nano

-POROUS SOLUTIONS LTD

N-Series

ultra-high purity nitrogen generators

Nitrogen purity: 95% to 99.999%

N plus 2

N-Series

ultra-high purity nitrogen generators

Nitrogen purity: 95% to 99.999%

N_2^{plus}

nano-porous solutions limited is one of the world's leading companies specialising in the design and manufacture of industrial compressed air and gas treatment products and dryers.

The business, which is based in the North East of England, has an extremely experienced team of product design and development engineers, led by Colin Billiet – the former Chief Executive of the domnick hunter group Plc.

Working with customers to determine their precise needs, applying our knowledge and experience, n-psl provides 'state of the art' high quality products with innovative features and benefits. Products are manufactured at our UK facility which is accredited to ISO9001:2008. This demonstrates our commitment to continual quality improvement and business excellence.

Dry and Pure Nitrogen

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 is expensive, unreliable, and a safety concern. Nitrogen generators allow users to produce Nitrogen in-house simply and inexpensively using an existing compressed air system.

n-psl recognizes the importance of having a safe, reliable and cost effective supply of high-purity Nitrogen. We have developed the N-Series, N_2^{plus} 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 and Development

Our R&D team endeavour 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 N-Series N_2^{plus} Nitrogen Generators are manufactured in a state of the art facility to the highest standards of build quality to ensure reliability and high levels of performance.

nano **N**-Series Nitrogen Generators

Nitrogen is a dry, inert gas which is used in a wide range of applications where Oxygen may be harmful to the product or processes. Nitrogen generators use 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.

The advanced nano N_2 *plus* range of Nitrogen Generators use integrated Adsorbent Media Tube (AMT) drying cartridges to provide dehydration of the compressed air prior to separation. This innovative feature (patent pending) eliminates the need for a separate desiccant dryer - saving up to 20% purge loss, significantly reducing capital and installation costs and reducing overall pressure drop by 0,7 barg (10 psig) or more over traditional Nitrogen generation systems.

A few of the many industries making the switch to nano N-Series Nitrogen generators include:

- Food Industry Modified Atmosphere Packaging (MAP)
- Beverage (bottling)
- Plastics (PET)
- Pharmaceutical (product transfer)
- Chemicals (blanketing)
- Laser Metal Cutting (burring reduction)
- Fire Prevention (eliminating combustion)
- Electronics (wave soldering)

Adsorbent Media Tubes (AMT)

Reliability is built in... and backed by our 2 year product warranty!

benefits - get more for your money

Guaranteed Performance

- Reliable performance based on decades of experience with pressure swing adsorption technology
- 100% function and performance tested at the 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

Environmentally Friendly

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

Safe & Reliable

- Eliminates the safety hazards of transporting and storing pressurized gas cylinders or liquid Nitrogen

Easy to Install

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

Easy to Maintain

- Integrated Adsorbent Media Tube (AMT) dryer cartridges eliminate the need for an external dryer of any type
- Integrated exhaust silencers require no maintenance or replacement and ensure proper performance
- Advanced controls simplify operation and require minimal training
- Innovative valves significantly reduce maintenance schedules and minimize downtime

Fits Any Application

- Available in a wide range of flow rates and purities (Oxygen contents from 5% to less than 10 ppm)
- Can handle any incoming power supply from 120 to 240 VAC in 50 or 60 Hz, or 24VDC - with just the flick of a switch

2 **Reliability is designed in**

Backed by our 2 year extended warranty

nano **N-Series** Nitrogen Generators

Integrated AMT dryer cartridge

Traditional Nitrogen generators often require installing and operating an external desiccant dryer. The innovative nano N_2 *plus* Nitrogen Generators feature an integrated Adsorbent Media Tube (AMT) drying cartridge which eliminates the need for a pre-treatment dryer of any type. The integrated drying system reduces purge loss by approximately 20% and reduces pressure drop by 10 psi or more, providing 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.

