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allow high-rise multifamily units to use continuously operating central fan systems for providing ventilation

Please see attached.

Additional submitted attachment is included below.

TAYLOR ENGINEERING

To:	Statewide Codes and Standards Team
From:	Steve Taylor
Subject:	Comments on T24-2019 Res IAQ Express Terms
Date:	November 9, 2017

The Statewide Utility CASE team submitted a comment on the Commission's T24-2019 Res IAQ Express Terms recommending that T24 allow high-rise multifamily units to use continuously operating central fan integrated (CFI) systems for providing ventilation if they have a variable speed fan with an efficacy at least 0.4 W/cfm at minimum fan speed. Under the Express Terms, these systems would be prohibited because of the blanket prohibition of using continuously operating CFI systems for ventilation. This requirement was copied from a requirement developed for single family homes. But it is not appropriate for multi-family HVAC and ventilation systems.

Whether minimum ventilation air is supplied by CFIs or a separate dedicated outdoor air system (DOAS), the energy to condition the outdoor air is clearly the same. Therefore, the primary energy concern is fan energy. But the Statewide Utility CASE team's proposal includes a very low fan energy use (0.4 W/cfm) when the system is at low speed as it would be when only supplying ventilation air (no heating or cooling). This low energy use is due to variable speed supply fans and cube-law fan energy performance as fan speed and airflow are reduced. Yet nowhere in the current or proposed T24 language is the fan efficacy of a DOAS addressed at all, so it is possible that CFI fan energy will be lower than DOAS.

One advantage of CFI is that fan-coils used for heating and cooling usually have enough fan static capability that they can handle the pressure drop of high efficiency MERV 13 filters, required in many areas where PM2.5 concentrations are high. The CFI allows the MERV 13 filter to not only filter ventilation air, but also recirculated air, thus reducing the concentration of particles introduced inside the space, e.g. from cooking and other occupant activities. Thus, indoor air quality is improved using CFIs versus a DOAS system with MERV 13 filters and a separate recirculating heating/cooling system.

It is also difficult in multi-family HVAC systems to address comfort issues using a DOAS that runs continuously for ventilation. It is not practical to provide the DOAS with heating/cooling capability so either the air is dumped into the occupied space without conditioning, causing drafts and discomfort, or the air must be supplied upstream of the separate heating/cooling system, which requires that it too operate, possibly at constant speed. Clearly the latter will increase fan energy use compared to a variable speed CFI providing ventilation.

During normal operation when heating or cooling is required, the variable speed CFI will also reduce fan energy compared to a DOAS and separate constant speed heating/cooling system.

I do acknowledge that a CFI balanced for minimum outdoor air at low speed will supply more outdoor air at higher speeds when space heating or cooling loads demand more air. But this is

a minority of the operating hours, and though outdoor air conditioning energy is increased in these modes, indoor air quality is improved due to higher ventilation rates.

But this ability to provide additional outdoor air also allows the system to prevent excessive negative pressures when many of the exhaust systems in the unit, such as kitchen hood fans and bathroom exhaust, are operating. It is not practical to balance exhaust and mechanically supplied outdoor air in these cases – the fans are all intermittent so the outdoor air supply system would have to have multiple speed capability and complex interlocks with the exhaust fans. Since multifamily units have low exterior wall area, and because walls to other units are well sealed for acoustic reasons, the ability to draw makeup air from the outside (infiltration) is reduced compared to single family homes. This can result in excessively negative pressure when all exhaust fans are on and only minimum outdoor air is being supplied. With a CFI, the outdoor air intake can be designed to passively allow makeup air to increase as unit room pressure falls due to exhaust fan operation. This is not possible with a DOAS.

In conclusion, variable speed CFIs improve indoor air quality and are as efficient as a DOAS plus separate heating/cooling system. I urge you to accept the Statewide Utility CASE team's recommendation.