



LASER GASES

supply solutions

- Lasers and laser gas information
- Solutions to maximise process efficiencies
- Supply options to suit your requirements

Expert, Cost Effective, Complete Laser Gas Solutions

Whatever the laser and process used, BOC Industrial can provide expert guidance and capability in laser gases to increase productivity and reduce cost.

BOC Industrial has over 30 years of experience as a laser gases supplier. We work closely with customers and laser manufacturers to improve all laser fabrication processes and support future developments. From laser cutting of thick or thin plate stainless and mild steels to welding of aluminium alloys - BOC Industrial can meet any size customer's laser process gas requirements.

BOC Industrial helps its customers to grow by delivering, maintaining and updating tailored cost effective solutions to support their future plans.

For the Laser industry
BOC Industrial has a range
of solutions that provide
the right combination of:

- Reduced downtime – continuous and reliable supply options and equipment
- Maximisation of laser lifetime – high purity lasing gases
- Improved productivity – a range of supply options that can meet different process requirements to give best output
- Improved quality and efficiency – the right type and purity of gas with the right supply option to give best results

Lasers explained

The word **LASER** is an acronym meaning:

Light
Amplification by
Stimulated
Emission of
Radiation

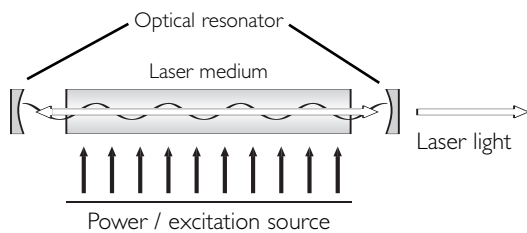
This acronym explains that a laser excites atoms, which then emit a specific kind of light - laser light. Light amplification by stimulated emission of radiation is basically a process that converts one form of energy to another. The medium in which the atoms are excited determines the type of laser light produced and the application it is used for. For industrial material processing there are four main types of laser:

- Carbon Dioxide (CO₂)
- Neodymium Yttrium Aluminium Garnet (Nd:YAG)
- Excited Dimer (Excimer)
- Fibre
- Diode

Laser gases

Most industrial lasers need gases both to generate the laser light (lasing gases) and to assist in the process, be it cutting or welding (assist gases). All BOC laser gases are produced at ISO 9002 accredited facilities and are designed to meet and exceed the specifications of laser manufacturers.

Key elements of a laser



Whether you have a CO₂, Nd:YAG, excimer or diode laser, gases of the correct quality are important not only to maintain the lasers reliability but also to ensure the highest process productivity. The BOC range of gases and services has been designed to do just that.

Lasing Gases

CO₂ and excimer lasers use gases for generating the laser beam. BOC Industrial provide a range of mixed and pure gases for lasing purposes. It is important for the purity of lasing gas to be extremely high to avoid contamination of laser components and resultant impaired laser performance. Moisture and hydrocarbons are particularly detrimental to performance of CO₂ lasers. BOC lasing gases have a high purity which exceeds manufacturer specification ensuring high reliability and maximisation of optics life.

BOC Industrial supplies a variety of pre-mixed gases and an extensive range of specialist gas mixtures for all major lasers. If your mixture is not listed please contact us directly.

Lasing gas for CO₂ Lasers:

Gas Description	Gas Contents	Pressure (bar)	Valve
Grade A Helium 99.996%	1.81m ³	200	BS3 - 5/8" BSP RH
	9.10m ³		
	194.7m ³		
CP Grade Helium 99.999%	1.81m ³	200	BS3 - 5/8" BSP RH
	9.10m ³		
	194.70m ³		
Laserpure Nitrogen 99.9992%	9.45m ³	200	BS3 - 5/8" BSP RH
Laserpure Carbon Dioxide 99.995%	35kg	50	BS8 - 0.860" RH

The new Laserpure range of gases have been specially designed in conjunction with laser manufacturers to offer customers an appropriate purity of gas for producing a high quality laser beam more cost effectively.

Premixed gases: (Purity 99.995% or higher)

Gas Description	Gas Contents	Pressure (bar)	Valve
Lasermix 1 4.5% Carbon Dioxide 13.5% Nitrogen Balance Helium	0.25m ³	137	BS3 5/8" BSP RH
	1.25m ³		
	8.8m ³	200	
Lasermix 2 9% Carbon Dioxide 13.5% Nitrogen Balance Helium	1.26m ³	137	BS3 5/8" BSP RH
	8.88m ³	200	
Lasermix 3 12% Carbon Dioxide 12% Nitrogen Balance Helium	1.26m ³	137	BS3 5/8" BSP RH
	8.95m ³	200	
Lasermix 4 5% Carbon Dioxide 40% Helium Balance Nitrogen	1.82m ³	200	BS3 5/8" BSP RH
	8.95m ³		
Lasermix 5 3.4% Carbon Dioxide 15.6% Nitrogen Balance Helium	8.78m ³	200	BS3 5/8" BSP RH
Lasermix 6 8% Carbon Dioxide 4% Carbon Monoxide 60% Nitrogen Balance Helium	7.69m ³	200	BS4 5/8" BSP LH
DC Premix for Rofin Sinar Laser	1.35m ³	150	DIN1 21.8mm LH

BOC is an approved supplier for the Rofin DC premix. Only Rofin approved suppliers are permitted to provide this product.

