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LARGE DIAMETER CEILING FANS

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California Energy Commission

Docket No. 25-BSTD-03

The California Statewide Codes and Standards Enhancement (CASE) initiative presents recommendations to support the California Energy Commission's (CEC's) efforts to update California's Energy Code (Title 24, Part 6), including revisions to simplify and clarify existing code requirements. Three California Investor-Owned Utilities (IOUs) — Pacific Gas & Electric Company, San Diego Gas & Electric, and Southern California Edison sponsored this effort as a group.

This letter recommends adjustments to the code for large diameter ceiling fans (LDCFs) to address fellow stakeholder concerns, ensure consistent interpretation and application of the requirements, and to support strong compliance. The proposal is intended to address widespread noncompliance with the relatively new federal requirements for LDCFs.

This letter offers support for the proposed Energy Code change and was developed in collaboration with fellow stakeholders. This letter does not recommend changes that will increase the stringency of existing federal requirements. As such, a cost-effectiveness analysis or use of the full codes and standards enhancement report template is not required.

1. Measure Description and Justification

1.1 Proposal Description

When a product is federally regulated, it is rare to find a manufacturer or importer to not have certified to the U.S. Department of Energy their product has been tested to the federal test procedure and meets the minimum efficiency requirements. LDCFs are the exception. Of 44 manufacturers or importers of LDCFs identified, only 19 appear in

DOE's Compliance Certification Database.¹ The Statewide CASE Team is prepared to share the list of identified manufacturers with CEC. In addition, the Statewide CASE Team can provide evidence of non-certified manufacturers' published data that clearly has not been calculated using the federal test procedure.

This is a proposal to add the federal minimum efficiency requirement for LDCFs, the Ceiling Fan Energy Index (CFEI) to the California Building Energy Code. The proposed text largely mirrors 10 CFR 430.32(s)(2)ii,² but has exceptions based on definitions found in Appendix U to 10 CFR Part 430, those definitions have been incorporated in the marked-up text to aid in user understanding and enforcement. In addition, text is added that requires LDCFs to be tested to Appendix U to aid users in specifying the equipment.

The same requirements appear in ASHRAE 90.1-2022 and IECC 2024, but without the exceptions. The Statewide CASE Team believes that to ensure that there are no concerns about preemption, the California Building Energy Code should include them.

1.2 Benefits of Proposed Change

Like many building energy codes, CEC does not include federal minimum efficiency requirements, but we believe this case merits an exception. Unlike air conditioners, heat pumps, and water heaters, where there are long-standing regulations and certification programs with nearly 100 percent manufacturer participation, LDCF regulation is new and only a minority of manufacturers certify performance. As a result of this, there are products on the market that report power consumption and airflow that result in efficiencies of more than 100 percent, and in some cases, more than 500 percent. As previously stated, the Statewide CASE Team can provide the cited examples on request.

The Ceiling Fan Energy Index (CFEI) is a very new metric that was codified by the United States Department of Energy (U.S. DOE) in 2021. Few practitioners or code officials are aware of it. The Statewide CASE Team reviewed more than twenty plan

¹ https://www.regulations.doe.gov/certification-data/CCMS-4-Ceiling_Fans.html#fq=%7B!tag%3DProduct_Group_Code_Description_s%7DProduct_Group_Code_Description_s%3A%22Large-Diameter%22&q=Product_Group_s%3A%22Ceiling%20Fans%22. Note that the manufacturer name is not shown in the database, but brand or model line is. The 19 manufacturers have a total of 94 brands.

² [https://www.ecfr.gov/current/title-10/part-430/subpart-C#p-430.32\(s\)\(2\)\(ii\)](https://www.ecfr.gov/current/title-10/part-430/subpart-C#p-430.32(s)(2)(ii)).

sets in the Dodge database that included LDCFs for recent California projects, and none of them specified CFEI or any level of power consumption.

The Statewide CASE Team believes that including a mandatory CFEI requirement in the California Building Energy Code that is the same as the federal requirement will educate users of the standard and code officials to specify CFEI and input power. This will ensure consumers are buying LDCFs that have been tested to the federal test procedure and are delivering the advertised power and airflow.