PLC controlled operation

Each N_2 *plus* Nitrogen Generator is operated by a robust and reliable PLC control system with digital and analog outputs for remote monitoring with alarm capabilities. A backlit, clear text display 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.

Floor or wall installation

The smallest NNG -110 model can be floor or wall mounted - simply by rotating the feet 90°.

Multi-bank design

The unique milti-bank design (NNG-2110 to NNG -2130) enables additional generators to be added in the future as demand increases. Your N_2 *plus* Nitrogen Generator can grow with your company.

Reliable high performance valves

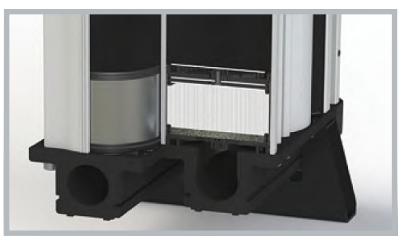
Inlet, exhaust and control air are managed through coaxial flow valves integrated into the upper and lower manifolds . These low maintenance valves provide unrestricted flow capacity. They are designed for durability, ease of maintenance and long service life and are backed by a comprehensive two year warranty.

Maximum corrosion protection

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

Optional Oxygen analyzer

Continuously monitors the Oxygen concentration in the Nitrogen stream. Analyzer is incorporated into the PLC controls to guarantee downstream purity levels are consistently maintained.



Integrated AMT drying cartridges

Adsorbent Media Tubes (AMT)

system performance

The technologically advanced nano N_2 *plus* Nitrogen Generator operates on the Pressure Swing Adsorption (PSA) principle to produce a continuous uninterrupted stream of Nitrogen gas from clean dry compressed air.

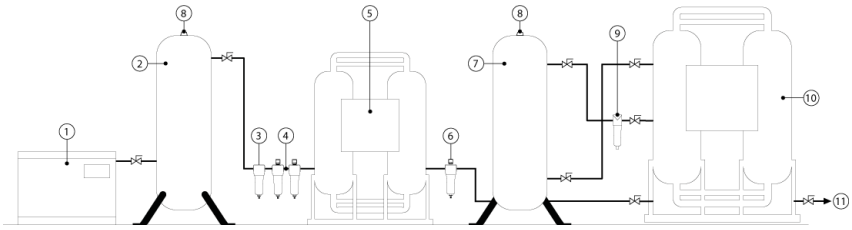
Pairs of dual chamber extruded aluminum columns are fitted with Adsorbent Media Tube (AMT) dryer cartridges and filled with Carbon Molecular Sieve (CMS). Joined via an upper and lower manifold the columns produce a two bed system.

Compressed air enters the bottom of the 'online' bed and flows up through the AMT stage drying the compressed air. The clean and dry air then flows up through the CMS stage where Oxygen and other trace gases are preferentially adsorbed allowing the Nitrogen to pass through.

After a pre-set time the control system automatically switches the beds. One bed is always online generating Nitrogen while the other is being regenerated.

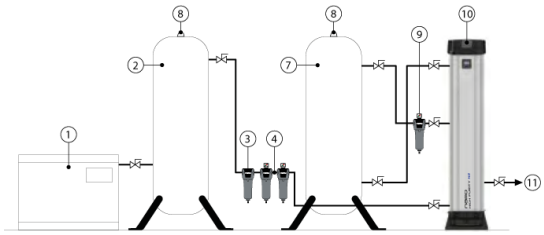
During regeneration the Oxygen that has been collected in the CMS stage and the moisture that has been collected in the AMT stage are exhausted to atmosphere. A small portion of the outlet Nitrogen gas is expanded into the bed to accelerate the regeneration process.

