



MAXIGAS Nitrogen Supply for laser applications

www.domnickhunter.com

Laser cutting with nitrogen

As our laser cutting demand grew, running 24 hours a day, organising delivery of 10 to 15 banks of nitrogen per week became almost a full time job. Generating our own nitrogen gives us an uninterrupted supply and huge cost savings.

> James Cooper, Managing Director Metalfacture, UK



Oxygen-cutting

The choice of assist gas depends on the material to be cut. Oxygen produces powerful exothermic reactions that support the cutting process and enable relatively thick materials such as carbon steels and low alloyed steels to be penetrated. The amount of oxygen gas used requires careful control to ensure violent reactions that may reduce cut quality do not occur.

Nitrogen-cutting

When cutting certain materials including stainless steel and high alloyed steels, any oxidation of the cut surface must be avoided, therefore an inert gas such as nitrogen is more suitable. Nitrogen is also used where cut parts will be painted or powder coated; oxides on cut edges would decrease the coatings bond and could lead to corrosion. In production intensive environments where a high degree of precision is required, nitrogen is used to cut metals with a thickness of up to 25mm.

By contrast to oxygen, which must not have impurities greater than 0.002% nitrogen purity has little effect on cutting speed provided it is 99.5% or above.

Inert gases do not produce an exothermic reaction which means the material is cut by laser power alone. For this reason a powerful laser and high-pressure assist gas are required normally at 35 barg.

Nitrogen-cutting requires the laser focal point to be positioned close to the back surface of the metal, (see figure 2) this results in a larger laser beam cross-section which means the kerf becomes wider and so more high-pressure nitrogen flows into the molten metal. A nozzle diameter of at least 1.5mm is the norm.



Figure 1: Oxygen-cutting



Figure 2: Nitrogen-cutting

Painted or primed surfaces

Oxygen-cutting of metals with a painted or primed surface (particularly zinc and iron oxide primers) can cause dross and other defects to form, which can be problematic at any subsequent TIG welding stage. Such defects can require costly finishing. Nitrogen-cutting will avoid these problems.

Galvanised metals

It is not advisable to use oxygen when cutting zinc coated galvanised metals as dross formation is a significant problem that can also create a rough cut edge. Nitrogen is much more suitable.

Aluminium

Oxygen and nitrogen can be used to cut aluminium, but oxygen-cutting will not have much effect on cut speed due to aluminium oxide's high melting point of 2072°C (3762°F). Oxygen, however, causes discontinuous reactions as the oxide seal bursts, which results in rough edges. Low pressure oxygen-cutting is sometimes used to combat this problem, but tends to cause a secondary dross formation problem. Nitrogen is a better alternative for aluminium alloys, while oxygen is more suited to pure aluminium.

Titanium

Titanium and titanium alloys should not be cut with oxygen or nitrogen, because they are absorbed into the titanium surface and form a brittle layer. Instead high purity argon and helium are more suitable.

Beam purging

Beam guidance systems are purged with nitrogen at approximately 3nm3/h to ensure there is no CO₂ or water vapour in the beam guide that could cause spurious laser splitting. Purging also reduces impurities that could absorb or reduce the laser power and alter its shape.

Laser sintering

Rapid prototyping applications purge selective laser sintering machines with nitrogen to create an inert environment for processing parts, protecting them against oxidation. Following an initial purge the system requires a constant supply during operation.

Nitrogen purity of 0.5% oxygen content has proved successful. A nitrogen storage vessel is usually required to cover the high nitrogen demand of this application.

Dry air

For optimum laser performance ambient heat should be carefully controlled, and the lens protected from dust particles. Dry air provided by the domnick hunter adsorption and refrigeration dryer ranges (preceded by a pre-filter) give laser users an effective solution.

Chilled water

The laser source generates a considerable amount of heat, it is therefore necessary to cool the laser with chilled water. The temperature tolerance of this water is approximately +/-1°C. The laser chiller range from domnick hunter has cooling capacities that range from 15 to 230kW and enables close water temperature control in all conditions within a +/-0.5°C parameter.

Benefits of using nitrogen

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

Why MAXIGAS

MAXIGAS is a cost effective alternative to other gas sources with no on-going costs such as refills, order processing or delivery charges.

It is also a safer alternative as manhandling of high-pressure cylinders is eliminated and there is no need for liquefied gas tanks.

Production downtime is minimised due to the permanent availability of an on-demand nitrogen supply.

Maxigas gives manufacturers increased control over flow rates and requires minimal maintenance. It can also bring valuable space saving advantages.

