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Morrison Products â€“ Title 20 Pre-Rulemaking June 2018 Draft Staff Report â€“ Commercial and Industrial Fans & Blowers

Additional submitted attachment is included below.

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California Energy Commission
Docket Unit, MS-4
Re: Docket No. 17-AAER-06
1516 Ninth Street
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September 28, 2018

Re: Morrison Products Proposal – Title 20 Pre-Rulemaking June 2018 Draft Staff Report – Commercial and Industrial Fans & Blowers
[Docket No. 17-AAER-06]

Dear CEC Staff:
The attached comments are submitted following the public meeting, July 11, 2018 to review of the Pre-Rulemaking June 2018 Draft Staff Report issued on June 11, 2018 for the Commercial and Industrial Fans & Blowers by the California Energy Commission (CEC) regarding minimum efficiency standards for commercial and industrial fans under California's Appliance Efficiency Standards in Title 20 of the California Code of Regulations, Sections 1601 through 1609.

Morrison Products, Inc. is a manufacturer of air moving products supplying blowers and fan products to manufacturers of air-conditioning and heating equipment. Morrison supplies fans to 200+ companies producing residential and commercial air conditioning equipment that is manufactured and sold in North America. We have three U.S. manufacturing facilities, regionally located with over 400 employees and one Mexican facility supplying Mexican, Central and South American customers with 100 employees.

General Background

The proposed draft standard for regulation of Commercial and Industrial Fans and Blowers is a continuation of the efforts by the U.S. Department of Energy to regulate the same products. It appears that the CEC adopted the third Notice of Data Availability (NODA3) with minimal adjustments while following DOE assumptions. The most significant change is the adjustment in volume of shipments to reflect California being 12% of the U.S. shipment of fans. Unfortunately, some significant problems with the NODA3 have not been remedied with corresponding adjustments to the results including the proper analysis of embedded fans. The following are some of the more significant corrections needed to ensure proper cost benefit analysis is made.

1. Volume of Central Station AHU – DOE used shipment volume from the U.S. Department of Commerce, Current Industrial Report MA35M and MA33M that overstates CS AHU volume from numbers prior to 2004. Data in the Current Industrial Report from 2005 onward reflect actual shipments and is consistent with numbers reported by industry trade

group AHRI that aggregates industry shipments data for the HAVC industry. The difference in shipments is greater than a reduction of six to one. Energy consumption and associated savings is greatly amplified by this overstatement of volume of shipments.

2. Return/Exhaust Fans in Unitary Equipment – Volume of shipments is over stated with the portion of units having a return or exhaust fans much greater than actual shipments. Small and medium sized unitary equipment rarely have these fans (5-7% for small and 7-10% for medium per AHRI) while large equipment typically does (60 to 75%) and very large (>760,000 BTU/h) may be upwards of 80%.
3. Number of Condensing Fans in Commercial Condensing Equipment - Average number of fans per condensing unit is closer to 7 rather than 14 as presented in NODA3. (The 14 fans would correspond to a 200-ton condensing unit – significantly larger than the average unit size.)
4. Chiller Shipment – DOE underestimates the number of chillers using 12,579 versus the CIR average of 26,000. (Note this is a net increase in current fan energy use and will serve to help in the calculation of potential energy savings.)
5. Fan Substitution – In NODA3, DOE suggested that fans could be substituted without penalty including the use of a 2” fan diameter change. This may not be a factor in standalone fans but is a real problem for any embedded application. A change in 2” on diameter will result in about a 4” increase in housing dimensions for the larger fan with properly designed housings to ensure benefits of increased efficiency are realized. (There are many fan housing design guides and literature references showing this and it is reflected in virtually all fan manufacturers catalogs.) The larger housing in an embedded application will negatively affect the fan performance/energy consumption through system effects from air passage narrowing. This happens due to the reality that cabinet sizes are limited for building design reasons. Details on system effects can be found in AMCA 201 publication.
6. Fan Substitution (Performance within 20%) – DOE‘s NODA3 analysis claims that fans can be selected and used with performance within 20% of the design point. The expectation that full function of an appliance will be accomplished with a 20% reduction of performance is not realistic. Heat load and ventilation requirements are only met with proper mass flow rates to conduct heat transfer or provide correct amount of clean air to meet building design requirements. Additionally, for any given system, the 20% reduction in airflow would lead to about a 50% reduction in power required. (From the system curve, 80% of design airflow leads to a 64% pressure requirement based on pressure being approximately proportional flow squared. With the power needed to drive the fan being proportional to the product of flow and pressure, it would be 51.2% for this scenario or 50% power reduction for 20% flow reduction.) As a contrary position, if flow can arbitrarily be reduced 20%, then why not just mandate all flows to be reduced by 20% and the state would save nearly 50% on energy – much greater than the amount available from this action. Obviously, this is not realistic but simply invalidates the claim by DOE that fan substitution within 20% is possible with minimal or no impact on applications.

