



6450-01-P

This document is scheduled to be published in the Federal Register on 08/08/2023 and available online at [federalregister.gov/d/2023-15712](https://www.federalregister.gov/d/2023-15712), and on [govinfo.gov](https://www.govinfo.gov)

## DEPARTMENT OF ENERGY

### 10 CFR Parts 429 and 431

[EERE-2021-BT-TP-0021]

RIN 1904-AF17

### Energy Conservation Program: Test Procedure for Fans and Blowers

**AGENCY:** Office of Energy Efficiency and Renewable Energy, Department of Energy.

**ACTION:** Final rule; technical amendments.

**SUMMARY:** On May 1, 2023, the U.S. Department of Energy (“DOE”) published a final rule adopting procedures for fans and blowers (hereafter the “May 2023 Final Rule”). This document corrects editorial and typographical errors in the May 2023 Final Rule. Neither the errors nor the corrections in this document affect the substance of the rulemaking or any conclusions reached in support of the final rule.

**DATES:** Effective [INSERT DATE OF PUBLICATION IN THE *FEDERAL REGISTER*].

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### SUPPLEMENTARY INFORMATION:

#### I. Background

The May 2023 final rule established: (1) test procedures for fans and blowers and incorporated the relevant industry test standards for measuring the fan electrical power and determining the fan energy index (“FEI”) of fans and blowers other than air-circulating fans; (2)

test procedure for air circulating fans measuring the fan airflow in cubic feet per minute per watt of electric power input (“CFM/Watt”); (3) supporting definitions; (4) requirements for alternative efficiency determination methods; and (5) sampling requirements. 88 FR 27312 (May 1, 2023).

Since the publication of the May 2023 Final Rule, DOE identified several typographical and editorial errors that could create confusion when conducting the DOE test procedure.

In the May 2023 Final Rule, in § 431.172, DOE introduced almost all definitions using “means the” or “means a” to describe each defined term. 88 FR 27312, 27389-27390. However, the definition of “air circulating fan discharge area” in § 431.172 of the regulatory text used a colon “:” rather than “means the” to introduce the definition. DOE replaces the colon “:” by “means the” to add consistency with how other definitions are presented. DOE notes that the meaning of the definition for “air circulating fan discharge area” is unchanged with this correction.

In the May 2023 Final Rule, DOE incorporated by reference AMCA 214-21, including the definitions of “fan static pressure” and “fan total pressure” in sections 3.41 and 3.43 of AMCA 214-21. 88 FR 27312, 27392. However, in the definition of “fan static air power” in § 431.172 of the regulatory text, the terms “static pressure” and “total pressure” are used without referencing the term “fan”. DOE is concerned that this may cause confusion as DOE incorporated the definitions of “fan static pressure” and “fan total pressure”<sup>1</sup>, but did not define the terms “static pressure” and “total pressure”. In addition, the terms “fan static pressure” and “fan total pressure” are used throughout the preamble of the May 2023 Final Rule and elsewhere in the regulatory text. 88 FR 27312, 27319, 27344, 27353, 27371, 27389, 27390, 27392. Consistent with the definition of “fan static pressure” and “fan total pressure” in sections 3.41 and 3.43 of AMCA 214-21, as incorporated by reference, and consistent with the terminology

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<sup>1</sup> As noted previously, DOE incorporated by reference AMCA 214-21, including the definitions of “fan static pressure” and “fan total pressure” in sections 3.41 and 3.43 of AMCA 214-21. 88 FR 27312, 27392.

used throughout the preamble of the May 2023 Final Rule and elsewhere in the regulatory text, DOE replaces “using static pressure instead of total pressure” with “using fan static pressure instead of fan total pressure” in the definition of “fan static air power” in §431.172. The meaning of the definition is unchanged by this correction.

DOE identified a missing hyphen in § 431.173, where the text reads as “ANSI/AMCA Standard 21016 (“AMCA 210–16”), rather than ANSI/AMCA Standard 210-16 (“AMCA 210–16”). 88 FR 27312, 27390. The reference should match the description in the preamble, which includes the hyphen. DOE corrects this to add the hyphen between 210 and 16.

