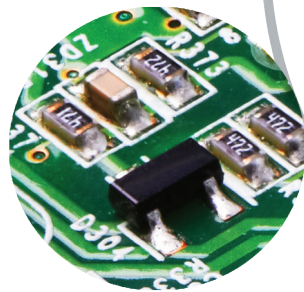
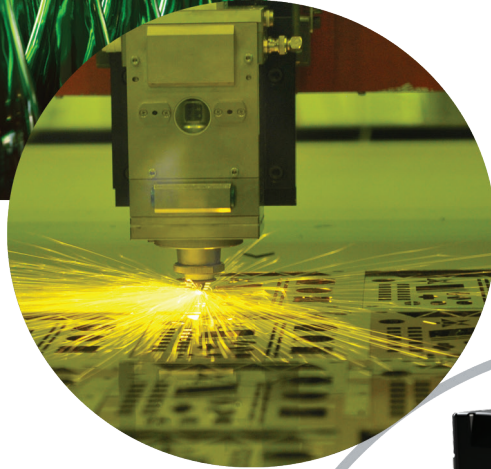


# nano

next  
generation



## ultra-high purity nitrogen generators

nitrogen purity: 95% to 99.999%



# ultra-high purity nitrogen generators

nitrogen purity: 95% to 99.999%

# gen<sub>2</sub>

Leading edge technology and hundreds of years of **experience**... nano-purification solutions, your world-class manufacturer of state-of-the-art compressed air and gas solutions to industry.

Our commitment at nano is to work alongside our **customers** and provide unique solutions with the highest quality products to solve your specific challenges.

A wealth of experience and leading edge products are only part of the equation. nano recognize that world-class customer **service** is the most important component to any successful business.

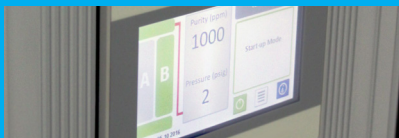
Experience. Customer. Service... **nano**



## dry and pure

Nitrogen is used in many commercial and industrial applications to improve the quality of a product or process or as a safety measure to prevent combustion. Liquid or bottled nitrogen delivery and storage can be expensive, unreliable and a safety concern. Nitrogen generators allow users to produce nitrogen in-house simply and inexpensively using an existing compressed air system.

nano recognizes the importance of having a safe, reliable and cost-effective supply of high-purity nitrogen. We have developed the GEN<sub>2</sub> nitrogen generator to meet the increasing demand for high quality complete packaged solutions which save energy and time while fulfilling the needs of their intended application.



## design

Our experienced team of design engineers are always looking for new and unique technologies and products to bring you the highest level of performance and lowest overall operating cost.



## research & development

Our R&D team endeavor to provide solutions that go beyond developing an existing product. They are continually researching new technologies which can provide unique advantages over competitive offerings.



## manufacture

The reliable and energy saving nano GEN<sub>2</sub> range of nitrogen generators are manufactured in our state-of-the-art facility to the highest standards of build quality to ensure equipment reliability and high levels of performance.



# GEN<sub>2</sub> nitrogen generators

Nitrogen is a dry, inert gas which is used in many commercial and industrial applications to improve quality or where oxygen may be harmful to the product or processes.

With traditional methods of gas supply such as liquid or bottled nitrogen, users are liable for hidden costs such as rental, refill and delivery, order processing charges as well as an environmental levy charge.

Nitrogen generators use regular compressed air to deliver a continuous supply of high purity nitrogen - offering a cost effective and reliable alternative to the use of cylinder or liquid nitrogen across a wide range of applications.

When you switch to a nano GEN<sub>2</sub> gas generator you can expect payback typically between 6 to 24 months. This unique design and energy saving function offers a number of significant advantages over delivered gas options as well as traditional generator designs.

The compact system can be installed easily and with a minimum cost and disruption and requires only a pre-treated compressed air system to start production. An on-site generator enables users to fulfill their 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.