Lasing gases for excimer lasers:

Gas Description	Gas Contents	Pressure (bar)	Valve
5% Fluorine Balance Helium	1.17m ³	134	DIN 8 1" RH
5% Hydrogen Chloride Balance Helium	1.16m ³	137	BS14 3/8" BSP RH
5% Hydrogen Chloride 1% Hydrogen Balance Helium	1.38m ³	150	BS15 3/8" BSP LH

BOC provides a range of lasing gases for use with excimer lasers. The lasing gases consist of a halogen donor; a rare gas buffer and inert gas diluent. Rare gases (neon, krypton and xenon) in pure form or as a mixture to your own specification are available from BOC.

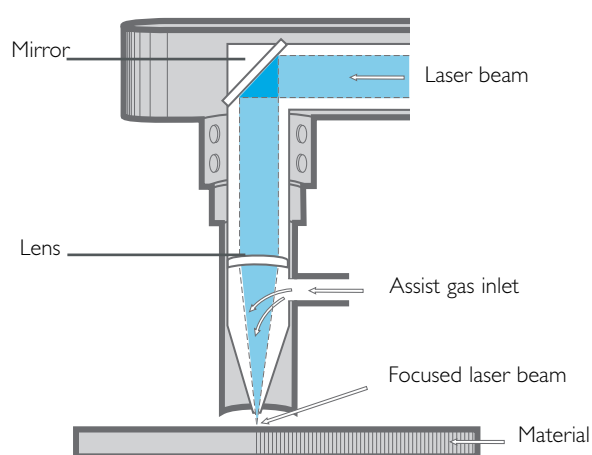
Assist gases

Assist or process gases are used at the point where the laser interacts with the material. The choice of assist gas is extremely important and can have a significant effect on the process quality and productivity.

Laser assist gases for cutting

The right gas supply to get the right quality job done, on time, for the right cost, every time – BOC can make it happen!

Schematic of Laser Cutting



Laser cutting uses the intense light beam from a laser to melt and/or vaporise material, and an assist gas flowing at pressure through a nozzle to remove the molten or vaporised material. One of the determining factors of the cutting speeds achievable is the laser power. The type of assist gas used, the supply pressure and flow rate are also important for attaining required cutting speed and quality for specific material thickness. Laser nozzle standoff distance and nozzle diameter affect the gas supply requirements. The main gases used for cutting are oxygen and nitrogen, while special applications may require argon.

- When cutting mild steel, using oxygen can enable cutting at higher speeds and greater thickness at lower pressure and flow rate than nitrogen
- Nitrogen and other inert assist gases prevent surface oxidation producing a higher quality finish requiring minimal preparation for other fabrication processes (such as welding) and surface treatment

Lasers can cut a wide range of materials including ferrous and non-ferrous metals, plastics, wood and ceramics. The choice of assist gas depends on the material being cut.

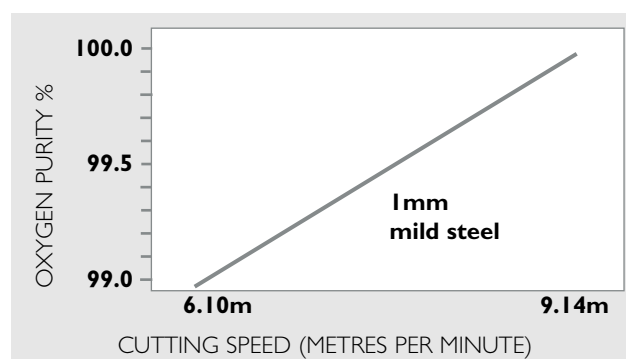
Gases for Laser cutting

Material \ Gas	Oxygen	Oxygen (High purity)	Nitrogen	Argon
Mild steel	•	•	•	
Stainless steel	•	•	•	
Aluminium			•	
Titanium				•

*Nitrogen or compressed air is normally used for cutting non-metallic materials.

For improved cut quality when using oxygen to cut greater material thickness it is recommended that oxygen pressure be reduced to avoid overly high temperatures and burning effects. When cutting with nitrogen increased pressure is required to cut larger material thickness

Effect of oxygen purity on cutting speed



Improving cutting speeds with high quality BOC oxygen.

- Compressed oxygen 99.5%
- Compressed high purity oxygen 99.95%
- Liquid oxygen 99.5%

Nitrogen Purity

A higher quality finish can be achieved with high purity BOC nitrogen.

- Compressed industrial nitrogen 99.998%
- Liquid nitrogen 99.999%

Laser assist gases for welding

Laser welding is an increasingly valuable process and offers many benefits such as low distortion (due to low heat input), high welding speed, high quality weld properties, and capability for weld geometries that cannot be achieved with electric arc welding. A laser welds by focusing its high energy light beam to melt metal forming a strong joint between components. Assist gas for laser welding is used to shield the molten weld pool and surrounding metal from the atmosphere, therefore inhibiting oxidation and suppressing plasma formation. Shield gases can also support the stability of welding conditions and improve the mechanical properties of the weld. In addition, the assist gas shields the focusing optics of the laser from being damaged by proximity to the process.

