International Energy Conservation Code
Consensus Committee-Residential

Draft Meeting Agenda (4/26/23 posting)

Webex Meeting Link

April 27, 2023
12:00 PM Eastern until complete

Committee Chair: JC Hudgison, CBO, Assoc. AIA
Committee Vice Chair: Bridget Herring

1. Call to order.

2. Meeting Conduct.
   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.

4. Approve Agenda

5. Approve Minutes-April 20, 2023

6. Administrative issues-staff

7. Action Items-items in bold prioritized for PNNL analysis

Tabled items from 4/13

RED1-27-22(Glide path to zero net energy)	Modeling as modified 9-3-2
RED1-28-22(Operational carbon rating and energy)	Modeling as modified 7-4-2

Tabled from 4/20

REPCD1-18-22(Floor insulation comment)	Envelope
RED1-194-22(Air space R-value requirements)	Envelope as modified 14-0
RED1-218-22(Radiant barriers)	Envelope approve 14-0
RED1-260-22(Editorial revision)	Envelope approve 14-0
REPCD1-4-22(R408.2 table TBD)	HVACR
REPCD1-5-22(Heat pump and TBD)	HVACR

REPCD-20-22(Efficient HVAC equipment comment)	HVACR
RED1-310-22(Demand recirc water system edit)	HVACR as modified 9-0
RED1-285-22(Duct system)	HVACR as modified 7-2
RED1-308-22(Max. total duct system leakage)	HVACR disapprove 9-0
RED1-307-22(Duct leakage table)	HVACR disapprove 7-0-2
RED1-305-22(Clarify duct location in ceiling)	HVACR disapprove 8-0
RED1-306-22(Ducts buried within ceiling insulation)	HVACR disapprove 8-0
RED1-302-22(Duct insulation exception)	HVACR approve 7-1-1
RED1-359-22(More efficient duct system)	HVACR approve 10-0
RED1-342-22(Electric readiness space heating option)	HVACR disapprove 5-4-0
RED1-343-22(H/ERV option)	HVACR as modified 7-0-2
~~RED1-352-22(Water heater efficiencies)~~	~~HVACR disapprove 8-0-1~~

~~withdrawn~~

RED1-77-22(R408 mech equipment edit)	HVACR disapprove 7-1-1
RED1-337-22(Air leakage and mech ventilation reorg)	HVACR approve 8-0

New proposals

RED1-304-22(Remove 3 in ducts located in cond. Space)	HVACR disapprove 11-0
RECD1-9-22(Thermal energy storage heating system)	HVACR as modified 7-4-0
~~RED1-346-22(EER to ground source heat pump req)~~	~~HVACR as modified 10-0-1~~

~~withdrawn~~

~~RED1-350-22(R408.2.2 updates)~~	~~HVACR disapprove 9-0-2~~

~~withdrawn~~

~~RED1-348-22(Efficient HVAC equipment comment)~~	~~HVACR disapprove 4-2-5~~

~~withdrawn~~

RED1-349-22 PI & II(Include LPG in HVAC equip. perf)	HVACR as modified 11-0
RED1-329-22(R403.8 stricken ref com provisions)	HVACR disapprove 8-2-1
RED1-315-22(AHRI Standard 1430-2022)	HVACR as modified 7-0-1
RED1-316-22(Demand response water heaters)	HVACR disapprove 6-4-0
RECD1-1-22(Exhaust control)	HVACR approve 5-3-1
RED1-78-22(R408 remove credit for appliances)	Modeling disapprove 7-6-3
RED1-360-22(R408 Efficient appliance option)	Modeling as modified 8-3-5
RED1-80-22(Remove appliances from table)	Modeling disapprove 7-6-3
RED1-73-22(R408 additional measure)	Modeling as modified 10-0-5
RED1-26-22(Additional energy efficiency)	Modeling disapprove 15-0
~~RED1-74-22(Cool roof in Table R408)~~	~~Modeling approve 15-0~~

~~withdrawn~~

~~RED1-81-22(Update Table R408.2 remove TBD)~~	~~Modeling disapprove 10-1-4~~

~~withdrawn~~

RED1-79-22(R408 total UA improvement options)	Modeling as modified 14-0-1
RED1-83-22(Additional envelope UA eff. Credits)	Modeling disapprove 14-0-1
RED1-71-22(Air leakage additional efficiency req)	Modeling as modified 13-0-2
RED1-82-22(R408 enhanced envelope clarification)	Modeling disapprove 15-0
RED1-257-22(Minimum roof reflectance)	Modeling approve 13-0-2
RED1-258-22(Minimum roof reflectance)	Modeling disapprove 11-0-4
RECD1-12-22(Fuel proposal)	Not heard by a subcommittee

8. Other business.

9. Upcoming meetings. TBD

10. Adjourn.

FOR FURTHER IECC Residential INFORMATION BE SURE TO VISIT THE ICC WEBSITE:
IECC Residential Website

Join by phone

1-844-740-1264 USA Toll Free

+1-415-655-0003 US Toll

FOR ADDITIONAL INFORMATION, PLEASE CONTACT:

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

International Energy Conservation Code
Code Change Proposal Tracking Sheet

Proposal #	RED1-027-22 Glide path to zero net energy
CDP ID #	1119
Code	IECC RE
Code Section(s)	Appendix RG
Location	appendix
Proponent	Gayathri Vijayakumar gayathri@swinter.com
Proposal Status	SC rev
Subcommittee	RE Econ, Model, Metric
Subcommittee Notes	Motion to Approve as shown on the screen Gayathri Vijayakumar; 2nd Shilpa Surana
Recommendation	The sub-committee supported a Glide Path Appendix as an optional pathway for AHJ's to adopt in order to achieve higher energy conservation without yet requiring net-zero performance or renewable installations. Compared to the version in the monograph, the Proponent had modified the ERI Max values to reflect 10% reduction below 2024 IECC ERI values without OPP and to revise the ERI Max values with OPP, based on recent PNNL analysis.
Vote	Approve 9/3/2
Recommendation Date	March 28, 2023
Next Step	To Subcommittee To Advisory Group_____ To Consensus Committee_____X_____
Consensus Committee	
Committee Response	
Vote	Affirmative_____ Negative_____ Table_____ To Subcommittee_____
Date	

RED1-27-22 Approved as Modified in red

Note: yellow is unique text in this Appendix; other text was copied from Main body and will be revised to match Main body, if the copied text has been modified by other approved RED1s.

IECC: APPENDIX RG (New), RG101 (New), RG405.2 (New), RG406.5 (New), R406.5 (New), RG408.2 (New)

Proponents: Gayathri Vijayakumar, representing Steven Winter Associates, Inc. (gvijayakumar@swinter.com); Mark Lyles, representing California IOUs (markl@newbuildings.org)

2024 International Energy Conservation Code [RE Project]

Add new text as follows:

APPENDIX RG
2024 IECC Stretch Code
RG101
COMPLIANCE

RG405.2 Simulated Performance compliance. Compliance based on total building performance requires that a *proposed design* meets all of the following:

1. The requirements of the sections indicated within Table R405.2.

2. The proposed total *building thermal envelope* TC, which is the sum of the U-factor times assembly area and F-factor times perimeter, shall be less than or equal to the *building thermal envelope* TC using the prescriptive U-factors and F-factors from Table R402.1.2 multiplied by 1.08 in Climate Zones 0, 1, and 2, and 1.10 in Climate Zones 3 through 8 in accordance with Equation 4-2. The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.

For Climate Zones 0-2: $TC_{Proposed\ design} \leq 1.08 \times TC_{Prescriptive\ reference\ design}$ (Equation 4-2)
For Climate Zones 3-8: $TC_{Proposed\ design} \leq 1.10 \times TC_{Prescriptive\ reference\ design}$

3. For buildings without a fuel burning appliance for space heating or water heating, the annual energy cost of the *proposed design* that is less than or equal to 75 percent of the annual energy cost of the *standard reference design*. For buildings with a fuel burning appliance for space heating or water heating, the annual energy cost of the *proposed design* that is less than or equal to 70 percent of the annual energy cost of the *standard reference design*. For dwelling units with greater than 5,000 square feet (465 m^2) of living space floor area located above grade plane, the annual energy cost of the *proposed design* shall be reduced by an additional 5 percent of annual energy cost of the *standard reference design*. Energy prices shall be taken from a source *approved* by the *code official*, such as the Department of Energy, Energy Information Administration's State Energy Data System Prices and Expenditures reports. *Code officials* shall be permitted to require time-of-use pricing in energy cost calculations.

Exceptions:

1.The energy use based on source energy expressed in Btu or Btu per square foot of conditioned floor area shall be permitted to be substituted for the energy cost. The source energy multipliers for all energy sources shall be obtained from ASHRAE Standard 105 (Tables K2, K4, or K8) or from another data source approved by the code official.

2.The energy use based on site energy expressed in Btu or Btu per square foot of conditioned floor area shall be permitted to be substituted for the energy cost for an all-electric building with on-site renewable energy installed.

RG406.5 ERI-based compliance. Compliance based on an ERI analysis requires that the *rated proposed design* and confirmed built dwelling be shown to have an ERI less than or equal to the appropriate value indicated in Table R406.5 when compared to the *ERI reference design* as follows:

1.Where on-site renewables are not installed, the maximum ENERGY RATING INDEX NOT INCLUDING OPP applies.

2.Where on-site renewables are installed, the maximum ENERGY RATING INDEX INCLUDING OPP applies.

Exception: Where the ERI analysis excludes OPP, the maximum ENERGY RATING INDEX NOT INCLUDING OPP shall be permitted.

TABLE R406.5 MAXIMUM ENERGY RATING INDEX

CLIMATE ZONE	ENERGY RATING INDEX NOT INCLUDING OPP	ENERGY RATING INDEX WITH OPP
0-1	~~45~~ 46	~~30~~ 27
2	~~45~~ 46	~~30~~ 26
3	45	~~30~~ 24
4	~~45~~ 48	~~30~~ 32
5	~~45~~ 49	~~30~~ 37
6	~~45~~ 48	~~30~~ 39
7	~~45~~ 47	~~30~~ 43
8	~~45~~ 47	~~30~~ 43

RG408.2 Additional energy efficiency credit requirements. No less than two measures shall be selected from Table R408.2 that meet or exceed a total of twenty credits. Five additional credits shall be selected for dwelling units with greater than 5,000 square feet (465 m^2) of living space floor area located above grade plane. Each measure selected shall meet the relevant subsections of Section R408 and receive credit as specified in Table R408.2 for the specific Climate Zone. For *dwelling units* in Group R-2 buildings, where applicable, the requirements shall be met in each dwelling unit in order to receive credit. Interpolation of credits between measures shall not be permitted.

Reason: This glide path appendix is being offered as a simple option for jurisdictions to adopt to exceed the energy performance 2024 IECC on their "glide path" to net zero energy. To attain that additional performance, this Appendix has three sections that would replace the corresponding sections in the main body of the code: one section from each Compliance option (Prescriptive, Simulated Performance, and ERI).
Where changes are made throughout the public comment period to these three copied sections, those changes would be intended to be updated here as well. Only highlighted text is intended to differ.

Bibliography:
None
Cost Impact:
The code change proposal will increase the cost of construction.
For jurisdictions that adopt this code, local building construction costs at the time of adoption should be considered to determine cost-effectiveness.

RED1-27-22 Approved as Modified in red by the Sub-Committee. Further modified after the vote in blue to align text copied from Main body with approved RED1s that changed that text & to show a draft User Note.
Note: yellow is unique text introduced by this Appendix and where discussion should focus; other black text was copied from Main body and have been revised since the SC vote as shown in blue just in order to match Main body.

IECC: APPENDIX RG (New), RG101 (New), RG405.2 (New), RG406.5 (New), R406.5 (New), RG408.2 (New)

Proponents: Gayathri Vijayakumar, representing Steven Winter Associates, Inc. (gvijayakumar@swinter.com); Mark Lyles, representing California IOUs (markl@newbuildings.org)

2024 International Energy Conservation Code [RE Project]

APPENDIX RG
2024 IECC Stretch Code

The provisions contained in this appendix are not mandatory unless specifically referenced in the

adopting ordinance.

User Note:

About this appendix: *This appendix provides requirements for residential buildings intended to result in lower energy consumption compared to adoption of the 2024 IECC Residential. Where adopted by ordinance as a requirement, Section RG405.2 language is intended to replace Section R405.2, Section RG406.5 language is intended to replace Section R406.5, and Section RG408.2 language is intended to replace Section R408.2. Where those sections of the code have been amended for other purposes, this Appendix is only intended to increase the number of credits required in the Prescriptive path, to increase the energy cost savings in the Simulated Performance path, and to lower the maximum ERI in the ERI path.*

Add new text as follows:

RG101
COMPLIANCE

RG405.2 Simulated building ~~P~~performance compliance. Compliance based on ~~total~~ simulated building performance requires that a *building* comply with ~~*proposed design* meets all of~~ the following:

1. The requirements of the sections indicated within Table R405.2.

2. The proposed total *building thermal envelope* thermal conductance TC~~, which is the sum of the U-factor times assembly area and F-factor times perimeter,~~ shall be less than or equal to the *building thermal envelope* thermal conductance TC using the prescriptive U-factors and F-factors from Table R402.1.2 multiplied by 1.08 in Climate Zones 0, 1, and 2, and ~~1.10~~ 1.15 in Climate Zones 3 through 8 in accordance with Equation 4-2 and Section R402.1.5. The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.

For Climate Zones 0-2: $TC_{Proposed\ design} \leq 1.08 \times TC_{Prescriptive\ reference\ design}$ (Equation 4-2)
For Climate Zones 3-8: $TC_{Proposed\ design} \leq$ ~~1.10~~ 1.15 $\times TC_{Prescriptive\ reference\ design}$

3. ~~For buildings without a fuel burning appliance for space heating or water heating, the annual energy cost of the *proposed design* that is less than or equal to 75 percent of the annual energy cost of the *standard reference design*.~~ For each *dwelling unit* ~~buildings~~ with ~~a~~ one or more fuel burning appliances for space heating, or water heating, or both, the annual energy cost of the *dwelling unit* shall be ~~*proposed design* that is~~ less than or equal to 70 percent of the annual energy cost of the *standard reference design*. For all other *dwelling units*, the annual energy cost of the *dwelling unit* shall be less than or equal to 75 percent of the annual energy cost of the *standard reference design*. For each *dwelling unit*~~s~~ with greater than 5,000 square feet (465 m^2) of *living space* ~~floor area~~ located above *grade plane*, the annual energy cost of the *dwelling unit* ~~*proposed design*~~ shall be reduced by an additional 5 percent of annual energy cost of the *standard reference design*. Energy prices shall be taken from an *approved* source ~~*approved* by the *code official*~~, such as the Department of Energy, Energy Information Administration's State Energy Data System Prices and Expenditures reports. *Code officials* shall be permitted to require time-of-use pricing in energy cost calculations.

Exceptions:

1.The energy use based on source energy expressed in Btu or Btu per square foot of conditioned floor area shall be permitted to be substituted for the energy cost. The source energy multiplier~~s~~ for electricity shall be 2.51. The source energy multiplier for fuels other than electricity shall be 1.09~~ all energy sources shall be obtained from ASHRAE Standard 105 (Tables K2, K4, or K8) or from another data source approved by the code official~~.

2.The energy use based on site energy expressed in Btu or Btu per square foot of conditioned floor area shall be permitted to be substituted for the energy cost ~~for an all-electric building with on-site renewable energy installed~~.

RG406.5 ERI-based compliance. Compliance based on an ERI analysis requires that the *rated* ~~*proposed*~~ *design* and each confirmed as-built *dwelling unit* be shown to have an ERI less than or equal to the ~~appropriate~~ applicable value indicated in Table R406.5 where ~~when~~ compared to the *ERI reference design* as follows:

1.Where on-site renewables are not installed, the maximum ENERGY RATING INDEX NOT INCLUDING OPP applies.

2.Where on-site renewables are installed, the maximum ENERGY RATING INDEX INCLUDING OPP applies.

Exceptions:

1. Where the ERI analysis excludes OPP, the maximum ENERGY RATING INDEX NOT INCLUDING OPP shall be permitted.
2. For buildings with twenty or more *dwelling units*, where *approved* by the *code official*, compliance shall be permitted using the Average Dwelling Unit Energy Rating Index, as calculated in accordance with ANSI/RESNET/ICC 301.

TABLE R406.5 MAXIMUM ENERGY RATING INDEX

CLIMATE ZONE	ENERGY RATING INDEX NOT INCLUDING OPP	ENERGY RATING INDEX WITH OPP
0-1	~~45~~ 46	~~30~~ 27
2	~~45~~ 46	~~30~~ 26

3	45	~~30~~ 24
4	~~45~~ 48	~~30~~ 32
5	~~45~~ 49	~~30~~ 37
6	~~45~~ 48	~~30~~ 39
7	~~45~~ 47	~~30~~ 43
8	~~45~~ 47	~~30~~ 43

~~RG408.2 Additional energy efficiency credit requirements. No less than two measures shall be selected from Table R408.2 that meet or exceed a total of twenty credits. Five additional credits shall be selected for dwelling units with greater than 5,000 square feet (465 m^2) of living space floor area located above grade plane. Each measure selected shall meet the relevant subsections of Section R408 and receive credit as specified in Table R408.2 for the specific Climate Zone. For *dwelling units* in Group R-2 buildings, where applicable, the requirements shall be met in each dwelling unit in order to receive credit. Interpolation of credits between measures shall not be permitted.~~

RG408.2 Additional energy efficiency credit requirements. *Residential buildings* shall earn not less than twenty credits from not less than two measures specified in Table R408.2. Five additional credits shall be earned for *dwelling units* with more than 5,000 square feet (465 m^2) of *living space* located above *grade plane*. To earn credit as specified in Table R408.2 for the applicable Climate Zone, each measure selected for compliance shall comply with the applicable subsections of Section R408. Each *dwelling unit* or sleeping unit shall comply with the selected measure to earn credit. Interpolation of credits between measures shall not be permitted.

Reason: This glide path appendix is being offered as a simple option for jurisdictions to adopt to exceed the energy performance 2024 IECC on their "glide path" to net zero energy. To attain that additional performance, this Appendix has three sections that would replace the corresponding sections in the main body of the code: one section from each Compliance option (Prescriptive, Simulated Performance, and ERI).
Where changes are made throughout the public comment period to these three copied sections, those changes would be intended to be updated here as well. Only highlighted text is intended to differ.

Bibliography:

None
Cost Impact:
The code change proposal will increase the cost of construction.
For jurisdictions that adopt this code, local building construction costs at the time of adoption should be considered to determine cost-effectiveness.

International Energy Conservation Code
Code Change Proposal Tracking Sheet

Proposal #	RED1-028-22 Operational Carbon Rating and Energy Reporting
CDP ID #	1170
Code	IECC RE
Code Section(s)	Appendix RH
Location	appendix
Proponent	Gayathri Vijayakumar gayathri@swinter.com
Proposal Status	SC rev
Subcommittee	RE Econ, Model, Metric
Subcommittee Notes	Motion to Approve Gayathri Vijayakumar; 2nd Shilpa Surana
Recommendation	The sub-committee supported the Carbon Rating Appendix as an optional pathway for AHJ's to adopt in order to demonstrate reductions in operational carbon. Based on discussion, a motion to modify the max CO2e Index was made, increasing it to 65 from 55.
Vote	Approve 7/4/2
Recommendation Date	March 28, 2023
Next Step	To Subcommittee To Advisory Group_____ To Consensus Committee_____X_____
Consensus Committee	
Committee Response	
Vote	Affirmative_____ Negative_____ Table_____ To Subcommittee_____
Date	

RED1-28-22 Approved as Modified in red by the Sub-Committee

Note: yellow is unique text in this Appendix; other text was copied from Main body and will be revised to match Main body, if the copied text has been modified by other approved RED1s.

IECC: APPENDIX RH (New), RH101 (New), SECTION 202 (New), RH102 (New), RH401.2 (New), RH401.3 (New), RH406.2 (New), RH406.7.2.2 (New)

Proponents: Gayathri Vijayakumar, representing Steven Winter Associates, Inc. (gvijayakumar@swinter.com)

2024 International Energy Conservation Code [RE Project]

Add new text as follows:

APPENDIX RH
Operational Carbon Rating and Energy Reporting

RH101
GENERAL DEFINITIONS

Add new definition as follows:

$CO2_e$ INDEX. A numerical integer value, calculated in accordance with ANSI / RESNET / ICC 301 that represents the relative Carbon Dioxide equivalence (CO_2e) emissions of a *rated design* as compared with the CO_2e emissions of the CO_2e reference design and where an Index value of 100 represents the CO_2e performance of the CO_2e reference design and an Index value of 0 (zero) represents a home that emits zero net CO_2e annually.

Add new text as follows:

RH102
COMPLIANCE

RH401.2 Application. Residential buildings shall comply with Section R406.

Exception: Additions, alterations, repairs and changes of occupancy to existing buildings complying with Chapter 5.

RH401.3 Certificate. A permanent certificate shall be completed by the builder or other *approved* party and posted on a wall in the space where the furnace is located, a utility room or an *approved* location inside the *building*. Where located on an electrical panel, the certificate shall not cover or obstruct the visibility of the circuit directory *label*, service disconnect *label* or other required labels. The certificate shall indicate the following:

1. The predominant R-values of insulation installed in or on ceilings, roofs, walls, foundation components such as slabs, *basement walls, crawl space walls* and floors and ducts outside *conditioned spaces*.

2. *U*-factors of fenestration and the solar heat gain coefficient (SHGC) of fenestration. Where there is more than one value for any component of the building envelope, the certificate shall indicate both the value covering the largest area and the area weighted average value if available.

3. The results from any required duct system and building envelope air leakage testing performed on the building.

4. The types, sizes and efficiencies of heating, cooling and service water-heating equipment. Where a gas-fired unvented room heater, electric furnace or baseboard electric heater is installed in the residence, the certificate shall indicate “gas-fired unvented room heater,” “electric furnace” or “baseboard electric heater,” as appropriate. An efficiency shall not be indicated for gas-fired unvented room heaters, electric furnaces and electric baseboard heaters.

5. Where on-site photovoltaic panel systems have been installed, the array capacity, inverter efficiency, panel tilt and orientation shall be noted on the certificate.

6. For buildings where an Energy Rating Index score is determined in accordance with Section R406, the Energy Rating Index score and CO2e Index, both with and without any on-site generation, shall be listed on the certificate.

7. The code edition under which the structure was permitted.

8. Where a solar-ready zone is provided, the certificate shall indicate the location, and dimensions.

RH406.2 ERI and CO2e Index compliance. Compliance based on the ERI and *CO_{2e} Index* requires that the *rated design* and confirmed built dwelling meet all of the following:

1. The requirements of the sections indicated within Table R406.2.

2. Maximum ERI values indicated in Table R406.5.

3. Maximum *CO_2e Index* of ~~55~~ 65, not including OPP, determined in accordance with ANSI/RESNET/ICC 301.

RH406.7.2.2 Confirmed compliance report for a certificate of occupancy. A confirmed compliance report submitted for obtaining the certificate of occupancy shall be made site and address specific and include the following:

1. Building street address or other *building site* identification.

2. Declaration of ERI and *CO_2e Index* on title page and on building plans.

3. The name of the individual performing the analysis and generating the report.

4. The name and version of the compliance software tool.

5. Documentation of all inputs entered into the software used to produce the results for the reference design and the constructed dwelling unit.

6. A final confirmed certificate indicating that the constructed building has been verified to comply with Sections R406.2 and R406.4. The certificate shall report the energy features that were confirmed to be in the building, including: component-level insulation *R*-values or *U*-factors; results from any required duct system and building envelope air leakage testing; and the type and rated efficiencies of the heating, cooling, mechanical ventilation, and service water-heating equipment installed. The certificate shall report the estimated *dwelling unit* energy use by fuel type, inclusive of all end-uses. Where on-site renewable energy systems have been installed on or in the building, the certificate shall report the type and production size of the installed system.

Reason:

As stated in the Executive Summary of the "Path Forward on Energy and Sustainability to Confront a Changing Climate," reduction of greenhouse gas emissions is part of our mission on this Committee. This proposal is a step toward that goal, by reporting an index, similar to ERI, that helps a builder/homeowner understand the performance of their home with respect to GHG. The calculation of this CO2e index has no added cost and requires no additional effort by the builder or rater. The same software that calculates an ERI in 2024 IECC R406 path will be done so in accordance with ANSI 301-2022. That Standard requires software to list this CO2e Index on labels & certificates. It will be published in time for reference within the 2024 IECC to include an update to GHG emission factors (Addendum B).
This proposal also provides an achievable but maximum CO2e Index and adds the reporting of energy use such that GHG emissions could be calculated separately, if other metrics are being used by the jurisdiction to document GHG performance.
Bibliography: None
Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The code change proposal will neither increase nor decrease the cost of construction since the reporting of this value is already part of compliance with the referenced Standard.

