Fan Regulations in the United States

AMCA European Fan Symposium 2024

Michael Ivanovich

AMCA International

AMCA European Fan Symposium 2024

Presentation Outline

01

A Brief History Why FEI

02

Regulatory Test Procedure

03

California Regulation

04

DOE Regulation (draft)

05

Near and Far Future

06

Resources & Bonus

Note:

Images generated using AI are property of AMCA International and were not seeded with any images from manufacturers or web resources

01: A Brief History of Why FEI

(and not FEG or FMEG)...

FEI = Fan Energy Index
FEG = Fan Efficiency Grade
FMEG = Fan-Motor Efficiency Grade

Note: Bonus Slides have a synopsis of the history dating back to 2010

So – in a nutshell

2010--2017

- ✓ European Comm. uses FMEG for its fan product regulation
- ✓ USA started with FEG for state building energy codes
- ✓ U.S. Dept. of Energy starts a product regulation and chooses neither FEG or FMEG
- ✓ AMCA and its members develop FEI
- ✓ DOE and stakeholders agree on FEI
- ✓ Trump gets elected president and stops DOE regulations
- ✓ California starts its own product-efficiency regulation as part of its “Title 20” regulatory language

So – in a nutshell

2017--2024

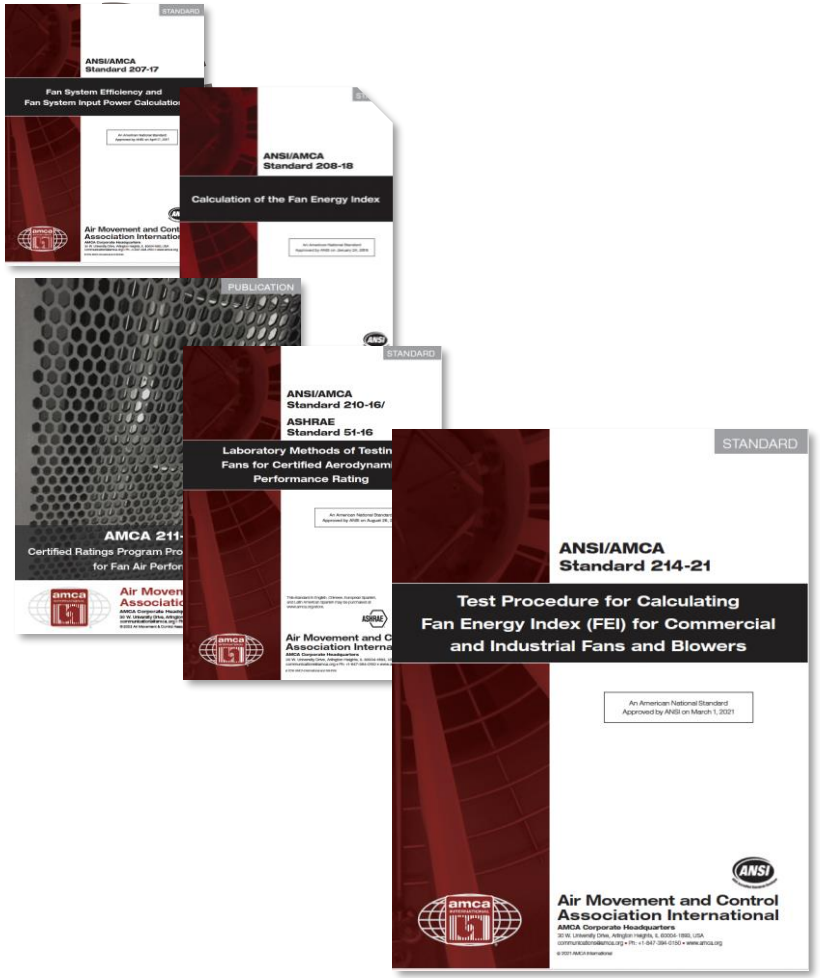
- ✓ AMCA publishes standards 207, 208, 214
- ✓ California Title 20 product –efficiency regulation adopts AMCA 214 and completes a regulation
- ✓ DOE finishes its test procedure and a draft energy standard
- ✓ California appliance regulation now in effect; harmonized with DOE test procedure

Future:

- ✓ DOE expected to finish appliance regulation with limits and labeling in 2024
- ✓ DOE would take effect in 2029; California synchronizes

02: Regulatory Test Procedure

...because test procedures are the foundation of any fan regulation...



