DOCKETED	
Docket Number:	21-BSTD-01
Project Title:	2022 Energy Code Update Rulemaking
TN #:	239070
Document Title:	Statewide Utility Codes and Standards Enhancement Team Comments - Nonresidential Air Distribution July 2021 Addendum
Description:	N/A
Filer:	System
Organization:	Statewide Utility Codes and Standards Enhancement Team
Submitter Role:	Public
Submission Date:	7/28/2021 5:46:05 PM
Docketed Date:	7/29/2021

Comment Received From: Statewide Utility Codes and Standards Enhancement Team
Submitted On: 7/28/2021
Docket Number: 21-BSTD-01

Nonresidential Air Distribution July 2021 Addendum

Additional submitted attachment is included below.

Nonresidential Air Distribution July 2021 Addendum

2022-NR-HVAC2-F | Nonresidential HVAC | July 2021 ADDENDUM

Prepared by Energy Solutions

Please submit comments to info@title24stakeholders.com.

CALIFORNIA ENERGY CODES & STANDARDS
A STATEWIDE UTILITY PROGRAM

This report was prepared by the California Statewide Codes and Standards Enhancement (CASE) Program that is funded, in part, by California utility customers under the auspices of the California Public Utilities Commission.

Pacific Gas and Electric Company | Southern California Edison Energy for What's Ahead | SDGE A Sempra Energy utility | LA DWP Los Angeles Department of Water & Power | SMUD

Document Information

Category:	Codes and Standards
Keywords:	Statewide Codes and Standards Enhancement (CASE) Initiative; California Statewide Utility Codes and Standards Team; Codes and Standards Enhancements; 2022 California Energy Code; 2022 Title 24, Part 6; efficiency; fans; fan power limitations; fan energy index; FEI; fan efficiency; high performance ducts.
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Addendum to Nonresidential Air Distribution – Final CASE Report

In September 2020, the Statewide CASE Team posted the Air Distribution Final CASE Report to title24stakeholders.com[1] and submitted to the Energy Commission's pre-rulemaking docket 19-BSTD-03[2]. The report outlined a number of mandatory and prescriptive code change recommendations that deal with improving efficiency of nonresidential air distribution systems. The CASE Report was structured around three submeasures:

- Fan Energy Index (FEI);
- Fan Power Budget; and
- Duct Leakage.

Since the submission of the Final CASE Report, there have been a number of discussions and meetings with stakeholders regarding both the exact list of component allowances as well as the underlying static pressure values chosen for each allowance in the Fan Power Budget submeasure. These discussions and meetings have resulted in recommended adjustments to the allowance tables. In addition, stakeholder feedback to the FEI submeasure has also resulted in changes to the proposed requirements.

The purpose of this Addendum is to detail the changes to the proposed FEI and Fan Power Budget submeasures as compared to the Air Distribution Final CASE Report.

The Statewide CASE Team understands that these changes will result in some impact to the energy savings estimates of this measure. The Statewide CASE Team is still in the process of analyzing the impact of these changes and will publish the new energy, demand, and greenhouse gas savings estimates in the CASE Study Results Report in fall 2021.

Fan Energy Index

Initially, the Statewide CASE team recommended that the new mandatory FEI requirements be 1.0 for all in-scope fans. This was a slightly more stringent requirement than the ASHRAE 90.1-2019 requirement that fans serving multi-zone VAV systems only had to achieve a 0.95 FEI. However, stakeholder feedback recommended that Title

[1] https://title24stakeholders.com/measures/cycle-2022/air-distribution/

[2] Docket 19-BSTD, TN# 234800, 03https://efiling.energy.ca.gov/GetDocument.aspx?tn=234800&DocumentContentId=67654

24, Part 6 align with ASHRAE 90.1, which the Statewide CASE Team agreed with. Additional stakeholder feedback resulted in Exception 1 to Section 120.10(a) being reworded to make it clearer that its intention is to exclude any products anticipated to have DOE appliance regulations in the near future (i.e., dehumidifying DX-DOAS and computer room ACs).

Summary of Changes to FEI Submeasure

Substantive change:

- Changed MZ-VAV FEI requirement from 1.0 to 0.95.

Editorial change:

- Adjusted language in Exception 1 to Section 120.10(a) intended to exclude any product categories that are subject to upcoming DOE appliance regulations (CRACs & DDX-DOAS).

Fan Power Budget Submeasure

Since the Final CASE report was posted in September 2020, numerous discussions and engagement with stakeholders has taken place, including with equipment manufacturers, energy efficiency advocates, and the design community. The fan power budget changes originally recommended in the September 2020 CASE Report were substantial and the Statewide CASE Team has continued to be receptive to stakeholder feedback. Every change enumerated below was made in response to a specific stakeholder concern. The changes are intended to make the new fan power budget better reflect actual designs and conditions encountered in the field.

