Update on the Regulation of Commercial and Industrial Fans and Blowers

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AMCA International

- Joined AMCA in 2011
- Coordinates global AMCA advocacy
- Primary staff person for U.S. state and federal regulations
- Past chief editor of HPAC Engineering and Consulting-Specifying Engineer
- B.Sc. Computer Science & Mathematics Utica College of Syracuse University
- M.Sc. Building Systems Engineering, University of Colorado, Boulder

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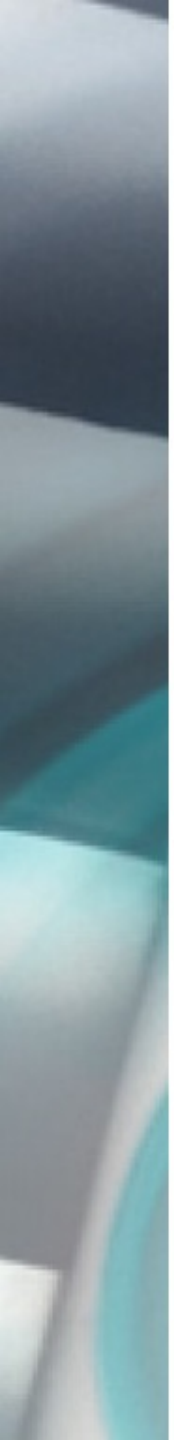
- Voting Member, ASHRAE 90.1 Mechanical Subcommittee
- Voting Member, NFPA 80/105 TC
- Voting Member, IAPMO UMC TC
- Corresponding Member, ASHRAE Technical Committees 5.2 and 5.6
- Staff liaison for AMCA's air control and air movement advocacy committees
- BS, Mechanical Engineering, University of North Carolina at Charlotte



Learning Objectives

This session will summarize the scope and essential provisions of the two fan-efficiency regulations, compare the regulations, and discuss compliance from various perspectives.

- Brief Introduction to AMCA International
- Overview of California Regulation for Commercial and Industrial Fans
- Overview of U.S. Department of Energy Test Procedure and DRAFT Energy Standard
- Compliance resources for manufacturers and practitioners

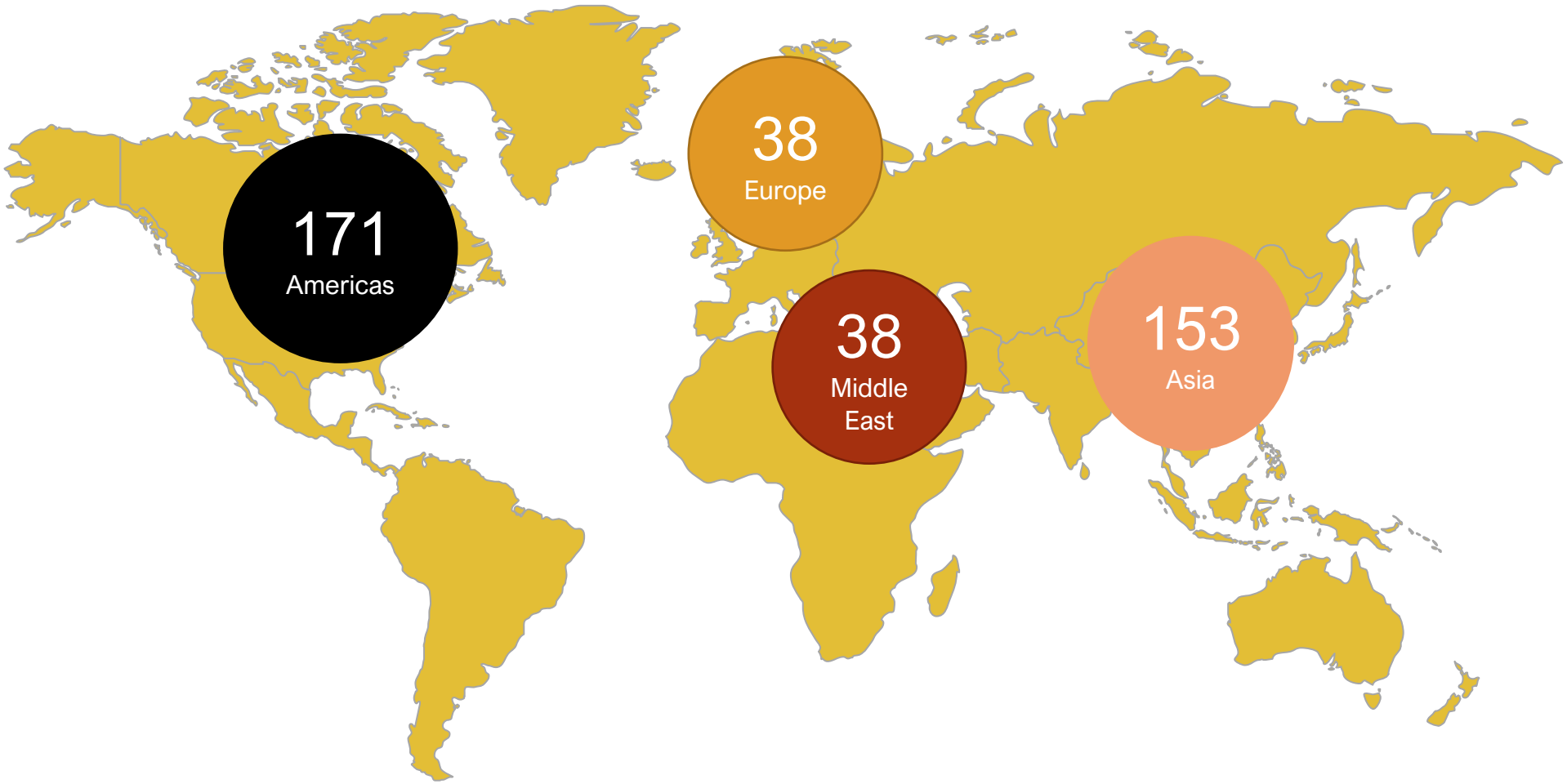
Outline

- About AMCA International
- Fan-Efficiency Codes, Standards, and Regulations
- Product Efficiency Regulations: California and U.S. Dept. of Energy
- More about DOE Regulation
- Fan Regulations Summary
- Resources for Today’s Presentation
- Q&A
- Bonus Slides (California Compliance, Acronyms, and More