~~wall assembly.~~

RED1-28-22 Approved as Modified in red by the Sub-Committee. Further modified after the vote in green to resolve objections and in blue to align text copied from Main body with approved RED1s that changed that text & to show a draft User Note.

Note: yellow is unique text introduced by this Appendix and where discussion should focus; other black text was copied from Main body and have been revised since the SC vote as shown in blue just in order to match Main body.

IECC: APPENDIX RH (New), RH101 (New), SECTION 202 (New), RH102 (New), RH401.2 (New), RH401.3 (New), RH406.2 (New), RH406.7.2.2 (New)

Proponents: Gayathri Vijayakumar, representing Steven Winter Associates, Inc. (gvijayakumar@swinter.com)

2024 International Energy Conservation Code [RE Project]

Add new text as follows:

APPENDIX RH

Operational Carbon Rating and Energy Reporting

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.

User Note:

About this appendix: *This appendix provides requirements for residential buildings intended to result in lower greenhouse gas emissions compared to adoption of the 2024 IECC Residential provisions by adding requirements to limit operational carbon. Where adopted by ordinance as a requirement, the defined terms in the General Definitions section should be added to R202. Section RH401.2 language is intended to replace Section R401.2 and Section RH401.3 language is intended to replace Section R401.3. Section RH406.2 language is intended to replace Section R406.2 and Section RH406.7.2.2 language is intended to replace Section R406.7.2.2. Energy use reporting is added to allow jurisdictions flexibility in calculating greenhouse gas emissions and other associated metrics.*

RH101

GENERAL DEFINITIONS

Add new definition as follows:

$CO2_e$ INDEX. A numerical integer value, calculated in accordance with ANSI / RESNET / ICC 301 that represents the relative Carbon Dioxide equivalence (CO_2e) emissions of a *rated design* as compared with the CO_2e emissions of the CO_2e reference design and where an Index value of 100 represents the CO_2e performance of the CO_2e reference design and an Index value of 0 (zero) represents a home that emits zero net CO_2e annually.

Add new text as follows:

RH102

COMPLIANCE

RH401.2 Application. Residential buildings shall comply with Section R406.

Exception: Additions, *alterations*, repairs and changes of occupancy to existing buildings complying with Chapter 5.

RH401.3 Certificate. A permanent certificate shall be completed by the builder or other *approved* party and posted on a wall in the space where the furnace is located, a utility room or an *approved* location inside the *building*. Where located on an electrical panel, the certificate shall not cover or obstruct the visibility of the circuit directory *label*, service disconnect *label* or other required labels. The certificate shall indicate the following:

1. The predominant R-values of insulation installed in or on ceilings, roofs, walls, foundation components such as slabs, *basement walls, crawl space walls* and floors and ducts outside *conditioned spaces*.

2. *U*-factors of fenestration and the solar heat gain coefficient (SHGC) of fenestration. Where there is more than one value for any component of the *building thermal envelope*, the certificate shall indicate both the value covering the largest area and the area weighted average value if available.

3. The results from any required duct system and *building thermal envelope* air leakage testing performed on the building.

4. The types, sizes and efficiencies of heating, cooling and service water-heating equipment. Where a gas-fired unvented room heater, electric furnace or baseboard electric heater is installed in the residence, the certificate shall indicate “gas-fired unvented room heater,” “electric furnace” or “baseboard electric heater,” as appropriate. An efficiency shall not be indicated for gas-fired unvented room heaters, electric furnaces and electric baseboard heaters.

5. Where on-site photovoltaic panel systems have been installed, the array capacity, inverter efficiency, panel tilt and orientation shall be noted on the certificate.

6. For buildings where an Energy Rating Index score is determined in accordance with Section R406, the Energy Rating Index score and *CO2e Index*, both with and without any on-site generation, shall be listed on the certificate.

7. The code edition under which the structure was permitted.

8. Where a solar-ready zone is provided, the certificate shall indicate the location, and dimensions.

RH406.2 ERI and CO2e Index compliance. Compliance based on the ERI and *CO_{2e} Index* requires that the *rated design* and ~~confirmed~~ as-built *dwelling unit* meet all of the following:

1. The requirements of the sections indicated within Table R406.2.

2. Maximum ERI values indicated in Table R406.5.

3. For all-electric *dwelling units*, m~~M~~aximum *CO_2e Index* of ~~55~~ 65, not including OPP, determined in accordance with ANSI/RESNET/ICC 301. For mixed-fuel *dwelling units*, a maximum *CO_2e Index* established at the time of adoption of this Appendix by the authority having jurisdiction based on the CO_2e emissions data specific to the jurisdiction.

RH406.7.2.2 Confirmed compliance report for a certificate of occupancy. A confirmed compliance report submitted for obtaining the certificate of occupancy shall be made site and address specific and include the following:

1. Building street address or other *building site* identification.

2. Declaration of ERI and *CO_2e Index* on title page and on building plans.

3. The name of the individual performing the analysis and generating the report.

4. The name and version of the compliance software tool.

5. Documentation of all inputs entered into the software used to produce the results for the *ERI* reference design and the ~~constructed~~ as-built *dwelling unit*.

6. A final confirmed certificate indicating that the ~~constructed~~ as-built building complies with Sections R406.2, R406.4 and R406.5. The certificate shall report the energy features that were confirmed to be in the building, including: component-level insulation *R*-values or *U*-factors; results from any required duct system and *building thermal envelope* air leakage testing; and the type and rated efficiencies of the heating, cooling, mechanical ventilation, and service water-heating equipment installed. The certificate shall report the estimated *dwelling unit* energy use by fuel type, inclusive of all end-uses. Where on-site renewable energy systems have been installed on or in the building, the certificate shall report the type and production size of the installed system.

Reason:

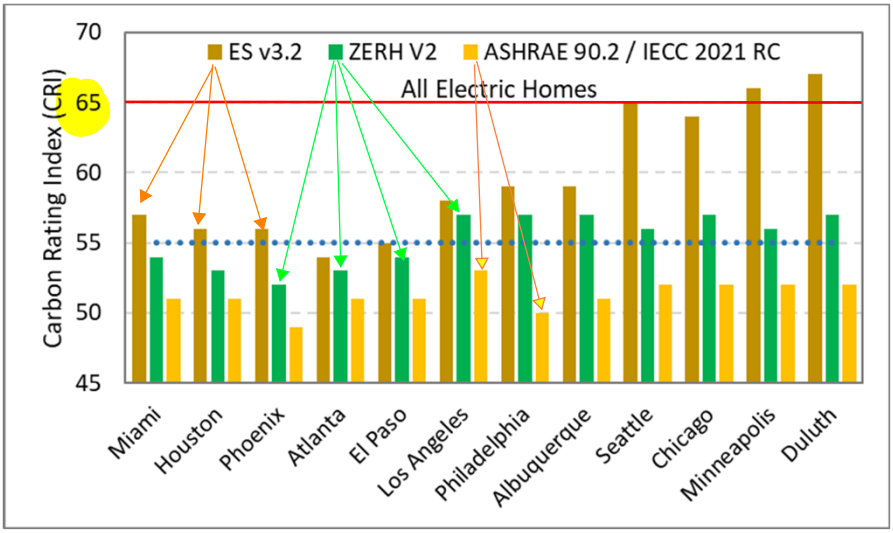
As stated in the Executive Summary of the "Path Forward on Energy and Sustainability to Confront a Changing Climate," reduction of greenhouse gas emissions is part of our mission on this Committee. This proposal is a step toward that goal, by reporting an index, similar to ERI, that helps a builder/homeowner understand the performance of their home with respect to GHG. The calculation of this CO2e index has no added cost and requires no additional effort by the builder or rater. The same software that calculates an ERI in 2024 IECC R406 path will be done so in accordance with ANSI 301-2022. That Standard requires software to list this CO2e Index on labels & certificates. It will be published in time for reference within the 2024 IECC to include an update to GHG emission factors (Addendum B).
This proposal also provides an achievable but maximum CO2e Index and adds the reporting of energy use such that GHG emissions could be calculated separately, if other metrics are being used by the jurisdiction to document GHG performance.
Bibliography: None
Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The code change proposal will neither increase nor decrease the cost of construction since the reporting of this value is already part of compliance with the referenced Standard.

During the Sub-Committee discussion of RED1-28, Philip Fairey of FSEC provided context and information on the CO2e Index (CRI) from the presentation below.

Sub-Committee was concerned that a maximum CO2e Index of 55 was too low for the Appendix and preferred to start with something more reasonable. 65 is shown below, in the context of the CRI's achieved by all-electric above-code homes.

Carbon Rating Index Evaluation

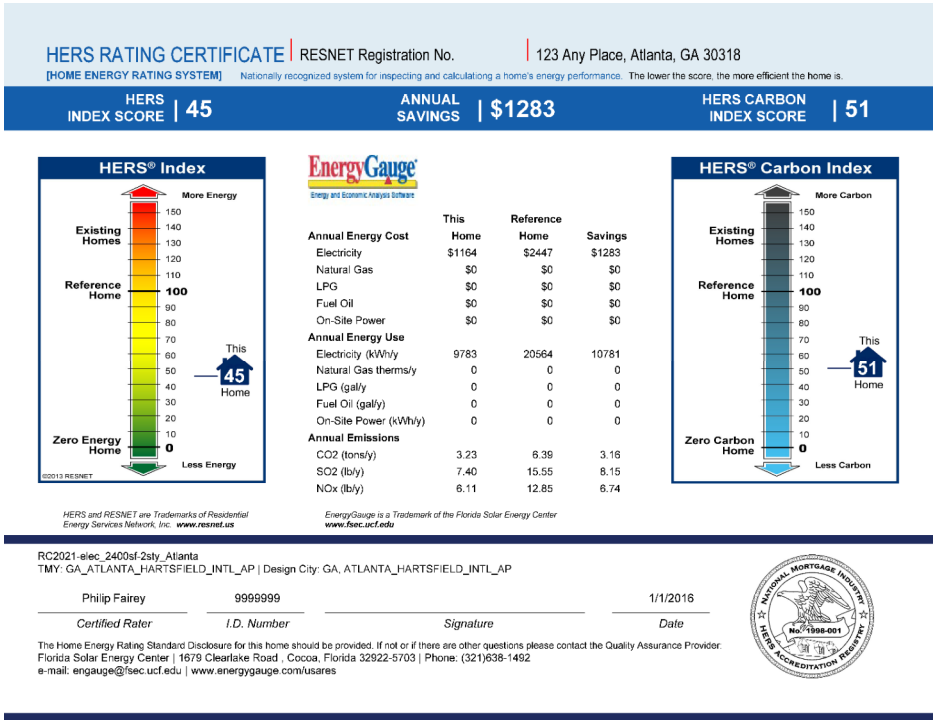
All electric homes that meet the requirements of ASHRAE 90.2 all fall below the proposed CRI maximum qualifying threshold of 55.



Sub-Committee expressed some concerns and questions about information provided on the label / certificate and whether it will cause confusion for homeowners.

Regardless of whether the rating is used for code compliance or not, all homeowners receive a certificate similar to below when an an energy rating is performed on their home in accordance with ANSI/RESNET/ICC 301, which lists ERI, CO2e Index, address, projected CO2e emissions, projected annual site energy, and projected annual energy costs.

ASHRAE 90.2 Home: Atlanta



HERS RATING CERTIFICATE | RESNET Registration No. | 123 Any Place, Atlanta, GA 30318

[HOME ENERGY RATING SYSTEM] Nationally recognized system for inspecting and calculationg a home's energy performance. The lower the score, the more efficient the home is.

HERS INDEX SCORE	ANNUAL SAVINGS	HERS CARBON INDEX SCORE
45	$1283	51

EnergyGauge
Energy and Economic Analysis Software

Annual Energy Cost	This Home	Reference Home	Savings
Electricity	$1164	$2447	$1283
Natural Gas	$0	$0	$0
LPG	$0	$0	$0
Fuel Oil	$0	$0	$0
On-Site Power	$0	$0	$0
Annual Energy Use			
Electricity (kWh/y	9783	20564	10781
Natural Gas therms/y	0	0	0
LPG (gal/y	0	0	0
Fuel Oil (gal/y)	0	0	0
On-Site Power (kWh/y)	0	0	0
Annual Emissions			
CO2 (tons/y)	3.23	6.39	3.16
SO2 (lb/y)	7.40	15.55	8.15
NOx (lb/y)	6.11	12.85	6.74

HERS and RESNET are Trademarks of Residential Energy Services Network, Inc. ***www.resnet.us***

EnergyGauge is a Trademark of the Florida Solar Energy Center ***www.fsec.ucf.edu***

RC2021-elec_2400sf-2sty_Atlanta
TMY: GA_ATLANTA_HARTSFIELD_INTL_AP | Design City: GA, ATLANTA_HARTSFIELD_INTL_AP

Philip Fairey	9999999		1/1/2016
Certified Rater	*I.D. Number*	*Signature*	*Date*

The Home Energy Rating Standard Disclosure for this home should be provided. If not or if there are other questions please contact the Quality Assurance Provider:
Florida Solar Energy Center | 1679 Clearlake Road , Cocoa, Florida 32922-5703 | Phone: (321)638-1492
e-mail: engauge@fsec.ucf.edu | www.energygauge.com/usares

International Energy Conservation Code
Code Change Proposal Tracking Sheet

Proposal #	RED1-194-22 Air space R-value requirements
CDP ID #	1135
Code	IECC RE
Code Section(s)	R303.1.5
Location	base
Proponent	Jay Crandell jcrandell@aresconsulting.biz
Proposal Status	SC rev
Subcommittee	RE Envelope
Subcommittee Notes	Unanimous bot for approval as modified
Recommendation	Adds language to ensure air space R-values are properly specified and applied for both reflective and non-reflective air spaces.
Vote	14-0-0 approve as modified
Recommendation Date	4-5-23
Next Step	To Subcommittee To Advisory Group_____ To Consensus Committee_X_____
Consensus Committee	
Committee Response	
Vote	Affirmative_____ Negative_____ Table_____ To Subcommittee_____
Date	

Proponent: Jay Crandell, ABTG/ARES, representing FSC

Revise proposal as follows (only highlighted changes):

Additional suggested edits added per feedback from RE Envelope subcommittee (Greg J.)

R303.1.5 Air spaces. Where the R-value of an enclosed reflective air space or enclosed non-reflective air space is used for compliance with this standard, the air space shall be enclosed in an ~~unventilated~~ cavity bounded on all sides by building components and constructed to minimize airflow into and out of the enclosed air space. Airflow shall be deemed minimized where one of the following conditions occur:

1. The enclosed air space is unventilated.

2. The enclosed air space is bounded on ~~at least~~ one or more sides by an anchored masonry veneer, constructed in accordance with Chapter 7 of the International Residential Code, and vented by veneer weep holes located only at the bottom portion of the air space and spaced not less than 15 inches (381 mm) on center with the top of the cavity air space closed.

~~The R-value of an enclosed reflective air space shall be determined in accordance with Part 460 of US FTC CFR Title 16 or ANSI/ASHRAE/IESNA 90.1, Appendix A, based on the building component containing the air space, air space thickness, effective emittance of the air space, and climate zone. Radiant barriers installed without facing an enclosed reflective air space shall not be counted as having an R-value. Enclosed non-reflective air spaces of minimum 1/2-inch (12.6 mm) thickness shall be assigned an R-value of R-0.9 or an R-value determined in accordance with ANSI/ASHRAE/IESNA 90.1, Appendix A, using an effective emittance of 0.82.~~

Exception: For ventilated cavities, the effect of the ventilation of air spaces located on the exterior side of the continuous air barrier and adjacent to and behind the exterior wall covering material shall be determined in accordance with ASTM C1363 modified with an airflow entering the bottom and

exiting the top of the air space at an air movement rate of not less than 70 mm/second.

(remainder of proposal unchanged)

REASON: This proposal was tabled until the RE-Envelope subcommittee's April 5th (final) meeting to allow time to respond to feedback and gain consensus from interested parties. The revisions as highlighted above are the result of discussions with interested parties to resolve concerns with the original RED1-194 proposal. Two revisions are made:

1) Delete "unventilated" from the charging language of R303.1.5 to align with changes made to the similar section in the commercial provisions.

2) Delete the 2nd paragraph in R303.1.5 which is not currently in the commercial provisions such that Section R303.1.5 aligns completely with the similar Section C402.2.7 of the commercial code.

International Energy Conservation Code

Code Change Proposal Tracking Sheet

Proposal #	RED1-218-22 Radiant barriers
CDP ID #	1091
Code	IECC RE
Code Section(s)	R402.3
Location	base
Proponent	Greg Johnson gjohnsonconsulting@gmail.com
Proposal Status	SC rev
Subcommittee	RE Envelope
Subcommittee Notes	Unanimous approval
Recommendation	This is an editorial update to remove unnecessary language.
Vote	14-0-0 for approval
Recommendation Date	4-5-23
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 #	RED1-260-22 Editorial revision
CDP ID #	1203
Code	IECC RE
Code Section(s)	R503.1.1
Location	base
Proponent	Hendrik Shank hendrikus.shank@dos.ny.gov
Proposal Status	SC rev
Subcommittee	RE Envelope
Subcommittee Notes	Unanimous approval
Recommendation	Editorial modification to italicize terms where the use is consistent with definitions..
Vote	14-0-0
Recommendation Date	3/22/23
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 #	RED1-310-22 Demand recirc water system edit
CDP ID #	1351
Code	IECC RE
Code Section(s)	R403.5.1.1.1
Location	base
Proponent	Alisa McMahon mcmahon.gbac@cox.net
Proposal Status	SC rev
Subcommittee	RE HVACR & WH
Subcommittee Notes	Presentation Alisa McMahon – Discussion started with a motion to approve "as modified" with an appropriate second. Questions and comments that came up during the discussion. 1. Question recommended distance language in R403.5.1.1 text in red. 2. Comment R403.5.1.1.1 strike out recommendation temperature. 3. R403.5.1.1.1.2 and 3 simplify language with recommendation adding friendly amendment to the "as modified"
Recommendation	Subcommittee having voted to approve "as modified" including friendly amendments. The recommendation from HVACR is to "approve as modified"
Vote	9/0/0
Recommendation Date	4/3/2023
Next Step	To Subcommittee To Advisory Group_____ To Consensus Committee___x_____
Consensus Committee	
Committee Response	
Vote	Affirmative_____ Negative_____ Table_____ To Subcommittee_____
Date	

RED1-310-22

Proponents: Alisa McMahon, representing self (mcmahon.gbac@cox.net)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R403.5.1.1.1 Demand recirculation water systems. Where installed, *d emand recirculation water systems* shall have controls that start the pump upon receiving a signal from the action of a user of a fixture or appliance~~, sensing the presence of a user of a fixture~~ or sensing the flow of hot or tempered water to a fixture fitting or appliance.

Reason: Using a control that senses the presence of a user (i.e., an occupancy sensor) means that every time someone walks up to, or even past, a fixture – *for any reason* – the demand recirculation pump activates and may in turn activate the water heater.

There are many reasons to approach a bathroom or kitchen sink that do not involve the use of hot water. In fact, anecdotally, I kept track of my approaches and found I use hot water < 5% of the time, often using no water at all (e.g., comb hair, look in mirror, get something from cabinet under sink).

Push button control is preferred because it eliminates these "false signals" for pump operation that an occupancy sensor would generate. (California Energy Commission Building Energy Efficiency Standards Residential Compliance Manual)

"False signals" waste energy, both transporting unneeded hot water and when the draw triggers the water heater to fire up.

California Building Energy Efficiency Standards and California Green Building Standards Code specify the following recirculation system controls:

- manual activation with thermostat automatic shut off in one- and two-family dwellings
- controls that sense hot water demand and recirculation return temperatures for central recirculation systems that serve multiple dwelling units

Both of these controls remain represented in R403.5.1.1.1 after this proposed change.

The City of Scottsdale (Arizona) recently adopted the 2021 IECC with this proposed change as a local amendment.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The code change proposal will neither increase nor decrease the cost of construction, but will decrease the cost of energy use.

Bibliography: https://www.energy.ca.gov/programs-and-topics/programs/building-energy-efficiency-standards/2019-building-energy-efficiency-0
https://up.codes/viewer/california/ca-green-code-2019/chapter/A4/residential-voluntary-measures#A4.303.5
https://up.codes/viewer/california/ca-green-code-2019/chapter/2/definitions#demand_hot_water_recirculation_system

Attached Files

- **CA Codes re Demand Recirc Controls.pdf**
  https://energy.cdpaccess.com/proposal/1351/2828/files/download/468/

Workgroup Recommendation

Representatives from four companies that manufacture hot water circulation pumps with and without demand controls were invited to meet with the proponent to discuss the intent of the proposal and the concerns that the proposal was trying to address. After some very productive conversations everyone agreed that rather than removing one of the methods of activating a demand-controlled circulation pump, it was more important to include provisions in the section that discuss how the controls need to limit the run time of the pump.

Staff note: The changes recommended here also belong in the IRC energy chapter.

Revise as follows

R403.5.1.1 Circulation systems. Heated water circulation systems shall be provided with a circulation pump. Gravity and thermosyphon circulation systems shall be prohibited. ~~The system return pipe shall be a dedicated return pipe or a cold water supply pipe. Gravity and thermosyphon circulation systems shall be prohibited.~~ Controls for circulating hot water system pumps shall automatically turn off the pump when the water in the circulation loop is at the desired temperature and when there is no demand for hot water. The system return pipe shall be a dedicated return pipe or a cold water supply pipe. Where a cold water supply pipe is used as the return pipe, a temperature sensor connected to the controls shall be located on the hot water supply no more than two feet from the connection to the cold water supply pipe. The controls shall limit the temperature of the water entering the cold water piping to not greater than 104°F (40°C).

R403.5.1.1.1 Demand recirculation water systems. ~~Where installed, d~~Demand recirculation water systems shall have controls that start the pump upon receiving a signal from the action of a user of a fixture or appliance, ~~sensing the presence of a user of a fixture~~ sensing the presence of a user of a fixture, or sensing the flow of hot or tempered water to a fixture fitting or appliance. The controls shall limit pump operation by:

1. Shutting off the pump when the temperature sensor detects one of the following:
    1.1. An increase in the water temperature of not more than 10°F (5.6°C) above the initial temperature of the water in the pipe.
    1.2. The temperature of the water in the pipe reaches 104°F (40°C).
2. Limiting pump operation to a maximum of five minutes following activation.
3. Not activating the pump for at least five minutes following shutoff or when the temperature of the water in the pipe exceeds 104°F (40°C).

Recommendation: Approve as modified

Reason: This section is missing one of the key elements for the energy efficiency of circulation loops: limiting the run time of the pump.

Green text is not new; it has been reordered for more logical flow.

Cost of construction: There is no increase in the cost of construction as the strategies for shutting off the pump are included in the manufacturer's controls.

International Energy Conservation Code
Code Change Proposal Tracking Sheet

Proposal #	RECD1-1-22 Intermittent exhaust control for bathroom and toilet rm
CDP ID #	
Code	
Code Section(s)	R403.6.4
Location	base
Proponent	HVACR subcommittee
Proposal Status	SC rev
Subcommittee	RE HVACR
Subcommittee Notes	Michael Fulton presenting. Motion to approve and a second opened the floor to discussion. A few questions regarding payback for this added cost to new construction. The proponent stated the payback is 1 – 4 years. A question was asked whether the ability can turn off the control. After discussion the subcommittee moved to a vote. With motion to approve the vote approved the proposal. Vote to approve carried.
Recommendation	HVACR recommendation is to approve as submitted.
Vote	Vote 5/3/1
Recommendation Date	4/3/2023
Next Step	To Subcommittee To Advisory Group_____ To Consensus Committee___x _____
Consensus Committee	
Committee Response	
Vote	Affirmative_____ Negative_____ Table_____ To Subcommittee_____
Date	

PROPOSED MODIFICATION NOT HEARD BY SUBCOMMITTEE

N1103.6.4(R403.6.4) Intermittent exhaust control for bathrooms and toilet rooms. Where an exhaust system serving a bathroom or toilet room is designed for intermittent operation, the exhaust system controls shall include one or more of the following:

1. A timer control with one or more delay setpoints that automatically turns off exhaust fans when the selected setpoint is reached. Not fewer than one delay-off setpoint shall be 30 minutes or less.
2. An occupant sensor control with one or more delay setpoints that automatically turns off exhaust fans in accordance with the selected delay setpoint after all occupants vacated the space. Not fewer than one delay-off setpoint shall be 30 minutes or less.
3. A humidity control with an adjustable setpoint ranging between 50 percent or more and 80 percent or less relative humidity that automatically turns off exhaust fans when the selected setpoint is reached.
4. A contaminant control that responds to a particle or gaseous concentration and automatically turns off exhaust fans when a design setpoint is reached.

