DRAFT White Paper:
Two Important Changes to the U.S. Regulation on Large Diameter Ceiling Fans:
A Correction to the Test Procedure and a Change of Metrics

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AMCA International
AMCARC: North American Air Movement Advocacy Committee

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This white paper is of interest to manufacturers, distributors, specifying engineers, and purchasers of large diameter ceiling fans for sale in the United States and Canada, and for members in countries that may regulate these products in the future.

Executive Summary

The U.S. Department of Energy (DOE) efficiency metric for large diameter ceiling fans (LDCF) has been replaced by a new metric. The DOE cubic-feet-per-minute (cfm) per watt (DOE cfm//W), averaged over time-weighted five test speeds, and which integrated an idle-fan standby-power measurement, has been replaced by Ceiling Fan Energy Index (CFEI), which is not time weighted, is calculated at two test speeds, and does not integrate a (still required) idle-fan standby-power measurement.

In a highly unusual development, a U.S. law was passed in 2020 to change the regulatory metric because the DOE cfm/W metric unintentionally capped the performance of LDCFs that had a high airflow utility relative to its blade span – i.e., larger-diameter fans can barely comply with the DOE requirement even though they are highly efficient for their utility, and future evolution of these products was unfairly limited.

Part 1 of this white paper provides background on the cfm/W metric initially used for the efficiency regulation's test procedure and energy standard, and why the metric needed to be changed. Part 2 describes the CFEI metric, how it came to replace cfm/W, and how to comply with the new CFEI requirements in the U.S. Code of Federal Regulations. Part 3 describes how CFEI is reflected AMCA standards, testing, and certification.

Part 1: The Problematic cfm/W Metric

Laboratory measurements of LDCF performance and calculation of the cfm/W metric at a single test speed are presented in ANSI/AMCA Standard 230-15, *Laboratory Methods of Testing Air Circulating Fans for Rating and Certification* (i.e., AMCA 230). The scope of AMCA 230 includes ceiling fans, as well as other types of circulating fans. AMCA 230 is referenced by the U.S. Department of Energy test procedure for ceiling fans only for large diameter ceiling fans, which a DOE-defined product class as ceiling fans having a blade span greater than 7-ft. The term 'blade span' is meant to include a fan's diameter, plus the extent to which the diameter is enlarged by "wing tips" extending from the blade (Figure X).

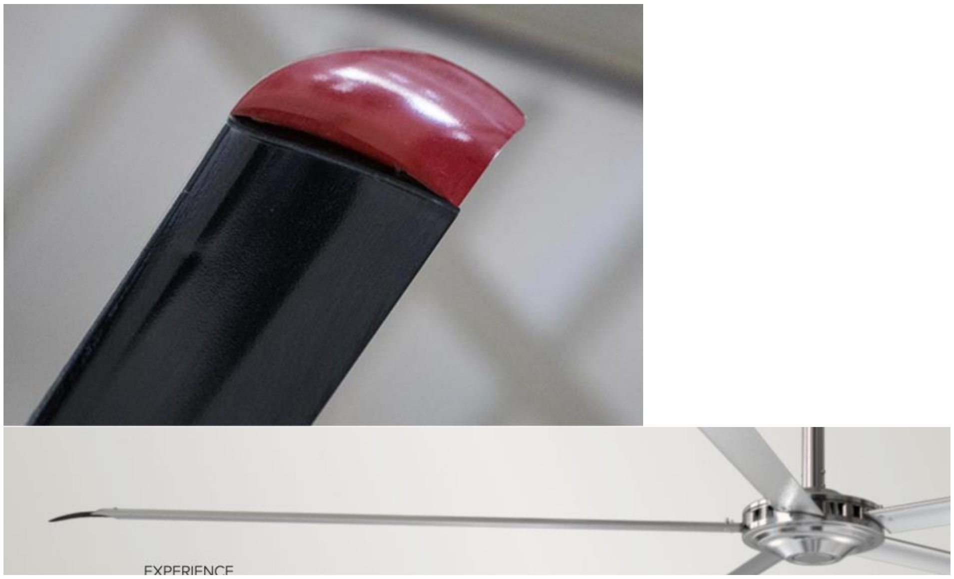

Figure x. Example of blade tip that needs to be included in measurement of blade span. Photo courtesy of Epic Fan.