Additionally, in the May 2023 Final Rule, the test procedure established for fans and blowers other than air circulating fans specifies that the applicable rating metric of FEI must be calculated using the electrical input power required to operate a fan in kilowatts (kW), abbreviated as “FEP”. 88 FR 27312, 27365. The May 2023 Final Rule generally uses the term “fan electrical input power” to designate the FEP throughout the preamble. 88 FR 27312, 27312, 27319, 27363, 27365, 27371. The preamble of the May 2023 Final Rule also uses the term “fan electrical power” to designate the FEP in one instance. 88 FR 27312, 27355. Further, in a number of places in the regulatory text, the term “fan electrical input power” and “fan electrical power” are used to describe the electrical input power to the fan in kilowatts (kW), abbreviated as “FEP”. 88 FR 27312, 27387, 27388, 27391, 27392, 27393. The May 2023 Final Rule also incorporates by reference AMCA 241-21 as the industry standards used to determine and define the FEP. In AMCA 214-21, the term “fan electrical power” is used to designate the FEP and defined in section 3 “Definitions” of AMCA 214-21, incorporated by reference. DOE believes that the use of “fan electrical input power” and “fan electrical power” to both designate the FEP may create confusion because only “fan electrical power” is the defined term. As such, DOE is correcting the regulatory text to only use “fan electrical power”, consistent with the definition in section 3 of AMCA 214-22, incorporated by reference, and replaces all instances of “fan electrical input power” with “fan electrical power”.

The preamble of the May 2023 Final Rule states that DOE is adopting the validation classes (1) through (9) and lists them as follows: (1) centrifugal housed; (2) radial housed; (3) centrifugal inline; (4) centrifugal unhooded; (5) centrifugal PRV exhaust; (6) centrifugal power roof ventilator (“PRV”) supply; (7) axial inline; (8) axial panel; (9) axial PRV. 88 FR 27312, 27373. The categories of PRVs are correctly listed in the preamble of the May 2023 Final Rule in footnote 20 where DOE specifies that PRVs include: Centrifugal PRV exhaust fans; Centrifugal PRV supply fans; and Axial PRVs, as defined in AMCA 214–21. 88 FR 27312, 27318. However, in the regulatory text, in § 429.70(n), DOE lists the following validation classes: centrifugal housed fan; radial housed fan; centrifugal inline fan; centrifugal unhooded fan; centrifugal power roof ventilator exhaust fan; centrifugal power roof ventilator supply fan; axial inline fan; axial panel fan; axial centrifugal power roof ventilator fan.” 88 FR 27312, 27388. DOE included the term “axial centrifugal power roof ventilator fan” as one of the validation classes instead of the correct term “axial power roof ventilator”. Similarly, the same error is included in § 431.174(a)(1), where DOE also used the term “axial centrifugal power roof ventilator fan” instead of “axial power roof ventilator” when listing the categories of fans in scope. 88 FR 27312, 27391. Therefore, DOE corrects this error and replaces the term “axial centrifugal power roof ventilator fan” by “axial power roof ventilator”.

In the May 2023 Final Rule, DOE established the metric for fans other than air circulating fans as the FEI, which is the fan energy index and represents the ratio of the electrical power of a reference fan to the electrical input power of the actual fan for which the FEI is calculated, both established at the same duty point. 88 FR 27312, 27349, 27365. However, in the regulatory text in § 429.69(a)(1)(iii), DOE wrote “any represented value of fan electrical input power (“FEI”), or other measure of energy consumption of a basic model for which consumers would favor higher values shall be less than or equal to the tested value” and incorrectly described the FEI as the “fan electrical input power”<sup>2</sup> rather than the “fan energy index”. 88 FR

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<sup>2</sup> As noted previously, the term “fan electrical input power” is equivalent to “fan electrical power”.

27312, 27387. In § 429.69(a)(1)(v), the FEI is correctly described: “any represented value of the fan energy index (“FEI”), or other measure of energy consumption of a basic model for which consumers would favor higher values”. 88 FR 27312, 27388. DOE corrects this error and replaces “fan electrical input power (“FEI”)” by “fan energy index (“FEI”)” in § 429.69(a)(1)(iii).