MAXIGAS deliverables

- Nitrogen purity of up to 10ppm oxygen content
- Nitrogen at 35 barg
- Ability to cut metals with thicknesses of up to 25mm
- On-demand nitrogen
- Increased control
- No reliance on gas deliveries in remote or congested areas
- Modular space saving design
- Ability to add extra banks of generators
- Simplicity
- Innovative regeneration feature requires minimal maintenance
- domnick hunter global service and support
- Easily retrofitted

MAXIGAS model N2MAX116 0

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MAXIGAS



How it works

MAXIGAS is constructed from pairs of extruded aluminum columns filled with carbon molecular sieve (CMS) and operates on the pressure swing adsorption (PSA) principle to produce a continuous stream of nitrogen gas from compressed air. Oxygen and other trace gases are preferentially adsorbed by the CMS, allowing nitrogen to pass through.

Carbon molecular sieve differs from ordinary activated carbons in that it has a much narrower range of pore openings. This allows small molecules such as oxygen to penetrate the pores and be separated from the air stream. The larger molecules of nitrogen by-pass the CMS and emerge as the product gas.

After a pre-set time when the online bed is almost saturated with adsorbed gases, the system automatically switches to regenerative mode, venting the contaminants from the CMS. The second CMS bed then comes online and takes over the separation process. The pair of CMS beds switch between separation and regeneration modes to ensure continuous and uninterrupted nitrogen production.



Carbon molecular sieve

Performance data

INCLE RANK

	Model	With Compressor	Without Compressor	Nitrogen Outlet Flowrate - Nm³/hr (ATP) v Oxygen Content						
				10ppm	100ppm	0.1%	0.5%		2%	3%
MAXIGAS MIDI	N2MID350		•	0.6	1.0	1.6	2.6	3.1	4.0	N/a
	N2MID351	•		0.0	1.0	1.0	2.0	5.1	4.0	IN/d
	N2MID600		•	0.9	15	2.6	3.9	4.6	6.1	N/a
	N2MID601	•		0.7	1.5	2.0	0.7	4.0	0.1	N/U
MAXIGAS	N2MAX104		•	1.3	2.2	4.5	7.6	9.0	11.8	13.8
	N2MAX106		•	1.9	3.2	6.7	11.4	13.5	17.7	20.7
	N2MAX108		•	2.6	4.4	9.0	15.3	18.0	23.6	27.6
	N2MAX110		•	3.2	5.3	11.3	19.1	22.6	29.5	34.5
	N2MAX112		•	5.2	8.4	18.4	30.8	36.4	41.2	47.8
	N2MAX116		•	6.9	11.2	24.5	41.0	48.5	52.9	61.4



Performance data based on 6barg (87psig) air inlet pressure, 20°-25°C (68°-77°F) ambient temperature. Consult domnick hunter for performance under other specific conditions.

Technical specifications

Ambient temp. range	5°-45°C (41-113°F)
Nitrogen outlet pressure	5 barg (72.5psig)
Min. air inlet pressure	6 barg (87psig)
Max. air inlet pressure	9.5 barg (138psig)
Inlet air quality	Dewpoint: -40°C (-40°F) Particulate: <0.1 micron Oil: <0.01 mg/m ³
Electrical supply	220V/1ph/50Hz or 110V/1ph/60Hz
Inlet/outlet connections	G ¹ / ₂

Weights and dimensions

Model				Weight (Kg)
N2MID350	1100	590	600	145
N2MID600	1100	590	600	180
N2MAX104	1650	500	810	250
N2MAX106	1650	500	980	330
N2MAX108	1650	500	1150	410
N2MAX110	1650	500	1320	490
N2MAX112	1760	600	1717	674
N2MAX116	1760	600	2055	837

Standard accessories

Oxygen analyser for continuous monitoring of nitrogen purity. Flow verification kit.

Analogue outputs for remote monitoring alarm connections.

Other dh products

- Compressed air filters
- Adsorbtion dryers
- Refrigeration dryers
- Chillers & Coolers
- Laboratory gas generators
- Oil/water separators
- Condensate drains

MAXIGAS MIDI

The MAXIGAS MIDI range is designed to offer the most compact solution for smaller scale nitrogen requirements. These units are available with the option of an integral oil-free air compressor, giving a more flexible and convenient nitrogen supply.





MAXIGAS modular concept

For higher flow rate applications, MAXIGAS can be multibanked to offer the most cost effective solution.

The modular design of the MAXIGAS system means you can simply add extra banks as your business grows and your gas requirements increase.

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