Nitrogen generation for the aerospace industry

aerospace  climate control   electromechanical  filtration  fluid & gas handling  hydraulics  pneumatics  process control  sealing & shielding

ENGINEERING YOUR SUCCESS.
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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 safety, ease of integration, low cost of ownership and energy savings can make a real difference.

Nitrogen Gas Generation

Parker manufactures both hollow-fibre membrane and Pressure Swing Adsorption (PSA) nitrogen gas generation technologies.

Nitrogen gas is now used extensively for tyre inflation and inert gas suppression. Unlike compressed air, nitrogen, due to its inert nature, will not support combustion if it comes into contact with extremely hot aircraft brake units i.e. tyre bursts.

Other related applications include aircraft oleo strut maintenance (nitrogen prevents oil ‘dieseling’ under heavy compression) and aircraft escape slide inflation systems.

Nitrogen is also widely used as an inerting gas for fuel tank vapours and other flammable or explosive compounds.
A dedicated solution for aviation applications where safety is a major issue

Parker offers a dedicated range of nitrogen gas generation solutions for civil and military aviation applications.

**Aircraft Tyre Inflation**
Tyres are generally inflated with nitrogen gas to prevent gradual deflation caused by oxygen permeating through the tyre wall and also, to reduce the risk of fire. Undercarriage and tyre manufacturing/maintenance facilities also use nitrogen gas.

**Oleo Strut Shock Absorbers**
Undercarriage oleo struts are basically oil/compressed gas shock absorber springs which are required to damp aircraft landing loads. Nitrogen is the inert choice for the gaseous component of the spring, as unlike compressed air, it will not promote oil ‘dieseling’ under compression.

**Escape Slide Inflation Systems**
For inflation systems, escape slides and life-rafts use nitrogen gas due to its inert, non-explosive properties.

**Fuel Tank Inerting Systems**
Fuel tank inerting is an industry-recognised solution that significantly decreases the risk of flammability in aircraft fuel tanks. The Parker Aerospace Fluid Systems Division uses the patented technology of Parker’s Filtration Separation Division to deliver nitrogen-enriched air to fuel tanks, providing a much safer, inert gaseous environment.
Aircraft tyre inflation

Many regulatory agencies require the use of nitrogen when inflating tyres.

Nitrogen provides a stable, inert inflation gas, whilst also eliminating the introduction of moisture into the tyre cavity. Nitrogen will not sustain combustion and limits degradation of the tyre material and oxidation of the wheel assemblies.

The majority of in-flight tyre bursts have been attributed to the tyres being weakened by foreign object damage or scuffing, creating a rapid release of pressure. Such failures are usually experienced after the undercarriage has been retracted for some time combining the effects of brake heat transfer, internal tyre temperature and differential pressure.

It is also possible for a tyre to fail explosively during flight without any significant prior degradation. A tyre inflated with air when subjected to excessive heating, can trigger a chemical reaction resulting in the release of volatile gases.

This chemical reaction in the presence of the oxygen may result in an in-flight fire or an explosive tyre decompression in the landing gear bay. This is due to the fact that conventional pressure relief devices are unable to respond adequately to rapid increases in gas pressure and temperature which can occur with auto-ignition.

Testing shows that the risk of auto-ignition can be reduced by using an inert gas for tyre inflation during servicing.

Using nitrogen can deliver other potential benefits as it will tend to reduce wheel corrosion, tyre fatigue and the risk of fire from fusible plugs melting due to brakes overheating.

Nitrogen is used both airside during aircraft turnaround as well as in the wheel and brake shop during maintenance overhaul.

Typical high pressure PSA nitrogen package
Oleo strut maintenance

An oleo strut, is a hydraulic device used as a shock absorber in the landing gear of aircraft, consisting of an oil-filled cylinder fitted with a hollow, perforated piston into which oil is slowly forced when a compressive force is applied to the landing gear.

Many shock absorbers contain compressed nitrogen which optimises the damping efficiency of the undercarriage.

So much heat is produced in the oleo strut on landing a large aircraft, that if oxygen was present, it could cause ‘dieseling’ of the hydraulic oil under extreme temperature and pressure.

There are other benefits of using nitrogen, firstly, it is a clean, dry gas, so there is no moisture to cause corrosion. Secondly, any possibility of nitrogen permeation through seals is reduced when compared to air containing 21% oxygen.