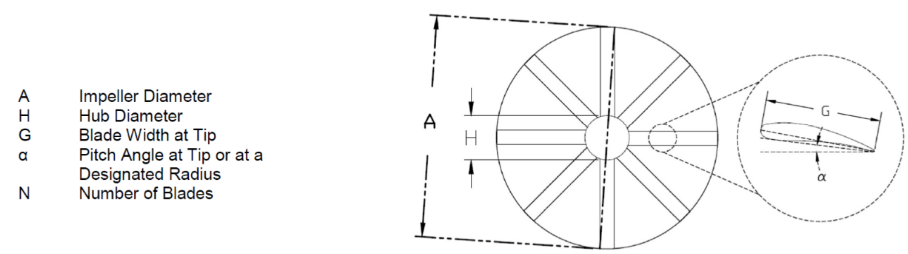

Figure A.37 Ceiling Fans

Figure X. Blade span (A) measurement for a large diameter ceiling fan must include the outermost surface, including wing tips. Courtesy of AMCA International.
Note: Change legend so A reads "Blade Span" and remove the inset of blade width at tip and the hub diameter H measurement. Show only "A."

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Ceiling fans with smaller diameters use a different test procedure and are not in the scope of this paper.

- Uniform testing & reporting procedures for determining
  - Thrust (lbs-f or N)
  - Airflow rate (CFM or m^3/s)
  - Power (W)
  - Efficacy (CFM/W or (m^3/s)/W) (at one speed)
  - Efficiency (input power/air power)

AMCA 230 describes how to make laboratory measurements on large diameter ceiling fans and calculate cfm/W for a given speed, and specifies that five test speeds (20%, 40%, 60%, 80%, and 100%) be run for variable-flow LDCFs. An average cfm/W is not calculated in the AMCA 230 procedure.

The initial DOE test procedure requires the same five speeds, but additionally requires that standby power consumption be measured while the fan is idle. In its calculation of cfm/W, DOE computes a weighted average of the five operating speeds weighted by time bins for each speed (each speed equally weighted as 2.40 hrs for a total of 12 operating hours per day) and an estimated standby power time of 12 hrs per day.

$$Ceiling\ Fan\ Efficiency\ (CFM/W) = \frac{\sum_i (CFM_i \times OH_i)}{W_{Sb} \times OH_{Sb} + \sum_i (W_i \times OH_i)}$$

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Where:

CFM_i = airflow at speed
OH_i = operating hours at speed
W_i = power consumption at speed
OH_{sb} = operating hours in standby mode, and
W_{sb} = power consumption in standby mode.

CFM/W vs CFEI

Table 4 compares DOE cfm/W and CFEI.

Parameter	**DOE cfm/W**	**CFEI**
Effective date	Jan. 19, 2017	May 27, 2021
Referenced test standard	10 CFR Part 430, Appendix U	10 CFR Part 430, Appendix U (corrected*)
Rating calculation standard	10 CFR Part 430, Subpart B, Appendix U	ANSI/AMCA Standard 208-18, *Calculation of the Fan Energy Index*, with the following modifications: (1) use of an airflow constant (Q_0) of 26,500 cfm; (2) use of a pressure constant (P_0) of 0.0027 in. w.g.; and (3) use of a fan-efficiency constant (η_0) of 42 percent.
Test speeds	20%, 40%, 60%, 80%, High Speed (100%); weighted by operating hours at speed.	100% and 40% or the closest speed not under 40%
Standby Power	Included in calculation based on 12-hrs standby per day	Not included in calculation
Mathematical function	Linear	Polynomial
Compliance shortcuts	Easy. Slowing an inefficient fan can make the fan compliant.	Difficult. CFEI ratings are more uniform across airflow ranges.
Benefits	Familiar	Allows evolution to greater utility (higher airflow for a given fan diameter) at conservative power. Only two test speeds needed for regulation. LDCF requirements can be tightened without the baseline changing.
Penalties	High-airflow fans (for a given diameter) have difficulty complying, thus, impeding evolution.	Coefficients for LDCF were developed to supplement ANSI/AMCA Standard 208-18, which was not designed to handle LDCF.