FEI-Based Test Procedure

ANSI/AMCA 214 developed to integrate several AMCA standards and publications, making it easier for regulators to use FEI

- AMCA 207: Part-load motor/drive coefficients
- AMCA 208: FEI calculation
- AMCA 210 and ISO 5801: By reference
- AMCA 211: Certified Ratings Program operating manual for fans to arrive at a complete FEI rating
- PLUS:
    - Annexes to help with regulatory labeling and filing, and to document interpolations and other calculations

- DOE and California regulators participate on the 214 technical committee as non-voting members

Key Components

1. Definitions of fan types, FEP, etc.
2. Does not cover embedded fans – which was a touchy subject for AMCA at the time
3. Describes how fans with FEI ratings could be registered in database for compliance
4. Table 7.1 assigns a single mandatory pressure basis (static or total) based on fan type; other basis could be used for marketing purposes
5. Interpolations, Fan Laws etc. needed to be in the test procedure for California to allow them (at the time)

DOE Test Procedure

- Adopted much of AMCA 214
- Rejected sections that calculate FEI if not tested with a speed controller
- Allows Alternative Efficiency Determination Methods (AEDM) in lieu of physically testing each model
- Did not include conservative calculation-only method
- At the core it uses AMCA 210 and ISO 5801 as method of test

Scope

- Fans from 0.75 kilowatts shaft power and 112.5 kW air power (i.e., fans with a rated shaft input power of greater than or equal to 1 horsepower (HP) and less than or equal to 150 air HP)

  OR

- An electrical input power greater than or equal to 0.89 kilowatt (kW)

.

In

- Axial inline
- Axial panel
- Axial PRV
- Centrifugal housed, unhoused
- Centrifugal PRV exhaust, supply
- Centrifugal inline
- Inline mixed-flow
- Power roof/wall ventilators
- Radial housed *

Note: These fan definitions differ from Europe, where some of these items are in the scope of ventilation unit regulation.

Out

- Specified embedded fan types:
  - Air curtain units
  - Fans in transportation
  - Intricate list of HVAC fans*
- Safety fans*
- Induced-flow fans
- Jet fans
- Positive pressure ventilators
- *Radial housed unshrouded fan with blade diameter at tip less than 30 inches or a blade width of less than 3 inches

- Etc… the list is quite long

03: California Title 20 Appliance Fan Regulation

In effect...

...Until DOE takes effect ~2029

California Energy Commission Title 20

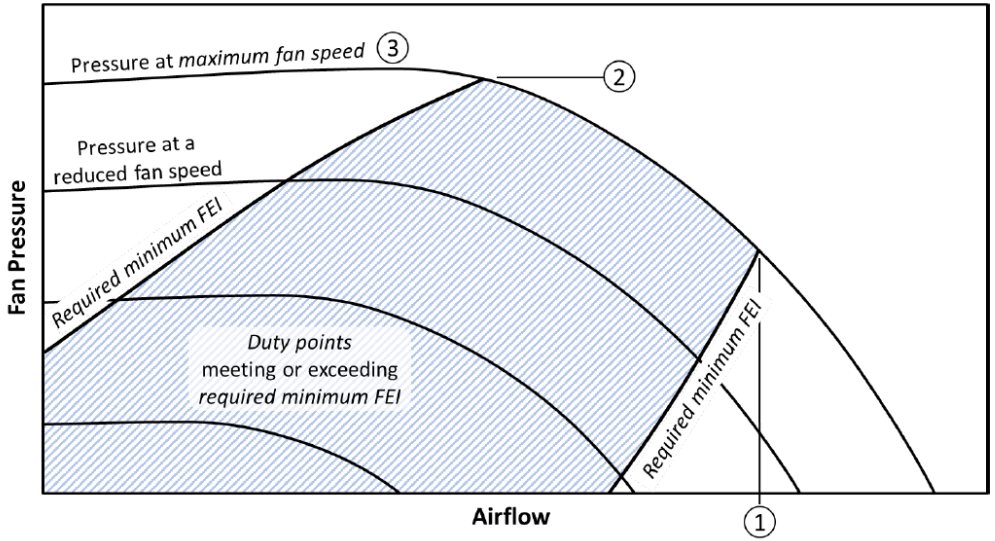
- Fans manufactured on or after 29 April 2024 must be marked and registered before being OFFERED for sale for end-use in California
- Uses DOE test procedure to test and rate fans
- Minimum fan performance based on FEI $\geq$ 1.00
- Uses the same scope as DOE but exempts all embedded fans regardless of DoE's exemption list.
- Testing embedded fans still required because of DOE preemption of California regulation

