NITROGEN GENERATION
ONSITE SOLUTIONS
MEMBRANE / PSA-N₂
OVERVIEW

Pulford Air & Gas are an Australian owned company who specializes in the design, manufacture and service of quality air compressors and nitrogen gas systems.

The company has been producing and servicing air compressors since 1925 and since 2005 has concentrated on developing on-site nitrogen systems for industry all over Australia, from mining to food packaging and everything in between.

We pride ourselves on being market focused, continually supporting the development of innovative new products.

With over 600 systems around Australia, Pulford’s Nitroplus systems are seen as the benchmark in on-site gas systems tailored to your industry and direct gas requirements.

The four key benefits of on-site nitrogen generation:

- No locked in contract with gas companies
- No running out of gas during production or batching
- No exorbitant delivery fees
- No cumbersome bottles or dangerous liquid nitrogen

The NitroPlus systems can be fully containerized for ease of installation and the potential to be moved should the need arise.

OUR NITROGEN SYSTEMS

The systems can be designed for any range or applications from 1m³/hr up to 3000m³/hr, and from 90% purity all the way up to 99.9995%.

Each application is different so Pulford take time to work through the application and requirement. As there are different ways of producing the nitrogen gas, it is important for the client that they choose the most efficient and economical on-site generator in order to maximize the return on the capital purchase.
NITROGEN – MEMBRANE OR PSA (PRESSURE SWING ABSORPTION)

There are two ways to produce the nitrogen gas, Membrane and PSA, it is crucial that you have the right process for your application.

MEMBRANE

Membrane gas production is efficient from 90% to 98% giving you constant flow through the use of separation technology. As air passes through the membrane under different pressure and flow characteristics, the purity of the nitrogen gas changes to effect the gas requirement desired at the outlet.

MEMBRANE GAS SEPARATION PRINCIPLE

Applications for membranes system are wide and varied. From coffee packaging to tyre filling all the way to fire suppression and chemical blanketing.
INHOUSE DESIGN

Many factors are considered when selecting the right membrane including flow and purity required, pressure at the outlet, air requirement and supply, cost of production and so on. Pulford work out the best combination of compressor and membrane to ensure you have an economically costed unit, with the lowest running costs to ensure your get the return on investment.

INFLUENCE OF PRESSURE

Relation flow and pressure at different purities

While membrane are efficient in many applications, the demand for air from the membrane means that in higher flows and in higher purity, there is a need for a different generator and this is where the PSA unit comes in.
PSA – PRESSURE SWING ABSORPTION

These generators use a different principle of adsorption rather than separation. By employing CMS (carbon molecular sieve) technology, the twin tower units are able to produce nitrogen gas at very high flows and purity, very efficiently.

OUTLINE DRAWING OF THE PSA NITROGEN GENERATOR

MAIN TECHNICAL PARAMETERS

<table>
<thead>
<tr>
<th>NITROGEN FLOW</th>
<th>NITROGEN PURITY</th>
<th>NITROGEN PRESSURE</th>
<th>DEW POINT</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1-3000Nm3/H</td>
<td>97-99.9995%</td>
<td>0.05-1.0MPa</td>
<td>-60°C</td>
<td>-45°C</td>
</tr>
</tbody>
</table>

COMPONENTS DESCRIPTION

1. COMPRESSED AIR CLEANING ASSEMBLY
   Parts – Filters, Refrigerant dryer, oil removal unit:
   Function – Removes Impurities such as water, oil and dust from compressed air and provides a clean air source for oxygen and nitrogen separation.

2. AIR TANK ASSEMBLY
   Parts – Air tank and valves
   Function – Buffers and reduces air pulsation and reduces system pressure fluctuation ensuring stable air passing through the air filtration assembly.

3. OXYGEN AND NITROGEN SEPARATION ASSEMBLY
   Parts – Two Adsorption towers, control valves, Carbon Molecular Sieve (CMS), cylinders and instrumentation.
   Function – Separates nitrogen from other elements in the compressed air.

4. NITROGEN BUFFER TANK ASSEMBLY
   Parts – Buffer tank, flow meter, pressure regulating valve
   Function – Balances the pressure and purity of the gas being produced ensure a stable supply of nitrogen.
PSA NITROGEN GENERATOR PRINCIPLES

Pressure Swing Adsorption (PSA) is an advanced gas generation technology. It remains the leading technology in the on-site gas supply field.