BOC Industrial have a wide range of knowledge from a long involvement with many welding processes and are committed to research and development of new processes for welding in the laser industry. The choice of assist gas can have a significant effect on both the weld quality and the process productivity. The main assist gases that are supplied are helium and argon, although for specialised applications, mixtures may give enhanced performance. BOC technical specialists will be able to advise on the best solution for any specific application.

Gases for Laser welding

Gas \ Laser	Helium	Argon
CO ₂	●	●*
ND:YAG		●
Fibre	●**	●
Diode		●

* Suitable for low power; thin sheet welding applications

** Seek BOC advice

Focusing on laser technology

BOC Industrial predicted the importance and growth of laser technology early on and has been working with laser users and manufacturers for many years developing new products and processes to aid in increasing quality and productivity. BOC have a global network of process experts and close links with worldwide research establishments and academia.

The BOC Industrial Fabrication Technology Centre (FTC) in Wolverhampton houses an industrial laser that is used for both research and development purposes. BOC experts have a wide range of experience covering all the key lasers, materials and processing applications. Process knowledge spans from high speed 'clean cutting' of thin section stainless steel up to thick section laser cutting (>50mm) of mild steel, and new processes for laser welding and surface treatment. The expertise of BOC is available at all times to advise and support customer operations.

The right supply option can reduce cost and increase performance.

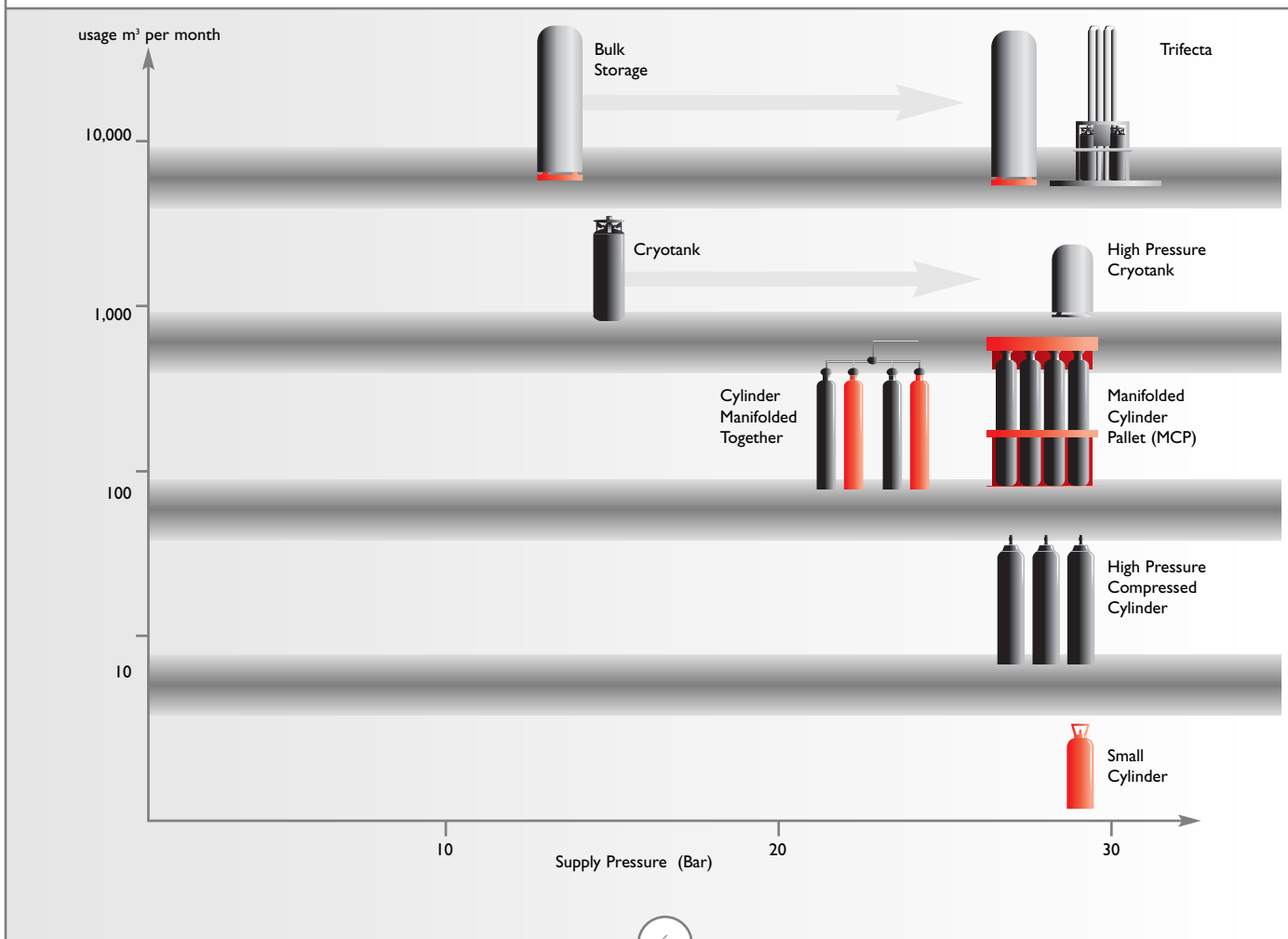
BOC Industrial has a complete range of supply options available. Whatever is most important to the customer - process, quality, productivity or cost - BOC Industrial will provide advice and guidance in selecting a capable and cost effective solution.

