

A Test System Optimized for Precise Measurement of High Fit Factors

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A test system has been optimized for the measurement of respirator fit factors, especially those greater than 10,000. The heart of the system is a condensation particle counter (CPC) that has been calibrated with a precision diluter to ensure proportional concentration response from concentrations of 1 p/cm^3 to $5 \times 10^5 \text{ p/cm}^3$. The proportionality is verified each day prior to testing and tracked with a control chart to ensure consistency. Other elements of the system include a chamber that is large enough to easily accommodate two treadmills side-by-side for testing two subjects simultaneously (with separate CPCs) and a constant output atomizer producing a NaCl aerosol with a geometric mean diameter between 60-70 nm at a flow rate of $4.25 \text{ m}^3/\text{min}$ (16.2 air changes per hour). The aerosol in the chamber is maintained at a concentration of approximately $2 \times 10^5 \text{ p/cm}^3$ and is measured at the beginning and end of each test. Initial and final concentrations are typically within 5% of each other over the course of a 12 minute set of exercises. Data is recorded every second and plotted in real time and test records are stored in a database for easy retrieval by product, test subject, or any other variable.