domnick hunter

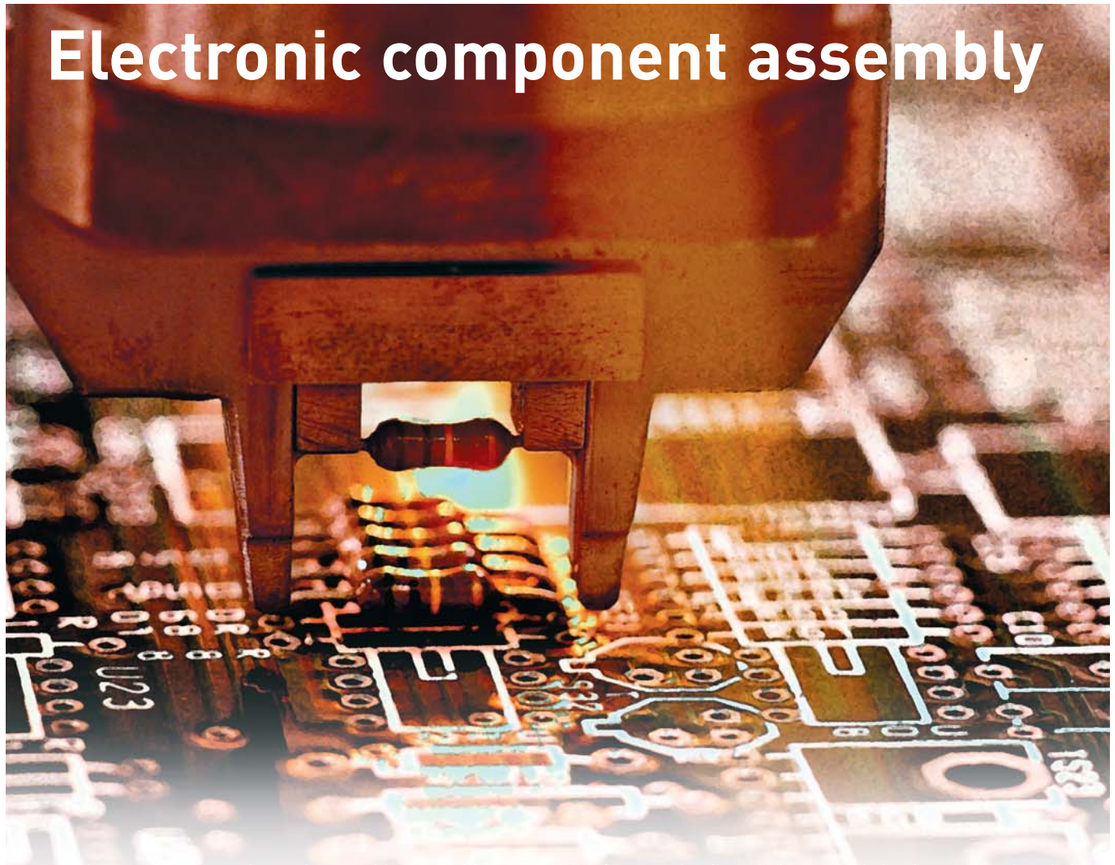
MAXIGAS Nitrogen Supply

for electronic assembly

Parker

ENGINEERING **YOUR** SUCCESS

Electronic component assembly



Nitrogen is commonly used to provide a suitable atmosphere for complex fine pitch assembly in electronic printed circuit board, hard disk and semiconductor manufacture where rework is costly or impossible or where there is a prerequisite for quality and reliability. A nitrogen enviroment increases surface tension and wetting forces while decreasing surface damping. This nitrogen use directly contributes to fewer defects. Some nitrogen applications are outlined here.

Integrated circuit packaging

Electronic packaging creates the interface between an integrated circuit (IC) and a printed circuit board (PCB). This gives improved electrical interconnection and protects the IC.

Technological advancements mean that these ICs are now advanced packages that can be costly. Nitrogen is vitally important to provide a controlled inert, clean dry and oxygen free environment. Nitrogen protects these valuable components from oxides and moisture that impair wire bonding and die attachment, effecting yields and finished product quality.

An average oven can hold up to 800kg of molten solder and if nitrogen purging is not carried out, can produce 100kg of dross after each production run. This is a costly problem in terms of solder and lost production time in cleaning machinery.

Lead-free soldering

The demand for lead-free soldering will increase dramatically due to impending legislation. However reflow temperatures of new alloys are substantially higher than lead based materials (usually around 220°C compared to 183°C). At these higher temperatures there is an increased risk of oxidation of boards, pads and some board laminates.

Oxidation can weaken solder joints, which results in unreliable components. Nitrogen displaces oxygen to protect metal surfaces and minimise the danger of 'pop-corning' which can cause distortion.