California Energy Commission Title 20

- Manufacturers must file covered models before “being offered for sale” in California
  - So, only certified fans can be in specs, submittals
- Filing is facilitated by spreadsheet upload to CEC online database per Table X in regulation
  - 26 required parameters

Key Compliance Parameters for FEI

Figure H.2 — Fans Offered for Sale Over a Continuous Range of Speeds Limited by Required Minimum FEI



Based on AMCA 214 – Annex H: Required Reported Values (Normative)

Definition of points	
1 -	Maximum airflow
2 -	Maximum pressure
3 -	Maximum fan speed
Note: These three points meet or exceed required minimum FEI	

Bonus Slides: Parameters to Certify Fans for CEC Title 20 Database

7

Parameters to identify and characterize the fan

19

Parameters to document compliant zone of fan operation for FEI $\geq$ 1.00 using AMCA 214 Annex H

Permanent Label Requirement

Manufacturer Name
Model Number
Manufacture Date

Fan Energy Index ≥ 1.00 Efficiency boundaries

a. Maximum air flow (CFM):
b. Maximum fan speed (RPM):
c. Maximum pressure (inches water gauge):
d. Type of pressure: ("Static" or "Total")

NOTE: Operation outside of these boundaries will result in an energy inefficient operation.

Manufacturer name or brand name

Enter Static or Total, depending on AMCA 214 designation, Table 7.1

California Bonus Slides

- How to search for fans in CEC database
- How to get a list of manufacturers that have filed products in the database
- How to download the entire CEC database

04: DOE Energy Standard

(work in progress)

DOE Notice of Proposed Rulemaking (NOPR)

- Significant deviations from California and energy codes
- FEI levels set by fan type; not ≥ 1.00 for all types
- Levels are set quite high, up to 48% more than 1.00
- No labeling or certification (filing) requirements (yet)
- Proposes to add a “calculation method” to test procedure
- Non-compliant duty points must have curves and tabulated values “grayed out” and include disclaimer:

SALE AT THESE DUTY POINTS VIOLATES DEPARTMENT OF ENERGY REGULATIONS UNDER EPCA

DOE Proposed FEI Minimums By Fan Type

Equipment Class	Fan Energy Index (FEI)
Axial Inline	1.18
Axial Panel	1.48
Axial Power Roof Ventilator	0.85
Centrifugal Housed	1.31
Centrifugal Unhoused	1.35
Centrifugal Inline	1.28
Radial Housed	1.17
Centrifugal Power Roof Ventilator - Exhaust	1.00
Centrifugal Power Roof Ventilator - Supply	1.19

*A if sold without a motor speed controller

*A*B if sold with a motr speed controller

A & B are adjustment parameters

05: Near and Far Future

Where will DOE land?

or

Thank you!