BOC Industrial is committed to tailoring and updating its service to customers now and in the future - supporting increased productivity and growth.

Lasing gases are needed in small quantities and therefore would be purchased in cylinders. Assist gases are used as part of the process and therefore much larger amounts are needed. The selection of supply modes is of particular importance for assist gas use, you should also consider the particular requirements of the process you are using.

We can tailor and adapt your supply depending on the gases you want, their purity and the pressure and flow rates required, taking into account your specific application.

Compressed and Liquid Supply Mode Guide



Compressed Cylinders

- Available in all gas products in a wide range of sizes and pressures
- Cost effective for low volumes



Manifolded Cylinder Pallets (MCPs)

MCPs are typically 15 cylinders connected together with a single or dual outlet.



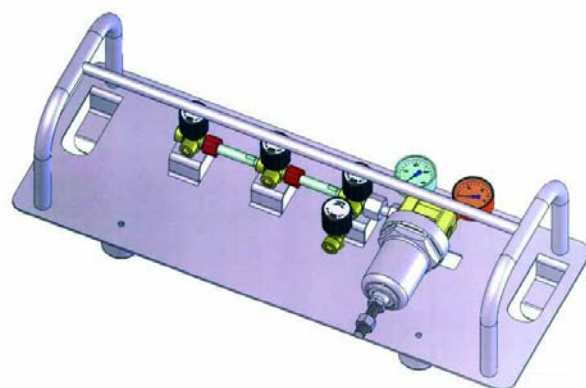
- Compact, providing increased storage capacity
- Significantly reduced cylinder handling costs
- Enables immediate supply set up with High Flow Regulator Panel
- Available for most pure gases and gas mixtures

In addition to the standard range of gases, BOC Industrial provide 300 bar nitrogen MCPs, providing 30% more product than that of 230 bar nitrogen cylinders. This provides opportunities for process improvements, increasing efficiencies and improved cylinder management. 300 bar nitrogen uses NEVOC outlet connection adapters.

Recommended for low volume user requiring flexible supply and as a back up for other solutions. With close customer management of stock, MCPs can provide continuous cost effective supply.

Product	Pressure (bar)	Volume(m ³)
Oxygen	230	166
Nitrogen	230	147
	300	192

High Flow Regulator Panel



This is a new innovation from BOC Industrial designed specifically for laser customers using MCPs. It is a portable unit with two inlets capable of attaching to one or two MCPs.

- Allows immediate set up of an assist gas supply
- Fits to both 230bar and 300bar nitrogen MCPs
- Two inlets and high performance regulator allow high flow and high pressure capability.
- Can attach to two MCPs to give increased storage capability

The High Flow Regulator is recommended for new customers requiring immediate supply of assist gas to start production and assess their supply needs before selecting their long term choice of assist gas supply. It can also be used as a high flow rate, high pressure supply for occasional use in cutting large thickness material with nitrogen assist gas (>6mm stainless steel).

With the high flow regulator panel:

Supply pressure	up to 32 bar
Max Flow rate	up to 200m ³ /hr*

*When connected to two MCP outlets

Cryogenic Vessels

Gas is stored in liquid form in cryogenic vessels supplied by BOC Cryospeed. Cryogenic Vessels are available for oxygen, argon and nitrogen in a range of sizes and pressures suitable for laser requirements:

- Medium pressure (up to 16 bar) – for oxygen, argon and nitrogen
- High pressure (up to 23 bar) – for nitrogen
- Ultra high pressure (up to 35 bar) – for nitrogen.



Cryotank 200

Advantages of cryogenic liquid supply:

- High purity gas supply
- Eliminates manual handling of cylinders
- High-pressure (up to 24 bar) and Ultra high pressure vessels offer a solution when higher outlet pressure is required
- Smaller footprint than equivalent number of compressed cylinders
- Vessels can be manifolded together to increase storage capability and flow rates

Cryogenic vessels are more cost effective than MCPs for laser users requiring continuous, flexible, low to medium flow rate gas supply. High-pressure vessels are suitable for higher volume higher flow rate requirements such as stainless steel cutting.

