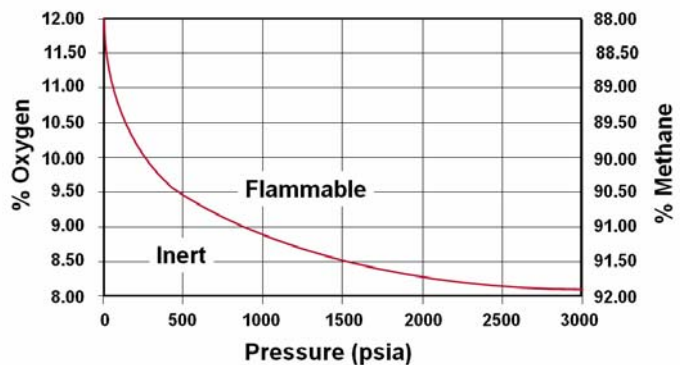
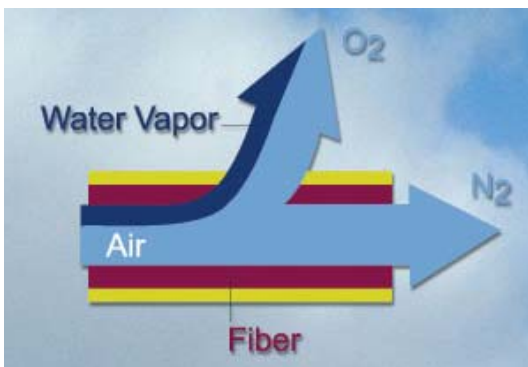




Membrane nitrogen generating units (MNGU) contain hollow fiber membranes that act as a molecular sieve, separating oxygen from the air. Primary air compressors inject air into the MNGU, where it is filtered, dried and brought to the correct temperature before passing through the membrane. Depending on the application, the resultant “Membrane Nitrogen” can have purities of between 94% and 99.9% nitrogen, with the balance being mainly oxygen and trace gases such as helium, carbon dioxide, etc.



The above graph shows the minimum oxygen concentration required for ignition in a worst-case scenario of methane and oxygen, at different pressures. For a downhole pressure of 1,500 psi for example, 8.5% of oxygen is still required for the mixture to ignite and explode (in presence of an ignition source). For underbalanced drilling and other applications the MNGU is run at about 97% purity, i.e. less than 3% oxygen.

The benefits of membrane nitrogen systems are as follows:

- Guaranteed supply of nitrogen in remote locations
- Simplified logistics
- Lower cost than cryogenic nitrogen

Membrane Nitrogen Generating Unit Specifications:

- Maximum nitrogen output: 2,000 scfm
- Typical purity range: 94 -99.9% nitrogen

Dimensions:

- Weight = 26,500 lbs., Width = 8', Length = 20', Height = 8'.
- 20' ISO container