS is utilised. This gives a very stable performance with maximum efficiency whilst reducing the overall amount of CMS required.



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Parker Nitrogen Gas Generators

NITROSource PSA/MIDIGAS PSA, nitrogen generation system

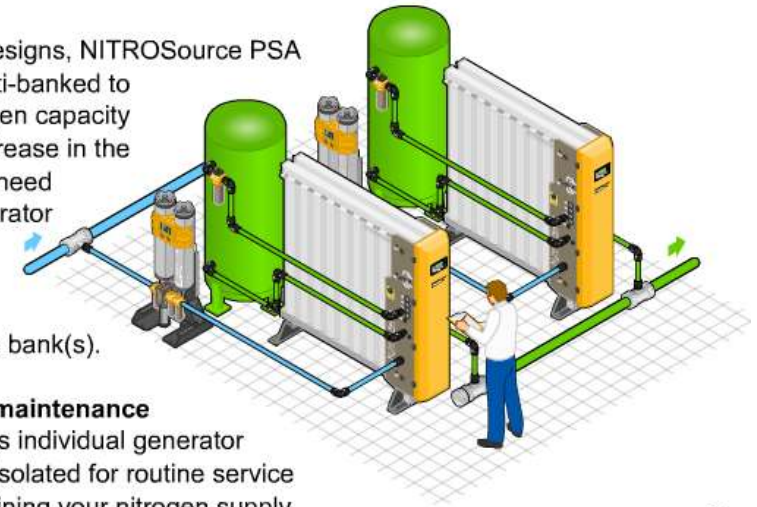
Robust, reliable and stable – your guarantee of performance with proven benefit of advanced aluminium extrusion technology. Parker has developed a range of nitrogen gas generators that operate on the same principle as traditional, twin tower units, but are typically 40% more compact than out-dated traditional systems.



Greater flexibility with multi-banking

Multi-banking

Unlike traditional designs, NITROSource PSA models can be multi-banked to provide extra nitrogen capacity should demand increase in the future. There is no need to replace the generator with a larger unit, additional capacity can be covered by simply adding extra bank(s).



Flexibility during maintenance

Multi-banking allows individual generator banks to be easily isolated for routine service work, whilst maintaining your nitrogen supply.

100% stand-by

Compared to traditional designs, 100% standby is available at a fraction of the cost as only one extra gas generator bank is required.

Fits through a standard doorway

NITROSource PSA will fit through a standard doorway, eliminating the need for special access or facility structural dismantling during installation.



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Parker Nitrogen Gas Generators

Benefits

- **Up to 90% cost savings**
Typical capital payback is achievable with 12-24 months
- **Energy savings**
Produces nitrogen from standard compressed air supply. No gas is wasted, returned in part used cylinders or lost through boil-off. Economy stand-by stops air usage when no gas is required.
- **Convenient and safe**
The easy to use systems are simple to install, require minimal maintenance and eliminate safety hazards associated with traditional gas supplies.
- **Space saving designs**
The compact design means the systems demand less floor space.
- **Flexible and modular**
The module concept allows the generators to grow with the factory/equipment.
- **Reduced carbon footprint**
The elimination of cylinder deliveries and transportation means carbon footprint can be reduced.



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Parker Nitrogen Gas Generators

What quality nitrogen do I require?

A dedicated solution for every application.

By combining the benefits of PSA technology with modern design, Parker has produced an extremely compact and reliable system to provide exactly the right quality and amount of nitrogen gas for your application

- **What do we mean by purity?**

By purity Dalco means to the maximum remaining oxygen content in the output nitrogen gas. PSA Nitrogen technology when combined with Parker compressed air pretreatment, guarantees the nitrogen gas to be commercially sterile, oil free, dry and particulate free within the specifications defined in the product

The maximum remaining oxygen content required will vary with every application.
Maximum cost and energy savings = maximum oxygen level permissible.