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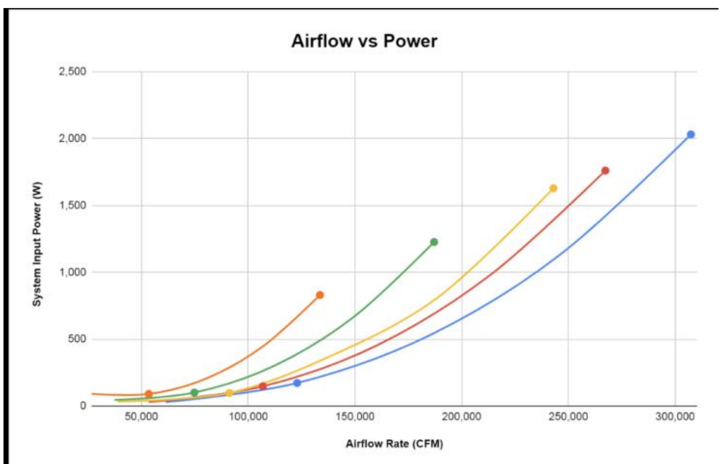
	Conversely, low airflow fans for a given diameter can use inefficient motors/drives/etc. and still easily comply, allowing low-efficiency models to remain in the market. Does not adequately address “outlier” very low-flow products, resulting in exceedingly high ratings. Makes rebates and green codes difficult.	Coefficients developed using high-volume, low-speed fans. LDCF class includes “outlier” very low-flow (for a given diameter) products that subsequently entered the market. Not well-known; market awareness and education needed.

Notes: *Corrected means using the AMCA 230-15 errata published by AMCA International on May 6, 2021. The errata is available at no cost at www.amca.org/LDCF.

TABLE 4. Comparison of DOE cfm/W and CFEI.



Fan Model	Color	$CFEI_{100}$ (≥ 1.00)	DOE CFM/W
Fan #1	●	1.72	234
Fan #2	●	1.38	234
Fan #3	●	1.18	234
Fan #4	●	0.85	234
Fan #5	●	0.63	234

Figure X. Input power versus airflow at five test speeds for seven 24-ft fans, WITH DOE average CFM/W and CFEI at high speed are shown in legend.

Due to the relationship between power and airflow defined in the fan laws, the CFM/W metric can be more easily gamed than CFEI. Figure X shows 5 different 24-ft diameter LDCF airflow versus power curves. For a given airflow, the lower the curve is on the chart, the more efficient (less power) the fan is at that duty point. Despite the differences in true operating efficiency at any common duty point, due to the nature of the CFM/W metric, all five fans actually have the same rating of 234 CFM/W. In contrast, the CFEI ratings at high speed are dramatically different. The most efficient fan (lowest power for a given airflow) is Fan 1, which has a CFEI rating of 1.72. The least efficient fan (highest power for a given airflow) is Fan 5, which has a CFI rating of 0.63. Fans 1 and 5 would both comply with the DOE CFM/W minimum efficiency requirement. However, Fan 1 would significantly exceed the DOE minimum efficiency requirement of 1.00 at high speed, while Fan 5 would be non-compliant since its CFEI is less than 1.00. Table Y summarizes the CFEI and DOE CFM/W ratings for all five fans from Figure X. As illustrated by this example, CFEI provides a better representation of how efficiently a LDCF performs.

Fan Model	Max CFM	$CFEI_{100}$ (≥ 1.00)	DOE CFM/W	Airfoil Eff	Trans Eff	Motor Eff	Drive Eff
Fan #1	307,395	1.72	234	57.0%	100%	108.0%	99.0%
Fan #2	267,300	1.38	234	52.0%	100%	95.0%	97.0%
Fan #3	243,000	1.18	234	47.0%	100%	90.0%	95.0%
Fan #4	187,110	0.85	234	42.0%	100%	70.0%	93.0%
Fan #5	133,650	0.63	234	37.0%	100%	55.0%	91.0%

Table Z - Illustration of Relative Component Efficiencies Required to Achieve 234 CFM/W at Various Airflows for 24 ft Diameter LDCF

Table Z has the same five 24 ft diameter LDCF that are shown in Figure X. As previously discussed, the relationship of power versus airflow dictated by the fan laws provides an inequitable efficiency requirement for LDCF. Fan 3 is representative of a high efficiency, current LDCF product offered on the market. Fan 1 represents a high airflow (for the given diameter) LDCF with the same DOE CFM/W as Fan 3. Note that despite increasing the airfoil efficiency by 10% (no small task) and the drive efficiency to 99%, the motor would have to increase its efficiency by 18% for Fan 1 to comply with the CFM/W requirements. This essentially makes a Fan 1 impossible to manufacture. On the other hand, Fan 5 represents a low airflow (for the given diameter) LDCF with the same DOE CMF/W as Fan 3. Note that even though both fans have the same DOE CFM/W rating, Fan 5 has a 10% less-efficient airfoil, 15% less-efficient motor and a 4% less-efficient drive.   This gives Fan 5 a free pass on efficiency compliance that leaves a lot of potential energy savings on the table. It should be noted that Fan 5 does not meet the CFEI requirements at high speed and would have to be made roughly 27% more efficient to comply based on the CFEI metric.

