High quality nitrogen for laser applications
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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 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 precision laser cutting, welding and eye surgery, to modified atmosphere packaging for perishable food products. However, while nitrogen is all around us, making up 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, under their complete control.

The Industrial Division has won a prestigious Queen’s Award for Enterprise 2010 in the International Trade category. A Queen’s Award recognises the division’s success in developing new export markets for its ranges of gas separation technologies, including the MAXIGAS nitrogen generation systems.
Laser technology

A laser is a device that generates an intense beam of coherent monochromatic radiation in the infrared, visible, or ultraviolet region of the electromagnetic spectrum, by stimulated emission of photons from an excited source.

“LASER” is the acronym for Light Amplification by Stimulated Emission of Radiation.

Since the first functioning ruby crystal laser was demonstrated in 1960 by Theodore H Maiman at Hughes Research Laboratories, California, practically every aspect of daily life is impacted upon in some way by laser technology.

Laser diodes read data on optical media in computers, Blu-Ray players and bar codes on practically everything purchased.

In manufacturing, lasers are used for critical applications such as the production of miniature hi-tech computer chips, measuring equipment to ensure machining tolerances within nanometers and for slicing through thick sheet metal with incredible speed and accuracy.

The global manufacturing environment is uncompromising, and to remain at the forefront, suppliers need to meet a multitude of demands - Shortest lead time, highest accuracy, zero rejects, environmentally friendly, with minimum risk, maximum up time and lowest cost.

Laser applications are no exception and as the technology evolves and develops to produce more powerful, faster and efficient machines, keeping costs under control to ensure they are financially viable is a constant challenge.

“Consumables” such as nitrogen assist and purge gas are a major source of cost and down time within laser technology cutting equipment. Whilst adding to the bottom line of the manufacturer, their costs are often difficult to fully recoup from the customer.

In many cases, nitrogen from traditional liquid and cylinder supply methods, can account for over 60% of the total laser running costs. In an extremely competitive marketplace, reducing these gas costs can ensure a significant advantage.

Laser Cutting Machines

Laser technology for cutting metals and also non-metallic components is now common place in many sheet metal production facilities. There are a wide variety of machines available, using differing technology, to produce the laser beam.

Popular systems such as –

Gas lasers using Carbon Dioxide as the lasing gas
Fibre optic lasers
Slab Lasers
Nd:YAG Lasers

Can all use nitrogen gas to prevent oxidation of the material being cut and hence allowances for operating costs need to include for this gas usage.

Fibre laser – Courtesy Bystronic UK
High quality nitrogen for the laser industry

Nitrogen gas is generally used in two key areas in conjunction with laser technology applications

As a blanketing or “assist” gas

Oxidisation of certain materials can be a very undesirable problem caused by the application of heat in the presence of oxygen. It can produce discolouration and cause a carbon layer to form on the cut edge. This can affect the appearance of the finished product or cause lack of adhesion for any coating or paint finish on the oxidised surface.

Due to its inert properties, nitrogen gas prevents oxidisation of the cut edge by allowing the laser to operate in an oxygen-free environment.

The nitrogen gas pressure is also used to clear the cut, by blowing away the molten material. This produces a clean edge without any residual material sticking to the underside of the material (sometimes referred to as ‘dross’).

To purge the path, the laser beam travels along to the target area.

On many laser generating machines, the beam is produced in one section and has to be directed to the point of use in another section.

The laser beam is generally contained within hollow, sometimes telescopic, tubes and flexible bellows and is focused and reflected by various lenses and mirrors to the target area.

To prevent the beam from distorting and to maintain power and intensity, the beam path needs to be kept clear of dirt particulate and any other contaminants that could cause it to diverge or lose power.

The lenses and water cooled mirrors also need to be kept free of dirt, condensing hydrocarbons and water vapour that could otherwise cause burning and marking of these expensive components.