7. FC Fans Available at EL5 – DOE also claimed that they found FC fans that could reach EL5 to justify not separating them from other centrifugal fans. This is an interesting claim as the intent of using the FEI metric was to ensure no fans are removed from the market, only their operating range was to be reduced to where they are efficient. Because of the design of the metric, it is a truism that all fans will be able to reach EL5. The problem would arise from the very limited operating range. To enable the use of FC fans at ever higher EL's, greater size will be necessary and more unique fan designs will need to be applied to a single product to ensure the entire operating map is covered (i.e. utility will be reduced and number of final assembly designs or SKU's increased). This will add to the design, development, testing, manufacturing and component costs with a greater number of designs needed.

Items Particular to the CEC Analysis

1. Title 24 Impact – CEC underestimates the effect Title 24 has on fan energy in practice. In the Staff Report, CEC states that Title 24 prescriptions do not apply to "every installation" (pg 26). Any HVAC system replacement is considered a major renovation and would require compliance with Title 24. Why would California not be enforcing this legal requirement? All fans in embedded systems sold and installed in California must comply with ASHRAE 90.1 and Title 24 requirements. The effect of these standards was not part of the DOE assessment because of differing levels of enforcement throughout the U.S. With California, the adoption and enforcement of ASHRAE 90.1 and Title 24 is consistent and should be part of this analysis.
2. Cost of change is woefully under counted in DOE's NODA3. This can be seen in the virtually flat cost shown in all the fan categories. The cost picture does not include the ever increasing cost of engineering of "better" and more fans, tooling changes, additional tooling, manufacturing changes, shorter production runs, equipment development and testing, compliance cost and the installation cost problem for potentially bigger appliances. This problem will be exaggerated with smaller volume for California shipments (12% of the US total as the CEC has defined it). Amortization of tooling, development and these shorter run costs will be over this smaller volume and correspondingly, piece price will increase. A full review of the analysis of cost is needed.
3. Labeling as proposed is problematic on a number of levels.
    a. The unknown operating point has a requirement that a performance matrix be part of the label. This is complex and would be overly confusing to consumers. The actual operating point may not be on the matrix or easily interpreted.
    b. The known operating point scenario is even more problematic. Even for engineered systems, the actual operating point is not the same as the design point. Reasons for this include design to build variation, miscalculation of air stream losses, leakage, appurtenance, diffuser and other devices not per manufacturer specifications along with many other factors. How would variable performance systems be listed? Filtration systems change over time. Air density changes over

time. Requiring performance point on the label will not help users, installers or inspectors but will lead to confusion.

Suggest labels include only manufacturer, part number and serial/date code. Performance details available at manufacturers website and referenced to the CEC website for compliance. Label should be affixed to the fan itself where possible. Embedded fans will be exempt so no label would be required (identify by equipment label and OEM bill of materials). Replacement parts should be labeled as replacement parts with appropriate part number traceable to OEM bill of materials.

