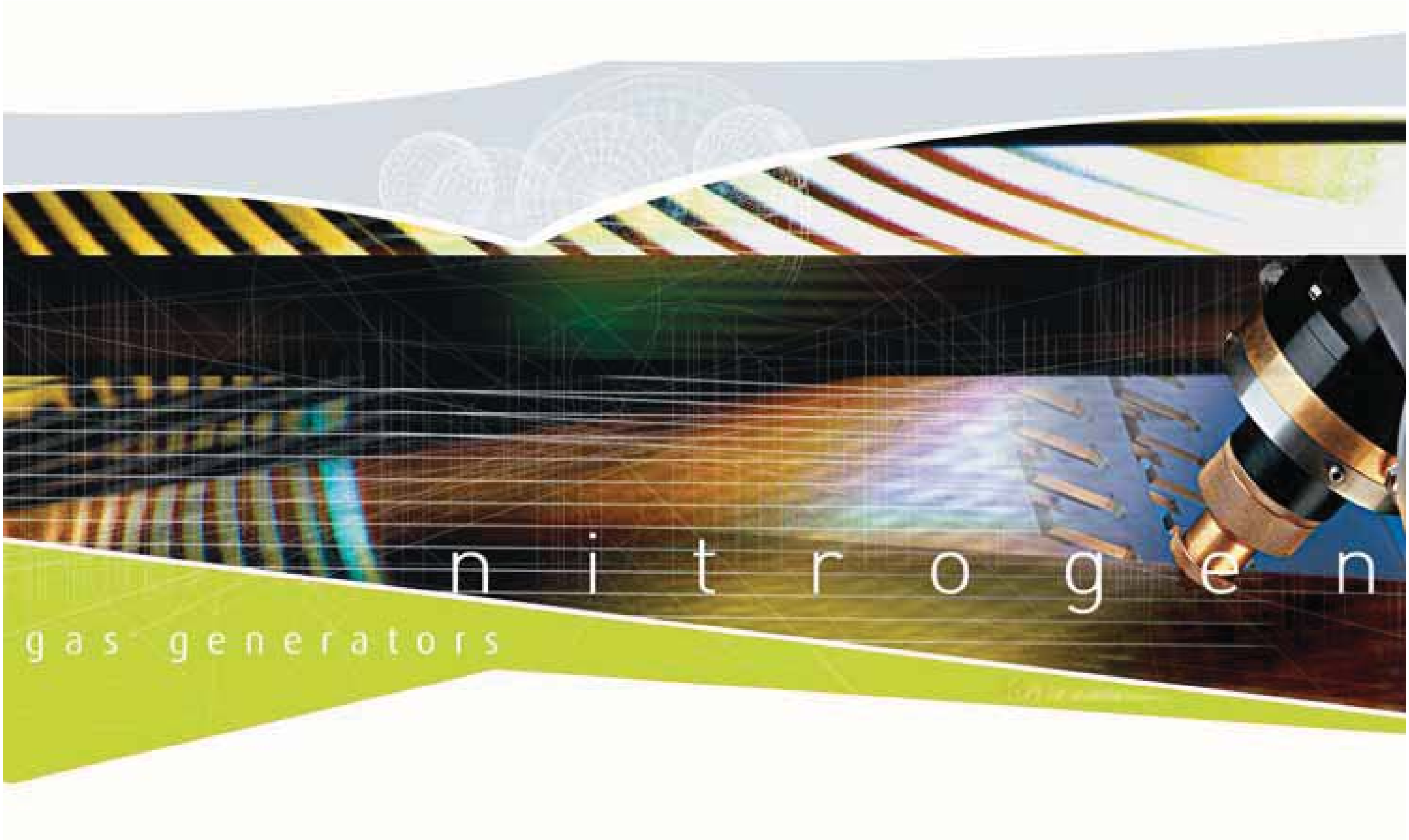
