

# Glove Box



Md Bodiuzzaman  
21-01-2017

# Glove Box

## Dry Box

A glove box is a sealed container that is designed to allow one to manipulate objects where a separate atmosphere is desired.

The inert atmosphere in glove box allows one to handle air-sensitive compounds without having to use complicated Schlenk-like glassware. This greatly reduces the amount of time needed to perform anaerobic reactions.

## Uses

- Inert atmosphere work  
high purity substances requiring argon or nitrogen atmosphere.
- Hazardous materials work  
radioactive materials, infectious disease agents etc.
- Manipulation of items in a vacuum chamber .



**‘Glove bags’ are cheaper**  
They are bags you can fill with inert gas and reach into with attached gloves.

# 1. Controlled Atmosphere Glove Box

- Maintains an inert atmosphere, i.e. nitrogen or argon
- Protects air-sensitive materials from oxygen and moisture contamination i.e. inorganic, organic, organometallic and biochemicals .



## Transfer chamber/ Antechamber

Chamber separating the inside of the glove box from the outside environment .



## Main chamber

A large chamber (molded fiberglass or stainless steel liner) with a glass front window and two neoprene gloves.



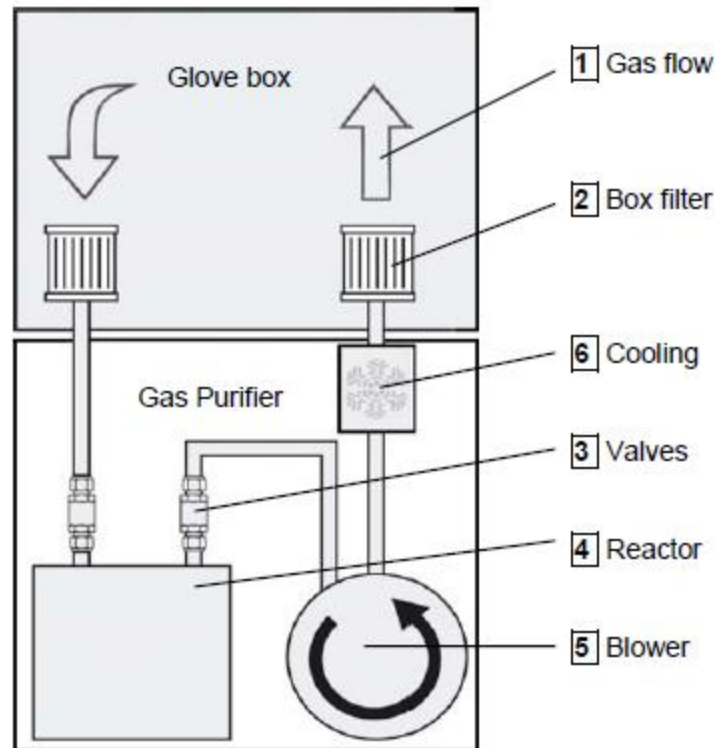
## Regenerative Drying Train

Reduces water contamination to 5 ppm, and oxygen to 1 ppm.

By manipulating the gas pressures inside the chambers, oxygen and moisture contaminants are replaced with a pure gas atmosphere

# Working principle

The Glove Box System works by the principle of gas circulation: the working gas permanently circulates between the Glove Box and the Gas Purifier. The Gas Purification System removes moisture and oxygen from the inert gas Glove Box atmosphere. It utilizes a proprietary reactive agent to withdraw oxygen from the inert gas. A proprietary adsorbent removes water. When the Gas Purification system becomes exhausted, it can be regenerated in a by passing a regeneration gas through it.



# Glovebox catalyst

Heated copper metal (or some other finely divided metal) is commonly used to remove oxygen, this oxygen removing column is normally regenerated by passing a hydrogen/nitrogen mixture through it while it is heated: the water formed is passed out of the box with the excess hydrogen and nitrogen. It is common to use molecular sieves to remove water by adsorbing it in the molecular sieves' pores.

## Chemical Reactions :

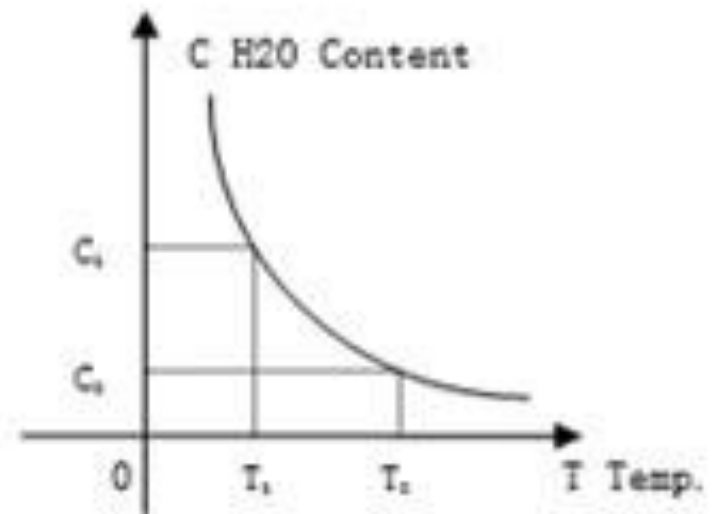
Circulation Process:  $\text{O}_2 + 2\text{Cu} = 2\text{CuO}$

