International Energy Conservation Code Consensus Committee-Commercial

Meeting Agenda (Draft 5/19)

May 25, 2022
2:00 PM Eastern to 5:00 PM Eastern (3 hours)
Webex Link

Committee Chair: Duane Jonlin
Committee Vice Chair: Emily Hoffman

1. Call to order.

2. Meeting Conduct. Staff
    a. Identification of Representation/Conflict of Interest
    b. ICC Council Policy 7 Committees: Section 5.1.10 Representation of Interests
    c. ICC Code of Ethics: ICC advocates commitment to a standard of professional behavior that exemplifies the highest ideals and principles of ethical conduct which include integrity, honesty, and fairness. As part of this commitment it is expected that participants shall act with courtesy, competence and respect for others.
    d. ICC Antitrust Compliance Guideline

3. Roll Call – Hoffman

4. Approval of Agenda

5. Approval of Minutes

6. Administrative issues.
    a. Progress indicators

7. Construction Cost & LCC Update-Social Cost of Carbon- Tillou

8. Action Items.
    a. Code Change Proposals

CEPI-178-21 (Lighting Interior Power)	(Elec disapprove 11-3-5)
CEPI-179-21 (Lighting Power Allowance Tables)	(Elec as modified 14-1-1)
CEPI-180-21 (Lighting decorative allowance)	(Elec disapprove 15-3-2)
CEPI-182-21 (Lighting decorative allowance)	(Elec approve 11-5-2)
CEPI-183-21 (Lighting retail display)	(Elec as modified 16-0-1)
CEPI-184-21 (Retail lighting)	(Elec as modified 10-6-3)
CEPI-83-21 (Clean water pumps)	(HVACR as modified 14-0-2)
CEPI-145-21 (Clean water pumps)	(HVACR disapprove 14-0-2)
CEPI-119-21 (Fan power limits)	(HVACR as modified 11-3-1)
CEPI-127-21 (Water Heating Efficiency table)	(HVACR as modified 13-2-2)

CEPI-126-21 (Water Heating Efficiency) (HVACR disapprove 13-2-2)
CEPI-129-21 (Service WH for R-1 and R-2) (HVACR disapprove 8-7-2)
CEPI-130-21 (Service WH insulation) (HVACR as modified 17-0-0)

9. Subcommittee & Temporary Work Group reports
    a. Envelope and Embodied Energy- Culp
    b. Electrical Power, Lighting, and Renewables-Jouaneh
    c. HVACR & Water Heating-Shelide
    d. Modeling, Whole-Building Metrics, Zero Energy-Eades

10. Other business.
    a. Public comment on any matters discussed at the meeting (Please limit comments to 2 minutes. Further comments can be directed to the Secretariat following the meeting to be considered at a future meeting.)

11. "3 Minutes of Fame." Speakers TBD

12. Upcoming meetings. June 8, 2022 2:00 Eastern

13. Adjourn.

FOR FURTHER INFORMATION BE SURE TO VISIT THE ICC WEBSITE:
IECC Commercial Consensus Committee Webpage
https://www.iccsafe.org/products-and-services/i-codes/code-development/cs/iecc-commercial-consensus-committee/
ICC Energy webpage
https://www.iccsafe.org/products-and-services/codes-standards/energy/
Code Change Proposal Submittals
https://energy.cdpaccess.com/login/
Energy Complete Monograph
Monograph

FOR ADDITIONAL INFORMATION, PLEASE CONTACT:

Kristopher Stenger, AIA, Director of Energy Programs
International Code Council
kstenger@iccsafe.org

International Energy Conservation Code
Code Change Proposal Tracking Sheet

Proposal #	CEPI-178-21 Lighting Interior Power
CDP ID #	400
Code	IECC CE
Code Section(s)	C405.3.1, Table C405.3.2(2) New Section n
Location	base
Proponent	Jonathan McHugh jon@mchughenergy.com
Proposal Status	SC rev
Subcommittee	CE Elec, Light
Subcommittee Notes	Reason: In favor of action taken on CEPI-179 that aligns the IECC values with ANSI/ASHRAE/ASHRAE Standard 90.1-2022.
Recommendation	DISAPPROVE
Vote	11 - 3 - 5
Recommendation Date	April 11, 2022
Next Step	To Subcommittee___________________________________ To Advisory Group___________________________________ To Consensus Committee________X__________
Consensus Committee	
Committee Response	
Vote	Affirmative___________ Negative____________ Table_____________ To Subcommittee___________________________
Date	

International Energy Conservation Code
Code Change Proposal Tracking Sheet

Proposal #	CEPI-179-21 Lighting Power Allowance Tables
CDP ID #	133
Code	IECC CE
Code Section(s)	C405.3.2(1) table, TABLE C405.3.2(2) New Section n
Location	base
Proponent	Jeremy Williams jeremy.williams@ee.doe.gov
Proposal Status	SC rev
Subcommittee	CE Elec, Light
Subcommittee Notes	Reason: Provides appropriate lighting power reduction possible by LED efficacy improve values.
Recommendation	AS MODIFIED See the modification v3 posted on teams site and also available below. https://2023701800.sharepoint.com/:w:/r/sites/ICC-IECCConsensusCommittee-CEElectricalPowerLightingRenewables/Shared%20Documents/CE%20Electrical%20Pow 179-21_v3.docx?d=wdd69428f204347f091d346f6958f1fc3&csf=1&web=1&e=KeUNuB THIS PROPOSAL DOES NOT SUPERCEDE CONFLICTING PROVISIONS IN CEPI-135
Vote	14-1-1
Recommendation Date	April 11, 2022
Next Step	To Subcommittee___________________________________ To Advisory Group___________________________________ To Consensus Committee_______X_________
Consensus Committee	
Committee Response	

CEPI-179-21

IECC®: TABLE C405.3.2(1), TABLE C405.3.2(2)

Proponents: Jeremy Williams, representing U.S. Department of Energy (jeremy.williams@ee.doe.gov)

2021 International Energy Conservation Code

Revise as follows:

TABLE C405.3.2(2) INTERIOR LIGHTING POWER ALLOWANCES: SPACE-BY-SPACE METHOD

Portions of table not shown remain unchanged.

COMMON SPACE TYPES[a]	LPD (watts/ft²)
Atrium	
Less than 40 feet in height	~~0.48~~ ~~0.409~~ 0.41
Greater than 40 feet in height	~~0.60~~ ~~0.509~~ 0.51
Audience seating area	
In an auditorium	~~0.61~~ 0.569 0.57
In a gymnasium	0.23
In a motion picture theater	0.27
In a penitentiary	~~0.67~~ ~~0.559~~ 0.56
In a performing arts theater	~~1.16~~ ~~1.09~~ 1.09
In a religious building	0.72
In a sports arena	~~0.33~~ ~~0.269~~ 0.27
Otherwise	0.33
Banking activity area	~~0.61~~ ~~0.559~~ 0.56
Breakroom (See Lounge/breakroom)	
Classroom/lecture hall/training room	
In a penitentiary	~~0.89~~ ~~0.739~~ 0.74
Otherwise	~~0.71~~ ~~0.719~~ 0.72
Computer room, data center	~~0.94~~ ~~0.749~~ 0.75
Conference/meeting/multipurpose room	~~0.97~~ ~~0.879~~ 0.88
Copy/print room	~~0.31~~ ~~0.559~~ 0.56
Corridor	
In a facility for the visually impaired (and not used primarily by the staff)[b]	0.71
In a hospital	~~0.71~~ ~~0.609~~ 0.61
Otherwise	~~0.41~~ ~~0.439~~ 0.44
Courtroom	~~1.20~~ ~~1.079~~ 1.08
Dining area	
In bar/lounge or leisure dining	~~0.86~~ ~~0.759~~ 0.76
In cafeteria or fast food dining	~~0.40~~ ~~0.359~~ 0.36

In a facility for the visually impaired (and not used primarily by the staff)[b]	~~1.27~~ ~~1.219~~ 1.22
In family dining	~~0.60~~ ~~0.519~~ 0.52
In a penitentiary	~~0.42~~ ~~0.349~~ 0.35
Otherwise	~~0.43~~ ~~0.419~~ 0.42
Electrical/mechanical room	~~0.43~~ ~~0.709~~ 0.71
Emergency vehicle garage	~~0.52~~ ~~0.509~~ 0.51
Food preparation area	~~1.09~~ ~~1.189~~ 1.19
Guestroom[c, d]	0.41
Laboratory	
In or as a classroom	~~1.11~~ ~~1.049~~ 1.05
Otherwise	~~1.33~~ ~~1.209~~ 1.21
Laundry/washing area	~~0.53~~ ~~0.509~~ 0.51
Loading dock, interior	0.88
Lobby	
For an elevator	~~0.65~~ ~~0.639~~ 0.64

COMMON SPACE TYPES	LPD (watts/ft²)
In a facility for the visually impaired (and not used primarily by the staff)[b]	~~1.69~~ ~~1.439~~ 1.44
In a hotel	~~0.51~~ 0.48
In a motion picture theater	~~0.23~~ ~~0.199~~ 0.20
In a performing arts theater	~~1.25~~ ~~1.209~~ 1.21
Otherwise	~~0.84~~ 0.~~769~~ 0.80
Locker room	~~0.52~~ 0.43
Lounge/breakroom	
In a healthcare facility	~~0.42~~ ~~0.769~~ 0.77
Mother's Wellness Room	0.68
Otherwise	~~0.59~~ ~~0.549~~ 0.55
Office	
Enclosed	~~0.74~~ ~~0.729~~ 0.73
Open plan	~~0.61~~ ~~0.559~~ 0.56
Parking area daylight transition zone	~~1.059~~ 1.06
Parking area, interior	~~0.15~~ ~~0.109~~ 0.11
Pharmacy area	~~1.66~~ ~~1.589~~ 1.59
Restroom	
In a facility for the visually impaired (and not used primarily by the staff[b]	~~1.26~~ ~~0.959~~ 0.96
Otherwise	~~0.63~~ ~~0.559~~ 0.74
Sales area	~~1.05~~ ~~0.849~~ 0.85

Seating area, general	~~0.23~~ ~~0.209~~ 0.21
Security Screening General Areas	~~0.639~~ 0.64
Security Screening in Transportation Facilities	~~0.929~~ 0.93
Security Screening Transportation Waiting Area	~~0.559~~ 0.56
Stairwell	~~0.49~~ ~~0.469~~ 0.47
Storage room	~~0.38~~ ~~0.349~~ 0.35
Vehicular maintenance area	~~0.60~~ ~~0.589~~ 0.59
Workshop	~~1.26~~ ~~1.169~~ 1.17
BUILDING TYPE SPECIFIC SPACE TYPES[a]	LPD (watts/ft²)
Automotive (see Vehicular maintenance area)	
Convention Center—exhibit space	~~0.61~~ ~~0.499~~ 0.50
Dormitory—living quarters[c, d]	~~0.50~~ ~~0.479~~ 0.48
Facility for the visually impaired[b]	
In a chapel (and not used primarily by the staff)	~~0.70~~ ~~0.579~~ 0.58
In a recreation room (and not used primarily by the staff)	~~1.77~~ ~~1.119~~ 1.20
Fire Station—sleeping quarters[c]	0.23
Gaming Establishments	
High Limits Game	~~1.679~~ 1.68
Slots	~~0.539~~ 0.54
Sportsbook	~~0.819~~ 0.82
Table Games	~~1.089~~ 1.09
Gymnasium/fitness center	
In an exercise area	~~0.90~~ ~~0.819~~ 0.82
In a playing area	~~0.85~~ ~~0.619~~ 0.82
Healthcare facility	
In an exam/treatment room	~~1.40~~ ~~1.329~~ 1.33

COMMON SPACE TYPES	LPD (watts/ft²)
In an imaging room	0.94
In a medical supply room	~~0.62~~ ~~0.559~~ 0.56
In a nursery	~~0.92~~ ~~0.869~~ 0.87
In a nurse's station	~~1.17~~ ~~1.069~~ 1.07
In an operating room	~~2.26~~ ~~2.309~~ 2.26
In a patient room[c]	0.68
In a physical therapy room	~~0.91~~ ~~0.819~~ 0.82
In a recovery room	~~1.25~~ ~~1.179~~ 1.18
In a telemedicine room	~~1.439~~ 1.44
Library	

