PSA NITROGEN GENERATORS
MOLECULAR SIEVE TECHNOLOGY

Technology License from
CarboTech AG
Your Adsorption Company
Since its inception in 1977, **MVS Engineering** has been at the forefront of technology and has supplied over 10000 units worldwide. We are a turnkey supplier of Air and Gas equipments and have been a market leader in developing and executing on-site systems for continuous uninterrupted supply of high purity gases and dry air.

Our products are offered in technical collaborations with world leading companies such as **CarboTech AC GmbH** (Germany), **Proton OnSite**, **Air Liquide**, **Adsorptech** and **Hy9** from USA. So, our customers not only benefit from world leading technologies, but also very price competitive solutions due to low manufacturing cost in India.

Reputed companies all over India and around 60 countries worldwide are proudly using MVS equipments.

---

**Gas Generators**
- Nitrogen - PSA and Membrane
- Oxygen - PSA, VPSA, Medical
- Hydrogen Gas
- Ammonia Crackers
- Inert Gas Generators
- Exo Gas Generators

**Air & Gas Dryers**
- Compressed Air Dryers
- Solvent / Liquid Dryers

**Gas Purification Units**
- Nitrogen Purifiers
- Hydrogen Purifiers
- Argon Gas Purifiers

**Air & Gas Heaters**
- Direct / Indirect gas and heater systems

---

MVS Engineering is an ISO 9001 certified company.
IN TECHNICAL COLLABORATION WITH CARBOTECH, GERMANY

CarboTech is Germany’s leading company in PSA-Nitrogen technology. CarboTech has its roots in Germany’s institutional mining research and coal industry. The company follows the tradition of all those who have extracted knowledge from Science and Technology to use it for the benefit of people and their environments in an economically sound manner.

MVS Engineering is CarboTech’s technological partner and licensee for PSA Nitrogen Technology and we source our Carbon Molecular Sieves - CMS (A Core PSA Nitrogen Component) from them.

![CarboTech Logo](image1)

![Certificate of Appointment](image2)

![ PSA Plant Setup](image3)
How is Nitrogen Produced?

The Nitrogen generator produces Nitrogen from air using Molecular Sieves Separation technology. It uses Carbon Molecular Sieves which has ability to preferentially remove oxygen from air. The process and supply of Molecular Sieves is licensed to us by CarboTech AC GmbH of Germany.

Nitrogen Generator consists of 2-Beds filled with Carbon Molecular Sieves. When compressed air is passed, Nitrogen comes out as product gas from one bed while other bed is simultaneously regenerated by de-pressurization to atmospheric pressure. This process is called “PRESSURE SWING ADSORPTION” (PSA).

Nitrogen Purity

Nitrogen gas of purity 95% to 99.9999% can be produced. A simple PSA unit produces Nitrogen of 99.5% purity and by adding a purification unit, high purity Nitrogen is produced. Following are various Models to produce different Nitrogen purities.

MS MODEL

This is the simplest model. It produces commercial grade Nitrogen purity up to 99.99% economically. When Carbon Molecular Sieves quantity is increased, higher 99.999% purity Nitrogen is produced. Higher the purity, higher would be the investment and higher would be the running cost. This model is economical and is recommended for purity up to 99.99%. This model is commonly used for purging/blanketing nitrogen gas requirements.

DX MODEL

This model is generally used in Metallurgical industries to produce oxygen free Nitrogen gas for Heat Treatment Furnaces. Here Oxygen is less than 1-ppm and Hydrogen is around 0.5 to 1% which is desirable as reducing constituent in most Heat Treatment applications.

By adding Palladium catalyst Deoxo Purification Unit in “Model-MS” Generator, it becomes “DX-Model”. This model also finds applications in Chemical / Electronic industries for high purity nitrogen gas.