Medium Pressure Vessels (up to 16 bar)

Features:

- Available for Nitrogen, Argon and Oxygen
- Filled on site providing a continuous product supply with no process interruption
- Can be manifolded together to increase storage capability
- Vessel legislative maintenance requirements included in rental agreement with BOC Cryospeed
- Relatively inexpensive start up costs
- Quick installation possible



Cryotank 230

Performance:	Cryotank 200	Cryotank 230
Liquid Capacity	200 litres	230 litres
Nominal Gas Capacity	Argon 164m ³	Argon 190m ³
	Oxygen 167m ³	Oxygen 194m ³
	Nitrogen 136m ³	Nitrogen 157m ³
Max Allowed Working Pressure	16 bar	16 bar
Flow Rate*	Argon 9m ³ /hour	Argon 11m ³ /hour
	Oxygen 10m ³ /hour	Oxygen 11m ³ /hour
	Nitrogen 11m ³ /hour	Nitrogen 11m ³ /hour
Duty Cycle	8 hours	8 hours

* Flow rate shown are for stated duty cycles and standard vaporiser

** Flow rates shown are for stated duty cycles

High (upto 23 bar) and Ultra High (up to 35 bar) Pressure Vessels

- Vessel legislative maintenance requirements included in rental agreement with BOC Cryospeed
- Higher flow rates are possible dependent on vaporiser used



Cryotank 950



Cryotank 1500



Cryotank 2000

High Pressure Cryogenic vessels (up to 24 bar working pressure):

	Cryotank 200	Cryotank 230	Cryotank 950	Cryotank 2000
Liquid Capacity	200 litres	230 litres	950 litres	2000 litres
Nominal Gas Capacity	Argon 164m ³	Argon 190m ³	Argon 784m ³	Argon 1652m ³
	Oxygen 168m ³	Oxygen 194m ³	Oxygen 801m ³	Oxygen 1686m ³
	Nitrogen 136m ³	Nitrogen 157m ³	Nitrogen 641m ³	Nitrogen 1350m ³
Max Allowed Working Pressure	23 bar	24 bar	24 bar	24 bar
Flow Rate*	Argon 9m ³ /hour	Argon 11m ³ /hour	Argon 25m ³ /hour	Argon 25m ³ /hour
	Oxygen 10m ³ /hour	Oxygen 11m ³ /hour	Oxygen 25m ³ /hour	Oxygen 25m ³ /hour
	Nitrogen 11m ³ /hour	Nitrogen 11m ³ /hour	Nitrogen 25m ³ /hour	Nitrogen 25m ³ /hour
Duty Cycle**	8 hours	8 hours	8 hours	8 hours

Ultra High Pressure Cryogenic vessels (up to 35 bar working pressure):

	Cryotank 950	Cryotank 1500	Cryotank 2000
Liquid Capacity	950 litres	1500 litres	2000 litres
Nominal Gas Capacity	Nitrogen 641m ³	Nitrogen 1013m ³	Nitrogen 1350m ³
Max Allowed Working Pressure	32 bar	32 bar	32 bar
Flow Rate*	Nitrogen 25m ³ /hour	Nitrogen 100m ³ /hour	Nitrogen 100m ³ /hour
Duty Cycle**	8 hours	8 hours	8 hours

* Flow rate shown are for stated duty cycles and standard vaporiser

** Flow rates shown are for stated duty cycles

BOC Cryospeed



BOC Cryospeed has over 30 years experience in the field of cryogenic gases and equipment and applications. Liquid product is delivered into the cryogenic vessels directly on customer sites reducing the hassle and manual handling incurred during cylinder change over.

BOC Cryospeed has a national delivery service from dedicated vehicles supported by product availability and security from a nation-wide network of air separation units and storage depots.

BOC Cryospeed Sales and Service Operators manage the cryogenic gas requirements of customers within a certain geographical area. They agree with customers a delivery schedule taking into account usage and storage capability. They will also regularly discuss any changes in your business requirements to ensure you have the product there when you need it most. They are trained to the highest standards in the latest legislation compliance relating to the use and storage of cryogenic products and vessels will help you to ensure onsite safety for your employees and process.

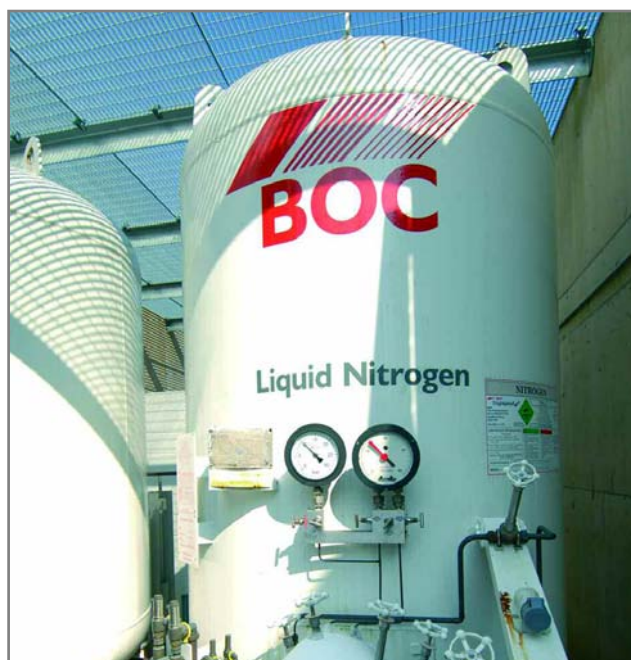
Bulk Delivery Service

Bulk liquid is supplied via BOC's national fleet of bulk tankers. Bulk supply customers can have a scheduled or a predicted delivery service to fit with requirements.