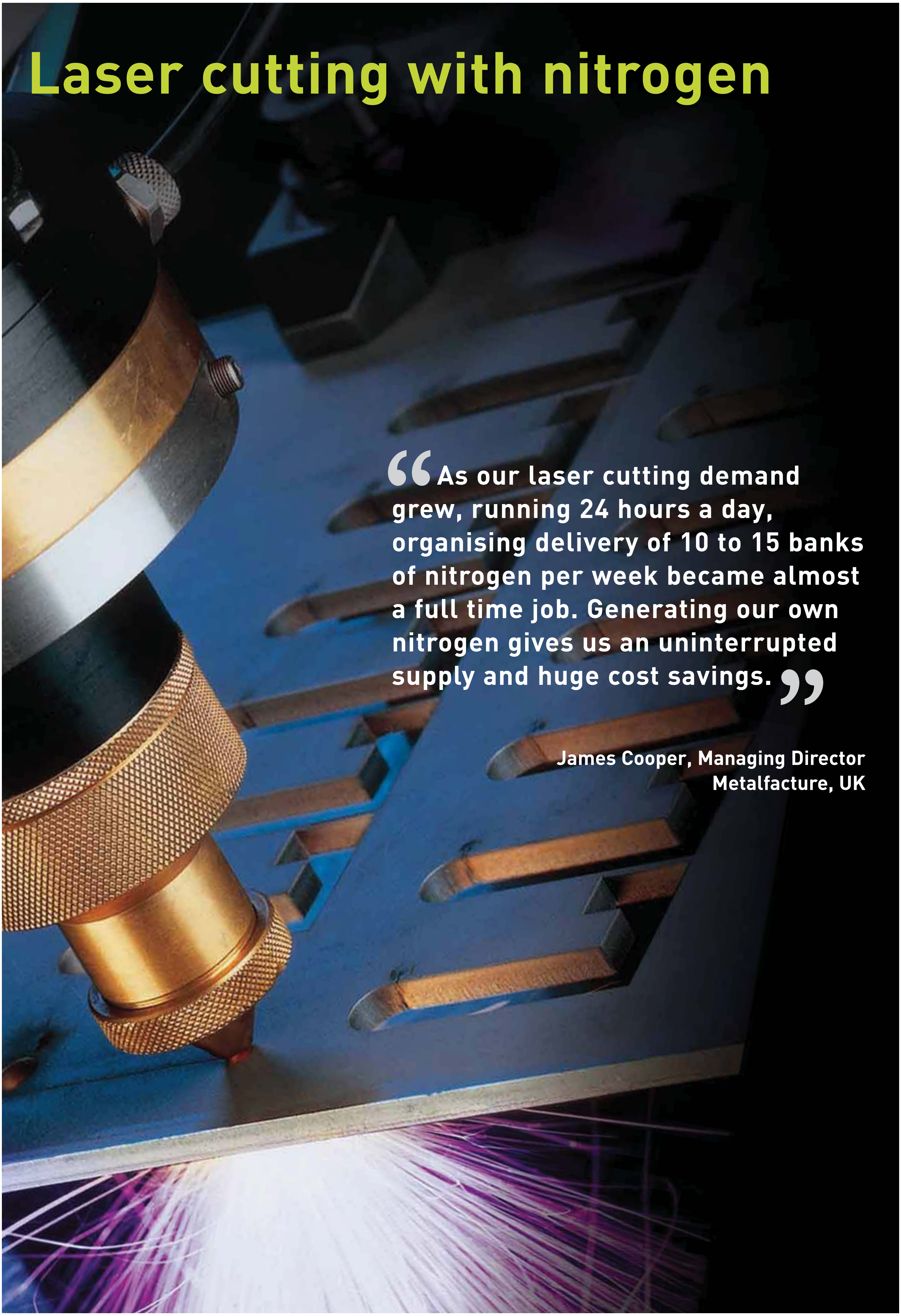
domnick hunter