In a reading area	~~0.96~~ ~~0.859~~ 0.86
In the stacks	1.18
Manufacturing facility	
In a detailed manufacturing area	~~0.80~~ ~~0.749~~ 0.75
In an equipment room	~~0.76~~ ~~0.729~~ 0.73
~~In an extra-high-bay area (greater than 50 feet floor-to-ceiling height)~~	~~1.42~~
In a low-bay area (less than 25 feet floor-to-ceiling height)	0.86
In a high-bay area (25–50 feet floor-to-ceiling height)	1.24
~~In a low-bay area (less than 25 feet floor-to-ceiling height)~~	~~0.86~~
In an extra-high-bay area (greater than 50 feet floor-to-ceiling height)	~~1.42~~ 1.36
Museum	
In a general exhibition area	0.31
In a restoration room	~~1.10~~ ~~1.239~~ 1.24
Performing arts theater—dressing room	~~0.41~~ ~~0.389~~ 0.39
Post office—sorting area	~~0.76~~ ~~0.709~~ 0.71
Religious buildings	
In a fellowship hall	~~0.54~~ ~~0.499~~ 0.50
In a worship/pulpit/choir area	~~0.85~~ ~~0.749~~ 0.75
Retail facilities	
In a dressing/fitting room	~~0.51~~ ~~0.449~~ 0.45
Hair salon	~~0.649~~ 0.65
Nail salon	~~0.749~~ 0.75
In a mall concourse	~~0.82~~ ~~0.569~~ 0.57
Massage space	~~0.809~~ 0.81
Sports arena—playing area	
For a Class I facility[e]	~~2.94~~ ~~2.859~~ 2.86
For a Class II facility[f]	~~2.01~~ ~~1.979~~ 1.98
For a Class III facility[g]	~~1.30~~ ~~1.289~~ 1.29
For a Class IV facility[h]	0.86
Sports arena—Pools	
For a Class I facility	~~2.199~~ 2.20
For a Class II facility	~~1.469~~ 1.47
For a Class III facility	~~0.989~~ 0.99
For a Class IV facility	~~0.589~~ 0.59
Transportation facility	
Airport Hanger	~~1.359~~ 1.36

COMMON SPACE TYPES	LPD (watts/ft²)
At a terminal ticket counter	~~0.51~~ ~~0.399~~ 0.40

In a baggage/carousel area	~~0.39~~ ~~0.279~~ 0.28
Passenger Loading Area	0.71
In an airport concourse	~~0.25~~ ~~0.489~~ 0.49
Warehouse—storage area	
For medium to bulky, palletized items	0.33
For smaller, hand-carried items	0.69

Reason: The values in Table C405.3.2(2) are interlinked with the values in Table C405.3.2(1). The building values [Table C405.3.2(1)] are comprised via aggregating the individual space values [Table C405.3.2(1)].
These proposed values were developed via a multi-step analysis:

- More than 150 data sheets from more than 10 lighting manufacturers data sheets were compiled.
- The 2021 data sheets indicate increased efficacy compared to products from 2018 and 2019. At least 2/3 of the data sheets compared were the same fixture from 2019 and 2021. For most of the directly tracked products, the efficacy of these fixtures had increased in this time.
- Lighting conditions were modeled for each of the spaces using these 2021 efficacy values and the resultant lighting power density values were these proposed values.

These proposed values represent a 4 - 5% reduction (based on a straight average of changes) compared to the previous version. These proposed values are similar to those that are being considered by ANSI/ASHRAE/IES Standard 90.1.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
There is no cost increase for this proposal. The proposed reduced lighting power density values are based on manufacturer data sheets. Manufacturers have improved the performance of their products and these values are based on their improvements. As stated in the rationale, more than 150 products were evaluated. Between 2018 and 2021, these fixtures became more efficient. Cost changes between 2018 and 2021 are not from changes in efficacy, but inflation, supply chain, and material constraints.

International Energy Conservation Code
Code Change Proposal Tracking Sheet

Proposal #	CEPI-180-21 Lighting decorative allowance
CDP ID #	233
Code	IECC CE
Code Section(s)	C405.3.2(2) table, C405.3.2.2.1 New Section n
Location	base
Proponent	Mike Kennedy mikekennedy@energysims.com
Proposal Status	SC rev
Subcommittee	CE Elec, Light
Subcommittee Notes	Reason: Based on prior action of approving CEPI-182 and concerns about the viability of the proposed values.
Recommendation	DISAPPROVE
Vote	15 - 3 - 1
Recommendation Date	April 25, 2022
Next Step	To Subcommittee___________________________________ To Advisory Group___________________________________ To Consensus Committee_________X__________
Consensus Committee	
Committee Response	
Vote	Affirmative___________ Negative____________ Table_____________ To Subcommittee___________________________
Date	

International Energy Conservation Code
Code Change Proposal Tracking Sheet

Proposal #	CEPI-182-21 Lighting decorative allowance
CDP ID #	137
Code	IECC CE
Code Section(s)	C405.3.2.2.1 New Section n
Location	base
Proponent	Jeremy Williams jeremy.williams@ee.doe.gov
Proposal Status	SC rev
Subcommittee	CE Elec, Light
Subcommittee Notes	Reason: Increases energy efficiency by reducing the decorative power allowance due to improvements in LED efficiency.
Recommendation	AS SUBMITTED THIS PROPOSAL SUPERCEDES ANY CONFLICTING PROVISIONS IN CEPI-184 AND CEPI-183.
Vote	11 - 5 - 2
Recommendation Date	April 11, 2022
Next Step	To Subcommittee___________________________________ To Advisory Group___________________________________ To Consensus Committee_______X_________
Consensus Committee	
Committee Response	
Vote	Affirmative__________ Negative___________ Table_____________ To Subcommittee___________________________
Date	

International Energy Conservation Code
Code Change Proposal Tracking Sheet

Proposal #	CEPI-183-21 Lighting Retail Display
CDP ID #	136
Code	IECC CE
Code Section(s)	C405.3.2.2.1 New Section n
Location	base
Proponent	Jeremy Williams jeremy.williams@ee.doe.gov
Proposal Status	SC rev
Subcommittee	CE Elec, Light
Subcommittee Notes	Reason: This will save energy in retail spaces and align with values in ANSI/ASHRAE/IES 90.1-2022.
Recommendation	AS MODIFIED Modification: Additional lighting power allowance = ~~1000W~~ 750 W + … for both imperial and SI equations.
Vote	16 - 0 - 1
Recommendation Date	April 11, 2022
Next Step	To Subcommittee____________________ To Advisory Group____________________ To Consensus Committee_______X_________
Consensus Committee	
Committee Response	
Vote	Affirmative__________ Negative___________ Table____________ To Subcommittee_________________________
Date	

International Energy Conservation Code
Code Change Proposal Tracking Sheet

Proposal #	CEPI-184-21 Retail Lighting
CDP ID #	289
Code	IECC CE
Code Section(s)	C405.3.2.2.1 New Section n
Location	base
Proponent	Jonathan McHugh jon@mchughenergy.com
Proposal Status	SC rev
Subcommittee	CE Elec, Light
Subcommittee Notes	Reason: This proposal will reduce initial cost and cost over the life of the system and provide sufficient decorative lighting power to provide for effective lighting designs while mitigating energy waste.
Recommendation	AS MODIFIED Modification: No changes are proposed / approved to C405.3.2.2.1 charging language, or to item 1 (retail lighting power allowances). This proposal is limited to items 2 (decorative lighting) and 3 (facilities for the visually impaired). THIS PROPOSAL SUPERCEDES ANY CONFLICTING PROVISIONS IN CEPI-183. THIS PROPOSAL IS SUPERCEDED BY ANY CONFLICTING PROVISIONS IN CEPI-182.
Vote	10 - 6 - 3
Recommendation Date	April 11, 2022
Next Step	To Subcommittee___________________________________ To Advisory Group__________________________________ To Consensus Committee_______X_________
Consensus Committee	
Committee Response	

Vote	Affirmative___________ Negative____________ Table_____________ To Subcommittee___________________________
Date	

International Energy Conservation Code
Code Change Proposal Tracking Sheet

Proposal #	CEPI-083-21 Clean Water Pumps
CDP ID #	144
Code	IECC CE
Code Section(s)	C403.15 New Section y
Location	base
Proponent	Nicholas O'Neil noneil@energy350.com
Proposal Status	SC rev
Subcommittee	CE HVACR & WH
Subcommittee Notes	• CEPI-83 and CEPI-145 are similar proposals • Proponents of each proposal worked together to create a simplified, more compact proposal (CEPI-83) that removed some of the content specific to federal regulations but not as applicable to the energy code itself. Proponents also maintained a longer version (CEPI-145) for committee consideration and discussion of the two options. CEPI-145 includes all of federal standard and 90.1. CEPI-83 is more condensed, removes equation that isn't really used in design as part of the code. • Formula in the code is fairly complex, and is generally not used by designers or building officials. It is accurate and aligned with federal regulations for equipment standards, but is not generally part of design considerations. • Proponents of CEPI-83 and CEPI-145 expressed support for both proposals, whichever the subcommittee prefers would be acceptable to them • Related US DOE standard is out for public comment now, and will likely include adding more pumps to scope than what is in this proposal. So IECC could be out of alignment after this is all done. • Federal standards typically have about a 5 year lead time, so new standards wouldn't go into effect until 2027-2028. • Subcommittee expressed a preference to keep the IECC book a little simpler, fewer pages, but would support either proposal. • Chris Perry, US DOE. No strong feelings between the two. Talked with Appliance Standards program, and they indicated CEPI-83 as aligning a little closer with their proposal.
Recommendation	Approve as modified Reason: Simplified version preferred by the committee. The methodology, requirements, and exceptions contained in this proposal mirror what is already included in ASHRAE 90.1-2019 and what is required by DOE to demonstrate compliance. Listing them in the IECC will provide designers with the necessary information on how to calculate PEI and which pumping systems are required to comply.
Vote	Approve As Modified Passed 15-0-1

Recommendation Date	5/12/2022
Next Step	To Subcommittee___________________________________ To Advisory Group___________________________________ To Consensus Committee _X______________
Consensus Committee	
Committee Response	
Vote	Affirmative__________ Negative___________ Table_____________ To Subcommittee___________________________
Date	

CEPI-83-21 As Modified

IECC®: SECTION 202 (New), C403.15 (New), Table C403.15 (New)

Proponents:

Nicholas O'Neil, representing NEEA (noneil@energy350.com); Kevin Rose, representing Northwest Energy Efficiency Alliance (NEEA) (krose@neea.org)

2021 International Energy Conservation Code

Add new definition as follows:

C202 BEST EFFICIENCY POINT (BEP). The pump hydraulic power operating point (consisting of both flow and head conditions) that results in the maximum efficiency.

C202 CLEAN WATER PUMP. A device that is designed for use in pumping water with a maximum nonabsorbent free solid content of 0.016 lb/ft^3 (0.256 kg/m^3) and with a maximum dissolved solid content of 3.1 lb/ft^3 (49.66 kg/m^3), provided that the total gas content of the water does not exceed the saturation volume, and disregarding any additives necessary to prevent the water from freezing at a minimum of 14°F (-10°C).

Pump Energy Index (PEI). The ratio of a pump's energy rating divided by the energy rating of a minimally compliant pump. For pumps with the constant load operating mode, the relevant PEI is PEI_{CL}. For pumps with the variable load operating mode, the relevant PEI is PEI_{VL}.

Add new text as follows:

C403.15 *Clean water pumps*.

***Clean water pumps* meeting all the following criteria shall achieve a PEI rating not greater than 1.0~~comply with the requirements shown in Table C403.15:~~**

1. **Shaft input power is greater than or equal to 1.0 hp (0.75 kW) and less than or equal to 200 hp (149.1 kW) at its BEP.**
2. **Designated as either an End suction Close-coupled, End Suction Frame Mounted, In-line, Radially Split Vertical, or Submersible**

Turbine pump.

