



T E C H N I C A L   A R T I C L E



**An Overview of Oxygen Generation**

# Technical article

## An Overview of Oxygen Generation

Humans need oxygen to live. It makes up 21% of the volume of the atmosphere at sea level but high oxygen levels are well tolerated by humans with 100% oxygen tolerated by healthy people for at least 12 hours and 50% indefinitely. High levels are actually good for people that have been exposed to carbon dioxide or smoke.

Low oxygen levels to 16% do not trigger significant physiological responses in healthy individuals - although will extinguish a flame! At 14% impaired judgement is seen, whilst at 10% a person would rapidly lapse into unconsciousness and death would occur quickly.

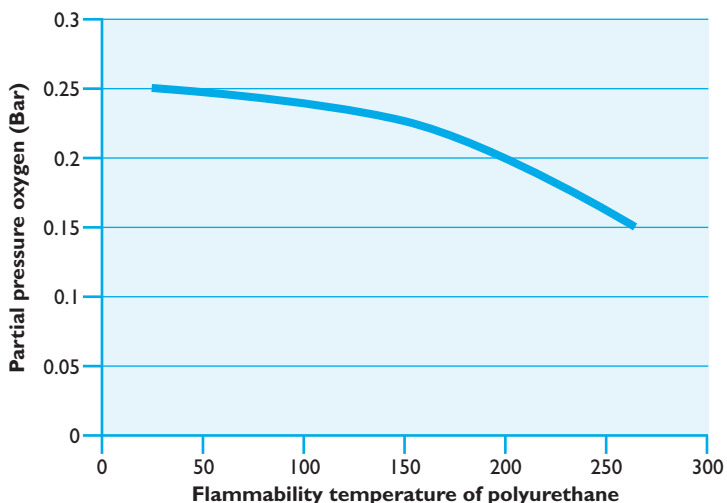
Oxygen is consumed at different rates depending on activity. At rest a normal adult would consume 18 litres/hr whilst running aerobically at full speed would consume 4 litres per minute - obviously for short periods since this effort cannot be sustained.

When humans are in any enclosed environment for extended periods there is a need to replenish the breathable atmosphere with oxygen.

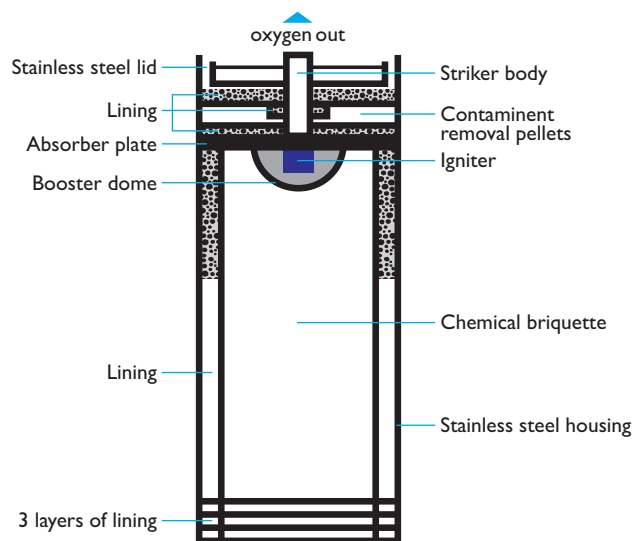
However, there are other effects which must be taken into consideration.

Taking the lower limit as 19% the upper limit should be below 25% to reduce the effects of enhanced flammability at high oxygen concentrations. See below.

**High oxygen concentrations can accelerate reactions so much as to transform benign oxidation reactions such as combustion into deflagration/detonation events. For this reason oxygen generators must be kept free from hydrocarbon contamination under all circumstances.**



## Oxygen generator design



Oxygen generators have the general design shown above with a chemical briquette, surrounded by insulation, inside some sort of protective container with an initiation mechanism.

**Initiation can be by any of the methods below:**

- Blank cartridge
- Chemical match
- Electric start
- Exothermic chemical reaction
- Spark

Click on <http://www.molecularproducts.com/video.htm> to see a video showing a bare chemical block being ignited using the chemical match type of initiator. Note the weight loss as the oxygen is liberated and the bubbles of gas at the burn front.

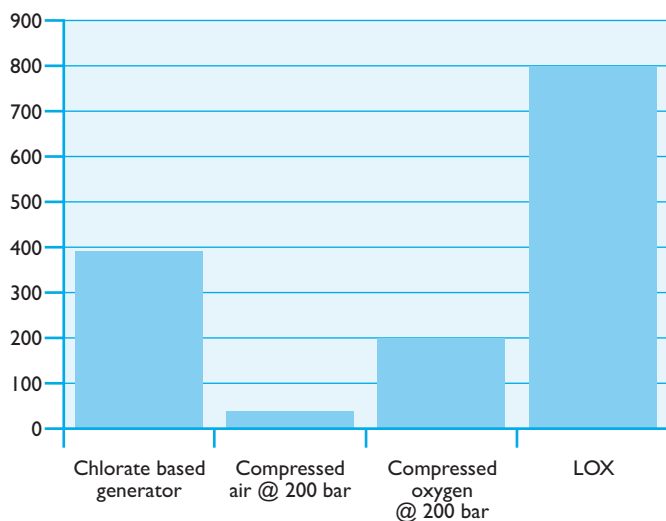
Molecular Products has chosen sodium chlorate as the primary material in its generators.

Sodium Chlorate has an extremely high oxygen storage capacity (784 litres oxygen/litre), in fact the theoretical volume/volume storage capacity is very similar to liquid oxygen (798 litres oxygen/litre). In reality, when combined with the necessary components to form a useful product which will release oxygen at a controlled and consistent rate, this storage capacity drops to around 600 litres oxygen/litres. Despite this, when compared with other methods of storing oxygen and taking into account ancillary equipment and maintenance requirements,

Molecular Products' chlorate based oxygen generators provide a simple and safe method for rapid oxygen generation. Some of the advantages include:-

- A simple, safe, reliable and economical source of oxygen for both operational and emergency uses
- Available as self contained or unit mounted variants
- Minimum stowage space when compared with alternative oxygen sources
- Long shelf life
- No external power sources required

### Litres oxygen/litre space occupied



The simplest form of Oxygen Generator is the CAN 33™ type, which is a solid block of sodium chlorate, formulated to produce 3300 litres of oxygen over a period of 40 to 60 minutes. It is supplied individually in a canister for storage but is removed from the canister for use and requires a specific furnace for operation. A more user friendly and flexible variant is the EO2-26™ type which is supplied in a thermally insulating canister with integral striker mechanism for use as is, without the requirement for a furnace. This allows the generator to be used almost anywhere, without the need for any ancillary equipment.

Further recent developments of this technology have led to the EO2 personal oxygen generator which supplies oxygen for use in medical emergencies and even more robust units for military use.

### EO2 - Personal oxygen generator

The EO2 is a recent development, based on the same underlying technology as the CAN33™ and EO2-26™ type generators; however it is designed for personal use and therefore has more sophisticated thermal management. The unit is designed to deliver a constant 6 litres per minute flow of oxygen over a period of 15 minutes. The oxygen produced is of medical grade and meets United States Pharmacopeia (USP) standards. The sophisticated thermal management technology within the EO2 ensures that in use the unit never exceeds 50°C to the touch. The unit can be used to provide high purity oxygen in medical emergencies by first responders or even the general public. The starting mechanism for the EO2 is a further innovative development which uses a simple cord-pull operation, compared with the percussion start on the EO2-26™ which requires a blank cartridge for operation.



EO2-26™

EO2-30™

CAN 33™

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