## benefits

### guaranteed performance

- reliable performance based on decades of experience with pressure swing adsorption technology
- 100% function and performance tested at our factory
- 2 year warranty

### rapid return on investment

- significant cost savings over cylinder or liquid supply provides a typical return on investment of less than 24 months

### easy to install

- the compact design allows installation in spaces too small for twin tower generator systems

### safe & reliable

- eliminates the safety hazards of transporting and storing pressurized gas cylinders or liquid nitrogen

### environmentally friendly

- lower air consumption and refined controls provide greater energy efficiency
- reduces carbon footprint by eliminating gas delivery to your facility

### easy to maintain

- advanced PLC with HMI touchscreen controls simplify operation and require minimal training
- innovative piston valves significantly reduce maintenance schedules and minimize downtime

### fits any application

- maximum design operating pressure of 232 psig available
- available in a wide range of flow rates and purities from 95% - 99.999%
- can handle any power supply from 100 to 240 VAC in 50 or 60 Hz, 24VDC optional

### design quality

- mass flow controller - ensures correct set pressure and flow
- integral oxygen analyzer - continuously measures gas purity
- purity guarantee valve - automatically vents off out of specification gas
- remote monitoring - enables connection to proprietary remote management and generator control systems

## system performance

The technologically advanced nano GEN<sub>2</sub> nitrogen generator operates on the Pressure Swing Adsorption (PSA) principle to produce a continuous uninterrupted stream of nitrogen gas from clean dry compressed air.

Pairs of dual chamber extruded aluminum columns are filled with Carbon Molecular Sieve (CMS). Joined via an upper and lower manifold, the high density filled columns produce a dual bed system.

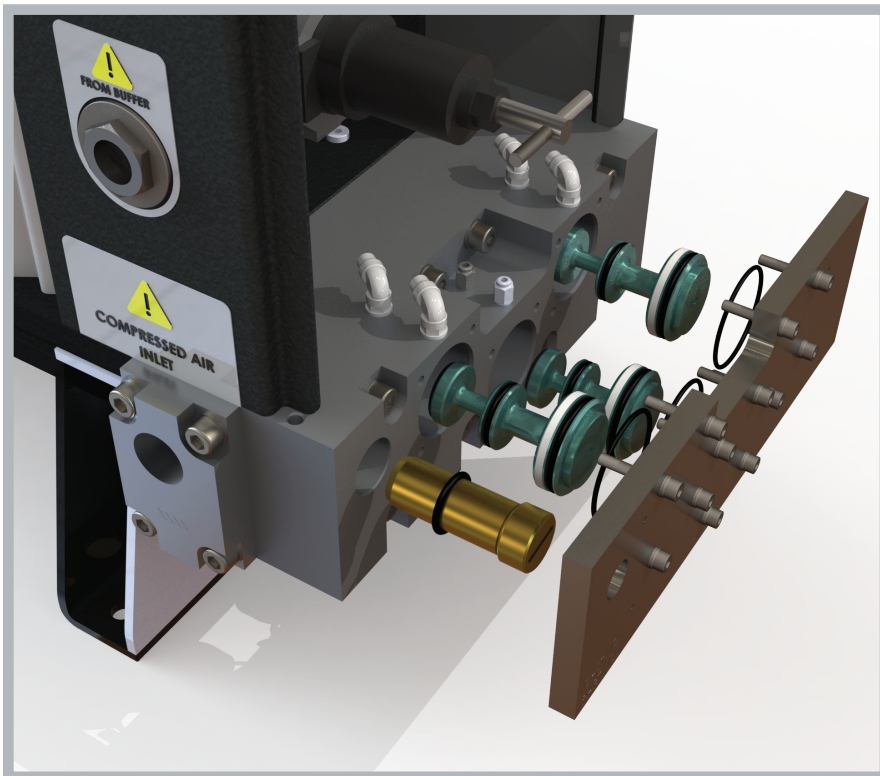
Compressed air enters through the inlet manifold (A) to the bottom of the 'online' bed and flows up through the CMS to separate the compressed air. The clean and dry air then flows up through the CMS stage (C) where oxygen and other trace gases are preferentially adsorbed allowing the nitrogen to pass through. The nitrogen then passes through the supporting bed layer (D) and outlet manifold (E) to the buffer vessel and a nano F<sup>1</sup> buffer vessel filter before reentering the GEN<sub>2</sub> nitrogen generator for purity monitoring.

After a preset time the control system automatically switches the beds. One bed is always online generating nitrogen while the other is being regenerated.

During regeneration, the oxygen that has been collected in the CMS stage and the moisture that has been collected in the optional integrated dryer stage are exhausted to atmosphere. A small portion of the outlet nitrogen gas is expanded into the bed to accelerate the regeneration process.