High Purity

10 ppm to 1000ppm
(99.999% - 99.99%)

- Heat Treatment
- Pharmaceutical
- Laser Cutting
- Electronics Soldering

Mid Purity

0.1% - 1%
(99.9% - 99%)

- Food MAP
- Food processing
- Beer dispense
- Wine blanketing
- Injection moulding
- Aluminium sparging

Low Purity

1%-5%
(99%-95%)

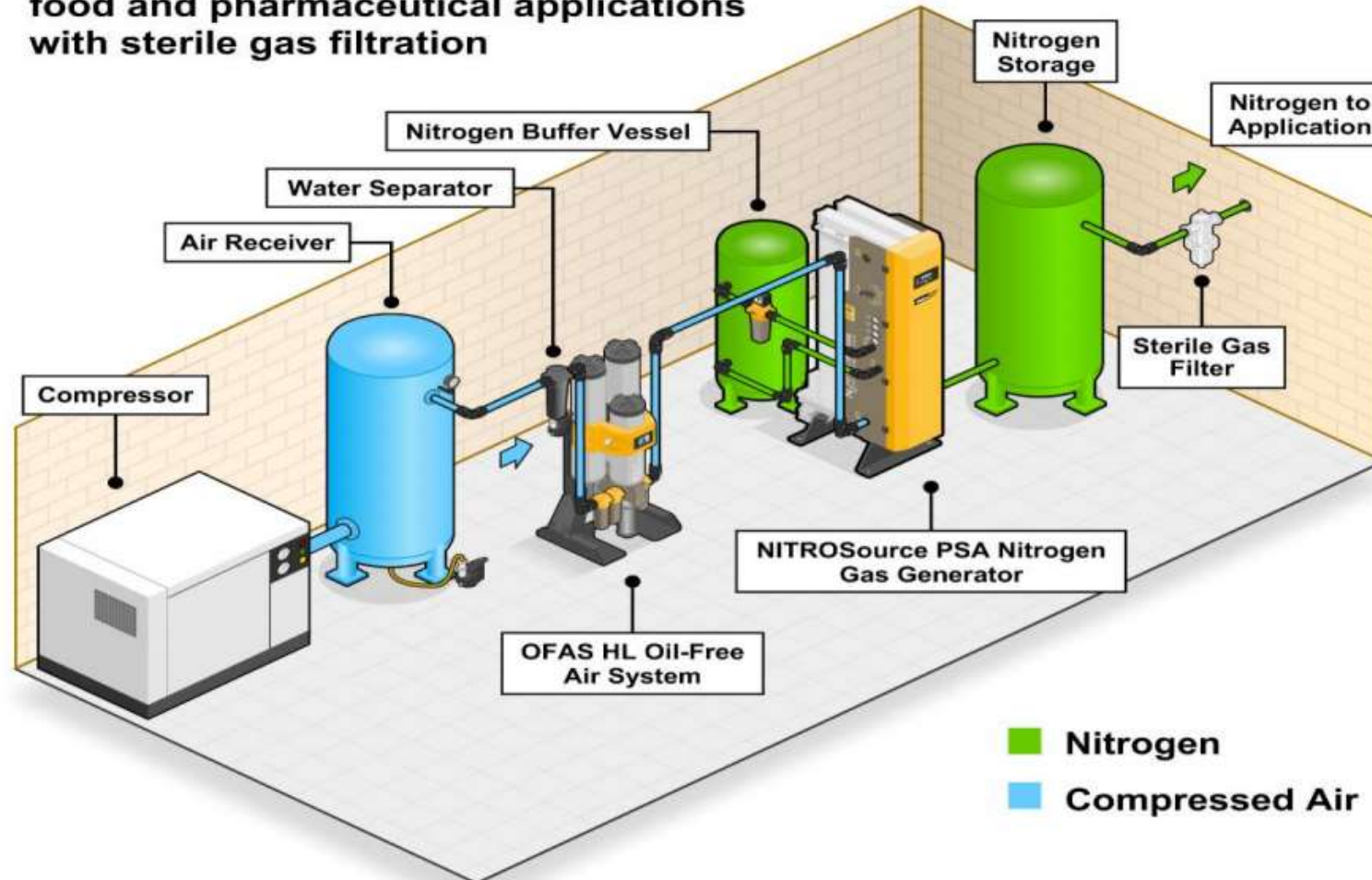
- Fire prevention
- Explosion prevention
- Pressure testing
- Chemical blanketing
- Autoclaves