As shown in the diagram above, CMS has different adsorption characteristics between oxygen and nitrogen. There are tiny holes inside the CMS and under certain pressure, the tiny holes have different adsorption capacity between the two gases. When air pressure increases the CMS adsorbs oxygen and produces nitrogen, when the air pressure drops to normal conditions, the CMS releases oxygen and regenerates itself. Two towers are provided so when one is adsorbing oxygen and producing nitrogen the other is releasing oxygen and regenerating. This alternate process gives you consistent supply of nitrogen gas.

EXCELLENT ENERGY-SAVING FEATURES REDUCE AIR USAGE COST

Advanced process flow directly reduces compressed air consumption.

The energy saving PSA generator provided by Pulford adopts an unequal pressure equalization process (patent 364126). This process changes the lower pressure equalizing position where the equalizing pressure comes from the middle part of the adsorbing tower and enters the bottom part of the releasing tower to equalize pressure. The inverted structure ensures the nitrogen purity is equalized through both adsorption and desorption.

The direct effect is the increase of nitrogen recycle rate and nitrogen production volume, the indirect benefit is energy saving.

THE HIGHER THE NITROGEN PURITY, THE MORE ENERGY-SAVING
WORLD FAMOUS MOLECULAR SIEVE ENSURES MAXIMUM ENERGY-SAVING

Pulford has been working with the leading manufacturers of PSA system for more than 10 years. Their technology in selecting the best CMS has led to the highly efficient world famous CMS product being used in today’s systems. Using only the best quality elements ensures reliability and energy efficiency.

ADVANCED LOAD ADAPTATION TECHNOLOGY FURTHER SAVES ENERGY

Load adaption is a new technology developed by Pulford’s leading supplier through years of constant PSA R&D. While monitoring the gas demands, the load adaption technology realizes energy saving by prolonging the adsorption circulation period reducing air requirement for the gas demand.

PATENT VALVE GUARANTEES STABLE EQUIPMENT OPERATION

Actuators located inside the valve body offer flexible function of open and close, swift reaction times for opening and closing, display feedback indicators, convenient installation and maintenance, zero leakage, and good air tightness. Valve seat life times are three times that of traditional valves.
NITROGEN BUFFER TANK ENSURES STABLE SYSTEM GAS SUPPLY

The nitrogen buffer tank assembly consists of a buffer tank, flow meter, dust filter pressure adjusting valve and throttle valve. The main purpose of this assembly is for stabilizing the pressure, purity and flow of the nitrogen produced by recirculating and dispersing of un-pure nitrogen produced.

PATENTED COMPACTION TECHNOLOGY ENSURE LONG LIFE OF THE CMS

Stable compacting pressure means there is no alteration in the packing and compaction of the CMS under travel conditions or during adsorption and desorption.

The unit is fitted with sinking alarms with auto shutdown features if the CMS becomes unstable and the volume reduces due to dusting.

LONG-DISTANCE SUPERVISION AND CONTROL

From a control room you can access the display of nitrogen control and purity, pressure, fault information and other features. Full equipment operating parameter control can be achieved remotely as an option.
PROFESSIONAL TECHNOLOGY ENSURES RELIABLE GAS SUPPLY

Two pneumatic valves connected in series through the middle of the adsorption towers open and close systematically to ensure that the purity of nitrogen during the adsorption process. The PLC judges the purity conditions of the nitrogen produced and opens or closes these valves electromagnetically to adjust the purity of the system.

EASY TO USE HUMAN MACHINE INTERFACE

Industrial touch screen displays nitrogen flow, purity, inlet and outlet pressure and fault information. The system can also be connected optionally to a network for remote operation where parameters can be modified online.

QUALITY COMPONENTS ENSURE RELIABLE EQUIPMENT LIFE
INDUSTRY USING NITROGEN GAS

FOOD & BEVERAGE

• Avoiding oxidation, mould growth, damp and pest infection
• Package process gas, retain freshness, storage of liquor and beverage

TYRE FILLING & MANUFACTURE

• Charging rubber capsule with N2 instead of water vapor for anti-oxidation under the high pressure forming.
• Advantages: effectively extended the lifetime for tire and significantly reduce the fabricating cost.
• Reduces tyre life / pressure stability

CHEMICAL INDUSTRIAL

• N2 blanketing and disperrement
• Clean, pressurisation, chemical reaction stir, chemical fiber production protection.
• Synthetic fiber swaging with N2, wire drawing anti-oxidation.

OTHER APPLICATIONS

• Nitrogen is also widely used in petroleum, metallurgy, electronics, transportation, agriculture, medicine and other industries as shielding gas, gas displacement, purge gas and fill medium.