COPPER-DX MODEL

In certain applications where one needs very pure gas free from Oxygen and Hydrogen, a Nitrogen Purification Module based on Copper Deoxo Catalyst is added. By adding this Catalyst Module to “MS-Model” Generator, it becomes Model “Copper-DX”. This finds application in synthetic fiber, optical cables and Electronic industries. Cost of production of Nitrogen from this model is higher. Nitrogen purity is 99.9999% and also very dry nitrogen gas.
## Models

<table>
<thead>
<tr>
<th>Gas Composition</th>
<th>MS</th>
<th>MS-H</th>
<th>DX</th>
<th>COPPER-DX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxygen</td>
<td>0.1 to 5%</td>
<td>1-ppm to 500-ppm</td>
<td>1-ppm to 3-ppm (max)</td>
<td>1-ppm</td>
</tr>
<tr>
<td>Hydrogen</td>
<td>Nil</td>
<td>Nil</td>
<td>0.5% or more</td>
<td>Nil</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>95 to 99.9%</td>
<td>99.95 to 99.9999%</td>
<td>Balance</td>
<td>99.9999%</td>
</tr>
<tr>
<td>Dew Point</td>
<td>(-40° to (-80°C)</td>
<td>(-40° to (-80°C)</td>
<td>(-40° to (-80°C)</td>
<td>(-40° to (-80°C)</td>
</tr>
<tr>
<td>Applications</td>
<td>As inert gas in Chemical industries, Food/Packaging, Furnaces, Pharmaceutical industries, for fire control in coal mines etc.</td>
<td>As inert gas in Chemical industries, Pharmaceutical industries, Heat Treatment Electronics and Synthetic Fiber Industries.</td>
<td>As inert gas in Chemical &amp; Metallurgical Industries. In applications where Oxygen impurity is not acceptable.</td>
<td>As inert gas in Electronics, Synthetic Fiber, Hi-tech industries where one needs Ultra-high purity Nitrogen.</td>
</tr>
<tr>
<td>N2 Capacity</td>
<td>1 to 5000 M³/hr</td>
<td>1 to 2000 M³/hr</td>
<td>1 to 5000 M³/hr</td>
<td>1 to 2000 M³/hr</td>
</tr>
</tbody>
</table>

### Flow Scheme

- **Air Compressor**
- **After Cooler**
- **PSA UNIT**
- **N2 SURGE VESSEL**
- **Deoxo Reactor**
- **N2 DRYER**
- **Pure & Dry Nitrogen gas**

### Features

- **Start-up time** is only **5 minutes**.
- **Nitrogen Gas supply** always under your control.
- Skid mounted units for easy site installation.
- **Cost of Nitrogen** only US$ 0.05 (Rs. 3/-) per cubic meter.
- **Very high reliability to run unit unattended**.
- Carbon Molecular Sieves life is around 10-years and in most cases it lasts whole life time of Gas Generator.

### Economics & Pay Back Period

<table>
<thead>
<tr>
<th>N₂ Capacities</th>
<th>N₂ Purity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - 5000 M³/hr</td>
<td>95 - 99.9999%</td>
</tr>
</tbody>
</table>

[www.mvsengg.com](http://www.mvsengg.com)
NITROGEN CAPACITY
Nitrogen Generators are tailor-made and are manufactured as per customer’s requirements. However, standard units are also available in the capacity of 1, 2, 5, 10, 25, 50, 75, 100, 150, 200, 300, 500, 1000 NM³/hr etc.

NITROGEN PRESSURE
Standard Nitrogen Generator produces Nitrogen at 6 barg pressure. This pressure comes automatically as feed air pressure to the PSA unit is 7 barg. However, by using air of higher pressure up to 13 barg, Nitrogen can be produced at 11 barg pressure also. If Nitrogen is needed at still higher pressure, we add a Nitrogen booster compressor after the Gas Generator.

HYDROGEN REQUIREMENT
In high purity Nitrogen Generator, a Deoxo Unit is provided in which Oxygen is removed by reacting with Hydrogen. This Hydrogen can be supplied either from Hydrogen Cylinders or one can take a captive Hydrogen Generator based on Ammonia Cracking process. In smaller capacity Nitrogen Generators since Hydrogen requirement is very little, Hydrogen Cylinders are economical. But, in bigger capacity Nitrogen Generators, Ammonia Cracking Unit works out to be more economical. Cost of Hydrogen generation by Ammonia Cracking is around $0.35 (Rs. 20/-) per cubic meter whereas cylinder Hydrogen gas costs $0.75 (Rs. 45/-) per cubic meter.

NITROGEN STORAGE TANK
To meet your varying Nitrogen demands, we provide an Intermediate Nitrogen storage tank after the Gas generator. This tank always receives Nitrogen from the Gas generator and supplies to your process as per demand. Normally Nitrogen Storage tank of 1/2-hour capacity is adequate. In case one needs higher storage capacity then we add a Nitrogen Booster Compressor and store the gas at high pressure to keep Storage Tank size smaller. A high Pressure Switch in Tank automatically stops the gas generator when pressure reaches the set value. When pressure in the tank falls, Gas generator restarts Nitrogen production automatically. The gas generator keeps switching on 4 off by pressure switch and you get nitrogen round the clock from the tank.

