Inert Gas:

Inert gas systems on ships

Inert gas is produced on board of mainly crude of oil carriers, gas carriers and Chemical carriers, and in Bulk carriers when carrying fish flower, and in refrigerating ships when carrying fruit products, by using either a flue gas system or by burning Marine Diesel Oil (MDO or MGO) in a dedicated inert gas generator, or produced clean Nitrogen by an dedicated Nitrogen Generator.

IG keeps the oxygen content of the tank/cargo hold atmosphere below 8%, thus making any air/hydrocarbon gas mixture in the tank too lean to ignite. IG is most important during discharging of cargo on tankers and during the ballast voyage when more cargo and/or hydrocarbon vapor is likely to be present in the tank atmosphere.

Inert gas can also be used to purge the tank of the volatile atmosphere in preparation for gas freeing - replacing the atmosphere with breathable air - or vice versa.

Inert Gas can also be used for emptying cargo lines or Cargo pumps.
Blanketing, typical Cargo tank

Blanketing area

Cargo level
Inerting ballast tanks

- Ballast tanks will be inerted to avoid presence of oxygen and so corrosion on the steel structure; No specific requirements for this regarding capacity etc.

- According IMO Marpol Regulation every double hull tanker should have the possibility to inert the ballast tanks in case of an collision because than cargo can leak from the Cargotanks into these ballast tanks, or to avoid that sparks will ignite the cargo in case of collided vessels will be drawn apart;

- According IMO Marpol Regulation the double hull tankers should have the possibility to inert the double hull ballast tanks in case the cargo tank will leak inside the ballast tanks. Continue monotoring of the ballast tanks for cargo leaks is therefore a compulsory regulation.

- Therefore there is also a connection from the deck inert Gas pipeline towards the ballast tanks.
Application for Refrigerated ship’s

On refrigerated ships we like to protect the cargo from riping fast, by controlling the atmosphere and thus the O2 and CO2 level around the refrigerated product.

This is called Controlled Atmosphere, (CA) and contain out of systems that keep the atmosphere fully controlled by the given setpoints.

As this Inert Gas, Nitrogen, will be filling up the left over air space between cargo and ship hold construction, and that in a time of totally 36 hours after loading, the required capacity of the Nitrogen plant is very low.

The pressure is about 0,06 bar and the O2 contents is depending on the product and the riping process they like to achieve.

Most of the times it is fitted into an container which can be shipped from port to port via land, from one ship to another ship.
Different types of Inert Gas

Inert Gas for ship’s can be one of the following gas and the choice of this gasses is depending on the product being carried and the capacity required.

.1 Inert Gas is generated by burning MDO (marine diesel oil) in a furnace and the exhaust gas is blown by ordinary blowers via a scrubber/filter unit for cleaning out the sulphur, towards the Cargo tanks; (This unit making the Inert gas is often called IGG) (Inert Gas Generator)

.2 Flue Gas. This Gas is exhaust gas from the steam generating boilers or occasionaly from the main engine and blown by a blower via a scrubber/filter unit for cleaning and cleaning out the sulphur towards the cargo tanks.

.3 Nitrogen, which is made by blowing compressed air from the booster compressor through a small fiber tube, like a Filter material, or via an absorbtion filtering system, by which the air and its gasses will be seperated and finaly N2 will be forwarded to the Cargo tank by means of the overpressure caused by the booster compressor.
Nitrogen

- Pressure is up to 11.5 bar depending on installation
- Gas composite:
  - up to 99.9% N2
- Dew point down to minus 70 celcius
- This gas can be used for all Cargoes as the purity of the N2 is very high and no water content or Hydrocarbons are present.
- For pipeline stripping a separate pipeline with buffer tank pressureized up to 11 bar can be used.
PSA system description

Pressure swing is like a water filter. When air passes through an absorbent material at high pressure, oxygen molecules are attracted and adhere to the material while argon and nitrogen molecules pass through.

In Pressure Swing adsorption, the Nitrogen/argon mixture is then kept and oxygen leaves the absorbent when the pressure is reduced. By using two absorbers together, one can be absorbing oxygen at high pressure while the other is being purged of absorbed oxygen. This way the production of high-purity nitrogen is almost continuous.

PSA units separate air using a special sieve (absorbent material) that absorbs Oxygen preferably to Nitrogen. When high-pressure air flows through the sieve, oxygen molecules are caught while Nitrogen molecules pass on. The sieve continues to absorb oxygen until a saturation point is reached. After that, the entering air stream is cut off and the oxygen is able to leave the tank at low pressure. In a PSA unit, two connected tanks, containing same sieve, work together to produce a near-continuous stream of Nitrogen. When one tank has become saturated and is releasing adsorbed oxygen, the entering air stream is switched to the other tank for adsorption.
It is Cheaper to install:

- Inert gas piping on deck do not need to be schedule 80 as the gas is clean and no corrosion will take place.
- Inert gas piping on deck need less drain connections due to dryer gas
- Inert Gas piping equipment as valves and pressure sensors can be size 8 inch instead of 16 inch piping as with the traditional IGG system which means a big reduction in cost. (VECS piping to be taken into consideration)
- No deck seal, no sea water cooling pipes and connected systems and no hull penetration of schedule 80 piping, no steam heating system;
- No hull penetration 8 inch for drain IGG scrubber tower cooling water
- No sea water cooling piping and separate pumping system
- Less fuel cost
- Easier pipe layout on deck, more room for better manifold
- No additional fuel system and local fire fighting system to be installed
PSA nitrogen generators
Adsorbent - Carbon Molecular Sieves

- Pore size: 0.4 nm
- O\textsubscript{2} molecule: 0.346 nm (3.46 Å)
- N\textsubscript{2} molecule: 0.364 nm (3.64 Å)
PSA nitrogen generators
Working conditions - flow

Inlet air flow
36.6 Nm³/h

Waste:
blow-off and purge
32.9 Nm³/h

Pure nitrogen flow – 99.999%
3.7 Nm³/h