## reliable high performance valves

Inlet, outlet and exhaust are managed through unique integrated nano piston valves, which are designed for reliability, long service life and ease of maintenance. The generator also incorporates adjustable equalization valves which smooth the column switch over, improve air/ N<sub>2</sub> ratios and extend CMS life. This highly durable valve system is backed by a comprehensive two-year warranty.



# nano GEN<sub>2</sub> nitrogen generators

Traditional nitrogen generators often require installing and operating an external desiccant dryer. The innovative nano GEN<sub>2plus</sub> nitrogen generators feature an integrated dryer cartridge which eliminates the need for a pretreatment dryer of any type. The integrated drying system reduces purge loss by approximately 20% and reduces pressure drop by 10 psi or more which provides significant energy savings over a traditional generator system.

## ecomode energy saving control

This unique control feature utilizes an outlet pressure monitor to reduce energy consumption during periods of low demand to ensure a continuous uninterrupted nitrogen supply while minimizing power consumption.

## multi-bank design

The unique multi-bank design (GEN2 1110 to GEN2 12130) enables additional generators to be added in the future as demand increases. Your GEN<sub>2</sub> nitrogen generator can grow with your company.

## PLC controlled operation

Each GEN<sub>2</sub> nitrogen generator is operated by a reliable PLC control system with digital and optional analog outputs for remote monitoring and alarm capabilities. GEN<sub>2</sub> includes an easy-to-operate touch screen graphical interface which offers valuable features including 'power on', 'hours run', 'oxygen purity', 'pressure', 'online column' and 'service required' indicators. In addition, four pressure gauges provide the operator with continuous indication of column A, column B, air inlet and nitrogen outlet pressures.

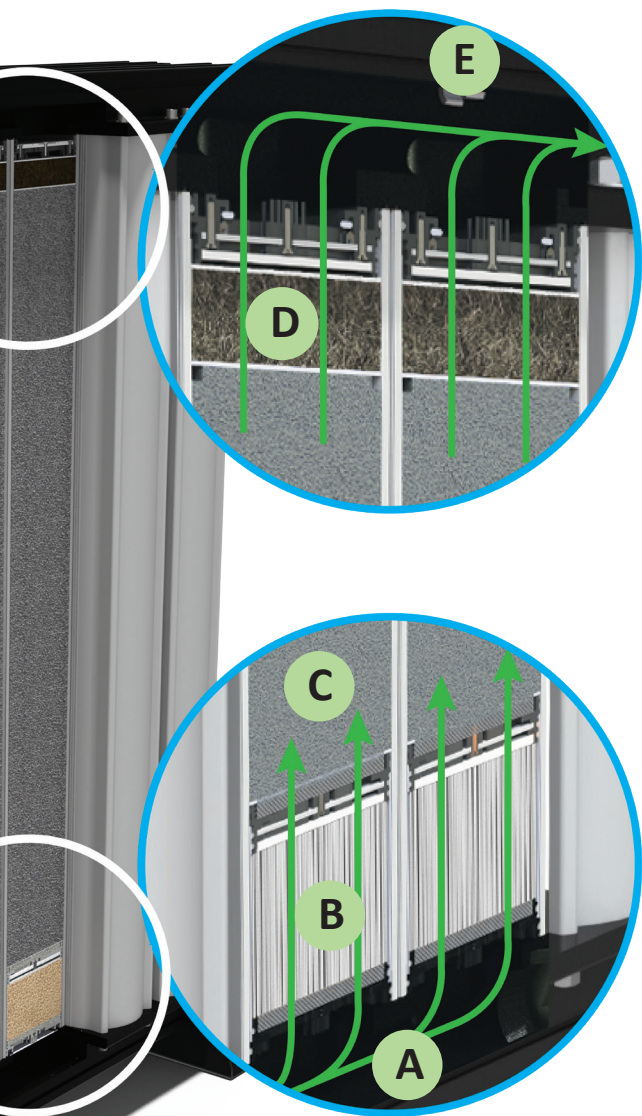


## maximum corrosion protection

High tensile aluminum columns are first alocromed and then powder coated to provide maximum protection for corrosive environments.

