

## A problem with ISO 16890: ratings can depend on test aerosol choice

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ISO Standard 16890 provides HVAC system designers an improved way to estimate the particulate air quality supplied by filtered outdoor air. It does this first by defining two bimodal particle-size distributions, one typical of urban locations, the other typical of rural locations. Each filter is tested for its efficiency as a function of particle size over the diameter range 0.3  $\mu\text{m}$  to 10  $\mu\text{m}$ .

The overall particle mass efficiency is then calculated for the filter as if it were to operate on the assumed urban and rural size distributions. This is done for three upper size limits, 10  $\mu\text{m}$ , 2.5  $\mu\text{m}$ , and 1  $\mu\text{m}$ , which yields three ratings called ePM10, ePM2.5 and ePM1. System designers can use local data (often supplied by government agencies) for the mass concentrations of particles smaller than the three sizes to estimate the mass concentrations in the filtered air entering the building. The impact of prefilter/filter combinations can be accounted for.

ISO 16890 uses two different test aerosols - liquid DEHS and dry, solid KCl. Normal testing by the standard uses KCl aerosol for the size range 1 to 10  $\mu\text{m}$ , to show the effects of particle adhesion. However, the standard allows either aerosol to be used over the entire range, if the laboratory first shows that all fractional efficiencies measured on a "reference filter" do not differ by more than 2%.

Nanoparticles can be included in the calculations if efficiency tests include the nanoparticle range, for there is no lower limit on the typical particle size distributions, and the local PM values are measured gravimetrically, using the mass captured by high efficiency sampling media. Our study was intended to evaluate the effects of filter fiber electrical charge on ePMX ratings for two filters, one a pocket design having charged polymer fibers, the other having uncharged glass fiber media in multiple mini-pleated panels. Both filters were tested before and after exposure to isopropyl alcohol (IPA) vapors, which eliminates electrical charges on filter fibers.

As expected, the filter with no charge on its media showed essentially the same efficiency at each particle size regardless of aerosol type or IPA treatment. For the intentionally charged filter, efficiency differed noticeably for the two aerosols. If a laboratory chooses the "reference filter" option, its filter ePMX values will depend on whether DEHS or KCl is chosen as a test aerosol.

### Session 6

#### 6. Regulation / Standardization