With these considerations, CFEI was developed to make it more difficult for inefficient fans to comply using slower speeds to game the cfm/W metric, and to remove the unintentional barrier for high-performing high-utility fans to comply with the requirement.

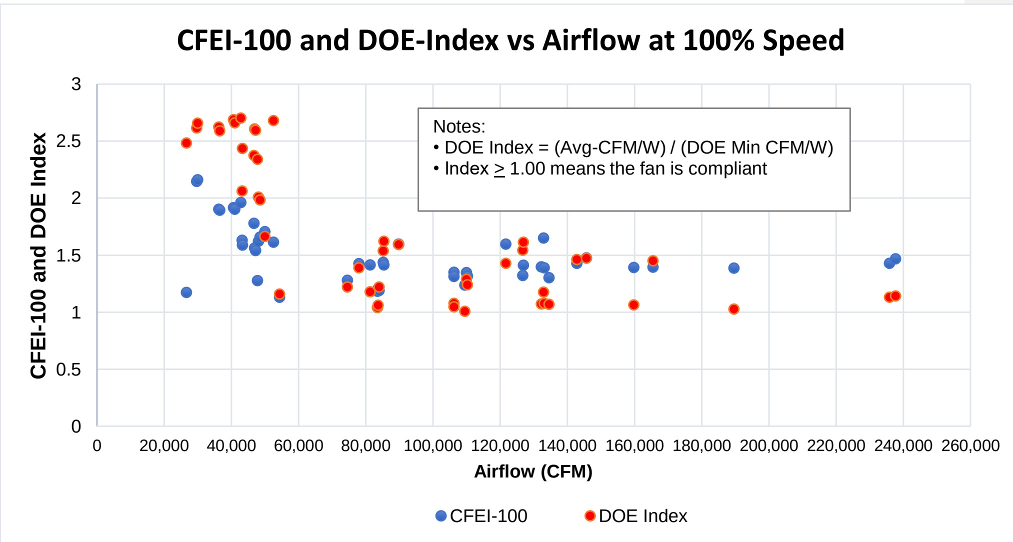


FIGURE 4. Data and calculated values for 49 AMCA-certified LDCF from a variety of manufacturers. CFEI at 100% speed is compared with an index of DOE cfm/W divided by the minimum DOE cfm/W requirement.

Part 2: CFEI and the 2020 Ceiling Fan Improvement Act

How CFEI Was Developed

Large diameter ceiling fans are always tested as completely assembled units that include fan impellers, motors, drives, and other controls. Because they are measured in free-air, without cages or other flow-encumbrances, they are considered a “total pressure” fan rather than a “static pressure” fan (such as a centrifugal fan). As such, when searching for a metric to replace cfm/W, the relative new metric, Fan Energy Index (FEI) was considered.

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FEI is defined in ANSI/AMCA Standard 208-18, *Calculating the Fan Energy Index* as a wire-to-air metric that has separate equations for fans rated using static pressure (P_s) or total pressure (P_t). FEI was developed to use in commercial and industrial fan regulations and energy codes and applies to the types of fans that were analyzed to develop the metric, including many types of centrifugal and axial fans.

AMCA 208 defines FEI as:

…a ratio of the electrical input power of a reference fan to the electrical input power of the actual fan for which the FEI is calculated, both calculated at the same duty point, i, which is characterized by a value of airflow (Qi) and pressure (Pt,i or Ps,i).

$$FEI_{t,i} \text{ or } FEI_{s,i} = \frac{\text{Reference Fan Electrical Input Power}}{\text{Actual Fan Electrical Input Power}} = \frac{FEP_{ref,i}}{FEP_{act,i}}$$

An “actual fan” is a fan that, for example, is being tested for compliance to a DOE regulation.

A reference fan is “a conceptual fan used to relate all fans to a common baseline.” The reference fan can produce the airflow and fan pressure required at a specified electrical input power, which translates to a fan system’s design condition.

“Conceptual fan” means the reference fan does not represent a specific fan type, such as axial or centrifugal, and is configured as having a transmission and a four-pole, 60-Hz IE3 (premium efficiency) motor.

In AMCA 208, there is an equation for calculating FEI that use coefficients derived from the test data for fans rated using total pressure. Because LDCFs were not in the data pool, the coefficients do not apply well for using FEI to rate LDCFs. Table Y shows a representation f how FEI values would be absurd for LDCFs using the coefficients in AMCA 208.

To fix this, a separate data pool from laboratory measurements of over 100 LDCF models was used to develop coefficients only LDCF application. To make this FEI calculated using “LDCF coefficients” distinct from the AMCA 208 FEI equation, the term Ceiling Fan Energy Index was coined.

