

TO: Newport HT50 Ventilator Distributors

SUBJECT: Changing Altitude Does Not Change Volume Delivery from the Newport HT50 Ventilator

The HT50's unique patented dual micro-pistons provide distinct advantages for patient ventilation. The design of this gas generator system combines the advantages of a piston system – better control of volume delivery, ability to drop bias flow to zero, etc. with the advantages of a turbine or blower system – more synchronized response to patient effort, ability to vary flow to meet patient need throughout the breath, etc. Another unique advantage is the ability to automatically adjust gas delivery at varying altitudes. With the Newport HT50 Ventilator, there is no need to make any kind of adjustments when ventilating at higher or lower altitudes or in helicopters or other aircraft.

Relationship Between Altitude and Gas Delivery

Changes in altitude affect the density of the air. In Denver, Colorado which is at 5,000 ft (1,713 meters) the air is much less dense than it is in Newport Beach, California, which is close to sea level. In Newport Beach, the 'weight' of the atmosphere is heavier and therefore more molecules are compressed into a given volume of air than in Denver. There is no difference in the mixture of molecules, just in the quantity. So, for example, even though the air is made up of 21% Oxygen in both Denver and Newport Beach, some people may have trouble breathing in Denver if they are used to breathing the atmosphere in Newport Beach. It is not that the percent of the air that is made up of oxygen is different in the two locales, there are just fewer molecules of oxygen available in the same breath volume at the higher altitude of Denver.

Just for comparison purposes, let's say that 1 Liter of air in Newport Beach contains 200 molecules and 1 Liter of air in Denver contains only about 120 molecules. Both will contain 21% Oxygen but in Newport Beach there will be 42 molecules (200 times 21%) of Oxygen per Liter of tidal volume and in Denver there will only be 25 molecules (120 times 21%) of Oxygen per Liter. Fewer molecules of Oxygen will be available with each breath in Denver than it will be in Newport Beach.

The Affect of Altitude on Ventilators Using Turbine and Blower Systems

This difference in gas density is important for turbine or blower gas delivery systems. These systems' efficiency is reduced with decreases in the air density. At higher altitudes where the air is less dense, the same motor revolutions will produce lower volumes. Unless the device offers the user the ability to manually input the altitude or atmospheric pressure or it automatically measures the atmospheric pressure and makes the necessary adjustments, the turbine and blower gas delivery systems will deliver lower volumes than what is set by the user when ventilating at higher altitudes.

Changing Altitude Does Not Change Volume Delivery from the Newport HT50 Ventilator Cont'd.

The Affect of Altitude on Ventilators Using Compressed Gas

For ventilators that use the compressed gas from cylinders to power breath delivery, the difference in atmospheric pressure is also important. When this kind of device is used in a helicopter for example, the atmospheric pressure drops as the helicopters goes higher but the pressure from the compressed gas cylinder does not. The gas will expand as it becomes less dense and therefore increases in volume. Unless the device measures flow as it leaves the ventilator and uses feedback control to adjust gas delivery the device will deliver a larger volume than the set volume at higher altitudes. If not carefully monitored and adjusted these systems can cause over distension and damage to the lungs.

The Affect of Altitude on the Newport HT50 with Dual Micro-Piston System

The HT50's unique dual micro-piston system has a great advantage here. Each piston stroke moves a known distance through a known diameter of its cylinder. Each piston stroke is a simple displacement of the volume in the cylinder to the patient's airway. The density of the air does not matter. It will deliver the same volume of air in Denver as it does in Newport Beach. Of course, just as it is true for those breathing without the support of a ventilator, each breath will contain fewer Oxygen molecules than it would at sea level. So the patient may need a higher $F_{I}O_2$ in Denver than when in Newport Beach. The great advantage is that there is no need to worry about altitude-induced changes in delivered tidal volumes that can cause under inflating or over inflating the lungs.

Summary

The Newport HT50 Ventilator offers a unique and distinct advantage over most turbine, blower and compressed gas powered ventilators when ventilating at high altitude.

Unlike ventilators that employ these other types of gas generator systems, there is no need for the user to make any kind of adjustment to the HT50 ventilator or volume related settings when ventilating at high altitudes because the volumes delivered by the HT50's dual micro-piston gas delivery system are not affected by altitude.

If you have any questions or need additional information, please contact Newport Product Manager: 1.949.642.3910 ext. 149 or email: Product@NewportNMI.com.