Do you have any questions?

mivanovich@amca.org
+1 708-714-6619
amca.org

06: Resources & Bonus Slides

- History of FEI as a regulatory metric
- Parameters to certify with California Energy Commission
- How to search for fans and manufacturers and download entire CEC database

Bonus Slides: History of FEI as a Regulatory Metric

A Brief History of Why FEI

- 2010: AMCA Standard 205 and ISO 12759
  - ISO: Fan Efficiency Grade (FEG) and Fan Motor Efficiency Grade (FMEG)
    - FEG:
      - Shaft-to-air, peak fan total efficiency
      - Needs selection window restriction to actually save energy

A Brief History of Why FEI

- 2010: AMCA Standard 205 and ISO 12759
  - ISO: Fan Efficiency Grade (FEG) and Fan Motor Efficiency Grade (FMEG)
    - FEG:
      - Shaft-to-air, peak fan total efficiency
      - Needs selection window restriction to actually save energy
    - FMEG:
      - Peak wire-to-air efficiency; pressure basis is optional - static and total
      - Compensation factors for unmatched components and for part load
      - No restricted selection window
  - AMCA: FEG only

A Brief History of Why FEI

- Initial Regulatory Paths:
  - Europe: ISO 12759 integrated into EcoDesign directive's European Commission 327 fan ***PRODUCT REGULATION***
    - Tier 1: 2011
    - Tier II, 2013
    - Tier III, 2024?
  - Europe regulates embedded fans (cascading regulation)
  - Regulates ventilating units separately

A Brief History of Why FEI

- Initial Regulatory Paths:
  - USA:
    - AMCA 205 and then AMCA 208 referenced by ASHRAE 90.1 ***MODEL BUILDING ENERGY CODES, subsquently*** adopted into state building energy codes
    - 2013: ASHRAE adopts FEG based on AMCA 205
    - 2019: ASHRAE adopts FEI based on AMCA 208

    - U.S. Department of Energy starts a product efficiency regulation in 2011

A Brief History of Why FEI (continued)

- USA … as FEG is adopted into model and state energy codes:
  - 2011: U.S. Dept. of Energy initiates federal fan efficiency rulemaking as a product-efficiency regulation
  - 2013: DOE “Framework Document” eliminates FEG and FMEG
    - FMEG: because peak only
    - FEG: because peak only; fan only; sizing window cannot be used in product regulation
  - 2014 (ish): AMCA/members proffer Fan Energy Index (FEI)
  - 2015: Public negotiations result in FEI / Fan Electrical Power (FEP) as metrics
  - 2017: DOE moratorium on new DOE regulations; California starts a STATE fan regulation

A Brief History – Why FEI (almost done)

- Finally – regulations begin to appear
  - 2017-2021: AMCA publishes standards for FEI-based fan regulation
    - Standards 207, 208, 214
    - AMCA Standard 214 combines AMCA 207, 208, 211 (ratings calculation) and references AMCA 210, ISO 5801 as methods of test
    - AMCA 214 is a “test procedure for FEI”
  - 2022: California adopts AMCA 214 and publishes a complete fan efficiency regulation, including labeling and filing
  - 2023: DOE publishes final test procedure, which California must adopt

A Brief History – Why FEI (almost done… I pomise)

- Finally – regulations begin to appear
  - 2024: DOE publishes draft regulation with minimum FEI levels, but no labeling or filing requirements
  - 2024: California publishes updated regulation, which took effect April 29, 2024
    - More than 100,000 fan models are certified
- Future:
  - 2024: DOE expected to publish final rule for fan regulation, and initiate labeling and filing rulemakings
  - 2029: Complete DOE regulation would take effect; California regulation synchronizes with DOE

A Brief History – Why FEI (almost done)

- Note: Late in the rulemaking process, DOE added circulating fans with electrical input power ≥ 125 W. These fans are tested to AMCA Standard 230-23, which is now being transformed into a future ISO Standard 21684. Circulating fans are not covered in this presentation. Regulatory metric is cfm/W. And DOE does not make metric conversions.

- Another note: DOE regulated ceiling fans separately, including fans with diameters ≥ 2.13 meters, which are called large diameter ceiling fans. LDCF. LDCF metric is Ceiling Fan Energy Index (CFEI). Also not covered in this presentation.