## oxygen analyzer

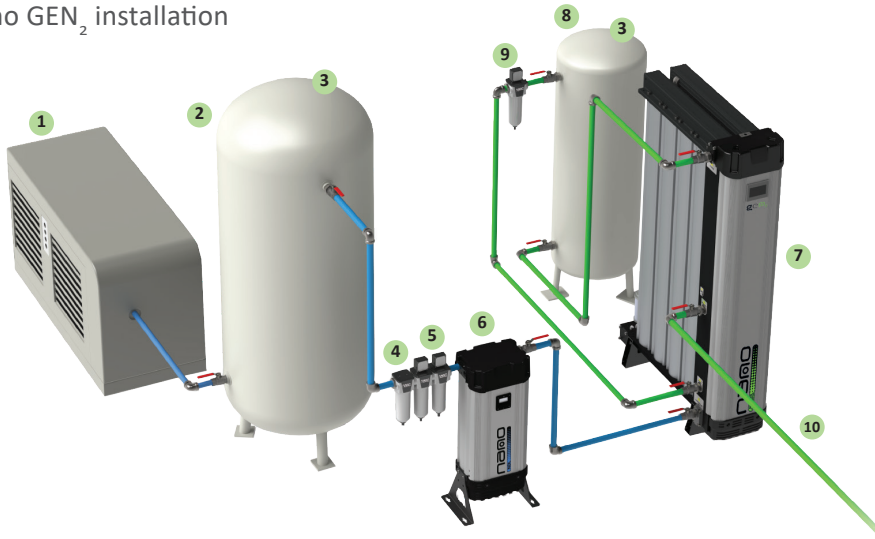
A built in oxygen analyzer continuously monitors the oxygen concentration in the nitrogen stream. Our NEW analyzer utilizes Zirconia Sensor Technology to give a more reliable measurement, faster response time and longer life compared to traditional analyzers. Incorporated into the PLC controls, our oxygen analyzer guarantees downstream purity levels are consistently achieved and maintained.



A	inlet manifold
B	integrated dryer (optional)
C	carbon molecular sieve (CMS)
D	integrated bed support layer
E	outlet manifold