3. A flow rate of 25 gal/min (1.5 L/s) or greater at its *best efficiency point (BEP)* at full impeller diameter
4. Maximum head of 459 ft (140m) at its BEP at full impeller diameter and the number of stages required for testing
5. Design temperature range from 14°F (-10°C) to 24 °F (120°C)
6. Designed to operate with either:
   6.1. a 2- or 4-pole induction motor, or
   6.2. a non-induction motor with a speed of rotation operating range that includes speeds of rotation between 2880 and 4320 rpm and/or 1440 and 2160 rpm, and
   6.3. in either (1) or (2), the driver and impeller must rotate at the same speed.
7. For submersible turbine pumps, a 6 inches (152 mm) or smaller bowl diameter
8. For end-suction close-coupled pumps and end-suction frame-mounted/own bearings pumps, specific speed less than or equal to 5000 rpm when calculated using U.S. customary units

Exceptions: The following pumps are exempt from these requirements:

1. Fire pumps
2. Self-priming pumps
3. Prime-assisted pumps
4. Magnet-driven pumps
5. Pumps designed to be used in a nuclear facility subject to 10 CFR 50, "Domestic Licensing of Production and Utilization Facilities."
6. Pumps meeting the design and construction requirements set forth in U.S. Military Specification MIL-P-17639F, "Pumps, Centrifugal, Miscellaneous Service, Naval Shipboard Use" (as amended); MIL-P-17 1D, "Pumps, Centrifugal, Boiler Feed, (Multi-Stage)" (as amended); MIL-P-17 40C, "Pumps, Centrifugal, Close-Coupled, Navy Standard (For Surface Ship Application)" (as amended); MIL- P-1 6 2D, "Pump, Centrifugal, Main Condenser Circulating, Naval Shipboard" (as amended); MIL-P-1 472G, "Pumps, Centrifugal, Condensate, Feed Booster, Waste Heat Boiler, And Distilling Plant" (as amended).

~~Table C403.15 MAXIMUM PUMP ENERGY INDEX (PEI)~~

Pump Type	Nominal Speed of Rotation (RPM)	Operating Mode	Maximum PEI[a]	C-Value b	Test Procedure
End suction, close coupled	1800	Constant load	1.00	128.47	10 CFR Part 431
End suction, close coupled	3600	Constant load	1.00	130.42	
End suction, close coupled	1800	Variable load	1.00	128.47	
End suction, close coupled	3600	Variable load	1.00	130.42	
End suction, frame mounted	1800	Constant load	1.00	128.85	
End suction, frame mounted	3600	Constant load	1.00	130.99	
End Suction, frame mounted	1800	Variable load	1.00	128.85	
End suction, frame mounted	3600	Variable load	1.00	130.99	
In-line	1800	Constant load	1.00	129.30	
In-line	3600	Constant load	1.00	133.84	
In-line	1800	Variable load	1.00	129.30	
In-line	3600	Variable load	1.00	133.84	
Radially split, vertical	1800	Constant load	1.00	129.63	
Radially split, vertical	3600	Constant load	1.00	133.20	
Radially split, vertical	1800	Variable load	1.00	129.63	
Radially split, vertical	3600	Variable load	1.00	133.20	
Submersible turbine	1800	Constant load	1.00	138.78	
Submersible turbine	3600	Constant load	1.00	134.85	
Submersible turbine	1800	Variable load	1.00	138.78	
Submersible turbine	3600	Variable load	1.00	134.85	

a. For pumps with the constant load operating mode, the relevant PEI is PEI_{CL}. For pumps with the variable load operating mode, the relevant PEI is PEI_{VL}.

b. The C-values shown in this table shall be used in the equation for PER_{STD} when calculating PEI_{CL} or PEI_{VL}.

Insert references as follows:

U.S. Department of Defense	3010 Defense Pentagon Washington, DC 20301
MIL-P-17639F (1996)	Pumps, Centrifugal, Miscellaneous Service, Naval Shipboard Use
MIL-P-17840C (1986)	Pumps, Centrifugal, Close-Coupled, Navy Standard (For Surface Ship Application)
MIL-P-17881D (1972)	Pumps, Centrifugal, Boiler Feed (Multi-Stage)
MIL-P-18472 (1989)	Pumps, Centrifugal, Condensate, Feed Booster, Waste Heat Boiler, and Distilling Plant
MIL-P-18682D	Pump, Centrifugal, Main Condenser Circulating, Naval Shipboard

International Energy Conservation Code
Code Change Proposal Tracking Sheet

Proposal #	CEPI-145-21 Clean Water Pumps
CDP ID #	109
Code	IECC RE
Code Section(s)	C405.13.1 (water pump) New Section y
Location	base
Proponent	Steven Rosenstock srosenstock@eei.org
Proposal Status	SC rev
Subcommittee	CE HVACR & WH
Subcommittee Notes	Similar to CEPI-83. Subcommittee preferred the as-modified, simplified version of CEPI-83 compared to this proposal.
Recommendation	Disapprove Reason: Based on subcommittee action on CEPI-83
Vote	Disapprove, 14-0-2
Recommendation Date	5/12/2022
Next Step	To Subcommittee___________________________________ To Advisory Group___________________________________ To Consensus Committee _X___________
Consensus Committee	
Committee Response	
Vote	Affirmative___________ Negative____________ Table_____________ To Subcommittee___________________________
Date	

International Energy Conservation Code
Code Change Proposal Tracking Sheet

Proposal #	CEPI-119-21 Fan Power Limits
CDP ID #	510
Code	IECC CE
Code Section(s)	C403.8.1, C403.8.1.1 (New), C403.8.1.2 (New), TABLE C403.8.1(1), TABLE C403.8.1(2), C403.8.1(1) (New), C403.8.1(2) (New), C403.8.1(3) (New), C503.3, C503.3.1 (New), C503.3 (New) New Section y
Location	base
Proponent	John Bade johnbade@2050partners.com
Proposal Status	SC rev
Subcommittee	CE HVACR & WH
Subcommittee Notes	• This proposal represents as shift from fan power budget based on brake HP to fan power budget based on kW input • Proposal is meant to clarify current code language and help with different interpretations • Proponent reviewed proposal • Realization that allowance for renovations was intended to be but not included in proposal. Proponent made additions during the meeting to incorporate it. • Subcommittee questions about where is this proposal in the ASHRAE process? Wants to harmonize with 90.1. Proponent responded that this proposal is in line with what is being discussed at ASHRAE. Intention is to be exactly in alignment between 90.1 and IECC.
Recommendation	Approve as Modified, See Attached As-Modified version Reason (referenced from original proposal): The fan power limits were one of the most successful energy savings addenda in the IECC. However, they have not been updated in a decade. This proposal provides some increase in stringency, but more importantly, it addresses flaws in the original to improve both enforceability and clarity.
Vote	Approve as modified 11-3-1
Recommendation Date	5/12/2022
Next Step	To Subcommittee____________________________________ To Advisory Group____________________________________ To Consensus Committee _X________________
Consensus Committee	

Committee Response	
Vote	Affirmative__________ Negative___________ Table____________ To Subcommittee__________________________
Date	

CEPI-119-21 As Modified

IECC®: SECTION 202, SECTION 202 (New), C202, C403.8.1, TABLE C403.8.1(1), TABLE C403.8.1(1) (New), TABLE C403.8.1(2), TABLE C403.8.1(2) (New), TABLE C403.8.1(3) (New), C403.8.1.1 (New), C403.8.1.2 (New), C503.3, TABLE C503.3 (New), C503.3.1

(New), AHRI Chapter 06 (New) Proponents:

John Bade, representing California Investor Owned Utilities (johnbade@2050partners.com)

2021 International Energy Conservation Code

Revise definitions as follows:

C202 ENTHALPY RECOVERY RATIO (ERR). Change in the enthalpy of the *outdoor air* supply divided by the difference between the *outdoor air* and entering exhaust air enthalpy, expressed as a percentage.

C202 FAN SYSTEM ELECTRICAL INPUT POWER. The sum of the fan electrical input power of all fans that are required to operate at *fan system design conditions* ~~to supply air from the heating or cooling source to the conditioned spaces and/or return it to the source or exhaust it to the outdoors~~.

C202 FAN SYSTEM DESIGN CONDITIONS. Operating conditions that can be expected to occur during normal system operation that result in the highest supply fan airflow rate of ~~to conditioned spaces served by~~ the *fan system* ~~system~~, other than during air economizer operation.

Add new definitions as follows:

C202 FAN ELECTRICAL INPUT POWER. The electrical input power in kilowatts required to operate an individual fan or *fan array* at design conditions. It includes the power consumption of motor controllers, if present.

C202 FAN NAMEPLATE ELECTRICAL INPUT POWER. Is the nominal electrical input power rating stamped on a fan assembly nameplate.

C202 FAN SYSTEM. All the fans that contribute to the movement of air serving *spaces* that pass through a point of a common duct, plenum, or cabinet.

C202 FAN SYSTEM, COMPLEX. a *fan system* that combines a *single-cabinet fan system* with other supply fans, exhaust fans, or both.

C202 FAN SYSTEM, EXHAUST/RELIEF. A *fan system* dedicated to the removal of air from interior spaces to the outdoors.

C202 FAN SYSTEM, RETURN. A *fan system* dedicated to removing air from the interior where some or all the air is to be recirculated except during economizer operation.

C202 FAN SYSTEM, SINGLE-CABINET. A *fan system* where a single fan, single fan array, a single set of fans operating in parallel, or fans or fan arrays in series and embedded in the same cabinet that both supply air to a space and recirculate the air.

C202 FAN SYSTEM, TRANSFER. A *fan system* that exclusively moves air from one occupied space to another.

C202 FAN SYSTEM AIRFLOW. The sum of the airflow of all fans with *fan electrical input power* greater than 1 kW at *fan system design conditions*, excluding the airflow that passes through downstream fans with *fan electrical input power* not greater than 1 kW.

Delete and substitute as follows:

~~**C403.8.1 Allowable fan horsepower.**~~

~~**Each HVAC system having a total fan system motor nameplate horsepower exceeding 5 hp (3.7 kW) at fan system design conditions shall not exceed the allowable *fan system motor nameplate hp* (Option 1) or *fan system bhp* (Option 2) shown in Table C403.8.1(1). This includes supply fans, exhaust fans, return/relief fans, and fan-powered terminal units associated with systems providing heating or cooling capability. Single-zone variable air volume systems shall comply with the constant volume fan power limitation.**~~

~~Exceptions:~~

1. ~~Hospital, vivarium and laboratory systems that utilize flow control devices on exhaust or return to maintain space pressure relationships necessary for occupant health and safety or environmental control shall be permitted to use variable volume fan power limitation.~~

2. ~~Individual exhaust fans with motor nameplate horsepower of 1 hp (0.746 kW) or less are exempt from the allowable fan horsepower requirement.~~

Delete without substitution:

~~TABLE C403.8.1(1) FAN POWER LIMITATION~~

	LIMIT	CONSTANT VOLUME	VARIABLE VOLUME
Option 1: Fan system motor nameplate hp	Allowable nameplate motor hp	hp :5 CFM_S x 0.0011	hp :5 CFM_S x 0.0015
Option 2: Fan system bhp	Allowable fan system bhp	bhp :5 CFM_S x 0.00094 + *A*	bhp :5 CFM_S x 0.0013 + *A*

For SI: 1 bhp = 735.5 W, 1 hp = 745.5 W, 1 cfm = 0.4719 L/s.

where:

CFM_S = The maximum design supply airflow rate to conditioned spaces served by the system in cubic feet per minute.

hp = The maximum combined motor nameplate horsepower.

bhp = The maximum combined fan brake horsepower.

A = Sum of [*PD* x CFM_D / 4131].

where:

PD **= Each applicable pressure drop adjustment from Table C403.8.1(2) in. w.c.**

CFM_D = The design airflow through each applicable device from Table C403.8.1(2) in cubic feet per minute.