Global Reach – Local Touch

Established in 1917
400 member companies

- Four regions: Americas, Europe, Middle East, and Asia
- More than half of AMCA members are outside the Americas



AMCA's Value Chain

Fan Efficiency Codes, Standards, & Regulations

Tip:

- This presentation updates information in the 2023 *AMCA inmotion* article:
  - Regulations for Commercial and Industrial Fans and Blowers
  - Regulations for Circulating Fans
  - www.amca.org/inmotion

Why Care About Fan Efficiency

- Fans use a lot of electricity.
- From Lawrence Berkely National Lab* study of installed motors/drives in commercial and industrial facilities:

  "Fan and blower systems were found to consume 21% of industrial motor system energy consumption and 36% of commercial motor system energy consumption."

  Tables ES-5 and ES-6: Total commercial and industrial annual electric consumption per year is 305,027 GWh/yr at a combined cost of $34.8B/yr**

  Note: 305,027 GWh/yr = 1.04 Quads

**Access to Vol 3 report (2022)*

*** Edison Electric Institute believes the $ is overstated and suggests the amount is closer to $21.90 billion/yr*

Thus: Rapid Fan-Industry Revolution

- Relatively recent initiatives to reduce fan-energy consumption
  - 2010: AMCA and ISO metric standards
  - 2011: European Commission finishes fan regulation; DOE starts one
  - 2013: ASHRAE 90.1 fan-efficiency provision
  - 2017: California fan rulemaking started
  - 2022: California finishes fan rulemaking
  - 2023: DOE finalizes test procedure; previews draft energy standard
  - 2024: California regulation will take effect; DOE will finish energy standard
  - 2029: DOE energy standard estimated to take effect
- In less than two decades, fan industry will be revolutionized around energy efficiency

Thus…

- For engineers, know about and follow energy codes
- Manufacturers need to comply with product-efficiency regulations
  - **Ignorance is DEFINITELY not bliss**

Codes, Standards, & Regulations

- Model Codes
  - Energy Efficiency Baseline Codes — **ASHRAE 90.1, IECC**
  - Green/High-Performance Codes — **ASHRAE 189.1, IGCC**
  - IAPMO Uniform Mechanical Code Appendix E — **UMC**
- State Energy Codes and Green Codes
  - Based on Model Codes — **Oregon, Florida, Washington, etc.**
  - Independent State Codes — **California Title 24**
- Product Regulations
  - Federal — **U.S. DOE Appliance & Equipment Stds.**
  - State — **California Title 20**

Fan-Efficiency Provisions in Codes

- All baseline energy codes have similar provisions for fans
  - Metric: Fan Energy Index (FEI) per ANSI/AMCA Standard 208-18, *Calculation of the Fan Energy Index*
  - Scope: (primarily) Standalone Fans ≥ 1 HP
  - Minimum Performance: FEI ≥ 1.00 for ALL covered fans*
  - Exemptions (there's a long list); circulating fans are exempt
  - FEI replaced Fan Efficiency Grade (FEG) in these editions:
    - **2019: ASHRAE 90.1**
    - **2020: ASHRAE 189.1**
    - **2021: IECC and IGCC**
    - **2022: Title 24 (FEG was never in Title 24; 2022 was first year for FEI)**

*ASHRAE 90.1 and UMC have FEI ≥ 0.95 for VAV systems

Fan-Efficiency Provisions in Codes

- All baseline energy codes have similar provisions for fan efficiency
  - One difference:
    - IECC and Cal. Title 24 require third-party (independent) ratings
    - ASHRAE 90.1 and UMC do not

- Find AMCA-certified FEI ratings at http://www.amca.org/FIND-FEI
  - Performs a database search for you
  - Results are a list of manufacturers with certified FEI ratings
  - Click on the manufacturer name to get product information; Then download fan-selector software
  - If AMCA-certified, greater confidence rating is accurate

Product Efficiency Regulations for California and the U.S. Dept. of Energy

DOE Regulation: Two Parts

- **Fans manufactured or imported for use in USA or its Territories**
- **Test Procedure**
  - Definitions
  - Scope
  - Method of Test
  - Sampling Plan
  - Ratings Calculation
  - Deadline (90 days)

  - Final: May 2023
  - Correction: August 2023
- **Energy Standard**
  - Scope
  - Minimum Performance Requirements
  - Labeling (optional)
  - Certification (optional)
  - Surveillance
  - Penalties for Noncompliance
  - Deadline (5 years)

  - Draft currently under public review
  - Will complete in 2024
  - Take effect in 2029

California Title 20 Regulation: Integrated

- Fans sold (from anywhere) for installation in California
- Integrated Test Procedure and Energy Standard
- Completed Nov. 16, 2022; deadline Nov. 16, 2023
  - DOE test procedure preempted T20 test procedure
  - CEC making adjustments; New deadline is April 29, 2024
- Once changes completed, Title 20 will remain in effect until DOE Energy Standard enforcement begins ~2029

Scope: Fan Sizes and Types

- California names regulation as “commercial and industrial fans and blowers”
- DOE uses “General Fans and Blowers” (GFB)
- California and DOE have similar scope
  - Fan Size: 1 HP (motor) ≤ 150 HP (air power)
  - Regulatory Metric: Fan Energy Index (FEI)

- DOE ALSO Includes Embedded Fans as GFB with very specific inclusions and exclusions
    - See Bonus Slides