1.3 Background Information

LDCFs are ceiling fans with a blade span greater than or equal to 84.5 inches.³ In commercial buildings, LDCFs are commonly used in large, open, high-ceiling spaces such as warehouses, factories, gyms, retail stores, and hangars to improve air circulation, enhance occupant comfort, and reduce thermal stratification.

Congress added the current federal framework for LDCFs through the Energy Act of 2020. That legislation amended the Energy Policy and Conservation Act (EPCA) to correctly address LDCFs.⁴ The law required that the metric for LDCFs be CFEI and specified that CFEI would be calculated per AMCA 208-18 Calculation of the Fan Energy Index, but with different airflow, pressure, and efficiency coefficients that were proposed by AMCA. The law also set the energy conservation standard, requiring that the LDCF will have a CFEI of not less than 1.00 at high fan speed and not less than 1.31 at 40 percent fan speed.⁵

U.S. DOE completed a further rulemaking in 2023 that removed the 24-foot cap on the diameter of regulated LDCFs.

As noted in Section 1.2, many manufacturers overstate their airflow and, therefore, their efficiency. Some of this stems from an error in AMCA 230-99, where the formula to calculate airflow based on the thrust of the fan overstated the value by 40 percent due to a missing square root sign. The error was largely corrected in AMCA 230-12, and not fully corrected until AMCA 230-15, the basis for the federal test procedure, was issued. We believe some manufactures are using results based on earlier versions. However,

³ The industry more often refers to large ceiling fans as high volume low speed (HVLS) fans, but that term does not appear in EPCA.

⁴ The U.S. DOE implemented and codified those amendments through a rulemaking that took effect May 27, 2021.

⁵ Or the closest fan speed to 40 percent that is not less than 40 percent.

we have examples of reported airflows that are higher than can be explained using the old test methods that we can share with the CEC.⁶

Enforcement of certification requirements by U.S. DOE has been inconsistent. In 2024 and 2025, DOE did fine several manufacturers for not submitting data to the DOE.⁷ Each order stated that the manufacturer knowingly sold LDCFs in commerce without certification for more than a year. There is no evidence of testing to enforce energy conservation standards on the DOE enforcement page.

As we noted earlier, CEC can normally be confident when incorporating federal energy conservation standards by reference because of robust DOE enforcement and widespread participation in manufacture certification programs which makes it difficult to offer less efficient products for sale. Furthermore, equipment specifiers know the minimum standards since energy conservation standards for those products are widely publicized and discussed in professional forums.

Unfortunately, those things are not true for LDCFs. As the DOE enforcement actions show, manufacturers openly defy the federal certification requirements. According to research shared with us by the Air Movement and Control Association (AMCA), after five years of the CFEI regulation being in effect, only nineteen of the forty-four companies that offer LDCFs in the United States are listed in the Compliance Certification Management System (CCMS)⁸. Furthermore, only ten manufacturers certify their performance with AMCA.⁹

It is for these reasons that the federal CFEI requirement was added to ASHRAE 90.1-2022 and IECC 2024.

2. Stakeholder Engagement to Inform Proposal

The Statewide CASE Team worked with AMCA and members of the LDCF industry on this proposal. We have had numerous conversations since the last DOE rulemaking in 2023, including:

- AMCA: Michael Ivanovich and Nazme Mohsina

⁶ The data is available upon request.

⁷ <https://www.energy.gov/gc/listings/compliance-certification-enforcement?page=1>.

⁸ Due to a flaw where CCMS incorrectly lists LDCF basic models in the “brand name” column, it appears that there are more than 90 brands listed. This is not correct.

⁹ <https://www.amca.org/certify/amca-certified/product-type/large-diameter-ceiling-fan.html>.

- BAF: Christian Taber
- Greenheck: Mike Wolf

The California Investor-Owned Utilities (CA IOUs) have worked extensively with AMCA on improving fan efficiency requirements in codes and standards. This work includes:

- California Title 20 General Fan and Blower FEI requirements
- The 2023 U.S. DOE rulemaking
- Adding FEI requirements for General Fans and Blowers to ASHRAE 90.1, Title 24 Part 6, and IECC 2024
- Adding CFEI requirements to ASHRAE 90.1 and IECC
- Adding the federal test procedure for air circulating fans to ASHRAE 90.1-2025 and IECC 2027.