TABLE C403.8.1(2) FAN POWER LIMITATION PRESSURE DROP ADJUSTMENT

DEVICE	ADJUSTMENT
Credits	
Return air or exhaust systems required by code or accreditation standards to be fully ducted, or systems required to maintain air pressure differentials between adjacent rooms	0.5 inch w.c. (2.15 inches w.c. for laboratory and vivarium systems)
Return and exhaust airflow control devices	0.5 inch w.c.
Exhaust filters, scrubbers or other exhaust treatment	The pressure drop of device calculated at fan system design condition
Particulate filtration credit: MERV 9 thru 12	0.5 inch w.c.
Particulate filtration credit: MERV 13 thru 15	0.9 inch w.c.
Particulate filtration credit: MERV 16 and greater and electronically enhanced filters	Pressure drop calculated at 2 times the clean filter pressure drop at fan system design condition.
Carbon and other gas-phase air cleaners	Clean filter pressure drop at fan system design condition.

~~Biosafety cabinet~~	~~Pressure drop of device at fan system design condition.~~
~~Energy recovery device, other than coil runaround loop~~	~~For each airstream, (2.2 x energy recovery effectiveness - 0.5) inch w.c.~~
~~Coil runaround loop~~	~~0.6 inch w.c. for each airstream.~~
~~Evaporative humidifier/cooler in series with another cooling coil~~	~~Pressure drop of device at fan system design conditions.~~
~~Sound attenuation section (fans serving spaces with design background noise goals below NC35)~~	~~0.15 inch w.c.~~
~~Exhaust system serving fume hoods~~	~~0.35 inch w.c.~~
~~Laboratory and vivarium exhaust systems in high-rise buildings~~	~~0.25 inch w.c./100 feet of vertical duct exceeding 75 feet.~~
~~Deductions~~	
~~Systems without central cooling device~~	~~- 0.6 inch w.c.~~
~~Systems without central heating~~	~~- 0.3 inch w.c.~~
~~Systems with central electric resistance heat~~	~~- 0.2 inch w.c.~~

~~For SI: 1 inch w.c. = 249 Pa, 1 inch = 25.4 mm, 1 foot = 304.8 mm.~~

~~w.c. = Water Column, NC = Noise Criterion.~~

Add new text as follows:

C403.8.1 Fan power.

For each *fan system* serving an occupied space or other *enclosed space* that includes at least one fan or *fan array* with *fan electrical input power*

greater than 1 kW, *fan system electrical input power* determined per Section C403.8.1.2 at the *fan system design airflow* shall not exceed the limit as calculated per Section C403.8.1.1. This section does not apply to fans serving heat rejection equipment.

C403.8.1.1 Determining Fan Power Limit.

To determine the maximum *fan system electrical input power* allowed for a *fan system*, complete steps 1 through 5:

1. Determine the *fan system's* classification. A *fan system* is considered to be multizone VAV if it meets the following requirements. *fan systems* that do not meet the requirements shall be classified as other fans:

   a. **The fan system must serve three or more HVAC zones and airflow to each must be individually controlled based on heating, cooling and/or ventilation requirements.**

   b. **The sum of the minimum airflows for each HVAC zone must be not greater than 40-percent of the *fan system design conditions*.**

   Exception to C403.8.1.1(1)

   Hospital, vivarium, and laboratory systems that use flow control devices on exhaust and/or return to maintain space pressure relationships necessary for occupant health and safety or environmental control shall use the multizone VAV fan power allowances.

2. Determine the *fan system airflow* and choose the appropriate table(s) for fan power allowance.

   a. **For *single-cabinet fan systems*, use the *fan system airflow* and the power allowances in both Table C403.8.1(1) and Table 1.1. C403.8.1(2).**

   b. **For *supply-only fan systems*, use the *fan system airflow* and power allowances in Table C403.8.1(1).**

   c. **For *relief fan systems*, use the design relief airflow and the power allowances in Table C403.8.1(2).**

   d. **For exhaust, return and transfer *fan systems*, use the *fan system airflow* and the power allowances in Table C403.8.1(2).**

   e. **For *complex fan systems* and DOAS with energy recovery *fan systems*, separately calculate the fan power allowance for the supply and return/exhaust systems and sum them. For the supply airflow, use supply airflow at the *fan system* design conditions, and the power allowances in Table C403.8.1(1). For the return /exhaust airflow, use return /exhaust airflow at the *fan system design conditions*, and the power allowances in Table C403.8.1(2).**

3. For each *fan system* determine the components included in the *fan system* and sum the fan power allowances of those components. All *fan systems* shall include the System Base Allowance. If, for a given component, only a portion of the *fan system airflow* passes through the component, calculate the fan power allowance for that component per equation 4-9:

$$FPA_{adj} = \frac{Q_{comp}}{Q_{sys}} \cdot FPA_{comp}$$

Where:

FPA_{adj} = The corrected fan power allowance for the component in w/cfm

Q_{comp} = The airflow through component in cfm

Q_{sys} = The *fan system airflow* in cfm

FPA_{comp} = The fan power allowance of the component from Table C403.8.1(1) or Table C403.8.1(2)

4. Multiply the *fan system* airflow by the sum of the fan power allowances for the *fan system*, then divide by 1000 to convert to kW.

$$FPL = \frac{Q_{sys} \cdot FPA_{sum}}{1,000}$$

Where:

FPL is the fan power limit in kW

Q_{sys} is the fan system airflow in cfm (L/s)

FPA_{sum} is the sum of the fan power allowances for the system in W/cfm.

1000 is the conversion from W to kW

5. For building sites at elevations greater than 3,000 ft (900m), multiply the fan power limit by the correction factor from Table C408.3.1(3).

$$FPL_{alt} = FPL \cdot C_{alt}$$

Where:

FPL_{alt} is the adjusted fan power limit in kW.

FPL is the fan power limit in kW calculated in step 4.

C_{alt} is the altitude correction factor from Table C408.3.1(3)

C403.8.1.2 Determining *Fan System Electrical Input Power*

The *fan system electrical input power* is the sum of the *fan electrical input power* of each fan or *fan array* included in the *fan system* other than fans with *fan electrical input power* ≤ 1 *kW*. If variable speed drives are used their efficiency losses shall be included. *Fan system input power* shall be calculated with mid-life filter pressure drop, which is the mean of the clean filter pressure drop and design final filter pressure drop. The *fan electrical input power* for each fan or *fan array* shall be determined using one of the following methods. There is no requirement to use the same method for all fans in a *fan system*:

1. Use the default *fan electrical input power* in Table C408.3.1(4) for one or more of the fans. This method cannot be used for complex *fan systems*.
2. Use the *fan electrical input power* at *fan system design conditions* provided by the manufacturer of the fan, *fan array*, or *equipment* that includes the fan or *fan array*, calculated per a test procedure included in 10 CFR Part 430, 10 CFR Part 431, ANSI/AMCA Standard 210, ASHRAE 51 AHRI Standard 430, AHRI Standard 440, or ISO 5801.
3. Use the *fan electrical input power* provided by the manufacturer, calculated at *fan system design conditions* per one of the methods listed in section 5.3 of ANSI/AMCA 208.
4. Use the *fan nameplate electrical input power*.

TABLE C403.8.1(1)

SUPPLY FAN POWER ALLOWANCES (W/CFM)

	Multi-Zone VAV *Fan System*[1] Airflow (cfm)			**All Other *Fan Systems* Airflow (cfm)**		
Air *System* Component	**<5,000**	**5,000 to <10,000**	**≥ 10,000**	**<5,000**	**5,000 to <10,000**	**≥ 10,000**
	W/cfm					
Supply System Base Allowance for each *fan system*	0.413	0.472	0.480	0.243	0.267	0.248
Particle filtration (select all that apply)						
Filter not higher than MERV 12 ~~or less~~	0.094	0.079	0.073	0.097	0.084	0.075
MERV 13 to MERV 16 Filter	0.210	0.177	0.165	0.217	0.185	0.168
HEPA Filter	0.347	0.292	0.277	0.357	0.304	0.278
Heating (select all that apply)						
Hydronic heating coil (central)	0.047	0.050	0.055	0.049	0.053	0.057
Electric heat	0.047	0.040	0.037	0.049	0.042	0.038
Gas or oil furnace <90% Et or <90% AFUE	0.071	0.060	0.073	0.061	0.063	0.075
Gas or oil furnace ≥90% Et or ≥90% AFUE	0.117	0.099	0.092	0.122	0.104	0.094
Cooling and dehumidification (select all that apply)						
Hydronic/DX cooling coil, or heat pump coil (wet) [Healthcare facilities can select twice]	0.141	0.118	0.110	0.146	0.125	0.112
Fluid economizer coil	0.141	0.118	0.110	0.146	0.125	0.112

	Multi-Zone VAV *Fan System*[1] Airflow (cfm)			All Other *Fan Systems* Airflow (cfm)		
Air *System* Component	<5,000	5,000 to <10,000	≥ 10,000	<5,000	5,000 to <10,000	≥ 10,000
	W/cfm					
Desiccant *system* – solid or liquid	0.164	0.138	0.128	0.170	0.145	0.131
Hot gas reheat coil	0.047	0.040	0.037	0.049	0.042	0.038
Series energy recovery	0.141	0.118	0.110	0.146	0.125	0.112
Evaporative humidifier/cooler in series with a cooling coil. Value shown is allowed W/cfm per 1.0 in. wg. Determine pressure loss (in. wg) at the lesser of 400 fpm or maximum velocity allowed by the manufacturer. [Calculation required, see note 2]	0.233	0.196	0.184	0.241	0.205	0.186
Energy recovery						
Enthalpy Recovery Ratio ≥ 0.50 and <0.55)	0.141	0.118	0.110	0.146	0.125	0.112
Enthalpy Recovery Ratio ≥ 0.55 and <0.60)	0.166	0.140	0.130	0.172	0.147	0.133
Enthalpy Recovery Ratio ≥ 0.60 and <0.65)	0.191	0.161	0.151	0.198	0.169	0.153
Enthalpy Recovery Ratio ≥ 0.65 and <0.70)	0.217	0.182	0.171	0.224	0.191	0.173
Enthalpy Recovery Ratio ≥ 0.70 and <0.75)	0.242	0.204	0.191	0.250	0.213	0.193
Enthalpy Recovery Ratio ≥ 0.75 and <0.80)	0.267	0.225	0.212	0.276	0.235	0.213
Enthalpy Recovery Ratio ≥ 0.8)	0.292	0.246	0.232	0.301	0.257	0.234
Run-around liquid or refrigerant coils	0.141	0.118	0.110	0.146	0.125	0.112
Gas-phase filtration						
Gas phase filtration	0.233	0.196	0.184	0.241	0.205	0.186
Other						
Economizer return damper	0.049	0.042	0.038	0.049	0.043	0.039
100% *Outdoor air system* meeting the requirements of Note 3.	0.000	0.000	0.000	0.073	0.104	0.112
Low-turndown single-zone VAV *fan systems* meeting the requirements in note 4.	0.000	0.000	0.000	0.073	0.104	0.094
Air blender	0.047	0.040	0.037	0.049	0.042	0.038

Air *System* Component	Multi-Zone VAV *Fan System*[1] Airflow (cfm)			All Other *Fan Systems* Airflow (cfm)		
	<5,000	5,000 to <10,000	≥ 10,000	<5,000	5,000 to <10,000	≥ 10,000
	W/cfm					
Sound attenuation section [fans serving spaces with design background noise goals below NC35]	0.035	0.030	0.027	0.036	0.032	0.029
Deduction for *systems* that feed a terminal unit or fan coil with a fan with electrical input power < 1*kW*	-0.500	-0.500	-0.500	-0.100	-0.100	-0.100

1. See section 6.5.3.1.1.1 (1) for requirements a for a Multizone VAV *System*

2. Power allowances require further calculation. Multiply the actual pressure drop of the device or component by the fan power allowance in Table 6.5.3-1.

3. The 100 percent outdoor air *system* must serve 3 or more *HVAC zones*.

4. 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 30 percent of the design wattage at that airflow. No more than 10 percent of the design load served by the *equipment* shall have fixed loads.

5. The deduction of 0.500 W/cfm is a default value for multizone VAV *fan systems*. If the terminal unit or fan coil manufacturer can demonstrate that the share of the unit's fan power required to move the *fan system*'s air is less than 0.500 W/cfm, that value may be used. The W/cfm shall be calculated by dividing the power required to operate the terminal unit's fan at *fan system* design conditions by the airflow of the terminal unit at those conditions.