N₂ CYLINDERS v/s N₂ GENERATOR

<table>
<thead>
<tr>
<th>NITROGEN CYLINDERS</th>
<th>NITROGEN GENERATORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Cylinder Nitrogen costs US$ 0.35 (Rs. 20/-) per cubic meter.</td>
<td>• Nitrogen Generator Gas production costs approx. US $ 0.05 (Rs. 3/-) per cubic meter only.</td>
</tr>
<tr>
<td>• Transfer and handling of Gas cylinders is very cumbersome and has high pressure risks.</td>
<td>• In-house Nitrogen generation whenever needed and in any quantity round the clock.</td>
</tr>
<tr>
<td>• Dependency on availability of Nitrogen Cylinders all the time.</td>
<td>• Continuous and reliable Nitrogen supply available. Your plant never suffers due to want of Nitrogen gas.</td>
</tr>
<tr>
<td>• Nitrogen purity in cylinders is not reliable and varies from lot to lot.</td>
<td>• Nitrogen purity is very steady and reliable.</td>
</tr>
</tbody>
</table>
### What is the purity of Nitrogen gas?
Several models are available to produce Nitrogen gas from 95% to 99.9999% purity. Oxygen level can be obtained as low as 1-ppm and Dew Point up to (-) 80°C.

### Can we get Nitrogen generator of size exactly as per our Nitrogen demand?
Yes, Nitrogen Generators are tailor made as per customer’s specifications of Nitrogen Purity and Nitrogen capacity. However, standard sizes are available as mentioned on Page-5.

### Is it easy to install?
Yes. The Gas generator is supplied fully assembled on steel frames which are kept on floor. You simply connect power and the Gas generator becomes ready for start-up. We provide services of Engineer to supervise its installation and commissioning at site.

### Does it make any noise?
The noise level is less than 75 dbA at 1-meter distance. A very effective silencer is provided in exhaust line. The total Gas Generator Package is “very silent”

### Does this Gas generator require an operator?
Continuous supervision is not needed. Once started, it can be left unattended. Several instruments monitor and control the running of Gas generator automatically.

### What is life of Molecular Sieves?
Life of Molecular Sieves is around 10-years and in majority of the cases it lasts whole lifetime of the Gas generator. However, Molecular Sieves life is reduced by oil in air. Therefore, it is essential to use special pre-filters if lubricated air is used and filters should be replaced timely.

### What is Maintenance Schedule?
The “Maintenance Schedule” is given in our “Operation Manual”. The maintenance is limited to only replacement of filter elements and preventive maintenance in Air Compressor.

### What happens if Gas generator does not produce required purity?
An On-line Oxygen Analyzer continuously monitors Nitrogen purity and shuts down the Gas generator automatically with alarm if purity drops below set limit.

### What happens to the Gas generator if the gas consumption is lower than Gas generator capacity?
Gas generator is designed to run continuously all 24-hours. But, if gas is not being consumed or consumption is low, pressure gradually builds up in Nitrogen Storage Tank. An automatic pressure switch stops the Gas generator. When pressure in the Nitrogen tank falls due to continuous gas consumption, the pressure switch automatically restarts the Gas generator.

### What is Nitrogen generation cost and how am I benefited?
The only expense in this Gas generator is of electricity for Air Compressor. Running cost is $0.05 (Rs. 3/-) per cubic meter of Nitrogen produced. This is very low as compared to cylinder Nitrogen cost of $0.35 (Rs. 20/-) per cubic meter. So, there is big cost saving when you install such Gas generator. Pay back period is only 1 to 2-years.
43 years experience in manufacturing Gas Generators

Collaborations and Partnerships with world leaders in Gas Generation field.

Strong Team of 150 Employees with large experience

Large Inventory of components for short delivery time

Service Support
We are only a phone call away for full diagnostic support and any assistance required

Experienced R&D Team which keeps innovating & refining the technology and reduce costs

1700+ NITROGEN PLANT REFERENCE

'MVS House', E-24, East of Kailash, New Delhi - 110065 (INDIA)
Phones: +91-11-49997000, Fax: +91-11-49997099
On-Site Gas Generation Solutions for Nitrogen, Oxygen & Hydrogen

Email: sales@mvsengg.com, Website: www.mvsengg.com