Regeneration Process:  $\text{CuO} + \text{H}_2 = \text{Cu} + \text{H}_2\text{O}$

## Molecular Sieve Features

❖ Under a lower temperature  $T_1$ , the water saturation level of the molecular sieves will become higher. So the molecular sieves can absorb large amounts of water.

❖ Under a higher temperature  $T_2$ , the water saturation level of the molecular sieves will become lower. The adsorbed water will be released through evaporation. As a result, the molecular sieves can be regenerated by heating and evacuation.



## 2. Multi-Hazard Glove Box

- Provides a physical barrier to protect operator from exposure to potentially dangerous particulates.
- Inlet air and air exiting the box is HEPA\* filtered to remove particulates.
- Adjustable air flow volumes from 0-60 cfm.

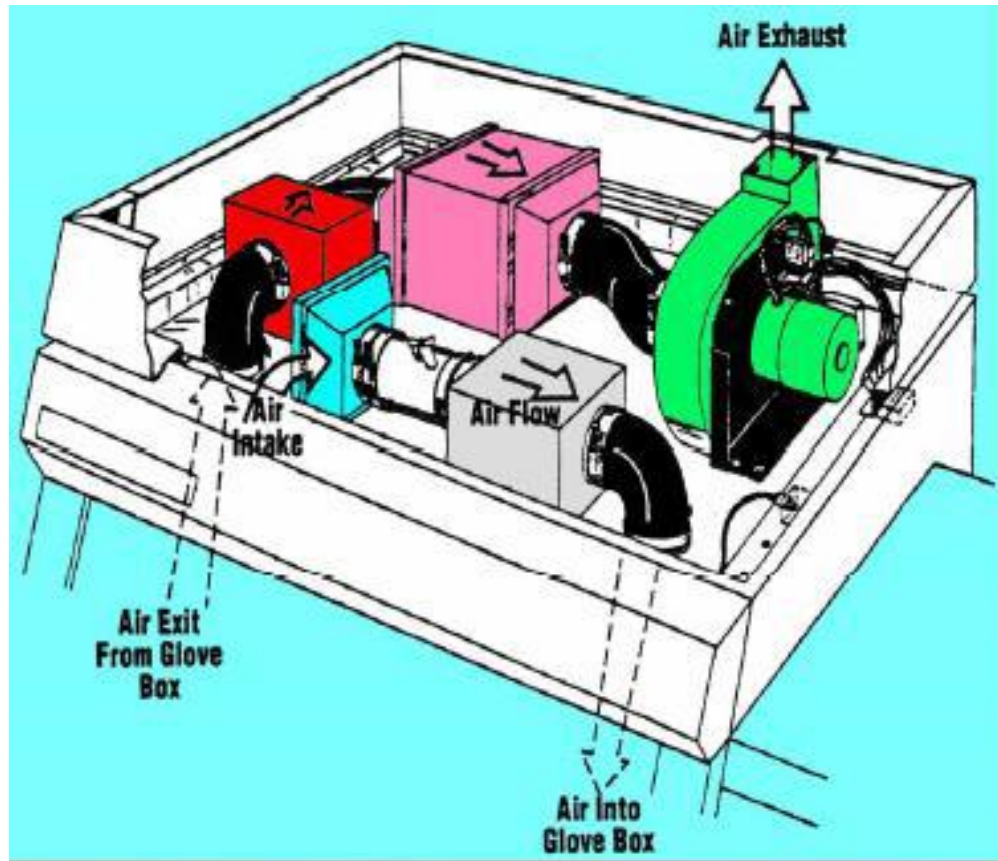
### \*High-efficiency particulate absorption (HEPA) Filter

- Disposable filter of boron silicate microfibers cast into a thin sheet.
- Retains airborne particles and microorganisms, but gases pass freely through filter.

removes 99.97% of particles that have a size of 0.3  $\mu\text{m}$  or larger from the air that pass through.



# Air filtration system in multi-hazard glove box



- Prefilter
- HEPA intake filter
- Primary exhaust HEPA filter
- Optional secondary exhaust filter (HEPA or Carbon)
- Blower

High-efficiency particulate absorption (HEPA)



# Disadvantages

- Use of solvents inside the box can interfere with the ability of the regeneration catalyst to remove oxygen and water.
- Organic solvents will attack the plastic seals. As a result the box will start to leak and water and oxygen can then enter the box.
- Oxygen and water can diffuse through the plastic gloves

**Thank you**