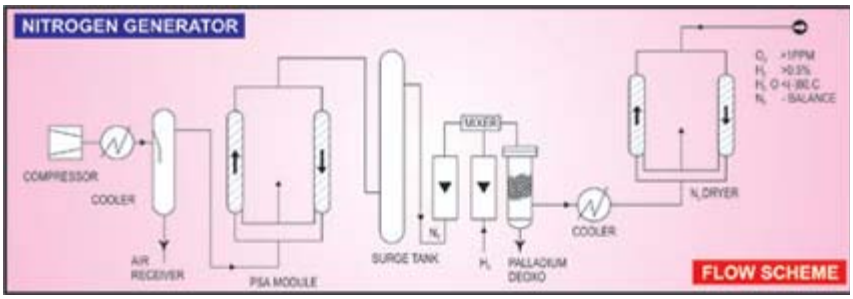
NITROGEN GAS GENERATORS PRINCIPLE



Nitrogen Gas Generators produces Nitrogen gas from atmospheric air by PSA (Pressure Swing Adsorption) Technology. PSA Technique is a simple & reliable process of separation of Nitrogen from compressed atmospheric air by adsorption of oxygen over a bed of Carbon Molecular Sieves (CMS). CMS is an adsorbent having infinite number of small pores. The diameter of the "Bottle Necks" is in the same range as those of the molecules.

Thus when CMS is used in the PSA process, an Oxygen Molecule, having a smaller diameter than a Nitrogen molecule traps in to the pores. Therefore the Nitrogen is recovered to a high degree while almost all the oxygen is adsorbed.

PROCESS

The production of Nitrogen gas from Atmospheric Air is based on Pressure Swing Adsorption (PSA) principle by adsorption of oxygen gas using a special grade of imported Carbon Molecular Sieves (CMS).
Atmospheric air is compressed by an Air Compressor to a pressure of 7.0 kg/cm2g and cooled to ambient temperature in a shell and tube type heat exchanger. The condensed moisture shall be drain out automatically from air receiver by automatic drain valve (ADT). The compressed air at ambient temperature is passed through PSA module packed with activated alumina and special grade of Carbon Molecular Sieves. The production of Nitrogen from air by PSA technology is largely based on the kinetic separation. Oxygen that is smaller in size (kinetic diameter 3.46 A0) diffuses much faster than Nitrogen (kinetic diameter 3.64 A0) and hence oxygen gets adsorbed in carbon molecular sieves and Nitrogen is collected as the high-pressure product.

The entire operation is fully automatic and controlled by a combination of sequence programmer and quick change over valves. Nitrogen gas of desired purity at 5.0 kg/cm2g pressure and having a Dew Point of (-) 40 degree celcius is produced by the PSA Unit, now flows to a surge vessel to balance the fluctuations in pressure and concentration.

Now the gas can be stored in a storage tank at 5 Kg/cm2g pressure from where it can be made available for process application. The storage tank can selected of any desired capacity as per peak hours demand for Nitrogen gas or power interruptions.

This system is fully automatic and need not any special operator for operation. Once it is started it generates Nitrogen at constant flow rate and at constant pressure.

Further the produced nitrogen gas can be boosted to high pressures by providing any reliable booster compressors up to 40 kg/cm2g pressure.

We offer three models of Nitrogen Plants and selection is based on the purity required.

SELECTION OF MODELS

	MODEL - MSU	MODEL – PDC	MODEL - CUC
TYPE	N2 direct from PSA Module	N2 from PSA further purified in Palladium Catalyst based De-Oxo Unit And dried in Gas Dryer.	N2 from PSA further purified in Copper based De-Oxo Unit And dried in Gas Dryer.
OXYGEN	5 – 0.01%	1 PPM	1 PPM
HYDROGEN	NIL	0.5 – 5.0%	NIL
NITROGEN	95 – 99.99%	99.9999%	99.9999%
ATM. DEW POINT (0C)	(-)40 TO (-)60	(-)40 TO (-)80	(-)40 TO (-)80
APPLICATIONS	As Inert Gas in Chemical industries,Food& Pharmaceuticals Industries, for Fire Control in Coal Mines etc.	As Inert Gas in Chemical Industries Food & Pharmaceuticals Industries, Heat Treatment Furnaces, Electronic, Synthetic Fiber Industries and where one needs High Purity gases and hydrogen is tolerable.	As Inert Gas in Electronic, Synthetic Fiber, Hi-tech Industries Where one needs Ultra High Purity gases and hydrogen is non - tolerable.
CAPACITIES NM3 / HR	01 TO 1000	01 TO 500	01 TO 300