In the test procedure NOPR published on July 25, 2022, DOE proposed to incorporate by reference AMCA 214–21 for air circulating fans, which relies on the FEP and FEI metrics (“wire-to-air metrics”) for air circulating fans. 87 FR 44194, 44236–44237. In the May 2023 Final Rule, DOE established the metric for air circulating fans in terms of efficacy in cubic feet per minute per watt (“CFM/W”) for air circulating fans at maximum speed. 88 FR 27312, 27371. This is also reflected in the regulatory text in section 2.2.1 of appendix B to subpart J of part 431 where DOE states that “The air circulating fan efficacy (*E<sub>fcirc</sub>*) in cubic feet per minute (“CFM”) per watt (“W”) (“CFM/W”) at maximum speed must be determined in accordance with the applicable sections of AMCA 230-23 as listed in section 2.2.2 of this appendix”. 88 FR 27312, 27393. However, in the May 2023 Final Rule, in the regulatory text in § 431.174, the text was not updated to reflect the adopted metric and incorrectly references the FEI and FEP metrics as proposed in the July 2022 NOPR, as follows: “Determine the FEI and the fan electrical input power (“FEP”) or the weighted-average FEI and weighted-average FEP as applicable, using the test procedure set forth in appendix B of this subpart”. 88 FR 27312, 27391. DOE corrects this error such that the text reflects the correct efficacy metric in CFM/W adopted for air circulating fans in the May 2023 Final Rule, such that it reads: “Determine the air circulating fan efficacy in cubic feet per minute per watt at maximum speed using the test procedure set forth in appendix B of this subpart.”

In the May 2023 Final Rule, DOE stated that, although it incorporated by reference AMCA 214-21, it does not include section 6.5 of AMCA 214.21 in its test procedure. 88 FR 27312, 27350. Similarly, in the regulatory text, when listing the applicable section of AMCA

214-21 in section 0 of appendix A to subpart J of part 431, DOE did not list section 6.5 of AMCA 214-21. 88 FR 27312, 27392. DOE also did not list section 6.5 of AMCA 214-21 as an applicable section in Table 1 appendix A to subpart J of part 431. *Id.* However, in the regulatory text, in section 2.2.1 of appendix A to subpart J of part 431, DOE mistakenly listed section 6.5 in the following statement “fan shaft power for fans tested in accordance with sections 6.3, 6.4 or 6.5 of AMCA 214–21”. 88 FR 27312, 27392. DOE corrects this error to be consistent with the discussion of the preamble and other sections of the regulatory text in the May 2023 Final Rule that excluded section 6.5 of AMCA 214-21.

In the May 2023 Final Rule, DOE adopted provisions to replace the motor efficiency values in Annex A of AMCA 214–21 with the values in Table 5 of 10 CFR 431.25. DOE stated that while the values are currently identical, referencing the CFR would ensure that the values of polyphase regulated motor efficiencies remain up to date with any potential future updates established by DOE. 88 FR 27312, 27349. In the regulatory text in § 429.69, to reflect this intent, DOE also states: “Manufacturers must update represented values to account for any change in the applicable motor standards in Table 5 of part 431 of this chapter”. In the regulatory text, DOE also included this provision in section 2.1 of appendix A to subpart J of part 431 as follows: “Where AMCA 214–21 refers to Annex A, “Polyphase Regulated Motor Efficiencies (Normative),” of AMCA 214–21, Table 5 of § 431.25 must be used instead.” However, because any potential future updates to electric motor energy conservation updates could appear in tables other than Table 5 of 10 CFR 431.25, DOE makes the following correction to reflect the intent of the preamble which is to remain up to date with any potential future updates established by DOE: “Polyphase Regulated Motor Efficiencies (Normative),” of AMCA 214–21, Table 5 of § 431.25 or the currently applicable standards in § 431.25 must be used instead.”