To calculate CFEI, use the FEI equation for total pressure found in AMCA 208, and substitute coefficients as follows:

- Airflow Constant: Q_0 = 26,500 cfms (12.507 m^3/s)
- Pressure Constant P_0 = 0.0027 in. WG (0.6719 pascals)
- Fan Efficiency Constant h_0 = 42 percent

Commented [CT1]: Maybe include a small table with a couple of fans calculated using FEI and CFEI? I think showing an FEI of 19 for a couple of LDCFs would illustrate why new coefficients were needed.

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Table ZZ shows CFEI values calculated with the coefficients above at high speed compared to FEI values for the same LDCF using the original coefficients specified in AMCA 208. These values are for actual fans tested by AMCA International at its headquarters laboratory in Arlington Heights, Ill.

Tested Fan	Impeller Dia (ft)	Drive Type	Airflow (cfm)	**$CFEI_{100}$**	FEI using AMCA 208
1	14	Direct	85,428	1.41	11.40
2	14	Direct	85,262	1.44	11.63
3	14	Gear	47,251	1.54	21.70
4	14	Gear	46,931	1.56	22.10
5	14	Direct	89,768	1.59	12.13

Table ZZ: For five AMCA-tested fans, comparison of CFEI, calculated from coefficients derived using LDCF lab data, and FEI, using coefficients found in AMCA 208, which were developed from lab data of fans that did not include LDCF. The table is sorted by ascending CFEI values.

How CFEI Replaced cfm/W

Because the DOE regulation was already published as a final rule, the only remedy for changing the regulatory metric was through legislation.

AMCA member companies working with consultants developed a bill that explained the need for the metric change and presented how the change could be made using CFEI. The bill later became known as The Ceiling Fan Improvement Act (H.R. 5758), and it was eventually combined with the Energy Act of 2020 Energy Act of 2020 (Public Law 116-260), which was signed into law on December 27, 2020 as part of the omnibus spending bill (Table X). The language of The Ceiling Fan Improvement Act is provided as Appendix 1.

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Date	Regulatory Event
07-24-2016	**Test Procedure Published**
01-23-2017	**Test Procedure Takes Effect**
01-19-2019	**Energy Standard Published**
01-21-20	**Energy Standard Enforcement Begins**
02-05-20	**H.R. 5758 introduced by B. Guthrie (R-KY) and J. Schakowski (D-IL) to Congress "Ceiling Fan Improvement Act"**
12-27-2020	**Omnibus Bill signed by President Donald Trump**
05-27-2021	***Federal Register* Publishes Codification Changes to Code of Federal Regulations**
05-27-2021	**CFEI Enforceable Metric for LDCF**

Table x: Simplified chronology of events leading to legislative replacement of CFM/W with CFEI.

Passing the law led to DOE having to administer a rulemaking that changed the language in the Code of Federal Regulations (i.e., a codification). DOE published the codification on May 27, 2021. The rule became enforceable on the same day it was published, so CFEI is now an enforced regulatory metric for LDCF efficiency

The codification changed most of the regulatory language for LDCFs, but not all. The following are CFR provisions for LDCFs, with annotations where no changes were made from the codification

- *Establishment of the LDCF Product Class: (no change)*
    - *(10 CFR 430.2 – Definitions). The term "ceiling fan" means a nonportable device that is suspended from a ceiling for circulating air via the rotation of fan blades.*
    - *(10 CFR 430, Appendix U to Subpart B (1.11)). Large-diameter ceiling fan means a ceiling fan that is greater than seven feet in diameter.*
    - …
- Establishment of the LDCF Test Procedure: (no change)
    - *(10 CFR 430, Appendix U to Subpart B (3.4)).* The test apparatus and instructions for testing large-diameter ceiling fans must conform to the requirements

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specified in sections 3 through 7 of AMCA 230-15 …with the following modifications:

    - 3.4.1. The test procedure is applicable to large-diameter ceiling fans up to 24 feet in diameter.
    - Etc.

- *Establishment of Energy Standard (Efficiency Requirement)*
    - (10 CFR 430.32(s)(2)). Large-diameter ceiling fans 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. [1]

- *Establishment of Energy Standard (Efficiency Requirement)*
    - 430.32(s)(2)(ii). 5. Calculation of Ceiling Fan Energy Index (CFEI) From the Test Results for Large-Diameter Ceiling Fans:
        - Calculate CFEI, which is the FEI for large-diameter ceiling fans, at the speeds specified in section 3.5 of this appendix according to ANSI/AMCA 208-18, (incorporated by reference, see § 430.3), with the following modifications:
        - (1) Using an Airflow Constant (Q0) of 26,500 cubic feet per minute;
        - (2) Using a Pressure Constant (P0) of 0.0027 inches water gauge; and
        - (3) Using a Fan Efficiency Constant (η0) of 42 percent.