Scope: Fan Sizes, Metric, and Types

General fans and blowers

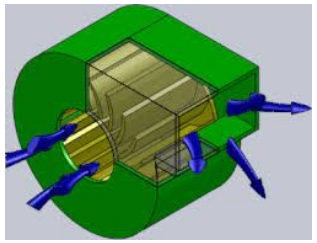
- Fan types (classes) included:
  - Radial housed fan
  - Centrifugal housed fan
  - Centrifugal inline fan
  - Centrifugal unhoused fan
  - Centrifugal power roof ventilator exhaust fan
  - Centrifugal power roof ventilator supply fan
  - Axial inline fan
  - Axial panel fan
  - Axial power roof ventilator fan

Centrifugal Fan Types

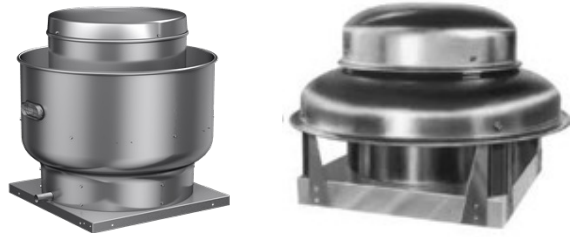
- Radial housed fan

- Centrifugal unhoused fan

- Centrifugal housed fan



- Centrifugal power roof ventilator exhaust fan



- Centrifugal inline fan

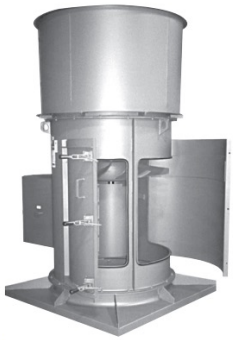
- Centrifugal power roof ventilator supply fan

Axial Fan Types

- Axial inline fan

- Axial panel fan

- Axial power roof ventilator fan



Scope Exclusions

- GFBs are not:

  (i) A radial housed unshrouded fan with blade diameter at tip less than 30 inches or a blade width of less than 3 inches;

  (ii) A safety fan;

  (iii) An induced flow fan;

  (iv) A jet fan;

  (v) A cross-flow fan;

  (vi) A fan manufactured exclusively to be powered by internal combustion engines;

  (vii) A fan that create a vacuum of 30 inches water gauge or greater;

  (viii) A fan that is designed and marketed to operate at or above 482 degrees Fahrenheit (250 degrees Celsius); or

See bonus slides for exclusions pertaining to fans embedded in equipment

MORE ABOUT U.S. DOE REGULATION

DOE Test Procedure

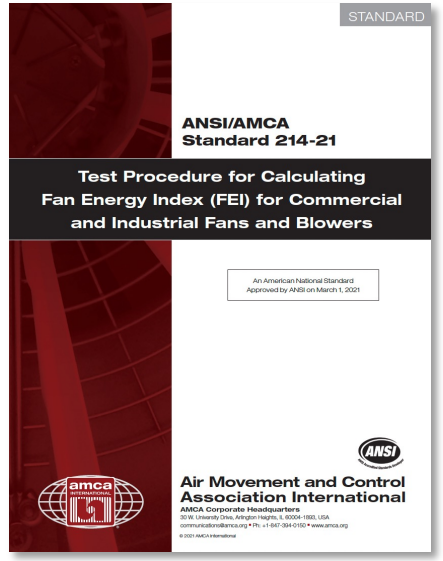
- Applies to manufacturers, which include business entities that package components into a “fan”
- Covers fans imported for sale in the USA and U.S. territories
- Canada usually adopts DOE efficiency regulations in time
- Deadline for compliance was Oct. 30, 2023
  - “Voluntary” representations of “energy usage” and “energy efficiency”
  - 34 companies asked for and received extension to April 29, 2024

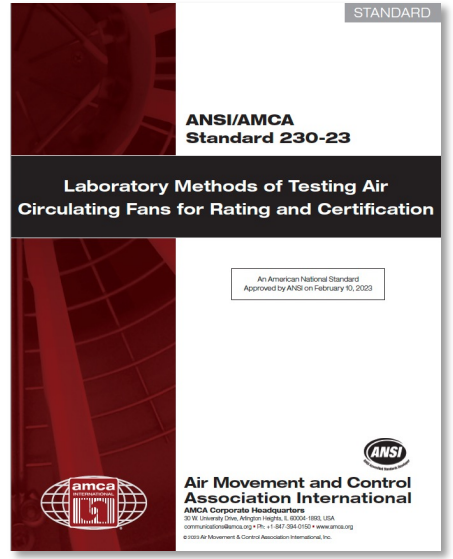
DOE Test Procedure

- Energy Usage and Efficiency Representations Covered
- Explicitly:
  - GFB: FEI and the intermediary parameter, Fan Electrical Power (FEP)
  - ACF: cfm/W
- Implicitly: Parameters measured or calculated using the test procedure:
- Examples:
    - Brake horsepower
    - Total efficiency
    - Static efficiency
    - Airflow
    - Etc.

DOE Test Procedure

- GFB Method of Test
  - ANSI/AMCA Standard 214-21*
  - FEI is regulatory metric
  - AMCA 214 references methods of test and integrates portions of other AMCA standards to make it easier for regulators to use FEI
- ACF Method of Test
  - ANSI/AMCA 230-23
  - Measuring and calculating cfm/W at maximum speed





* Bonus slides have complete references to AMCA standards

DOE Test Procedure

- Manufacturer impact: Published fan information (ratings/representations) must conform to test procedure by October 30, 2023:
  - Selection software
  - Websites
  - Labels and Markings
  - Hardcopy literature (catalogs, data sheets) can be phased out
- There are no filing requirements
- Enforceable – DOE can levy fines and civil penalties for non-compliance up to $584 per product per day from date of non-compliance

DOE Energy Standard

- On Jan. 19, DOE published the draft energy standard in the *Federal Register*
- The 60-day public review/comment period will close on March 19, 2024
- Public hearing scheduled for Feb. 21, 2024, 8 a.m. – 4 p.m. EST
- Final Rule expected late 2024
- Compliance deadline is sometime in 2029
  - 5 years from Final Rule