Nitrogen is the ideal medium to use for beam guide-way purging as it is dry, clean, oil-free and has a very low contaminating content.
Problems with typical nitrogen supply methods

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

When considering an outsourced nitrogen supply, a reliable supplier must be found, valuable space in or outside the company’s premises must be allocated and procedures to monitor and manage the supply and arrange delivery and payment of the gas must be made. Additionally, safety and handling concerns need to be taken into account.

The cost of addressing these issues can be high and difficult to budget for, while the price of gas and supplier rates continually increase and the environmental impact of truck based deliveries gain significance. An ideal solution lies in a range of gas generation systems from Parker, which enable users to produce their total demand for 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.
The dedicated, cost effective solution

Nitrogen gas generators allow companies to take control of their own gas supply and reduce costs considerably.

Integrated nitrogen generation systems from Parker use air from a standard industrial compressor that is essentially ‘sieved’ so that oxygen and other trace gases are removed, while nitrogen is allowed to pass through to the application.

Air separation is not a new idea, but the design and control features employed on Parker generators help to maximise gas output and reduce air consumption to achieve high levels of efficiency.

Taking control of a nitrogen supply in this way, rather than relying on a third party, can reduce costs considerably. Cylinders, liquid mini tanks and bulk storage vessels present many on-going costs such as rental, refill and delivery, environmental levy and order processing charges.

These costs however, can be reduced by up to 90% once a nitrogen generation system has been installed.

For example, if a company using liquid nitrogen switched to gas generation technology, it could expect the new system to pay for itself in typically less than two years.

If a company using cylinders switched to gas generation technology, the payback period could be less than 12 months in many cases.

In addition to the cost benefits, nitrogen generators also offer a more convenient solution when compared to external sources.

The compact systems can be installed quickly, easily and with minimum cost and disruption and only require a pre-treated compressed air supply to begin production.

The systems eliminate the need for transportation and storage which are essential for external supplies, so they help to minimise the environmental impact of using nitrogen for industrial processes. Moreover, the systems can help achieve safer working environments as they remove the safety risks concerned with external supplies such as storage, handling and replacing heavy, high pressure cylinders.

Parker nitrogen generators have many advantages over traditional nitrogen supplies:

- Enhanced safety - no manual handling of heavy cylinders or risk from very cold liquid.
- Increased productivity owing to an on demand supply.
- Maximum up time, no need to stop the process to change cylinder packs or wait for a liquid tank to be re-filled.
- No gas wasted through liquid “boil off” or expensive facility fees for special high pressure liquid vessels.
- The most economical set-up tailored to laser power and type of material to be processed.
- Cost savings following pay-back of up to 90%
- No gas wasted – At typical laser inlet pressures of 30 bar g, 13% of the gas contained within a cylinder supply at 200 bar g fill pressure is returned to the gas company. Paid for but unused!
- When laser cutting with oxygen assist gas, Parker generators can provide an extremely cost effective beam purge solution saving money compared to using cylinder packs.
Technological excellence

Using the latest technology, Parker designs and manufactures both hollow fibre membranes and Pressure Swing Adsorption (PSA) nitrogen gas generators to provide a solution for every laser application that requires nitrogen gas.

The Parker range of nitrogen gas generators includes:

- NitroSource HiFluxx membrane nitrogen gas generators
- NitroFlow basic membrane nitrogen gas generators
- NitroFlow membrane nitrogen gas generators
- MIDIGAS PSA nitrogen gas generators
- MAXIGAS PSA nitrogen gas generators

Ancillary Parker products available for laser solutions:

- Chillers for laser cooling applications - mirrors and resonator etc.
- Compressed air pre- treatment packages for laser pneumatics and where clean, dry compressed air is specified for beam guide-way purge.
Nitrogen is used for many laser applications

Nitrogen is a clean, dry, inert gas primarily used for displacing oxygen from products and/or processes and is used in a wide range of laser applications.