Manual-off functionality shall not be used in lieu of the minimum setpoint functionality required by this section.

Exception: Bathroom and toilet room exhaust systems serving as an integral component of an outdoor air ventilation system or a whole-house mechanical ventilation system.

International Energy Conservation Code
Code Change Proposal Tracking Sheet

Proposal #	RED1-285-22 Duct system
CDP ID #	1060
Code	IECC RE
Code Section(s)	R401.3
Location	base
Proponent	Gary Klein iecc-pipe-insulation@2050partners.com
Proposal Status	SC rev
Subcommittee	RE HVACR & WH
Subcommittee Notes	Ducts working group Chair (HVACR) Gary Klein opened the discussion with a recommendation from the working group to approve as modified. Gayathri Vijayakumar presented the proposal with the most recent Modification. This is a very detailed proposal with many Proposals folded into this proposal. Many members of the HVACR subcommittee and interested participated in the working Group discussions and input into this proposal. Vote on the proposal "as modified" carried with strong support. 7/2/0 - Gayathri Vijayakumar presented an addition a change incorporated into 285 which is RED1-285-22 with R408. Vote to approve as amended carried 7/1/1
Recommendation	Recommendation from the subcommittee voting is to approve "as modified"
Vote	7/2/0
Recommendation Date	4/3/2023
Next Step	To Subcommittee To Advisory Group_____ To Consensus Committee__x _____
Consensus Committee	
Committee Response	
Vote	Affirmative_____ Negative_____ Table_____ To Subcommittee

Date	

RED1-285-22 – AS MODIFIED IN RED BY DUCT WORKING GROUP AND HVACR-WH SUBCOMMITTEE

IECC: SECTION 202 (New), SECTION 202, R401.3, R402.2.9, TABLE R402.5.1.1, SECTION R403, R403.3, R403.3.1, R403.3.2, R403.3.3, R403.3.3.1, R403.3.4, R403.3.4.1, R403.3.5, R403.3.6, TABLE R403.3.6, R403.3.7, R403.3.8, TABLE R403.6.2, SECTION R405, R405.3.2.1, TABLE R405.4.2(1), TABLE R405.4.2(2), SECTION R408, TABLE R408.2, R408.2.4, SECTION R502, R502.2.2, SECTION R503, R503.1.2, R503.1.2.1, R503.1.2.3

Proponents: Gary Klein, representing Self (gary@garykleinassociates.com); Mark Lyles, representing California IOUs (markl@newbuildings.org); Gayathri Vijayakumar, representing Steven Winter Associates, Inc. (gvijayakumar@swinter.com)

2024 International Energy Conservation Code [RE Project]

Add new definition as follows:

AIR-HANDLING UNIT. A blower or fan used for the purpose of distributing supply air to a room, space or area.

Revise as follows:

CONDITIONED SPACE. An area, room or space that is enclosed within the *building thermal envelope* and is directly or indirectly heated or cooled. Spaces are indirectly heated or cooled where they communicate through openings with conditioned spaces, where they are separated from conditioned spaces by uninsulated walls, floors or ceilings, or where they contain uninsulated ~~ducts~~ *ducts*, piping or other sources of heating or cooling.

Add new definition as follows:

DAMPER. A manually or automatically controlled device to regulate draft or the rate of flow of air or combustion gases.

Revise as follows:

DUCT SYSTEM. ~~A continuous passageway for the transmission of air that, in addition to ducts, includes duct fittings, dampers, plenums, fans and accessory air-handling equipment and appliances~~ A system that consists of *space conditioning equipment*, *ductwork*, and shall include any apparatus installed in connection therewith.

Add new definition as follows:

DUCTWORK. The assemblies of connected *ducts*, *plenums*, boots, fittings, *dampers*, supply registers, return grilles, and filter grilles through which air is supplied to or returned from the space to be heated or cooled. Supply ductwork delivers air to the spaces from the *space conditioning equipment*. Return ductwork conveys air from the spaces back to the *space conditioning equipment*.

HEAT EXCHANGER. A device that transfers heat from one medium to another.

OCCUPIABLE SPACE. An enclosed space intended for human activities, excluding those spaces intended primarily for other purposes, such as storage rooms and equipment rooms, that are only intended to be occupied occasionally and for short periods of time.

PLENUM. An enclosed portion of the building structure, other than an *occupiable space* being conditioned, that is designed to allow air movement, and thereby serve as part of the supply or return *ductwork*.

SPACE CONDITIONING. The treatment of air so as to control simultaneously the temperature, humidity, cleanness and distribution of the air to meet the requirements of a conditioned space.

SPACE CONDITIONING EQUIPMENT. The *heat exchangers*, *air-handling units*, filter boxes, and any apparatus installed in connection therewith used to provide *space conditioning*.

Revise as follows:

R401.3 Certificate. A permanent certificate shall be completed by the builder or other approved party and posted on a wall in the space where the furnace is located, a utility room or an *approved* location inside the *building*. Where located on an electrical panel, the certificate shall not cover or

obstruct the visibility of the circuit directory *label*, service disconnect *label* or other required labels. The certificate shall indicate the following:

1. **The predominant *R*-values of insulation installed in or on ceilings, roofs, walls, foundation components such as slabs, *basement walls*, *crawl space walls* and floors and *ducts* ~~ducts~~ outside *conditioned spaces*.**
2. ***U*-factors of fenestration and the *solar heat gain coefficient* (SHGC) of fenestration. Where there is more than one value for any component of the building envelope, the certificate shall indicate both the value covering the largest area and the area weighted average value if available.**
3. **The results from any required *duct system* ~~duct system~~ and building envelope air leakage testing performed on the building.**

4. The types, sizes and efficiencies of heating, cooling and service water-heating equipment. Where a gas-fired unvented room heater, electric furnace or baseboard electric heater is installed in the residence, the certificate shall indicate "gas-fired unvented room heater," "electric furnace" or "baseboard electric heater," as appropriate. An efficiency shall not be indicated for gas-fired unvented room heaters, electric furnaces and electric baseboard heaters.
5. Where on-site *photovoltaic panel* systems have been installed, the array capacity, inverter efficiency, panel tilt and orientation shall be noted on the certificate.
6. For buildings where an Energy Rating Index score is determined in accordance with Section R406, the Energy Rating Index score, both with and without any on-site generation, shall be listed on the certificate.
7. The code edition under which the structure was permitted, the compliance path used, and where applicable, the additional efficiency measures selected for compliance with R408.
8. Where a solar-ready zone is provided, the certificate shall indicate the location, and dimensions.

R402.2.9 Basement walls. Basement walls shall be insulated in accordance with Table R402.1.3. Exception: Basement walls associated with unconditioned basements where all of the following requirements are met:

1. The floor overhead, including the underside stairway stringer leading to the basement, is insulated in accordance with Section R402.1.3 and applicable provisions of Sections R402.2 and R402.2.8.
2. There are no uninsulated ~~duct~~ *ductwork*, domestic hot water piping, or hydronic heating surfaces exposed to the basement.
3. There are no HVAC supply or return diffusers serving the basement.
4. The walls surrounding the stairway and adjacent to *conditioned space* are insulated in accordance with Section R402.1.3 and applicable provisions of Section R402.2.
5. The door(s) leading to the basement from *conditioned spaces* are insulated in accordance with Section R402.1.3 and applicable provisions of Section R402.2, and weatherstripped in accordance with Section R402.5.
6. The building thermal envelope separating the basement from adjacent *conditioned spaces* complies with Section R402.5.

TABLE R402.5.1.1 AIR BARRIER, AIR SEALING AND INSULATION INSTALLATION[a]

Portions of table not shown remain unchanged.

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
Shafts, penetrations	*Duct* ~~Duct~~ and flue shafts to exterior or unconditioned space shall be sealed. Utility penetrations of the air barrier shall be caulked, gasketed or otherwise sealed and shall allow for expansion, contraction of materials and mechanical vibration.	Insulation shall be fitted tightly around utilities passing through shafts and penetrations in the building thermal envelope to maintain required *R*-value.
Recessed lighting	Recessed light fixtures installed in the building thermal envelope shall be air sealed in accordance with Section R402.5.5.	Recessed light fixtures installed in the building thermal envelope shall be airtight and IC rated, and shall be buried in or surrounded with insulation.
Electrical,communication, and other equipment boxes, housings, and enclosures	Boxes, housing, and enclosures that penetrate the air barrier shall be caulked, taped, gasketed, or otherwise sealed to the air barrier element being penetrated. All concealed openings into the box, housing, or enclosure shall be sealed. The continuity of the air barrier shall be maintained around boxes, housings, and enclosures that penetrate the air barrier. Alternatively, air-sealed boxes shall be installed in accordance with R402.5.6.	Boxes, housing, and enclosures shall be ~~burried~~ buried in or surrounded by insulation.
HVAC register boots	HVAC supply and return register boots ~~that penetrate building thermal envelope~~ shall be sealed to the subfloor, wall covering or ceiling penetrated by the boot.	HVAC supply and return register boots located ~~in~~ within a ~~the building's thermal envelope~~ *building thermal envelope* assembly shall be buried ~~burried~~ in or ~~and~~ surrounded by insulation.

a. Inspection of log walls shall be in accordance with the provisions of ICC 400.

b. Insulation full enclosure is not required in unconditioned/ventilated attic spaces and at rim joists.

SECTION R403 SYSTEMS

Revise as follows:

R403.3 Duct systems. ~~Ducts and air handlers~~ *Duct systems* shall be installed in accordance with Sections R403.3.1 through R403.3.~~8~~7~~9~~.

Exception: *Ducts* serving ventilation systems that are not integrated with *duct systems* serving heating or cooling systems.

R403.3.1 ~~Ducts~~ Ductwork located outside conditioned space. Supply and return *ductwork* ~~*ducts*~~ located outside *conditioned space* shall be insulated to an *R*-value of not less than R-8 for *ducts* 3 inches (76 mm) in diameter and larger and not less than R-6 for *ducts* smaller than 3 inches (76 mm) in diameter. *Ductwork* ~~*Ducts*~~ buried beneath a building shall be insulated as required per this section or have an equivalent *thermal distribution efficiency*. Underground *ductwork* ~~*ducts*~~ utilizing the *thermal distribution efficiency* method shall be listed and *labeled* to indicate the *R*-value equivalency.

R403.3.2 Ducts ~~systems~~ located in conditioned space. For ~~ductwork~~ *duct systems* to be considered inside a *conditioned space*, the *space conditioning equipment* shall be located completely within the *continuous air barrier* and ~~within~~ the *building thermal envelope*. The *ductwork* ~~it~~ shall comply with ~~one of~~ the following:

1. The ~~duct system~~ *ductwork* shall be located completely within the *continuous air barrier* and ~~within~~ the building thermal envelope.

2. *Ductwork* ~~Ductwork~~in ventilated attic spaces or unvented attics with vapor diffusion ports shall be buried within ceiling insulation in accordance with Section R403.3.3 and ~~all of~~ shall comply with the following ~~conditions shall exist~~:

   2.1. ~~The air handler is located completely within the *continuous air barrier* and within the *building thermal envelope*.~~

   2.2 1. The ~~duct~~ *ductwork* leakage, as measured either by a rough-in test of the supply and return ~~ducts~~ *ductwork* or a post-construction ~~total~~ *duct system* leakage test to outside the *building thermal envelope* in accordance with Section R403.3. 5~~6~~, ~~is less than or equal to~~ is not greater than 1.5 cubic feet per minute (42.5 L/min) per 100 square feet (9.29 m^2) of *conditioned floor area* served by the *duct system*.

   2.3 2. The ceiling insulation *R*-value installed against and above the insulated ~~duct~~ *ductwork* is greater than or equal to the proposed ceiling insulation *R*-value, less the *R*-value of the insulation on the ~~duct~~ *ductwork*.

3. *Ductwork* ~~located in~~ contained within wall or floor building assemblies separating unconditioned from conditioned space shall comply with the following:

   3.1. A *continuous air barrier* shall be installed as part of the building assembly between the ~~duct~~ *ductwork* and the unconditioned space.

   3.2. ~~Ducts~~ *Ductwork* shall be installed in accordance with Section R403.3.1.

   Exception: Where the building assembly cavities containing ~~ducts~~ *ductwork* have been air sealed in accordance with Section R402.5.1, duct insulation is not required.

   3.3. Not less than R-10 assembly insulation, ~~and~~ or not less than 50 percent of the required R-value specified in Table R402.1.3, whichever is greater, shall be located between the ~~duct~~ *ductwork* and the unconditioned space.

   3.4 ~~For ducts in these building assemblies to be considered within conditioned space, the air handling equipment shall be installed within conditioned space.~~ Segments of ductwork contained within these building assemblies shall not be considered completely inside *conditioned space* in Sections R405 or R406.

R403.3.3 Ductwork ~~Ducts~~ buried within ceiling insulation. Where supply and return *ductwork* ~~air ducts~~ are partially or completely buried in ceiling insulation, such *ductwork* ~~ducts~~ shall comply with ~~all of~~ the following:

1. The supply and return ~~ducts~~ *ductwork* shall be insulated with ~~have an insulation *R*-value~~ not less than R-8 insulation.
2. At all points along ~~each duct~~ the *ductwork*, the sum of the ceiling insulation *R*-value against and above the top of the ~~duct~~ *ductwork*, and against and below the bottom of the ~~duct~~ *ductwork*, shall be not less than R-19, excluding the *R*-value of the duct insulation.
3. In Climate Zones 0A, 1A, 2A and 3A, the supply ~~ducts~~ *ductwork* shall be completely buried within ceiling insulation, insulated to an *R*-value of not less than R-13 and in compliance with the vapor retarder requirements of Section 604.11 of the International Mechanical Code or Section M1601.4.6 of the International Residential Code, as applicable.

   Exception: Sections of the supply ~~ducts~~ *ductwork* that are less than 3 feet (914 mm) from the supply outlet ~~shall not be required to comply with these requirements~~.

4. In Climate Zones 0A, 1A, 2A and 3A ~~when~~ where installed in an unvented attic with vapor diffusion ports, the supply ~~ducts~~ *ductwork* shall be completely buried within ceiling insulation, insulated to an *R*-value of not less than R-8 and in compliance with the vapor retarder requirements of Section 604.11 of the *International Mechanical Code* or Section M1601.4.6 of the *International Residential Code*, as applicable.

   Exception: Sections of the supply ~~ducts~~ *ductwork* duct that are less than 3 feet (914 mm) from the supply outlet ~~shall not be required to comply with these requirements~~.

4.1 Air permeable insulation installed in unvented attics shall ~~be in compliance~~ comply with ~~the requirements of~~ Section R806.5.5.2 of the *International Residential Code*.

R403.3.3.1 Effective R-value of deeply buried ducts. Where using the Building Simulated Performance Compliance Option in accordance with Section R401.2.2, sections of ~~ducts~~ *ductwork* that are installed in accordance with Section R403.3.3 surrounded with blown-in attic insulation having an *R*-value of R-30 or greater and located such that the top of the ~~duct~~ *ductwork* is not less than 3.5 inches (89 mm) below the top of the insulation, shall be considered as having an effective duct insulation *R*-value of R-25.

R403.3.4 Sealing. ~~Ducts, air handlers~~ *Ductwork*, *air-handling units* and filter boxes shall be sealed. Joints and seams shall comply with either the International Mechanical Code or International Residential Code, as applicable.

R403.3.4.1 Sealed ~~air handler~~ air-handling unit. ~~Air handlers~~*Air-handling units* shall have a manufacturer's designation for an air leakage of not greater than 2 percent of the design airflow rate when tested in accordance with ASHRAE 193.

R403.3.5 Duct system testing. Each *duct system* ~~ducts system~~ shall be tested for air leakage in accordance with ANSI/RESNET/ICC 380 or ASTM E1554 . Total leakage shall be measured with a pressure differential of 0.1 inch water gauge ~~w.g.~~(25 Pa) across the ~~system~~ *duct system* and

shall include the measured leakage from both the supply and return *ductwork*. ~~Registers shall be sealed during the test.~~ A written report of the test results shall be signed by the party conducting the test and provided to the *code official*. *Duct system* ~~Duct system~~ leakage testing at either rough-in or post-construction shall be permitted with or without the installation of registers or grilles. Where installed, registers and grilles shall be temporarily sealed during the test. Where not installed, the face of the register boots shall be temporarily sealed.

Exceptions:

1. Testing shall not be required for *duct systems* ~~duct systems~~ serving ventilation systems that are not integrated with *duct systems* ~~duct systems~~ serving heating or cooling systems.
2. Testing shall not be required where there is not more than 10 feet of total *ductwork* external to the *space conditioning equipment* and both the following are met :
   a. The *duct system* is located entirely within *conditioned space* .
   b. The *ductwork* does not include *plenums* constructed of building cavities or sheetrock.
3. W here the *space conditioning equipment* is not installed , testing shall be permitted. The total measured leakage of the supply and return *ductwork* shall be less than or equal to 3.0 cubic f eet per minute (85 L/min) per 100 square feet (9.29 m^2) of *conditioned floor area.*

~~2~~ 4. Where tested in accordance with Section R403.3.7, testing of each *duct system* ~~duct system~~ is not required.

R403.3.6 Duct system leakage. The total measured ~~duct system~~ *duct system* leakage shall not be greater than the values in Table R403.3.6, based on the conditioned floor area, number of ducted returns, and location of the *duct system.* For buildings complying with Section R405 or R406, where ~~duct system~~ *duct system* duct system leakage to outside is tested in accordance with ANSI/RESNET/ICC 380 or ASTM E1554, the leakage to outside value shall not be used for compliance with this section, but shall be permitted to be used in the calculation procedures of Section R405 and R406.

TABLE R403.3.6 MAXIMUM TOTAL DUCT SYSTEM LEAKAGE

ROUGH IN	POST CONSTRUCTION	
Duct systems serving more than 1,000 ft² of conditioned floor area	cfm/100 ft² (LPM/9.29 m²)	cfm/100 ft² (LPM/9.29 m²)
Air handler is not installed	3 (85)	NA
Air handler is installed	4 (113.3)	4 (113.3)
Duct systems located in conditioned space, with air handler installed	8 (226.6)	8 (226.6)
Duct systems serving less than or equal to 1,000 ft² of conditioned floor area	cfm (LPM)	cfm (LPM)
Air handler is not installed	30 (849.5)	NA
Air handler is installed	40 (1132.7)	40 (1132.7)
Duct systems located in conditioned space, with air handler installed	80 (2265.4)	80 (2265.4)

	Duct systems serving more than 1,000 ft² of conditioned floor area		*Duct systems* serving less than or equal to 1,000 ft² or less of conditioned floor area
	cfm/100 ft² (LPM/9.29 m²)		cfm (LPM)
	Number of ducted returns [a]		
	< 3	≥ 3	Any
Space conditioning equipment is not installed [b, e]	3 (85)	4 (113.3)	30 (850 849.5)
All components of the *duct system* are installed	4 (113.3)	6 (170)	40 (11332.7)
Space conditioning equipment is not installed, but the *ductwork* is located entirely in *conditioned space* [cd]	6 (170)	8(227)	60 (1699)
All components of the *duct system* are installed and entirely located in *conditioned space* [c]	8 (2276.6)	12(340)	80 (2265.4)

a. A ducted return is a *duct* made of sheet metal or flexible *duct* that connects one or more return grilles to the return-side inlet of the *air-handling unit*. Any other approach to convey air from return or transfer grille(s) to the *air-handling unit* does not constitute a ducted return for the purpose of determining maximum total *duct system* leakage allowance.

b. Where the *space conditioning equipment* is not installed, *duct system* testing shall be permitted and shall include the measured leakage from both the supply and return *ductwork*. *Duct system* testing shall not be performed if the return *ductwork* is not installed.

c. For *duct systems* to be considered inside a *conditioned space*, where the *ductwork* is located in ventilated attic spaces or unvented attics with vapor diffusion ports, *duct system* leakage to outside shall comply with Item 2.1 of Section R403.3.2. ~~be measured in accordance with ANSI/RESNET/ICC 380 or ASTM E1554 and shall be less than or equal to 1.5 cubic feet per minute (42.5 L/min) per 100 square feet (9.29 m²) of *conditioned floor area* served by the *duct system*.~~

d. Prior to certificate of occupancy, where the *air-handling unit* is verified as being located in unconditioned space, the total *duct system* leakage must be re-tested.

R403.3.7 Dwelling unit sampling. For buildings with eight or more *dwelling units* the duct systems in the greater of seven, or 20 percent of the *dwelling units* in the building shall be tested, including a top floor unit, a ground floor unit, a middle floor unit, and the unit with the largest conditioned floor area. Where buildings have fewer than eight *dwelling units*, the duct systems in each unit shall be tested. Where the leakage ~~rate~~ of a *duct system* is greater than the maximum permitted *duct system* leakage ~~rate~~, corrective actions shall be made to the *duct system* ~~system~~ and the *duct system* shall be retested until it passes. For each tested *dwelling unit* that has a greater total *duct system* leakage ~~rate~~ than the maximum permitted *duct system* leakage ~~rate~~, an additional three *dwelling units*, including the corrected unit, shall be tested.

R403.3.~~8~~2 Building cavities. *Building* framing cavities shall not be used as ~~ducts~~ *ductwork* or *plenums*.

R403.3.1 ~~Duct~~ System Design. *Duct systems* serving one or two *dwelling units* shall be designed and sized in accordance with ANSI/ACCA Manual D. *Duct systems* serving more than two *dwelling units* shall be sized in accordance with the ASHRAE Handbook of Fundamentals, ANSI/ACCA Manual D, or other equivalent computation procedure.

TABLE R403.6.2 WHOLE-DWELLING MECHANICAL VENTILATION SYSTEM FAN EFFICACY[a]

Portions of table not shown remain unchanged.

SYSTEM TYPE	AIRFLOW RATE (CFM)	MINIMUM EFFICACY (CFM/WATT)	TEST PROCEDURE
~~Air handler~~ *Air-handling unit* that is integrated to tested and *listed* HVAC equipment	Any	1.2	Outdoor airflow as specified. *Air-handling unit* ~~Air handler~~ fan power determined in accordance with the HVAC appliance's test method referenced by Section C403.3.2 of the IECC-Commercial Provisions.

For SI: 1 cubic foot per minute = 0.47 L/s.

a. **Design outdoor airflow rate/watts of fan used.**

SECTION R405 SIMULATED BUILDING PERFORMANCE

Revise as follows:

R405.3.2.1 Compliance report for permit application. A compliance report submitted with the application for building permit shall include the following:

1. **Building street address, or other *building site* identification.**
2. **The name of the individual performing the analysis and generating the compliance report.**
3. **The name and version of the compliance software tool.**
4. **Documentation of all inputs entered into the software used to produce the results for the reference design and/or the rated home.**
5. **A certificate indicating that the proposed design complies with Section R405.3. The certificate shall document the building components' energy specifications that are included in the calculation including: component-level insulation *R*-values or *U*-factors; ~~duct system~~ *duct system* and building envelope air leakage testing assumptions; and the type and rated efficiencies of proposed heating, cooling, mechanical ventilation and service water-heating equipment to be installed. If on-site renewable energy systems will be installed, the certificate shall report the type and production size of the proposed system.**
6. **Where a site-specific report is not generated, the proposed design shall be based on the worst-case orientation and configuration of the rated home.**

TABLE R405.4.2(1) SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

Portions of table not shown remain unchanged.