TABLE C403.8.1(2)

EXHAUST, RETURN, RELIEF, TRANSFER FAN SYSTEM POWER ALLOWANCES (W/CFM)

	Multi-Zone VAV *Fan System*[1] airflow (cfm)			All Other *Fan Systems* Airflow (cfm)		
Air *System* Component	<5,000	5,000 to <10,000	≥ 10,000	<5,000	5,000 to <10,000	≥ 10,000
	W/cfm					
Exhaust, Return, Relief, and Transfer *System* Base Allowance for each *fan system*	0.231	0.256	0.248	0.194	0.192	0.200
Particle filtration						
Filter (any MERV value)[2]	0.049	0.042	0.038	0.049	0.043	0.039
Energy recovery						
Enthalpy Recovery Ratio ≥ 0.50 and <0.55)	0.146	0.125	0.112	0.146	0.128	0.114
Enthalpy Recovery Ratio ≥ 0.55 and <0.60)	0.173	0.148	0.133	0.173	0.150	0.135

Enthalpy Recovery Ratio ≥ 0.60 and <0.65)	0.199	0.170	0.153	0.199	0.173	0.155
Enthalpy Recovery Ratio ≥ 0.65 and <0.70)	0.225	0.192	0.173	0.226	0.196	0.176
Enthalpy Recovery Ratio ≥ 0.70 and <0.75)	0.250	0.214	0.193	0.252	0.218	0.196
Enthalpy Recovery Ratio ≥ 0.75 and <0.80)	0.276	0.236	0.213	0.277	0.240	0.216
Enthalpy Recovery Ratio ≥ 0.8)	0.302	0.258	0.234	0.303	0.263	0.236
Run-around liquid or refrigerant coils	0.146	0.125	0.112	0.146	0.128	0.114
Special exhaust and return *system* requirements (select all that apply)						
Return or exhaust *systems* required to be fully ducted by code or accreditation standards	0.122	0.105	0.094	0.122	0.107	0.096
Return and/or exhaust airflow control devices required by code or accreditation standards to maintain pressure relationships between *spaces*	0.122	0.105	0.094	0.122	0.107	0.096
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 3]	0.061	0.053	0.047	0.061	0.054	0.048
Exhaust system serving fume hoods	0.085	0.074	0.066	0.085	0.075	0.067
Biosafety cabinet. Value shown is allowed W/cfm per 1.0 in. wg air pressure drop. [Calculation required, see note 3]	0.241	0.206	0.186	0.242	0.210	0.188
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 3]	0.241	0.206	0.186	0.242	0.210	0.188
Other						
Sound attenuation section (fans serving *spaces* with design background noise goals below NC35)	0.036	0.032	0.029	0.036	0.032	0.029

1. See Section C408.3.1.1 for requirements for a Multi-Zone VAV System.

2. Particle filter pressure loss can only be counted once per *fan system*.

3. Power allowances require further calculation. Multiply the actual pressure drop of the device or component by the fan power allowance in Table C403.8.1(2)

TABLE C403.8.1(3): FAN POWER LIMIT ALTITUDE CORRECTION FACTOR

Altitude (ft)	Correction factor
<3,000	1.000
≥3,000 and <4,000	0.896
≥4,000 and <5,000	0.864
≥5,000 and <6,000	0.832

≥6,000	0.801

TABLE C403.8.1(4)

DEFAULT VALUES FOR FAN ELECTRICAL INPUT POWER BASED ON MOTOR NAMEPLATE HP

Motor Nameplate Horsepower	Variable-Speed Drive (*kW*)	Without Variable-Speed Drive (*kW*)
≤1	0.96	0.89
>1 and ≤1.5	1.38	1.29
>1.5 and ≤2	1.84	1.72
>2 and ≤3	2.73	2.57
>3 and ≤5	4.38	4.17
>5 and ≤7.5	6.43	6.15
>7.5 and ≤10	8.46	8.13
>10 and ≤15	12.47	12.03
>15 and ≤20	16.55	16.04
>20 and ≤25	20.58	19.92
>25 and ≤30	24.59	23.77
>30 and ≤40	32.74	31.70
>40 and ≤50	40.71	39.46
>50 and ≤60	48.50	47.10
>60 and ≤75	60.45	58.87
>75 and ≤100	80.4	78.17

1. This table cannot be used for Motor Nameplate Horsepower values greater than 100.

2. This table is to be used only with motors with a service factor ≤1.15. If the service factor is not provided, this table may not be used.

Add new text as follows:

C503.3 Heating and cooling systems.
New heating, cooling and duct systems that are part of the *alteration* shall comply with Sections C403 and C408.

C503.3.1 Economizers.

New cooling systems that are part of *alteration* shall comply with Section C403.5.

C503.3.2 Fan Power Limit

If a new *fan system* is installed and the existing duct system is not replaced, a fan power allowance as shown in Table C503.3 shall be added to that allowed in Section C403.8.

TABLE C503.3

ADDITIONAL FAN POWER ALLOWANCES (W/CFM)

	Multi-Zone VAV *Fan System*[1] airflow (cfm)			**All Other *Fan Systems* Airflow (cfm)**		
Air *System* Component	**<5,000**	**5,000 to <10,000**	**≥ 10,000**	**<5,000**	**5,000 to <10,000**	**≥ 10,000**
	W/cfm					
Supply f*an system*	0.358	0.386	0.372	0.460	0.468	0.434
Exhaust, return, relief, transfer *fan system*	0.253	0.256	0.232	0.289	0.291	0.262

unit with adapter curb						
Exhaust/ Relief/ Return/ Transfer *Fan system*	0.070	0.061	0.054	0.070	0.062	0.055
Additional Allowance						
Exhaust/ Relief/ Return/ Transfer *Fan system*	0.016	0.017	0.220	0.000	0.000	0.000

a. See definition of *FAN SYSTEM, MULTI-ZONE VARIABLE AIR VOLUME (VAV)*

C503.3.1 Additional fan power allowances.
Additional Fan Power Allowances are available when determining the Fan Power Budget (Fan kW_{budget}) as specified in Table C503.4. These values can be added to the Fan Power Allowance values in Table C403.8.1(1) and Table C403.8.1(2) when calculating a new Fan kW_{budget} for the *fan system* being altered.

Add new standard(s) as follows:

AHRI Air-Conditioning, Heating, & Refrigeration Institute 2111 Wilson Blvd, Suite 500 Arlington VA 22201

AHRI 1060-2018 **Performance Rating of Air-to-Air Exchangers for Energy Recovery Ventilation Equipment**

AHRI Standard 430-2020 Performance Rating of Central Station Air-Handling Units

Reason Statement:

The fan power limits were one of the most successful energy savings addenda in the IECC. However, they have not been updated in a decade.

This proposal provides some increase in stringency, but more importantly, it addresses flaws in the original to improve both enforceability and clarity.

The improvements include:

- **The requirements are based on actual energy input rather than brake horsepower. Designs**
- **now get credit for using direct-drive transmissions vs. belt-drive.**
- **The scope has been expanded to include fan systems down to 1 kW of input power from the previous lower threshold of 5 brake horsepower.**
- **Fan systems to which the requirements apply have been clearly defined.**
- **Fan system components that were not included previously have been added (e.g., hot gas reheat coils) Equipment that**
- **does not include mechanical heating or cooling have been brought into scope.**

A similar proposal was approved by the California Energy Commission for Title 24-2022. The measure was reviewed with stakeholders in several meetings and went through three stages of public review. The Codes and Standards Enhancement Report that includes an in=depth discussion of the proposal and energy savings analysis is available at this link: https://title24stakeholders.com/wp-content/uploads/2020/09/2022_T24-Final-CASE-Report_Air-Distribution.pdf.

This proposal is also soon to be voted on by SSPC 90.1. The draft of that addendum has been reviewed in two rounds of stakeholder meetings.

Cost Impact:

The code change proposal will increase the cost of construction.

Cost-effectiveness for Proposal 510 - Fan Power Limits

The proposed values reduce the allowed fan system electrical input power by about 10% on average, the amount varies by system. A large multi-zone VAV system will see a reduction of about 13% if it includes MERV-13 filters. On the other hand with the new credit for single-zone VAV systems that are configured to turn down to 50% of airflow, there is no increase in stringency at all.

There are many ways to improve a system to achieve the goal. Though the improvements here are based on the cost difference between a belt-drive centrifugal fan and a direct-drive plenum fan, there are many options to reduce pressure drop in the fan system that will yield the same results for less money. In fact, the California Title 24 cost-effectiveness was based entirely on improving the design of the duct system while leaving the current minimum-efficiency air handler systems unchanged. Some of the options for improving fan system performance include:

Reducing duct pressure drop through the selection of high-performance fittings.

Using angle filters in place of flat filters.

Locating equipment so that duct runs, and in particular vertical shafts, are straight.

Careful consideration of design and the placement of the first turn in the duct system after leaving the air handler (this is often the highest pressure drop in the system).

However, for the purpose of this exercise, the cost of a belt-driven centrifugal fan with a variable-frequency drive was compared to a direct-drive plenum fan. The reduction in transmission losses alone make up for most of the required improvement in electrical input power. The two systems were run in the prototype buildings used by ASHRAE 90.1 in all climate zones. The majority of fans in the prototype buildings that are large enough to meet the threshold of 1 kW of input power in the proposal are variable-speed fans.
Manufacture cost data was used to compare the cost per design cfm of the two different fans at two different sizes:

3,000 cfm - $0.346 per cfm

10,000 cfm - $0.192 per cfm

The following tables show the annual energy cost savings for various buildings. The savings vary by climate, with warmer and wetter climates generally showing higher savings. The annual savings were multiplied by 12, which is the ASHRAE scalar limit for equipment with a 15-year lifespan. In nearly all cases, the cost per cfm of an improved fan is less than the scalar limit.
Primary school – these typically have fans that are about 3,000 cfm or a little more. In all cases, the savings are greater than the $0.346 additional cost:

	Elec Energy Savings (kWh)	Gas Energy Savings (Therm)	Elec Energy Cost Savings ($)	Gas Energy Cost Savings ($)	Total Energy Cost Savings ($)	Annual Savings X12	Modeled Airflow	$/cfm
Albuquerque	13085	-84	1438	-67	1371	$16,450	25169.5	$0.65
Atlanta	12935	-7	1422	-5	1416	$16,994	25169.5	$0.68
Buffalo	11531	-51	1267	-41	1226	$14,717	25169.5	$0.58
Denver	12004	-118	1319	-95	1224	$14,694	25169.5	$0.58
Dubai	18103	0	1990	0	1990	$23,875	25169.5	$0.95
ElPaso	13822	-50	1519	-40	1479	$17,744	25169.5	$0.70
Fairbanks	14078	-157	1547	-126	1422	$17,059	25169.5	$0.68
GreatFalls	11509	-40	1265	-32	1232	$14,790	25169.5	$0.59
HoChiMinh	14873	0	1635	0	1635	$19,615	25169.5	$0.78
InternationalFalls	12749	-95	1401	-76	1325	$15,904	25169.5	$0.63
Miami	15460	0	1699	0	1699	$20,384	25169.5	$0.81
NewDelhi	16277	1	1789	1	1790	$21,476	25169.5	$0.85
NewYork	11932	-12	1311	-10	1302	$15,622	25169.5	$0.62
PortAngeles	10436	-1	1147	-1	1146	$13,756	25169.5	$0.55
Rochester	12563	-72	1381	-58	1323	$15,872	25169.5	$0.63
SanDiego	11373	-10	1250	-8	1242	$14,903	25169.5	$0.59
Seattle	11632	-139	1278	-111	1167	$14,004	25169.5	$0.56
Tampa	16769	-1	1843	-1	1842	$22,108	25169.5	$0.88
Tucson	12771	0	1404	0	1404	$16,847	25169.5	$0.67

Large Hotel – These typically use large VAV fans. Again, in all cases, the additional cost of $0.192 per cfm is much less than the projected savings:

	Elec Energy Savings (kWh)	Gas Energy Savings (Therm)	Elec Energy Cost Savings ($)	Gas Energy Cost Savings ($)	Total Energy Cost Savings ($)	Annual Savings X12	Modeled Airflow	$/cfm
Albuquerque	24756	-20	2721	-16	2704	$32,451	40110.4	$0.81
Atlanta	20992	-24	2307	-19	2288	$27,453	40110.4	$0.68
Buffalo	19504	-60	2144	-49	2095	$25,140	40110.4	$0.63
Denver	24984	-45	2746	-36	2710	$32,520	40110.4	$0.81
Dubai	24856	-3	2732	-2	2729	$32,752	40110.4	$0.82
ElPaso	23902	-12	2627	-10	2617	$31,407	40110.4	$0.78
Fairbanks	16880	-72	1855	-58	1797	$21,565	40110.4	$0.54
GreatFalls	21103	-55	2319	-44	2275	$27,300	40110.4	$0.68
HoChiMinh	26707	-10	2935	-8	2927	$35,128	40110.4	$0.88
Honolulu	22710	-3	2496	-3	2493	$29,918	40110.4	$0.75
InternationalFalls	18937	-73	2081	-59	2022	$24,267	40110.4	$0.61
NewDelhi	24433	-8	2685	-7	2679	$32,143	40110.4	$0.80
NewYork	20083	-38	2207	-31	2177	$26,118	40110.4	$0.65
PortAngeles	19082	-24	2097	-19	2078	$24,937	40110.4	$0.62
Rochester	19824	-84	2179	-67	2112	$25,338	40110.4	$0.63
SanDiego	19085	-16	2097	-13	2084	$25,013	40110.4	$0.62
Seattle	19438	-27	2136	-22	2115	$25,375	40110.4	$0.63
Tampa	23725	-9	2607	-7	2600	$31,201	40110.4	$0.78
Tucson	23380	-11	2569	-9	2560	$30,726	40110.4	$0.77

Standalone Retail – These prototypes use a mix of small and large fans. However, the 12-year savings are much higher than the per cfm cost of both sizes.

