Glove box

'Dry box'

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

To provide a physical barrier

•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, especially those involving a lot of manipulations of solids.

•A wide range of glove boxes are commercially available, and can come with a custom number of glove ports, refrigerators, coldwells, electrical leads, built-in solvent taps, etc.

S. Krikalev working with a portable glove box at the International Space Station

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 vaccum 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. inorganics, organics, organometallics 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.

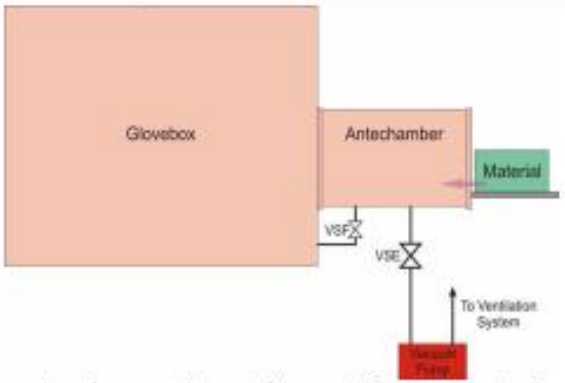
Regenerative Drying Train

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

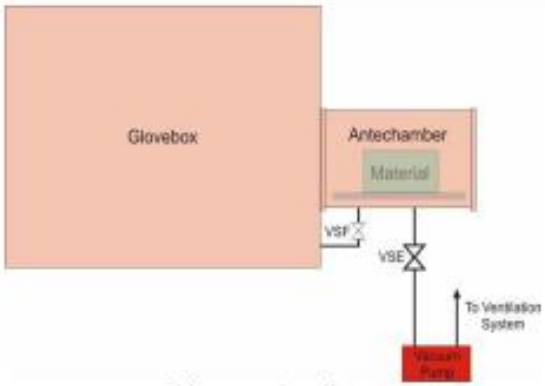
By manipulating the gas pressures inside the chambers, oxygen and moisture contaminants are replaced with a pure gas atmosphere.

Vaccum chamber operation

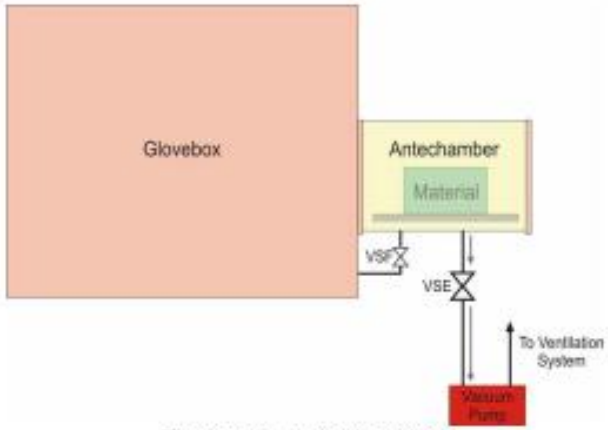
Method of Operation



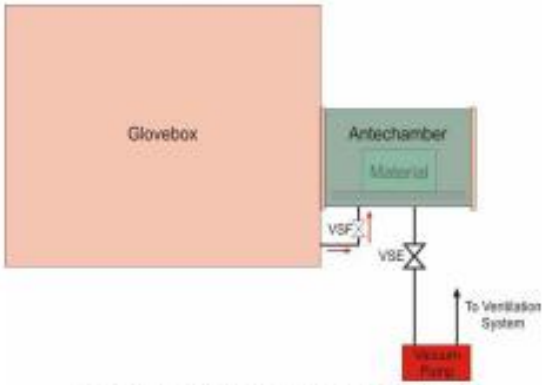
Open outer door and transfer material into antechamber



Close outer door

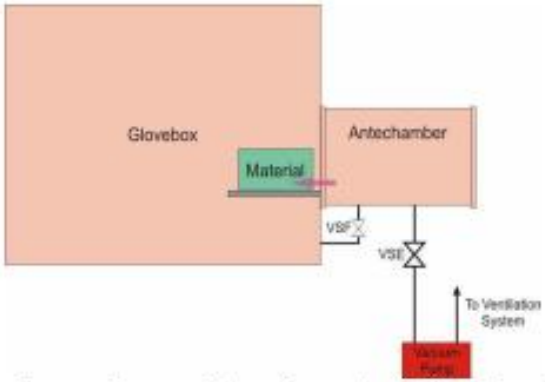


Evacuate antechamber



Refill antechamber with box gas

Repeat the Evacuate and Refill antechamber steps according to the guidelines listed in Chapter 9 Section 9.4 Antechamber Operation.



Open inner door and transfer material into glovebox

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.

Bubbler

Pressure relief “bubbler” manometer prevents glove box damage from extreme high or low pressures.

U-tube is filled with vacuum pump oil, which moves within the column releasing excess pressure

2. Multi-Hazard Glove Box

- Provides a physical barrier to protect operator from exposure to potentially dangerous particulates.