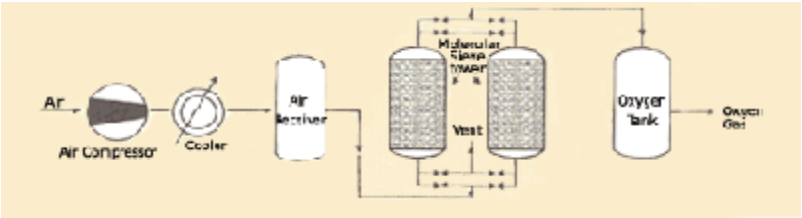
ADVANTAGES

- Electronic Programmable Control Panel (PLC System).
- Automatic start and stop.
- Highly reliable to run un-attended for months.
- Very low maintenance cost.
- Nitrogen gas supply always under your control.
- Self-contained Skid Mounted Units for easy site installation.
- Carbon Molecular Sieves life is minimum 10-12 years.

NITROGEN GENERATORS V/S NITROGEN CYCLINDERS

	NITROGEN GENERATORS	NITROGEN CYCLINDERS
ECONOMY	N2 Generator gas costs only Rs. 3 -5 /- Per Nm3 for commercial grade.	N2 Cylinders gas costs Rs. 15-20 /-Per Nm3 for commercial grade.
HIDDEN COST	No hidden costs with Nitrogen generators	Many hidden costs e.g. Cylinder gas price, Cylinder demurrage, labour cost to change cylinder etc.
SAFETY	N2 Purity is very steady and reliable.	N2 Purity is never reliable and varies from cylinder to cylinder.
RELIABILITY	Gets continuous and reliable N2 supply round the clock & thus production never suffers due to want of N2 gas.	Dependency on the availability of the cylinders all the times

OXYGEN GAS GENERATOR



PRINCIPLE OF OPERATION

Oxygen Gas Generators are based on the PSA technology. A special grade of synthetic Zeolite, known as molecular sieves is used to separate oxygen from atmospheric air. Oxygen generator consists of two adsorption vessels, filled with molecular sieves are alternately charged with compressed air up to 5 bar pressure. Nitrogen is adsorbed and enriched oxygen flows to the surge tank. After the adsorption cycle, one bed is depressurized to atmospheric pressure, thereby evacuating nitrogen and sieve bed gets regenerated completely by counter current oxygen flow from the other bed.

SALIENT FEATURES

1) Operation is cyclic and automatic.

2) Automatic start-up and shut-off.

3) Working life of molecular sieves is almost 10 years on continuous run of .... the plant.

4) Very low maintenance cost.

APPLICATIONS

- Steel Plants.
- Welding.
- Brazing.
- Paper Industries.
- Chemical Oxidations.
- Battery Manufacturing.
- Ozone Generation.

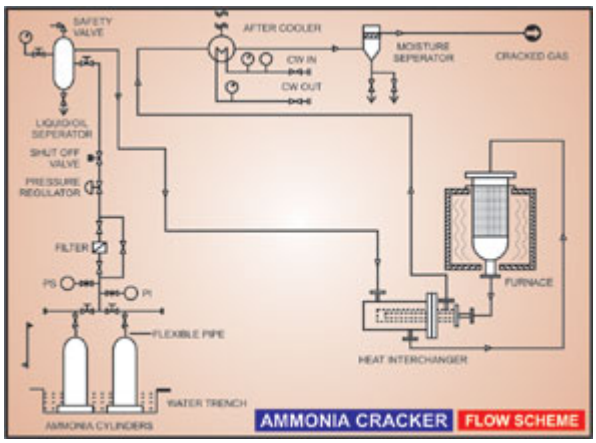
HYDROGEN GAS GENERATORS PRINCIPLE

These are Catalytic cracking units in which Ammonia is dissociated to Nitrogen and Hydrogen. Commercial grade liquid ammonia from cylinders or tank is used as feedstock. The Product gas has 75% Hydrogen and 25% Nitrogen. This gas is further purified in a Molecular Sieves unit by removing un-cracked Ammonia and moisture. Purified gas is then used in Heat treatment furnaces like Annealing, Sintering and as Reducing furnace atmosphere.