In the May 2023 Final Rule, DOE established stability criteria for testing both air circulating fans and fan and blowers other than air circulating fans. As part of the stability requirements for fans and blowers other than air circulating fans, DOE stated that it was adopting

provisions to require that the stability will be evaluated and confirmed over at least three 60-second data collection intervals, and that the fan input power shall be monitored at least every 5 seconds over the 60-second data collection intervals. 88 FR 27312, 27360. In addition, DOE specified that the average fan speed from one data collection interval to the next must be within  $\pm 1$  percent or 1 rpm, whichever is greater; and the average input power by reaction dynamometer, torque meter or calibrated motor must be within  $\pm 4$  percent, or the average input power by electrical meter must be within  $\pm 2$  percent of the mean or 1 watt, whichever is greater.

*Id.* However, in the May 2023 Final Rule, DOE included incorrect regulatory text for the stability requirement for input power in section 2.4(b)(2) of appendix A to subpart J of part 431, specifying that “the average input power from the last 60-second interval varies by less than the absolute value of 1 percent, whichever is greater, compared to the average input power measured during the previous 60-second test interval.” 88 FR 27312, 27393. DOE is correcting this error in section 2.4(b)(2) of appendix A to subpart J of part 431 to remove this language and replace it with the appropriate stability requirement that “the average input power from the last 60-second interval by reaction dynamometer, torque meter or calibrated motor must be  $\pm 4$  percent, or the average input power by electrical meter must be  $\pm 2$  percent of the mean or 1 watt, whichever is greater, compared to the average input power measured during the previous 60-second test interval.”

In addition, for the stability conditions for fans and blowers other than air circulating fans in section 2.4(b) of appendix A to subpart J of part 431, DOE identified that the units for recording input power are listed as “pound-force, pound-force-in, or watts.” 88 FR 27312, 27393. but the units should be “horsepower or watts.” The pound-force and pound-force-in were listed incorrectly and the horsepower or watts are the correct units, consistent with AMCA 214–21, incorporated by reference. Therefore, DOE is correcting this error and replacing the units for input power in section 2.4(b) in appendix A to subpart J of part 431 with “horsepower or watts.”

DOE identified that in the description of the stability conditions for air circulating fans in section 2.5(b)(3) of appendix B to subpart J of part 431, DOE defines the stable load differential as “varies by less than the absolute value of 1 percent, whichever is greater.” The term “whichever is greater” is unnecessary as there is not a second criteria. In the May 2023 Final Rule, DOE stated that the average load differential from one data collection interval to the next must be within  $\pm 1$  percent. 88 FR 27312, 27362. DOE corrects this error by removing the text “whichever is greater” from section 2.5(b)(3) of appendix B to subpart J of part 431.

DOE identified inconsistencies in the rounding requirements for FEP for fans and blowers other than air circulating fans. Section 2.6 of appendix A to subpart J of part 431 specifies that FEP must be rounded to three significant figures, but § 429.69(a)(1)(ii) and (iv) specifies that any represented value of FEP, fan shaft input power, or other measure of energy consumption of a basic model for which consumers would favor a lower value must be rounded to the nearest hundredth. 88 FR 27312, 27387-27388, 27393. In the May 2023 Final Rule, DOE noted that it was adopting requirements that FEP (in kilowatts) shall be rounded to three significant figures. 88 FR 27312, 27364. DOE acknowledges that § 429.69(a)(1)(ii) and (iv) contains the incorrect rounding requirements and DOE is revising these sections to specify that FEP be rounded to three significant figures. Fan shaft input power and other measures of energy consumption of a basic model for which consumers would favor a lower value must still be rounded to the nearest hundredth.