By far the most common application for Parker nitrogen gas generators within the laser industry is for use in conjunction with CO₂ or fibre laser cutting machines. Nitrogen gas is used as an ‘assist gas’ to blanket the material being processed, preventing oxidation or discoloration, and to blow away the molten material from the cut edge.

Nitrogen 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.

Depending upon the laser power and the thickness and type of material to be cut, Parker can provide the right solution in terms of nitrogen gas pressure, purity and flow to ensure optimum cost benefits and efficiency for the customer.

Typical material thickness to be laser cut can vary from fractions of a millimetre to over 25 mm thick (with required nitrogen pressures of up to 28 barg and flow rates to over 100 m³/hr).

Some examples:
- Stainless Steel
- Aluminium
- Galvanised Mild Steel
- Zintec
- Mild Steel
- Fabric type material
- Printed Circuit Boards
- Wood
- Plastic

Benefits of using nitrogen
- Increased productivity through higher cutting speed
- Clean cut edges that require less material handling
- No overheating from exothermic reactions
- Improved corrosion resistance
- Reduced discoloration
- Oxide-free cuts
- Dross-free finish

Two types of nitrogen gas generation package are generally provided:

A cylinder filling system that is designed to produce a small amount of gas on a continuous basis and then compress it to high pressure, (300 – 350 bar g) for storage in a high pressure storage bank(s).

This type of system is ideal for intermittent usage or where demand can fluctuate from high to low flow requirements frequently. Typically, a contract laser cutting establishment would benefit from this type of installation.

A gas on demand system that is designed to meet the maximum flow requirement of the application with a small buffer stored at 40 bar g.

This type of system is ideal for a continuous usage 24/7 where the type of material throughput is consistent.
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 eye surgery involves the use of an Excimer laser to alter the shape of the cornea, (clear covering over the front of the eye), to correct short or long sightedness.

Nitrogen gas is used within the Excimer laser to purge the beam path and also to operate the pneumatics controlling the fluorine gas where the beam is generated.

SLS – Selective Laser Sintering

Using 3D CAD data the SLS machine produces a product or prototype component formed in an inerted chamber from powders such as nylon, glass filled nylon, alumide or special metals.

A laser melts the powder layer by layer and as it solidifies, it forms the desired structure, more powder is deposited for the next layer to be produced etc.

To prevent the powder from oxidising within the chamber, it is purged rapidly to remove ambient air prior to the SLS procedure starting and then a constant lower purge flow of nitrogen is used to keep the chamber at low oxygen levels throughout the process.

Electron Beam Welding

Although not a laser, Electron Beam Welding, (EBW), technology can use nitrogen gas in a similar way to a laser for beam guide purging.

EBW is a fusion welding process in which a high-velocity electron beam is focused on the materials to be joined. The materials melts under kinetic energy heating created by the impacting electrons.

To prevent dissipation of the electron beam, the beam guide-way is purged with high purity nitrogen.

Laser Ablation

Laser ablation is a process used to remove very thin layers of material with extreme accuracy or it can be used to deposit thin layers of material by creating an ablation plume or vapour from a target material so it can be deposited onto a substrate.

This process typically uses pulsed Nd:YAG, Excimer or CO₂ lasers. Nitrogen is used as a blanketing gas to prevent oxidisation of the material being processed.

Laser ablation is often used for the “micro machining” of components or for creating wafers used in the electronics industry. Within the electronics industry lasers are used for vapour deposition to create substrates onto a silicon wafer and photolithography is used to “carve” circuit patterns onto layers of doped and un-doped silicon to produce silicon chips.

The Parker design philosophy

In addition to nitrogen generation, Parker offers a wide range of high quality compressed air purification solutions which are essential to all modern production facilities. It has built an unrivalled reputation for delivering high quality products which are developed using The Parker design philosophy.