MAXIGAS Nitrogen Supply
for laser applications

www.domnickhunter.com

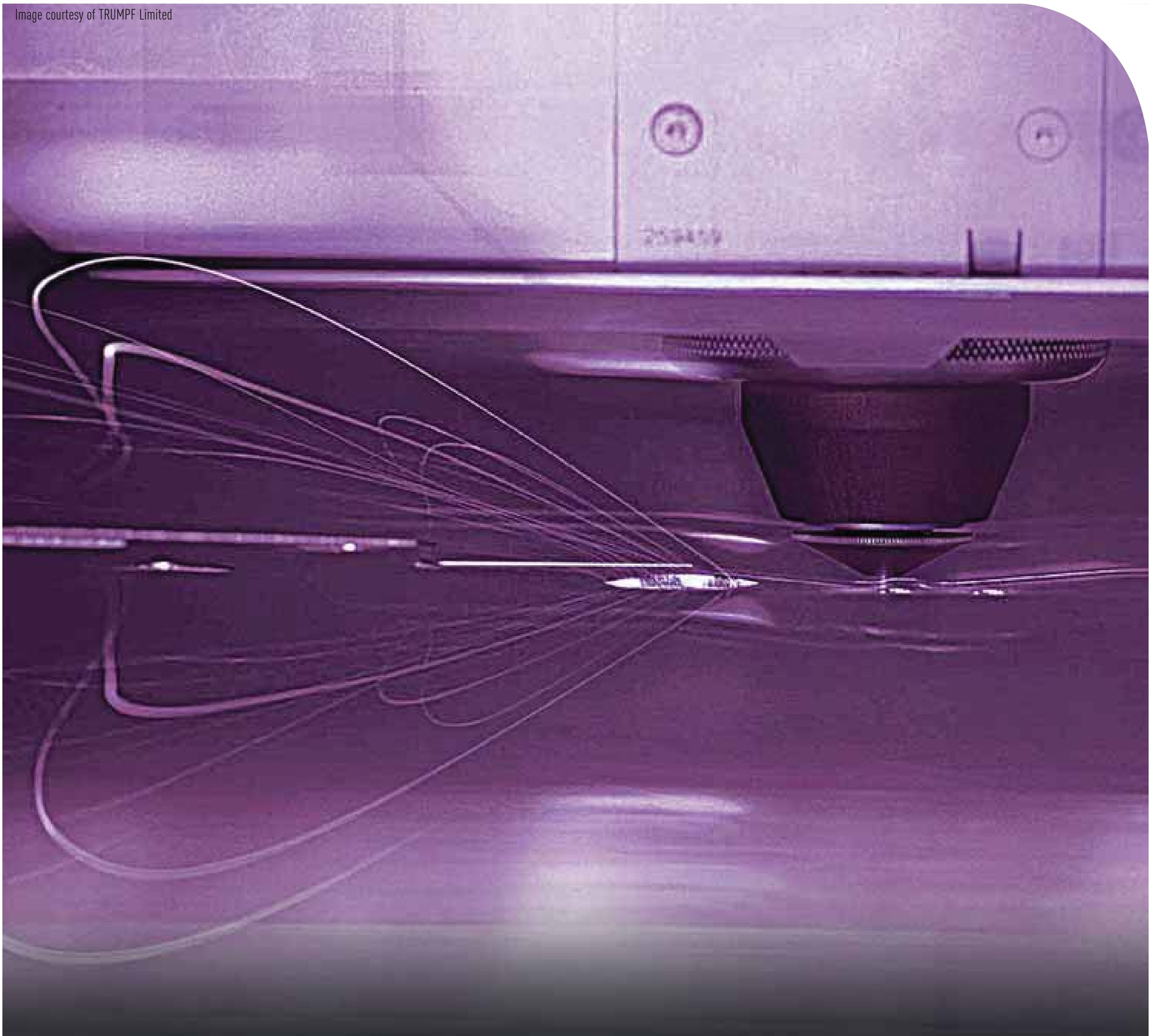
Laser cutting with nitrogen



"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

Image courtesy of TRUMPF Limited



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.