Selecting BOC Tel-Tank system, a remote telemetry technology, means customers can let BOC monitor product level in vessels. This ensures correct levels of product are constantly maintained hands free and cost effectively.



Bulk Tanks



For customers with high volume requirements a bulk cryogenic storage vessel sited on the premises offers a secure and cost effective solution. A distribution pipeline can support several points of use.

Advantages:

- High purity gas
- Supply can be managed for the customer by BOC
- Medium pressure tanks offer continuous supply of oxygen, nitrogen or argon.
- Ultra high pressure tanks offer high pressure, high flow rate nitrogen supply with near continuous operation with well planned delivery scheduling

Medium pressure bulk tanks are the most cost effective solution for continuous low pressure and high volume requirements. Ultra high pressure tanks require blow down of pressure for filling but offer a cost effective solution for processes requiring high peak performance.

	Medium Pressure Tanks	Ultra High Pressure Tanks
Liquid Capacity	4000 – 11,000 Litres	6000-11,000 Litres
Max Allowed Working Pressure	12 bar	30 bar
Flow Rate	Flow rate determined by the type of vaporiser used	
Duty Cycle	24hours	24hours

Trifecta

The Trifecta is a high performance system enabling a continuous, high pressure and high flow rate nitrogen supply. An automatic monitoring system constantly maintains output pressure. The Trifecta system consists of two cryogenic vessels and a vaporiser. It is a specialist gas supply system, originally designed to meet the requirements of laser cutting customers.

Trifecta Benefits:

- Maintains continuous flow and pressure even when bulk tank is being filled
- Self contained modular system for simple on-site installation
- Continuous gas supply and no time delay to build pressure
- Minimum product wastage
- No handling costs
- Minimal disruption when upgrading - can be used in conjunction with customer's existing liquid tank
- Easy to install and maintain

The use of two cryogenic tanks in the system ensures a constant flow rate of gas is maintained.

The Trifecta is a reliable, efficient and cost effective solution for high volume high pressure nitrogen supply requirements where complete flexibility and constant supply are paramount for ensuring productivity.

Performance with medium pressure bulk tank

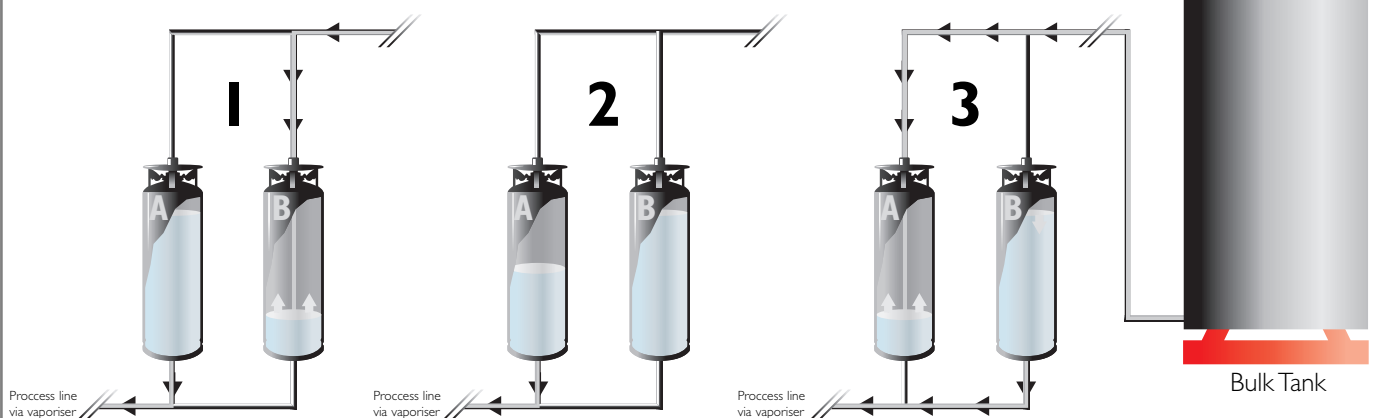
Pressure:	Up to 30 bar
Flow rates:	240m ³ /hr maximum
Duty Cycle	24hour duty cycle



The following diagram shows how the Trifecta operates.

Operating Cycle

- 1** A = Supplying high Pressure gas
B = Filling from bulk tank
- 2** A = Continues to supply
B = Full and pressure increases to operating pressure. Tank on standby
- 3** A = Empty - starts to refill
B = Supplying with no interruption



Nitrogen generators

Nitrogen generators utilise pressure swing absorption (PSA) technology that removes oxygen from air to produce a continuous flow of nitrogen to the customer on site.