Therefore, nitrogen is the effective choice of compressed gas used in oleo struts and the refilling of the gas is an essential part of the maintenance process.

Escape slide inflation systems

For inflation systems, escape slides and life-rafts use nitrogen gas due to its inert, non-explosive properties.

The FAA requires evacuation of the entire aircraft in 90 seconds using 50% of the available evacuation exits. The inflation system usually consists of a pressurised cylinder, a regulating valve, two high pressure hoses and two aspirators. The cylinder can be from 100 to about 1000 cubic inches, filled to about 3000 psi with either gaseous nitrogen, or a mixture of gaseous CO₂ and nitrogen. CO₂ is used to slow down the rate at which the valve expends the gases.
Fuel tank inerting systems

Parker fuel tank inerting systems use nitrogen to reduce the risk of flammability.

Fuel tank inerting is an industry-recognised solution that significantly decreases the risk of flammability in aircraft fuel tanks. The Parker Aerospace Fluid Systems Division uses the patented technology of Parker’s Filtration Separation Division to deliver nitrogen-enriched air to fuel tanks, providing a much safer, inert gaseous environment.

Permeable membrane bundles remove oxygen from air, producing nitrogen-enriched air that is much less combustible in aircraft fuel tanks. Designed into most new commercial aircraft being built in the Western world, Parker’s fuel tank inerting systems are also being added to much of the existing global fleet, for enhanced safety.

Four decades of experience

The world leader in fuel tank inerting systems, Parker aerospace has more than 45 years of flight-proven inerting experience in both military and commercial aircraft applications. No other aerospace company can offer either the depth or breadth of Parker’s proven inerting and fuel system pedigree. The company’s unmatched expertise in the design, manufacture, integration, and support of fuel systems enables Parker to bring fuel tank inerting systems to market quickly and cost effectively. By approaching fuel tank inerting from a fuel system perspective, Parker has developed extensive analytical and test capabilities and integrated system solutions.

It is the kind of expertise that makes Parker a low-risk, high-value partner.
The benefits of generating your own nitrogen

Nitrogen gas is an essential part of aircraft maintenance, operation and turnaround.

Parker is a world leader in filtration, purification and separation technologies and is universally known for developing high quality products, technical innovation and partnerships with customers. It is a major supplier to a number of the world’s leading airlines and ground support companies who rely on its global experience and support and already realise the benefits of on-site gas generation.

**Nitrogen Purity**

Parker nitrogen systems deliver the purity and pressure your aviation operation needs. Minimum purity limits for nitrogen gas in the aviation industry are specified under Federal Specification (A-A-59503A TYPE 1 GRADE A or B). Additionally, major airlines and tyre manufacturers also stipulate other critical specifications.

The system is designed to exceed these specifications and to provide a consistent high purity gas on demand.

The system design also allows for data capture of gas purity for future traceability.

**Costs**

The cost of generating your own gas airside can be up to 90% less than the on-going purchase of cylinder gas with the elimination of rental, re-fill, delivery, handling and order processing costs.

**Time**

By generating your own gas, you can save time and money by removing the need for handling cylinders on and off airfield through security which can be very labour intensive and time consuming. Spent cylinders are simply returned to the filling station for re-fill.

**Flexible**

The unique modular gas generator design means that your system can be easily expanded as future airfield nitrogen requirements increase.

**Convenient Supply**

With the Parker nitrogen systems, nitrogen is available on demand, 24 hours a day, eliminating the risks from gas running out. In addition, as gas is produced airside, it eliminates any security concerns relating to moving cylinders on and off the airfield through security.
Pressure Swing Adsorption (PSA) and Membrane technologies

Parker manufactures both PSA and hollow-fibre membrane nitrogen gas generation technologies. Selection depends upon whether the application requires a higher or lower nitrogen gas purity.

**PSA nitrogen generators**
The Parker MIDIGAS and MAXIGAS ranges, use a principle known as Pressure Swing Adsorption (PSA) to produce a continuous stream of nitrogen from compressed air.

The modular gas generator consists of pairs of extruded aluminium columns, which are filled with carbon molecular sieve (CMS). Pre-treated compressed air is fed into the bottom of the 'on-line' column and flows up through the CMS, which preferentially adsorbs (captures) oxygen and other trace gases, but allows nitrogen to pass through. After a pre-set time, the on-line column automatically switches to the regenerative mode, venting contaminants from the CMS and allowing the process to begin again.