So – in a nutshell

2010--2017

- ✓ European Comm. uses FMEG for its fan product regulation
- ✓ USA started with FEG for state building energy codes
- ✓ U.S. Dept. of Energy starts a product regulation and chooses neither FEG or FMEG
- ✓ AMCA and its members develop FEI
- ✓ DOE and stakeholders agree on FEI
- ✓ Trump gets elected president and stops DOE regulations
- ✓ California starts its own product-efficiency regulation as part of its “Title 20” regulatory language

So – in a nutshell

2017--2024

- ✓ AMCA publishes standards 207, 208, 214
- ✓ California Title 20 product –efficiency regulation adopts AMCA 214 and completes a regulation
- ✓ DOE finishes its test procedure and a draft energy standard
- ✓ California appliance regulation now in effect; harmonized with DOE test procedure

Future:

- ✓ DOE expected to finish appliance regulation with limits and labeling in 2024
- ✓ DOE would take effect in 2029; California synchronizes

Bonus Slides: Parameters to Certify with CEC Section 1606

Table X – Section 1606

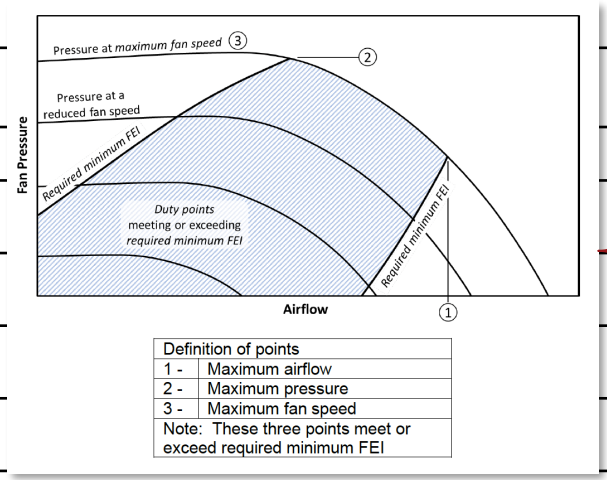
Data Submittal Requirements

Required Information	Possible Answers
Fan type	Centrifugal housed, centrifugal inline, centrifugal unhoused, centrifugal PRV supply, centrifugal PRV exhaust, axial inline, axial PRV, inline mixed-flow, power roof/wall ventilators, axial panel, radial housed
Fan impeller diameter (in.)	
Type of Motor (if fans sold with a motor)	None, Single-phase induction, Polyphase induction, Synchronous DC (including ECM), Permanent magnet AC, or Other
Motor nameplate horsepower (if fan sold with an induction motor) (hp)	
Pressure type	S = Static pressure; T = Total pressure
Transmission type (if fan is sold with a transmission)	Direct, V-belt, synchronous-belt, flexible coupling, none
Type of Controller (if fan sold with controller)	None, Variable frequency drive, or Other

Characterization of the fan

Table X – Section 1606

Required Information	Permissible Answers
Maximum fan speed (RPM)	
Airflow at maximum fan speed (CFM)	
Pressure at maximum fan speed (inches water gauge)	
FEP_{act} at maximum fan speed (kW)	
FEP_{ref} at maximum fan speed (kW)	
Maximum pressure (inches water gauge)	
Airflow at maximum pressure (CFM)	
Fan speed at maximum pressure (RPM)	
FEP_{act} at maximum pressure (kW)	
FEP_{ref} at maximum pressure (kW)	
Maximum air flow (CFM)	



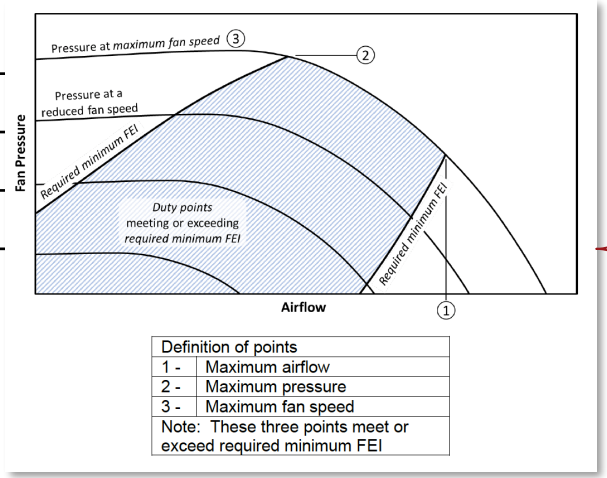
Definition of points	
1 -	Maximum airflow
2 -	Maximum pressure
3 -	Maximum fan speed
Note: These three points meet or exceed required minimum FEI	