Typical Nitrogen generator installation



1	Compressor
2	Wet Air Receiver
3	Water Separator
4	Pre Filters**
5	Dryer *
6	Dust Filter *
7	Buffer Vessel
8	Pressure Relief Valves
9	Dust Filter
10	Nitrogen Generator
11	Nitrogen Outlet

nano N_2 *plus* installation



* Not required with nano N_2 *plus*

** See service & maintenance parts for details.

PLC controls with clear text display

Reliable & durable coaxial flow valves

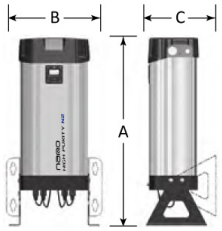
nano N-Series generators - in detail

Model	Inlet Pressure	Outlet Pressure	Outlet Flow (1)	Maximum oxygen content in outlet gas (purity)											
				10 ppm	50 ppm	100 ppm	250 ppm	500 ppm	0.10%	0.50%	1%	2%	3%	4%	5%
NNG-1110	7 barg		m^3/hr	0.6	1.0	1.6	1.9	2.1	2.5	3.8	4.5	5.5	6.5	7.5	8.0
	100 psig		scfh	21	35	56	67	74	88	134	159	194	230	265	282
	9 barg	7.5 barg	m^3/hr	0.65	1.25	2	2.4	2.7	3	4.8	5.7	7	8.25	9.5	10
	130 psig	110 psig	scfh	23	44	71	85	95	106	169	201	247	291	335	353
Buffer Tank 50 litres/15 US gallons/3,000 cu ins															
NNG-2110	7 barg		m^3/hr	1.2	2.0	3.2	3.8	4.2	5.0	7.6	9.0	11.0	13.0	15.0	16.0
	100 psig		scfh	42	71	113	134	148	177	268	318	388	459	530	565
	9 barg	7.5 barg	m^3/hr	1.3	2.5	4	4.8	5.4	6	9.6	11.4	14	16.5	19	20
	130 psig	110 psig	scfh	46	88	141	169	191	212	339	403	494	583	671	706
Buffer Tank 100 litres/30 US gallons/6,000 cu ins															
NNG-3110	7 barg		m^3/hr	1.8	3	4.8	5.7	6.3	7.5	11.4	13.5	16.5	19.5	22.5	24
	100 psig		scfh	64	106	169	201	222	265	403	477	583	689	794	847
	9 barg	7.5 barg	m^3/hr	1.95	3.75	6	7.2	8.1	9	14.4	17.1	21	24.75	28.5	30
	130 psig	110 psig	scfh	69	132	212	254	286	318	508	604	742	874	1006	1059
Buffer Tank 150 litres/45 US gallons/9,000 cu ins															
NNG-2130	7 barg		m^3/hr	2	3.8	5.4	7.2	8.6	9	14.2	18	22	26	29	32
	100 psig		scfh	71	134	191	254	304	318	501	636	777	918	1024	1130
	9 barg	7.5 barg	m^3/hr	2.4	4.2	6	8.2	10	10.6	16.8	22.8	28	33	38	40
	130 psig	110 psig	scfh	85	148	212	290	353	374	593	805	989	1165	1342	1412
Buffer Tank 150 litres/45 US gallons/9,000 cu ins															
NNG-3130	7 barg		m^3/hr	3	5.7	8.1	10.8	12.9	13.5	21.3	27	33	39	43.5	48
	100 psig		scfh	106	201	286	381	455	477	752	953	1165	1377	1536	1695