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Standard Installations

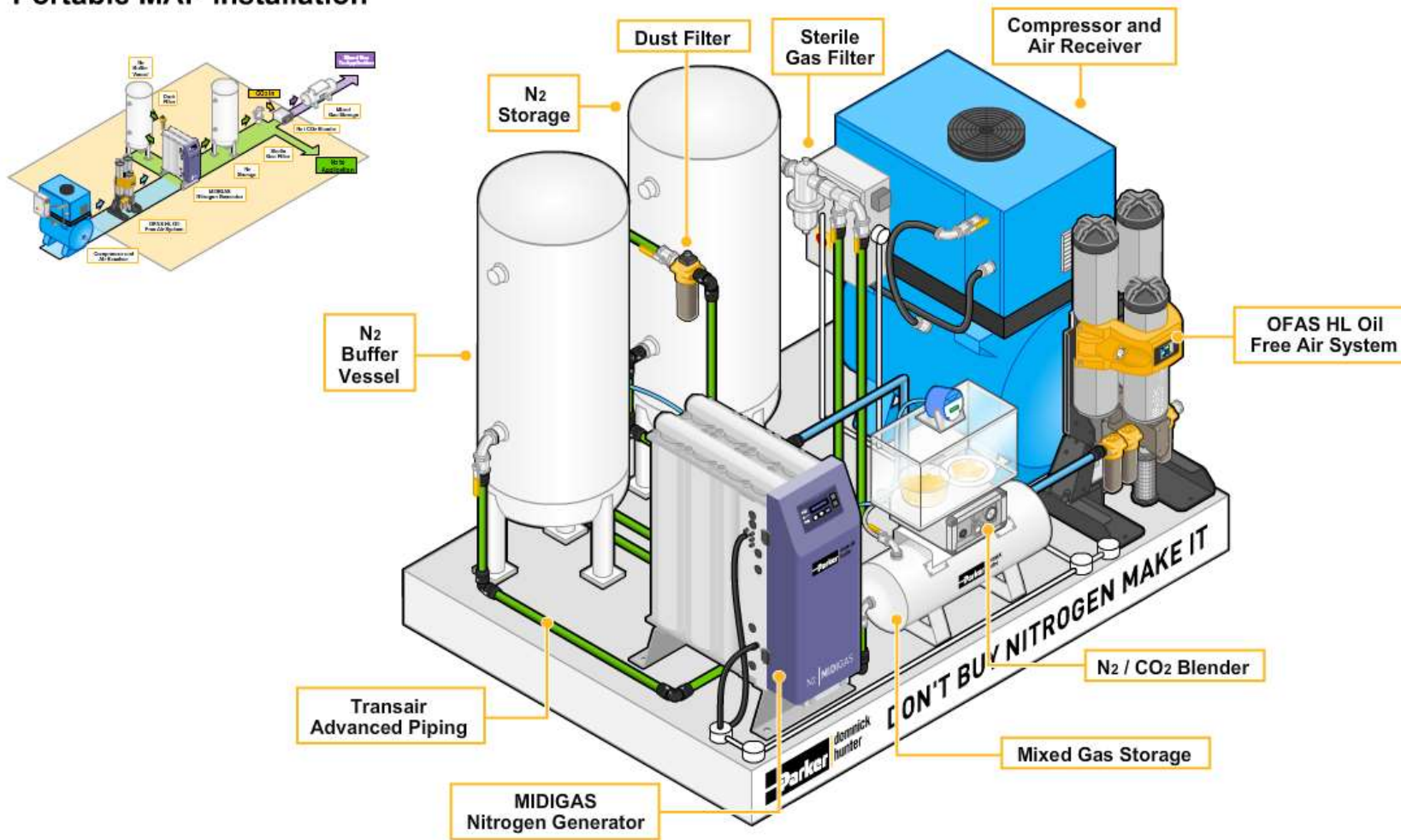
Typical NITROSource PSA layout for food and pharmaceutical applications with sterile gas filtration



