

The particle separation ability of the D-Fend Pro water trap

SUMMARY

The D-Fend™ Pro is a water trap used with the single-width CARESCAPE™ respiratory modules. *see figures 1 and 2.* The water trap is designed to protect the modules from moisture, humidity and contaminants, which can harm the gas bench and affect measurement accuracy, with its special polytetrafluoroethylene (PTFE) membrane. A study was conducted by an independent research facility to test the water trap's particle separation ability, using particles of different sizes. Results showed that the D-Fend Pro water trap separated at least 99.98% of the particles with a particle size as small as 0.15 µm. Bacteria typically has a particle size of 0.5 µm to 5 µm.¹



Figure 1. The D-Fend Pro and D-Fend Pro+ water traps



Figure 2. CARESCAPE respiratory modules

INTRODUCTION

Then side-stream airway gas monitoring, sampled gases are transported from the patient into the gas bench for analysis. However, sometimes there is moisture and contaminants in the sampled gas, and these can cause damage to the gas analysis system and affect the module's performance. To remove the moisture and contaminants before it enters the system, the sampled gas passes through a water trap.

The D-Fend Pro water trap protects the gas bench and enables seamless operation of the CARESCAPE respiratory module. The gas flow channels in the D-Fend Pro water trap are streamlined to ensure fast rise times of the gas measurements, even at 120 ml/min sample gas flow. In addition, the lower sampling flow rate helps to address problems of moisture and humidity associated with airway gas monitoring. During the measurement the gas is sampled through the channels, where the filter membrane inhibits humidity, contamination and secretions from passing through the water trap.

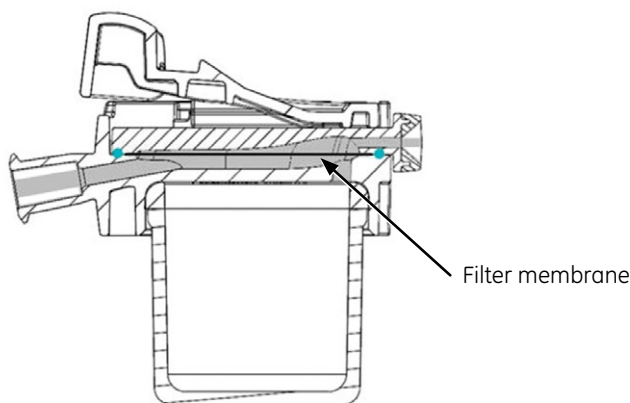


Figure 3. The inner design of D-Fend Pro water trap's air channels (grey) and filter membrane (black)

The key component of D-Fend Pro water trap is the filter membrane developed by GE. This PTFE membrane comprises the hydrophobic and oleophobic effect. The hydrophobic property enables the filter to prevent condensed water from passing through the water trap, and the oleophobic property provides protection against liquids with a surface tension lower than a surface tension of water. To determine the particle filtration efficiency of the D-Fend Pro water trap the PTFE membrane's resistance to permeation was tested.

STUDY METHOD

Diethylhexyl sebacate (DEHS) particles were pumped through the D-Fend Pro water trap at a constant rate of 100ml/min. The particle proportion was measured both from the inlet and the outlet of the water trap with a particle size analyzer (PMS LAS-X II). The particle measurement range was from 0.15 μm to 2 μm . The membrane's resistance, E, to permeation of particles with a particle size, d, is defined by the equation:

$$E(d) = C_i(d) / C_o(d)$$

where $C_i(d)$ and $C_o(d)$ are the proportion of particles with size d in the inlet and outlet, respectively. The test was conducted for 10 individual D-Fend Pro water trap units.

STUDY RESULTS

The results of the resistance to permeation of the D-Fend Pro water trap for particles with a size from 0.15 μm to 1 μm are presented in figure 4. The D-Fend Pro's resistance to permeation was 99.98% for particles with a size from 0.15 μm to 0.3 μm and 99.99% for particles with a size from 0.3 μm to 2 μm .

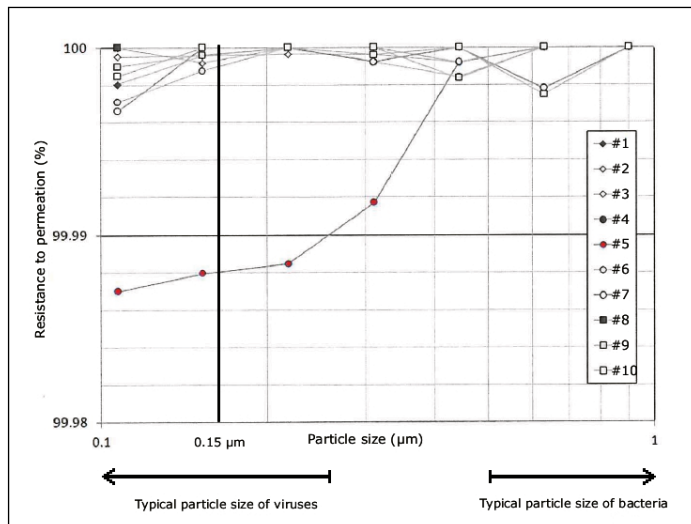


Figure 4. Results of the D-Fend Pro's ability to separate particles

CONCLUSION

In a test conducted by an independent research facility, the PTFE membrane of the D-Fend Pro water trap inhibited at least 99.98% of particles with a size of 0.15 μm or larger from passing through the water trap. This separation ability exceeds the requirements to separate particles with a size comparable to bacteria and a share of viruses, as bacteria have typically a particle size from 0.5 μm to 5 μm , and viruses from 0.02 μm to 0.25 μm . The study shows that the water trap design helps protect the modules from particles on the sizes of some of the main contaminants found in the sampling system.

REFERENCES

1. Gillen, Alan L. The Genesis of Germs. New Leaf Publishing Group, 2007.

STUDY DOCUMENTATION

This paper is based on the following internal GE documentation (M1243549):

Results of the D-Fend Pro Water Trap's particle separation ability tests in VNV-REPORT: Kaasumittausmodulin suodattimen erotuskykymittaus. 14.12.2011

ADDITIONAL RESOURCES

For white papers, guides and other instructive materials about GE Healthcare's clinical measurements, technologies and applications, please visit <http://clinicalview.gehealthcare.com/>



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