<table>
<tr><th>BUILDING COMPONENT</th><th>STANDARD REFERENCE DESIGN</th><th>PROPOSED DESIGN</th></tr>
<tr><td></td><td>Duct location</td><td>Duct location: as proposed</td></tr>
<tr><td></td><td>
<table>
<tr><th>Foundation type</th><th>Slab on grade</th><th>Unconditioned crawl space</th><th>Basement or conditioned crawl space</th></tr>
<tr><td>Duct location (supply and return)</td><td>One-story building: 100% in unconditioned attic

All other: 75% in unconditioned attic and 25% inside conditioned space</td><td>One-story building: 100% in unconditioned crawl space

All other: 75% in unconditioned crawlspace and 25% inside conditioned space</td><td>~~75~~50% inside conditioned space

~~25~~50% unconditioned attic</td></tr>
</table>
</td><td></td></tr>
<tr><td></td><td>Duct Insulation: in accordance with Section R403.3.1</td><td>Duct Insulation: as proposed</td></tr>
<tr><td>Thermal distribution systems</td><td>~~Duct system~~ Duct system leakage to outside:
For duct systems serving > 1,000ft² of conditioned floor area, the duct leakage to outside rate shall be 4 cfm (113.3 L/min) per 100 ft² (9.29 m²) of conditioned floor area.
For duct systems serving ≤ 1,000ft² of conditioned floor area, the duct leakage to outside rate shall be 40 cfm (1132.7 L/min).</td><td>Duct System Leakage to Outside: The measured total duct system leakage rate shall be entered into the software as the duct system leakage to outside rate.
Exceptions:
1. When duct system leakage to outside is tested in accordance ANSI/ RESNET/ICC 380 or ASTM E1554, the measured value shall be permitted to be entered.
2. When total duct system leakage is measured without the space conditioning equipment ~~air handler~~ installed, the simulation value shall be 4 cfm (113.3 L/min) per 100 ft² (9.29 m²) of conditioned floor area.</td></tr>
<tr><td></td><td>Distribution System Efficiency (DSE):

For hydronic systems and ductless systems a thermal distribution system efficiency (DSE) of 0.88 shall be applied to both the heating and cooling system efficiencies.</td><td>Distribution System Efficiency (DSE):

For hydronic systems and ductless systems, DSE shall be as specified in Table R405.4.2(2).</td></tr>
</table>

For SI: 1 square foot = 0.93 m², 1 British thermal unit = 1055 J, 1 pound per square foot = 4.88 kg/m², 1 gallon (US) = 3.785 L, °C = (°F-32)/1.8, 1 degree = 0.79 rad.

a. Where required by the code official, testing shall be conducted by an approved party. Hourly calculations as specified in the ASHRAE *Handbook of Fundamentals*, or the equivalent, shall be used to determine the energy loads resulting from infiltration.

b. The combined air exchange rate for infiltration and mechanical ventilation shall be determined in accordance with Equation 43 of 2001 ASHRAE *Handbook of Fundamentals,* page 26.24 and the "Whole-house Ventilation" provisions of 2001 ASHRAE *Handbook of Fundamentals,* page 26.19 for intermittent mechanical ventilation.

c. Thermal storage element shall mean a component that is not part of the floors, walls or ceilings that is part of a passive solar system, and that provides thermal storage such as enclosed water columns, rock beds, or phase-change containers. A thermal storage element shall be in the same room as fenestration that faces within 15 degrees (0.26 rad) of true south, or shall be connected to such a room with pipes or ducts that allow the element to be actively charged.

d. For a proposed design with multiple heating, cooling or water heating systems using different fuel types, the applicable standard reference design system capacities and fuel types shall be weighted in accordance with their respective loads as calculated by accepted engineering practice for each equipment and fuel type present.

e. For a proposed design without a proposed heating system, a heating system having the prevailing federal minimum efficiency shall be assumed for both the standard reference design and proposed design.

f. For a proposed design home without a proposed cooling system, an electric air conditioner having the prevailing federal minimum efficiency shall be assumed for both the standard reference design and the proposed design.

g. For a proposed design the following assumptions shall be made for both the proposed design and standard reference design.

Fuel Type: Same as the predominant heating fuel type

Rated Storage Volume: 40 Gallons

Draw Pattern: Medium

Efficiency: Uniform Energy Factor complying with 10 CFR §130.32

h. For residences with conditioned basements, R-2 and R-4 residences, and for townhouse units, the following formula shall be used to determine glazing area:

AF $= A_s \times FA \times F$

where:

AF = Total glazing area.

A_s = Standard reference design total glazing area.

FA = (Above-grade thermal boundary gross wall area)/(above-grade boundary wall area + 0.5 × below-grade boundary wall area).

F = (above-grade thermal boundary wall area)/(above-grade thermal boundary wall area + common wall area) or 0.56, whichever is greater.

and where:

- Thermal boundary wall is any wall that separates *conditioned space* from unconditioned space or ambient conditions.
- Above-grade thermal boundary wall is any thermal boundary wall component not in contact with soil.
- Below-grade boundary wall is any thermal boundary wall in soil contact.

- Common wall area is the area of walls shared with an adjoining dwelling unit.

i. The factor for the compactness of the hot water distribution system is the ratio of the area of the rectangle that bounds the source of hot water and the fixtures that it serves (the "hot water rectangle") divided by the floor area of the dwelling.

1. Sources of hot water include water heaters, or in multiple-family buildings with central water heating systems, circulation loops or electric heat traced pipes.
2. The hot water rectangle shall include the source of hot water and the points of termination of all hot water fixture supply piping.
3. The hot water rectangle shall be shown on the floor plans and the area shall be computed to the nearest square foot.
4. Where there is more than one water heater and each water heater serves different plumbing fixtures and appliances, it is permissible to establish a separate hot water rectangle for each hot water distribution system and add the area of these rectangles together to determine the compactness ratio.
5. The basement or attic shall be counted as a story when it contains the water heater.
6. Compliance shall be demonstrated by providing a drawing on the plans that shows the hot water distribution system rectangle(s), comparing the area of the rectangle(s) to the area of the dwelling and identifying the appropriate compactness ratio and *HWDS* factor.

j. For a proposed design with electric resistance heating, a split system heat pump complying with 10 CFR §430.32 (2021) shall be assumed modeled in the standard reference design.

k. For heating systems, cooling systems, or water heating systems not included in Table R405.4.2(1), the standard reference design shall be the same as proposed design.

l. Only sections of *ductwork* that are installed in accordance with Items 1 or 2 of Section R403.3.2, shall be assumed to be located inside *conditioned space*. All other sections of *ductwork* shall not be assumed to be located completely inside *conditioned space*.

m. Sections of *ductwork* installed in accordance with Section R403.3.3.1, shall be assumed to have an effective duct insulation R-value of R-25.

TABLE R405.4.2(2) DEFAULT DISTRIBUTION SYSTEM EFFICIENCIES FOR PROPOSED DESIGNS[a]

DISTRIBUTION SYSTEM CONFIGURATION AND CONDITION	FORCED AIR SYSTEMS	HYDRONIC SYSTEMS[b]
Distribution system components located in unconditioned space	NA	0.95
Distribution system components entirely located in *conditioned space*[c]	NA	1
"Ductless" systems[d]	1	NA

a. Default values in this table are for untested distribution systems, which must still meet minimum requirements from ~~form~~ Section R403 ~~for duct system insulation~~.

b. Hydronic systems shall mean those systems that distribute heating and cooling energy directly to individual spaces using liquids pumped through closed-loop piping and that do not depend on ducted, forced airflow to maintain space temperatures.

c. Entire system in *conditioned space* shall mean that no component of the distribution system, ~~including the air handling unit,~~ is located outside of the *conditioned space*.

d. Ductless systems shall be allowed to have forced airflow across a coil but shall not have greater than 10 ft. of ~~any~~ ducted airflow external to the ~~manufacturer's air-handler enclosure~~ *space conditioning equipment*.

SECTION R408

ADDITIONAL EFFICIENCY REQUIREMENTS

Revise as follows:

TABLE R408.2 CREDITS FOR ADDITIONAL ENERGY EFFICIENCY

Portions of table not shown remain unchanged.

Measure Number	Measure Description	Credit Value								
		Climate Zone 0 & 1	Climate Zone 2	Climate Zone 3	Climate Zone 4	Climate Zone 4C	Climate Zone 5	Climate Zone 6	Climate Zone 7	Climate Zone 8
R408.2.4(2)	100% of *duct systems* ~~ducts~~ in *conditioned space*	4	6	8	12	12	15	17	19	20
R408.2.4(3)	≥ 80% of *ductwork* inside *conditioned space*	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.4(~~4~~3)	Reduced total duct leakage	1	1	1	1	1	1	2	2	2

R408.2.4 More efficient ~~duct~~ thermal distribution system option. The thermal distribution system shall ~~meet one of the~~ comply with one of the following ~~efficiencies~~:

1. ~~100 percent of~~ The ductless thermal distribution system or hydronic thermal distribution system is located completely inside the *building thermal envelope*.
2. ~~100 percent of t~~The The *space conditioning equipment* is located inside *conditioned space*. In addition, 100 percent of the *ductwork system* ~~thermal distribution system~~ is located completely inside *conditioned space* as defined by item 1 and item 2 of Section R403.3.2.
3. The *space conditioning equipment* is located inside *conditioned space* and no less than 80 percent of *ductwork* is located completely inside *conditioned space* as defined by item 1 and item 2 of Section R403.3.2. In addition, no more than 20 percent of *ductwork* is contained within building assemblies separating unconditioned from *conditioned space* as defined by item 3 of Section R403.3.2.
4. ~~When~~ Where ~~ducts are~~ *ductwork* is located outside *conditioned space*, the total leakage ~~of the ducts,~~ of the *duct system* measured in accordance with R403.3.5, ~~shall be in accordance with~~ is one of the following:

   4.1 Where the *space conditioning equipment* ~~air handler~~ is installed at the time of testing, total leakage is not greater than 2.0 cubic feet per minute (0.94 L/s) per 100 square feet (9.29 m^2) of conditioned floor area.

   4.2 Where the *space conditioning equipment* ~~air handler~~ is not installed at the time of testing, total leakage is not greater than 1.75 cubic feet per minute (0.83 L/s) per 100 square feet (9.29 m^2) of conditioned floor area.

SECTION R502 ADDITIONS

Revise as follows:

R502.2.2 Heating and cooling systems. HVAC *ductwork* ~~ducts~~ newly installed as part of an *addition* shall comply with Section R403.

Exception: Where *ductwork* ~~ducts~~ from an existing heating and cooling system ~~are~~ is extended into an *addition* Section R403.3.5 and Section R403.3.6 shall not be required.

Section 503 Alterations

Revise as follows:

R503.1.2 Heating and cooling systems. New heating and cooling systems and *ductwork* ~~duct systems~~ that are part of the alteration shall comply with Section R403 and this section . Alterations to existing heating and, ~~cooling~~ systems and *ductwork* ~~duct systems~~ shall comply with this section.

Exception: Where *ductwork* ~~ducts~~ from an existing heating and cooling system ~~are~~ is extended to an *addition*.

R503.1.2.1 ~~Ducts~~ *Ductwork*. HVAC *ductwork* ~~ducts~~ newly installed as part of an alteration shall comply with Section R403.

Exception: Where *ductwork* ~~ducts~~ from an existing heating and cooling system ~~are~~ is extended to an *addition*.

R503.1.2.3 Duct system leakage. Where an *alteration* includes any of the following, *duct systems* ~~ducts~~ shall be tested in accordance with Section R403.3.5 and shall have a total leakage less than or equal to 12.0 cubic feet per minute (339.9 L/min) per 100 square feet (9.29 m^2) of conditioned floor area:

1. **Where 25 percent or more of the registers that are part of the duct system are relocated.**
2. **Where 25 percent or more of the total length of all *ductwork* ~~ducts~~ in the *duct system* are relocated.**
3. **Where the total length of all *ductwork* ~~ducts~~ in the *duct system* is increased by 25 percent or more.**

Exception: *Duct systems* located entirely inside a *conditioned space* in accordance with Section R403.3.2.

Reason: This public comment is being submitted to achieve the following:

- **Better define what the code means when it says "ducts", "ductwork", and "duct system", by using 2021 IMC definitions, modified as needed.**
- **Use these defined terms to better clarify what is meant by "ducts in *conditioned space*" and what components are included in the "total duct leakage test"**
- **Clarify what must be tested during the total duct leakage test (i.e., ALWAYS the return 'ductwork' which now clearly includes sheetrocked plenums, but sometimes air-handler can be excluded if lower allowance is met)**
- **Reduce the use of the phrase "rough-in" and "post-construction" since that is not actually the criteria of importance**

Add a test exemption for ductless systems, including ducted systems with less than 10 ft of ductwork, when in *conditioned space* Provide a greater duct leakage allowance where a greater amount of return ductwork (ducted returns) is installed (like ENERGY STAR).

Bibliography: None

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The proposed changes clarify existing provisions and do not increase the stringency of the requirements.

- RED1-285-22 – AS MODIFIED IN BLUE SINCE APPROVED BY RES HVACR-WH SUBCOMMITTEE

IECC: SECTION 202 (New), SECTION 202, R401.3, R402.2.9, TABLE R402.5.1.1, SECTION R403, R403.3, R403.3.1, R403.3.2, R403.3.3, R403.3.3.1, R403.3.4, R403.3.4.1, R403.3.5, R403.3.6, TABLE R403.3.6, R403.3.7, R403.3.8, TABLE R403.6.2, SECTION R405, R405.3.2.1, TABLE R405.4.2(1), TABLE R405.4.2(2), SECTION R408, TABLE R408.2, R408.2.4, SECTION R502, R502.2.2, SECTION R503, R503.1.2, R503.1.2.1, R503.1.2.3

Proponents: Gary Klein, representing Self (gary@garykleinassociates.com); Mark Lyles, representing California IOUs (markl@newbuildings.org); Gayathri Vijayakumar, representing Steven Winter Associates, Inc. (gvijayakumar@swinter.com)

2024 International Energy Conservation Code [RE Project]

Add new definition as follows:

AIR-HANDLING UNIT. A blower or fan used for the purpose of distributing supply air to a room, space or area.

Revise as follows:

CONDITIONED SPACE. An area, room or space that is enclosed within the *building thermal envelope* and is directly or indirectly heated or cooled. Spaces are indirectly heated or cooled where they communicate through openings with conditioned spaces, where they are separated from conditioned spaces by uninsulated walls, floors or ceilings, or where they contain uninsulated ~~ducts~~ *ducts*, piping or other sources of heating or cooling.

Add new definition as follows:

DAMPER. A manually or automatically controlled device to regulate draft or the rate of flow of air or combustion gases.

Revise as follows:

DUCT SYSTEM. ~~A continuous passageway for the transmission of air that, in addition to ducts, includes duct fittings, dampers, plenums, fans and accessory air-handling equipment and appliances~~ A system that consists of *space conditioning equipment*, *ductwork*, and ~~shall include~~ includes any apparatus installed in connection therewith.

Add new definition as follows:

DUCTWORK. The assemblies of connected *ducts*, *plenums*, boots, fittings, *dampers*, supply registers, return grilles, and filter grilles through which air is supplied to or returned from the space to be heated, ~~or~~ cooled, or ventilated. Supply ductwork delivers air to the spaces from the *space conditioning equipment*. Return ductwork conveys air from the spaces back to the *space conditioning equipment*. Ventilation ductwork conveys air to or from any space.

HEAT EXCHANGER. A device that transfers heat from one medium to another.

OCCUPIABLE SPACE. An enclosed space intended for human activities, excluding those spaces intended primarily for other purposes, such as storage rooms and equipment rooms, that are only intended to be occupied occasionally and for short periods of time.

PLENUM. An enclosed portion of the building structure, other than an *occupiable space* being conditioned, that is designed to allow air movement, and thereby serve as part of the supply or return *ductwork*.

SPACE CONDITIONING. The treatment of air so as to control simultaneously the temperature, humidity, ~~cleanness~~ filtration, and distribution of the air to meet the requirements of a conditioned space.

SPACE CONDITIONING EQUIPMENT. The *heat exchangers*, *air-handling units*, filter boxes, and any apparatus installed in connection therewith used to provide *space conditioning*.

Revise as follows:

R401.3 Certificate. A permanent certificate shall be completed by the builder or other *approved* party and posted on a wall in the space where the furnace is located, a utility room or an *approved* location inside the *building*. Where located on an electrical panel, the certificate shall not cover or obstruct the visibility of the circuit directory *label*, service disconnect *label* or other required labels. The certificate shall indicate the following:

9. The predominant *R*-values of insulation installed in or on ceilings, roofs, walls, foundation components such as slabs, *basement walls*, *crawl space walls* and floors and *ducts* ~~ducts~~ outside *conditioned spaces*.
10. *U*-factors of fenestration and the *solar heat gain coefficient* (SHGC) of fenestration. Where there is more than one value for any component of the building envelope, the certificate shall indicate both the value covering the largest area and the area weighted average value if available.
11. The results from any required *duct system* ~~duct system~~ and building envelope air leakage testing performed on the building.
12. The types, sizes and efficiencies of heating, cooling and service water-heating equipment. Where a gas-fired unvented room heater, electric furnace or baseboard electric heater is installed in the residence, the certificate shall indicate "gas-fired unvented room heater," "electric furnace" or "baseboard electric heater," as appropriate. An efficiency shall not be indicated for gas-fired unvented room heaters, electric furnaces and electric baseboard heaters.

13. Where on-site *photovoltaic panel* systems have been installed, the array capacity, inverter efficiency, panel tilt and orientation shall be noted on the certificate.

14. For buildings where an Energy Rating Index score is determined in accordance with Section R406, the Energy Rating Index score, both with and without any on-site generation, shall be listed on the certificate.

15. The code edition under which the structure was permitted, the compliance path used, and where applicable, the additional efficiency measures selected for compliance with R408.

16. Where a solar-ready zone is provided, the certificate shall indicate the location, and dimensions.

R402.2.9 Basement walls. Basement walls shall be insulated in accordance with Table R402.1.3.

Exception: Basement walls associated with unconditioned basements where ~~all of~~ the following requirements are met:

7. The floor overhead, including the underside stairway stringer leading to the basement, is insulated in accordance with Section R402.1.3 and applicable provisions of Sections R402.2 and R402.2.8.

8. There are no uninsulated ~~duct~~ *ductwork*, domestic hot water piping, or hydronic heating surfaces exposed to the basement.

9. There are no HVAC supply or return diffusers serving the basement.

10. The walls surrounding the stairway and adjacent to *conditioned space* are insulated in accordance with Section R402.1.3 and applicable provisions of Section R402.2.

11. The door(s) leading to the basement from *conditioned spaces* are insulated in accordance with Section R402.1.3 and applicable provisions of Section R402.2, and weatherstripped in accordance with Section R402.5.

12. The building thermal envelope separating the basement from adjacent *conditioned spaces* complies with Section R402.5.

TABLE R402.5.1.1 AIR BARRIER, AIR SEALING AND INSULATION INSTALLATION[a]

Portions of table not shown remain unchanged.

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
Shafts, penetrations	*Duct* ~~Duct~~ and flue shafts to exterior or unconditioned space shall be sealed. Utility penetrations of the air barrier shall be caulked, gasketed or otherwise sealed and shall allow for expansion, contraction of materials and mechanical vibration.	Insulation shall be fitted tightly around utilities passing through shafts and penetrations in the building thermal envelope to maintain required *R*-value.
Recessed lighting	Recessed light fixtures installed in the building thermal envelope shall be air sealed in accordance with Section R402.5.5.	Recessed light fixtures installed in the building thermal envelope shall be airtight and IC rated, and shall be buried in or surrounded with insulation.
Electrical,communication, and other equipment boxes, housings, and enclosures	Boxes, housing, and enclosures that penetrate the air barrier shall be caulked, taped, gasketed, or otherwise sealed to the air barrier element being penetrated. All concealed openings into the box, housing, or enclosure shall be sealed. The continuity of the air barrier shall be maintained around boxes, housings, and enclosures that penetrate the air barrier. Alternatively, air-sealed boxes shall be installed in accordance with R402.5.6.	Boxes, housing, and enclosures shall be ~~burried~~ buried in or surrounded by insulation.
HVAC register boots	HVAC supply and return register boots ~~that penetrate building thermal envelope~~ shall be sealed to the subfloor, wall covering or ceiling penetrated by the boot.	HVAC supply and return register boots located ~~in~~ within a ~~the building's thermal envelope~~ *building thermal envelope* assembly shall be buried ~~burried~~ in or ~~and~~ surrounded by insulation.

c. Inspection of log walls shall be in accordance with the provisions of ICC 400.

d. Insulation full enclosure is not required in unconditioned/ventilated attic spaces and at rim joists.

SECTION R403 SYSTEMS

Revise as follows:

R403.3 Duct systems. ~~Ducts and air handlers~~ *Duct systems* shall be installed in accordance with Sections R403.3.1 through R403.3.~~8~~7~~9~~.

Exception: ~~*Ducts* serving ventilation systems~~ Ventilation *ductwork* ~~that~~ is ~~are~~ not integrated with *duct systems* serving heating or cooling systems.

R403.3.1 ~~Ducts~~ Ductwork located outside conditioned space. Supply and return *ductwork* ~~*duct*s~~ located outside *conditioned space* shall be insulated to an *R*-value of not less than R-8 for *ducts* 3 inches (76 mm) in diameter and larger and not less than R-6 for *ducts* smaller than 3 inches (76 mm) in diameter. *Ductwork* ~~*Duct*s~~ buried beneath a building shall be insulated as required per this section or have an equivalent *thermal distribution efficiency*. Underground *ductwork* ~~*duct*s~~ utilizing the *thermal distribution efficiency* method shall be listed and *labeled* to indicate the *R*- value equivalency.

R403.3.2 Ducts systems located in conditioned space. For ~~ductwork~~ *duct systems* to be considered inside a *conditioned space*, the *space conditioning equipment* shall be located completely ~~within the *continuous air barrier* and within~~ on the conditioned side of the *building thermal envelope*. The *ductwork* ~~it~~ shall comply with ~~one of~~ the following as applicable:

~~4.~~ The ~~duct system~~ *ductwork* shall be located completely ~~within the *continuous air barrier* and within~~ on the conditioned side of the *building thermal envelope.*

5. *Ductwork* ~~Ductwork~~ in ventilated attic spaces or unvented attics with vapor diffusion ports shall be buried within ceiling insulation in accordance with Section R403.3.3 and ~~all of~~ shall comply with the following ~~conditions shall exist~~:

5.1. ~~The air handler is located completely within the *continuous air barrier* and within the *building thermal envelope*.~~

2.~~2~~1. The ~~duct~~ *ductwork* leakage, as measured either by a rough-in test of the supply and return ~~ducts~~ *ductwork* or a post-construction ~~total~~ *duct system* leakage test to outside the *building thermal envelope* in accordance with Section R403.3. ~~5~~6, ~~is less than or equal to~~ is not greater than 1.5 cubic feet per minute (42.5 L/min) per 100 square feet (9.29 m^2) of *conditioned floor area* served by the *duct system*.

2.~~3~~2. The ceiling insulation *R*-value installed against and above the insulated ~~duct~~ *ductwork* is greater than or equal to the proposed ceiling insulation *R*-value, less the *R*-value of the insulation on the ~~duct~~ *ductwork*.

6. *Ductwork* ~~located in~~ contained within wall or floor ~~building~~ assemblies separating unconditioned from conditioned space shall comply with the following:

6.1. A *continuous air barrier* shall be installed as part of the building assembly between the ~~duct~~ *ductwork* and the unconditioned space.

6.2. ~~Ducts~~ *Ductwork* shall be installed in accordance with Section R403.3.1.

Exception: Where the building assembly cavities containing ~~ducts~~ *ductwork* have been air sealed in accordance with Section R402.5.1, duct insulation is not required.

6.3. Not less than R-10 ~~assembly~~ insulation, ~~and~~ or not less than 50 percent of the ~~assembly~~ ~~insulation~~ required insulation R-value specified in Table R402.1.3, whichever is greater, shall be located between the ~~duct~~ *ductwork* and the unconditioned space.

~~3.4 For ducts in these building assemblies to be considered within conditioned space, the air handling equipment shall be installed within conditioned space.~~

Segments of *ductwork* contained within ~~these~~ such building assemblies shall not be considered completely inside *conditioned space* ~~in~~ for compliance with Sections R405 or R406.

R403.3.3 Ductwork ~~Ducts~~ buried within ceiling insulation. Where supply and return *ductwork* ~~air ducts~~ ~~are~~ is partially or completely buried in ceiling insulation, such *ductwork* ~~ducts~~ shall comply with ~~all of~~ the following:

5. The supply and return ~~ducts~~ *ductwork* shall be insulated with ~~have an insulation *R*-value~~ not less than R-8 insulation.

6. At all points along ~~each duct~~ the *ductwork*, the sum of the ceiling insulation *R*-value against and above the top of the ~~duct~~ *ductwork*, and against and below the bottom of the ~~duct~~ *ductwork*, shall be not less than R-19, excluding the *R*-value of the duct insulation.

7. In Climate Zones 0A, 1A, 2A and 3A, the supply ~~ducts~~ *ductwork* shall be completely buried within ceiling insulation, insulated to an *R*-value of not less than R-13 and in compliance with the vapor retarder requirements of Section 604.11 of the *International Mechanical Code* or Section M1601.4.6 of the *International Residential Code*, as applicable**.**

Exception: Sections of the supply ~~ducts~~ *ductwork* that are less than 3 feet (914 mm) from the supply outlet ~~shall not be required to comply with these requirements~~.