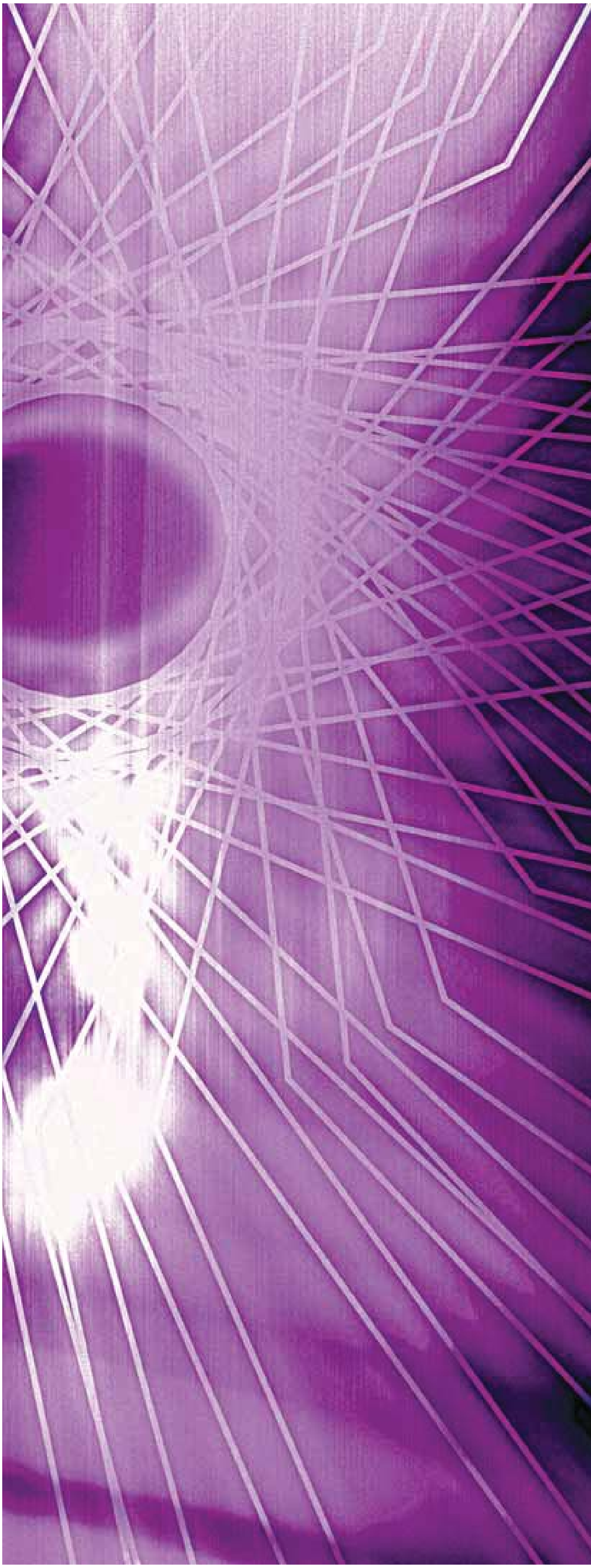
Nitrogen-cutting

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.

