DOCKETED

Docket Number:	17-BSTD-02
Project Title:	2019 Title 24, Part 6, Building Energy Efficiency Standards Rulemaking
TN #:	222959
Document Title:	Comments on HVAC System Filter Requirements in 2019 Tile 24, Part 6 45-Day Language
Description:	Comments in support of residential air filtration requirements in proposed 2019 Title 24, Part 6.
Filer:	Jeff Miller
Organization:	Brett Singer, Ph.D. and Iain Walker, Ph.D from Lawrence Berkeley National Lab
Submitter Role:	Public Agency
Submission Date:	3/13/2018 3:58:56 PM
Docketed Date:	3/13/2018

Comments on HVAC System Filter Requirements in 2019 Title 24, Part 6 45-Day Language

March 9, 2018

Submitted by:

Brett Singer, Ph.D.
Staff Scientist and Indoor Environment Group Leader
Lawrence Berkeley National Lab

Iain Walker, PhD.
Staff Scientist and Residential Building Systems Group Leader
Lawrence Berkeley National Lab

Summary Comments:

We strongly support the proposed changes to upgrade the filtration requirement on mechanical space conditioning equipment and supply ventilation systems to MERV13, as specified in Section 150.0(m)12.A.

We also strongly support the language of Section 150.0(m)12.D that requires either a two-inch deep filter slot with clean-filter pressure drop determined by the system design (D.i) or a maximum clean-filter pressure drop of 25 Pa for one-inch filters (D.ii). And we feel that EXCEPTION 1, specified in sub-section D.iii is an appropriate accommodation.

Further, we are strongly supportive of including both of these requirements, as they are synergistically beneficial to maintaining acceptable indoor air quality in new California homes.

Rationale:

An LBNL analysis (Logue et al., 2012) has shown that exposure to fine particulate matter or $PM_{2.5}$ in homes is very likely responsible for more aggregated health damage than exposure to any other single non-biological air pollutant, and may cause more damage than all the others combined. Polluted outdoor air is one of the main sources of indoor $PM_{2.5}$ and several areas of California are considered "non-attainment", meaning they have outdoor concentrations that exceed health-based standards set by the US EPA. Equipping a central air handler with an air filter that removes the "accumulation mode" particles that dominate outdoor $PM_{2.5}$ is an effective way to reduce chronic exposures through "free" filtration that occurs when the system operates for thermal conditioning. And it enables whole-house air cleaning as needed by operating the air handler in "fan-only" mode. It is important that the requirement specify MERV13 or a higher MERV rating because MERV13 is the lowest MERV filter that is required to demonstrate removal of particles smaller than 1 micrometer in diameter.

It is particularly important to specify MERV13 filtration on the supply ventilation system because otherwise this approach to ventilation would lead to higher indoor concentrations of outdoor $PM_{2.5}$ compared to the use of exhaust ventilation. This was demonstrated in a recent ARB-funded study conducted by LBNL (Singer et al., 2016).

The requirements related to a maximum pressure drop for 1 inch filters or use of a 2 inch filter and specified pressure drop are important to reduce the risk of having an airflow system (central forced air or supply ventilation) experience degraded performance from a large pressure drop associated with a high performance filter. When new, thicker filters generally have lower pressure drop than thinner filters of the same MERV rating, though there are also some 1-inch filters MERV13 filters that have lower pressure drops than some 2-inch MERV13 filters when new. Data provided to the CEC in a comment submitted by Brent Stephens and Torkan Fazli of the Illinois Institute of Technology demonstrate this point.

The data provided by Stephens and Fazli demonstrate that there is a small benefit to new filter pressure when going from a 2-inch to a 4-inch filter; but the benefit is much larger when going from 1-inch to 2-inch.

Regarding the relationship between pressure drop and filter thickness, we also wish to comment on the comment and data provided by the California Statewide Utility Codes and Standards Team on February 20. In their comment, they provide pressure drop vs. airflow for a suite of 24x24-inch filters that were tested new and clean. In their comments they make the following statements about the data (numbers added by us):

> [1] The results show that acceptable pressure drops of less than 0.20 inch w.c. can be achieved by either one- or two-inch deep MERV 13 filters.
>
> [2] No correlation was found between filter MERV ratings and pressure drop.
>
> [3] One-inch and two-inch deep filters can have the same pressure drop at the same MERV rating, allowing either to be used."

While points 1 and 3 are solidly supported by the data they present and by other data we have seen, point #2 is inconsistent with other data we have seen, e.g. as provided by Stephens and Fazli, and with the data presented in Figure 3 of the CASE team comment. That figure shows pressure drop vs. flow for three 1" and three 2" MERV13 filters. While there is overlap there is also a trend of the 2" filters tending to have lower pressure drops than the 1" filters across the range of flows / velocities studied.

Both the data shown in Figure 3 of the CASE team comment and the data provided by Stephens and Fazli support the CEC's proposal to allow a 2" or thicker filter with specified airflow and pressure drop of <0.1 iwc as a compliance option.

Please also consider this: as filters load over time, the greater capacity of thicker filters reduces the likelihood that the pressure drop of a loaded filter will increase to the point that it degrades system performance.

In summary, the available preliminary data that has been collected to support the proposed 2019 Title 24, Part 6 air filtration requirements confirm that filters with the capability to comply with the requirements are readily available, and thicker filters tend to have lower pressure drops relative to 1-inch filters, when new.

Citations:

Logue JM, Price PN, Sherman MH, Singer BC. 2012. A method to estimate the chronic health burden of air pollutants in U.S. residences. *Environmental Health Perspectives* 120(2): 216-222. DOI: 10.1289/ehp.1104035. LBNL-5267E.

Singer BC, Delp WW, Black DR, Walker IS. 2016. Measured performance of filtration and ventilation systems for fine and ultrafine particles and ozone in an unoccupied modern California house. *Indoor Air* 27(4):780-790*. Published online 05-Dec-2016*. doi.org/10.1111/ina.12359. LBNL-1006961.