Also, as part of the stability condition requirements for both air circulating fans and fans and blowers other than air circulating fans, in the May 2023 Final Rule, DOE adopted provisions in section 2.4(b)(3) of appendix A to subpart J of part 431 and section 2.5(b)(4) of appendix B to subpart J of part 431 that slope of the fan speed, input power, and load differential<sup>3</sup> measurements from one data collection interval to the next shall not be trending positive or negative. 88 FR 27312, 27393, 27394. Specifically, DOE adopted requirements that if the slope

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<sup>3</sup> Load differential is applicable to only air circulating fans.

of 3 or more successive data collection intervals are all positive or all negative, additional data collection intervals must be run until a negative or positive slope, respectively, is achieved. *Id.* DOE notes that the requirements may not be explicit as to whether a linear trendline should be applied to the data. DOE assumed that a linear trendline would be used and notes that the requirement to calculate the “slope” for each sampling interval implies a linear fit trendline, however, DOE is correcting the requirements in section 2.4(b)(3) of appendix A to subpart J of part 431 and section 2.5(b)(4) of appendix B to subpart J of part 431 to explicitly state that a linear fit trendline shall be applied when evaluating the slopes for each data collection interval.

In the May 2023 Final Rule, DOE incorporated by reference AMCA 230-23 and adopted by reference the equations for calculating ambient air density, as defined in Equations 8.5 and section 8.6 of AMCA 230-23. 88 FR 27312, 27393. However, DOE identified a typographical error in Equations 8.5 and section 8.6 of AMCA 230-23. The equations are given as:

$$\rho_0 = \left( \frac{p_b - 0.378p_p}{R(t_{d0} - 273.15)} \right) \quad \text{SI} \quad \text{Eq. 8.5}$$

$$\rho_0 = 70.73 \left( \frac{p_b - 0.378p_p}{R(t_{d0} - 459.67)} \right) \quad \text{IP} \quad \text{Eq. 8.6}$$

The correct forms of these equations should use a plus sign in the denominator, rather than a minus sign, to correctly convert the temperature in either degrees Celsius to Kelvin or to convert degrees Fahrenheit to Rankine. SI

DOE also notes that the corrected forms of these equations are consistent with the equations used to calculate ambient air density in AMCA 210-16. DOE amends appendix B to subpart J of part 431 to exclude Equations 8.5 and 8.6 in

AMCA 230-23 and to include the corrected equations used to calculate ambient

air density, which are given as:  $\rho_0 = \left( \frac{p_b - 0.378p_p}{R(t_{d0} + 273.15)} \right)$

$$\rho_0 = 70.73 \left( \frac{p_b - 0.378p_p}{R(t_{d0} + 459.67)} \right) \quad \text{I-P}$$

## **II. Need for Correction**

As published, the regulatory text in the May 2023 Final Rule may result in confusion due to the errors discussed in section I of this document. Because this final rule would simply correct errors in the text without making substantive changes in the May 2023 Final Rule, the changes addressed in this document are technical in nature.

## **III. Procedural Issues and Regulatory Review**

DOE has concluded that the determinations made pursuant to the various procedural requirements applicable to the May 2023 Final Rule remain unchanged for this final rule technical correction. These determinations are set forth in the May 2023 Final Rule. 88 FR 27312, 27383-27387.

Pursuant to the Administrative Procedure Act, 5 U.S.C. 553(b), DOE finds that there is good cause to not issue a separate notice to solicit public comment on the changes contained in this document. Neither the errors nor the corrections in this document affect the substance of the May 2023 Final Rule or any of the conclusions reached in support of the final rule. For these reasons, this rule is not subject to the 30-day delay in effective date requirement of 5 U.S.C. 553(d) otherwise applicable to rules that make substantive changes.

## **List of Subjects**

## **10 CFR Part 429**

Administrative practice and procedure, Confidential business information, Energy conservation, Household appliances, Imports, Intergovernmental relations, Reporting and recordkeeping requirements, Small businesses.

## **10 CFR Part 431**

Administrative practice and procedure, Confidential business information, Energy conservation, Household appliances, Imports, Incorporation by reference, Intergovernmental relations, Laboratories, Reporting and recordkeeping requirements, Small businesses.

### **Signing Authority**

This document of the Department of Energy was signed on July 19, 2023, by Francisco Alejandro Moreno Acting Assistant Secretary for Energy Efficiency and Renewable Energy, pursuant to delegated authority from the Secretary of Energy. That document with the original signature and date is maintained by DOE. For administrative purposes only, and in compliance with requirements of the Office of the Federal Register, the undersigned DOE Federal Register Liaison Officer has been authorized to sign and submit the document in electronic format for publication, as an official document of the Department of Energy. This administrative process in no way alters the legal effect of this document upon publication in the *Federal Register*.