Major Elements of DOE Fan Regulation

- Difference from Energy Codes and Title 20:
  - GFB FEI requirements based on fan type
  - Not all fans have same FEI level
  - The levels are higher than ≥ 1.00 for most categories
- Filing and labeling requirements reserved for future rulemaking
- Non-compliant duty points would have to be ”grayed out” and identified with this disclaimer:

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

DOE Proposed Standards for GFB

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 drive

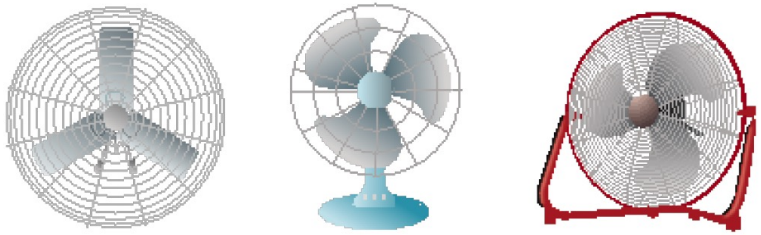
*A*B if sold with a drive

A & B are adjustment parameters

DOE Levels Vs. Energy Code and Title 20

- FEI is a ratio of a baseline fan vs. fan being considered
- Baseline Fan has an FEI = 1.00
- Fan with FEI 1.10 is 10% more efficient at the design airflow and pressure
  - Axial Panel Fan: 1.48 is almost 50% more efficient than currently required
  - Centrifugal Unhoused: 1.35 is 35% more efficient than currently required

DOE Also Regulates Air Circulating Fans



Unhoused Axial

Housed Axial

Covered if ≥ 125 electrical input power

Housed centrifugal ACF are exempt from energy standard

- Carpet drying fans, for example

Circulating Fans

- DOE test procedure references ANSI/AMCA 230-23 as method of test
- Metric is cfm/W measured at fan maximum speed
- Efficacy values vary based on fan diameter (in inches)

Table I-3 Proposed Energy Conservation Standards for ACFs

Equipment Class*	Efficacy at Maximum Speed (CFM/W)
Axial ACFs; 12 inches ≤ D < 36 inches	12.2
Axial ACFs; 36 inches ≤ D < 48 inches	17.3
Axial ACFs; 48 inches ≤ D	21.5
Housed Centrifugal ACFs	N/A

*D: Diameter in inches

N/A: Not applicable; DOE is not proposing to set a standard for this equipment class.

FAN REGULATIONS SUMMARY

Summary

- Fan efficiency requirements in model energy and green codes:
  - 2013-2018: FEG-based
  - 2019-current: FEI-based

- California Title 20 fan regulation completed Nov. 16, 2022; initial deadline of Nov. 16, 2023, extended to April 29, 2024
  - Fans manufactured after deadline need to be registered in MAEDbS
  - Covers most types of ‘stand alone’ fans
  - CEC changing Title 20 test procedure to align with DOE for method of test
  - Embedded fans and circulating fans are not in scope

Summary

- DOE test procedure for fans finalized May 1, 2023
  - Initial deadline of Oct. 30, 2023, extended for 34 manufacturers to April 29, 2024
  - Representations of most fan-performance parameters must comply with test procedure
- DOE Energy Standard undergoing public review
  - Estimated to be finalized in 2024
  - Estimated to take effect in 2029
  - DOE's proposed performance requirements based on fan type with FEI much higher than 1.00 for most categories
  - Embedded fans and circulating fans included
    - Circulating-fans metric is cfm/W based on AMCA Standard 230-23

Recommendations

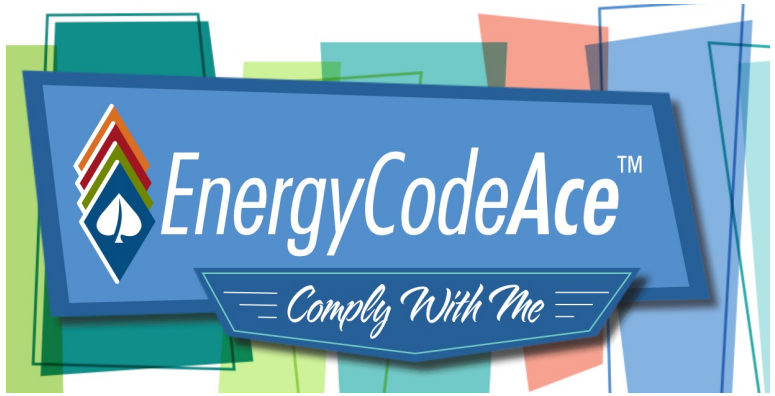
- Manufacturers: Take the regulations seriously
  - DOE fines can be ruinous
  - Review the draft DOE energy standard and provide comments to DOE

- Practitioners:
  - Opt for AMCA-certified manufacturer fan-selector software
    - FEI is complicated for manufacturers; FEI a “software-generated” metric
    - AMCA-certified provides highest confidence software and results are accurate
  - EnergyCodeAce.com is a great resource for California Title 20 and 24
  - Learn to use MAEDbS for California compliance-checking
  - Consider reviewing the DOE energy standard – explore fan selections and note impacts

Resources for Today's Presentation

Other Resources

- **CEC Title 20 Energy Code Ace**
  - www.energycodeace.com
  - Education, compliance, Q&A, regulatory language



- **DOE Fans and Blowers Rulemaking "Home Page"**
  - http://tinyurl.com/yckavb97
  - Current announcements and hyperlinks to rulemakings and dockets
  - Sign up for email alerts to changes
  - Obtain copies of the NOPR and supporting documents
  - Register for Feb. 21 hearing, in person or remote
  - See instructions for filing comments to DOE by March 19, 2024

How to Get Certified FEI Ratings for Fans

- Because of these complexities, AMCA recommends specifying AMCA-certified fans
  - www.amca.org/Find-FEI
  - 600+ fan models are certified
  - Get a hyperlinked list of manufacturers with certified software having FEI ratings
  - Download manufacturer software

AMCA Resources

- AMCA International: *www.amca.org*
- AMCA Certified FEI ratings: *www.amca.org/find-FEI*
- AMCA Standards 214, 230: *www.amca.org/store*
  (Available for purchase)
- AMCA microsite for FEI training, technical papers, PowerPoints, and regulatory status: *www.amca.org/fei*
- Other AMCA Web pages for webinars, papers, etc. on many other topics: *www.amca.org/educate*

Thank you!
Questions?

