

FACTORS THAT INFLUENCE PENETRATION TEST RESULTS WITH PHOTOMETER-BASED AIR FILTER TEST EQUIPMENT

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The test equipment used for testing filters needs to give consistent results. Most test equipment can be verified by tracing the results to a standard. In general, there are not standards for air filter media but there are standards for testing respiratory filters that are tested at similar flow rates as filter media. Respirators filters can be tested to standards such as ISO 16900-3, 42CFR part 84, EN 143 and GB2626. These standards typically define key parameters for testing such as flow rate, aerosol concentration, particle size parameters, and ambient test conditions. Unfortunately measurements that are compliant to the standards requirements don't necessarily result in consistent penetration test results. While count median diameter and the geometric standard deviation is the most accurate way to define a sub-micrometer particle size distribution, the aerosol undergoes changes in the aerosol path of the filter tester that can change the size distribution in subtle ways that can have a large influence on filter penetration results.

Light scatter photometers are a standard method for testing air filter media and some filter types. They have the benefit of being able to measure particle concentrations much higher than particle counting instruments and they can be used during the loading of filters. The Light scatter properties of sub-micrometer particles are proportional to the sixth power of the diameter resulting in the largest particle contributing the vast majority of the light scatter signal. Therefore, small changes in the upper end of the distribution can have significant effects on the signal and this changes the measured penetration of particles through the filter.

While developing a new version of a photometer-based tester, the model 8130A, it was important to verify the continuity of measurement results to the previous version, model 8130, which had been in use for more than 20 years. In that time the 8130 has become the reference instrument in many filter media labs. In order to obtain continuity of measurement results a test matrix was devised and executed to compare the two filter testers (models 8130A and 8130). Tests were done with two different aerosols, several mechanical filter media types with different numbers of sheets to produce different penetration levels and also different flow rates were used. Testing shows an excellent agreement for every media/aerosol combination and at different flow rates with measured penetrations typically within $\pm 10\%$ of the global mean obtained from multiple testers. The comparison test results will be presented and discussed and recommendations on best practices will be given.