

Guide to Nitrogen Gas Generation PPNG & PMNG

April 2018

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Gas Generators

Pneumatech designs and manufactures both standard and engineered on-site gas generator products. Nitrogen and Oxygen generators are available with Pressure Swing Adsorption (PSA) and Membrane technology.

Nitrogen Generators PPNG

PPNG nitrogen generators use Pressure Swing Adsorption technology to extract nitrogen molecules from compressed air, and can reach purities from 95% up to 99.999%. Nitrogen pressures can go up to 12 bar (g) without the need for an additional booster.

With its PPNG series, Pneumatech follows the plug-and-play philosophy. Pressure vessels, valves , exhaust system, sensors and controls are all integrated within a compact canopy, designed for easy transport, installation and service.

The Purelogic is the central brain of the nitrogen generator, It optimises operating costs thanks to the availability of the energy saving control, ensures maximum reliability by keeping track of the most important parameters of the generator; and offers impressive control and monitoring capabilities.

The optional flow meter and inlet pressure dew point sensor can be added to the scope of supply to further exploit the monitoring capabilities of the Purelogic controller.

Nitrogen Generators PMNG

Pneumatech's PMNG nitrogen generators utilise proprietary membrane separation technology. Membrane generators are an excellent choice in low (95%) to medium (99,5%) purity applications such as tyre inflation, fire prevention, tank blanketing and pipeline drying. Nitrogen pressures can go up to 12 bar (g) without the need for an additional booster.

With the PMNG, on-site nitrogen supply becomes exceptionally convenient. All pre-filters and controls are included inside the canopy. Only a supply of dry compressed air and electricity is needed to get nitrogen at the outlet of the generator. An outlet buffer vessel is not required, resulting in significant space savings and easy installation. Also the start-up procedure of the PMNG is made so straightforward that it does not require any specialist interventions.

Thanks to the Purelogic controller, the PMNG offers impressive control and monitoring capabilities. Various pressure and temperature sensors ensure that the membranes are used in the right working conditions. The nitrogen purity can easily be set with the purity regulator and is reliably monitored. The optional pressure dew point (PDP) sensor and oil indicator sensor safeguard air purity of class 1:4:1 according to ISO8573:1:2010 at the inlet of the membranes.

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Application and Uses

- Chemical Industry - Widely used for blanketing and purging applications to displace or dilute all unwanted gas or vapour and prevent explosions.
- Metal Industry - Shielding or assist gas for plasma cutting aluminium and stainless steel and as an assist gas for laser cutting stainless steel.
- Metal Industry - Heat treatment process to protect some of the most reactive metals.
- Aviation - Tyre inflation to maintain consistent pressures and help extend tyre life.
- Food and Beverage - Widely used within Food & Beverage industry as Modified Atmosphere Packaging as a way of extending product shelf life.
- 3D printing - Selective laser sintering to prevent oxidisation.
- Plastic Industry - Injection blow moulding to reduce wall thickness and imperfections such as cracks or discolouration.
- Electronics Industry - Soldering of PCB's to improve joint quality.
- Drinks Industry - Purging during wine bottling to prevent bacterial growth, preserve taste and extend shelf life.
- Pharmaceutical Industry - Packaging to extend shelf life and ensure quality of product.

Automotive | Textile | Power Generation | General Industry | Oil & Gas | Food & Beverage | Electronics

Case Study

Cofresh, one of the UK's favourite manufacturers of Indian snack foods has optimised its compressed air supply system with a Pneumatech Nitrogen Generator and associated ancillaries.

By supplying Nitrogen to a given Purity, Pressure and Flow rate the negative effects of oxygen on the snack products is eliminated and significantly increase the shelf life and quality of the snack. Allowing Cofresh to meet its increasing worldwide consumer base, exporting the snacks all over the world.

Benefits of Nitrogen N2

- Inert to nearly all substances at ambient temperatures.
- Nitrogen keeps laser-cut surfaces oxide-free due to the chemical inertness to react with the atmosphere.
- Reduces internal degradation of the rubber in tyres due to oxidisation.
- Widely used within the food industry for Modified Atmospehere Packaging to extend product shelf life - Nitrogen even has it's own food grade standard E941

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Quick Tip!