Parker has been supplying industry with high efficiency filtration and purification products since 1963. Its philosophy 'Designed for Air Quality & Energy Efficiency' ensures products not only provide the user with clean, high quality air, but also with low lifetime costs and reduced carbon dioxide (CO₂) emissions.

Air Quality
Parker has been instrumental in the development of both ISO8573 and ISO12500, the international standards for compressed air quality and compressed air filter testing respectively. All Parker products are designed to provide air quality in accordance with ISO8573-1:2001, the latest revision of this air quality standard.

Energy Efficiency
In times of increasing energy costs, an efficient and cost effective manufacturing process is a major factor in maintaining the profitability and growth of businesses. All Parker products are designed to not only minimise the use of compressed air and electricity in their operation, but also to significantly reduce the operational costs of the compressor by minimising pressure loss.

Low Lifetime Costs
Equipment with a low purchase cost may turn out to be a poor investment in the long term. By guaranteeing air quality and ensuring energy consumption is kept to a minimum, Parker purification products can reduce the total cost of ownership and help improve profitability through improved manufacturing efficiencies.

Reduced CO₂ Emissions
Many countries worldwide are looking closely at their manufacturing industries in an effort to reduce the amount of harmful greenhouse gases released into the atmosphere. The use of electricity has a direct impact on the generation and release of CO₂. By significantly reducing the energy consumption of its products, Parker can help businesses to reduce their carbon footprint and protect the environment.
OEM partnership

Parker is an ideal partner for developing customized OEM solutions and its gas generation systems can be fully integrated into companies’ own system designs. Parker professionals have the skills, expertise and experience to work closely with company design teams to help significantly add value and deliver optimum results.

As a partner, Parker offers:
- Intimate, in-depth knowledge of gas generation technology
- Knowledge of a wide range of applications and markets
- Expertise in integrated system design
- Experience in developing customised solutions
- Support for integrating the system into business’ processes

Committed to environmental responsibility

Parker is fully committed to its environmental responsibility and it is certified to ISO14001 standards. This means that it is taking steps to minimise its environmental impact; both by the way it conducts business and with the type of products and solutions it offers.

Gas generation offers a real low carbon alternative to traditional methods of nitrogen supply and one that environmentally aware customers may welcome.

A significant amount of energy is wasted through process inefficiencies when considering traditional nitrogen supplies, such as turning air into a liquid at very low temperatures, or compressing gas to high pressures, not to mention the CO₂ emitted from the delivery trucks. However, Parker nitrogen generators offer a convenient and energy efficient option; producing just the right amount of gas at low pressure and ambient temperature, at the site of the application and without any waste or delivery trucks to consider.
After sales service

Businesses need much more than a supply of high quality products in order to maintain their competitive edge.

Modern production technologies are becoming increasingly demanding on the provision of high quality and reliable solutions. Products that are manufactured by Parker are designed to meet and often exceed international standards.

As well as the requirement for quality and reliability, there are additional factors to consider when choosing the right service provider for purification and separation systems. For example, knowledge of the many regulations regarding the management of industrial waste, energy efficiency improvement programmes and environmental considerations.

It is anticipated that future legislations will demand further in-depth technical and knowledge-based support from service providers. Parker’s commitment to industry does not stop with the supply of high quality products. It is also committed to ensuring that its equipment provides a trouble-free service from a bespoke maintenance and verification package – all tailored to specific requirements.

The company offers a wide range of valuable services that will impact positively on businesses production efficiency and product quality, with reduced production rejections and operational costs.

From initial selection to installation, commissioning, preventative maintenance and extended services, Parker is redefining customer service.
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 00800 27 27 5374.