As noted above, the changes resulted from numerous discussions and meetings with stakeholders. However, there are several docketed comments from stakeholders that were particularly important for adjusting the fan power budget submeasure, which are listed for reference:

- AHRI[3]
- Daikin Applied[4]

[3] Docket 19-BSTD-03, TN # 237084, https://efiling.energy.ca.gov/GetDocument.aspx?tn=237084&DocumentContentId=70265

[4] Docket 19-BSTD-03, TN # 235314, https://efiling.energy.ca.gov/GetDocument.aspx?tn=235314&DocumentContentId=68198

- Carrier[5]
- AHRI[6]
- Trane[7]
- Carrier[8]

The substantive changes summarized below strike an appropriate balance between addressing stakeholder concerns and preserving the original goals of the submeasure, which were to improve the layout and increase the stringency of the fan power budget.

Summary of Changes to Fan Power Budget Submeasure

Substantive changes

Changes from CASE Report to Express Terms

- Added in credit for zones greater than 6 stories away from the air handling unit (0.5").

Changes from Express Terms to 45-Day Language

- Changed the calculated motor and transmission efficiency assumption to include motor controllers for all single zone systems.
- Added an economizer return damper credit to the tables.
- Removed "Terminal re-heat (hydronic or electric resistance)" allowance from Table 140.4-A and added the equivalent static pressure into base allowance.
- Removed "General Odor Control" allowance.

Changes from 45-Day to 15Day Language

- Added in a credit for SZ-VAV systems that can turn down to 50 percent or less of full airflow.

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[5] Docket 19-BSTD-03, TN # 237142, https://efiling.energy.ca.gov/GetDocument.aspx?tn=237142&DocumentContentId=70323

[6] Docket 19-BSTD-01, TN # 238322, https://efiling.energy.ca.gov/GetDocument.aspx?tn=238322&DocumentContentId=71617

[7] Docket 19-BSTD-01, TN # 238344 https://efiling.energy.ca.gov/GetDocument.aspx?tn=238344&DocumentContentId=71630

[8] Docket 19-BSTD-01, TN # 238418 https://efiling.energy.ca.gov/GetDocument.aspx?tn=238418&DocumentContentId=71720

- Added in a credit for replacement units that require a conversion curb.
- Changed “sensible only” HRV credit back to “coil runaround loop” which will have the practical impact of sending all sensible HRVs to the energy recovery ventilation rows where they can choose a credit based on the system’s ERR value.

Editorial changes

- Revised order of columns so that they now range from smallest to largest airflow bins.
- Changed “constant volume and single-zone VAV” to “All other fan systems” in column headings.
- Moved MZ-VAV description to the definitions section.
- Changed wording of “gas phase filtration” row to comply with Energy Commission Americans with Disabilities Act (ADA) requirements.
- Combined definitions for exhaust & relief fan systems since the measure itself doesn’t distinguish between those two types of systems.

Updates to Tables Showing Underlying Static Pressures

Appendix N of the Final CASE Report described the underlying methodology necessary to calculate the watts per cubic feet per minute (W/cfm) values that end up in Tables 140.4-A B and Table 141.0-D. Due to the changes highlighted above, there were changes to some of the underlying static pressure values. The static pressure values shown below align with what has been included in the Energy Commission’s 15-Day Language. For convenience, all static pressure values have been reproduced in Table 1, Table 2, and Table 3 below. Changed static pressure values are highlighted in red.

Table 1: Supply Fan System Reference Pressures (Pref) inches of water gauge (in. wg) for Table 140.4-A

Airflow	Multi-Zone VAV Systems ≤5,000 cfm[1]	Multi-ZoneVAV Systems >5,000 and ≤10,000 cfm[1]	Multi-Zone VAV Systems >10,000 cfm[1]	All Other Fan Systems ≤5,000 cfm	All Other Fan Systems >5,000 and ≤10,000 cfm	All Other Fan Systems >10,000 cfm[1]