Signed in Washington, DC, on July 20, 2023.

Treena V. Garrett,  
Federal Register Liaison Officer,  
U.S. Department of Energy.

For the reasons stated in the preamble, DOE corrects parts 429 and 431 of chapter II, subchapter D, of title 10 of the Code of Federal Regulations by making the following correcting amendments:

**PART 429— CERTIFICATION, COMPLIANCE, AND ENFORCEMENT FOR  
CONSUMER PRODUCTS AND COMMERCIAL AND INDUSTRIAL EQUIPMENT**

1. The authority citation for part 429 continues to read as follows:

**Authority:** 42 U.S.C. 6291-6317; 28 U.S.C. 2461 note.

**§ 429.69 [Amended]**

2. Amend § 429.69 by:

a. In paragraph (a)(1)(ii), removing the words “fan electrical input power (“FEP”)” and adding in its place, the words “fan electrical power (“FEP”).”

b. In paragraphs (a)(1)(ii) and (a)(1)(iv)(B), removing the text “Represented values must be rounded to the nearest hundredth” and adding in its place, the text “Represented values other than FEP must be rounded to the nearest hundredth. FEP must be rounded to three significant figures.”

c. In paragraph (a)(1)(iii), removing the words “fan electrical input power (“FEI”)” and adding in its place, the words “fan energy index (“FEI”).”

**§ 429.70 [Amended]**

3. Amend § 429.70 in paragraph (n)(2)(i) by removing the words “axial centrifugal power roof ventilator fan” and adding in its place, the words “axial power roof ventilator.”

**PART 431 -- ENERGY EFFICIENCY PROGRAM FOR CERTAIN COMMERCIAL  
AND INDUSTRIAL EQUIPMENT**

4. The authority citation for part 431 continues to read as follows:

**Authority:** 42 U.S.C. 6291–6317; 28 U.S.C. 2461 note.

5. Amend § 431.172 by revising the definitions for “Air circulating fan discharge area” and “Fan static air power” to read as follows:

**§431.172 Definitions.**

\* \* \* \* \*

*Air circulating fan discharge area* means the area of a circle having a diameter equal to the blade tip diameter.

\* \* \* \* \*

*Fan static air power* means the static power delivered to air by the fan or blower; it is proportional to the product of the fan airflow rate, the fan static pressure and the compressibility coefficient and is calculated in accordance with section 7.8.1 of AMCA 210–16 (incorporated by reference, see § 431.173), using fan static pressure instead of fan total pressure.

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6. Amend § 431.173 by revising paragraph (b)(1) to read as follows:

**§ 431.173 Materials incorporated by reference.**

\* \* \* \* \*

(b) \* \* \*

(1) ANSI/AMCA Standard 210-16 (“AMCA 210–16”), Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating, ANSI-approved August 26, 2016; IBR approved for § 431.172; appendix A to this subpart. (Co-published as ASHRAE 51–16).

\* \* \* \* \*

7. Amend § 431.174 by:

- a. In paragraph (a)(1), removing the words “axial centrifugal power roof ventilator” and adding in its place, the words “axial power roof ventilator”;

- b. In paragraph (a)(4)(i)(B) and paragraph (c), removing the words “fan electrical input power” and adding in its place, the words “fan electrical power”; and
- c. Revising paragraph (d).

The revision read as follows:

**§ 431.174 Test Procedure for fans or blowers.**

\* \* \* \* \*

(d) *Testing and calculations for air circulating fan.* Determine the air circulating fan efficacy in cubic feet per minute per watt at maximum speed using the test procedure set forth in appendix B to this subpart.