	Elec Energy Savings (kWh)	Gas Energy Savings (Therm)	Elec Energy Cost Savings ($)	Gas Energy Cost Savings ($)	Total Energy Cost Savings ($)	Annual Savings X12	Modeled Airflow	$/cfm
Albuquerque	7589	-85	834	-68	766	$9,195	23371.2	$0.39
Atlanta	4501	-43	495	-35	460	$5,521	23371.2	$0.24
Buffalo	6972	-152	766	-122	645	$7,736	23371.2	$0.33
Denver	7759	-136	853	-109	744	$8,927	23371.2	$0.38
Dubai	10695	0	1175	0	1175	$14,103	23371.2	$0.60
ElPaso	10139	-66	1114	-53	1061	$12,736	23371.2	$0.54
Fairbanks	7159	-186	787	-149	638	$7,653	23371.2	$0.33
GreatFalls	7475	-171	822	-137	684	$8,210	23371.2	$0.35
HoChiMinh	10356	0	1138	0	1138	$13,657	23371.2	$0.58
InternationalFalls	6591	-140	724	-113	612	$7,341	23371.2	$0.31
Miami	9071	-1	997	-1	996	$11,956	23371.2	$0.51
NewDelhi	9863	-15	1084	-12	1072	$12,863	23371.2	$0.55
NewYork	6897	-121	758	-97	661	$7,927	23371.2	$0.34
PortAngeles	6750	-133	742	-106	635	$7,625	23371.2	$0.33
Rochester	7617	-179	837	-144	693	$8,320	23371.2	$0.36
SanDiego	6986	-11	768	-9	759	$9,109	23371.2	$0.39
Seattle	6975	-114	767	-92	675	$8,100	23371.2	$0.35
Tampa	7270	-12	799	-10	789	$9,472	23371.2	$0.41
Tucson	7817	-10	859	-8	851	$10,216	23371.2	$0.44

Large Office - These prototypes use large VAV fans. In this case, the additional cost of $0.192 per cfm meets the scalar for most climate zones. It does not meet the scalar for Climate Zone 8.

	Elec Energy Sa	Gas Energy Sa	Total Energy U	nergy Savings (	ergy Savings (T	nergy Cost Savi	ergy Cost Savi	nergy Cost Savi	Annual Savings X12	N
Albuquerque	222.89	-9.75	213.14	61963	-92	6810	-74	6736	$80,828	2
Atlanta	172.59	-0.7	171.89	47980	-7	5273	-5	5268	$63,212	2
Buffalo	152.66	-1.6	151.06	42439	-15	4664	-12	4652	$55,823	2
Denver	200.94	-15.33	185.61	55861	-145	6139	-117	6023	$72,271	2
Dubai	224.07	-0.08	223.99	62291	-1	6846	-1	6845	$82,143	2
ElPaso	231.17	-3.94	227.23	64265	-37	7063	-30	7033	$84,394	2
Fairbanks	52.95	-4.04	48.91	14720	-38	1618	-31	1587	$19,044	2
GreatFalls	148.99	-7.86	141.13	41419	-75	4552	-60	4492	$53,906	2
HoChiMinh	352.43	-0.45	351.98	97976	-4	10768	-3	10764	$129,169	2
InternationalFalls	189.47	-1.72	187.75	52673	-16	5789	-13	5776	$69,308	2
Miami	334.69	-0.31	334.38	93044	-3	10226	-2	10223	$122,678	2
NewDelhi	215.16	-1.05	214.11	59814	-10	6574	-8	6566	$78,788	2
NewYork	226.87	-0.49	226.38	63070	-5	6931	-4	6928	$83,132	2
PortAngeles	191.2	-16.32	174.88	53154	-155	5842	-124	5717	$68,610	2
Rochester	102.91	-0.29	102.62	28609	-3	3144	-2	3142	$37,703	2
SanDiego	158.62	-1.12	157.5	44096	-11	4846	-9	4838	$58,052	2
Seattle	240.28	-13.24	227.04	66798	-126	7341	-101	7240	$86,885	2
Tampa	222.8	-0.17	222.63	61938	-2	6807	-1	6806	$81,669	2
Tucson	219.17	-1.47	217.7	60929	-14	6696	-11	6685	$80,219	2

International Energy Conservation Code
Code Change Proposal Tracking Sheet

Proposal #	CEPI-127-21 Water Heating Efficiency Table
CDP ID #	160
Code	IECC CE
Code Section(s)	C404.2 table New Section n
Location	base
Proponent	Mike Kennedy mikekennedy@energysims.com
Proposal Status	SC rev
Subcommittee	CE HVACR & WH
Subcommittee Notes	• Very similar to CEPI-126. Proponents worked to combine into one A/M proposal CEPI-127 • Replaces water heating efficiency table with updated values to align with federal value updates
Recommendation	Approve As Modified (refer to As Modified Attachment) Reason (reference original proposal): The current IECC Table C404.2 uses Energy Factor (EF) which DOE replaced with the Universal Energy Factor (UEF) in 2017. New equipment are ratings are published in UEF and EF is generally not published. As such this table needs to be changed. The proposed table C404.2 updates the values to the current DOE standards requirements. It is taken from language proposed for the Washington State Energy Code. Alternate approaches would include deleting the table entirely or adopting a table similar to 90.1. Most of the values in Table C404.2 are based upon national standards of one sort and another. As such most equipment will comply whether the table is in the code or not. Simply eliminating the table is an option and would keep code officials from worrying about water heater efficiency. Or a table similar to that adopted by 90.1 could be used. It lists all the equipment categories but for standards equipment simply states that it's regulated by DOE standards
Vote	Approve As Modified 13-2-2
Recommendation Date	5/12/2022
Next Step	To Subcommittee________________ To Advisory Group________________ To Consensus Committee _X________
Consensus Committee	

Committee Response	
Vote	Affirmative___________ Negative____________ Table_____________ To Subcommittee___________________________
Date	

CEPI-127-21 Replacement / As Modified

IECC®: TABLE C404.2

Proponents: Mike Kennedy, Mike D. Kennedy Inc., representing Northwest Energy Efficiency Alliance; Kevin Rose, representing Northwest Energy Efficiency Alliance (NEEA) (krose@neea.org)

2021 International Energy Conservation Code

Delete and substitute as follows:

TABLE C404.2 MINIMUM PERFORMANCE OF WATER-HEATING EQUIPMENT

EQUIPMENT TYPE	SIZE CATEGORY (input)	SUBCATEGORY OR RATING CONDITION	PERFORMANCE REQUIRED[a, b]	TEST PROCEDURE
Water heaters, electric	≤ 12 kW[d]	Tabletop[e], ≥ 20 gallons and ≤ 120 gallons	0.93 − 0.00132V, EF	DOE 10 CFR Part 430
		Resistance ≥ 20 gallons and ≤ 55 gallons	0.960 − 0.0003V, EF	
		Grid-enabled[f] > 75 gallons and ≤ 120 gallons	1.061 − 0.00168V, EF	
	> 12 kW	Resistance	(0.3 + 27/V_m), %/h (Q/800 + 110$\sqrt{V}$)SL, Btu/h	ANSI Z21.10.3
	≤ 24 amps and ≤ 250 volts	Heat pump > 55 gallons and ≤ 120 gallons	2.057 − 0.00113V, EF (Q/800 + 110$\sqrt{V}$)SL, Btu/h	DOE 10 CFR Part 430
Storage water heaters, gas	≤ 75,000 Btu/h	≥ 20 gallons and ≥ 55 gallons	0.675 − 0.0015V, EF	DOE 10 CFR Part 430
		> 55 gallons and ≤ 100 gallons	0.8012 − 0.00078V, EF	
	> 75,000 Btu/h and ≤ 155,000 Btu/h	< 4,000 Btu/h/gal	80% E_t (Q/800 + 110$\sqrt{V}$)SL, Btu/h	ANSI Z21.10.3
	> 155,000 Btu/h	< 4,000 Btu/h/gal	80% E_t (Q/800 + 110$\sqrt{V}$)SL, Btu/h	
Instantaneous water heaters, gas	> 50,000 Btu/h and < 200,000 Btu/h[c]	≥ 4,000 Btu/h/gal and < 2 gal	0.82 − 0.0019V, EF	DOE 10 CFR Part 430
	≥ 200,000 Btu/h	≥ 4,000 Btu/h/gal and < 10 gal	80% E_t	
	≥ 200,000 Btu/h	≥ 4,000 Btu/h/gal and ≥ 10 gal	80% E_t (Q/800 + 110$\sqrt{V}$)SL, Btu/h	ANSI Z21.10.3
Storage water heaters, oil	≤ 105,000 Btu/h	≥ 20 gal and ≤ 50 gallons	0.68 − 0.0019V, EF (Q/800 + 110$\sqrt{V}$)SL, Btu/h	DOE 10 CFR Part 430
	≥ 105,000 Btu/h	< 4,000 Btu/h/gal	80% E_t	ANSI Z21.10.3
Instantaneous water heaters, oil	≤ 210,000 Btu/h	≥ 4,000 Btu/h/gal and < 2 gal	0.59 − 0.0019V, EF	DOE 10 CFR Part 430
	> 210,000 Btu/h	≥ 4,000 Btu/h/gal and < 10 gal	80% E_t	
	> 210,000 Btu/h	≥ 4,000 Btu/h/gal and ≥ 10 gal	78% E_t	ANSI Z21.10.3
Hot water supply boilers, gas and oil	Hot water supply boilers,gas	Hot water supply boilers,oil		≥ 300,000 Btu/h and <

	~~12,500,000 Btu/h~~			
	~~≥ 300,000 Btu/h and < 12,500,000 Btu/h~~	~~≥ 4,000 Btu/h/gal and < 10 gal~~		
	~~> 300,000 Btu/h and < 12,500,000 Btu/h~~	~~80% E_t~~	~~ANSI Z21.10.3~~	
		~~≥ 4,000 Btu/h/gal and ≥ 10 gal~~		
		~~80% E_t~~		
		~~> 4,000 Btu/h/gal and > 10 gal~~		
		~~78% E_t~~		
~~Pool heaters, gas and oil~~	~~All~~	—	~~82% E_t~~	~~ASHRAE 146~~
~~Heat pump pool heaters~~	~~All~~	—	~~4.0 COP~~	~~AHRI 1160~~
~~Unfired storage tanks~~	~~All~~	—	~~Minimum insulation requirement R-12.5~~(h × ft^2 × °F)/Btu	~~(none)~~