8. In Climate Zones 0A, 1A, 2A and 3A ~~when~~ where installed in an unvented attic with vapor diffusion ports, the supply ~~ducts~~ *ductwork* shall be completely buried within ceiling insulation, insulated to an *R*-value of not less than R-8 and in compliance with the vapor retarder requirements of Section 604.11 of the *International Mechanical Code* or Section M1601.4.6 of the *International Residential Code*, as applicable.

Exception: Sections of the supply ~~ducts~~ *ductwork* duct that are less than 3 feet (914 mm) from the supply outlet ~~shall not be required to comply with these requirements~~.

8.1 Air permeable insulation installed in unvented attics shall ~~be in compliance~~ comply with ~~the requirements of~~ Section R806.5.2 of the *International Residential Code*.

R403.3.3.1 Effective R-value of deeply buried ducts. Where ~~complying using Section R405, the Building Simulated Performance Compliance Option in accordance with Section R401.2.2,~~ sections of ~~ducts~~ *ductwork* that are installed in accordance with Section R403.3.3 surrounded with blown-in attic insulation having an *R*-value of R-30 or greater, and located such that the top of the ~~duct~~ *ductwork* is not less than 3.5 inches (89 mm) below the top of the insulation, shall be considered as having an effective duct insulation *R*-value of R-25.

R403.3.4 Sealing. ~~Ducts, air handlers~~ *Ductwork*, *air-handling units* and filter boxes shall be sealed. Joints and seams shall comply with ~~either~~ the International Mechanical Code or the International Residential Code, as applicable.

R403.3.4.1 Sealed ~~air handler~~ air-handling unit. ~~Air handlers~~ *Air-handling units* shall have a manufacturer's designation for an air leakage ~~of~~ not greater than 2 percent of the design airflow rate when tested in accordance with ASHRAE 193.

R403.3.5 Duct system testing. Each *duct system* ~~ducts system~~ shall be tested for air leakage in accordance with ANSI/RESNET/ICC 380 or ASTM E1554. Total leakage shall be measured with a pressure differential of 0.1 inch water gauge ~~w.g.~~(25 Pa) across the ~~system~~ *duct system* and shall include the measured leakage from ~~both~~ the supply and return *ductwork*. ~~Registers shall be sealed during the test.~~ A written report of the test results shall be signed by the party conducting the test and provided to the *code official*. *Duct system* ~~Duct system~~ leakage testing at either rough-in or post-construction shall be permitted with or without the installation of registers or grilles. Where installed, registers and grilles shall be ~~temporarily~~ sealed during the test. Where registers and grilles are not installed, the face of the register boots shall be ~~temporarily~~ sealed during the test.

Exceptions:

4. Testing shall not be required for *duct systems* ~~duct systems~~ serving ventilation systems that are not integrated with *duct systems* ~~duct systems~~ serving heating or cooling systems.

5. Testing shall not be required where there is not more than 10 feet of total *ductwork* external to the *space conditioning equipment* and both the following are met :

   a. The *duct system* is located entirely within *conditioned space* .

   b. The *ductwork* does not include *plenums* constructed of building cavities or ~~sheetrock~~ gypsum board.

6. Where the *space conditioning equipment* is not installed, testing shall be permitted. The total measured leakage of the supply and return *ductwork* shall be less than or equal to 3.0 cubic feet per minute (85 L/min) per 100 square feet (9.29 m^2) of *conditioned floor area.*

~~2~~ 4. Where tested in accordance with Section R403.3.7, testing of each *duct system* ~~duct system~~ is not required.

R403.3.6 Duct system leakage. The total measured ~~duct system~~ *duct system* leakage shall not be greater than the values in Table R403.3.6, based on the conditioned floor area, number of ducted returns, and location of the *duct system.* For buildings complying with Section R405 or R406, where ~~duct system~~ *duct system* ~~duct system~~ leakage to outside is tested in accordance with ANSI/RESNET/ICC 380 or ASTM E1554, the leakage to outside value shall not be used for compliance with this section, but shall be permitted to be used in the calculation procedures of Section R405 and R406.

TABLE R403.3.6 MAXIMUM TOTAL DUCT SYSTEM LEAKAGE

~~ROUGH IN~~	~~POST CONSTRUCTION~~	
~~Duct systems serving more than 1,000 ft^2 of conditioned floor area~~	~~cfm/100 ft^2 (LPM/9.29 m^2)~~	~~cfm/100 ft^2 (LPM/9.29 m^2)~~
~~Air handler is not installed~~	~~3 (85)~~	~~NA~~
~~Air handler is installed~~	~~4 (113.3)~~	~~4 (113.3)~~
~~Duct systems located in conditioned space, with air handler installed~~	~~8 (226.6)~~	~~8 (226.6)~~
~~Duct systems serving less than or equal to 1,000 ft^2 of conditioned floor area~~	~~cfm (LPM)~~	~~cfm (LPM)~~
~~Air handler is not installed~~	~~30 (849.5)~~	~~NA~~
~~Air handler is installed~~	~~40 (1132.7)~~	~~40 (1132.7)~~
~~Duct systems located in conditioned space, with air handler installed~~	~~80 (2265.4)~~	~~80 (2265.4)~~

	Duct systems serving more than 1,000 ft² of conditioned floor area		*Duct systems* serving ~~less than or equal to~~ 1,000 ft² or less of conditioned floor area
	cfm/100 ft² (LPM/9.29 m²)		cfm (LPM)
	Number of ducted returns [a]		
	< 3	≥ 3	Any
Space conditioning equipment is not installed [b, e]	3 (85)	4 (113~~.3~~)	30 (850 ~~849.5~~)
All components of the *duct system* are installed	4 (113~~.3~~)	6 (170)	40 (11332~~.7~~)
Space conditioning equipment is not installed, but the *ductwork* is located entirely in *conditioned space* [cd]	6 (170)	8(227)	60 (1699)
All components of the *duct system* are installed and entirely located in *conditioned space* [c]	8 (2276~~.6~~)	12(340)	80 2265~~.4~~)

e. A ducted return is a *duct* made of sheet metal or flexible *duct* that connects one or more return grilles to the return-side inlet of the *air-handling unit*. Any other ~~approach~~ method to convey air from return or transfer grille(s) to the *air-handling unit* does not constitute a ducted return for the purpose of determining maximum total *duct system* leakage allowance.

f. ~~Where the *space conditioning equipment* is not installed, *duct system* testing shall be permitted and shall include the measured leakage from both the supply and return *ductwork*. *Duct system* testing shall not be performed if the return *ductwork* is not installed.~~ *Duct system* testing is permitted where *space conditioning equipment* is not installed, provided the return *ductwork* is installed, and the measured leakage from the supply and return ductwork is included.

g. For *duct systems* to be considered inside a *conditioned space*, where the *ductwork* is located in ventilated attic spaces or unvented attics with vapor diffusion ports, *duct system* leakage to outside ~~shall~~ must comply with Item 2.1 of Section R403.3.2. ~~be measured in accordance with ANSI/RESNET/ICC 380 or ASTM E1554 and shall be less than or equal to 1.5 cubic feet per minute (42.5 L/min) per 100 square feet (9.29 m²) of *conditioned floor area* served by the *duct system*~~.

h. Prior to certificate of occupancy, where the *air-handling unit* is not verified as being located in ~~*un*~~*conditioned space*, the total *duct system* leakage must be re-tested.

R403.3.7 Dwelling unit sampling. For buildings with eight or more *dwelling units* the duct systems in the greater of seven, or 20 percent of the *dwelling units* in the building shall be tested, including a top floor unit, a ground floor unit, a middle floor unit, and the unit with the largest conditioned floor area. Where buildings have fewer than eight *dwelling units*, the duct systems in each unit shall be tested. Where the leakage ~~rate~~ of a *duct system* is greater than the maximum permitted *duct system* leakage ~~rate~~, corrective actions shall be made to the *duct system* ~~system~~ and the *duct system* shall be retested until it passes. For each tested *dwelling unit* that has a greater total *duct system* leakage ~~rate~~ than the maximum permitted *duct system* leakage ~~rate~~, an additional three *dwelling units*, including the corrected unit, shall be tested.

R403.3.~~8~~2 Building cavities. *Building* framing cavities shall not be used as ~~ducts~~ *ductwork* or *plenums*.

R403.3.1 Duct System Design. *Duct systems* serving one or two *dwelling units* shall be designed and sized in accordance with ANSI/ACCA Manual D. *Duct systems* serving more than two *dwelling units* shall be sized in accordance with the ASHRAE Handbook of Fundamentals, ANSI/ACCA Manual D, or other equivalent computation procedure.

TABLE R403.6.2 WHOLE-DWELLING MECHANICAL VENTILATION SYSTEM FAN EFFICACY[a]
Portions of table not shown remain unchanged.

SYSTEM TYPE	AIRFLOW RATE (CFM)	MINIMUM EFFICACY (CFM/WATT)	TEST PROCEDURE

~~Air-handler~~ *Air-handling unit* that is integrated to tested and *listed* HVAC equipment	Any	1.2	Outdoor airflow as specified. *Air-handling unit* ~~Air-handler~~ fan power determined in accordance with the HVAC appliance's test method referenced by Section C403.3.2 of the IECC-Commercial Provisions.

For SI: 1 cubic foot per minute = 0.47 L/s.

a. Design outdoor airflow rate/watts of fan used.

SECTION R405 SIMULATED BUILDING PERFORMANCE

Revise as follows:

R405.3.2.1 Compliance report for permit application. A compliance report submitted with the application for building permit shall include the following:

7. Building street address, or other *building site* identification.
8. The name of the individual performing the analysis and generating the compliance report.
9. The name and version of the compliance software tool.
10. Documentation of all inputs ~~entered into~~ to the software used to produce the results for the reference design ~~and,~~ or the rated home.
11. A certificate indicating that the proposed design complies with Section R405.3. The certificate shall document the building components' energy specifications that are included in the calculation including: component-level insulation *R*-values or *U*-factors; ~~duct system~~ *duct system* and building envelope air leakage testing assumptions; and the type and rated efficiencies of proposed heating, cooling, mechanical ventilation and service water-heating equipment to be installed. If on-site renewable energy systems will be installed, the certificate shall report the type and production size of the proposed system.
12. Where a site-specific report is not generated, the proposed design shall be based on the worst-case orientation and configuration of the rated home.

TABLE R405.4.2(1) SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

Portions of table not shown remain unchanged.

<table>
<tr><th>BUILDING COMPONENT</th><th>STANDARD REFERENCE DESIGN</th><th>PROPOSED DESIGN</th></tr>
<tr><td></td><td>Duct location</td><td>Duct location: as proposed</td></tr>
<tr><td></td><td>
<table>
<tr><th>Foundation type</th><th>Slab on grade</th><th>Unconditioned crawl space</th><th>Basement or conditioned crawl space</th></tr>
<tr><td>Duct location (supply and return)</td><td>One-story building: 100% in unconditioned attic

All other: 75% in unconditioned attic and 25% inside conditioned space</td><td>One-story building: 100% in unconditioned crawl space

All other: 75% in unconditioned crawlspace and 25% inside conditioned space</td><td>~~75~~50% inside conditioned space

~~25~~50% unconditioned attic</td></tr>
</table>
</td><td></td></tr>
<tr><td></td><td>Duct Insulation: in accordance with Section R403.3.1</td><td>Duct Insulation: as proposed</td></tr>
<tr><td rowspan="2">Thermal distribution systems</td><td>~~Duct system~~ Duct system leakage to outside:
For duct systems serving > 1,000ft² of conditioned floor area, the duct leakage to outside rate shall be 4 cfm (113.3 L/min) per 100 ft² (9.29 m²) of conditioned floor area.
For duct systems serving ≤ 1,000ft² of conditioned floor area, the duct leakage to outside rate shall be 40 cfm (1132.7 L/min).</td><td>Duct System Leakage to Outside: The measure d total duct system leakage rate shall be entered into the software as the duct system leakage to outside rate.
Exceptions:
<table>
<tr><td>1.</td><td>~~When~~ Where duct system leakage to outside is tested in accordance ANSI/ RESNET/ICC 380 or ASTM E1554, the measured value shall be permitted to be entered.</td></tr>
<tr><td>2.</td><td>~~When~~ Where total duct system leakage is measured without the space conditioning equipment ~~air handler~~ installed, the simulation value shall be 4 cfm (113.3 L/min) per 100 ft² (9.29 m²) of conditioned floor area.</td></tr>
</table>
</td></tr>
<tr><td>Distribution System Efficiency (DSE):

For hydronic systems and ductless systems a thermal distribution system efficiency (DSE) of 0.88 shall be applied to both the heating and cooling system efficiencies.</td><td>Distribution System Efficiency (DSE):

For hydronic systems and ductless systems, DSE shall be as specified in Table R405.4.2(2).</td></tr>
</table>

For SI: 1 square foot = 0.93 m², 1 British thermal unit = 1055 J, 1 pound per square foot = 4.88 kg/m², 1 gallon (US) = 3.785 L, °C = (°F-32)/1.8, 1 degree = 0.79 rad.

a. Where required by the code official, testing shall be conducted by an approved party. Hourly calculations as specified in the ASHRAE *Handbook of Fundamentals*, or the equivalent, shall be used to determine the energy loads resulting from infiltration.

b. The combined air exchange rate for infiltration and mechanical ventilation shall be determined in accordance with Equation 43 of 2001 ASHRAE *Handbook of Fundamentals,* page 26.24 and the "Whole-house Ventilation" provisions of 2001 ASHRAE *Handbook of Fundamentals,* page 26.19 for intermittent mechanical ventilation.

c. Thermal storage element shall mean a component that is not part of the floors, walls or ceilings that is part of a passive solar system, and that provides thermal storage such as enclosed water columns, rock beds, or phase-change containers. A thermal storage element shall be in the same room as fenestration that faces within 15 degrees (0.26 rad) of true south, or shall be connected to such a room with pipes or ducts that allow the element to be actively charged.

d. For a proposed design with multiple heating, cooling or water heating systems using different fuel types, the applicable standard reference design system capacities and fuel types shall be weighted in accordance with their respective loads as calculated by accepted engineering practice for each equipment and fuel type present.

e. For a proposed design without a proposed heating system, a heating system having the prevailing federal minimum efficiency shall be assumed for both the standard reference design and proposed design.

f. For a proposed design home without a proposed cooling system, an electric air conditioner having the prevailing federal minimum efficiency shall be assumed for both the standard reference design and the proposed design.

g. For a proposed design the following assumptions shall be made for both the proposed design and standard reference design.

Fuel Type: Same as the predominant heating fuel type Rated

Storage Volume: 40 Gallons

Draw Pattern: Medium

Efficiency: Uniform Energy Factor complying with 10 CFR §130.32

h. For residences with conditioned basements, R-2 and R-4 residences, and for townhouse units, the following formula shall be used to determine glazing area:

AF $= A_s \times FA \times F$

where:

AF = Total glazing area.

A_s = Standard reference design total glazing area.

FA = (Above-grade thermal boundary gross wall area)/(above-grade boundary wall area + 0.5 × below-grade boundary wall area).

F = (above-grade thermal boundary wall area)/(above-grade thermal boundary wall area + common wall area) or 0.56, whichever is greater.

and where:

- Thermal boundary wall is any wall that separates *conditioned space* from unconditioned space or ambient conditions.
- Above-grade thermal boundary wall is any thermal boundary wall component not in contact with soil.
- Below-grade boundary wall is any thermal boundary wall in soil contact.

- Common wall area is the area of walls shared with an adjoining dwelling unit.

i. The factor for the compactness of the hot water distribution system is the ratio of the area of the rectangle that bounds the source of hot water and the fixtures that it serves (the "hot water rectangle") divided by the floor area of the dwelling.

1. Sources of hot water include water heaters, or in multiple-family buildings with central water heating systems, circulation loops or electric heat traced pipes.
2. The hot water rectangle shall include the source of hot water and the points of termination of all hot water fixture supply piping.
3. The hot water rectangle shall be shown on the floor plans and the area shall be computed to the nearest square foot.
4. Where there is more than one water heater and each water heater serves different plumbing fixtures and appliances, it is permissible to establish a separate hot water rectangle for each hot water distribution system and add the area of these rectangles together to determine the compactness ratio.
5. The basement or attic shall be counted as a story when it contains the water heater.
6. Compliance shall be demonstrated by providing a drawing on the plans that shows the hot water distribution system rectangle(s), comparing the area of the rectangle(s) to the area of the dwelling and identifying the appropriate compactness ratio and *HWDS* factor.

j. For a proposed design with electric resistance heating, a split system heat pump complying with 10 CFR §430.32 (2021) shall be assumed modeled in the standard reference design.

k. For heating systems, cooling systems, or water heating systems not included in Table R405.4.2(1), the standard reference design shall be the same as proposed design.

l. Only sections of *ductwork* that are installed in accordance with Items 1 or 2 of Section R403.3.2, ~~shall~~ are ~~be~~ assumed to be located completely inside *conditioned space*. All other sections of *ductwork* ~~shall~~ are not ~~be~~ assumed to be located completely inside *conditioned space*.

m. Sections of *ductwork* installed in accordance with Section R403.3.3.1, ~~shall~~ are ~~be~~ assumed to have an effective duct insulation R-value of R-25.

TABLE R405.4.2(2) DEFAULT DISTRIBUTION SYSTEM EFFICIENCIES FOR PROPOSED DESIGNS[a]

DISTRIBUTION SYSTEM CONFIGURATION AND CONDITION	FORCED AIR SYSTEMS	HYDRONIC SYSTEMS[b]
Distribution system components located in unconditioned space	NA	0.95
Distribution system components entirely located in *conditioned space*[c]	NA	1
"Ductless" systems[d]	1	NA

e. Default values in this table are for untested distribution systems, which must still ~~meet minimum requirements from~~ form comply with Section R403 ~~for duct system insulation~~.

f. Hydronic systems ~~shall~~ means those systems that distribute heating and cooling energy directly to individual spaces using liquids pumped through closed-loop piping and that do not depend on ducted, forced airflow to maintain space temperatures.

g. Entire system in *conditioned space* ~~shall~~ means that no component of the distribution system, ~~including the air handling unit,~~ is located outside of the *conditioned space*.

h. Ductless systems ~~shall be~~ are allowed to have forced airflow across a coil but ~~shall~~ must not have greater than 10 ft. of ~~any~~ ducted airflow external to the ~~manufacturer's air handler enclosure~~ *space conditioning equipment*.

SECTION R408

ADDITIONAL EFFICIENCY REQUIREMENTS

Revise as follows:

TABLE R408.2 CREDITS FOR ADDITIONAL ENERGY EFFICIENCY

Portions of table not shown remain unchanged.

Measure Number	Measure Description	Credit Value								
		Climate Zone 0 & 1	Climate Zone 2	Climate Zone 3	Climate Zone 4	Climate Zone 4C	Climate Zone 5	Climate Zone 6	Climate Zone 7	Climate Zone 8
R408.2.4(2)	100% of *duct systems* ~~ducts~~ in *conditioned space*	4	6	8	12	12	15	17	19	20
R408.2.4(3)	≥ 80% of *ductwork* inside *conditioned space*	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.4(~~4~~3)	Reduced total duct leakage	1	1	1	1	1	1	2	2	2

R408.2.4 More efficient ~~duct~~ thermal distribution system option. The thermal distribution system shall ~~meet one of the~~ comply with one of the following ~~efficiencies~~:

5. ~~100 percent of~~ The ductless thermal distribution system or hydronic thermal distribution system is located completely ~~inside~~ on the conditioned side of the *building thermal envelope*.

6. ~~100 percent of t~~The *space conditioning equipment* is located inside *conditioned space*. In addition, 100 percent of the *ductwork* ~~*system* thermal distribution system~~ is located completely inside *conditioned space* as defined by item 1 and item 2 of Section R403.3.2.

7. The *space conditioning equipment* is located inside *conditioned space* and no less than 80 percent of *ductwork* is located completely inside *conditioned space* as defined by item 1 and item 2 of Section R403.3.2. In addition, no more than 20 percent of *ductwork* is contained within building assemblies separating unconditioned from *conditioned space* as defined by item 3 of Section R403.3.2.

8. ~~When~~ Where ~~ducts are~~ *ductwork* is located outside *conditioned space*, the total leakage ~~of the ducts,~~ of the *duct system* measured in accordance with R403.3.5, ~~shall be in accordance with~~ is one of the following:

8.1 Where the *space conditioning equipment* ~~air handler~~ is installed at the time of testing, total leakage is not greater than 2.0 cubic feet per minute (0.94 L/s) per 100 square feet (9.29 m^2) of conditioned floor area.

8.2 Where the *space conditioning equipment* ~~air handler~~ is not installed at the time of testing, total leakage is not greater than 1.75 cubic feet per minute (0.83 L/s) per 100 square feet (9.29 m^2) of conditioned floor area.

SECTION R502 ADDITIONS

Revise as follows:

R502.2.2 Heating and cooling systems. HVAC *ductwork* ~~ducts~~ newly installed as part of an *addition* shall comply with Section R403.

Exception: Where *ductwork* ~~ducts~~ from an existing heating and cooling system ~~are~~ is extended into an *addition* Section R403.3.5 and Section R403.3.6 shall not be required.

Section 503 Alterations

Revise as follows:

R503.1.2 Heating and cooling systems. New heating and cooling systems and *ductwork* ~~duct systems~~ that are part of the alteration shall comply with Section R403 and this section . Alterations to existing heating and, cooling systems and *ductwork* ~~duct systems~~ shall comply with this section.

Exception: Where *ductwork* ~~ducts~~ from an existing heating and cooling system ~~are~~ is extended to an *addition*.

R503.1.2.1 ~~Ducts~~ *Ductwork*. HVAC *ductwork* ~~ducts~~ newly installed as part of an alteration shall comply with Section R403.

Exception: Where *ductwork* ~~ducts~~ from an existing heating and cooling system ~~are~~ is extended to an *addition*.

R503.1.2.3 Duct system leakage. Where an *alteration* includes any of the following, *duct systems* ~~ducts~~ shall be tested in accordance with Section R403.3.5 and shall have a total leakage less than or equal to 12.0 cubic feet per minute (339.9 L/min) per 100 square feet (9.29 m^2) of conditioned floor area:

4. Where 25 percent or more of the registers that are part of the duct system are relocated.
5. Where 25 percent or more of the total length of all *ductwork* ~~ducts~~ in the *duct system* are relocated.
6. Where the total length of all *ductwork* ~~ducts~~ in the *duct system* is increased by 25 percent or more.

Exception: *Duct systems* located entirely inside a *conditioned space* in accordance with Section R403.3.2.

Reason: This public comment is being submitted to achieve the following:

- **Better define what the code means when it says "ducts", "ductwork", and "duct system", by using 2021 IMC**
- **definitions, modified as needed. Use these defined terms to better clarify what is meant by "ducts in *conditioned space*" and what components are included in the "total duct leakage test"**
- **Clarify what must be tested during the total duct leakage test (i.e., ALWAYS the return 'ductwork' which now clearly includes sheetrocked plenums, but sometimes air-handler can be excluded if lower allowance is met)**
- **Reduce the use of the phrase "rough-in" and "post-construction" since that is not actually the criteria of importance**
- **Add a test exemption for ductless systems, including ducted systems with less than 10 ft of ductwork, when in**
- ***conditioned space* Provide a greater duct leakage allowance where a greater amount of return ductwork (ducted returns) is installed (like ENERGY STAR).**

Bibliography: None

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction. The proposed changes clarify existing provisions and do not increase the stringency of the requirements.

RED1-285-22 – AS MODIFIED IN BLUE SINCE APPROVED BY RES HVACR-WH SUBCOMMITTEE

IECC: SECTION 202 (New), SECTION 202, R401.3, R402.2.9, TABLE R402.5.1.1, SECTION R403, R403.3, R403.3.1, R403.3.2, R403.3.3, R403.3.3.1, R403.3.4, R403.3.4.1, R403.3.5, R403.3.6, TABLE R403.3.6, R403.3.7, R403.3.8, TABLE R403.6.2, SECTION R405, R405.3.2.1, TABLE R405.4.2(1), TABLE R405.4.2(2), SECTION R408, TABLE R408.2, R408.2.4, SECTION R502, R502.2.2, SECTION R503, R503.1.2, R503.1.2.1, R503.1.2.3

Proponents: Gary Klein, representing Self (gary@garykleinassociates.com); Mark Lyles, representing California IOUs (markl@newbuildings.org); Gayathri Vijayakumar, representing Steven Winter Associates, Inc. (gvijayakumar@swinter.com)

2024 International Energy Conservation Code [RE Project]

Add new definition as follows:

AIR-HANDLING UNIT. A blower or fan used for the purpose of distributing supply air to a room, space or area.

