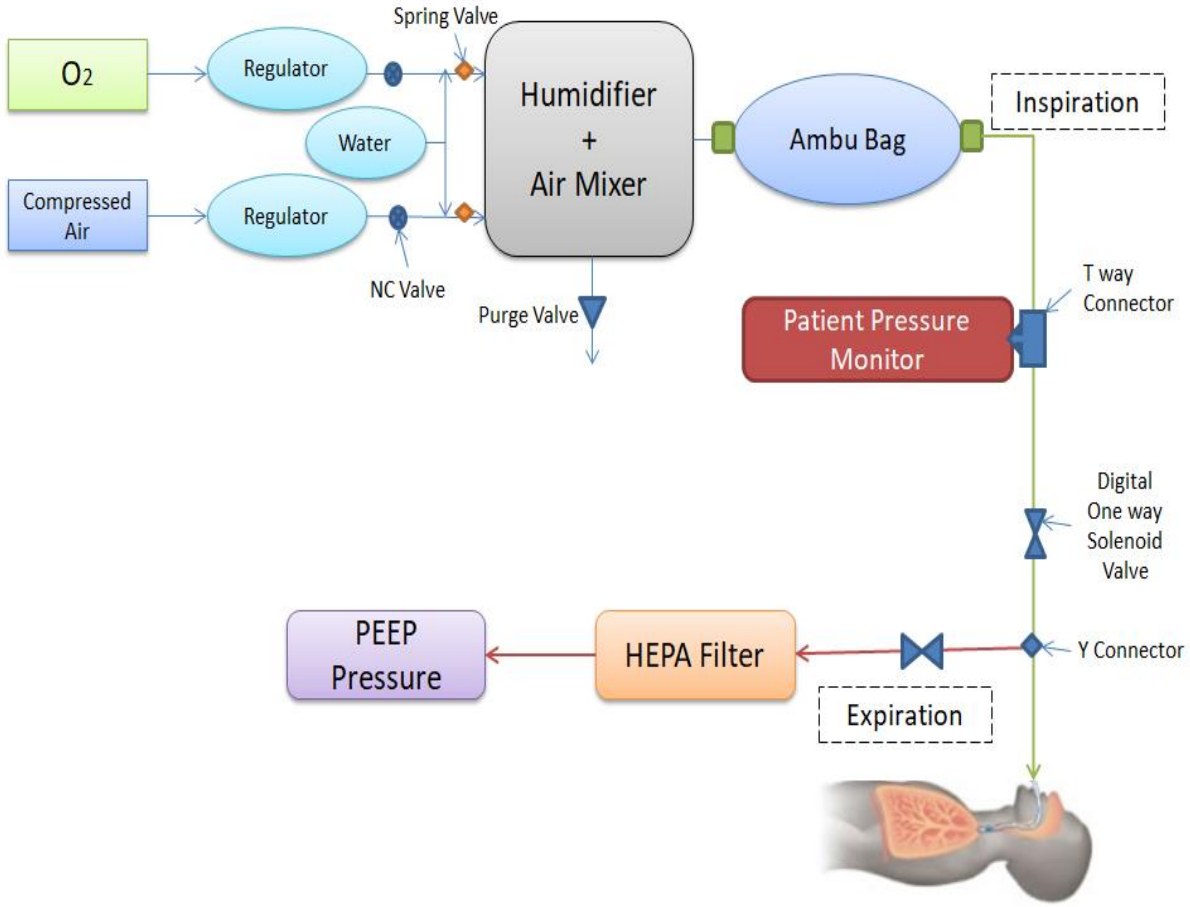
Penumatic Circuit for Ventilator:

Basic operation:

1. The compressed air is filtered purified air, preferably from a monitored and maintained medical air supply at a hospital or medical facility. If another source of air is used, it must at a minimum come from an oil-free compressor source and be filtered.
2. The compressed air regulator reduces the incoming pressure to a lower level. Regulator uses to provide the correct proportion of oxygen and compressed air in the system. This proportion value varies on patient requirements.
3. The oxygen valve is closed, the water mist injector is closed, the purge valve is closed, the patient inlet valve is closed, and the patient outlet valve is open.
4. The compressed air valve opens and air fills in the bag and inflates to the desired level.
5. The compressed air valve is closed, the patient inlet valve opens and the patient outlet valve closes.



Pneumatic Circuit Diagram of Ventilator System

6. Regulated oxygen and air are allowed for the mixup in the presence of water and forward to Ambu bag.
7. Ambu bag contains a pressurised air which is compressed with the designed mechanism for continuous pumping.
8. Air is monitored with pressure valve at T connector.
9. In the process of inspiration, Pressurised air passes from one way valve and reaches to patient lungs.
10. In an expiration, air exhausts through y connector and moves to PEEP.
11. During the cycle, solenoid valve work as a control valve at a junction of Y connector because during inspiration process, solenoid valve at expiration side is closed and air reaches directly to the lungs without any diversion. During the expiration process, solenoid valve at inspiration side is closed, and exhaled air is routed through a HEPA filter to prevent the spread of disease organisms into the room air.
12. The air drives up the left side of the manometer in the PEEP unit which provides a calibrated amount of backpressure. The air then traverses the bottom and bubbles through the water column to exit. The PEEP can be controlled by changing the volume of water in the PEEP unit.

Pneumatic Components in Ventilator System:

Name of Components	Qty.
O_2 Cylinder	1
Regulator Valve	2
Humidifier Chamber	1
Ambu Bag	1
Ventilator Y connector Tubing Kit	1
Digital One way solenoid Valve	2
Spring operated NC Valve	2
Purge Valve	1
Pressure Measured Device	1
Breathing Mask	1

Essential Design Process:

Adjustment of oxygen ratio

1. The oxygen supply can come from a controlled regulated hospital source or from a portable tank.
2. The oxygen regulator pressure is adjusted to be the same as the compressed air regulator pressure.
3. During the bag fill phase the control microprocessor will open the compressed air valve for part of the cycle and open the oxygen valve for part of the cycle to adjust the oxygen ratio.
4. The microprocessor uses the fill time from the last cycle in order to calculate the proper time percentages.
5. The oxygen ratio can be changed at any time during operation as required by controlling an input setting to the microprocessor.

Humidification

1. Whenever there is airflow into the humidifier mixer, the water spray will draw water into the flow stream to mix with the gas stream (oxygen or air). This functions similar to the way a carburetor does in an automobile.
2. The spring check valves prevent recirculating flow from the other stream, prevent backflow or air leakage into the water container.
3. Since not all the injected water may evaporate into the air stream, there is a purge valve to remove accumulated water.
4. The purge valve will open for a short interval at the beginning of every fill cycle to clear any accumulated water in the humidifier mixer chamber.

Safety Design

1. Due to the mix of NC and NO valves, when the power is off, the patient will default to exhale mode with no pressure applied.
2. A safety limit switch prevents the bag from overinflating. It cuts power to the oxygen valve and compressed air valve when it is activated.
3. A mechanical relay prevents both the oxygen valve and the compressed air valve from ever being actuated at the same time.
4. A mechanical relay prevents the patient inlet valve from ever being actuated whenever the oxygen valve or the compressed air valve is actuated.