Advantages:

- Stand alone self contained unit
- Maintenance included in package
- Contained buffer storage enables constant supply of nitrogen
- Reduced operating costs for certain applications

Nitrogen generated is lower purity (up to 99.95%) than compressed or liquid supply so this solution is only cost effective for cutting applications that do not require high surface finish.

Performance:

Supply Pressure:	Up to 8 bar *
Flow rates:	Up to 60m ³ /hr **

*Higher pressure available using a boost compressor

**Please note: nitrogen purity is dependent on flow rate

BOC Industrial can set up a nitrogen generator system supply to provide correct purity, pressure and flow rate for suitable applications and required duty cycles.

Customer Engineering Service

Installing, maintaining and upgrading reliable supply options

BOC have national coverage of engineers designing, installing and maintaining BOC supply systems, pipe work and gas control equipment.

Safety

- BOC practises 100% safety 100% of the time
- All installations and delivery procedures comply with regulations and standards.
- BOC can provide advice and services to help customers meet strict regulations and improve their safety standards.

BOC Onstream service

In February 2000, The Pressure Systems Safety Regulations 2000 (PSSR) were introduced. All users of pressure systems in the UK are now legally required to follow this legislation, which sets out that all privately owned equipment must be maintained and regularly examined. As part of the OnStream service, BOC carry out a series

of physical examinations of your compressed gas and cryogenic pressure systems and then, upon satisfactory completion of the examination, issue the required documentation to prove PSSR 2000 compliance.

For more information see the BOC publication: 'OnStream - The Productive Maintenance Plan' (FAB/008048)


High quality laser gas equipment

BOC produces a range of laser gas regulation equipment which is carefully designed and engineered to meet or exceed the high quality standards specified by today's laser manufacturers. It is important that the correct equipment is used. The BOC assist gas regulators are engineered to match both flow and pressure requirements and are tailored to the gas supply mode recommended for you. BOC's lasing gas regulators contain stainless steel diaphragms, which help prevent contamination of the laser resonator, maximising laser performance. Our range of gas control equipment ensures that the purity of the gas you use is maintained from point of delivery to point of use.


Equipment Specification

Laser Assist Gas Equipment

Multi-stage Oxygen regulator

Series 9500	Benefits and Features	Performance
	<ul style="list-style-type: none"> • For oxygen use • Constant and accurate delivery of the required pressure of gas • Accurate performance up to 10 bar • No need for continuous re-adjustment • Two stage pressure reduction for precise pressure control independent of cylinder content • Extra sensitive neoprene diaphragms for quick response to changes in pressure • Chrome-plated forged zinc bonnet for maximum durability 	<p>Maximum inlet pressure 300 bar Outlet pressure 0-10 bar Max outlet flow (at 150 bar) 72m³/hour</p>

High Pressure Nitrogen regulator

Series HP Multi Stage	Benefits and Features	Performance
	<ul style="list-style-type: none"> • For nitrogen use • Provides precise control of high pressure nitrogen supply • Constant and accurate delivery of the required pressure of gas up to 42 bar • Stainless steel diaphragms on first and second stage • No need for continuous re-adjustment • Designed to give adequate dissipation of any cooling as result of the pressure reduction of the gas. 	<p>Maximum inlet pressure 300 bar Outlet pressure 0-42 bar Max outlet flow (at max pressures) 320m³/hour</p>

Lasing Gases Equipment

LAS PDS – Changeover Manifold



Benefits and Features

- For 'Laserpure' gases and helium lasing gases
- Automatic changeover manifold for continuity of gas supply.
- Effective two stage regulation for controllable and stable outlet pressures
- Stainless steel diaphragm
- Flexible hoses with non return valves to connect to cylinders
- Interstage relief valve
- Bracket mounted

Performance

Maximum inlet pressure 207 bar
Outlet pressure 0-8.6 bar
Max outlet flow (at max pressures) 20.4m³/hour
Changeover pressure 11-14 bar
Operating temperature -17 °C to +57 °C