Revise as follows:

CONDITIONED SPACE. An area, room or space that is enclosed within the *building thermal envelope* and is directly or indirectly heated or cooled. Spaces are indirectly heated or cooled where they communicate through openings with conditioned spaces, where they are separated from conditioned spaces by uninsulated walls, floors or ceilings, or where they contain uninsulated ~~ducts~~ *ducts*, piping or other sources of heating or cooling.

Add new definition as follows:

DAMPER. A manually or automatically controlled device to regulate draft or the rate of flow of air or combustion gases.

Revise as follows:

DUCT SYSTEM. ~~A continuous passageway for the transmission of air that, in addition to ducts, includes duct fittings, dampers, plenums, fans and accessory air-handling equipment and appliances~~ A system that consists of *space conditioning equipment*, *ductwork*, and ~~shall include~~ includes any apparatus installed in connection therewith.

Add new definition as follows:

DUCTWORK. The assemblies of connected *ducts*, *plenums*, boots, fittings, *dampers*, supply registers, return grilles, and filter grilles through which air is supplied to or returned from the space to be heated, ~~or~~ cooled, or ventilated. Supply ductwork delivers air to the spaces from the *space conditioning equipment*. Return ductwork conveys air from the spaces back to the *space conditioning equipment*. Ventilation ductwork conveys air to or from any space.

HEAT EXCHANGER. A device that transfers heat from one medium to another.

OCCUPIABLE SPACE. An enclosed space intended for human activities, excluding those spaces intended primarily for other purposes, such as storage rooms and equipment rooms, that are only intended to be occupied occasionally and for short periods of time.

PLENUM. An enclosed portion of the building structure, other than an *occupiable space* being conditioned, that is designed to allow air movement, and thereby serve as part of the supply or return *ductwork*.

SPACE CONDITIONING. The treatment of air so as to control simultaneously the temperature, humidity, ~~cleanness~~ filtration, and distribution of the air to meet the requirements of a conditioned space.

SPACE CONDITIONING EQUIPMENT. The *heat exchangers*, *air-handling units*, filter boxes, and any apparatus installed in connection therewith used to provide *space conditioning*.

Revise as follows:

R401.3 Certificate. A permanent certificate shall be completed by the builder or other *approved* party and posted on a wall in the space where the furnace is located, a utility room or an *approved* location inside the *building*. Where located on an electrical panel, the certificate shall not cover or obstruct the visibility of the circuit directory *label*, service disconnect *label* or other required labels. The certificate shall indicate the following:

1. The predominant *R*-values of insulation installed in or on ceilings, roofs, walls, foundation components such as slabs, *basement walls*, *crawl space walls* and floors and *ducts* ~~ducts~~ outside *conditioned spaces*.
2. *U*-factors of fenestration and the *solar heat gain coefficient* (SHGC) of fenestration. Where there is more than one value for any component of the building envelope, the certificate shall indicate both the value covering the largest area and the area weighted average value if available.
3. The results from any required *duct system* ~~duct system~~ and building envelope air leakage testing performed on the building.
4. The types, sizes and efficiencies of heating, cooling and service water-heating equipment. Where a gas-fired unvented room heater, electric furnace or baseboard electric heater is installed in the residence, the certificate shall indicate “gas-fired unvented room heater,” “electric furnace” or “baseboard electric heater,” as appropriate. An efficiency shall not be indicated for gas-fired unvented room heaters, electric furnaces and electric baseboard heaters.
5. Where on-site *photovoltaic panel* systems have been installed, the array capacity, inverter efficiency, panel tilt and orientation shall be noted on the certificate.

6. For buildings where an Energy Rating Index score is determined in accordance with Section R406, the Energy Rating Index score, both with and without any on-site generation, shall be listed on the certificate.
7. The code edition under which the structure was permitted, the compliance path used, and where applicable, the additional efficiency measures selected for compliance with R408.
8. Where a solar-ready zone is provided, the certificate shall indicate the location, and dimensions.

R402.2.9 Basement walls. Basement walls shall be insulated in accordance with Table R402.1.3.

Exception: Basement walls associated with unconditioned basements where ~~all of~~ the following requirements are met:

1. The floor overhead, including the underside stairway stringer leading to the basement, is insulated in accordance with Section R402.1.3 and applicable provisions of Sections R402.2 and R402.2.8.
2. There are no uninsulated ~~duct~~ *ductwork*, domestic hot water piping, or hydronic heating surfaces exposed to the basement.
3. There are no HVAC supply or return diffusers serving the basement.
4. The walls surrounding the stairway and adjacent to *conditioned space* are insulated in accordance with Section R402.1.3 and applicable provisions of Section R402.2.
5. The door(s) leading to the basement from *conditioned spaces* are insulated in accordance with Section R402.1.3 and applicable provisions of Section R402.2, and weatherstripped in accordance with Section R402.5.
6. The building thermal envelope separating the basement from adjacent *conditioned spaces* complies with Section R402.5.

TABLE R402.5.1.1 AIR BARRIER, AIR SEALING AND INSULATION INSTALLATION[a]

Portions of table not shown remain unchanged.

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
Shafts, penetrations	*Duct* ~~Duct~~ and flue shafts to exterior or unconditioned space shall be sealed. Utility penetrations of the air barrier shall be caulked, gasketed or otherwise sealed and shall allow for expansion, contraction of materials and mechanical vibration.	Insulation shall be fitted tightly around utilities passing through shafts and penetrations in the building thermal envelope to maintain required *R*-value.
Recessed lighting	Recessed light fixtures installed in the building thermal envelope shall be air sealed in accordance with Section R402.5.5.	Recessed light fixtures installed in the building thermal envelope shall be airtight and IC rated, and shall be buried in or surrounded with insulation.
Electrical,communication, and other equipment boxes, housings, and enclosures	Boxes, housing, and enclosures that penetrate the air barrier shall be caulked, taped, gasketed, or otherwise sealed to the air barrier element being penetrated. All concealed openings into the box, housing, or enclosure shall be sealed. The continuity of the air barrier shall be maintained around boxes, housings, and enclosures that penetrate the air barrier. Alternatively, air-sealed boxes shall be installed in accordance with R402.5.6.	Boxes, housing, and enclosures shall be ~~burried~~ buried in or surrounded by insulation.
HVAC register boots	HVAC supply and return register boots ~~that penetrate building thermal envelope~~ shall be sealed to the subfloor, wall covering or ceiling penetrated by the boot.	HVAC supply and return register boots located ~~in~~ within a ~~the building's thermal envelope~~ *building thermal envelope* assembly shall be buried ~~burried~~ in or ~~and~~ surrounded by insulation.

a. Inspection of log walls shall be in accordance with the provisions of ICC 400.

b. Insulation full enclosure is not required in unconditioned/ventilated attic spaces and at rim joists.

SECTION R403
SYSTEMS

Revise as follows:

R403.3 Duct systems. ~~Ducts and air handlers~~ *Duct systems* shall be installed in accordance with Sections R403.3.1 through R403.3.~~8~~7~~9~~.

Exception: ~~*Ducts* serving ventilation systems~~ Ventilation *ductwork* ~~that~~ is ~~are~~ not integrated with *duct systems* serving heating or cooling systems.

R403.3.1 ~~Ducts~~ Ductwork located outside conditioned space. Supply and return *ductwork* ~~*ducts*~~ located outside *conditioned space* shall be insulated to an *R*-value of not less than R-8 for *ducts* 3 inches (76 mm) in diameter and larger and not less than R-6 for *ducts* smaller than 3 inches (76 mm) in diameter. *Ductwork* ~~*Ducts*~~ buried beneath a building shall be insulated as required per this section or have an equivalent *thermal distribution efficiency*. Underground *ductwork* ~~*ducts*~~ utilizing the *thermal distribution efficiency* method shall be listed and *labeled* to indicate the *R*- value equivalency.

R403.3.2 Ducts systems located in conditioned space. For ~~ductwork~~ *duct systems* to be considered inside a *conditioned space,* the *space conditioning equipment* shall be located completely ~~within the *continuous air barrier* and within~~ on the conditioned side of the *building thermal envelope*. The *ductwork* ~~it~~ shall comply with ~~one of~~ the following as applicable:

1. The ~~duct system~~ *ductwork* shall be located completely ~~within the *continuous air barrier* and within~~ on the conditioned side of the *building thermal envelope.*
2. *Ductwork* ~~Ductwork~~ in ventilated attic spaces or unvented attics with vapor diffusion ports shall be buried within ceiling insulation in accordance with Section R403.3.3 and ~~all of~~ shall comply with the following ~~conditions shall exist~~:

   ~~2.1. The air handler is located completely within the *continuous air barrier* and within the *building thermal envelope.*~~

   2.21. The ~~duct~~ *ductwork* leakage, as measured either by a rough-in test of the supply and return ~~ducts~~ *ductwork* or a post-construction ~~total~~ *duct system* leakage test to outside the *building thermal envelope* in accordance with Section R403.3. ~~5~~6, ~~is less than or equal to~~ is not greater than 1.5 cubic feet per minute (42.5 L/min) per 100 square feet (9.29 m^2) of *conditioned floor area* served by the *duct system*.

   2.32. The ceiling insulation *R*-value installed against and above the insulated ~~duct~~ *ductwork* is greater than or equal to the proposed ceiling insulation *R*-value, less the *R*-value of the insulation on the ~~duct~~ *ductwork*.

3. *Ductwork* ~~located in~~ contained within wall or floor ~~building~~ assemblies separating unconditioned from conditioned space shall comply with the following:

~~3.1.~~ A *continuous air barrier* shall be installed as part of the building assembly between the ~~duct~~ *ductwork* and the unconditioned space.

~~3.2. Ducts~~ *Ductwork* shall be installed in accordance with Section R403.3.1.

Exception: Where the building assembly cavities containing ~~ducts~~ *ductwork* have been air sealed in accordance with Section R402.5.1, duct insulation is not required.

~~3.3.~~ Not less than R-10 ~~assembly~~ insulation, ~~and~~ or not less than 50 percent of the ~~assembly~~ ~~insulation~~ required insulation R-value specified in Table R402.1.3, whichever is greater, shall be located between the ~~duct~~ *ductwork* and the unconditioned space.

~~3.4 For ducts in these building assemblies to be considered within conditioned space, the air handling equipment shall be installed within conditioned space.~~

Segments of *ductwork* contained within ~~these~~ such building assemblies shall not be considered completely inside *conditioned space* ~~in~~ for compliance with Sections R405 or R406.

R403.3.3 Ductwork ~~Ducts~~ buried within ceiling insulation. Where supply and return *ductwork* ~~air ducts~~ ~~are~~ is partially or completely buried in ceiling insulation, such *ductwork* ~~ducts~~ shall comply with ~~all of~~ the following:

1. The supply and return ~~ducts~~ *ductwork* shall be insulated with ~~have an insulation *R*-value~~ not less than R-8 insulation.
2. At all points along ~~each duct~~ the *ductwork*, the sum of the ceiling insulation *R*-value against and above the top of the ~~duct~~ *ductwork*, and against and below the bottom of the ~~duct~~ *ductwork*, shall be not less than R-19, excluding the *R*-value of the duct insulation.
3. In Climate Zones 0A, 1A, 2A and 3A, the supply ~~ducts~~ *ductwork* shall be completely buried within ceiling insulation, insulated to an *R*-value of not less than R-13 and in compliance with the vapor retarder requirements of Section 604.11 of the *International Mechanical Code* or Section M1601.4.6 of the *International Residential Code*, as applicable**.**

Exception: Sections of the supply ~~ducts~~ *ductwork* that are less than 3 feet (914 mm) from the supply outlet ~~shall not be required to comply with these requirements~~.

4. In Climate Zones 0A, 1A, 2A and 3A ~~when~~ where installed in an unvented attic with vapor diffusion ports, the supply ~~ducts~~ *ductwork* shall be completely buried within ceiling insulation, insulated to an *R*-value of not less than R-8 and in compliance with the vapor retarder requirements of Section 604.11 of the *International Mechanical Code* or Section M1601.4.6 of the *International Residential Code*, as applicable.

Exception: Sections of the supply ~~ducts~~ *ductwork* duct that are less than 3 feet (914 mm) from the supply outlet ~~shall not be required to comply with these requirements~~.

4.1 Air permeable insulation installed in unvented attics shall ~~be in compliance~~ comply with ~~the requirements of~~ Section R806.5.5.2 of the *International Residential Code*.

R403.3.3.1 Effective R-value of deeply buried ducts. Where ~~complying~~ using ~~Section R405, the Building Simulated Performance Compliance Option in accordance with Section R401.2.2,~~ sections of ~~ducts~~ *ductwork* that are installed in accordance with Section R403.3.3 surrounded with blown-in attic insulation having an *R*-value of R-30 or greater, and located such that the top of the ~~duct~~ *ductwork* is not less than 3.5 inches (89 mm) below the top of the insulation, shall be considered as having an effective duct insulation *R*-value of R-25.

R403.3.4 Sealing. ~~Ducts, air handlers~~ *Ductwork*, *air-handling units* and filter boxes shall be sealed. Joints and seams shall comply with ~~either~~ the International Mechanical Code or the International Residential Code, as applicable.

R403.3.4.1 Sealed ~~air handler~~ air-handling unit. ~~Air~~ ~~handlers~~*Air-handling units* shall have a manufacturer's designation for an air leakage ~~of~~ not greater than 2 percent of the design airflow rate when tested in accordance with ASHRAE 193.

R403.3.5 Duct system testing. Each *duct system* ~~ducts system~~ shall be tested for air leakage in accordance with ANSI/RESNET/ICC 380 or ASTM E1554. Total leakage shall be measured with a pressure differential of 0.1 inch water gauge ~~w.g.~~(25 Pa) across the ~~system~~ *duct system* and shall include the measured leakage from ~~both~~ the supply and return *ductwork*. ~~Registers shall be sealed during the test.~~ A written report of the test results shall be signed by the party conducting the test and provided to the *code official*. *Duct system* ~~Duct system~~ leakage testing at either rough-in or post-construction shall be permitted with or without the installation of registers or grilles. Where installed, registers and grilles shall be ~~temporarily~~ sealed during the test. Where registers and grilles are not installed, the face of the register boots shall be ~~temporarily~~ sealed during the test.

Exceptions:

1. Testing shall not be required for *duct systems* ~~duct systems~~ serving ventilation systems that are not integrated with *duct systems* ~~duct systems~~ serving heating or cooling systems.
2. Testing shall not be required where there is not more than 10 feet of total *ductwork* external to the *space conditioning equipment* and both the following are met :

   a. The *duct system* is located entirely within *conditioned space* .

b. The *ductwork* does not include *plenums* constructed of building cavities or ~~sheetrock~~ gypsum board.

3. Where the *space conditioning equipment* is not installed, testing shall be permitted. The total measured leakage of the supply and return *ductwork* shall be less than or equal to 3.0 cubic feet per minute (85 L/min) per 100 square feet (9.29 m^2) of *conditioned floor area.*

~~2~~ 4. Where tested in accordance with Section R403.3.7, testing of each *duct system* ~~duct system~~ is not required.

R403.3.6 Duct system leakage. The total measured ~~duct system~~ *duct system* leakage shall not be greater than the values in Table R403.3.6, based on the conditioned floor area, number of ducted returns, and location of the *duct system.* For buildings complying with Section R405 or R406, where ~~duct system~~ *duct system* ~~duct system~~ leakage to outside is tested in accordance with ANSI/RESNET/ICC 380 or ASTM E1554, the leakage to outside value shall not be used for compliance with this section, but shall be permitted to be used in the calculation procedures of Section R405 and R406.

TABLE R403.3.6 MAXIMUM TOTAL DUCT SYSTEM LEAKAGE

~~ROUGH IN~~	~~POST CONSTRUCTION~~	
~~Duct systems serving more than 1,000 ft^2 of conditioned floor area~~	~~cfm/100 ft^2 (LPM/9.29 m^2)~~	~~cfm/100 ft^2 (LPM/9.29 m^2)~~
~~Air handler is not installed~~	~~3 (85)~~	~~NA~~
~~Air handler is installed~~	~~4 (113.3)~~	~~4 (113.3)~~
~~Duct systems located in conditioned space, with air handler installed~~	~~8 (226.6)~~	~~8 (226.6)~~
~~Duct systems serving less than or equal to 1,000 ft^2 of conditioned floor area~~	~~cfm (LPM)~~	~~cfm (LPM)~~
~~Air handler is not installed~~	~~30 (849.5)~~	~~NA~~
~~Air handler is installed~~	~~40 (1132.7)~~	~~40 (1132.7)~~
~~Duct systems located in conditioned space, with air handler installed~~	~~80 (2265.4)~~	~~80 (2265.4)~~

	Duct systems serving more than 1,000 ft² of conditioned floor area		*Duct systems* serving ~~less than or equal to~~ 1,000 ft² or less of conditioned floor area
	cfm/100 ft² (LPM/9.29 m²)		cfm (LPM)
	Number of ducted returns [a]		
	< 3	≥ 3	Any
Space conditioning equipment is not installed [b, c]	3 (85)	4 (113.3)	30 (850 ~~849.5~~)
All components of the *duct system* are installed	4 (113.3)	6 (170)	40 (11332.7)
Space conditioning equipment is not installed, but the *ductwork* is located entirely in *conditioned space* [cd]	6 (170)	8(227)	60 (1699)
All components of the *duct system* are installed and entirely located in *conditioned space* [c]	8 (2276.6)	12(340)	80 2265.4)

a. A ducted return is a *duct* made of sheet metal or flexible *duct* that connects one or more return grilles to the return-side inlet of the *air-handling unit*. Any other ~~approach~~ method to convey air from return or transfer grille(s) to the *air-handling unit* does not constitute a ducted return for the purpose of determining maximum total *duct system* leakage allowance.

b. ~~Where the *space conditioning equipment* is not installed, *duct system* testing shall be permitted and shall include the measured leakage from both the supply and return *ductwork*. *Duct system* testing shall not be performed if the return *ductwork* is not installed.~~ *Duct system* testing is permitted where *space conditioning equipment* is not installed, provided the return *ductwork* is installed, and the measured leakage from the supply and return ductwork is included.

c. For *duct systems* to be considered inside a *conditioned space*, where the *ductwork* is located in ventilated attic spaces or unvented attics with vapor diffusion ports, *duct system* leakage to outside ~~shall~~ must comply with Item 2.1 of Section R403.3.2. ~~be measured in accordance with ANSI/RESNET/ICC 380 or ASTM E1554 and shall be less than or equal to 1.5 cubic feet per minute (42.5 L/min) per 100 square feet (9.29 m²) of *conditioned floor area* served by the *duct system*~~.

d. Prior to certificate of occupancy, where the *air-handling unit* is not verified as being located in ~~*un*~~*conditioned space*, the total *duct system* leakage must be re-tested.

R403.3.7 Dwelling unit sampling. For buildings with eight or more *dwelling units* the duct systems in the greater of seven, or 20 percent of the *dwelling units* in the building shall be tested, including a top floor unit, a ground floor unit, a middle floor unit, and the unit with the largest conditioned floor area. Where buildings have fewer than eight *dwelling units*, the duct systems in each unit shall be tested. Where the leakage ~~rate~~ of a *duct system* is greater than the maximum permitted *duct system* leakage ~~rate~~, corrective actions shall be made to the *duct system* ~~system~~ and the *duct system* shall be retested until it passes. For each tested *dwelling unit* that has a greater total *duct system* leakage ~~rate~~ than the maximum permitted *duct system* leakage ~~rate~~, an additional three *dwelling units*, including the corrected unit, shall be tested.

R403.3.~~8~~2 Building cavities. *Building* framing cavities shall not be used as ~~ducts~~ *ductwork* or *plenums*.

R403.3.1 Duct System Design. *Duct systems* serving one or two *dwelling units* shall be designed and sized in accordance with ANSI/ACCA Manual D. *Duct systems* serving more than two *dwelling units* shall be sized in accordance with the ASHRAE Handbook of Fundamentals, ANSI/ACCA Manual D, or other equivalent computation procedure.

TABLE R403.6.2 WHOLE-DWELLING MECHANICAL VENTILATION SYSTEM FAN EFFICACY[a]
Portions of table not shown remain unchanged.

SYSTEM TYPE	AIRFLOW RATE (CFM)	MINIMUM EFFICACY (CFM/WATT)	TEST PROCEDURE
~~Air-handler~~ *Air-handling unit* that is integrated to tested and *listed* HVAC equipment	Any	1.2	Outdoor airflow as specified. *Air-handling unit* ~~Air-handler~~ fan power determined in accordance with the HVAC appliance's test method referenced by Section C403.3.2 of the IECC-Commercial Provisions.

For SI: 1 cubic foot per minute = 0.47 L/s.

a. Design outdoor airflow rate/watts of fan used.

SECTION R405
SIMULATED BUILDING PERFORMANCE

Revise as follows:

R405.3.2.1 Compliance report for permit application. A compliance report submitted with the application for building permit shall include the following:

1. Building street address, or other *building site* identification.
2. The name of the individual performing the analysis and generating the compliance report.
3. The name and version of the compliance software tool.
4. Documentation of all inputs ~~entered into~~ to the software used to produce the results for the reference design ~~and/~~or the rated home.
5. A certificate indicating that the proposed design complies with Section R405.3. The certificate shall document the building components' energy specifications that are included in the calculation including: component-level insulation *R*-values or *U*-factors; ~~duct system~~ *duct system* and building envelope air leakage testing assumptions; and the type and rated efficiencies of proposed heating, cooling, mechanical ventilation and service water-heating equipment to be installed. If on-site renewable energy systems will be installed, the certificate shall report the type and production size of the proposed system.
6. Where a site-specific report is not generated, the proposed design shall be based on the worst-case orientation and configuration of the rated home.

TABLE R405.4.2(1) SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

Portions of table not shown remain unchanged.

<table>
<tr><th>BUILDING COMPONENT</th><th>STANDARD REFERENCE DESIGN</th><th>PROPOSED DESIGN</th></tr>
<tr><td></td><td>Duct location</td><td>Duct location: as proposed</td></tr>
<tr><td></td><td>
<table>
<tr><td>Foundation type</td><td>Slab on grade</td><td>Unconditioned crawl space</td><td>Basement or conditioned crawl space</td></tr>
<tr><td>Duct location (supply and return)</td><td>One-story building: 100% in unconditioned attic

All other: 75% in unconditioned attic and 25% inside conditioned space</td><td>One-story building: 100% in unconditioned crawl space

All other: 75% in unconditioned crawlspace and 25% inside conditioned space</td><td>~~75~~50% inside conditioned space

~~25~~50% unconditioned attic</td></tr>
</table>
</td><td></td></tr>
<tr><td></td><td>Duct Insulation: in accordance with Section R403.3.1</td><td>Duct Insulation: as proposed</td></tr>
<tr><td rowspan="2">Thermal distribution systems</td><td>~~Duct system~~ Duct system leakage to outside:
For duct systems serving > 1,000ft^2 of conditioned floor area, the duct leakage to outside rate shall be 4 cfm (113.3 L/min) per 100 ft^2 (9.29 m^2) of conditioned floor area.
For duct systems serving ≤ 1,000ft^2 of conditioned floor area, the duct leakage to outside rate shall be 40 cfm (1132.7 L/min).</td><td>Duct System Leakage to Outside: The measured total duct system leakage rate shall be entered into the software as the duct system leakage to outside rate.
Exceptions:
<table>
<tr><td>1.</td><td>~~When~~ Where duct system leakage to outside is tested in accordance ANSI/ RESNET/ICC 380 or ASTM E1554, the measured value shall be permitted to be entered.</td></tr>
<tr><td>2.</td><td>~~When~~ Where total duct system leakage is measured without the space conditioning equipment ~~air handler~~ installed, the simulation value shall be 4 cfm (113.3 L/min) per 100 ft^2 (9.29 m^2) of conditioned floor area.</td></tr>
</table>
</td></tr>
<tr><td>Distribution System Efficiency (DSE):

For hydronic systems and ductless systems a thermal distribution system efficiency (DSE) of 0.88 shall be applied to both the heating and cooling system efficiencies.</td><td>Distribution System Efficiency (DSE):

For hydronic systems and ductless systems, DSE shall be as specified in Table R405.4.2(2).</td></tr>
</table>

For SI: 1 square foot = 0.93 m^2, 1 British thermal unit = 1055 J, 1 pound per square foot = 4.88 kg/m^2, 1 gallon (US) = 3.785 L, °C = (°F-32)/1.8, 1 degree = 0.79 rad.

a. Where required by the code official, testing shall be conducted by an approved party. Hourly calculations as specified in the ASHRAE *Handbook of Fundamentals,* or the equivalent, shall be used to determine the energy loads resulting from infiltration.

b. The combined air exchange rate for infiltration and mechanical ventilation shall be determined in accordance with Equation 43 of 2001 ASHRAE *Handbook of Fundamentals,* page 26.24 and the "Whole-house Ventilation" provisions of 2001 ASHRAE *Handbook of Fundamentals,* page 26.19 for intermittent mechanical ventilation.

c. Thermal storage element shall mean a component that is not part of the floors, walls or ceilings that is part of a passive solar system, and that

provides thermal storage such as enclosed water columns, rock beds, or phase-change containers. A thermal storage element shall be in the same room as fenestration that faces within 15 degrees (0.26 rad) of true south, or shall be connected to such a room with pipes or ducts that allow the element to be actively charged.

d. For a proposed design with multiple heating, cooling or water heating systems using different fuel types, the applicable standard reference design system capacities and fuel types shall be weighted in accordance with their respective loads as calculated by accepted engineering practice for each equipment and fuel type present.

e. For a proposed design without a proposed heating system, a heating system having the prevailing federal minimum efficiency shall be assumed for both the standard reference design and proposed design.

f. For a proposed design home without a proposed cooling system, an electric air conditioner having the prevailing federal minimum efficiency shall be assumed for both the standard reference design and the proposed design.

g. For a proposed design the following assumptions shall be made for both the proposed design and standard reference design.

