

Hygienic Security and The PORTACOUNT[®] Respirator Fit Tester

Application Note ITI-034

Can a person being fit tested with a PORTACOUNT Respirator Fit Tester be exposed to exhaled moisture from a previous test subject?

Introduction

On occasion, TSI receives an inquiry regarding the potential exposure of fit test subjects to moisture exhaled during earlier fit tests. Obviously, respirator masks used for fit testing must be sanitized in-between fit tests, but what about the PORTACOUNT twin-tube? The first several inches of the twin-tube typically becomes fogged with moisture during a fit test. This occurs because moisture in the test subject's warm breath condenses when it contacts the cold walls of the tube. The concern is that a momentary flow reversal, perhaps caused by inhaling sharply, could expose the test subject to moisture left over from a previous test.

Discussion and Test Results

One way to alleviate concern would be to change the twin-tube assembly for each fit test. This would certainly work, but the cost may be prohibitive. Alternately, you could have an inventory of twin-tubes and a method for cleaning and drying the tubes prior to re-use. See the end of this document for information on obtaining spare twin-tubes.

Fortunately, discarding or cleaning the PORTACOUNT twin-tube assembly after each fit test is not necessary. TSI has tested the PORTACOUNT fit tester and determined that air cannot reverse direction and flow from the sample tube back into the mask being tested. Air inside the mask sample tube always travels from the mask to the PORTACOUNT fit tester, or is prevented from moving at all (such as when the ambient tube is in use). This test was done using a PORTACOUNT Plus Model 8020, however, the results will be identical when the N95-Companion accessory is attached since the pump in the PORTACOUNT fit tester still does all the work.

To determine how much vacuum is required to reverse the air flow through the mask sample tube, we connected a sensitive flow meter in-line with the PORTACOUNT Respirator Fit Tester. A vacuum pump and HEPA filter were attached to the end of the mask sample tube to simulate a person wearing a respirator (see diagram on last page). The vacuum level was adjusted using a needle valve located between the pump and the sample line. The small HEPA filter served the purpose of providing a flow restriction similar to that of a respirator cartridge. There was no need to filter the air for this experiment.



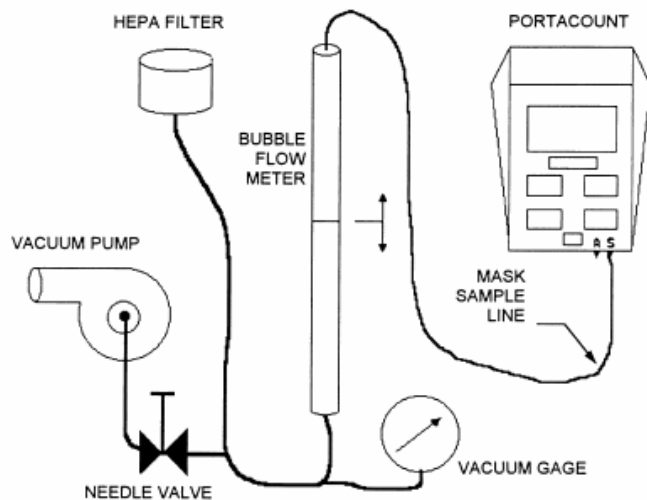
An adult male respirator wearer can generate a peak in-mask vacuum level of 2.0 inches of water while breathing deeply. We wanted to know if 2.0 inches of water could cause flow to stop or reverse. For test purposes, we challenged the PORTACOUNT Respirator Fit Tester at higher and higher vacuum levels until the flow was forced to stop. The table below shows the results.

Test No.	In-Mask Vacuum (inches H ₂ O)	Flow Rate (liters/min)	Flow Direction Inside Mask Sample Tube
1	0	0.74	into PORTACOUNT
2	2*	0.71	into PORTACOUNT
3	7	0.70	into PORTACOUNT
4	14	0.63	into PORTACOUNT
5	21	0.55	into PORTACOUNT
6	28	0.48	into PORTACOUNT
7	55	0	No Flow

* Peak in-mask vacuum for adult male = 2.0 inches of water

As can be seen from the data above, an in-mask vacuum level that is over 27 times higher (55 in. H₂O) than can be created by a respirator wearer (2.0 in. H₂O) is needed to stop the air flow through the PORTACOUNT sample line.

The PORTACOUNT fit tester uses a solenoid valve to switch between the ambient and the mask sample line of the twin-tube assembly. During an ambient measurement, the valve holds the mask sample line tightly closed. Using the same apparatus as above, we were unable to draw air out of the mask sample line while the valve held that line closed, regardless of the vacuum level applied. This was true even during the moment when the valve was in the process of switching.



Conclusion

Air drawn into the PORTACOUNT twin-tube always travels from the test respirator towards the PORTACOUNT fit tester or is stopped. It is not possible for a respirator wearer to inhale with sufficient force to reverse the air flow direction inside the PORTACOUNT twin-tube during a fit test.

If you need replacement twin-tubes, the following items are available:

Part No.	Description
800197	Twin-tube for PORTACOUNT, blue/clear, 5-foot, pkg. of 1
801501	Pendant Twin-tube for N95-Companion, 18-inch, pkg. of 5
8017	Sampling Hose Kit for PORTACOUNT (3 ea. 5-foot Twin-tubes, 10 ea. 3/16 and 1/4 adapters)
3001744	Bulk Twin-tube, blue/clear (priced per foot - specify length - 100 foot minimum)

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