Lead solder will be banned in the EU by January 2006. The problem is an environmental one as old parts can pose an environmental risk if lead is allowed to contaminate groundwater.

A likely replacement to tin (Sn)/lead (Pb) solder is one containing a major part of tin and small amounts of silver (Ag) and copper (Cu). Problems of poor wetting when using the traditional Sn/Pb solder could be overcome by increasing the super heat (the difference between the soldering temperature and the liquidus temperature), however this is much more difficult when using the new solders because they have higher liquidus temperatures. A nitrogen atmosphere is crucial to lead-free soldering as it increases the process window.

Reflow soldering

This is the most widely used soldering method for attaching surface mount devices (SMDs), multi-chip modules and other components to boards.

improving product quality and reliability

The oxygen part per million (PPM) inside the reflow oven must be controlled. A low oxygen level is maintained by diffusing nitrogen into the respective oven zones to displace oxygen. There is no simple answer as to the optimum oxygen level inside the oven, however independent tests have shown that with the use of low solids pates, an oxygen level of 100 PPM has provided ample benefit. At 100 PPM or lower, the wetting force can be improved by as much as 50% compared to normal atmospheric conditions.

Joint quality is greatly improved (see figure1) compared to soldering in normal atmospheric conditions with fewer defects and irregular shapes in the solde, (see figure2).

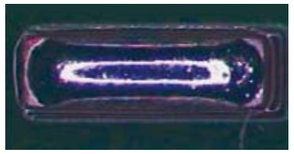


Figure 1

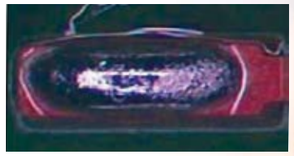


Figure 2

Nitrogen reflow soldering typically reduces ICT defects by between 50% and 60%. Yeld improvements of 5% to 6.8% are also possible.

Reflow soldering of pin-through-hole (PTH) connectors and components (also known as intrusive and pin-in-paste) benefits from nitrogen which increases the wetting force and speed of solder joint formation, nitrogen also produces stronger joints with very minimal cracks or voids.

Closed-loop reflow soldering

Closed loop systems reduce nitrogen consumption by maintaining a pre-set PPM oxygen level within reflow ovens. When the closed loop system is switched on at the beginning of the day, it automatically purges the oven with an increased amount of nitrogen until the desired oxygen level is achieved. The system then continually adapts the nitrogen flow to maintain the optimum oxygen PPM.

Wave soldering

Nitrogen improves wave soldering processes by substantially reducing dross; it also increases surface tension on the solder material resulting in improved adhesion.

Nitrogen is sometimes viewed as an extra cost; however the added benefits that it brings in terms of improved quality and increased yields as well as labour and material savings far out weigh its cost. This is especially true in wave soldering where dross and the problems it causes are reduced.

Selective soldering

Selective soldering can be compared to wave soldering with a mask. It is used where SMDs are required on both sides of the board in addition to PTHs. Most assembly lines use the mini-wave soldering method.

Like wave soldering, mini-waves create dross; in order to achieve wave precision the solder must be dross-free. Nitrogen is essential in achieving dross-free waves for high yields. Nitrogen flow rates are normally around 2.8Nm3/hr.

Forming gases

A mixture of nitrogen and hydrogen gas provides a controlled or reduced atmosphere necessary for high temperature assembly where there is the risk of undesirable oxides forming on surfaces. In certain circumstances fluxless soldering may even be possible.

Burn-in ovens

The continuous drive for further miniaturisation of components drives the need for dynamic burn-in as a means of improving device quality. Higher speed burn-ins can be achieved using nitrogen at higher temperatures without unwanted oxidation of pins, sockets or IC boards. Nitrogen flowrates are quite high, while typical purity ranges from 97 to 99.99%.

Rework

Soldering complexity means a certain amount of defects are to be expected, however due to the high cost of components it is common to correct or rework small errors. A hot gas provides a localised heat source that enables solder to be melted and components moved or weak joints to be re-soldered. Reworking is a delicate process that must be carried out without causing further damage; nitrogen's inert properties make it preferential to hot air.

Dry storage

Replacement parts need to be available for the lifetime of finished products, even if the product itself is obsolete (particularly important to military, aerospace and automotive industries). Finished PCBs require long-term storage in a clean dry inert atmosphere.

SMDs and other work in progress need to be stored in a dry place to prevent moisture from atmospheric humidity, which could cause 'pop-corning' at the soldering stage, permeating components. Suitable storage will minimise the need for baking which can be time consuming and ineffective.

Using nitrogen in dry cabinets offers effective protection against moisture, particulate and physical shock, it is much more effective than filtered and dried air because it prevents moisture absorption and will dry components that may already have been exposed to moisture.