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m², °C = [(°F) – 32]/1.8, 1 British thermal unit per hour = 0.2931 W, 1 gallon = 3.785 L, 1 British thermal unit per hour per gallon = 0.078 W/L.

a. Energy factor (EF) and thermal efficiency (E_t) are minimum requirements. In the EF equation, V is the rated volume in gallons.

b. Standby loss (SL) is the maximum Btu/h based on a nominal 70°F temperature difference between stored water and ambient requirements. In the SL equation, Q is the nameplate input rate in Btu/h. In the equations for electric water heaters, V is the rated volume in gallons and V_m is the measured volume in gallons. In the SL equation for oil and gas water heaters and boilers, V is the rated volume in gallons.

c. Instantaneous water heaters with input rates below 200,000 Btu/h shall comply with these requirements where the water heater is designed to heat water to temperatures 180°F or higher.

d. Electric water heaters with an input rating of 12 kW (40,950 Btu/h) or less that are designed to heat water to temperatures of 180°F or greater shall comply with the requirements for electric water heaters that have an input rating greater than 12 kW (40,950 Btu/h).

e A tabletop water heater is a water heater that is enclosed in a rectangular cabinet with a flat top surface not more than 3 feet in height.

f. A grid-enabled water heater is an electric-resistance water heater that meets all of the following:

1. Has a rated storage tank volume of more than 75 gallons.
2. Was manufactured on or after April 16, 2015.
3. Is equipped at the point of manufacture with an activation lock.
4. Bears a permanent label applied by the manufacturer that complies with all of the following:
   - 4.1. Is made of material not adversely affected by water.
   - 4.2. Is attached by means of nonwater-soluble adhesive.
   - 4.3. Advises purchasers and end users of the intended and appropriate use of the product with the following notice printed in 16.5 point Arial Narrow Bold font: "IMPORTANT INFORMATION: This water heater is intended only for use as part of an electric thermal storage or demand response program. It will not provide adequate hot water unless enrolled in such a program and activated by your utility company or another program operator. Confirm the availability of a program in your local area before purchasing or installing this product."

TABLE C404.2 MINIMUM PERFORMANCE OF WATER-HEATING EQUIPMENT

EQUIPMENT TYPE	SIZE CATEGORY	SUBCATEGORY OR RATING CONDITION	DRAW PATTERN	PERFORMANCE REQUIRED[a]	TEST PROCEDURE[b]
Electric Table-top water heaters[c]	≤12 kW	≥ 20 gal ≤ 120 gal [d]	Very small Low Medium High	UEF ≥ 0.6323 – (0.0058 × Vr) UEF ≥ 0.9188 – (0.0031 × Vr) UEF ≥ 0.9577 – (0.0023 × Vr) UEF ≥ 0.9884 – (0.0016 × Vr)	DOE 10 CFR Part 430 App. E
Electric Storage water heaters[e,f]: resistance and heat pump	≤12 kW	≥ 20 gal ≤ 55 gal [d]	Very small Low Medium High	UEF ≥ 0.8808 – (0.0008 × Vr) UEF ≥ 0.9254 – (0.0003 × Vr) UEF ≥ 0.9307 – (0.0002 × Vr) UEF ≥ 0.9349 – (0.0001 × Vr)	DOE 10 CFR Part 430 App. E
	≤12 kW	> 55 gal ≤120 gal [d]	Very small Low Medium High	UEF ≥ 1.9236 – (0.0011 × Vr) UEF ≥ 2.0440 – (0.0011 × Vr) UEF ≥ 2.1171 – (0.0011 × Vr) UEF ≥ 2.2418 – (0.0011 × Vr)	DOE 10 CFR Part 430 App. E
Electric Storage water heaters[e,f]	> 12 kW	-		(0.3 + 27/Vm), %h	DOE 10 CFR 431.106 App B.
Grid-enabled water heaters [g]	-	>75 gal [d]	Very small Low Medium High	UEF ≥ 1.0136 – (0.0028 × Vr) UEF ≥ 0.9984 – (0.0014 × Vr) UEF ≥ 0.9853 – (0.0010 × Vr)	10 CFR 430 Appendix E

				UEF ≥ 0.9720 – (0.0007 × Vr)	
Electric Instantaneous water heaters[h]	≤12 kW	< 2 gal [d]	Very small Low Medium High	UEF ≥ 0.91 UEF ≥ 0.91 UEF ≥ 0.91 UEF ≥ 0.92	DOE 10 CFR Part 430
	>12 kW & ≤ 58.6 kW [i]	≤ 2 gal & ≤180F	All	UEF ≥ 0.80	DOE 10 CFR Part 430
Gas Storage water heaters[e]	≤ 75,000 Btu/h	≥20 gal & ≤ 55 gal [d]	Very small Low Medium High	UEF ≥ 0.3456 – (0.0020 × Vr) UEF ≥ 0.5982 – (0.0019 × Vr) UEF ≥ 0.6483 – (0.0017 × Vr) UEF ≥ 0.6920 – (0.0013 × Vr)	DOE 10 CFR Part 430 App. E
	≤ 75,000 Btu/h	> 55 gal & ≤ 100 gal [d]	Very small Low Medium High	UEF ≥ 0.6470 – (0.0006 × Vr) UEF ≥ 0.7689 – (0.0005 × Vr) UEF ≥ 0.7897 – (0.0004 × Vr) UEF ≥ 0.8072 – (0.0003 × Vr)	DOE 10 CFR Part 430 App. E
	> 75,000 Btu/h and ≤ 105,000 Btu/h [j,k]	≤ 120 gal ≤ 180 F	Very small Low Medium High	UEF ≥ 0.2674-0.0009 x Vr UEF ≥ 0.5362-0.0012 x Vr UEF ≥ 0.6002-0.0011 x Vr UEF ≥ 0.6597-0.0009 x Vr	DOE 10 CFR Part 430 App. E
	> 105,000 Btu/h [k]	-	-	80% E_t SL ≤ (Q/800 +110√V) Btu/h	DOE 10 CFR 431.106
Gas Instantaneous water heaters[i]	> 50,000 Btu/h and < 200,000 Btu/h [k]	< 2 gal [d]	Very small Low Medium High	UEF ≥ 0.80 UEF ≥ 0.81 UEF ≥ 0.81 UEF ≥ 0.81	DOE 10 CFR Part 430 App. E
	≥ 200,000 Btu/h [k]	< 10 gal	-	80% *Et*	DOE 10 CFR 431.106
	≥ 200,000 Btu/h [k]	≥10 gal	-	80% E_t SL ≤ (Q/800 +110√V), Btu/h	
Oil Storage water heaters[e]	≤ 105,000 Btu/h	≤ 50 gal [d]	Very small Low Medium High	UEF = 0.2509 – (0.0012 × Vr) UEF = 0.5330 – (0.0016 × Vr) UEF = 0.6078 – (0.0016 × Vr) UEF = 0.6815 – (0.0014 × Vr)	DOE 10 CFR Part 430
	> 105,000 Btu/h and ≤140,000 Btu/h[l]	≤ 120 gal ≤ 180 F	Very small Low Medium High	UEF ≥ 0.2932-0.0015 x Vr UEF ≥ 0.5596-0.0018 x Vr UEF ≥ 0.6194-0.0016 x Vr UEF ≥ 0.6740-0.0013 x Vr	DOE 10 CFR Part 430 App. E
	>140,000 Btu/h	All	-	80% *Et* SL ≤ (Q/800 +110√V), Btu/h	DOE 10 CFR 431.106
Oil Instantaneous water heaters[h]	≤ 210,000 Btu/h	< 2 gal	-	80% Et EF ≥ 0.59 - 0.0005 x V	DOE 10 CFR Part 430 App. E
	> 210,000 Btu/h	< 10 gal	-	80% *Et*	DOE 10 CFR 431.106

	> 210,000 Btu/h	≥ 10 gal	-	78% E_t SL ≤ (Q/800 +110√V), Btu/h	DOE 10 CFR 431.106
Hot water supply boilers, gas andoil[h]	≥300,000 Btu/h and < 12,500,000 Btu/h	< 10 gal	-	80% *Et*	DOE 10 CFR 431.106
Hot water supply boilers, gas[i]	≥300,000 Btu/h and < 12,500,000 Btu/h	≥ 10 gal	-	80% E_t SL ≤ (Q/800 +110√V), Btu/h	DOE 10 CFR 431.106
Hot water supply boilers, oil[h]	≥300,000 Btu/h and < 12,500,000 Btu/h	≥ 10 gal	-	78% E_t SL ≤ (Q/800 +110√V), Btu/h	DOE 10 CFR 431.106
Pool heaters, gas[-d]	All	—	-	82% *Et*	DOE 10 CFR Part 430 App. P
Heat pump pool heaters	All	50°F db 44.2°F wb outdoor air 80.0°F entering water	-	4.0 COP	DOE 10 CFR Part 430 App. P
Unfired storage tanks	All	—	-	Minimum insulation requirement R-12.5 (h-ft²-°F)/Btu	(none)

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m², °C = [(°F) – 32]/1.8, 1 British thermal unit per hour = 0.2931 W, 1 gallon = 3.785 L, 1 Britishthermal unit per hour per gallon = 0.078 W/L.

a. Thermal efficiency (E_t) is a minimum requirement, while standby loss is a maximum requirement. In the standby loss equation, V is the ratedvolume in gallons and Q is the nameplate input rate in Btu/h. V_m is the measured volume in the tank in gallons. Standby loss for electric water heaters is in terms of %/h and denoted by the term "S," and standby loss for gas and oil water heaters is in terms of Btu/h and denoted by the term "SL" Draw pattern refers to the water draw profile in the Uniform Energy Factor (UEF) test. UEF and Energy Factor (EF) are minimum requirements. In the UEF standard equations, V_r refers to the rated volume in gallons.

b. Chapter 6 contains a complete specification, including the year version, of the referenced test procedure.

c. A tabletop water heater is a storage water heater that is enclosed in a rectangular cabinet with a flat top surface not more than three feet (0.91 m) in height and has a ratio of input capacity (Btu/h) to tank volume (gal) < 4000.

d. Water heaters or gas pool heaters in this category are regulated as consumer products by the USDOE as defined in 10 CFR 430.

e. Storage water heaters have a ratio of input capacity (Btu/h) to tank volume (gal) < 4000.

f. Efficiency requirements for electric storage water heaters ≤ 12 kW apply to both electric resistance and heat pump water heaters. There areno minimum efficiency requirements for electric heat pump water heaters greater than 12kW or for gas heat pump water heaters.

g. A grid-enabled water heater is an electric resistance water heater that meets all of the following:

1. Has a rated storage tank volume of more than 75 gallons.
2. Is manufactured on or after April 16, 2015.
3. Is equipped at the point of manufacture with an activation lock.
4. Bears a permanent label applied by the manufacturer that complies with all of the following:
   - 4.1 Is made of material not adversely affected by water.
   - 4.2 Is attached by means of non-water soluble adhesive.
   - 4.3 Advises purchasers and end-users of the intended and appropriate use of the product with the following notice printed in 16.5 point Arial Narrow Bold font: "IMPORTANT INFORMATION: This water heater is intended only for use as a part of an electric thermal storage or demand response program. It will not

provide adequate hot water unless enrolled in such a program and activated by your utility company or another program operator. Confirm the availability of a program in your local area before purchasing or installing this product."

h. Instantaneous water heaters and hot water supply boilers have an input capacity (Btu/h) divided by storage volume (gal) ≥ 4000 Btu/h-gal.

i. Electric instantaneous water heaters with input capacity >12 kW and ≤58.6 kW that have either (1) a storage volume >2 gal; or (2) isdesigned to provide outlet hot water at temperatures greater than 180°F; or (3) uses three-phase power have no efficiency standard.

j. Gas storage water heaters with input capacity >75,000 Btu/h and ≤105,000 Btu/h must comply with the requirements for the >105,000 Btu/hif the water heater either (1) has a storage volume >120 gal; (2) is designed to provide outlet hot water at temperatures greater than 180°F; or (3) uses three-phase power.

k. Refer to Section C404.2.1 for additional requirements for gas storage and instantaneous water heaters and gas hot-water supply boilers.

l. Oil storage water heaters with input capacity >105,000 Btu/h and ≤140,000 Btu/h must comply with the requirements for the >140,000 Btu/h if the water heater either (1) has a storage volume >120 gal; (2) is designed to provide outlet hot water at temperatures greater than 180°F; or (3) uses three-phase power.