LAS 302 - The high purity regulator



Benefits and Features

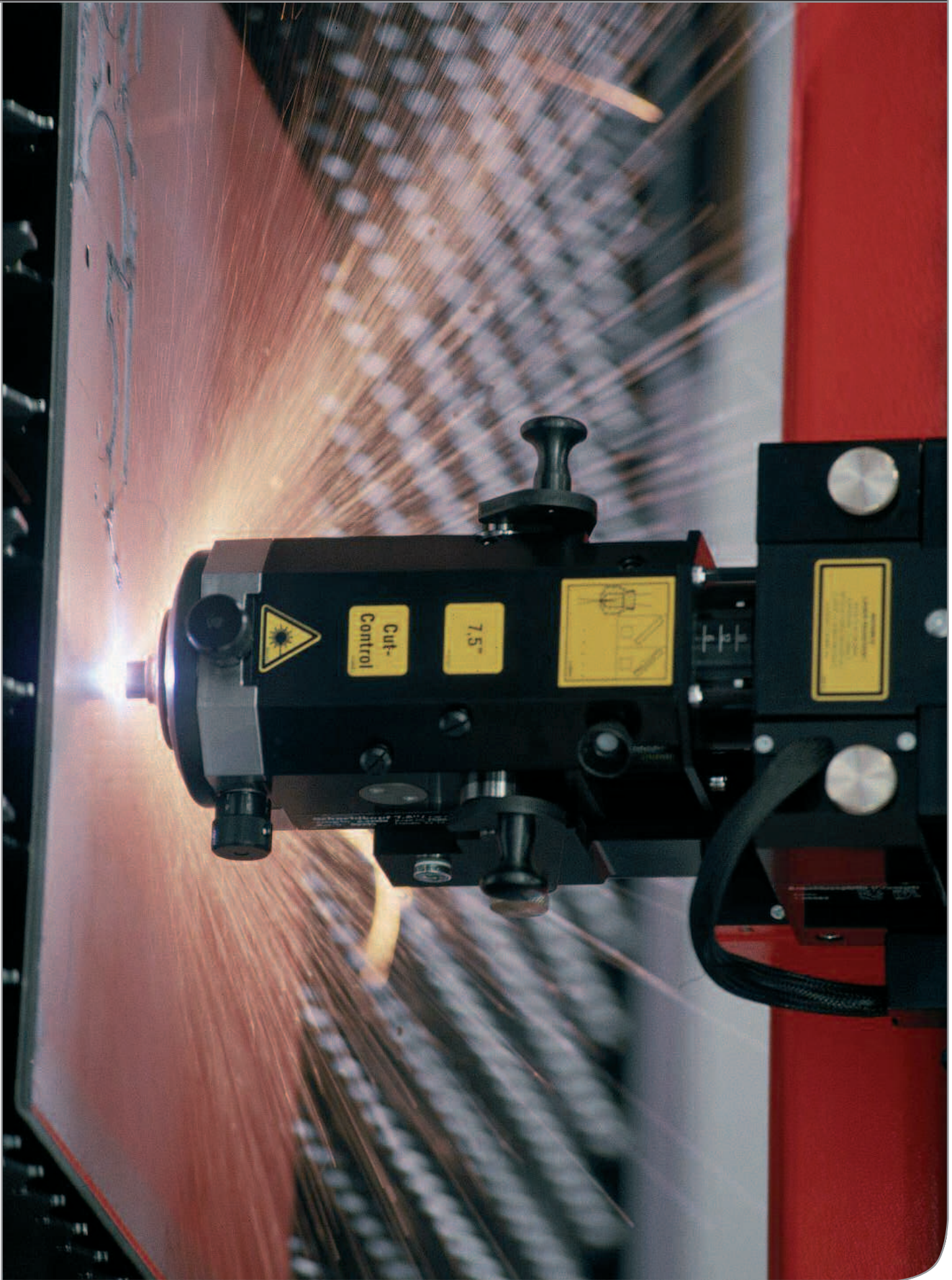
- For 'Laserpure' gases and lasing gas mixtures
- Chrome plated body for improved purity
- Two stage pressure reduction for precise pressure control independent of cylinder contents
- Stainless steel diaphragms on first and second stage
- Hand-tightening cylinder connection on BS3 models
- Custom options including panel mounting
- Side inlet

Performance

Maximum inlet pressure 207 bar
Outlet pressure 0-8.6 bar
Max outlet flow (at max pressures) 18m³/hour
Operating temperature -17 °C to +57 °C

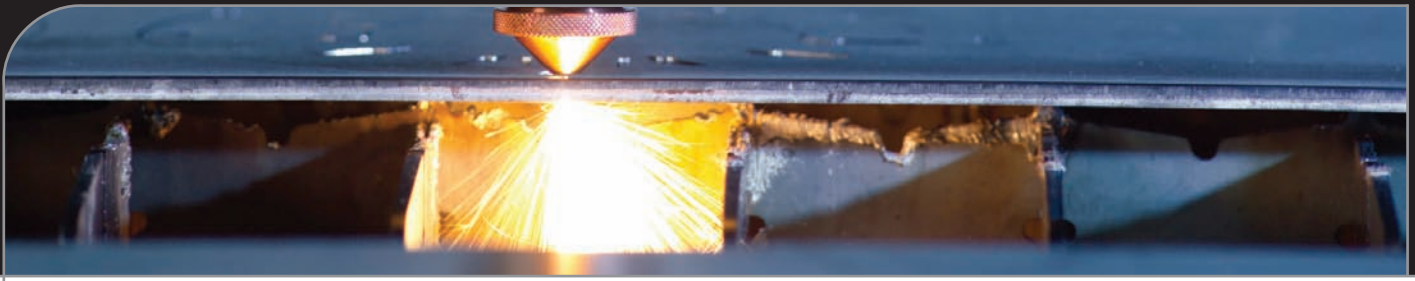
*BOC's range of lasing gas regulators can be fitted with a variety of inlet connections to fit our range of lasing gases.





Tap into our laser expertise by emailing BOC Industrial at custserv@boc.com or call 0800 111 333 or visit www.bocindustrial.co.uk

 **BOC**
Industrial 



For product and safety enquiries please phone

0800 111 333

For further information on gas supply options visit

www.bocindustrial.co.uk

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