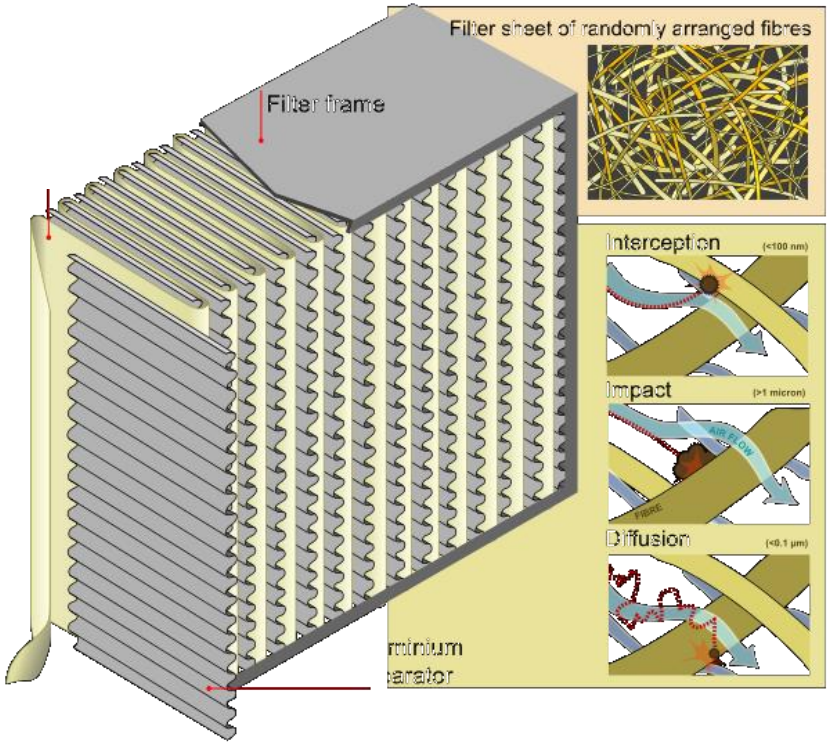
- Inlet air and air exiting the box is HEPA* filtered to remove particulates.

- Adjustable air flow volumes from 0-60 cfm.

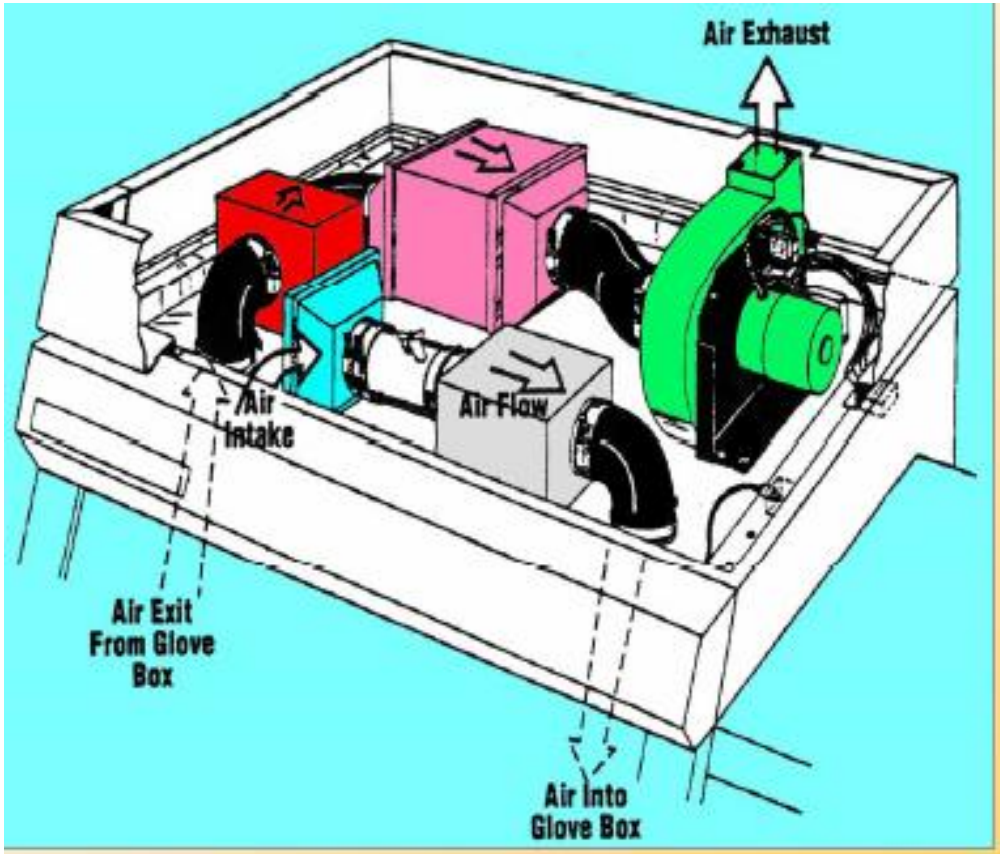
*High-efficiency particulate absorption (HEPA) Filter

- Disposable filter of boron silicate microfibers cast into a thin sheet.
- Media is folded to maximize its surface area.
- Retains airborne particles and microorganisms, but gases pass freely through filter.

Filter removes 99.97% of particles that have a size of 0.3 µm 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

3. Combination Glove Box

- Handles both atmosphere sensitive materials and hazardous materials.

- Converts quickly from controlled atmosphere function to vented hazardous material operation.

Disadvantages

- Use of solvents inside the box can interfere with the ability of the regeneration catalyst to remove oxygen and water and can also limit the lifetime of any oxygen and water sensors that are in use.
- 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