For a PDF of this presentation… contact:

- Michael Ivanovich, mivanovich@amca.org
- Zac Johnson, zjohnson@amca.org

To receive PDH credit, you must complete the post-course evaluation

BONUS SLIDES

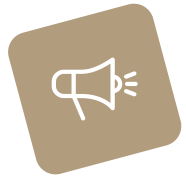
COMPLIANCE WITH CALIFORNIA TITLE 20

AMCA Value Chain to Industry

- Standards
  - Developed using ANSI consensus process. Participation open to nonmembers. Fan standards largely harmonized with ISO

- Testing
  - Independent testing of products being certified. Some contract & research testing

- Certification
  - More than 4,000 products in AMCA Certified Ratings Program. Certification increases confidence products will perform as rated, raising confidence systems will perform as designed



- Advocacy
  - Improve codes, standards, regulations toward higher safety, efficiency, cost effectiveness

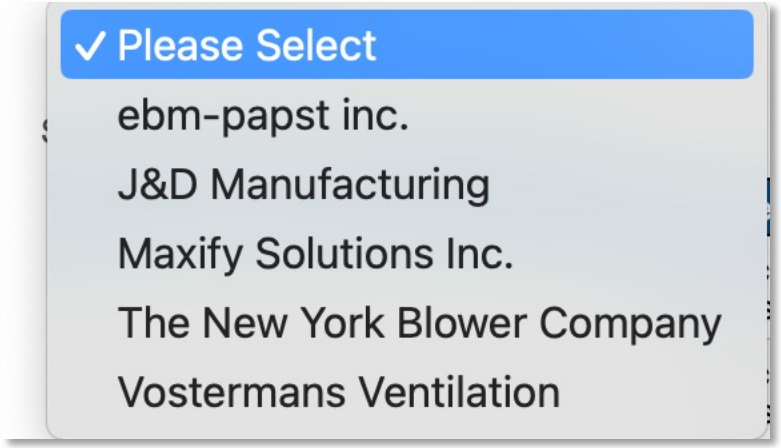
- Education
  - Educate members and industry to improve designs, product selections, and regulatory compliance

California Compliance Check: How to Find Fans

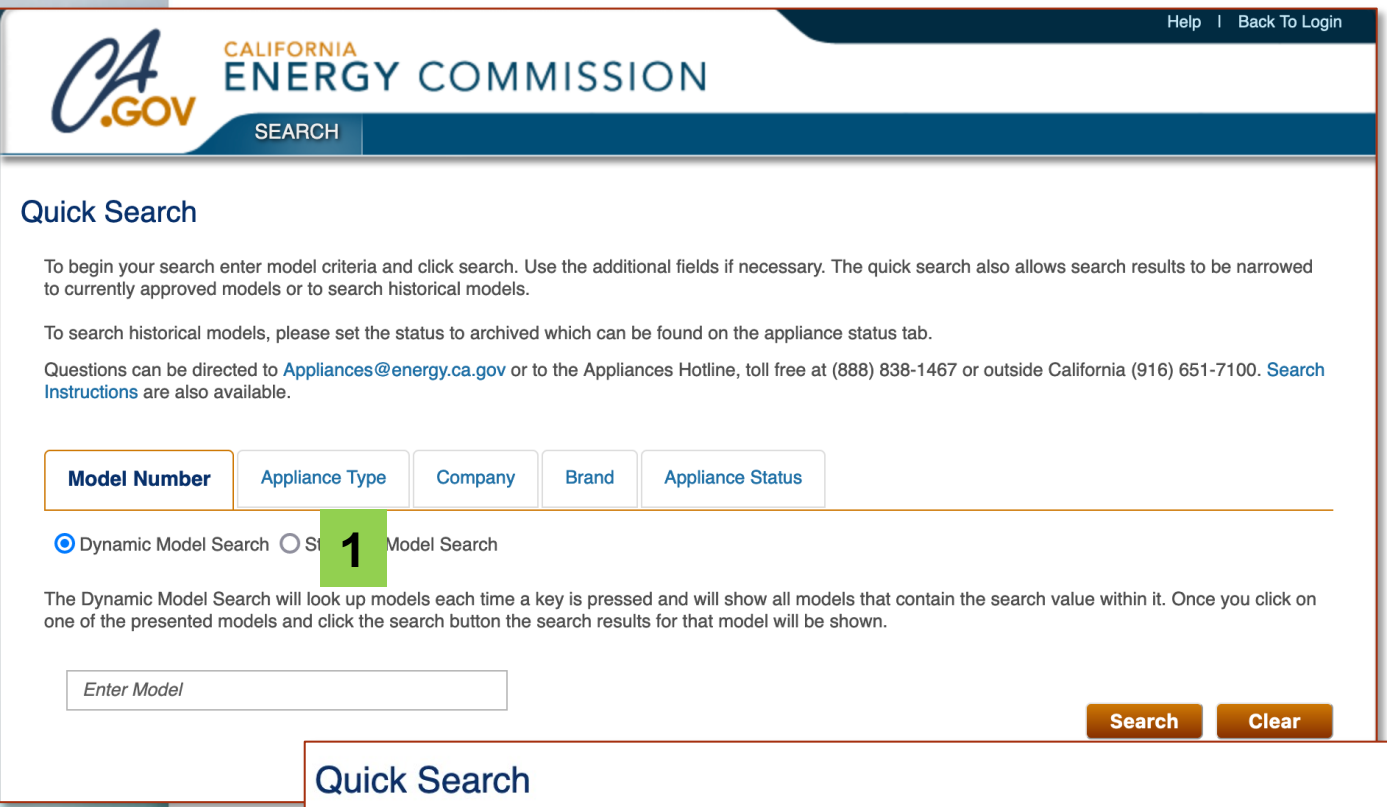
https://cacertappliances.energy.ca.gov/Pages/ApplianceSearch.aspx

MAEDbS Quick Search for Manufacturers:

1. **Click on** Appliance Type
2. **Category Select:** Fans and Humidifiers
3. **Appliance Type Select:** Commercial and Industrial Fans and Blowers
4. **Click** Search
5. **Click** Company for list of companies that have provided data



Can also search by Model Number!