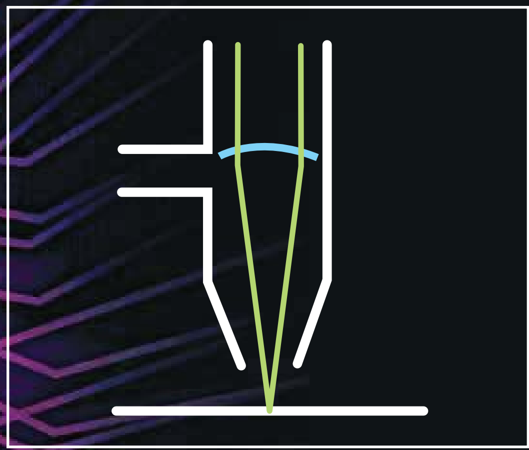


Figure 1: Oxygen-cutting

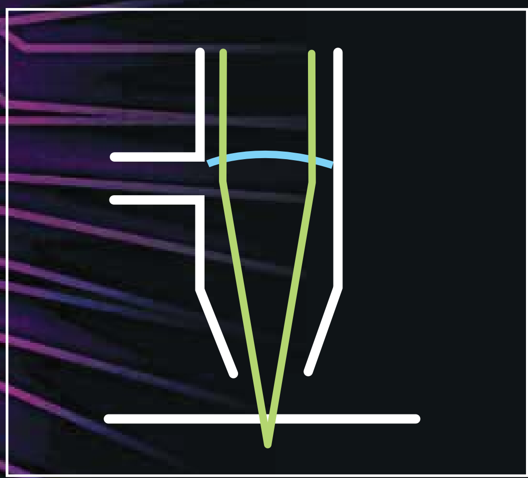


Figure 2: Nitrogen-cutting

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 CO_2 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