To date, no changes have been made to the filing of certification data, however, on August 6, 2021, DOE published a Notice of Proposed Rulemaking that proposes new LDCF parameters that must be filed. DOE is proposing to add blade span (inches) and CFEI at high speed and 40% speed or the speed closest to 40% without being less than 40%.

With the CFEI codification complete and in force, manufacturers of LDCFs must change their published cfm/Watt ratings to Ceiling Fan Energy Index (CFE) ratings and determine if their products comply with the new CFEI minimum efficiencies. It's possible that some fans that complied with the cfm/W requirement may not comply with the CFEI requirement, and vice-versa. Therefore, manufacturers need to examine their filings on the DOE Compliance Certification Management System (CCMS) online database. Products that no longer comply must be removed from the market and the compliance filing removed, as well. Products that did not comply with the cfm/W requirement but comply with the CFEI requirement can be filed as complying and be returned to the market.

Other types of circulating fans, such as air circulating fan heads (Figure X), that can be ceiling-mounted, are possibly covered by the ceiling fan regulation. DOE is currently evaluating responses to a Notice of Proposed Rulemaking from September 2019 that seeks to clarify

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[1] *Note the requirement is for the LDCF to comply with both test speeds, not one or the other.*

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coverage of air circulating fan heads. Because these types of fans have blade spans less than seven feet they cannot be tested to AMCA 230; however, they still have to meet the design requirements (See sidebar: Design Requirements – A Little-Known DOE Regulatory Requirement). Design requirements a features of a product's design and operation that must be included in products that are covered by the definition of the product in the DOE test procedure.

Figure X: Photo of an air circulating fan head mounted to a ceiling beam. The fan cannot be tested to AMCA 230, but may need to meet the design requirements of a ceiling fan. Photo courtesy of AMCA International.

Part 3: AMCA LDCF Testing and Certification

AMCA testing

AMCA International tests LDCFs at its headquarters laboratory in Arlington Heights, Illinois using AMCA 230-15 as the method of test. The AMCA Laboratory is certified by A2LA to ISO/IEC 17025, *Testing and Calibration Laboratories,* which "enables laboratories to demonstrate that they operate competently and generate valid results, thereby promoting confidence in their work both nationally and around the world."

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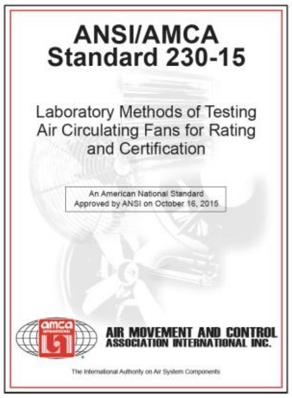


Cover of AMCA 230-15.

AMCA 230-15 can be obtained at nominal cost at www.amca.org/store.

The AMCA Lab can test LDCFs with blade spans between 7.5-ft (2.3 m) to 18-ft (5.5 m). Fans with blade spans over 18-ft and up to 24-ft (7.3-m) are tested at the NOW Arena near Chicago.

Ratings calculations for CFEI are performed per U.S. Department of Energy requirements, as described in this paper and included in AMCA Lab test reports. Because cfm/W ratings are used where DOE regulations are not applicable, cfm/W ratings are included in AMCA Lab test reports. Because Canada efficiency regulations are based on DOE regulations, but have not yet been updated to include CFEI ratings, AMCA will continue to include DOE cfm/W ratings in its test reports. Although not used in CFEI ratings, standby power measurements are still required by the DOE test procedure, so they will continue to be included in AMCA Lab test reports.

An error was recently discovered in AMCA 230-15, leading to errata being published on May 6, 2021. The errata fixed a problem whereby the measurement of input electrical power needed to be converted from ambient air to standard air. Left uncorrected, ratings from fans tested in one location could be different if tested at a location with a substantially different elevation and consequent air density (for example, Chicago vs. Denver). The errata is provided as Appendix 3 to this paper, and is available as a stand-alone document at www.amca.org/LDCF.

AMCA 230, apart from the 2021 errata, was last updated in 2015. It is scheduled for an ANSI revision cycle in 2022. The revision cycle will incorporate the 2021 errata, add the CFEI calculation such that AMCA 208 will not need to be obtained separately, and make its terminology consistent with the DOE regulatory language.