Help | Back To Login
CALIFORNIA
ENERGY COMMISSION
SEARCH
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
Dynamic Model Search
1
Model Search
The Dynamic Model Search will look up models each time a key is pressed and will show all models that contain the search value within it. Once you click on one of the presented models and click the search button the search results for that model will be shown.
Enter Model
Search
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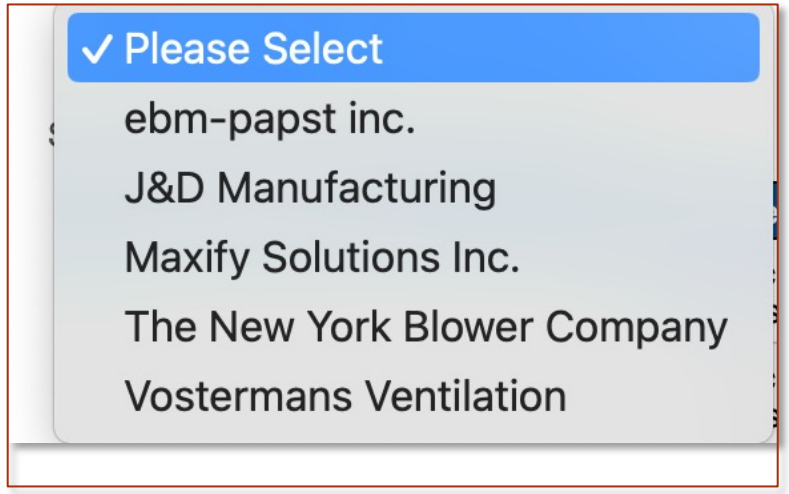
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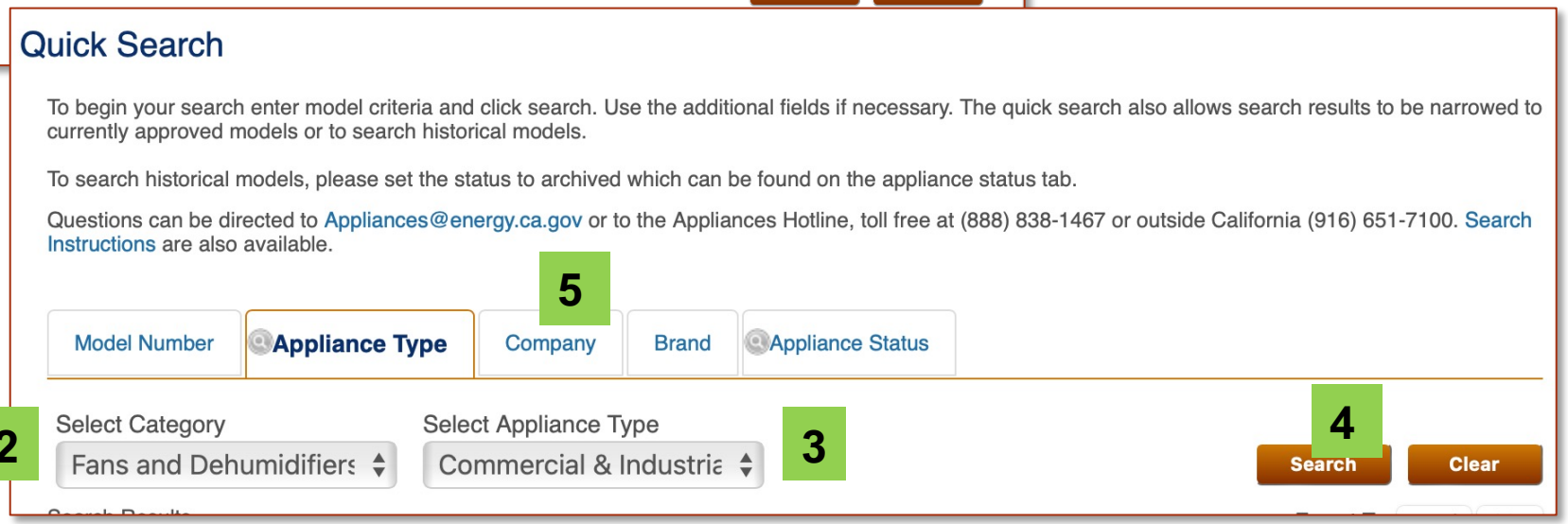
J&D Manufacturing
Maxify Solutions Inc.
The New York Blower Company
Vostermans Ventilation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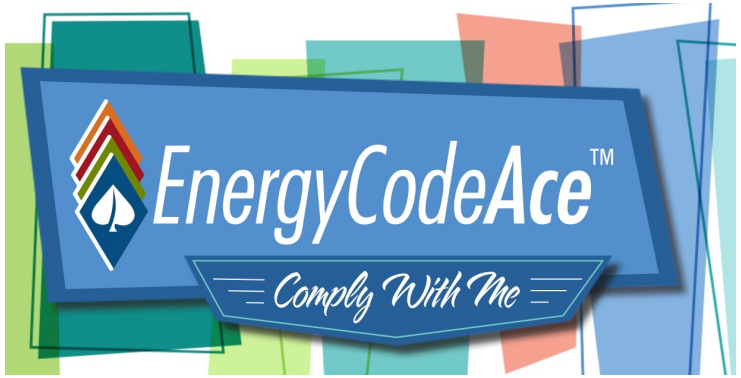
5
Model Number
Appliance Type
Company
Brand
Appliance Status
2
Select Category
Fans and Dehumidifiers
Select Appliance Type
Commercial & Industria
3
4
Search
Clear

