

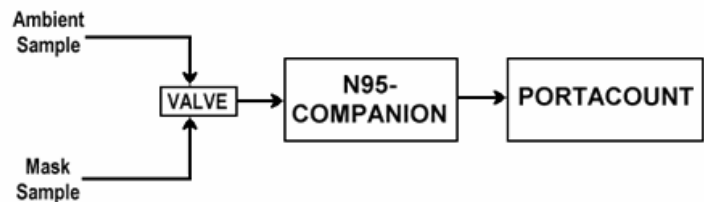
## PORTACOUNT<sup>®</sup> PRO<sup>+</sup> Model 8038 UNIVERSAL

### Respirator Fit Tester Theory of Operation

Application Note RFT-001

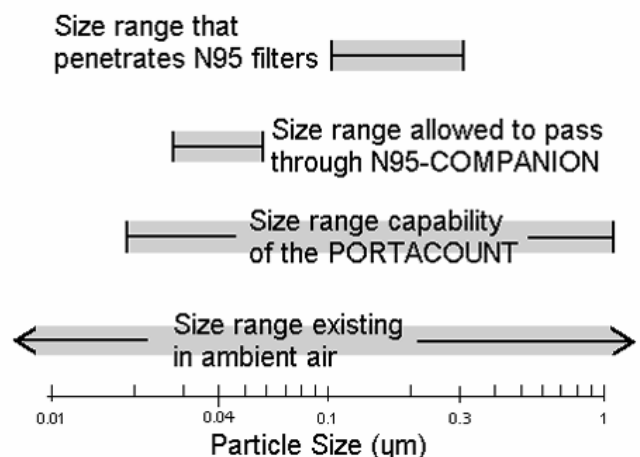
The PORTACOUNT<sup>®</sup> PRO<sup>+</sup> Universal Respirator Fit Tester is essentially a PORTACOUNT Pro Respirator Fit Tester with a built-in N95-COMPANION<sup>™</sup> technology, that selects particles in a specific size range and passes them on to the PORTACOUNT Respirator Fit Tester.

Particles that are not in the target size range are discarded. Without the built-in N95-COMPANION technology, the discarded particles could be incorrectly counted as face seal leakage, because many of them are in the size range that can penetrate an N95 filter.<sup>1</sup> With the built-in N95-COMPANION technology enabled, the PORTACOUNT PRO fit tester "sees" only particles that are in the right size range for effective quantitative fit testing.



Aerosol-based quantitative respirator fit testing relies on the premise that all particles detected inside the mask got there through a face seal leak. When the respirator being fit tested is equipped with high efficiency filters such as HEPA, N100, R100, P100, N99, R99 or P99, this assumption is valid because virtually all particles are trapped.<sup>2</sup> They cannot enter the mask through the filter.

When the respirator is equipped with lower efficiency filters such as N95, R95 or P95, the assumption that all particles detected inside the mask got there through a face seal leak is no longer valid. Up to 5% of the particles may penetrate through the filter. Unless taken into account, the particles that slip through the



<sup>1</sup>There is a common misconception that fiber-type filters behave like a sieve, trapping large particles and allowing small ones to pass. This could not be further from the truth! If you are not familiar with the way fibrous filters trap particles, please refer to Applications Note ITI-041 Mechanisms of Filtration for High Efficiency Fibrous Filters.

<sup>2</sup>When ambient air is used as the challenge aerosol, N99, R99, P99, N100, R100 and P100 filters can safely be assumed to trap all particles. The N95-Companion is not needed.

filter will be interpreted as face seal leakage and a lower than deserved fit factor will result. This conservative fit factor will often be below the required pass/fail level (typically 100). In some cases (using a PORTACOUNT Pro by itself), the fit test would fail even if you glued an N95 mask onto the person's face!

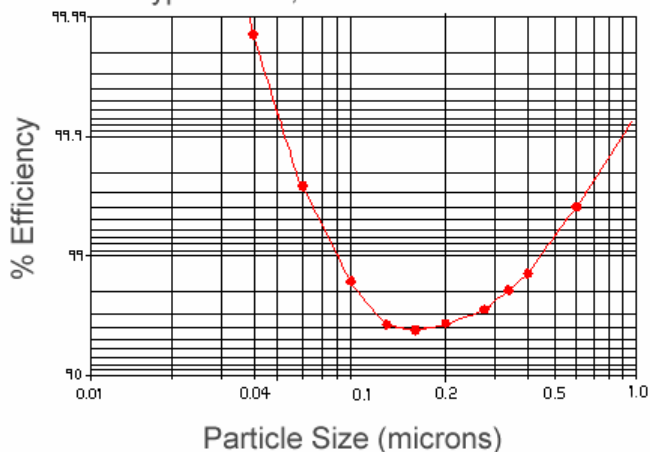
The PORTACOUNT® PRO+ Universal fit tests N95, R95 and P95 respirators by restricting the size range of the particles counted, thereby eliminating particles in the size range that can penetrate through the respirator filter and be counted incorrectly as face seal leakage. Since the remaining particles cannot get through a class 95 filter, the assumption that all particles detected in the mask got there through a face seal leak is valid again!

An unavoidable consequence of eliminating all unwanted particles is that many desirable particles are also eliminated. This results in far fewer particles being available for fit testing than there would be if the built-in N95-COMPANION technology was not used. Even so, the low particle concentrations restrict the system to a maximum fit factor of 200.

Since the only difference between fit testing with the PORTACOUNT PRO alone versus the PORTACOUNT® PRO+ Universal with built-in N95-COMPANION technology is the particle size of the aerosol, it is reasonable to wonder if particle size affects the result of the fit factor measurement. Over the years, a number of studies have been conducted that address this question. Most of the research shows that particles greater than about 2 microns in diameter have difficulty penetrating face seal leaks. Unfortunately, these studies for the most part neglected to examine the behavior of particles below a few tenths of a micron, which is the range used by the PORTACOUNT PRO and the PORTACOUNT® PRO+ Universal Fit Testers.

To address this void in the research, TSI conducted a study using particles in the size range from 0.02 to 1.0 micron. The results show that all particles in the range used by the PORTACOUNT PRO and PORTACOUNT® PRO+ Universal Fit Testers are in fact appropriate for respirator fit testing. Please refer to [Application Note ITI-055 Penetration of Ambient Aerosols Through Respirator Faceseal Leaks](#).

Efficiency Curve  
for  
Typical N95, R95 and P95 Filters



*Licensed under US Patent No. 5,117,190 and other patents from Commissariat a L'Energie Atomique, France. U.S. Patent No. 6,125,845. Other patents pending.*

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