Fuel Type: Same as the predominant heating fuel type Rated

Storage Volume: 40 Gallons

Draw Pattern: Medium

Efficiency: Uniform Energy Factor complying with 10 CFR §130.32

h. For residences with conditioned basements, R-2 and R-4 residences, and for townhouse units, the following formula shall be used to determine glazing area:

AF $= A_s \times FA \times F$

where:

AF	= Total glazing area.
A_s	= Standard reference design total glazing area.
FA	= (Above-grade thermal boundary gross wall area)/(above-grade boundary wall area + 0.5 × below-grade boundary wall area).
F	= (above-grade thermal boundary wall area)/(above-grade thermal boundary wall area + common wall area) or 0.56, whichever is greater.

and where:

- Thermal boundary wall is any wall that separates *conditioned space* from unconditioned space or ambient conditions.
- Above-grade thermal boundary wall is any thermal boundary wall component not in contact with soil.
- Below-grade boundary wall is any thermal boundary wall in soil contact.

- Common wall area is the area of walls shared with an adjoining dwelling unit.

i. The factor for the compactness of the hot water distribution system is the ratio of the area of the rectangle that bounds the source of hot water and the fixtures that it serves (the "hot water rectangle") divided by the floor area of the dwelling.

1. Sources of hot water include water heaters, or in multiple-family buildings with central water heating systems, circulation loops or electric heat traced pipes.
2. The hot water rectangle shall include the source of hot water and the points of termination of all hot water fixture supply piping.
3. The hot water rectangle shall be shown on the floor plans and the area shall be computed to the nearest square foot.
4. Where there is more than one water heater and each water heater serves different plumbing fixtures and appliances, it is permissible to establish a separate hot water rectangle for each hot water distribution system and add the area of these rectangles together to determine the compactness ratio.
5. The basement or attic shall be counted as a story when it contains the water heater.
6. Compliance shall be demonstrated by providing a drawing on the plans that shows the hot water distribution system rectangle(s), comparing the area of the rectangle(s) to the area of the dwelling and identifying the appropriate compactness ratio and *HWDS* factor.

j. For a proposed design with electric resistance heating, a split system heat pump complying with 10 CFR §430.32 (2021) shall be assumed modeled in the standard reference design.

k. For heating systems, cooling systems, or water heating systems not included in Table R405.4.2(1), the standard reference design shall be the same as proposed design.

l. Only sections of *ductwork* that are installed in accordance with Items 1 or 2 of Section R403.3.2, ~~shall~~ are ~~be~~ assumed to be located completely inside *conditioned space*. All other sections of *ductwork* ~~shall~~ are not ~~be~~ assumed to be located completely inside *conditioned space*.

m. Sections of *ductwork* installed in accordance with Section R403.3.3.1, ~~shall~~ are ~~be~~ assumed to have an effective duct insulation R-value of R-25.

TABLE R405.4.2(2) DEFAULT DISTRIBUTION SYSTEM EFFICIENCIES FOR PROPOSED DESIGNS[a]

DISTRIBUTION SYSTEM CONFIGURATION AND CONDITION	FORCED AIR SYSTEMS	HYDRONIC SYSTEMS[b]
Distribution system components located in unconditioned space	NA	0.95
Distribution system components entirely located in *conditioned space*[c]	NA	1
"Ductless" systems[d]	1	NA

a. Default values in this table are for untested distribution systems, which must still ~~meet minimum requirements~~ from ~~form~~ comply with Section R403 ~~for duct system insulation~~.

b. Hydronic systems ~~shall~~ means those systems that distribute heating and cooling energy directly to individual spaces using liquids pumped through closed-loop piping and that do not depend on ducted, forced airflow to maintain space temperatures.

c. Entire system in *conditioned space* ~~shall~~ means that no component of the distribution system, ~~including the air-handling unit,~~ is located outside of the *conditioned space*.

d. Ductless systems ~~shall be~~ are allowed to have forced airflow across a coil but ~~shall~~ must not have greater than 10 ft. of ~~any~~ ducted airflow external to the ~~manufacturer's air-handler enclosure~~ *space conditioning equipment*.

SECTION R408
ADDITIONAL EFFICIENCY REQUIREMENTS

Revise as follows:

TABLE R408.2 CREDITS FOR ADDITIONAL ENERGY EFFICIENCY

Portions of table not shown remain unchanged.

Measure Number	Measure Description	Credit Value								
		Climate Zone 0 & 1	Climate Zone 2	Climate Zone 3	Climate Zone 4	Climate Zone 4C	Climate Zone 5	Climate Zone 6	Climate Zone 7	Climate Zone 8
R408.2.4(2)	100% of *duct systems* ~~ducts~~ in *conditioned space*	4	6	8	12	12	15	17	19	20
R408.2.4(3)	≥ 80% of *ductwork* inside *conditioned space*	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.4(~~43~~)	Reduced total duct leakage	1	1	1	1	1	1	2	2	2

R408.2.4 More efficient ~~duct~~ thermal distribution system option. The thermal distribution system shall ~~meet one of the~~ comply with one of the following ~~efficiencies~~:

1. ~~100 percent of~~ The ductless thermal distribution system or hydronic thermal distribution system is located completely ~~inside~~ on the conditioned side of the *building thermal envelope*.
2. ~~100 percent of t~~The The *space conditioning equipment* is located inside *conditioned space*. In addition, 100 percent of the *ductwork* ~~*system* thermal distribution system~~ is located completely inside *conditioned space* as defined by item 1 and item 2 of Section R403.3.2.
3. The *space conditioning equipment* is located inside *conditioned space* and no less than 80 percent of *ductwork* is located completely inside *conditioned space* as defined by item 1 and item 2 of Section R403.3.2. In addition, no more than 20 percent of *ductwork* is contained within building assemblies separating unconditioned from *conditioned space* as defined by item 3 of Section R403.3.2.
4. ~~When~~ Where ~~ducts are~~ *ductwork* is located outside *conditioned space*, the total leakage ~~of the ducts,~~ of the *duct system* measured in accordance with R403.3.5, ~~shall be in accordance with~~ is one of the following:

   4.1 Where the *space conditioning equipment* ~~air handler~~ is installed at the time of testing, total leakage is not greater than 2.0 cubic feet per minute (0.94 L/s) per 100 square feet (9.29 m^2) of conditioned floor area.

   4.2 Where the *space conditioning equipment* ~~air handler~~ is not installed at the time of testing, total leakage is not greater than 1.75 cubic feet per minute (0.83 L/s) per 100 square feet (9.29 m^2) of conditioned floor area.

SECTION R502
ADDITIONS

Revise as follows:

R502.2.2 Heating and cooling systems. HVAC *ductwork* ~~ducts~~ newly installed as part of an *addition* shall comply with Section R403.

Exception: Where *ductwork* ~~ducts~~ from an existing heating and cooling system ~~are~~ is extended into an *addition* Section R403.3.5 and Section R403.3.6 shall not be required.

SECTION R503
ALTERATIONS

Revise as follows:

R503.1.2 Heating and cooling systems. New heating and cooling systems and *ductwork* ~~duct systems~~ that are part of the alteration shall comply with Section R403 and this section . Alterations to existing heating and, cooling systems ~~and~~ *ductwork* ~~duct systems~~ shall comply with this section.

Exception: Where *ductwork* ~~ducts~~ from an existing heating and cooling system ~~are~~ is extended to an *addition*.

R503.1.2.1 ~~Ducts~~ *Ductwork*. HVAC *ductwork* ~~ducts~~ newly installed as part of an alteration shall comply with Section R403.

Exception: Where *ductwork* ~~ducts~~ from an existing heating and cooling system ~~are~~ is extended to an *addition*.

R503.1.2.3 Duct system leakage. Where an *alteration* includes any of the following, *duct systems* ~~ducts~~ shall be tested in accordance with Section R403.3.5 and shall have a total leakage less than or equal to 12.0 cubic feet per minute (339.9 L/min) per 100 square feet (9.29 m^2) of conditioned floor area:

1. Where 25 percent or more of the registers that are part of the duct system are relocated.
2. Where 25 percent or more of the total length of all *ductwork* ~~ducts~~ in the *duct system* are relocated.
3. Where the total length of all *ductwork* ~~ducts~~ in the *duct system* is increased by 25 percent or more.

Exception: *Duct systems* located entirely inside a *conditioned space* in accordance with Section R403.3.2.

Reason: This public comment is being submitted to achieve the following:

- **Better define what the code means when it says "ducts", "ductwork", and "duct system", by using 2021 IMC definitions, modified as needed.**
- **Use these defined terms to better clarify what is meant by "ducts in *conditioned space*" and what components are included in the "total duct leakage test"**
- **Clarify what must be tested during the total duct leakage test (i.e., ALWAYS the return 'ductwork' which now clearly includes sheetrocked plenums, but sometimes air-handler can be excluded if lower allowance is met)**
- **Reduce the use of the phrase "rough-in" and "post-construction" since that is not actually the criteria of importance**

Add a test exemption for ductless systems, including ducted systems with less than 10 ft of ductwork, when in *conditioned space* Provide a greater duct leakage allowance where a greater amount of return ductwork (ducted returns) is installed (like ENERGY STAR).

Bibliography: None

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The proposed changes clarify existing provisions and do not increase the stringency of the requirements.

International Energy Conservation Code
Code Change Proposal Tracking Sheet

Proposal #	RED1-308-22 Max. total duct system leakage
CDP ID #	1094
Code	IECC RE
Code Section(s)	R403.3.6 table
Location	base
Proponent	Greg Johnson gjohnsonconsulting@gmail.com
Proposal Status	SC rev
Subcommittee	RE HVACR & WH
Subcommittee Notes	Discussion opened with a presentation from the Chair HVACR working Group. The proposal is an editorial change – changes are incorporated into RED1-285. Motion to disapprove properly seconded. Reason the editorial change was rolled into RED1-285-22. No discussion and no one in option of the disapproval. Subcommittee vote to disapprove 9/0/0
Recommendation	Subcommittee motion is to disapprove as submitted
Vote	9/0/0
Recommendation Date	4/3/2023
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 #	RED1-307-22 Duct leakage table
CDP ID #	1066
Code	IECC RE
Code Section(s)	R403.3.6 table
Location	base
Proponent	Robby Schwarz robby@btankinc.com
Proposal Status	SC rev
Subcommittee	RE HVACR & WH
Subcommittee Notes	Subcommittee started to hear this proposal on 3/27/2023- Proponent Robby Schwarz not present. Motion to table with a second carried. Table the motion to the next meeting. Vote to table approved 9/0/0- subcommittee meeting 4/3/2023 - Recommendation from the Chair of HVACR and Water Heating Working Group Gary Klein. Followed by a motion and a second to disapprove. Proponent Robby Schwarz was not able to attend the subcommittee meeting. Vote to disapprove carried 7/0/2
Recommendation	Subcommittee recommendation is to Disapprove as submitted.
Vote	7/0/2
Recommendation Date	4/3/2023
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 #	RED1-305-22 Clarify duct location in ceiling
CDP ID #	1339
Code	IECC RE
Code Section(s)	R403.3.3
Location	base
Proponent	Jay Crandell jcrandell@aresconsulting.biz
Proposal Status	SC rev
Subcommittee	RE HVACR & WH
Subcommittee Notes	Discussion opened with a motion to disapprove. The reason for the motion and a second is because the language in this proposal has been incorporated into RED1-285-22.
Recommendation	The subcommittee recommendation is to disapprove as submitted.
Vote	8/0/0 for disapproval
Recommendation Date	4/3/2023
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 #	RED1-306-22 Ducts buried within ceiling insulation edit
CDP ID #	1093
Code	IECC RE
Code Section(s)	R403.3.3
Location	base
Proponent	Greg Johnson gjohnsonconsulting@gmail.com
Proposal Status	SC rev
Subcommittee	RE HVACR & WH
Subcommittee Notes	Discussion opened with a motion to disapprove. The reason for the motion and a second is because the language in this proposal has been incorporated into RED1-285-22.
Recommendation	Recommendation is to Disapprove
Vote	8/0/0 for disapproval
Recommendation Date	4/3/2023
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 #	RED1-302-22 Duct insulation exception
CDP ID #	1000
Code	IECC RE
Code Section(s)	R403.3.2
Location	base
Proponent	Vladimir Kochkin vkochkin@nahb.org
Proposal Status	SC rev
Subcommittee	RE HVACR & WH
Subcommittee Notes	Ducts working group Chair Gary Klein recommendations from the working group is to approve. Proponent Vladimir Kochkin presented the proposal specifics. Main focus of the proposal is to clean up the language in R403.3.2 clarifying the provisions. Motion and a proper second to approve discussion moved forward. Vladamir answered questions including regarding exception.
Recommendation	HVACR recommendation is to approve
Vote	vote to approve 7/1/1
Recommendation Date	4/3/2023
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 #	RED1-359-22 More efficient duct system
CDP ID #	1432
Code	IECC RE
Code Section(s)	R408.2.4
Location	base
Proponent	Greg Johnson gjohnsonconsulting@gmail.com
Proposal Status	SC rev
Subcommittee	RE HVACR & WH
Subcommittee Notes	Motion to approve with a proper second. Little discussion motion to approved carried with a vote of 10/0/0
Recommendation	Subcommittee recommendation is to approve
Vote	10/0/0
Recommendation Date	
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 #	RED1-342-22 Electric readiness space heating option
CDP ID #	1256
Code	IECC RE
Code Section(s)	R408.2 Table
Location	base
Proponent	Mark Lyles markl@newbuildings.org
Proposal Status	SC rev
Subcommittee	RE HVACR & WH
Subcommittee Notes	Proposal presented and the discussion opened with a motion to disapprove with a proper second. The proposal is a credit in R408 for gas heating readiness. Comments and questions 1. Comment; this does not belong in the main body of the code 2. Question; PNNL range of point values by climate zones? Vote to disapprove carried with a vote of 5/4/0
Recommendation	Recommendation is to disapprove
Vote	vote to disapprove 5/4/0
Recommendation Date	4/3/2023
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 #	RED1-343-22 H/ERV Option
CDP ID #	1330
Code	IECC RE
Code Section(s)	R408.2 Table
Location	base
Proponent	Mark Lyles markl@newbuildings.org
Proposal Status	SC rev
Subcommittee	RE HVACR & WH
Subcommittee Notes	Proposal presented. Gary Klein motion to approve "AS Modified" with with a second from Kevin Rose. Vladimir supportive of the motion to approve C/O proponent of the proposal. PNNL is considering. Motion to approved "AS modified" carried with a vote of 7/0/2
Recommendation	Recommendation to Approve "AS modified"
Vote	7/0/2
Recommendation Date	4/3/2023
Next Step	To Subcommittee To Advisory Group_____ To Consensus Committee___x _____
Consensus Committee	
Committee Response	
Vote	Affirmative_____ Negative_____ Table_____ To Subcommittee_____
Date	

RED1-343-22 MODIFICATION (shown in red)

Modification does the following things:

1. Replaces 2021 IMC definition for 'balanced ventilation' with a 2024 IRC definition for 'balanced ventilation system', and then revised as needed where the term is used
2. Adds the less than sign, decimal, and "0" to the applicable rows in the table
3. Replaces the credits awarded in CZ 6, 7, & 8 with 'TBD', given that 2.5 ACH50 and ERV/HRVs are now required in those CZs and the points may need to be re-calculated by PNNL
4. Updated the last sentence in R408.2.5 to match PCD1 as updated after Errata
5. In that same sentence, add "NMT"

IECC: SECTION 202 (New), TABLE R408.2, R408.2.5

Proponents: Mark Lyles, representing California IOUs (markl@newbuildings.org); Gayathri Vijayakumar, representing Steven Winter Associates, Inc. (gvijayakumar@swinter.com); Vladimir Kochkin, representing NAHB (vkochkin@nahb.org); Jennifer Amann, representing ACEEE (jamann@aceee.org)

2024 International Energy Conservation Code [RE Project]

Add new definition as follows:

BALANCED VENTILATION SYSTEM. ~~Any combination of concurrently operating mechanical exhaust and mechanical supply whereby the total mechanical exhaust airflow rate is within 10 percent of the total mechanical supply airflow rate.~~ A ventilation system that simultaneously supplies outdoor air to and exhausts air from a space, where the mechanical supply airflow rate and the mechanical exhaust airflow rate are each within 10% of the average of the two airflow rates.

Revise as follows:

TABLE R408.2 CREDITS FOR ADDITIONAL ENERGY EFFICIENCY

Measure Number	Measure Description	Credit Value								
		Climate Zone 0 & 1	Climate Zone 2	Climate Zone 3	Climate Zone 4	Climate Zone 4C	Climate Zone 5	Climate Zone 6	Climate Zone 7	Climate Zone 8
R408.2.5(1)	ERV or HRV installed	TBD	TBD	TBD	TBD	TBD	TBD	0	0	0
R408.2.5(~~1~~2)	≤ 2.0 ACH50 ~~air leakage rate~~ with ERV or HRV installed	1	4	5	10	10	13	TBD ~~15~~	TBD ~~8~~	TBD ~~8~~
R408.2.5(~~2~~3)	≤ 2.0 ACH50 ~~air leakage rate~~ with a	2	3	2	4	4	5	TBD ~~6~~	TBD ~~6~~	TBD ~~6~~

	balanced ventilation system									
R408.2.5(~~3~~4)	≤ 1.5 ACH50 ~~air leakage rate~~ with ERV or HRV installed	2	4	6	12	12	15	TBD ~~18~~	TBD ~~11~~	TBD ~~11~~
R408.2.5(45)	≤ 1.0 ACH50 ~~air leakage rate~~ with ERV or HRV installed	2	5	6	14	14	17	TBD ~~21~~	TBD ~~14~~	TBD ~~14~~

R408.2.5 Improved air sealing and efficient ventilation system option. ~~The measured air leakage rate shall be less than or equal to 3.0 ACH50, with either an Energy Recovery Ventilator (ERV) or Heat Recovery Ventilator (HRV) installed. Minimum HRV and ERV requirements, measured at the lowest tested net supply airflow, shall be greater than or equal to 75 percent Sensible Recovery Efficiency (SRE), less than or equal to 1.1 cubic feet per minute per watt (0.03 m3/min/watt) and shall not use recirculation as a defrost strategy. In addition, the ERV shall be greater than or equal to 50 percent Latent Recovery/Moisture Transfer (LRMT).~~ The measured air leakage rate and ventilation system shall meet ~~be~~ one of the following:

1. ~~Less than or equal to 2.0 ACH50, with e~~ Either an Energy Recovery Ventilator (ERV) or Heat Recovery Ventilator (HRV) installed.
2. Less than or equal to 2.0 ACH50, with either an ERV or HRV installed.

~~2~~3. Less than or equal to 2.0 ACH50, with a *balanced ventilation system* ~~as defined in Section 202 of the 2021 *International Mechanical Code*~~.

~~3~~4. Less than or equal to 1.5 ACH50, with either an ERV or HRV installed.

~~4~~5. Less than equal to 1.0 ACH50, with either an ERV or HRV installed.

In addition, for measures requiring either an ERV or HRV, ~~M~~ ~~minimum HRV and ERV requirements, measured at the lowest tested net supply airflow, shall be greater than or equal to 75 percent Sensible Recovery Efficiency (SRE), less than or equal to 1.1 cubic feet per minute per watt (0.03 m^3/min/watt) and shall not use recirculation as a defrost strategy. In addition, the ERV shall be greater than or equal to 50 percent Latent Recovery/Moisture Transfer (LRMT).~~ HRV and ERV Sensible Recovery Efficiency (SRE) shall be no less than 75 percent at 32°F (0°C), at the lowest listed net airflow. ERV Latent Recovery/Moisture Transfer (LRMT) or Net Moisture Transfer (NMT) shall be no less than 50 percent, at the lowest listed net airflow. In Climate Zone 8, recirculation shall not be used as a defrost strategy.

International Energy Conservation Code
Code Change Proposal Tracking Sheet

Proposal #	RED1-077-22 R408 mech equipment edit
CDP ID #	1239
Code	IECC RE
Code Section(s)	R408.2 Table
Location	base
Proponent	Amy Boyce amy.boyce@imt.org
Proposal Status	SC rev
Subcommittee	RE HVACR
Subcommittee Notes	Proponent is not able to be on the call. Presenting Cherylyn Kelly. R408 options. Correction of language in the code that allows a home to meet a lower code. With a motion and a proper second to Disapprove the floor opened to discuss. Some in support and some agree with disapproval. Motion to disapprove carried with a vote of 7/1/1
Recommendation	Subcommittee recommendation is to disapproved
Vote	Disapprove with a vote of 7/1/1
Recommendation Date	4/3/2023
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 #	RED1-337-22 Air leakage and mech ventilation reorg
CDP ID #	1469
Code	IECC RE
Code Section(s)	R405.4.2(1) Table
Location	base
Proponent	Mike Moore mmoore@statorllc.com
Proposal Status	SC rev
Subcommittee	RE HVACR
Subcommittee Notes	Mike Moore presented this proposal as an editorial and sync with other sections and table of proposals. Motion to approve Gary Heikkinen and a second from Mary Koban. Note this proposal was requested to be moved to modeling and since this meeting 1/30/2023 and vote Modeling has the proposal.
Recommendation	Subcommittee recommendation is to approve this motion
Vote	8/0/0
Recommendation Date	1/30/2023
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 #	RED1-304-22 Remove 3 in ducts located in conditioned space
CDP ID #	1490
Code	IECC RE
Code Section(s)	R403.3.2
Location	base
Proponent	Alisa McMahon mcmahon.gbac@cox.net
Proposal Status	SC rev
Subcommittee	RE HVACR & WH
Subcommittee Notes	Scheduled for the 3rd of April subcommittee meeting. When the agenda was approved, this proposal was moved to the 10th of April. Proponent Alisa Mcmahon presented the proposal and recommended disapproval. A motions was made to disapprove the proposal with a proper second. No discussion
Recommendation	Recommendation of the subcommittee is to disapprove RED1-304-22 Reason: Proponent request disapproval to support the Duct Working Group Proposal RED1-285-22 as approved by the HVACR/WH subcommittee
Vote	11/0/0
Recommendation Date	4/10/2023
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 #	RECD1-9-22 Thermal energy storage heating system
CDP ID #	
Code	
Code Section(s)	R408.2.10
Location	base
Proponent	HVACR subcommittee
Proposal Status	SC rev
Subcommittee	RE HVACR
Subcommittee Notes	Presenting Kyle Bergeron (AHRI). Motion to approved Kyle Bergeron (committee voting member) with a second Mark Lyles. Several minutes of discussion, questions, comments and most of the general discussion circled around the proposal was not needed. An friendly amendment to change space conditioning to space heating. The conversation took a new turn to move the charging section to the exception section.
Recommendation	Recommendation from the subcommittee is to “approve as modified”
Vote	7/4/0
Recommendation Date	4/10/2023
Next Step	To Subcommittee To Advisory Group_____ To Consensus Committee___x _____
Consensus Committee	
Committee Response	
Vote	Affirmative_____ Negative_____ Table_____ To Subcommittee_____
Date	

Proponent: Kyle Bergeron (kbergeron@ahrinet.org) AHRI

2024 International Energy Conservation Code

SECTION R202

GENERAL DEFINITIONS

Add text as follows:

~~Thermal Energy Storage Heating System: A non-portable heating system, with a nameplate capacity of not less than 5 kWh, that adds heat to a storage medium which is subsequently used to provide energy for space heating of the interior of a building. The heat storage medium consists of a phase change or solid storage material.~~

SECTION R403

ADDITIONAL EFFICIENCY REQUIREMENTS

R403.7 Equipment sizing and efficiency rating. Heating and cooling equipment shall be sized in accordance with ACCA Manual S based on building loads calculated in accordance with ACCA Manual J or other approved heating and cooling calculation methodologies. New or replacement heating and cooling equipment shall have an efficiency rating equal to or greater than the minimum required by federal law for the geographic location where the equipment is installed.