AMCA Certification

The AMCA Certified Ratings Program (CRP) was instituted to provide confidence that manufacturers' product ratings are accurate and enable comparisons of like products across different manufacturers. The AMCA CRP currently covers more than 4,000 product lines worldwide.

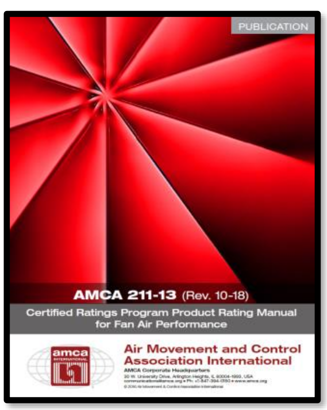
AMCA certifies LDCF ratings per AMCA Publication 211-13 (Rev. 10-18), *Certified Ratings Program Product Rating Manual for Fan Air Performance.* However, because AMCA 211 was last updated in 2018, it does not currently include CFEI. AMCA 211 has since been updated to include CFEI, however, the revision is currently undergoing final approval. The publication date is expected in the later months of 2021. The current edition of AMCA 211 certifies these LDCF parameters:

- Volumetric airflow rate
- The DOE cfm/W
- Fan system input power, phase, voltage and frequency
- Efficacy (volumetric airflow rate/electrical input power)
- Nominal impeller speed
- Direction of operation

AMCA 211 is currently undergoing a revision that would enable CFEI certification.

AMCA 211 can be obtained at no cost from www.amca.org/store.

To find AMCA-certified LDCF product lines, visit www.amca.org/certify and search by Product Type for "Lage Diameter Ceiling Fan." Click on any of the resulting manufacturers to obtain links to catalogs of certified LDCF models.



Cover of AMCA 211-13 (Rev 10-18).

References

1. ANSI/AMCA Standard 208-18, *Calculation of the Fan Energy Index*. AMCA International. 2018.
2. ANSI/AMCA Standard 230-15, *Laboratory Methods of Testing Air Circulating Fans for Rating and Certification*. AMCA International. 2015.
3. U.S. Code of Federal Regulations. 10 CFR Appendix U to Subpart B of Part 430 - Uniform Test Method for Measuring the Energy Consumption of Ceiling Fans. January 2017. https://www.law.cornell.edu/cfr/text/10/appendix-U_to_subpart_B_of_part_430
4. Energy Conservation Program: Test Procedure for Ceiling Fans; Notice of proposed rulemaking and request for comment. U.S. Department of Energy. September 30, 2019. https://www.regulations.gov/document/EERE-2013-BT-TP-0050-0024
5. AMCA 211-13 (Rev. 10-18), Certified Ratings Program Product Rating Manual for Fan Air Performance. AMCA International. 2018.
6. Notice of Proposed Rulemaking and Request for Comment: Energy Conservation Program for Appliance Standards: Certification for Ceiling Fan Light Kits, General Service Incandescent Lamps, Incandescent Reflector Lamps, Ceiling Fans, Consumer Furnaces and Boilers, Consumer Water Heaters, Dishwashers, Commercial Clothes Washers, Battery Chargers, and Dedicated-Purpose Pool Pumps, 43120-43143 [2021-15579]. U.S. Department of Energy. August 6, 2021. https://www.federalregister.gov/documents/2021/08/06/2021-15579/energy-conservation-program-for-appliance-standards-certification-for-ceiling-fan-light-kits-general

Sidebar: Design Requirements – A Little-Known DOE Regulatory Requirement

Apart from a test procedure and energy standard, there is another facet of DOE regulations called "design requirements." Design requirements specify features of a products design and operation that must be included that are covered by the definition of a covered product even if the covered product cannot be tested to the federal test procedure. Products that cannot be tested to the federal procedure are not held to the energy standard, but they must comply with the design requirements.

The design requirements for ceiling fans were published with the first ceiling fan regulation in 2006 as:

42 U.S.C. 6295(ff) Ceiling fans and ceiling fan light kits

(A) All ceiling fans manufactured on or after January 1, 2007, shall have the following features:
- *(i) Fan speed controls separate from any lighting controls.*
- *(ii) Adjustable speed controls (either more than 1 speed or variable speed).*
- *(iii) The capability of reversible fan action, except for—*
  - *(I) fans sold for industrial applications;*
  - *(II) fans sold for outdoor applications; and*
  - *(III) cases in which safety standards would be violated by the use of the reversible mode.*