Over the years, the CA IOUs have discussed the problem of the lack of compliance with the U.S. DOE regulations extensively, and we have seen little improvement. We believe the best way to encourage compliance is to have requirements in the building code that encourage designers and code officials to enforce them.

The following is the text of 10 CFR 430.32(s)(2)(ii), the U.S. DOE regulation for LDCFs and is used as the basis for this code proposal:

(ii) Large-diameter ceiling fans, as defined in appendix U to subpart B of this part, manufactured on or after January 21, 2020, shall have a CFEI greater than or equal to -

(A) 1.00 at high speed; and

(B) 1.31 at 40 percent speed or the nearest speed that is not less than 40 percent speed.

(iii) The provisions in this appendix apply to ceiling fans except:

(A) Ceiling fans where the plane of rotation of a ceiling fan's blades is not less than or equal to 45 degrees from horizontal, or cannot be adjusted based on the manufacturer's specifications to be less than or equal to 45 degrees from horizontal;

(B) Centrifugal ceiling fans, as defined in Appendix U of this part;

(C) Belt-driven ceiling fans, as defined in Appendix U of this part;

(D) Oscillating ceiling fans, as defined in Appendix U of this part; and

(E) Highly-decorative ceiling fans, as defined in Appendix U of this part.

3. Proposed Code Language

3.1 Guide to Markup Language

3.1.1 Energy Code (Title 24, Part 6)

Add the following definitions:

SECTION 100.1 – DEFINITIONS AND RULES OF CONSTRUCTION

BELT-DRIVEN CEILING FAN is a *ceiling fan* with a series of one or more fan heads, each driven by a belt connected to one or more motors that are located outside of the fan head.

CEILING FAN ENERGY INDEX (CFEI) is the ratio of the electric input power of a reference ceiling fan to the electric input power of the actual ceiling fan as calculated per AMCA 208 with the following modifications to the calculations for the reference fan: using an airflow constant (Q_0) of 26,500 cfm, a pressure constant (P_0) of 0.002700 in. of water, and a fan efficiency constant (η_0) of 42%.

CENTRIFUGAL CEILING FAN is a *ceiling fan* for which the primary airflow direction is in the same plane as the rotation of the fan blades.

HIGHLY-DECORATIVE CEILING FAN is a *ceiling fan* with a maximum represented value of blade revolutions per minute (RPM) of 90 RPM, and a represented value of airflow at high speed of less than 1,840 CFM.

LARGE-DIAMETER CEILING FAN is a *ceiling fan* that is not a highly-decorative *ceiling fan* or belt-driven *ceiling fan* and has a represented value of blade span, greater than seven feet.

NON-HORIZONTAL CEILING FAN is a *ceiling fan* where the plane of rotation of the *ceiling fan's* blades is not less than or equal to 45 degrees from horizontal, or cannot be adjusted based on the manufacturer's specifications to be less than or equal to 45 degrees from horizontal;

OSCILLATING CEILING FAN is a *ceiling fan* containing one or more fan heads for which the axis of rotation of the fan blades cannot remain in a fixed position relative to the ceiling. Such fans have no inherent means by which to disable the oscillating function separate from the fan blade rotation.

Add Section 400.5.7 [New Section] as follows:

SECTION 400.5 [Section 110.2] – MANDATORY REQUIREMENTS FOR SPACE-CONDITIONING EQUIPMENT

...

400.5.7 [New Section] Large-diameter ceiling fans manufactured on or after January 21, 2020, shall be tested to Appendix U to 10 CFR Part 430, and shall have a Ceiling Fan Energy Index (CFEI) greater than or equal to:

1. 1.00 at high speed; and
2. 1.31 at 40 percent speed or the nearest speed that is not less than 40 percent speed.

Exception 1 to 400.5.7 : Hotel/motel buildings and nonresidential buildings with Group R occupancies.

Exception 2 to 400.5.7: Non-horizontal ceiling fans, centrifugal ceiling fans, belt-driven ceiling fans, oscillating ceiling fans, and highly-decorative ceiling fans.