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2019 Draft Standards Comments - Ingersoll Rand

Additional submitted attachment is included below.

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October 20, 2017

California Energy Commission
Docket Unit, MS-4
Re: Docket No. 17-BTSD-01
1516 Ninth Street
Sacramento, CA 95814-5512

Re: Docket No. 17-BTSD-01 – Draft 2019 Building Energy Efficiency Standards

Dear Mr. Alatorre:

Thank you for the opportunity to submit comments regarding the Draft 2019 Building Energy Efficiency Standards, presented by the California Energy Commission (CEC) on October 4, 2017.

Ingersoll Rand (NYSE:IR) advances the quality of life by creating and sustaining safe, comfortable and efficient environments. Our people and our family of brands - including Club Car, Ingersoll Rand, Thermo King and Trane - work together to enhance the quality and comfort of air in homes and buildings; transport and protect food and perishables; and increase industrial productivity and efficiency. Our company is helping to solve some of the world's most pressing challenges including the demand for energy resources and its impact on the environment. As such Ingersoll Rand announced in 2014 a roadmap to increase energy efficiency and reduce environmental impact from our operations and product portfolio to result in 20.85 million metric tons of CO_2e avoidance globally by 2020. Most recently, Ingersoll Rand was an original signatory to the "We Are Still In" declaration confirming our commitment to stand by plans that align with the targets set by the Paris Agreement regarding reducing carbon emissions to avert the worst effects of climate change.

Trane is a U.S. and global manufacturing leader of commercial heating, ventilation and cooling (HVAC) products. The measures covered on the June 20th call affect a number of Trane products and applications, including both HVAC equipment and controls. Collectively, these products account for a significant portion of our company's commercial and HVAC revenue.

MERV 13 Filtration Proposal (Mandatory Requirement 120.1.b and c):

The proposed draft standards language for this section requires MERV 13 filters 2" in depth or greater in hi-rise residential and all non-residential and hotel/motel buildings that introduce outdoor air into occupied spaces. By definition, all cooling air-handlers with an airside economizer would be subject to this requirement. Requiring MERV 13 filters on all cooling equipment with airside economizers is an extreme measure that will likely bring unintended consequences, including making this equipment less energy efficient. First, the pressure drop associated with MERV 13 filters is magnitudes larger than MERV 6 or MERV 8 filters typically used in these applications. This will drive larger bhp motors to overcome the resultant additional static pressure, which in turn increases the kW of the equipment. The amount of additional energy consumption from HVAC equipment due to this requirement would be significant, and would very likely be greater than any energy-related benefit associated with this proposal.

In addition, requiring MERV 13 filters in every outdoor air application statewide is not necessary. While there are certain buildings in certain locations where this level of filtration may make sense, ASHRAE 62.1-2016 references the national standards and guidelines on PM10, PM2.5 and Ozone areas as

defined by the Environmental Protection Agency. For the state of California, there are indeed some areas that fall into the extreme nonattainment category. However, most of the geographical area of the state would be categorized as marginal to compliant with outdoor air quality standards. At the very least, these areas of the state should be exempt from the MERV 13 filtration requirement.

Fan Power Limitation Proposal (Prescriptive Requirement 140.4.c):

It appears that the intention of the proposed language in Section 140.4.c of the draft standards is to align with requirements outlined in ASHRAE 90.1-2016. However, rather than harmonizing with the 90.1 standard, the proposed Title 24 language for goes well beyond those requirements with bhp limits that are significantly more stringent. For comparison, proposed language for Title 24-2019 and current language from ASHRAE 90.1-2016 are included in Figures 1 and 2, respectively, below.

Figure 1: Proposed Fan Power Limitation in Title 24-2019

Table 140.4 - A Fan Power Limitation [1]

	Limit	Constant Volume	Variable Volume
Option 1: Fan system motor nameplate hp	Allowable motor nameplate hp	$hp \leq cfm_s \times 0.00095$	$hp \leq cfm_s \times 0.0013$
Option 2: Fan system bhp	Allowable fan system bhp	$bhp \leq cfm_s \times 0.00082 + A$	$bhp \leq cfm_s \times 0.0011 + A$

[1] cfm_s = maximum design supply airflow rate to conditioned spaces served by the system in cubic feet per minute

hp = maximum combined motor nameplate horsepower for all fans in the system

bhp = maximum combined fan-brake horsepower for all fans in the system

A = sum of (PD x cfm_D/4131)

PD = each applicable pressure drop adjustment from Table 140.4 – B, in inches of water

cfm_D = the design airflow through each applicable device from Table 140.4 – B, in cubic feet per minute

Figure 2: Existing Fan Power Limitation in ASHRAE Standard 90.1-2016

Table 6.5.3.1-1 Fan Power Limitation[a]

	Limit	Constant Volume	Variable Volume
Option 1: Fan *system* motor nameplate hp	Allowable *motor nameplate hp*	$hp \leq cfm_S \times 0.0011$	$hp \leq cfm_S \times 0.0015$
Option 2: Fan *system* bhp	Allowable fan *system* bhp	$bhp \leq cfm_S \times 0.00094 + A$	$bhp \leq cfm_S \times 0.0013 + A$

a. where
cfm_S = maximum design supply airflow rate to *conditioned spaces* served by the *system* in cubic feet per minute
hp = maximum combined motor *nameplate horsepower*
bhp = maximum combined fan-brake horsepower
A = sum of (PD × cfm_D/4131)
where
PD = each applicable pressure drop adjustment from Table 6.5.3.1-2 in in. of water
cfm_D = the design airflow through each applicable device from Table 6.5.3.1-2 in cubic feet per minute

