

# **Design summary, change log and updates.**

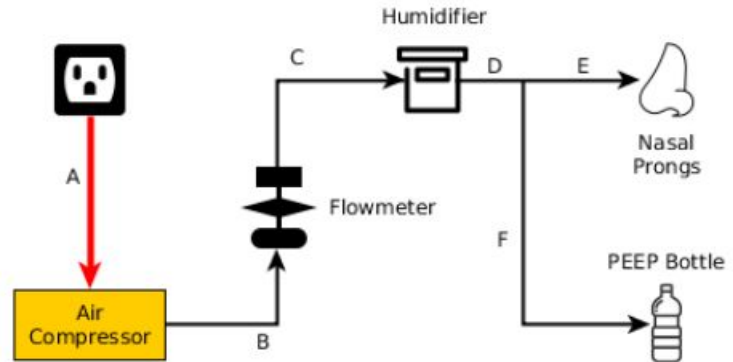
This document is the chronological archive of the open hubble CPAP Design. It shows the working principle of the CPAP system

## **Iteration 1:**

This is the first proposed design. It includes industrial grade as well as readily available off-the-shelf materials.

It consists of the basic fundamental parts of the system. I.e.

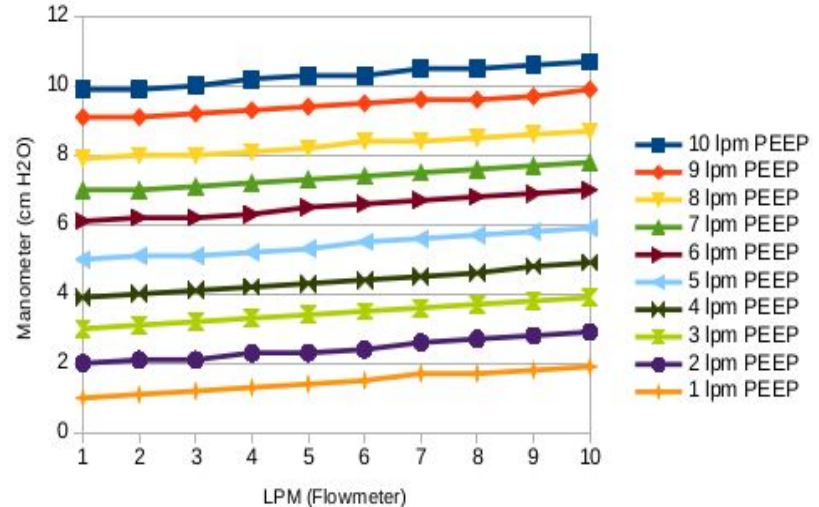
- Air compressor
- Flow meter
- Humidifier
- PEEP bottle
- Nasal prong



## **Iteration 2:**

Tests, observations and changes:

- Air compressor, alternative enclosure and hardware selection.
- Breathing circuit pressure validation: relation between PEEP submersion depth (cm), Flow rate(Lpm) and pressure (manometer reading)
- Pressure deviations between bubbling & non-bubbling humidifiers.
- Water filling and submersion depth control.



### **Iteration 2.0**

- Gas detection (NH<sub>4</sub>, CO, CO<sub>2</sub>, Propane etc.) to identify the reason of smell inside the breathing circuit.
- Effect on humidity with variable surface area inside the humidifier to control humidification.

### **Iteration 2.1**

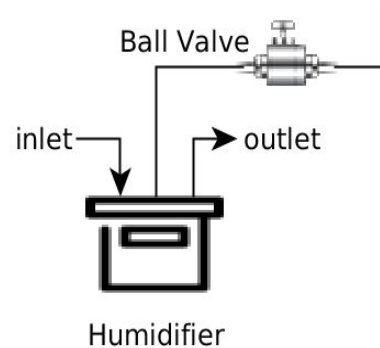
- Breathing circuit leakage detection technique and results

### **Iteration 2.2**

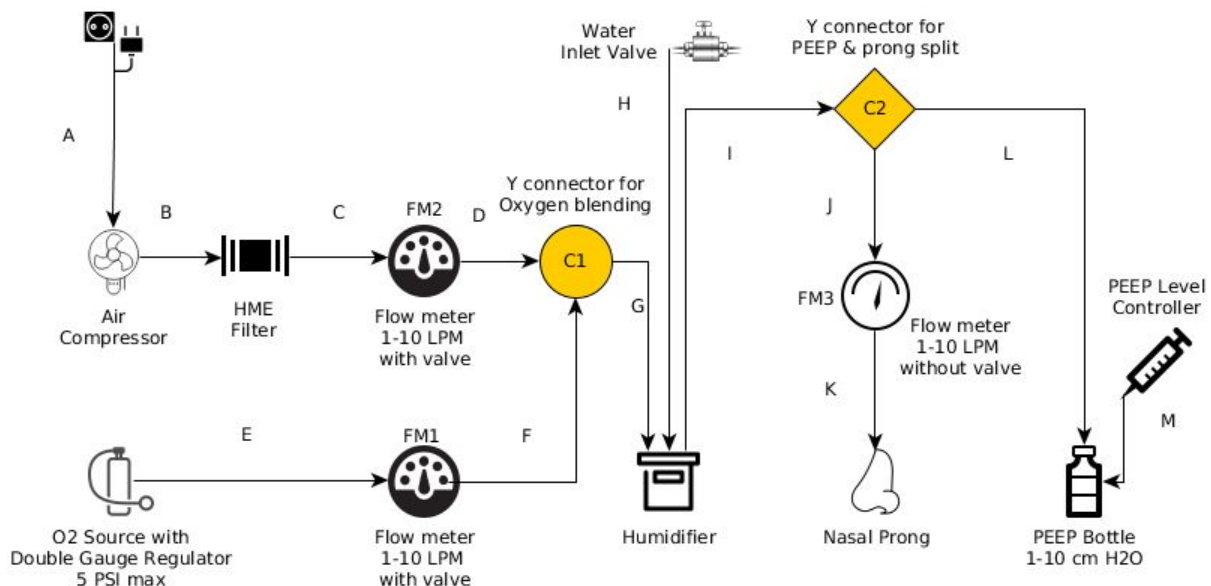
- Load testing for 3 days & observations on stability of the in-circuit humidification irrespective of ambient temperature & humidity change.

### **Iteration 3:**

- Comparison with Pumani and experiments on rebreathing of CO<sub>2</sub> in Open bubble CPAP.
- Humidifier water filling mechanism with ball valve.
- Load testing with the new humidifier setup, continuous run for more than 8 hours
- Comparison between looped vs unidirectional (separate inspiratory & expiratory limb) nasal prongs usage.



### **Iteration 4:**



- Humidifier selection revised. Medical grade commonly available bottle shaped humidifiers.
- Alternate silicone tubing for the breathing circuit. (ID-8mm, OD-12 mm)  
It has advantage of compatibility with a wide range of tube connectors.
- Oxygen blending feature addition in CPAP.

- **3-Flow-Meter method in contrast with existing pumani 2 FM design.**
- **Oxygen cylinder valve comparison and operating pressure levels selection.**