**Parker’s Motion & Control Technologies**

**Aerospace**
- **Key Markets**
  - Aftermarket services
  - Commercial transports
  - Engines
  - General & business aviation
  - Helicopters
  - Launch vehicles
  - Military aircraft
  - Missiles
  - Power generation
  - Regional transports
  - Unmanned aerial vehicles

**Climate Control**
- **Key Markets**
  - Agriculture
  - Air conditioning
  - Construction Machinery
  - Food & beverage
  - Industrial machinery
  - Life sciences
  - Oil & gas
  - Precision-cooling
  - Process
  - Refrigeration
  - Transportation

**Electromechanical**
- **Key Products**
  - Accumulators
  - Advanced actuators
  - CO₂ controls
  - Electrocontrollers
  - Filter driers
  - Hand-shut-off valves
  - Heat exchangers
  - Hose & fittings
  - Pressure regulating valves
  - Refrigerant distributors
  - Safety relief valves
  - Smart pumps
  - Solenoid valves
  - Thermostatic expansion valves

**Fluid & Gas Handling**
- **Key Products**
  - Check valves
  - Connectors for low pressure
  - Fluid conveyance
  - Deep sea umbilicals
  - Diagnostic equipment
  - Hose couplings
  - Industrial hose
  - Misting systems & power cables
  - PTFE hose & tubing
  - Quick couplings
  - Rubber & thermoplastic hose
  - Tube fittings & adapters
  - Tubing & plastic fittings

**Hydraulics**
- **Key Products**
  - Accumulators
  - Cartridge valves
  - Electrohydraulic actuators
  - Human machine interfaces
  - Hybrid drives
  - Hydraulic cylinders
  - Hydraulic motors & pumps
  - Hydraulic systems
  - Hydraulic valves & controls
  - Hydraulic steering
  - Integrated hydraulic circuits
  - Power take-offs
  - Power units
  - Rotary actuators
  - Sensors

**Pneumatics**
- **Key Products**
  - Actuators
  - Bio-pharmaceuticals
  - Chemical & refining
  - Compressed air & systems
  - Factory automation
  - Fluid power
  - Marine & shipbuilding
  - Medical & dental
  - Pneumatic accessories
  - Pneumatic actuators & grippers
  - Pneumatic valves & controls
  - Quick disconnects
  - Rotary actuators
  - Rubber & Thermoplastic hose & couplings
  - Structural-actuators
  - Thermoplastic tubing & fittings
  - Vacuum generators, cups & sensors

**Process Control**
- **Key Products**
  - Analytical instruments
  - Analytical sample conditioning products & systems
  - Chemical injection fittings & valves
  - Fluoropolymer chemical delivery fittings & valves
  - Flue gas delivery valving, regulators & digital flow controllers
  - Industrial mass flow meters/ controllers
  - Precision industrial regulators & flow controllers
  - Process control & digital flow controllers
  - Process control double block & bleed
  - Process control fittings, valves
  - Regulators & manifold valves

**Filtration**
- **Key Products**
  - Analytical gas generators
  - Compressed air filters & dryers
  - Fluid condition monitoring systems
  - Hydraulic & lubrication filters
  - Instrumentation filters
  - Membrane & fuel filters
  - Microfiltration
  - Sterile air filtration
  - Water desalination & purification filters & systems

**Sealing & Shielding**
- **Key Products**
  - Dynamic seals
  - Elastomers & rings
  - Electro-medical instrument design & assembly
  - EMI shielding
  - Exhaust & precision cut, fabricated elastomeric seals
  - High temperature metal seals
  - Homogeneous & inserted elastomeric shapes
  - Medical device fabrication & assembly
  - Metal & plastic retained composite seals
  - Shielded electrical windows
  - Silicone tubing & fittings
  - Thermal management
  - Vibration dampening

**Key Markets**
- Aerospace
- Chemical processing
- Consumer
- Fluid power
- General industrial
- Information technology
- Life sciences
- Microelectronics
- Military
- Oil & gas
- Power generation
- Renewable energy
- Telecommunications
- Transportation

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**Key Markets**
- Aerospace
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- General & business aviation
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- Launch vehicles
- Military aircraft
- Missiles
- Power generation & renewable energy
- Process
- Refrigeration
- Transportation
- Water Purification