Note that the formulas for both Option 1 and Option 2 in the proposed Title 24 Section 140.4.c language are more extreme than current ASHRAE 90.1 requirements in both cases. It appears that perhaps the formula for bhp (Option 2) in 90.1 was inadvertently copied as the nameplate hp (Option 1) requirement in Title 24. Subsequently, the Title 24 formula for bhp (Option 2) was written in as an even more stringent value. In the interest of aligning Title 24 Section 140.4.c with the stringency of 90.1-2016, the proposed language should be corrected so that it is in sync with the ASHRAE 90.1-2016 standard.

However, if this difference was indeed intended, we caution the CEC against increasing the bhp limitation requirements. The fan bhp limitations written into ASHRAE 90.1-2016 were developed with great consideration toward energy efficiency gains, but balanced this with the limitations of HVAC equipment as designed and applied. In the analysis used to support 90.1-2016, the assumption used was for an HVAC system operating at 350 FPM, which is very low compared to a typical design of approximately 500 FPM. The overarching objective of the fan power limitation and allowances table was to make sure that good designs would pass but poor designs would fail. Using the lower velocity to develop the ASHRAE formulas has stringency already built in when compared with the standard practice. Increasing the stringency of these formulas will result in the elimination of more good designs that will not pass and will no longer be viable HVAC designs under the code.

In addition, Title 24-2016 increases the stringency of many HVAC-related requirements beyond ASHRAE 90.1-2016, which improve energy efficiency and air quality, but also create impediments to greater systems efficiency through additional prescriptive requirements that limit design flexibility. Airside economizers, low leak dampers, powered exhaust air control, exhaust air energy recovery, and increased filtration efficiency are examples of requirements that increase the necessary bhp capacity in a cooling HVAC air handler. There are also legitimate HVAC application constraints that are difficult to meet under ASHRAE 90.1-2016 tables, such as systems requiring a return fan. Finally, more stringent bhp limitations will shift system designs to those using motors under 5 hp capacity which are exempt from the limit and less efficient than larger motors. Combined with a MERV 13 filter, this market shift will result in higher annual building fan energy. Taken at the systems level, the fan bhp limitations required by ASHRAE 90.1-2016 yield the most energy efficient HVAC designs, and we recommend that these requirements be maintained in Title 24-2019.

Please also note that the draft standard adds a new restriction in a foot note for Table 140.4-B “Fan Power Limitation Pressure Adjustment.” The energy recovery pressure adjustment can only be used if energy recovery is required by code. This will indirectly forbid the use of exhaust energy recovery unless specified by code. This will deter those who are going beyond the code minimum and choose to recover energy where profitable but not prescribed. Code basis for the energy recovery requirement is where there is a reasonable pay back for the application, not everywhere it will save energy. There are additional applications where energy recovery will reduce annual energy usage. The proposed footnote 1 in the table should be removed as it will prevent those who wish to make this additional investment in energy conservation although it is not required.

Limitation of Air-cooled Chillers (Prescriptive Requirement 140.4.j):

Title 24-2016 limits buildings with chilled water plants to no more than 300 tons of capacity provided by air-cooled chillers, unless the system meets an exception. While the intent of this requirement may be to shift more cooling capacity to water-cooled chilled-water systems, in application, it has led to more HVAC systems served by air-cooled rooftop units – even when air-cooled chillers are the optimal, and more efficient, solution.

The draft standards for Title 24-2019 removes EXCEPTION 3, which would no longer allow air-cooled chillers approved by the CEC to comply with this requirement. The proposed language removes a potential loophole, and improves the overall requirement. However, we recommend striking Section 140.4(j) in its entirety, in order to allow the design of more optimal HVAC systems which can utilize air-cooled chillers as needed and capture additional energy savings.

Models assume idealized performance. Actual energy use diverges more between modeled and actual performance in water-cooled than in air-cooled chilled-water systems. This is because air-cooled chilled-water systems are more unitized, and achieve certified performance using internal optimizations within the chiller controller between compressors, expansion devices and condenser fans. The system performance does not depend on dynamically optimizing (with a separate system controller) the

operation of the cooling tower, chillers and condenser pumps. More of the chilled-water system can be verified by factory performance, certification and challenge tests when air-cooled chillers are used. There is no certification of water-cooled for the equivalent scope as air-cooled chillers. In short, the performance of a water-cooled systems is generally more efficient as applications become larger and more complex, but is also more dependent on the chiller plant operator and applied system algorithms, which are not always available.

The new proposed third exception to this limit for healthcare facilities shows that at least some of the time, applications need more flexibility in chiller plant decisions. We believe that other applications beyond healthcare deserve this same flexibility.

ASHRAE 90.1 has been carefully considering a similar requirement for many years, and has not found a clear and obvious need for a prescriptive requirement for water-cooled chillers. We encourage CEC to seek out the results of the ASHRAE simulations.

Ingersoll Rand has a long history of working collaboratively and constructively with the California Energy Commission and looks forward to further conversation regarding our comments. If you would like further elaboration on our comments or additional background, please do not hesitate to contact me.

Sincerely,

Beth Braddy

Beth Braddy
Trane Unitary Product Planning