Gas Consumption with Air Entrainment

Gas consumption is very important during critical care transports since there is a fixed supply of oxygen available. The Crossvent Series of ventilators is very gas efficient. The following indicates how one might calculate the tank duration for a given scenario. Secondly, calculating tank duration when using air entrainment is also indicated.

To calculate the approximate duration of a gas cylinder when using a Bio-Med Devices Crossvent Ventilator, use the following formula:

$$\frac{\text{Cylinder Pressure x Factor}^{(1)}}{\text{(Minute Volume + LPM *)}} = \text{minutes remaining}$$

* Average logic gas consumption for Crossvent ventilators

(1) Factors (commonly used for cylinders using oxygen or air)

D-Cyl	E-Cyl	G-Cyl	H-Cyl	M-Cyl
.16	.28	2.41	3.14	1.56

Example: Using the vent on 100% oxygen with the tidal volume set to 600 ml, a respiratory rate of 12 breaths per minute, and an e-cylinder tank pressure of 2000 psi we would achieve:

$$\frac{2000 \times .28}{7.2 + 2} = \frac{560}{9.2} = 60.8 \text{ minutes}$$

In order to calculate the amount of gas used when the vent is in the air entrainment mode, we must first calculate how much air flow is being entrained for a given flow of oxygen from the tank. In order to calculate this the following equation is used:

$$FiO2 = \frac{.21 \times \text{Flow of Air} + \text{Flow of Oxygen}}{\text{Flow of Air} + \text{Flow of Oxygen}}$$

If 3 is used as the liter flow of Oxygen and use .50 to represent the 50% FiO2 that is delivered when the vent is on air entrainment, the equation can be solved for the Flow of Air being entrained. Once this value is attained the Flow of Oxygen can be compared to the Total Flow to determine a factor needed to use in the tank duration formula from above:

$$\frac{\text{3 lpm of Oxygen}}{\text{8.1724 lpm of Total flow}} = .3671$$

Therefore, in the tank duration formula (using our example from above), in order to calculate the approximate tank duration when the ventilator is being used with air entrainment (50% FiO2) multiply the total liter per minute usage by 0.3671:

$$\frac{\text{Cylinder Pressure x Factor}^{(1)}}{\text{(Minute Volume + LPM *)} \times 0.3671} = \frac{2000 \times .28}{(7.2 + 2) \times 0.3671} = \frac{560}{3.38} = 165.68 \text{ minutes}$$

An oxygen cylinder would therefore last 2.73 times longer on air entrainment (50%) than on 100% oxygen (or almost 3 times as long).