Parameters associated with AMCA 214 Annex H

Table X – Section 1606

Data Submittal Requirements

Required Information	Permissible Answers
Pressure at maximum airflow (inches water gauge)	
Fan speed at maximum airflow (RPM)	
FEP_{act} at maximum airflow (kW)	
FEP_{ref} at maximum airflow (kW)	



Definition of points	
1 -	Maximum airflow
2 -	Maximum pressure
3 -	Maximum fan speed
Note: These three points meet or exceed required minimum FEI	

Parameters associated with AMCA 214 Annex H

Bonus Slides: How to Search CEC Database for Fans, Manufacturers and Download Entire Database

CEC Title 20 MAEDbS Database Search for fans

- For list of all fans in dataset: Visit https://cacertappliances.energy.ca.gov/Pages/ApplianceSearch.aspx
- Click on Appliance Type
- Select Fans and Dehumidifiers
- Select Commercial and Industrial Fans
- Click on Search
- 102,787 models in database as of June 23, 2024

Quick Search

To begin your search enter model criteria and click search. Use the additional fields if necessary. The quick search also allows search results to be narrowed to currently approved models or to search historical models.

To search historical models, please set the status to archived which can be found on the appliance status tab.

Questions can be directed to Appliances@energy.ca.gov or to the Appliances Hotline, toll free at (888) 838-1467 or outside California (916) 651-7100. Search Instructions are also available.

Model Number | **Appliance Type** | Company | Brand | Appliance Status

Select Category: Fans and Dehumidifiers

Select Appliance Type: Commercial & Industria

Search | Clear

Search Results 102787 record(s) found

Export To: Excel CSV

MAEDbS Quick Search: List of Manufacturers

- On search results page:
  - Click on Company
  - Select Company (drop down menu header) to get list of manufacturers that have models in the database

MAEDbS Advanced Search: Download All Data

- Visit
  - https://cacertappliances.energy.ca.gov/Pages/Search/AdvancedSearch.aspx
- Select Fans and Dehumidifiers and Commercial and Industrial Fans as for Quick Search
- Select Fields to Display
  - Select ”All” for complete database or pick what you want
  - Apply up to five filters or none (to get all data)
  - Click Search
  - Wait….
  - When prompted, enter email address and await file

CALIFORNIA ENERGY COMMISSION

SEARCH

Advanced Search

The Advanced Search allows you to create a narrower search by selecting unique model criteria. You will be guided to select the category, type, then narrow your search results with additional filters. In this search you can select the fields displayed in the results by checking the "Select All" box. There are also additional filters that can be applied to look up specific model information.

To search historical models, please set the appliance status to archived.

Questions can be directed to Appliances@energy.ca.gov or to the Appliances Hotline, toll free at (888) 838-1467 or outside California (916) 651-7100. Search Instructions are also available.