Chapter 6

Referenced Standards

Delete Table C404.2 from:

AHRI 1160 (I-P) –2014: Performance Rating of Heat Pump Pool Heaters (with Addendum 1)

ANSI Z21.10.3/CSA 4.3–17: Gas Water Heaters, Volume III–Storage Water Heaters with Input Ratings Above 75,000 Btu per Hour,
Circulating Tank and Instantaneous

ASHRAE 146–2011: Testing for Rating Pool Heaters

Insert Table C404.2:

DOE 10 CFR, Part 431–20~~15~~22: Energy Efficiency Program for Certain Commercial and Industrial Equipment: Test Procedures and
Efficiency Standards; Final Rules

Reason: The current IECC Table C404.2 uses Energy Factor (EF) which DOE replaced with the Universal Energy Factor (UEF) in 2017. Newequipment are ratings are published in UEF and EF is generally not published. As such this table needs to be changed. The proposed table C404.2 updates the values to the current DOE standards requirements. It is taken from language proposed for the WashingtonState Energy Code. Alternate approaches would include deleting the table entirely or adopting a table similar to 90.1. Most of the values in Table C404.2 are based upon national standards of one sort and another. As such most equipment will comply whether the table is in the code or not.
Simply eliminating the table is an option and would keep code officials from worrying about water heater efficiency. Or a table similar to that adoptedby 90.1 could be used. It lists all the equipment categories but for standards equipment simply states that it's regulated by DOE standards.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction. This proposal updates code to reflect current federal standards and therefore will not increase the cost.

International Energy Conservation Code
Code Change Proposal Tracking Sheet

Proposal #	CEPI-126-21 Water Heating Efficiency
CDP ID #	427
Code	IECC CE
Code Section(s)	C404.2 table New Section n
Location	base
Proponent	Steven Rosenstock srosenstock@eei.org
Proposal Status	SC rev
Subcommittee	CE HVACR & WH
Subcommittee Notes	• Very similar to CEPI-127. Proponents worked to combine into one A/M proposal CEPI-127 • Replaces water heating efficiency table with updated values to align with federal value updates
Recommendation	Disapprove Reason: based on subcommittee action on CEPI-127
Vote	Disapprove 13-2-0
Recommendation Date	5/12/2022
Next Step	To Subcommittee___________________________________ To Advisory Group___________________________________ To Consensus Committee _X_____________
Consensus Committee	
Committee Response	
Vote	Affirmative___________ Negative____________ Table_____________ To Subcommittee___________________________
Date	

International Energy Conservation Code
Code Change Proposal Tracking Sheet

Proposal #	CEPI-129-21 Service WH for R-1 and R-2
CDP ID #	403
Code	IECC CE
Code Section(s)	C404.2.1, C404.2.2, C404.2.2.1, C404.2.2.2, C406.7.4 New Section y
Location	base
Proponent	Evan Green evan@ecotope.com
Proposal Status	SC rev
Subcommittee	CE HVACR & WH
Subcommittee Notes	• Proponent presented that the proposal is meant to encourage heat pump water heaters in multifamily. It is modeled after the city of Seattle code that is set to also go into effect in WA soon. The proposal is strongly discouraging electric heating with efficiencies/COP =< 1. Gas HPWH are allowed via exception. • Proponent stated that this applies to central systems. It is meant to encourage heat pump water heaters because there are other paths, but the easiest path is to use a heat pump water heater. Proposal applies to > 55 gallon systems. • Per proponent, the proposal is only meant to apply to central systems in Group R1 and R2 occupancies. However, per subcommittee discussion, this is not the way the language is actually written and structured in the proposal. Section 404.2.1 (which includes a 1,000,000 btu/hr threshold) is separate than 404.2.2 (which does not have a minimum application threshold). • Subcommittee discussion that the intent of the proposal is understood, but the proposal would disallow a number of legal products and equipment types and would likely lead to federal preemption issues. • Subcommittee discussion that there are significant issues with the proposal as presented and it needs work. • Subcommittee discussion about how this is a useful opportunity to parse issues with the proposal, Some members preferred tabling the proposal and taking the opportunity to work on it and amend it before the next meeting. • A motion was made and seconded to disapprove the proposal.

Recommendation	Disapprove Reason: This proposal has language issues and leads to federal preemption issues.
Vote	Disapprove 8-7-3
Recommendation Date	5/12/2022
Next Step	To Subcommittee___________________________________ To Advisory Group___________________________________ To Consensus Committee __X______________
Consensus Committee	
Committee Response	
Vote	Affirmative___________ Negative____________ Table_____________ To Subcommittee___________________________
Date	

International Energy Conservation Code
Code Change Proposal Tracking Sheet

Proposal #	CEPI-130-21 Service water heating insulation
CDP ID #	498
Code	IECC CE
Code Section(s)	C404.4 New Section n
Location	base
Proponent	Gary Klein iecc-pipe-insulation@2050partners.com
Proposal Status	SC rev
Subcommittee	CE HVACR & WH
Subcommittee Notes	• Proponent provided editorial comments and changes to the original proposal • Subcommittee comments on the existing exception for water not heated by fossil fuels or electricity. Solar thermal water heaters vs solar PV conundrum. This may be something to address during public comments. Do we really need this exception? Hot water is hot water and should probably be insulated, with energy savings and safety considerations.
Recommendation	Approve as modified Reason (reference original proposal): The existing pipe insulation thickness requirements for service water heating piping come from Table C403.12.3, which was developed primarily for space heating. The major change in this proposal is to include a pipe insulation wall thickness table in the service water heating section of the IECC. Having a separate table will allow requirements for service water heating piping insulation to be based on typical service water heating operation and operating temperatures, which may be very different from those for mechanical systems.
Vote	Approve as Modified Passed 17-0-0
Recommendation Date	5/12/2022
Next Step	To Subcommittee_________________________________ To Advisory Group_________________________________ To Consensus Committee_X_______________
Consensus Committee	

Committee Response	
Vote	Affirmative__________ Negative___________ Table____________ To Subcommittee_________________________
Date	

CEPI-130-21 As Modified

IECC®: C404.4, C404.4.1 (New), TABLE C404.4.1 (New)

Proponents:

Gary Klein, Gary Klein and Associates, Inc., representing Self (gary@garykleinassociates.com); Emily Toto, representing ASHRAE (etoto@ashrae.org); John Bade, representing California Investor Owned Utilities (johnbade@2050partners.com)

2021 International Energy Conservation Code

Revise as follows:

C404.4 ~~Insulation of piping~~ Service water heating system piping insulation.

~~Piping from a water heater to the termination of the heated water fixture supply pipe shall be insulated in accordance with Table C403.12.3. On both the inlet and outlet piping of a storage water heater or heated water storage tank, the piping to a heat trap or the first 8 feet (2438 mm) of piping, whichever is less, shall be insulated. Piping that is heat traced shall be insulated in accordance with Table C403.12.3 or the heat trace manufacturer's instructions. Tubular pipe insulation shall be installed in accordance with the insulation manufacturer's instructions. Pipe insulation shall be continuous except where the piping passes through a framing member. The minimum insulation thickness requirements of this section shall not supersede any greater insulation thickness requirements necessary for the protection of piping from freezing temperatures or the protection of personnel against external surface temperatures on the insulation.~~

Service water heating system piping shall be surrounded by uncompressed insulation. The wall thickness of the insulation shall be ~~greater than or equal to~~ not less than the thickness shown in Table C404.4.1. Where the insulation thermal conductivity is not within the range in the table, the following equation shall be used to calculate the minimum insulation thickness:

$t_{alt} = r\cdot[(1 + t_{table}/r)^{k_{alt}/k_{upper}} - 1]$

Where:

t_{alt} = minimum insulation thickness of the alternate material (in.) (mm)

r = actual outside radius of pipe (in.) (mm)

t_{table} = insulation thickness listed in this table for applicable fluid temperature and pipesize

k_{alt} = thermal conductivity of the alternate material at mean rating temperature indicated for the applicable fluid temperature [Btu·in/h·ft2·°F] [W (m·°C)]

k_{upper} = the upper value of the thermal conductivity range listed in this table for the applicable fluid temperature [Btu·in/h·ft2·°F] [W (m·°C)]

For nonmetallic piping thicker than Schedule 80 and having thermal resistance greater than that of steel pipe, reduced insulation thicknesses are permitted if documentation is provided showing that the pipe with the proposed insulation has no more heat transfer per foot (meter) than a steel pipe of the same size with the insulation thickness shown in the table.

Exception: Tubular pipe insulation shall not be required on the following:

1. ~~The tubing from the connection at the termination of the fixture supply piping to a plumbing fixture or plumbing appliance.~~ Factory-installed piping within water heaters and hot water storage tanks
2. Valves, pumps, and strainers ~~and threaded unions~~ in piping that is not ~~more~~greater than 1 inch (25 mm) ~~or less~~ in nominal diameter. ~~Piping that conveys hot water that has not been heated through the use of fossil fuels or electricity~~
3. Piping that conveys hot water that has not been heated through the use of fossil fuels or electricity
4. Piping from user-controlled shower and bath mixing valves to the water outlets~~. For piping 1 in. (25 mm) or less, insulation is not required for valves or strainers.~~
5. Cold-water piping of a demand recirculation water system. ~~Piping in existing buildings where alterations are made to existing service water heating systems where there is insufficient space or access to meet the requirements.~~
6. Piping in existing buildings where alterations are made to existing service water heating systems where there is insufficient space or access to meet the requirements.
7. Piping at locations where a vertical support of the piping is installed.
8. ~~Insulation is not required at the point w~~Where piping passes through a framing member if it requires increasing the size of the framing member.

~~Tubing from a hot drinking-water heating unit to the water outlet.~~

~~Piping surrounded by building insulation with a thermal resistance (R-value) of not less than R-3.~~

Add new text as follows:

C404.4.1 Installation Requirements.

The following piping shall be insulated per the requirements of this section:

1. Recirculating system piping, including the supply and return piping.
2. The first 8 feet (2.4m) of outlet piping from:
   - 2.1. Storage *water heaters*
   - 2.2. Hot water storage tanks
   - 2.3. Any *water heater* and hot water supply boiler containing not less than 10 ~~or more~~ gallons (37.9 L) of water heated by a direct heat source, an indirect heat source, or both a direct heat source and an indirect heat source.
3. The first 8 feet (2.4m) of branch piping connecting to recirculated, heat traced, or impedance heated piping.
4. The make-up water inlet piping between heat traps and the storage water heaters and the storage tanks they are serving,
5. Nonrecirculating service water heating storage-system.
6. Hot water piping between multiple water heaters, between multiple hot water storage tanks, and between water heaters and hot water storage tanks.
7. Piping that is externally heated (such as heat trace or impedance heating).
8. For direct-buried service water heating system piping, reduction of these thicknesses by 1.5 inches (38.1 mm) shall be permitted (before thickness adjustment required in ~~Table~~ C404.4~~.1 (footnote a)~~) but not to thicknesses less than 1 in (25.4 mm).

TABLE C404.4.1 MINIMUM PIPING INSULATION THICKNESS FOR SERVICE WATER HEAING SYSTEMS[a]

Service Hot-Water Temperature Range	Insulation Thermal Conductivity		Nominal Pipe or Tube Size, in.				
	Conductivity, Btu in h ft2 °	Mean Rating Temperature, ºF	<1	1 to <1-1 2	1-1 2 to <4	4 to <8	:> 8
			Insulation Thickness, in.				
105°F to 140°F	0.22 to 0.28	100	1.0	1.0	1.5	1.5	1.5
>140°F to 200°F	0.25 to 0.29	125	1.0	1.0	2.0	2.0	2.0
>200°F	0.27 to 0.30	150	1.5	1.5	2.5	3.0	3.0

a. These thicknesses are based on energy efficiency considerations only. Additional insulation may be necessary for safety.