- 8. Amend appendix A to subpart J of part 431 by revising sections 2.1., 2.2.1. and 2.4(b), (b)(2), and (3) to read as follows:

**APPENDIX A TO SUBPART J OF PART 431 – UNIFORM TEST METHOD FOR THE MEASUREMENT OF ENERGY CONSUMPTION OF FANS AND BLOWERS OTHER THAN AIR CIRCULATING FANS**

\* \* \* \* \*

2.1. *General.*

This section describes the test procedure for fans and blowers other than air circulating fans. In cases where there is a conflict, the provisions in this appendix take precedence over AMCA 214–21. Where AMCA 214–21 refers to Annex A, “Polyphase Regulated Motor Efficiencies (Normative),” of AMCA 214–21, Table 5 of § 431.25 or the currently applicable standards in § 431.25 must be used instead.

2.2 *Testing*

2.2.1. *General.*

The fan electrical power (FEPact) in kilowatts must be determined at every duty point specified by the manufacturer in accordance with one of the test methods listed in table 1, and the following sections of AMCA 214–21: Section 2, “References (Normative)”; Section 7, “Testing,” including the provisions of AMCA 210–16 and ISO 5801:2017 as referenced by Section 7 and implicated by sections 2.2.2 and 2.2.3 of this appendix; Section 8.1, “Laboratory Measurement Only” (as applicable); and Annex J, “Other data and calculations to be retained.”

**Table 1 to Appendix A to Subpart J of Part 431**

| Driver                    | Motor Controller Present? | Transmission Configuration?   | Test Method                               | Applicable Section(s) of AMCA 214-21  |
|---------------------------|---------------------------|---|---|---|
| Electric motor            | Yes or No                 | Any   | Wire-to-air                               | 6.1 “Wire-to-Air Testing at the Required Duty Point”  |
| Electric motor            | Yes or No                 | Any   | Calculation based on Wire-to-air testing  | 6.2 “Calculated Ratings Based on Wire to Air Testing” (references Section 8.2.3, “Calculation to other speeds and densities for wire-to-air testing,” and Annex G, “Wire-to-Air Measurement – Calculation to Other Speeds and Densities (Normative)”)                                 |
| Regulated polyphase motor | No                        | Direct drive, V-belt drive, flexible coupling or synchronous belt drive | Shaft-to-air                              | 6.4 “Fans with Polyphase Regulated Motors,” (references Annex D, “Motor Performance Constants (Normative)”)*  |
| None or non-electric      | No                        | None  | Shaft-to-air                              | Section 6.3, “Bare Shaft Fans”  |
| Regulated polyphase motor | No                        | Direct drive, V-belt drive, flexible coupling or synchronous belt drive | Calculation based on Shaft-to-air testing | Section 8.2.1, “Fan laws and other calculation methods for shaft-to-air testing”(references Annex D, “Motor Performance Constants (Normative),” Annex E, “Calculation Methods for Fans Tested Shaft-to-Air,” and Annex K, “Proportionality and Dimensional Requirements (Normative)”) |
| None or non-electric      | No                        | None  | Calculation based on Shaft-to-air testing | Section 8.2.1, “Fan laws and other calculation methods for shaft-to-air testing” (references Annex E, “Calculation Methods for Fans Tested Shaft-to-Air,” and Annex   |

|  |  |  |  |   |
|--|--|--|--|---|
|  |  |  |  | K, “Proportionality and Dimensional Requirements (Normative)” |
|--|--|--|--|---|

\*Excluding Section 6.4.1.4, “Requirements for the VFD, if included” and Section 6.4.2.4, “Combined motor-VFD efficiency.”

Testing must be performed in accordance with the required test configuration listed in Table 7.1 of AMCA 214-21. The following values must be determined in accordance with this appendix at each duty point specified by the manufacturer: fan airflow in cubic feet per minute; fan air density; fan total pressure in inches of water gauge for fans using a total pressure basis FEI in accordance with Table 7.1 of AMCA 214-21; fan static pressure in inches of water gauge for fans using a static pressure basis FEI in accordance with Table 7.1 of AMCA 214-21; fan speed in revolutions per minute; and fan shaft input power in horsepower for fans tested in accordance with sections 6.3 or 6.4 of AMCA 214-21.

