**gVent Testing Methods & Test Results**

Prototype 3 of the gVent was tested over a 2.5 hour period throughout which it was cycling continuously, at various ventilation parameters. It performed reliably through the duration of the testing session.

**Pressures - Testing maximum and minimum**

To test maximum and minimum pressures we used a manometer connected to the upper portion of the inner cylinder of the gravity ventilator, correlated for validation to the externalized water column representative of internal pressures. We did not have access to a pressure gauge to place distal in the circuit but would conduct further testing to confirm pressures more proximal to the patient.

Minimum inspiratory pressure - 16cm H2O

This is limited by the weight of the upper cylinder as it is essentially the weight of the upper cylinder, as indicated on the manometer the minimum pressure was 16cm H20. Lower pressures could be achieved through further manufacturing of a lighter upper cylinder.

Maximum inspiratory pressure - 40cm of H2O

This was recorded by adding weights to the upper cylinder. At this point, the water seal gave way and pressure was released through bubbling. Given that 40cm of H2O is the upper limit of a clinically safe inspiratory pressure this is a desirable feature. However, theoretically, we could reach a high maximum pressure by increasing the amount of water used to fill our cylinder.

The system is currently designed as a 1 way non-rebreathing circuit. Therefore, maximum positive end expiratory pressure (PEEP) is simply controlled by putting the distal end of the exhaust tubing under controlled pressure. By placing an AMBU bag PEEP valve on the distal end of the exhaust tubing set to 25cm H2O we were able to confirm the system’s ability to hold a pressure in the test lung. This was only confirmed visually as we did not have access to an inline manometer at the time of testing.

**Flow - Testing maximum and minimum**

To test maximum flow, the system was set at a RR of 13, with an I:E ratio of 1:1 with near maximum driving pressures at 39cm of H20. The circuit was connected to a flowmeter that read out both flow and tidal volumes.

With these parameters a maximum tidal volume of 1.955 L and maximum flow of 56.05 SLP was recorded.

At this time we are very pleased with these values and feel our greatest limiting factor is the small diameter of our current solenoid valve (¼”).

**Time to repressurize the system**

This test was completed by depressurizing the system completely by exposing the outflow port to room air, then reconnecting the circuit to the flowmeter in the testing environment. We confirmed the starting pressure was 0 cmH20 on the manometer and then filled the system with an inflow of 15L/min. We measured the elapsed time to reach a pressure of 25 cm of H2O as indicated on the manometer attached to the cylinder.

As per our testing, it would take 5.25s to pressurize the column from 0cmH20 to 25cm H20 with hospital wall inflow oxygen governed at a maximum of 15 L/min.

**Respiratory rate**

By increasing the commanded respiratory rate we can test the upper limit.

The system has shown the capability to run at a respiratory rate of 40 bpm. The minimum of 6 bpm can also be easily achieved and maintained by the system. Currently our code is set to enable a range of 5-50bpm, this range is easily adjusted by changing the values entered in the code.

**I:E Ratio**

Included in our code is an adjustment of I:E ratio from 1:1 through to 1:5. We successfully tested the ability to program and run the system on all four settings.

**Confirming adequate water volumes**

The system relies on a water column within the two cylinders, therefore we must ensure there is an appropriate volume of water to drive the system. The system can accommodate a large range of water volumes but inherent in the design the system will 1) bottom out when the water volume is too low to meet the pressure demands and 2) bubble over if the water level is too high to accommodate the increased volume of the cylinder descending into the water column. More concisely, the system simply would not operate if the water level was not sufficient.

**Confirming FiO2**

The system is not currently sensing gas composition. If the supply was purely wall oxygen we would expect the FiO2 to be 100%. We could mix this with room air to decrease incrementally. An oxygen sensor would need to be placed in the circuit to record the actual FiO2, this would be a meaningful addition.