De-ionised water storage

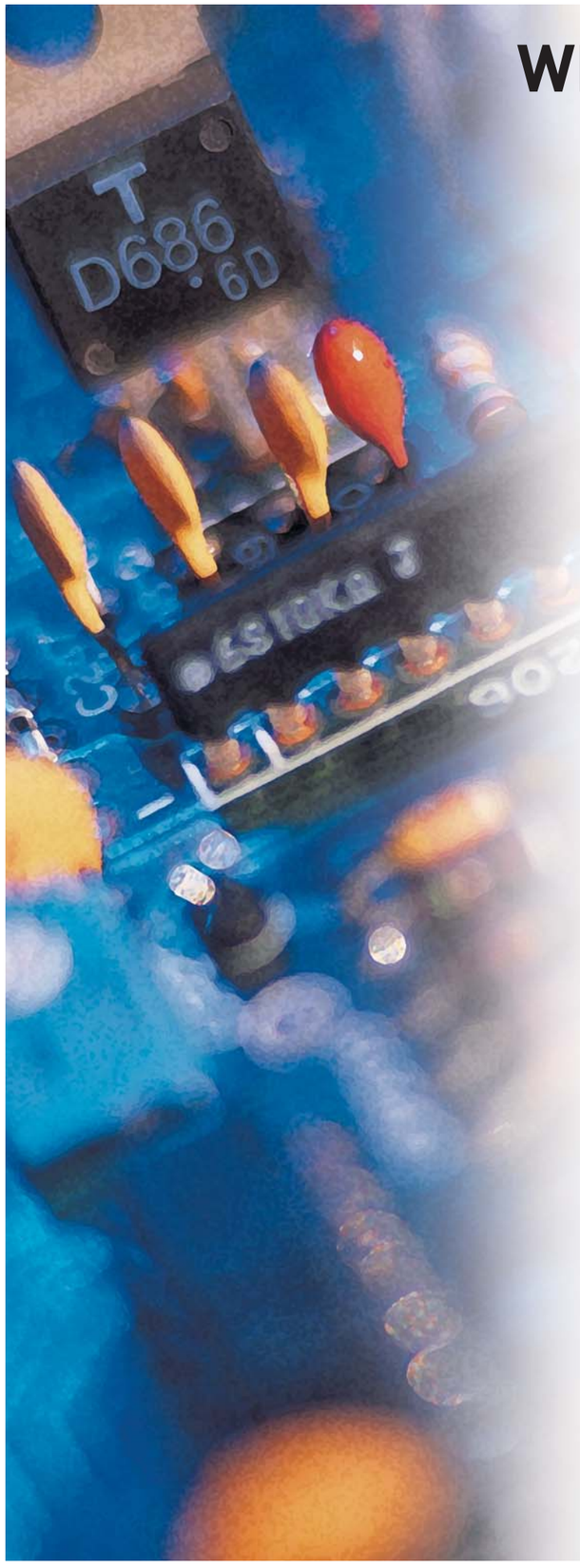
De-ionised water is widely used by electronics manufacturers. Nitrogen gas is used to blanket bulk storage of this essential commodity to preserve the quality of the water, preventing ingress of airborne bacteria and particulate. Purity levels of 98 to 99% with dewpoints of -40°C (-100°F) mean MAXIGAS is the ideal solution for this application.

Nitrogen benefits:

- Reduced defects
- More reliable components
- Increased flexibility – wider process window
- Improved design specifications
- Reduced cleaning of assembly tools
- Aesthetic appearance – shiny joints
- Improved wettability
- Increased surface tension
- Reduced product returns
- Decreased time to market

Additional benefits of nitrogen in wave soldering:

- Dross reduction
- Reduced flux consumption



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.

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 10 PPM oxygen content
- 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 to existing applications

MAXIGAS
model N2MAX116

How it works

MAXIGAS is constructed from pairs of extruded aluminium 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

	Model	With Compressor	Without Compressor	Nitrogen Outlet Flowrate - Nm³/hr (ATP) v Oxygen Content						
				10ppm	100ppm	0.1%	0.5%	1%	2%	3%
MAXIGAS MIDI	N2MID350		•	0.6	1.0	1.6	2.6	3.1	4.0	N/a
	N2MID351	•								
	N2MID600		•	0.9	1.5	2.6	3.9	4.6	6.1	N/a
	N2MID601	•								
SINGLE BANK 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.

MAXIGAS installation

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/m³
Electrical supply	220V/1ph/50Hz or 110V/1ph/60Hz
Inlet/outlet connections	G½

Weights and dimensions

Model	Height (mm)	Width (mm)	Depth (mm)	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
- Sterile air filters
- Compressed air dryers
- Laboratory gas generators
- Oil/water separators

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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