Supply System Base Allowance for AHU serving spaces ≤ 6 floors away).	1.50	2.00	2.00	0.80	1.00	1.00
Supply system base allowance forAHU serving spaces > 6 floors away	2.00	2.50	2.50	1.30	1.50	1.50
MERV 13 to MERV 16 Filter upstreamof thermal conditioning equipment (two times the clean filter pressure drop)[2]	0.60	0.60	0.60	0.60	0.60	0.60
MERV 13 to MERV 16 Final filter downstream of thermal conditioning equipment. (two times the clean filter pressure drop)[2]	1.00	1.00	1.00	1.00	1.00	1.00
Filtration allowance for > MERV 16 or HEPA Filter (twotimes the clean filter pressure drop) [2]	1.50	1.50	1.50	1.50	1.50	1.50
Central Hydronic heating coil allowance	0.20	0.25	0.30	0.20	0.25	0.30
Electric heat allowance	0.20	0.20	0.20	0.20	0.20	0.20
Gas heat allowance	0.30	0.30	0.40	0.25	0.30	0.40
Hydronic/DX cooling coil or heatpump coil (wet) allowance[3]	0.60	0.60	0.60	0.60	0.60	0.60

Solid or liquid Desiccant system allowance	0.70	0.70	0.70	0.70	0.70	0.70
Reheat Coil for Dehumidification Allowance	0.20	0.20	0.20	0.20	0.20	0.20
Allowance for Evaporative humidifier/cooler in series with a cooling coil. Value shown is allowed watts/cfm per 1.0 Inches of water gauge (in.w.g.) Determine pressure loss (in.w.g.) at 400 fpm or maximum velocity allowed by the manufacturer, whichever is less. *[Calculation required, see note 4]*	1.00	1.00	1.00	1.00	1.00	1.00
Allowance for 100% Outdoor air system[5].	0.00	0.00	0.00	0.30	0.50	0.60
Energy recovery allowance for 0.50 ≤ ERR <0.55 [6]	0.60	0.60	0.60	0.60	0.60	0.60
Energy recovery allowance for 0.55 ≤ ERR <0.60 [6]	0.71	0.71	0.71	0.71	0.71	0.71
Energy recovery allowance for 0.60 ≤ ERR <0.65 [6]	0.82	0.82	0.82	0.82	0.82	0.82

Energy recovery allowance for 0.65 ≤ ERR <0.70 [6]	0.93	0.93	0.93	0.93	0.93	0.93
Energy recovery allowance for 0.70 ≤ ERR <0.75 [6]	1.04	1.04	1.04	1.04	1.04	1.04
Energy recovery allowance for 0.75 ≤ ERR <0.80 [6]	1.15	1.15	1.15	1.15	1.15	1.15
Energy recovery allowance for ERR ≥ 0.80 [6]	1.26	1.26	1.26	1.26	1.26	1.26
Coil Runaround Loop	0.60	0.60	0.60	0.60	0.60	0.60
Allowance for Gas phase filtration. Value shown is allowed w/cfm per1.0 in. wg air pressure drop. *[Calculation required, see note 4]*	1.00	1.00	1.00	1.00	1.00	1.00
Economizer Return Damper	0.20	0.20	0.20	0.20	0.20	0.20
Air blender allowance	0.20	0.20	0.20	0.20	0.20	0.20
Sound attenuation section [fans serving spaces with design background noise goals below NC35]	0.15	0.15	0.15	0.15	0.15	0.15

Deduction for systems that feeda terminal unit with a fan with electrical input power < 1kW	-	-	-	-	-	-
Low-turndown single-zone VAV fan systems meeting the requirements in note 7.	0.00	0.00	0.00	0.30	0.50	0.50

Footnotes to Table 140.4-A

1. See Section 100.1 for the definition of FAN SYSTEM, MULTI-ZONE VARIABLE AIR VOLUME (VAV).
2. Filter fan power allowance can only be counted once per fan system, except fan systems in healthcare facilities, which can claim one of the MERV 13 to 16 filter allowances and the HEPA filter allowance if both are included in the fan system.
3. Healthcare facilities can claim this fan power allowance twice per fan system where coil design leaving air temperature is less than 44 ºF.
4. Power allowance requires further calculation by multiplying the actual inches of water gauge (in.w.g.) of the device/ component by the watts/ cfm in Table140.4-A.
5. The 100% outdoor air system must serve 3 or more HVAC zones and airflow during non-economizer operating periods must not exceed 135% of minimumrequirements in Section 120.1(c)(3).
6. Enthalpy Recovery Ratio (ERR) calculated per ANSI/ASHRAE 84-2020.
7. A low-turndown single-zone VAV fan system must be capable of and configured to reduce airflow to 50 percent of design airflow and use no more than 30percent of the design wattage at that airflow. No more than 10 percent of the design load served by the equipment shall have fixed loads.