Recent Searches

Commercial & Industrial Fans & Blowers

Select Appliance Type

Select Category: Fans and Dehumidifier

Select Appliance: Commercial & Industri

Select Appliance Status: Approved

Select Fields to Display

- [x] Select/Deselect All
- [x] Manufacturer
- [x] Brand
- [x] Model Number
- [x] Regulatory
- [x] Fan Type
- [x] Fan Impeller Diameter (In.)
- [x] Motor Type (If Fan Is Sold With A Motor)
- [x] Motor Nam
- [x] Pressure Type
- [x] Transmission Type (If Fan Is Sold With A Transmission)
- [x] Controller Type (If Fan Is Sold With Controller)
- [x] Maximum
- [x] Airflow At Maximum Fan Speed (CFM)
- [x] Pressure At Maximum Fan Speed (Inches Water Gauge)
- [x] Fepact At Maximum Fan Speed (Kw)
- [x] Fepref At
- [x] Maximum Pressure (Inches Water Gauge)
- [x] Airflow At Maximum Pressure (CFM)
- [x] Fan Speed At Maximum Pressure (RPM)
- [x] Fepact At
- [x] Fepref At Maximum Pressure (Kw)
- [x] Maximum Air Flow (CFM)
- [x] Pressure At Maximum Airflow (Inches Water Gauge)
- [x] Fan Speed
- [x] Fepact At Maximum Airflow (Kw)
- [x] Fepref At Maximum Airflow (Kw)
- [x] Add Date
- [x] Reference

Pressure (Kw)

(Inches Water Gauge)

Filters

Please Select

Please Select

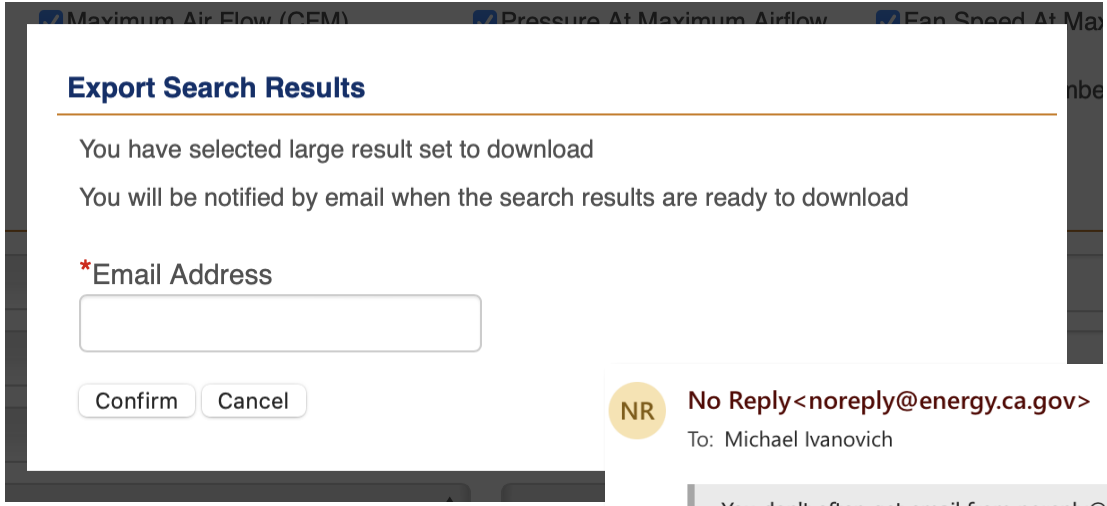
Please Select

Please Select

Please Select

Search

Clear



NR **No Reply<noreply@energy.ca.gov>**

To: Michael Ivanovich

Sun 6/23/2024 9:01 AM

You don't often get email from noreply@energy.ca.gov. Learn why this is important

EXTERNAL

Your advanced search export for Commercial & Industrial Fans & Blowers is ready. Please click on the following link to download your document. The link will expire in 30 days. https://cacertappliances.energy.ca.gov/Pages/Common/DownloadAdvancedSearchResult.aspx?DocumentID=6c74639f-04d4-45c2-9a66-18144d50e7af

Reply Forward

Bonus Slides: U.S. Dept. of Energy Resources

DOE Fan Regulation Resources

- Appliances Standards Fans and Blowers Pages
  https://www1.eere.energy.gov/buildings/appliance_standards/standards.aspx?productid=51&action=viewlive

  or

  https://www.energy.gov/eere/buildings/fans-and-blowers

- Appliance Standards Ceiling Fans Page
  https://www.energy.gov/eere/buildings/ceiling-fans

Fans and Blowers

Buildings

Buildings » Fans and Blowers

As defined in the Code of Federal Regulations (CFR), a "fan or blower" means a rotary bladed machine used to convert electrical or mechanical power to air power, with an energy output limited to 25 kilojoule (kJ)/kilogram (kg) of air. It consists of an impeller, a shaft and bearings and/or driver to support the impeller, as well as a structure or housing. A fan or blower may include a transmission, driver, and/or motor controller. 10 CFR 431.172.