	9 barg	7.5 barg	m^3/hr	3.6	6.3	9	12.3	15	15.9	25.2	34.2	42	49.5	57	60
	130 psig	110 psig	scfh	127	222	318	434	530	561	890	1208	1483	1748	2013	2119
Buffer Tank 250 litres/45 US gallons/15,000 cu ins															
NNG-4130	7 barg		m^3/hr	4	7.6	10.8	14.4	17.2	18	28.4	36	44	52	58	64
	100 psig		scfh	141	268	381	508	607	636	1003	1271	1554	1836	2048	2260
	9 barg	7.5 barg	m^3/hr	4.8	8.4	12	16.4	20	21.2	33.6	45.6	56	66	76	80
	130 psig	110 psig	scfh	169	297	424	579	706	749	1186	1610	1977	2330	2684	2825
Buffer Tank 250 litres/45 US gallons/15,000 cu ins															
NNG-6130	7 barg		m^3/hr	6	11.4	16.2	21.6	25.8	27	42.6	54	66	78	87	96
	100 psig		scfh	212	403	572	763	911	953	1504	1907	2330	2754	3072	3390
	9 barg	7.5 barg	m^3/hr	7.2	12.6	18	24.6	30	31.8	50.4	68.4	84	99	114	120
	130 psig	110 psig	scfh	254	445	636	869	1059	1123	1780	2415	2966	3496	4025	4237
Buffer Tank 250 litres/45 US gallons/15,000 cu ins															
NNG-8130	7 barg		m^3/hr	7.6	14.44	20.52	27.36	32.68	34.2	53.96	68.4	83.6	98.8	110.2	121.6
	100 psig		scfh	268	510	725	966	1154	1208	1905	2415	2952	3489	3891	4294
	9 barg	7.5 barg	m^3/hr	9.12	15.96	22.8	33.16	38	40.28	63.84	86.64	106.4	125.4	144.4	152
	130 psig	110 psig	scfh	322	564	805	1100	1342	1422	2254	3059	3757	4428	5099	5367
Buffer Tank 500 litres/90 US gallons/30,000 cu ins															
NNG-10130	7 barg		m^3/hr	9.3	17.67	25.11	33.48	39.99	41.85	66.03	83.7	102.3	120.9	134.85	148.8
	100 psig		scfh	328	624	887	1182	1412	1478	2332	2955	3612	4269	4762	5254
	9 barg	7.5 barg	m^3/hr	11.16	19.53	27.9	38.13	46.5	49.29	78.12	106.02	130.2	153.45	176.7	186
	130 psig	110 psig	scfh	394	690	985	1346	1642	1740	2758	3744	4597	5418	6239	6568
Buffer Tank 500 litres/90 US gallons/30,000 cu ins															
NNG-12130	7 barg		m^3/hr	10.8	20.52	29.16	38.88	46.44	48.6	76.68	97.2	118.8	140.4	156.6	172.8
	100 psig		scfh	381	725	1030	1373	1640	1716	2708	3432	4195	4958	5530	6102
	9 barg	7.5 barg	m^3/hr	13	23	32	44	54	57	91	123	151	178	205	216
	130 psig	110 psig	scfh	458	801	1144	1564	1907	2021	3203	4347	5339	6292	7246	7627
Buffer Tank 500 litres/90 US gallons/30,000 cu ins															
Nominal Air: Nitrogen Ratio				11	9	7	5	4.5	3.5	3	2.8	2.5	2.3	2.2	2.1