Table 2: Exhaust, Relief, Return and Transfer Fan System Reference Pressures (Pref) in. wg for Table 140.4-B

Airflow	Multi-Zone VAV Systems[1] ≤5,000 cfm	Multi-Zone VAV Systems[1] >5,000 and ≤10,000 cfm	Multi-Zone VAV Systems[1] >10,000 cfm	All Other Fan Systems ≤5,000 cfm	All Other Fan Systems >5,000 and ≤10,000 cfm	All Other Fan Systems >10,000 cfm
Exhaust System Base Allowance	0.75	0.95	1.00	0.60	0.65	0.75

Filter (any MERV value)[2]	0.20	0.20	0.20	0.20	0.20	0.20
Energy Recovery Allowance For 0.50 ≤ ERR <0.55 [3]	0.60	0.60	0.60	0.60	0.60	0.60
Energy Recovery Allowance For 0.55 ≤ ERR <0.60 [3]	0.71	0.71	0.71	0.71	0.71	0.71
Energy Recovery Allowance For 0.60 ≤ ERR <0.65 [3]	0.82	0.82	0.82	0.82	0.82	0.82
Energy Recovery Allowance For 0.65 ≤ ERR <0.70 [3]	0.93	0.93	0.93	0.93	0.93	0.93
Energy Recovery Allowance For 0.70 ≤ ERR <0.75 [3]	1.04	1.04	1.04	1.04	1.04	1.04
Energy Recovery Allowance For 0.75 ≤ ERR <0.80 [3]	1.15	1.15	1.15	1.15	1.15	1.15
Energy Recovery Allowance For ERR ≥ 0.80 [3]	1.26	1.26	1.26	1.26	1.26	1.26
Coil Runaround Loop	0.60	0.60	0.60	0.60	0.60	0.60
Return or exhaust systems required by code or accreditation standards to be fully ducted, or systems required to maintain air pressure differentials between adjacent rooms	0.50	0.50	0.50	0.50	0.50	0.50
Return and/or exhaust airflow control devices required for space pressurization control	0.50	0.50	0.50	0.50	0.50	0.50
Laboratory and vivarium exhaust systems in high-rise buildings for vertical duct exceeding 75 ft. Value shown is allowed w/cfm per 0.25 in. wg for each 100 feet exceeding 75 feet. [Calculation required, see note 4]	0.25	0.25	0.25	0.25	0.25	0.25
Biosafety cabinet. Value shown is allowed w/cfm per 1.0 in. wg air pressure drop. [Calculation required, see note 4]	Pressure drop of device at fan system design condition.					

Exhaust filters, scrubbers, or other exhaust treatment required by code or standard. Value shown is allowed w/cfm per 1.0 in. wg air pressure drop. [Calculation required, see note 4]	Pressure loss at 400 sfpm or maximum velocity allowed by the manufacturer, whichever is less.					
Healthcare facility allowance[5]	1.00	1.00	1.00	1.00	1.00	1.00
Sound attenuation section [Fans serving spaces with design background noise goals below NC35.]	0.15	0.15	0.15	0.15	0.15	0.15

Footnotes to Table 140.4-B

1. See FAN SYSTEM, MULTI-ZONE VARIABLE AIR VOLUME (VAV) in definitions for Multizone to be classified as a Multi-Zone VAV System.
2. Filter pressure loss can only be counted once per fan system.
3. Enthalpy Recovery Ratio (ERR) calculated per ANSI/ASHRAE 84-2020.
4. Power allowance requires further calculation, multiplying the actual pressure drop (in. wg.) of the device/ component by the watts/cfm in the Table 140.4-B.
5. This allowance can only be taken for healthcare facilities.

Table 3: Additions/Alterations – Supply and Return Fan System Reference Pressures (Pref) in. wg for Table 141.0-D

Airflow	**Multi-ZoneVAV Systems[1] ≤5,000 cfm**	**Multi-Zone VAV Systems[1] >5,000 and ≤10,000 cfm**	**Multi-Zone VAV Systems[1] >10,000 cfm**	**All Other Fan Systems ≤5,000 cfm**	**All OtherFan Systems >5,000 and ≤10,000 cfm**	**All Other Fan Systems >10,000 cfm**
Supply Fan System Additional Allowance	0.60	0.60	0.60	0.60	0.60	0.60
Supply Fan System Additional Allowance In Unit with Adapter Curb	0.14	0.17	0.24	0	0	0

Exhaust/ Relief/ Return/ Transfer Fan System Additional Allowance	0.30	0.30	0.30	0.30	0.30	0.30
Exhaust/ Relief/ Return/ Transfer Fan System Additional Allowance In Unit with Adapter Curb	0.07	0.09	0.12	0	0	0

Footnotes to Table 141.0-D:

1. See FAN SYSTEM, MULTI-ZONE VARIABLE AIR VOLUME (VAV) for the definition of a Multi-Zone VAV System.