California Title 20 Resources

- **Energy Code Ace** www.energycodeace.com
  - Education, compliance, Q&A, regulatory language
  - Modules and fact sheets for manufacturers, designers
  - MAEDbS training
  - Recently updated training modules

  - Has resources for Title 24 energy code as well



California Title 20 Permanent Label

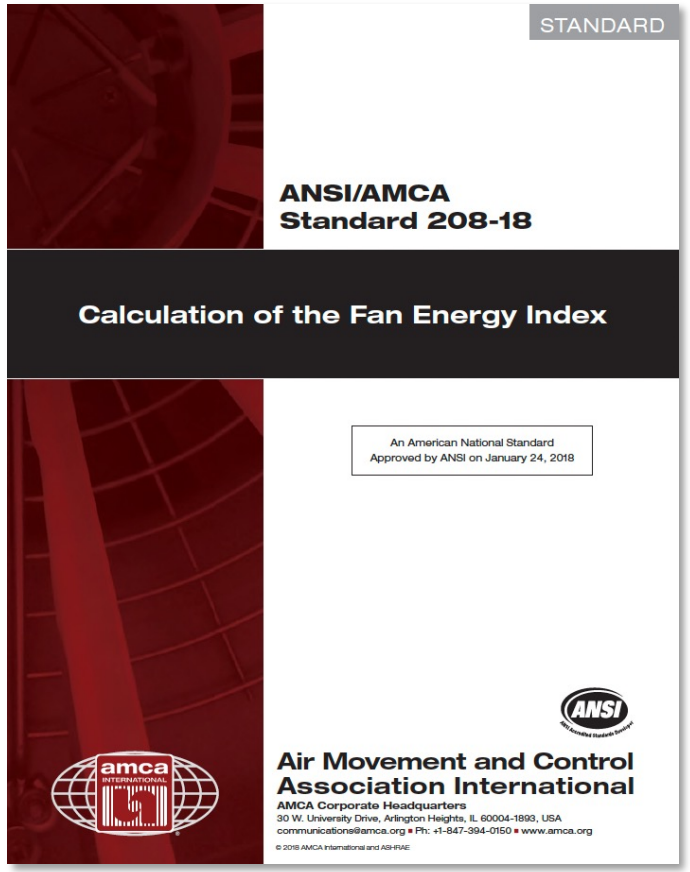
- Part 1: Manufacturer, model, and date of manufacture
- Part 2: Fan Energy Index ≥ 1.00 Efficiency boundaries
  a. maximum air flow (SCFM);
  b. maximum fan speed (RPM);
  c. maximum pressure (inches water gauge).
  NOTE: Operation outside of these boundaries will result in an energy inefficient operation.
- Parts 1 and 2 do not have to be on the same label
- New: Labels must be “permanent” and legible: readable without removing parts and using visual aids

Glossary of Acronyms and Abbreviations

• ASHRAE 90.1	ANSI/ASHRAE/IEC Standard 90.1, *Energy Standard for Buildings Except Low-Rise Residential Buildings*
• ASHRAE 189.1	ANSI/ASHRAE/IEC/USGBC Standard 189.1, *Standard for the Design of High-Performance Green Buildings*
• IECC	*International Energy Conservation Code*
• IGCC	*International Green Construction Code*
• IAPMO	International Association of Plumbing and Mechanical Officials
• UMC	*Uniform Mechanical Code*
• Title 20	*California Title 20 Appliance Efficiency Regulations*
• Title 24	*California Energy Code for Residential and Commercial Buildings*
• DOE	U.S. Department of Energy (Appliances and Equipment Standards Program)
• CFR	Code of Federal Regulations
• FEI	Fan Energy Index

Referenced AMCA Standards in Codes & Regulations

- Codes and Regulations typically reference standards for testing and/or rating calculations
- ANSI/AMCA Standard 210, Test standard for centrifugal, axial fans
  - DOE regulation for general fans and blowers
- ANSI/AMCA Standard 214, Test standard and ratings calculation for Fan Energy Index
  - DOE regulation for general fans and blowers
- ANSI/AMCA Standard 230, Test standard and ratings calculation for circulating fans, including ceiling fans
  - DOE regulations for large-diameter ceiling fans and air circulating fans
- ANSI/AMCA Standard 208, Rating calculation standard for FEI
  - Model and state energy codes


