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Unites States Environmental Protection Agency
Washington, D.C. 20460
Office of Air and Radiation

Re: Draft 1 Version 4.0 ENERGY STAR Residential Ceiling Fans specification comments

Date: 5/12/2016

MacorAir is predominately a large ceiling fan manufacturer but we have a few offerings that are residential. In regards to the new draft of the residential ceiling fan specification we have the following comments:

Overall we are in favor or revising the Energy Star specification for ceiling fans so that they are more aligned with the DOE standards and incorporate additional CFLK requirements. However we do have a few negative comments.

In general we are opposed to the use of CFM/W as and efficiency metric. It is a flawed metric. Due to the nature of the equations that govern volumetric flow and power, reducing the RPM of a fan will overly increase the CFM/W value; giving the false impression that a fan is more efficient at lower speeds. In most cases a fan is less efficient at lower speeds. The fan laws illustrate this point. For a fan of constant diameter, the flow and power fan laws are as follows.

$$\frac{q_1}{q_2} = \frac{\omega_1}{\omega_2}$$
$$\frac{P_1}{P_2} = \left(\frac{\omega_1}{\omega_2}\right)^3$$

Where, q1 and q2 are the volumetric flowrates at speeds one and two, ω1 and ω2 are the rotational speeds one and two, and P1 and P2 are the power usage at speeds one and two. Combining these two equations we can find the CFM/W relationship at the two speeds.

$$\frac{CFM/W_1}{CFM/W_2} = \left(\frac{\omega_2}{\omega_1}\right)^2$$

Thus, if the second fan is half of the first speed, so is the flowrate. However, the power usage is 1/8th and the CFM/W is 4 times as great. This relationship makes it very difficult to compare CFM/W across various fan designs and sizes. If one fan has a max CFM lower than another, it will have an inflated CFM/W. Additionally; a fan manufacturer could artificially reduce the max speed of their fan to meet a desired (competitive or regulated) CFM/W value. If that is the case, the customer is being denied the full capability of the fan.

Instead of CFM//W we propose the use of an efficiency based on the wind power that the fan produces. If this is used there is no need to adjust the required efficiency for fan size or CFM output. We also made this proposal to the DOE when they were developing their standards but it was rejected.

If you do wish to continue with the use of CFM/W we take issue with the minimum requirement used in Table 1. We feel that the line is too steep and that it requires far too high a CFM/W for

larger ceiling fans (roughly from 60 inches to 84 inches). It is also curios that below 38 inches the DOE requirement is more strict that the Energy Star requirement.

Thank you for your consideration and we look forward to see how the next revision turns out.

Respectfully,

Jonathan Hollist
R&D Engineer
MacroAir Technologies Inc.