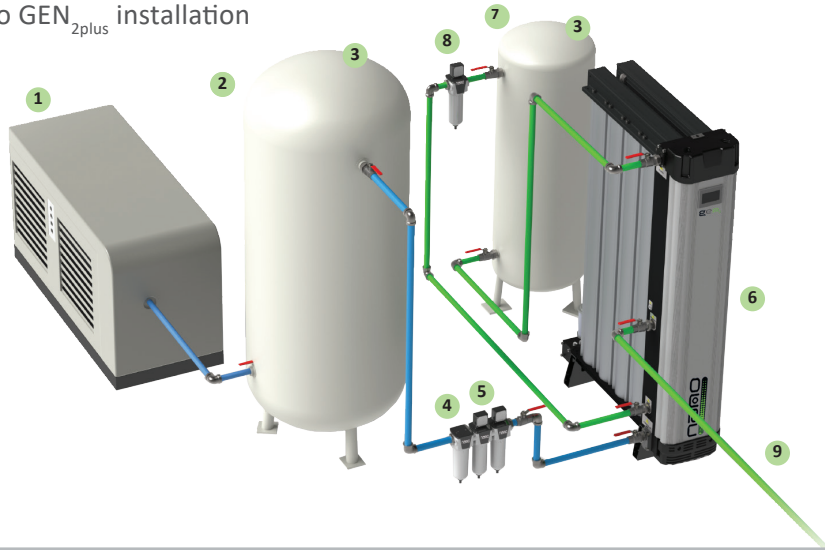
# installation

nano GEN<sub>2</sub> installation



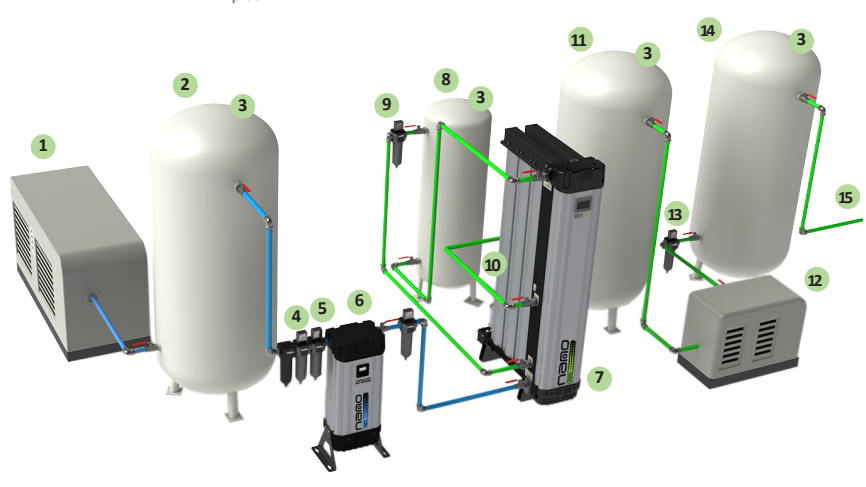
1	compressor
2	wet air receiver
3	pressure relief valves
4	water separator
5	pre filters
6	dryer with integrated dust filter
7	nitrogen generator
8	buffer vessel
9	buffer vessel filter
10	nitrogen outlet

nano GEN<sub>2plus</sub> installation



1	compressor
2	wet air receiver
3	pressure relief valves
4	water separator
5	pre filters
6	nitrogen generator with integrated dryer
7	buffer tank
8	buffer vessel filter
9	nitrogen outlet

nano GEN<sub>2</sub> or GEN<sub>2plus</sub> installation with booster compressor



1	compressor
2	wet air receiver
3	pressure relief valves
4	water separator
5	pre filters
6	optional dryer with integrated dust filter
7	nitrogen generator
8	nitrogen buffer vessel
9	buffer vessel filter
10	nitrogen outlet
11	inlet buffer tank to booster compressor
12	booster compressor
13	mid- or high pressure filters
14	mid- or high pressure nitrogen storage
15	high pressure nitrogen outlet

# GEN<sub>2</sub> in action - return on investment

*“We are so impressed with the operation and performance of the GEN<sub>2</sub> units we are looking to add additional modules next year.”*

A major peanut & snack foods packager in the southeastern US needed to reduce their nitrogen gas costs. They turned to nano-purification solutions and their local authorized nano distributor for assistance. nano worked alongside their distributor with the end customer to design a PSA N<sub>2</sub> generation system which reduced nitrogen gas costs from \$0.52/100 ft<sup>3</sup> down to less than \$0.10/100 ft<sup>3</sup>. Dual GEN2 12130 units produce an impressive 7,840 cfh of nitrogen gas. The modular and expandable design of the nano GEN<sub>2</sub> allows for the customer to simply add modular units as their production increases. The integrated energy efficient ecomode function eliminates the costly compressed air requirement during periods of low or no production.



dual nano GEN2 12130 in service

<b>current liquid N2 cost</b>	application		
	average flow rate	7,840	scfh
	yearly hours of operation	5,840	hours/year
	annual gas requirements	457,856	100 ft <sup>3</sup> /year
	N2 current cost (delivered gas)		
	price per ccf	\$0.52	per 100 ft <sup>3</sup>
	tank rental	included	per year
	delivery and handling fees	included	per year
	total delivered N2 cost per ccf	\$0.52	per ccf
	total delivered N2 annual cost	\$238,085.12	per year

<b>proposed self generated N2 system</b>	N2 system investment		
	air compressor		n/a
	pre-treatment dryer		n/a
	wet air tank		n/a
	N2 generator	\$104,695.06	
	optional equipment	\$40,000.00	installation
	total capital investment	\$144,695.06	
	available depreciation time-frame	7	years
	avg annual investment that can be deducted	\$19,389.14	per year
	compressor requirements		
	air required to the N2 inlet	402	scfm
	cost of compression	\$31,239.02	per year
	estimated maintenance	\$2,000.00	per year
	energy cost \$/kWh	\$0.07	\$/kWh
	annual operating investment	\$33,239.09	per year
	total N2 generation cost per ccf	\$0.07	per ccf
annual cost of N2 generation	\$33,239.09	per year	

<b>financial analysis</b>	ROI investment summary		
	cost per ccf		
	delivered gas	\$0.52	per ccf
	generated on-site	\$0.07	per ccf
	operational costs per year		
	delivered gas	\$238,085.12	per year
	generated on-site	\$33,239.09	per year
	savings by self generating N2		
	generated on-site vs. delivered	\$0.45	per 100 ft <sup>3</sup>
	generated on-site vs. delivered	\$204,846.03	per year
	7 year total savings	\$1,433,922.21	
ROI	8	months	