Items Concerning the FEI Metric

1. Fans are often part of the appliance or system in which they are installed. As such their performance is affected by parts of the system and the opposite is true, the systems performance is affected by the fan. This integration of designs has the simple effect of making it very difficult to compare fan level performance with system level for embedded fans. To accurately compare, one really needs to test the system. If a system is being tested, then the regulation should be on the system as opposed to the fan only. As an example, please see the FEI Paradox problem presented by AHRI at the July 11 meeting. Two Air Handling Units (AHU) operating at the same duty point (cfm and pressure) had differing FEI's with Unit A having a higher FEI than Unit B (1.17 vs 1.09) yet Unit B actually needed 1/3 less power than Unit A (8.44 hp vs 12.88 hp). FEI may be a good metric for standalone fans but is not a good metric for embedded ones. (Note both of these have FEI's greater than 1.0 but it could easily be a scenario where one unit passes and the other is below 1.0. Also note, this may also be an issue for utilities seeking to offer rebates for better FEI – the recommendation has been that utilities could use this to incentivize higher efficiency, as 1.10 represents a 10% improvement, but this scenario illustrates this potentially could lead to rewards for more power being used.)
2. FEI has potential for other negative consequences or incentives. Only operating points to the left of the peak efficiency curve does the FEI increase with reduced pressure and corresponding reduced power. To the right of the peak efficiency curve, the FEI increases with increased pressure and correspondingly power is increasingly consumed. To the untrained or the devious, this would signal a need to increase pressure in actuality or report a higher pressure than actually used. In other words, FEI has potential for perverse incentives that could lead to increased power consumption.
3. Input data for the DOE analysis came from AMCA's database of blowers. As such, this data has some problems for use in a regulatory evaluation and enforcement. (AMCA as a trade association has a long and admirable history creating standards for commercial use and level, reliable trade of fans so that buyers and sellers could be assured of performance but that is different than regulation.)

a. Some of the data is certified and some not. Certification has a higher level of confidence but still a greater level of uncertainty than is typically required by regulatory bodies. See AMCA standards for acceptance criteria.
b. AMCA's performance test standard (AMCA 210/ASHRAE 51) does not have a required speed of test. Legacy test data used by DOE could be at any speed of test and not at the speed of test agreed at the DOE meetings and incorporated into the term sheet. This is important for speed of test affects the efficiency measured for any fluid turbomachinery and thus reported levels of compliance.
c. All fan data is reported as "typical" and as such is representative of nominal designs. It does not take into account measurement uncertainty or manufacturers' uncertainty. All the legacy data used by DOE is per this practice. The regulatory scenario contemplated by DOE would have a minimum energy value at a given operating point. The tolerance for going from nominal to minimum is not accounted for in the analysis.

Recommendation

We are in agreement with the position taken by AHRI and submitted today. Key factor in the reason for our support include embedded fans in HVAC products should be outside the scope of this potential regulation as their energy has been accounted for in system regulation of the HVAC equipment through Titles 20 and 24. The energy consumed by these fans has been under regulation and has constraints on the amount consumed by product and application. Additional regulation would be redundant, would add cost and not provide value to the state or its citizens. This is true for virtually all HVAC appliances for they have either product efficiency standards that include fan energy or building code standards that include product performance for all buildings and repairs in California.

Fans in products per Title 20 that have regulated energy consumption as part of their system performance will not see energy savings but a shift in where the energy is consumed in an appliance. For example, air-conditioning systems must comply with an overall efficiency requirement that includes fan performance. Improving the fan energy use will result in an offset in other component energy use or reduction in system efficiency so that a minimally compliant system will be available for sale at the lowest cost point. Component regulation does not lead to pareto optimal outcomes but rather distortions that lead to suboptimal systems developed by artificially constrained designers.

Fans in other HVAC appliances are subject to Title 24 fan power limitations and installed system performance limitations. Those fans should be outside the scope as they have energy consumption included in the California plans at the best possible point – the point of application. There is no doubt about the intended use, performance or energy consumption as that is measured as installed. Use of compliant products operating as designed is assured.

Stand-alone fans, as represented by fans outside of an appliance, can be measured per a fan standard, ACMA 210/ASHRAE 51, and can have a regulation considered for ones to be installed in Commercial and Industrial applications. A rating system (AMCA's FEP/FEI type of system may be good) could be implemented for fans that fall outside of already existing regulations (Title 20 and 24) to ensure fans not already regulated have a level field. Fully developing the appropriate test procedure and regulatory scheme will take further review as outlined above and should be part of the on-going proceedings and public meetings to review options with all interested parties.

We are appreciative of the opportunity to participate in this rulemaking process. We want help create sensible solutions that drive systems to better energy efficiency in a cost effective manner so that solutions are adopted.

If you have any questions or wish to discuss this further, please do not hesitate to contact me.

Sincerely,

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