Sidebar: Ceiling Fan Regulation Resources

- AMCA LDCF Advocacy Web Page
  - www.amca.org/ldcf
- U.S. DOE Appliance and Equipment Standards Program
  - https://www.energy.gov/eere/buildings/appliance-and-equipment-standards-program
- DOE Ceiling Fan Regulations (and *listserver* signup)
  - https://www1.eere.energy.gov/buildings/appliance_standards/standards.aspx?productid=5
- Test Procedure
  - https://www.ecfr.gov/cgi-bin/text-idx?SID=9630460a5b59e8f0b16d3b0411a98094&mc=true&node=ap10.3.430_127.u&rgn=div9
- Energy Standard
  - https://www.ecfr.gov/cgi-bin/text-idx?rgn=div8&node=10:3.0.1.4.18.3.9.2
- Compliance database for ceiling fans for filed data:
  - https://www.regulations.doe.gov/certification-data/CCMS-4-Ceiling_Fans.html#q=Product_Group_s%3A%22Ceiling%20Fans%22
- Canadian ceiling fan efficiency regulation:

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- https://canadagazette.gc.ca/rp-pr/p2/2019/2019-06-12/html/sor-dors163-eng.html

Sidebar: Other AMCA Resources

Readers of this white paper may find the following AMCA resources useful when working with LDCFs and other air-movement or control products.

- **AMCA International**: www.amca.org
- **AMCA Standards and Publications:** www.amca.org/store
- **AMCA White Papers:** https://www.amca.org/educate/#articles-and-technical-papers
- **AMCA Webinars (with PDHs)**: www.amca.org/educate
- **AMCA Certified Ratings Program:** www.amca.org/certify
- **LDCF Testing at AMCA Lab:** www.amca.org/test
- **AMCA Fan Energy Index (FEI) Microsite:** www.amca.org/fei

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Appendix 1: Ceiling Fan Improvement Act as Included in the Energy Act of 2020

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SEC. 1008. MODIFICATIONS TO THE CEILING FAN ENERGYCONSERVATION STANDARD.

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(a) In General.—Section 325(ff)(6) of the Energy Policy and Conservation Act (42 U.S.C. 6295(ff)(6)) is amended by adding at the end the following:

''(C)(i) Large-diameter ceiling fans manufactured on or after January 21, 2020, shall—

''(I) not be required to meet minimum ceiling fan efficiency in terms of ratio of the total airflow to the total power consumption as described in the final rule titled 'Energy Conservation Program: Energy Conservation Standards for Ceiling Fans' (82 Fed. Reg. 6826 (January 19, 2017)); and

''(II) have a CFEI greater than or equal to—

''(aa) 1.00 at high speed; and

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

''(ii) For purposes of this subparagraph, the term 'CFEI' means the Fan Energy Index for large-diameter

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ceiling fans, calculated in accordance with ANSI/AMCA Standard 208–18 titled ‘Calculation of the Fan Energy Index’, with the following modifications:

''(I) Using an Airflow Constant (Q_0) of 26,500 cubic feet per minute.

''(II) Using a Pressure Constant (P_0) of 0.0027 inches water gauge.

''(III) Using a Fan Efficiency Constant (η_0) of 42 percent.''.

(b) REVISION.—For purposes of section 325(m) of the Energy Policy and Conservation Act (42 U.S.C. 6295(m)), the standard established in section 325(ff)(6)(C) of such Act (as added by subsection (a) of this section) shall be treated as if such standard was issued on January 19, 2017.

Appendix 2:

TECHNICAL ERRATA SHEET FOR ANSI/AMCA STANDARD 230-15 Density Corrections

May 6, 2021

The corrections listed in this errata sheet apply to all copies of ANSI/AMCA Standard 230-15, *Laboratory Methods of Testing Air Circulating Fans for Rating and Certification*.
The corrections are not part of the approved, published document because they did not undergo the rigorous process of consensus development required by the American National Standards Institute (ANSI).

In Section 9, measured fan thrust is converted to standard air density, but the power does not include a density correction. This technical erratum addresses that omission.
In Table 1, add the following variable:

Symbol	Description	SI Unit	IP Unit
W_0	Measured electrical input power	W	W

In Section 8.2.4, replace "W_E" with "W_0".

Insert a new section after Section 9.4:

9.4a Power
The electrical input power, W_E, shall be calculated from the measured electrical input power, W_0, using the following equation:

$$W_E = W_0 \left(\frac{\rho_{std}}{\rho_0}\right)$$

In Section 9.5.1, replace all instances of "W_E" with "W_0", including in Equation 9.7.

In Section 10, include "Measured electrical input power" in "Data at test conditions" and "Electrical input power" in "Calculated values."

END OF ERRATUM