Look for the bottles first as these are easier wins, liquid tanks tend to be 2-3 year supply contracts.

Points to Note

Onsite gas generation eliminates:

- Health and Safety - Manual handling of single cylinders.
- Multiple bottle pack rental for standby bottle packs on high volume usage will require lots of storage space.
- Enviromental - no transport delivery costs saves carbon footprint.

Gas Company Suppl

- The most commonly used bottle is the size “W” with a fill pressure of 230 Bar (g)although fill pressures can vary from 200-300 Bar (g). The water fill volume is 48 litres.
- The cylinder contents can be calculated by multiplying the fill volume by the fill pressure. 48 litres x 230 Bar (g) equates to 11,040 litres of gas or 11M³.
- A manifold cylinder pack typically holds 15 size “W” botles. At 230 Bar (g) cylinders this equates to 165M³ of gas.
- The charges typically include the delivery costs and also the rental of cylinders, any spare packs or empty packs on site will incur these charges. Other factors to note are health and safety obligations - storage, manual handling. Plus any late deliveries can result in no gas so production losses.

Un-useable gas 5% to 20%

- It is worth noting that not all the gas within a cylinder can be used - if the end user has a process requiring 10 Bar g then supply pressure would be 12 Bar (g).
- On a single bottle the remaining un-useable gas would be 0.57M³ and a manifold cylinder pack this increases to 8.6M³ of gas.
- This is 5% of gas which the end user has been charged for that is returned each time to the supply company and if using higher pressures of say 40 Bar (g) this equates to 20%.

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Liquid Mini Tanks

- Typically stainless steel construction with an inner vessel in sizes ranging from 200 to 2000 litres at operating pressures between 16 and 32 Bar.
- Cryogenic liquid cylinders are insulated, vacuum jacketed pressure vessels with an internal evaporator to convert liquid to gas.
- Designed for low flow rates due to the size of the internal evaporator, temperatures also play a key part in ensuring complete evaporation of the liquid.
- Flow rate and duty cycle will have been provided by the supplying gas company and will be typically 11 -25 M^3/hr and 8 hour duty cycle.
- Liquid mini tanks will often be filled twice a week by cryogenic tanker - delivery will vary in quantity as the tanks are topped up rather than filled from empty.
- Gas company will invoice monthly for litres of liquid N2 delivered, environmental levy to cover CO2 emissions from manufacture and delivery, number of deliveries and mini tank rental.
- With temperature fluctuations this will cause the liquid to heat up and evaporate which is vented to atmosphere with losses of 2% per day from mini tank.

Quick check!

- Is the nitrogen outlet pipework to the customers process insulated? If it is this would indicate the N2 is being supplied as Cryogenic N2 for freezing or refrigerant cooling applications.
- Pneumatech PPNG nitrogen generators can only provide gaseous nitrogen.

Capacity in M^3 of N2

- Liquid capacity of tank will be on dataplate in litres.
- Typical sizes range from 200 - 2000 litres.
- Multiply litres x 0.694 to obtain M^3 of gas.
- Nominal gas capacity from 136M^3 to 1350M^3.

Points to note

- Duty cycle is 8 hours max.
- Flow rate limitations.
- Static evaporation losses typically 2% per day.
- Delivery charges.
- Rental charges.
- Chance to run out of gas.

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Bulk Liquid Tanks

Capacity in M^3 of N2

- Liquid capacity of tank will be on dataplate in litres.
- Typical sizes range from 2000- 49000 litres.
- Multiply litres x 0.694 to obtain M^3 of gas.
- Nominal gas capacity from 1388M^3 to 34000M^3.

Points to note

- Static evaporation losses typically 3-10% per month.
- Delivery charges.
- Rental charges.
- Gas companies will have on site N2 generator and use liquid tank as back up.
- Liquid tank used for stand by, back up or peak shaving is very wasteful due to the boil off rate.
- An oversized vessel for the actual demand is again wasteful - has the users demand dropped?