RECENT AND ONGOING ACTIVITIES +

CURRENT STANDARD +

CURRENT TEST PROCEDURE +

HELPFUL LINKS +

CONTACT INFORMATION +

RECENT AND ONGOING ACTIVITIES —

For the latest information on the planned timing of future DOE regulatory milestones, see the current **Office of Management and Budget Unified Agenda of Regulatory and Deregulatory Actions** . All planned dates are preliminary and subject to change.

STANDARDS	
Notice of Proposed Rulemaking	• Federal Register, **89FR3714** (January 19, 2024)
Notice of Data Availability	• Federal Register, **87FR62038** (October 13, 2022)
Request for Information	• Federal Register, **87FR7048** (February 8, 2022)
Final Rule; Final Determination	• Federal Register, **8**

The fans and blowers energy conservation standard rulemakin
all notices, public comments, public meeting transcripts, and
rulemaking.

Public Meeting Information

There is no public meeting scheduled at this time.

Submitting Public Comments

The comment period has closed.

Links to energy standard and test procedure rulemakings in Federal Register

TEST PROCEDURE	
Final Rule; Correction **Final Rule**	• Federal Register, **88FR53371** (August 8, 2023) • Federal Register, **88FR27312** (May 1, 2023)
Notice of Proposed Rulemaking	• Federal Register, **87FR44194** (July 25, 2022)
Request for Information; Comment Extension **Request for information**	• Federal Register, **86FR59308** (October 27, 2021) • Federal Register, **86FR54412** (October 1, 2021).

he fans and blowers test procedure rulemaking docket **EERE-2021-BT-TP-0021** contains all notices, public comments, public meeting transcripts, and supporting documents pertaining to this rulemaking.

Fans and Blowers

Buildings

Buildings » Fans and Blowers

As defined in the Code of Federal Regulations (CFR), a "fan or blower" means a rotary bladed machine used to convert electrical or mechanical power to air power, with an energy output limited to 25 kilojoule (kJ)/kilogram (kg) of air. It consists of an impeller, a shaft and bearings and/or driver to support the impeller, as well as a structure or housing. A fan or blower may include a transmission, driver, and/or motor controller. 10 CFR 431.172.

Subscribe

Sign up for email updates on regulations for this and other products

Enter Email Address GO

RECENT AND ONGOING ACTIVITIES —

For the latest information on the planned timing of future DOE regulatory milestones, see the current Office of Management and Budget Unified Agenda of Regulatory and Deregulatory Actions . All planned dates are preliminary and subject to change.

STANDARDS	
Notice of Proposed Rulemaking	• Federal Register, 89FR3714 (January 19, 2024)
Notice of Data Availability	• Federal Register, 87FR62038 (October 13, 2022)
Request for Information	• Federal Register, 87FR7048 (February 8, 2022)
Final Rule; Final Determination	• Federal Register, 86FR46579 (August 19, 2021)

The fans and blowers energy conservation standard rulemaking docket EERE-2020-BT-STD-0002 contains all notices, public comments, public meeting transcripts, and supporting documents pertaining to this rulemaking.

Docket for energy standard

motor controller. 10 CFR 431.172.

RECENT AND ONGOING ACTIVITIES +

CURRENT STANDARD +

CURRENT TEST PROCEDURE −

All representations of energy efficiency and energy use of fans and blowers, including those made on marketing materials and product labels, must be made in accordance with this test procedure for fans and blowers specified at **10 CFR 431.174** and **Appendix A to Subpart J of 10 CFR Part 431** - Uniform Test Method for the Measurement of Energy Consumption of Fans and Blowers Other Than Air Circulating Fans and **Appendix B to Subpart J of 10 CFR Part 431** - Uniform Test Method for the Measurement of Energy Consumption of Air Circulating Fans.

Useful info and links for test procedure