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Standard Installations

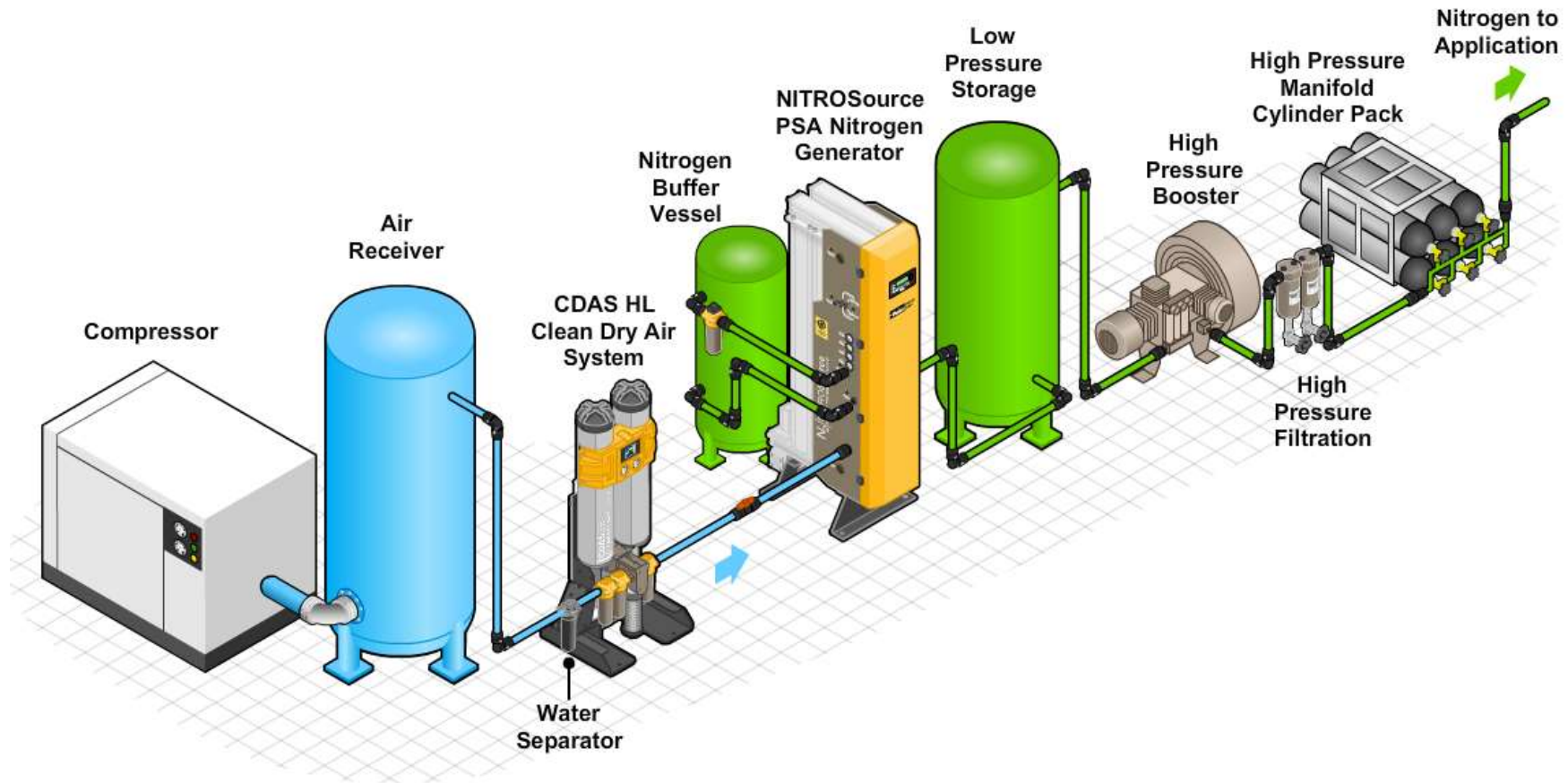
Portable MAP installation



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Standard Installations

High pressure installation



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Completed Installations



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Completed Installations

Keogh Crisps
Container



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Completed Installations

Oakpark Skid System



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Completed Installations



Skid System – No compressor



Skid System – With compressor



Don't Buy Nitrogen.... Make it!

Completed Installations



Chef in a box -
Inside



Chef in a box -
Outside



Don't Buy Nitrogen.... Make it!

Completed Installations

California System



Don't Buy Nitrogen.... Make it!

Advantages of On-Site Nitrogen Generation

- Massive price savings of up to 95%
- Short pay-back period of 12-24 months
- Variable gas purity – 95% - 99.999%
- No need for bulk delivery/storage bottles
- Low running costs

- Versatility for expansion with our modular design
- Pure, dry nitrogen
- Full independent systems with own compressor
- Rent option available
- Reduced downtime



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