It is widely used in Stainless steel and Carbon steel Bright Annealing. Investment in such Hydrogen gas generator is extremely low and also cost of Hydrogen produced is very low. The cracking furnaces are electrically heated or fuel fired type.

Standard Sizes available - 1NM 3 /hr to 500 NM 3 /hr

AMMONIA CRACKING UNIT GAS COMPOSITION



PRINCIPLE OF OPERATION

Ammonia Cracker gas generator produces mixture of Hydrogen and Nitrogen which is commonly used in Heat treatment furnaces. Ammonia gas from cylinders is passed over a bed of Nickel Catalyst at 850 degree celcius temperatures and cracking takes place into its basic constituents i.e. 75% H2 & 25% N2.

Ammonia cracking reaction is Endothermic and hence it requires heat from outside source. The source is electrically heated type furnace (Rectangular shape) and a Retort made of heat resistant provided inside to hold the catalyst.

PROCESS OF OPERATION

Ammonia gas is supplied from the battery of cylinders at the battery limit of the unit. The liquid ammonia cylinders are kept vertically in a water trench and vapor ammonia gas from the top of the cylinders is supplied to the unit. The vapor Ammonia Pressure is reduced to the required 0.5 kg/cm2 g by pressure regulator. It is then passed through the heat interchanger where ammonia vapor gets pre-heated up and then enters the catalyst tube (i.e. Retort) from top. In retort, it comes in contact with catalyst and gets cracked at high temperature.

The ammonia cracking reaction is endothermic and takes place at approximately at 850 degree celcius temperatures. The heat of reaction is supplied by providing electrical heating elements in the heating chamber. The furnace has temperature controller for automatic temperature control, which controls the reaction temperature.

The cracked ammonia gas coming out from the bottom of the retort at around 850 degree celcius is then passed through the heat inter-changer to pre-heat the un-cracked ammonia feed. Here the cracked gases gets cooled to around 400 degree celcius. For further cooling these gases now passes through a water cooler to bring them to around 40 degree celcius.

In the cracked ammonia outlet line a Rotameter is provided to indicate continuous flow. This Ammonia Cracker can be operated at any capacity from 10 to 100 % rating simply by throttling ammonia feed line valve. Whenever ammonia is not in use, nothing need to be done except closing the feed valve. The temperature of the ammonia cracking furnace is automatically controlled by the temperature controllers. The ammonia cracking plant can be kept in hot condition for days and days. Whenever you wish to restart cracking process, it can be done instantaneously. Whenever plant is to be shut-down for long time, the ammonia cracking furnace can also be shut-down. It takes around 8-hours for Ammonia Cracking Furnace for heat up to reach operating temperature of 850 degree celcius.

PURIFIER

For reducing residual ammonia and to get very dry gas, a Molecular seives based purifier is provided after Ammonia cracking unit. This reduces ammonia down to 1-ppm level and dries gas up to (-) 80 degree celcius dew point.

	Without Purifie	With Purifie
Hydrogen	75%	75%
Nitrogen	25%	25%
Oxygen	Nil	Nil
Residual Ammonia	100 PPM(max)	1 PPM (max)
Dew Point	(-) 30 0C	(-) 80 0C

CAPACITIES OFFERED

3 Nm3/hr to 300 Nm3/hr.

SALIENT FEATURES

- Fully automatic, skid mounted units.
- Rectangular furnace has hinged type door for easy inspection and maintenance.
- Power consumption is low as 0.5 KW per NM3 of gas generated.
- Skin temperature as low as 35 degree celcius above ambient.
- High turn down ratio.
- Very safe and proven design, No operator is required.

Exo - Gas Generator

EXO-gas generators produces protective atmosphere for Heat Treatment furnaces. Lean Exo-gas or Rich Exo-gas is produced simply by changing air/fuel ratio.

Lean Exo-gas generators are suitable for non-ferrous metals heat treatment whereas Rich Exo-gas generators are used for heat treatment of steel/brazing/annealing applications.

Gas Composition	Lean Exo	Rich Exo
CO 2	11 to 13%	5 to 6%
CO	0.5 to 1.5%	11 to 12%
H 2	0.5 to 2%	12 to 13%
N 2	Balance	Balance