# sizing & specifications

generator model	rated outlet flow <sup>(1)</sup>	nitrogen purity at the outlet (maximum oxygen content)*											dimensions ins			approx. weight lbs	
		99.999% (10 ppm)	99.995% (50 ppm)	99.99% (100 ppm)	99.975% (250 ppm)	99.95% (500 ppm)	99.9% (0.10%)	99.5% (0.50%)	99% (1%)	98% (2%)	97% (3%)	96% (4%)	95% (5%)	A	B		C
GEN2 1110	scfh	49	71	81	95	109	127	184	205	258	293	335	364	47.8	15.7	23.0	375
GEN2 2110	scfh	99	141	162	191	219	254	367	410	516	586	671	727	47.8	15.7	29.6	437
GEN2 3110	scfh	148	212	244	286	328	381	551	614	773	879	1006	1091	47.8	15.7	36.2	560
GEN2 2130	scfh	180	254	297	353	403	466	667	742	932	1070	1218	1324	71.3	15.7	29.6	589
GEN2 3130	scfh	270	381	445	529	604	699	1001	1112	1398	1605	1828	1986	71.3	15.7	36.2	780
GEN2 4130	scfh	360	509	593	706	805	932	1335	1483	1865	2140	2437	2649	71.3	15.7	42.8	972
GEN2 6130	scfh	540	763	890	1058	1208	1398	2002	2225	2797	3210	3655	3973	71.3	15.7	55.9	1356
GEN2 8130	scfh	720	1017	1187	1411	1610	1865	2670	2966	3729	4280	4873	5297	71.3	15.7	69.3	1739
GEN2 10130	scfh	828	1170	1365	1623	1852	2144	3070	3411	4289	4922	5604	6092	71.3	15.7	82.5	2123
GEN2 12130	scfh	962	1358	1584	1884	2150	2489	3564	3960	4979	5714	6506	7072	71.3	15.7	95.6	2507

\*without integrated dryer system

## specifications

design operating pressure range	87 - 174 psig (6 - 12 barg) <sup>(2)</sup>
design operating temperature range	41 - 122°F (5 - 50°C)
maximum inlet particulate	0.1 micron
maximum inlet dew point	80°F (27°C) PDP
maximum inlet oil content	0.01 ppm <sup>(3)</sup>
maximum outlet dew point	-40°F (-40°C) PDP <sup>(4)</sup>
supply voltage	100 - 240 VAC (50 or 60Hz) or 24VDC

## pressure correction factors<sup>(5)</sup>

operating pressure psig	90	100	115	130	145
operating pressure barg	6	7	8	9	10
correction factor	0.90	1.00	1.10	1.20	1.20

## temperature correction factors<sup>(5)</sup>

inlet temperature °F	41	50	59	68	77	86	95	104	113	122
inlet temperature °C	5	10	15	20	25	30	35	40	45	50
correction factor	0.8	0.9	0.94	1.00	1.00	0.98	0.95	0.90	0.85	0.72

(1) at 100 psig (7 barg) inlet pressure and 68 - 77°F (20 - 25°C) inlet temperature. For outlet flow at all other conditions refer to the correction factors above or contact support@n-psi.com

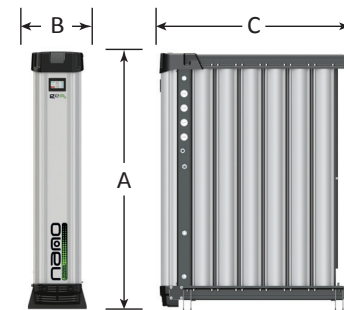
(2) 232 psig (16 barg) is available upon request. Consult factory

(3) including oil vapor

(4) outlet gas dew point is < -76°F (-60°C) in high purity applications

(5) to be used as a rough guide only. All applications should be confirmed by nano. Contact us for sizing assistance

(6) manufacturers of CMS (Carbon Molecular Sieve) recommend a pressure dew point of -4°F (-20°C) to maximize air separation capacity and ensure long service-life



GEN2 1110 to GEN2 12130

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united states

nano-purification solutions ltd  
gateshead, tyne and wear  
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