STANDARD
ANSI/AMCA
Standard 208-18
Calculation of the Fan Energy Index
An American National Standard
Approved by ANSI on January 24, 2018
Air Movement and Control
Association International
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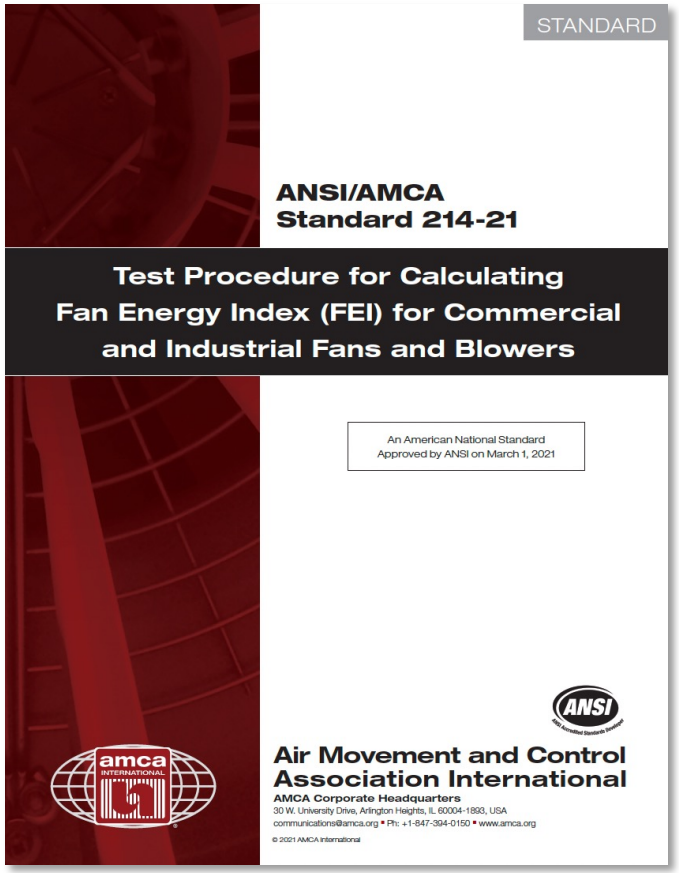
STANDARD
ANSI/AMCA
Standard 214-21
Test Procedure for Calculating
Fan Energy Index (FEI) for Commercial
and Industrial Fans and Blowers
An American National Standard
Approved by ANSI on March 1, 2021
Air Movement and Control
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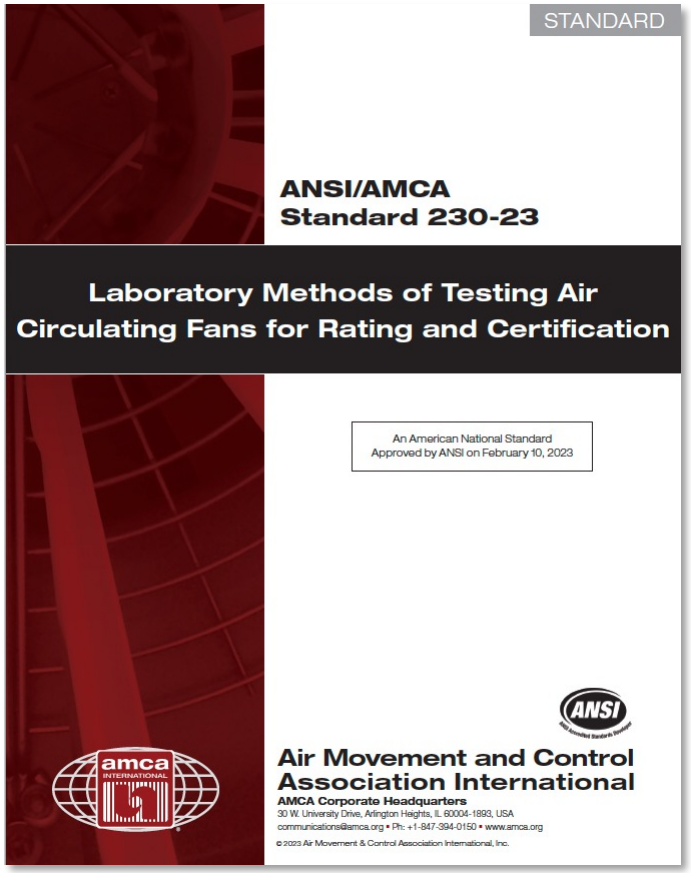
STANDARD
ANSI/AMCA
Standard 230-23
Laboratory Methods of Testing Air
Circulating Fans for Rating and Certification
An American National Standard
Approved by ANSI on February 10, 2023
Air Movement and Control
Association International
AMCA Corporate Headquarters
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DOE Code of Federal Regulations References

- DOE test procedure:
  - General Fans and Blowers: Appendix A to Subpart J of 10 CFR Part 431
  - Circulating Fans: Appendix B to Subpart J of 10 CFR Part 431

Scope Exclusions

- GFBs are not:

  (i) A radial housed unshrouded fan with blade diameter at tip less than 30 inches or a blade width of less than 3 inches;

  (ii) A safety fan;

  (iii) An induced flow fan;

  (iv) A jet fan;

  (v) A cross-flow fan;

  (vi) A fan manufactured exclusively to be powered by internal combustion engines;

  (vii) A fan that create a vacuum of 30 inches water gauge or greater;

  (viii) A fan that is designed and marketed to operate at or above 482 degrees Fahrenheit (250 degrees Celsius); or

Scope Exclusions - continued

- GFBs are not:
  (ix) A fan and blower embedded in the equipment listed below;
  - GFBs are not an embedded fan subject to the following exclusions:
    (i) The federal test procedure does not apply to fans embedded in:
    - (A) Single phase central air conditioners and heat pumps rated with a certified cooling capacity less than 65,000 Btu/h
    - (B) Three phase, air-cooled, small commercial packaged air-conditioning and heating equipment rated with a certified cooling capacity less than 65,000 Btu/h
    - (C) Transport refrigeration (*i.e.,* Trailer refrigeration, Self-powered truck refrigeration, Vehicle-powered truck refrigeration, Marine/Rail container refrigerant);
    - (D) Vacuum cleaners;
    - (E) Heat Rejection Equipment: Packaged evaporative open-circuit cooling towers; Evaporative field-erected open-circuit cooling towers; Packaged evaporative closed-circuit cooling towers; Evaporative field-erected closed-circuit cooling towers; Packaged evaporative condensers; Field-erected evaporative condensers; Packaged air-cooled (dry) coolers; Field-erected air-cooled (dry) cooler; Air-cooled steam condensers; Hybrid (water saving) versions of all of the previously listed equipment that contain both evaporative and air-cooled heat exchange sections;
    - (F) Air curtains; and
    - (G) Direct expansion-dedicated outdoor air system that are subject to any of DOE's test procedures

Scope Exclusions - continued

(ii) The federal test procedure does not apply to *supply or condenser fans* embedded in:

- (A) Air-cooled commercial package air conditioners and heat pumps (CUAC/CUHP) with a certified cooling capacity between 5.5 ton (65,000 Btu/h) and 63.5 ton (760,000 Btu/h)
- (B) Water-cooled and evaporatively-cooled commercial air conditioners that are subject to DOE's energy conservation standard
- (C) Water-source heat pumps that are subject to DOE's energy conservation standard
- (D) Single package vertical air conditioners and heat pumps
- (E) Packaged terminal air conditioners and heat pumps (PTAC/PTHP)
- (F) Computer room air conditioners that are subject to DOE's energy conservation standards; and
- (G) Variable refrigerant flow multi-split air conditioners and heat pumps (VRF)