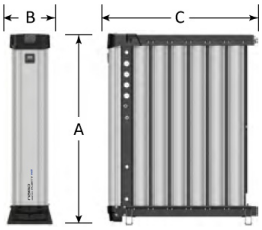
(1) At 7 barg (100 psig) inlet pressure and 20 - 25°C (68 - 77°F) inlet temperature.

sizing

Model	Dimensions mm (in)			Weight Kg (Lbs)
	A	B	C	
NNG-1110	1240 (49)	400 (16)	300 (12)	50 (176)
NNG-2110	1200 (47)	400 (16)	650 (26)	110 (242)
NNG -3110	1200 (47)	400 (16)	820 (32)	170 (374)
NNG-2130	1800 (71)	400 (16)	650 (26)	166 (365)
NNG -3130	1800 (71)	400 (16)	820 (32)	222 (490)
NNG-4130	1800 (71)	400 (16)	990 (39)	277 (610)
NNG-6130	1800 (71)	400 (16)	1320 (52)	387 (852)
NNG-8130	1800 (71)	400 (16)	1660 (65)	550 (1100)
NNG-10130	1800 (71)	400 (16)	2000 (79)	610 (1350)
NNG-12130	1800 (71)	400 (16)	2330 (92)	722 (1600)



NNG-1110



NNG-2110 to 12130

service & maintenance parts

Service & Maintenance Parts	Qty.	Part Number
O_2 Analyzer Cell	1	NDK020
Inlet Valves*	1	NVKD3 2
Exhaust Valves*	1	NVKD3 2
Outlet Valves*	1	NVKD3 1
Pilot Valve Set	1	NPVKD3
Integrated Column After Filters	8	NDK100
Pre Fillter Element (grade M1 = 1 micron)	1	E0070M1
Pre Fillter Element (grade M01 = 0.01 micron)	1	E0070M01
Buffer Vessel Fillter Element (grade M1 = 1 micron)	1	E0070M1

* Note: Includes (2) Valves.

specifications

Outlet Gas Dewpoint	< -40°C/°F (high purities < 60°C/-75°F)						
Minimum Working Pressure	6 barg (87 psig)						
Maximum Working Pressure	10 barg (145 psig) up to 16 barg (232 psig) available on request						
Supply Voltage	100-240VAC / 50-60Hz or 24V DC						
Minimum Inlet Temperature	1.5°C (34.7°F)						
Maximum Inlet Temperature	35°C (95°F)						
Temperature Correction Factors for other Consult Factory	20-25°C (68-77°F) 1		26-35°C (70-95°F) 0.95			36-40°C (97-104°F) 0.9	
Pressure Correction Factors bar (psig) factor	6 (87) 0.9	7 (100) 1	8 (116) 1.1	9 (130) 1.2	10 (145) 1.25	11 (160) 1.3	12-16 (174-232) 1.35

Inlet Air Purity	Dirt	Humidity	Oil, including Vapour
External Dryer	≤0.1µ	Pressure dew point -40°C/°F	≤0.01mg/m³
Integral AMT Dryer	≤0.1µ	PDP +27°C (80°F) maximum	≤0.01mg/m³

Inlet Air Purity Requirements			Inlet Temperature		Working Pressure		Outlet Gas Dewpoint	Supply Voltage
Particulate	Dewpoint	Oil Content	Minimum	Maximum	Minimum	Maximum		
< 0.1 micron	< 27°C (80°F) PDP	< 0.1 ppm (2)	1.5°C (35°F)	35°C (95°F)	6 barg (87 psig)	10 barg (3) (145 psig)	< -40°C (-40°F) PDP (4)	120-240 VAC 50 or 60 Hz or 24 VDC

(2) Including oil vapor.

(3) 16 barg (232 psig) maximum working pressure models are available on request.

(4) Outlet gas dewpoint is < -60°C (-76°F) in high purity applications.

Ultra High Purity Compressed Air Desiccant Dryers

D

Clean and dry compressed air is easily achieved with the range of ultra high purity heatless desiccant compressed air dryers. They offer unprecedented equipment reliability and high levels of performance.

D-Series

CO_2 Adsorption Dryers

C

The nano C-Series of CO2 Adsorption Dryers purify compressed air to deliver a continuous supply of clean, dry (-70°C pdp) and CO2 free (<1 ppm) purge gas.

C-Series

Nitrogen Generators

N

The nano N-Series range of Nitrogen generators use regular compressed air to deliver a continuous supply of high purity Nitrogen whilst offering a cost effective, reliable and safe alternative to the use of bottled gases. Nitrogen Purity from 97% to 99.999%.

N-Series

AMT Products [Adsorbent Media Tubes]

AMT

With Applications in Drying Compressed Air and Gases, CO_2 Recovery and Contaminant Removal from air and gases, there are many and varied types of product options available for Adsorbent Media Tube (AMT) technology.

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