In addition, if applying the equations in Section E.2 of Annex E of AMCA 214-21 for compressible flows, the compressibility coefficients must be included in the equations as applicable.

All measurements must be recorded at the resolution of the test instrumentation and calculations must be rounded to the number of significant digits present at the resolution of the test instrumentation.

In cases where there is a conflict, the provisions in AMCA 214-21 take precedence over AMCA 210-16 and ISO 5801:2017. In addition, the provisions in this appendix apply.

\* \* \* \* \*

2.4. *Stability Conditions.*

\* \* \* \* \*

(b) After the fan has been run-in, record the fan speed in rpm and the input power (in horsepower or watts) at least every 5 seconds for at least three 60-second intervals. Readings shall be made simultaneously. Repeat these measurements over 60-second intervals until:

\* \* \* \* \*

(2) The average input power from the last 60-second interval by reaction dynamometer, torque meter or calibrated motor must be  $\pm 4$  percent, or the average input power by electrical meter must be  $\pm 2$  percent of the mean or 1 watt, whichever is greater, compared to the average input power measured during the previous 60-second test interval; and

(3) The slopes of a linear fit trendline calculated from the individual data collected for fan speed and input power during at least three 60-second sampling intervals include both positive and negative values (*e.g.*, two positive and one negative slope value or one positive and two negative slope values). If three positive or three negative slopes are determined in succession, additional sampling intervals are required until slopes from three successive sampling intervals include both positive and negative values.

\* \* \* \* \*

9. Amend appendix B to subpart J of part 431 by:

- a. Revising sections 0.1;
- b. In section 2.2.1., remove the text “section 2.2.2 of this appendix” and add, in its place, the text “section 0.1 of this appendix”;
- c. Removing section 2.2.2.;
- d. Revising sections 2.5(b)(3) and (4); and
- e. Adding section 2.6.

The revisions and addition read as follows:

**APPENDIX B TO SUBPART J OF PART 431 – UNIFORM TEST METHOD FOR THE MEASUREMENT OF ENERGY CONSUMPTION OF AIR CIRCULATING FANS**

\* \* \* \* \*

0.1 AMCA 230–23:

- (a) Section 4, “Definitions/Units of Measurement/Symbols,”;
- (b) Section 5, “Instruments and Methods of Measurement,”;
- (c) Section 6, “Equipment and Setup,”;
- (d) Section 7, “Observations and Conduct of Test,”;
- (e) Section 8, “Calculations,” excluding equations 8.5 and 8.6; and
- (f) Section 9, “Report and Results of Test,”.

\* \* \* \* \*

2.5. *Stability Conditions.*

\* \* \* \* \*

(b) \* \* \*

(3) The average load differential of the last 120-second interval varies by less than the absolute value of 1 percent compared to the average load differential during the previous 120-second test interval; and

(4) The slopes of a linear fit trendline calculated from the individual data collected for fan speed, input power, and load differential during at least three 120-second intervals include both positive and negative values (*e.g.*, two positive and one negative slope value or one positive and two negative slope values). If three positive or three negative slopes are determined in succession, additional sampling intervals are required until slopes from three successive 120-second intervals include both positive and negative values.

2.6. *Calculation of Ambient Air Density.*

For any references to ambient air density,  $\rho_0$ , in AMCA 230-23, calculate  $\rho_0$ , expressed in  $\text{kg/m}^3$  when using SI units or  $\text{lbm/ft}^3$  when using I-P units, as follows:

$$\rho_0 = \left( \frac{p_b - 0.378p_p}{R(t_{d0} + 273.15)} \right) \quad \text{SI}$$

$$\rho_0 = 70.73 \left( \frac{p_b - 0.378p_p}{R(t_{d0} + 459.67)} \right) \quad \text{I-P}$$

where  $p_b$  is the measured barometric pressure of the air,  $T_{d0}$  is the measured dry-bulb temperature of the air,  $p_p$  is the partial vapor pressure,  $R$  is the gas constant, which are all determined according to section 8.2 of AMCA 230-23.

[FR Doc. 2023-15712 Filed: 8/7/2023 8:45 am; Publication Date: 8/8/2023]