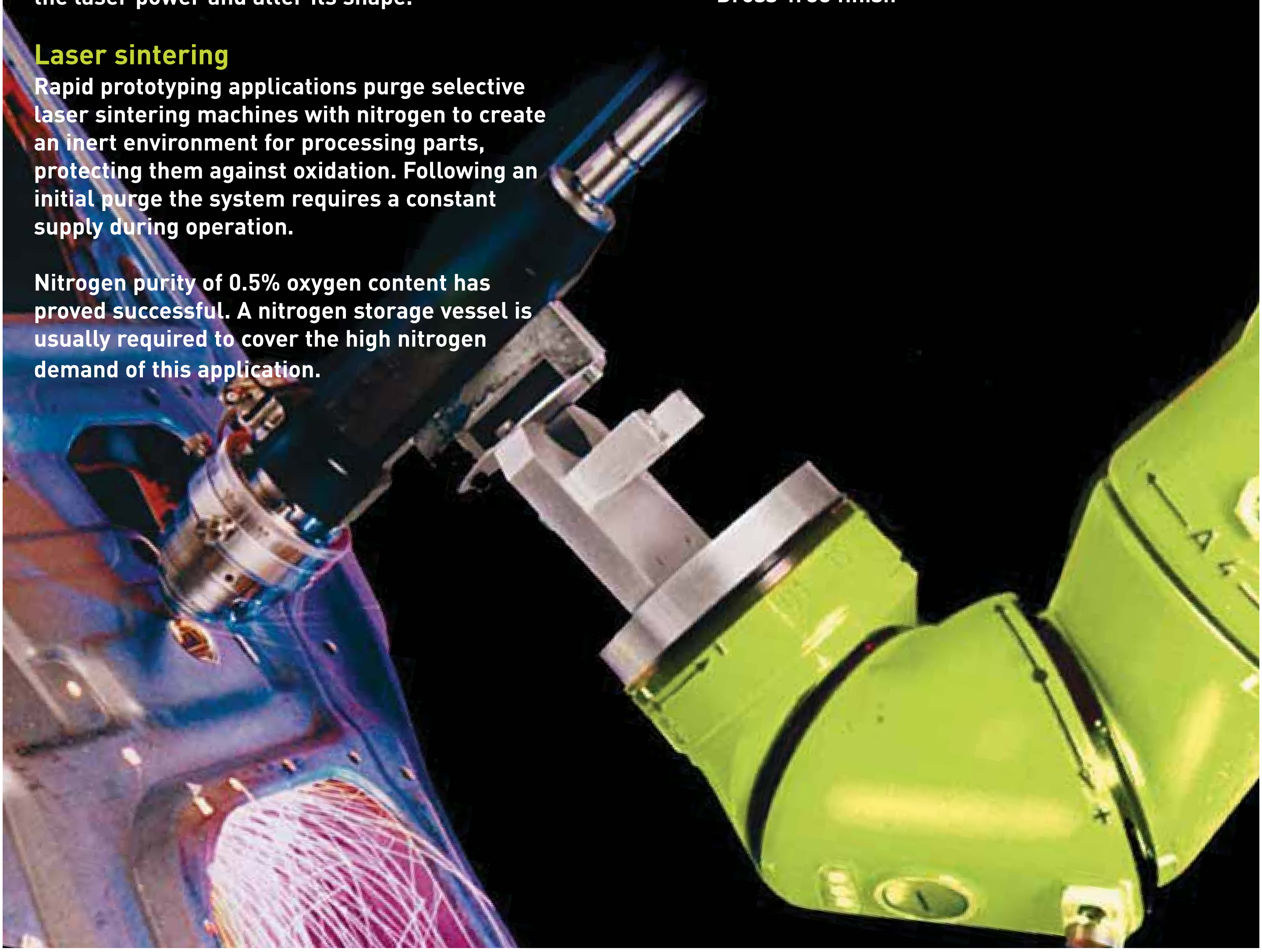


Image courtesy of TRUMPF Limited

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

Image courtesy of TRUMPF Limited

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

Product Selection

Performance data is based on 7 bar g (100 psi g) air inlet pressure and 20º -25ºC (66º - 77ºF) ambient temperature. Consult Parker domnick hunter for performance under other specific conditions.

Nitrogen Outlet Capacity (Nm³ / hour) V Oxygen Content

Model	10ppm	50ppm	100ppm	250ppm	500ppm	0.1%	0.5%	1.0%	2.0%	3.0%	4.0%	5.0%
MIDIGAS 2	0,55	-	1,2	1,5	1,9	2,4	3,4	4,3	5,8	7,2	8,4	9,4
MIDIGAS 4	1,2	-	2,4	3,2	3,9	4,7	6,9	8,5	11,6	14,3	16,7	18,8
MIDIGAS 6	1,5	-	3,2	4,2	5,3	6,5	9,5	11,5	15,2	18,7	21,7	24,5
MAXIGAS 104	2	3,8	5,5	7,1	8,6	9	14,1	17,8	22	25,8	29	32,2
MAXIGAS 106	3	5,7	8,3	10,7	13	13,4	21,2	26,6	32,8	38,7	43,5	48,3
MAXIGAS 108	4	7,6	11	14,3	17,3	18	28,3	35,5	43,8	51,6	58	64,4
MAXIGAS 110	5	9,5	13,8	17,8	21,6	22,4	35,3	44,4	54,7	64,5	72,5	80,4
MAXIGAS 112	6	11,3	16,5	21,4	25,9	26,8	42,4	53,3	65,7	77,4	87,1	96,5
MAXIGAS 116	7,9	14,4	20,9	27,1	32,8	34	53,7	67,5	83,2	98,1	110,3	122,3
MAXIGAS 120	9,8	17,4	25,3	32,8	39,7	41,2	65	81,7	100,7	118,7	133,5	148

Weights and Dimensions

Model	Height (mm)	Width (mm)	Depth (mm)	Weight (kg)
MIDIGAS 2	1034	450	471	98
MIDIGAS 4	1034	450	640	145
MIDIGAS 6	1034	450	809	196
MAXIGAS 104	1894	550	692	336
MAXIGAS 106	1894	550	861	394
MAXIGAS 108	1894	550	1029	488
MAXIGAS 110	1894	550	1198	582
MAXIGAS 112	1894	550	1368	676
MAXIGAS 116	1894	550	1765	864
MAXIGAS 120	1894	550	2043	1052

Technical Data

Ambient Temperature Range		: 5-50 °C
Max. Nitrogen Outlet Pressure		: 16,5 barg
Min. /Max. Air Inlet Pressure (MAXIGAS)		: 6-18 barg
Min. /Max. Air Inlet Pressure (MIDIGAS)		: 6-13 barg
Inlet Air Quality:	Dewpoint	: - 40 °C
	Particulate	: < 0,1 micron
	Oil	: < 0,01 mg/m3
Electrical Suply		: 220 V/1ph/50 Hz
Inlet /Outlet Connections		: Air G1 – Nitrogen G½

MIDIGAS Nitrogen Generator

MAXIGAS Nitrogen Generator