Whilst using CMS for air separation is not a new idea, the radical design and control system employed on the Parker nitrogen generators has maximised gas output and reduced compressed air consumption to achieve even higher levels of efficiency than previously possible.

**Membrane nitrogen generators**
The Nitrosource and Nitroflow ranges of membrane nitrogen generators use hollow-fibre membrane technology to selectively separate the component gases within air. The generator comprises tubes containing bundles of hollow-fibres, each approx 0.5mm diameter. Air is fed through the centre of the membrane fibres where medium to fast gases such as oxygen, carbon dioxide and water vapour dissipate through the wall of the fibre and are vented to atmosphere. Nitrogen gas is retained within the fibre and is fed through to the application. The Parker membrane is extremely robust, highly permeable and durable, ensuring a very long trouble-free service life with low cost of ownership.
Typical high pressure PSA system (40-350 bar g)

Parker nitrogen gas generation systems are designed to deliver high purity, high pressure nitrogen gas, eliminating the need for delivery of costly, high pressure cylinders. Packages can be either skid mounted or free standing depending on local requirements.

**How it works**

Nitrogen gas is used in a number of ground support operations and for logistics purposes it is stored and transported in high pressure cylinders.

Commonly, cylinder gas is brought into the airfield from outside, however this is costly, labour intensive and can raise security and safety concerns.

The high pressure nitrogen package can be skid mounted or free standing. It will generate nitrogen gas from compressed air, which can then be stored or used directly in ground support or maintenance operations.

Compressed air is purified using PNEUDRI dryers and OIL-X EVOLUTION filters to ensure the highest quality compressed air supply. The nitrogen generator removes the oxygen from the compressed air supply to produce a consistent high purity low pressure nitrogen gas. The gas is then boosted to its working pressure using a high pressure booster. Final filtration follows before storage in high pressure receivers. The system can be designed for small or large airfield operation, can operate 24/7 and the modular concept allows for future gas generator expansion.
Other Parker aviation solutions

Nitrogen Applications:
- Aircraft pipe-line purging and blanketing
- Oleo strut manufacture, overhaul and testing
- Tyre and wheel manufacturing and overhaul facilities
- Sealed optics and instrument pod inerting
- Laser cutting and welding of engine and airframe components
- Heat treatment of aircraft components
- Autoclave inerting for composite airframe sections
- Avionics manufacture - selective, wave and reflow soldering

Hydraulic Applications:
- Fluid transfer systems
- Filtration systems
- Filter cartridges
- Automatic particle counters

Fuel Applications:
- Racor aviation fuel filtration vessels and elements
- Fuel cleanliness and condition monitoring instrumentation

Recommended reading – please request your copy:

Leaflet 1
Fuel Systems Innovation
Fuel and Inerting / Pneumatics / Lubrication and heat management / Water and waste

Leaflet 2
Aerospace Market
Filtration Products and Solutions
Email: racor@parker.com

Leaflet 3
Filtration, purification and separation of air and gases for military applications
Email: psgsales@parker.com

Aftermarket support

Many applications require much more than simply supplying high quality compressed air and gas products in order to maintain operational effectiveness.

Equipment manufacturers must not only comply with ever increasing industry standards, they must also provide maximum utilisation and optimum efficiency from their products to ensure total reliability and a minimum lifetime cost of ownership.

Our commitment goes much further than simply supplying high quality products. Our aim is to maximise benefits to your application and systems by providing you with an unparalleled service.

From product design and selection through to installation, validation, training and maintenance, Parker can support you every step of the way.

For further information please email: dhindsales@parker.com
or visit: www.domnickhunter.com

INTERNATIONAL APPROVALS

[Images of various approval logos]
At Parker, we're guided by a relentless drive to help our customers become more productive and achieve higher levels of profitability by engineering the best systems for their requirements. It means looking at customer applications from many angles to find new ways to create value. Whatever the motion and control technology need, Parker has the experience, breadth of product and global reach to consistently deliver. No company knows more about motion and control technology than Parker. For further info call 08000 27 27 5374.

Parker’s Motion & Control Technologies

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