Bulk Liquid Tanks

- Typically carbon steel construction with an inner vessel in sizes ranging from 2000 to 49000 litres at operating pressures between 16 and 32 Bar.
- Cryogenic liquid cylinders are insulated, vacuum jacketed pressure vessels with an external evaporator to convert liquid to gas.
- Designed for high flow rates - severe icing on evaporator a good indicator of high flow rates being drawn.
- Liquid tanks will often be filled twice a week by cryogenic tanker - delivery will vary in quantity as the tanks are topped up rather than filled from empty. Telemetry on tank feeds levels back to gas company and deliveries planned.
- Gas company will invoice monthly for litres of liquid N2 delivered, environmental levy to cover CO2 emissions from manufacture and delivery, number of deliveries and tank rental.
- In general it can be assumed a liquid nitrogen vessel will boil off or waste somewhere between 3 and 10% of its contents in a month. If no gas is being drawn off or used a bulk vessel will loose all it's contents in 3 months.
- Air products publish figures for boil off per month based on vessel size on website.

Quick check!

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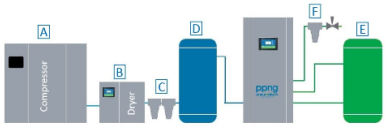
Performance data										
Type	Nominal performance at specified conditions				Effective performance at specified nitrogen output level					Sizing
Model	Nitrogen flow	Air ratio	Air consumption	N2 purity	Nitrogen flow	Air ratio	Air consumption	N2 purity	Outlet pressure	
	[Nm³/h]*		[Nm³/h]*	%	[Nm³/h]*		[Nm³/h]*	%	[barg]	
PPNG41HE PPM	22,5	4,7	106	99,9900	23	4,7	107	99,9890	6,3	Undersized
PPNG50HE PPM	27,5	4,7	130	99,9900	23	5,3	121	99,9960	6,3	Recommended
PPNG63HE PPM	33,7	4,4	147	99,9900	23	5,5	127	99,9980	6,3	Oversized

Recommended equipment						
A Min. compressor FAD	B Fridge dryer	C G, C & D size	C VT size	D Air receiver	E N2 receiver	F D size
[Nm³/h]*				[L]	[L]	
118	Standalone	4 HE	VT2	1500	1000	2 HE
134	Standalone	4 HE	VT2	1500	1000	2 HE
140	Standalone	4 HE	VT2	2000	1500	2 HE

Notes:
always refer to the installation proposal for a detailed overview of the installation and sizing of all equipment
* Nm³/h: reference at 20°C, 1000mbar, 0% R.H.
** Nitrogen purity = actual inert gas purity

Proposal image****



download report

Sizing the system

- 3 key figures for sizing nitrogen generator are - Purity - Pressure - Flow
- Does the end user know the flow rate they require? Are there any flow meters in the system to verify this?
- To establish usage, are the delivery notes / invoices available from the existing supplier? (if the application is seasonal, multiple delivery notes / invoices will be required).
- Where is the nitrogen being used, number of packaging machines, tanks to blanket etc? The more information on the application the better as it will allow us to establish a data base on application - flow rates and purity.
- Purity - The level of purity provided from bottles supplied by gas companies will be 99.999%. However, most applications do not require this level of purity. Establish the purity level required or the details of the application. If not available other site references / applications will assist us in obtaining this.
- Shift patterns - gas usage over 8 hour, 16 hour, 24 hour and 5 or 7 days.
- Pressure required at point of use.
- Sizing a nitrogen generator is very similar to sizing a compressor. How much nitrogen is required (flow)? What pressure is required? What purity is required?

Typical N2 Industry Applications

N2 Application	Industry	Typical Purity (%)	Typical Pressure (BAR)
Paint blanketing/ spray		95-98	3
Soldering - Lead free soldering		99.99	5-6
Dry box storage		95-99	3
Parts cleaning		95-98	3
Modified Atmospheric Packaging		99.5	3
Pneumatic Transport - All Drinks		99.9	5-6
Food Injection		99.9	3
Fire Prevention		95-99	3
Inert blanketing		95-99	3
Purging natural gas lines		95-98	3
Gas Sealing		95-97	3
Injection Moulding		95	3
Heat Treating		95-99	3

Key

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