Revise as follows:

R403.7.1 Electric-resistance space heating. Detached one- and two-family dwellings and townhouses in Climate Zones 4 through 8 using electric -resistance space heating shall limit the total installed heating capacity of all electric-resistance space heating serving the dwelling unit to no more than 2 kW, or shall install a heat pump in the largest space that is not used as a bedroom.

Exception:

1. This limit does not apply to a non-portable thermal energy storage heating system, with a nameplate capacity of not less than 5 kWh, that adds heat to a storage medium which which is subsequently used to provide energy for space heating. The heat storage medium consists of a phase change or solid storage material.

Reason: The definition of thermal energy storage is aligned with the US tax code for incentives through investment tax credits (26 U.S. Code § 48). These definitions are necessary to ensure that code compliance paths include thermal storage technology, which has been identified as a national priority by Congress. The minimum size of 5kW ensures that the system will keep home energy use off peak, which is the primary purpose and function of the devices.

Cost Impact: Will not increase the cost of construction.

This proposal adds no substantive requirements and, thus, does not add to the cost of construction.

Modification after subcommittee review

Proponent: Kyle Bergeron (kbergeron@ahrinet.org) AHRI

2024 International Energy Conservation Code

SECTION R202

GENERAL DEFINITIONS

Add text as follows:

~~Thermal Energy Storage Heating System: A non-portable heating system, with a nameplate capacity of not less than 5 kWh, that adds heat to a storage medium which is subsequently used to provide energy for space heating of the interior of a building. The heat storage medium consists of a phase change or solid storage material.~~

SECTION R403

ADDITIONAL EFFICIENCY REQUIREMENTS

R403.7 Equipment sizing and efficiency rating. Heating and cooling equipment shall be sized in accordance with ACCA Manual S based on building loads calculated in accordance with ACCA Manual J or other approved heating and cooling calculation methodologies. New or replacement heating and cooling equipment shall have an efficiency rating equal to or greater than the minimum required by federal law for the geographic location where the equipment is installed.

Revise as follows:

R403.7.1 Electric-resistance space heating. Detached one- and two-family dwellings and townhouses in Climate Zones 4 through 8 using electric -resistance space heating shall limit the total installed heating capacity of all electric-resistance space heating serving the dwelling unit to no more than 2 kW, or shall install a heat pump in the largest space that is not used as a bedroom.

Exception:

1. This limit does not apply to ~~a~~ non-portable thermal energy storage heating systems, with ~~a~~ nameplate ~~capacity~~ capacities of ~~not less than~~ 5 kWh or more, that adds heat to ~~a~~ storage mediums ~~which is subsequently~~ used to provide energy for space heating. The heat storage medium consists of a phase change or solid ~~storage~~ material.

Reason: The definition of thermal energy storage is aligned with the US tax code for incentives through investment tax credits (26 U.S. Code § 48). These definitions are necessary to ensure that code compliance paths include thermal storage technology, which has been identified as a national priority by Congress. The minimum size of 5kW ensures that the system will keep home energy use off peak, which is the primary purpose and function of the devices.

Cost Impact: Will not increase the cost of construction.

This proposal adds no substantive requirements and, thus, does not add to the cost of construction.

International Energy Conservation Code
Code Change Proposal Tracking Sheet

Proposal #	RED1-349-22 PI & II Include LPG in HVAC equip performance options
CDP ID #	1261
Code	IECC RE
Code Section(s)	R408.2.2
Location	base
Proponent	Tom Ortiz tortiz@npga.org
Proposal Status	SC rev
Subcommittee	RE HVACR & WH
Subcommittee Notes	Bruce Swiecincki presenting (Tom Ortiz) not present – Discussion started with a motion to approve. Discussion moved to adding propane, one commenter was in favor of RED1-351 rather than this proposal. With a friendly amendment and some editorial changes, the proposal as modified passed with a strong approval vote.
Recommendation	Recommendation of the subcommittee is to approve as modified
Vote	11/0/0
Recommendation Date	4/10/2023
Next Step	To Subcommittee To Advisory Group_____ To Consensus Committee___x_____
Consensus Committee	
Committee Response	
Vote	Affirmative_____ Negative_____ Table_____ To Subcommittee_____
Date	

RED1-349-22 Part I

IECC: R408.2.2

Proponents:
Tom Ortiz, representing National Propane Gas Association (tortiz@npga.org); Bruce Swiecicki, representing National Propane Gas Association (bswiecicki@npga.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R408.2.2 More efficient HVAC equipment performance option.

Heating and cooling *equipment* shall meet one of the following efficiencies

Centrally Ducted Systems:

- 1.

  Greater than or equal to 16

- 2.

  Greater than or equal to 18 SEER (16.9 SEER2) and 14 EER (13.4 EER2) air conditioner.

- 3.

  Greater than or equal to 92 AFUE ~~natural gas or propane~~ fuel gas furnace.

- 4.

  Greater than or equal to 95 AFUE ~~natural gas or propane~~ fuel gas furnace and 15.2 SEER2 in Climate Zones 5, 6 and 7

- 5.

  Greater than or equal to 95 AFUE ~~natural gas or propane~~ fuel gas furnace and 16.0 SEER2 in other Climate Zones for air conditioner.

- 6.

  Greater than or equal to 95 AFUE ~~natural gas or propane~~ fuel gas furnace and 8.5 HSPF2/16.0 SEER2 air source heat pump.

- 7.

  Greater than or equal to 96 AFUE ~~natural gas or propane~~ fuel gas furnace.

- 8.

  Greater than or equal to 8.5 HSPF2/16.0 SEER2 air source heat pump.

- 9.

  Greater than or equal to 9 HSPF (7.6 HSPF2) /16 SEER (15.2 SEER2) air source heat pump.

- 10.

Greater than or equal to 10 HSPF (8.5 HSPF2) /16SEER (15.2 SEER2) air source heat pump.

- 11.

  Greater than or equal to 3.5 COP ground source heat pump.

Ductless Systems:

- 12.

  Single Zone: 8.5 HSPF2/16.9 SEER2 variable speed air source heat pump.

- 13.

  Multi Zone: 8.5 HSPF2/16.9 SEER2 variable speed air source heat pump (Non-Ducted Indoor Units).

- 14.

  Multi Zone: 8.5 HSPF2/15.2 SEER2 variable speed air source heat pump (Ducted or Mixed Indoor Units)

Reason:

Are LPG systems included in the definition of "natural gas"? If not, must be included.
Cost Impact:
The code change proposal will neither increase nor decrease the cost of construction.
There will be no effect on the cost of construction.

International Energy Conservation Code
Code Change Proposal Tracking Sheet

Proposal #	RED1-329-22 R403.8 stricken ref com provisions
CDP ID #	1095
Code	IECC RE
Code Section(s)	R403.8
Location	base
Proponent	Greg Johnson gjohnsonconsulting@gmail.com
Proposal Status	SC rev
Subcommittee	RE HVACR & WH
Subcommittee Notes	Greg is not able to participate today in the discussion. Motion and a second received to table to proposal. Motion to table approved by a vote of 8/0/0. Table until the 3/27/2023 subcommittee meeting. Proposal presented by Greg Johnson 4/10/2023 subcommittee meeting. The purpose is to tie in commercial and residential and clean up language where commercial language passes across to residential. Most interested parties and members of the committee praised the work as needed the overwhelming consideration is the proposal is not ready or incomplete. The proponent will continue work on an "as modified" to present when the proposal goes to Consensus.
Recommendation	Recommendation of the subcommittee is to disapprove
Vote	8/2/1
Recommendation Date	4/10/2023
Next Step	To Subcommittee To Advisory Group_____ To Consensus Committee____x _____
Consensus Committee	

Committee Response	
Vote	Affirmative_____ Negative_____ Table_____ To Subcommittee_____
Date	

RED1-329-22 proposed modification 04-21-2023

R403.8 Systems serving multiple dwelling units. Except for systems complying with ~~R403.5.2, and systems complying with~~ Section ~~R403.8~~ R403.9, systems ~~Systems~~ serving multiple dwelling units shall comply with Sections C403 and C404 of the International Energy Conservation Code—Commercial Provisions instead of Section R403.

~~(insert new section):~~

~~**R403.5.2 Controls for hot water storage.** The controls on pumps that circulate water between a water heater and a heated water storage tank shall limit operation of the pump from heating cycle startup to not greater than 5 minutes after the end of the cycle. (Extracted from C404.6.3)~~

(insert new sections and renumber as follows):

~~**R403.8**~~ R403.9 **Mechanical systems located outside of the building thermal envelope.** Mechanical systems providing heat outside of the thermal envelope of a building shall comply with Sections R403.8.1 R403.9.1 through ~~R403.8.4~~ R403.9.4.

~~**R403.8.1**~~ R403.9.1 **Heating outside a building.** Systems installed to provide heat outside a building shall be radiant systems. Such heating systems shall be controlled by an occupancy sensing device or a timer switch, so that the system is automatically de-energized when occupants are not present.

~~**R403.9 R403.8.2**~~ R403.9.2 **Snow melt and ice system controls.** Snow- and ice-melting systems, supplied through energy service to the building, shall include automatic controls capable of shutting off the system when the pavement temperature is greater than 50°F (10°C) and precipitation is not falling, and an automatic or manual control that will allow shutoff when the outdoor temperature is greater than 40°F (4.8°C).

(Renumber as follows):

~~R403.10~~ ~~R403.8.3~~ R403.9.3 **Roof and gutter deicing controls** Roof and gutter deicing systems, including but not limited to self-regulating cable, shall include automatic controls configured to shut off the system when the outdoor temperature is above 40°F (4.8°C) maximum and shall include one of the following:

1. A moisture sensor configured to shut off the system in the absence of moisture, or
2. A programmable timer configured to shut off the system for 8 hours minimum at night.

~~R403.8.4~~ R403.9.4 **Freeze protection system controls.** Freeze protection systems, such as heat tracing of outdoor piping and heat exchangers, including self-regulating heat tracing, shall include automatic controls configured to shut off the systems when outdoor air temperatures are above 40°F (4.8°C) or when the conditions of the protected fluid will prevent freezing.

Reason: This modification extracts sections of C403 and C404 (copied and pasted) that do not have a corresponding section in the IECC-R. Despite the goal of bringing all such requirements into the IECC-R, some requirements of C403 and C404 are quite extensive and many new since the 2021 IECC. Reluctantly, it appears the better option at this time to maintain a reference to those provisions until the 2027 development cycle when additional time and expertise is available to help bring those provisions into the IECC-R.

International Energy Conservation Code
Code Change Proposal Tracking Sheet

Proposal #	RED1-315-22 AHRI Standard 1430-2022
CDP ID #	1227
Code	IECC RE
Code Section(s)	R403.5.5
Location	base
Proponent	Mary Koban mkoban@ahrinet.org
Proposal Status	SC rev
Subcommittee	RE HVACR & WH
Subcommittee Notes	Proponent presenting Kyle Bergeron AHRI "as modified Motion to approve as modified with a second discussion opened. A few questions requesting explanations on certain aspect and the comments were mostly in support of approval as modified. Vote to "approve as modified"7/0/1
Recommendation	Subcommittee having voted to approve "as modified" our recommendation is to approve as modified
Vote	7/0/1
Recommendation Date	3/27/2023
Next Step	To Subcommittee To Advisory Group_____ To Consensus Committee____x_____
Consensus Committee	
Committee Response	
Vote	Affirmative_____ Negative_____ Table_____ To Subcommittee_____
Date	

RED1-315-22

Proponents: Mary Koban, representing AHRI (mkoban@ahrinet.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R403.5.5 Demand responsive water heating. Electric storage water heaters with a rated water storage volume of 40 gallons (150L) to 120 gallons (450L) and a nameplate input rating equal to or less than 12kW shall be provided with demand responsive controls in accordance with Table R403.5.5 or ~~another equivalent approved standard.~~ AHRI Standard 1430-2022 (I-P).

Exceptions:

1. Water heaters that are capable of delivering water at a temperature of 180°F (82°C) or greater.
2. Water heaters that comply with Section IV, Part HLW or Section X of the ASME Boiler and Pressure Vessel Code.
3. Water heaters that use 3-phase electric power.

Add new standard(s) as follows:

AHRI

AHRI Standard 1430-2022 (I-P) Demand Flexible Electric Storage Water Heaters
2111 Wilson Blvd, Suite 500
Arlington, VA 22201

Reason: AHRI notes that AHRI Standard 1430 is a harmonized specification for demand flexible electric resistance storage and electric heat pump water heaters (HPWH)s capable of load management that policymakers can use, state government, electric utilities, authorized third parties, manufacturers, designers, installers, contractors, and users. By providing standardized requirements for Demand Flexible Electric Storage Water Heaters (DFWH), utilities and load management program managers can be assured that DFWHs can communicate using standard hardware and software.
AHRI Standard 1430 published December 2022. Therefore, the standard is ready to be included in the code to guide DFWHs.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Referencing AHRI Standard 1430 will neither increase nor decrease the cost of construction. If anything, since manufacturers will already employ AHRI 1430, the expected cost to manufacture products will decrease.

Bibliography: AHRI notes that AHRI Standard 1430 is available as a free download at the following link: https://www.ahrinet.org/sites/default/files/2022-12/AHRI%20Standard%201430-2022%20%28I-P%29.pdf.
The standard has also been uploaded for convenience.

Workgroup Recommendation

Revise as Follows

R403.5.5 Demand responsive water heating. Electric storage water heaters with a rated water storage volume of 40 gallons (150L) to 120 gallons (450L) and a nameplate input rating equal to or less than 12kW shall be provided with demand responsive controls in accordance with Table R403.5.5 ~~or another equivalent approved standard AHRI Standard 1430-2022 (I-P).~~

Exceptions:

1. Water heaters that are capable of delivering water at a temperature of 180°F (82°C) or greater.
2. Water heaters that comply with Section IV, Part HLW or Section X of the ASME Boiler and Pressure Vessel Code.
3. Water heaters that use 3-phase electric power.

TABLE R403.5.5
DEMAND RESPONSIVE CONTROLS FOR WATER HEATING

Equipment Type	Controls	
	Manufactured Before 7/1/2025	Manufactured On or After 7/1/ 2025
Electric storage water heaters	AHRI Standard 1430-2022 (I-P) or ANSI/CTA-2045-B Level 1 and also capable of initiating water heating to meet the temperature set point in response to a demand response signal.	AHRI Standard 1430-2022 (I-P) ~~ANSI/CTA-2045-B Level 2, except "Price Stream Communication" functionality as defined in the standard.~~

Add new standard(s) as follows:

AHRI	AHRI Standard 1430-2022 (I-P) Demand Flexible Electric Storage Water Heaters 2111 Wilson Blvd, Suite 500 Arlington, VA 22201

Reason: In addition to the reason statement in the proposal, the workgroup agreed that including the AHRI standard in the Table was a better way to include it in the code.

Cost impact: no change from the original proposal.

Bibliography: no change from the original proposal.

International Energy Conservation Code
Code Change Proposal Tracking Sheet

Proposal #	RED1-316-22 Demand response water heaters
CDP ID #	1059
Code	IECC RE
Code Section(s)	R403.5.5
Location	base
Proponent	Greg Johnson gjohnsonconsulting@gmail.com
Proposal Status	SC rev
Subcommittee	RE HVACR & WH
Subcommittee Notes	Proposal presented "as modified Motion to approve " as modified" with a second discussion opened up. Main objection is moving the language to R408. Motion to approve "as modified" failed 2/7/1. New motion to disapprove "as modified" with a second. Motion carried to disapprove vote 6/4/0
Recommendation	Subcommittee having voted to disapprove " as modified". My recommendation based on the subcommitee vote is to disapprove.
Vote	6/4/0
Recommendation Date	3/27/2023
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 #	RED1-078-22 R408 remove credit for appliances
CDP ID #	1242
Code	IECC RE
Code Section(s)	R408.2 Table
Location	base
Proponent	Amy Boyce amy.boyce@imt.org
Proposal Status	SC rev
Subcommittee	RE Econ, Model, Metric
Subcommittee Notes	Motion to Approve: Amy Boyce; 2nd Jay Crandell
Recommendation	Reason Statement: Including credit for the installation of appliances runs the risk of free-ridership issues and provides significant credit at the expense of other more permanent measures. RED1-078 & RED1-080 voted together by SC with each proponent agreeing they were the same proposals. Motion to Approve *failed*. Based on prior SC action, motions for Approve that fail are reported as Disapprove
Vote	Disapprove 7/6/3
Recommendation Date	April 11, 2023
Next Step	To Subcommittee To Advisory Group_____ To Consensus Committee_____
Consensus Committee	
Committee Response	
Vote	Affirmative_____ Negative_____ Table_____ To Subcommittee_____
Date	

International Energy Conservation Code
Code Change Proposal Tracking Sheet

Proposal #	RED1-080-22 Remove appliances from table
CDP ID #	1492
Code	IECC RE
Code Section(s)	R408.2 Table
Location	base
Proponent	Alisa McMahon mcmahon.gbac@cox.net
Proposal Status	SC rev
Subcommittee	RE Econ, Model, Metric
Subcommittee Notes	Motion to Approve: Amy Boyce; 2nd Jay Crandell
Recommendation	Reason Statement: Including credit for the installation of appliances runs the risk of free-ridership issues and provides significant credit at the expense of other more permanent measures. RED1-078 & RED1-080 voted together by SC with each proponent agreeing they were the same proposals. Motion to Approve *failed*. Based on prior SC action, motions for Approve that fail are reported as Disapprove
Vote	Disapprove 7/6/3
Recommendation Date	April 11, 2023
Next Step	To Subcommittee To Advisory Group_____ To Consensus Committee_____X_____
Consensus Committee	
Committee Response	
Vote	Affirmative_____ Negative_____ Table_____ To Subcommittee_____
Date	

RED1-80-22 Modification not heard by subcommittee

Proponents: Alisa McMahon, representing self (mcmahon.gbac@cox.net)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

TABLE R408.2 CREDITS FOR ADDITIONAL ENERGY EFFICIENCY

Portions of table not shown remain unchanged.

Measure Number	Measure Description	Credit Value								
		Climate Zone 0 & 1	Climate Zone 2	Climate Zone 3	Climate Zone 4	Climate Zone 4C	Climate Zone 5	Climate Zone 6	Climate Zone 7	Climate Zone 8
R408.2.6	Energy efficient appliances	~~9~~ TBD	~~8~~ TBD	~~8~~ TBD	~~7~~ TBD	~~7~~ TBD	~~5~~ TBD	~~5~~ TBD	~~5~~ TBD	~~4~~ TBD

Reason:

The credit values appear to be excessively high. This observation was made by several participants when RED1-80 was heard in subcommittee. PNNL has expressed a desire to reanalyze R408.2.6.

International Energy Conservation Code
Code Change Proposal Tracking Sheet

Proposal #	RED1-360-22 R408 Efficient appliance option
CDP ID #	1067
Code	IECC RE
Code Section(s)	R408.2.6 Table
Location	base
Proponent	Mark Lyles
Proposal Status	SC rev
Subcommittee	RE Econ, Model, Metric
Subcommittee Notes	Motion to Approve as Modified: Pamela Fasse; 2nd Shilpa Surana
Recommendation	Reason Statement: Improves clarity of the requirements to meet the appliance credit.
Vote	Approve 8/3/5
Recommendation Date	April 11, 2023
Next Step	To Subcommittee To Advisory Group_____ To Consensus Committee_____X_____
Consensus Committee	
Committee Response	
Vote	Affirmative_____ Negative_____ Table_____ To Subcommittee_____
Date	

RED1-360 – FURTHER MODIFIED AFTER SC VOTE IN BLUE

Section R202

COMMON AREAS. All *conditioned spaces* within Group R occupancy buildings that are not *dwelling units* or sleeping units.

Table R408.2.6 MINIMUM EFFICIENCY REQUIREMENTS: APPLIANCES ~~SPECIFICATION REFERENCE DOCUMENT~~

Appliance	Efficiency Improvement	Test Procedure
Refrigerator	~~Energy Star Program Requirements, Product Specification for Consumer Refrigeration Products, Version 5.1 (08/05/2021)~~ Maximum Annual Energy Consumption (AEC) No greater than 620 kWh/yr	10 CFR 430, Subpart B, Appendix A.
Dishwasher	~~Energy Star Program Requirements for Residential Dishwashers, Version 6.0 (01/29/2016)~~ Maximum Annual Energy Consumption (AEC) No greater than ~~270~~ 240 kWh/yr	10 CFR 430, Subpart B, Appendix C1
~~Clothes dryer~~	~~Energy Star Program Requirements, Product Specification for Clothes Dryers, Version 1.1 (05/05/2017)~~	
Clothes Washer ~~and Clothes Dryer~~	~~Energy Star Program Requirements, Product Specification for Clothes Washers, Version 8.1 (02/05/2018)~~ Clothes Washer located within *dwelling* units: Maximum Annual Energy Consumption (AEC) ~~for Clothes Washer[a][1][2]~~ No greater than 130 kWh/yr and Integrated Modified Energy Factor (IMEF) > 1.84 cu.ft/kWh/cycle Clothes Washer not located within *dwelling* units and where *dwelling* units are not provided with laundry facilities:[2] Modified Energy Factor (MEF) > 2.0 cu.ft/kWh/cycle	10 CFR 430 Subpart B, Appendix J2 and 10 CFR 430, Subpart B, Appendices D1 and D2

~~* 1 Credit for Clothes Washer/Clothes Dryer pair is based on Clothes Washer efficiency~~

~~2 For buildings without in-unit clothes washer hook-ups, credit is available where all clothes washers installed in common laundry rooms are horizontal-axis commercial clothes washers with a clothes container compartment not more than 3.5 cubic feet.~~

R408.2.6 Energy efficient appliances. ~~All a~~appliances Appliances installed in a *residential building* ~~dwelling unit~~ shall ~~meet~~ comply with the ~~product energy~~ efficiency requirements ~~specifications listed~~

specified in Table R408.2.6~~, or equivalent energy efficiency specifications~~. Not less than three appliance types from Table R408.2.6 shall be installed ~~for compliance with this section~~.

Exception:

In Group R-2 occupancies where a dishwasher is not installed in each *dwelling* unit, ~~compliance can be met with~~ not less than two appliance types ~~from~~ complying with Table R408.2.6 shall be installed. In *common areas* each appliance type shall comply with Table R408.2.6.

Reason Statement:

The objective of Section R408.2.5 was to encourage installation of appliances meeting ENERGY STAR criteria. Unfortunately, IECC does not allow direct reference to ENERGY STAR product specifications. The intent of the proposed change is to specify requirements which will meet the Energy Star product specification criteria in a way that is easily confirmed by a code official. Specifically, the proposed changes remove the reference to Energy Star program requirements and introduce maximum Annual Energy Consumption requirements for Refrigerators, Dishwashers and Clothes Washers ~~and Clothes Dryers~~. Code officials will be able to readily confirm compliance by comparing the Annual Energy Consumption listed on the Energy Guide label of products in the building with these maximum Annual Energy Consumption requirements. Annual energy consumption for the dishwasher has been modified to align with Energy Star Dishwasher Specification version 7.0. Additional clarification has been added to make this credit available where appliances are present in common spaces of multifamily buildings.

International Energy Conservation Code
Code Change Proposal Tracking Sheet

Proposal #	RED1-073-22 R408 additional measures
CDP ID #	1369
Code	IECC RE
Code Section(s)	R408.2
Location	base
Proponent	Alex Smith asmith@nahb.org
Proposal Status	SC rev
Subcommittee	RE Econ, Model, Metric
Subcommittee Notes	Motion to Approve as Modified by SC: Vladimir Kochkin; 2nd Shilpa Surana
Recommendation	Reason Statement: the modification further clarifies the language; provides additional direction for implementation in MF buildings; coordinates with other proposals that have been approved for this section.
Vote	Approve 10/0/5
Recommendation Date	April 11, 2023
Next Step	To Subcommittee To Advisory Group_____ To Consensus Committee_____X_____
Consensus Committee	
Committee Response	
Vote	Affirmative_____ Negative_____ Table_____ To Subcommittee_____
Date	

RED1-73-22 MODIFICATION APPROVED BY SC (edits shown in red are different from monograph). Text in Blue shows rows/text to align with RED1-358 that were approved by SC.

Text in Green was added after the SC Vote to use a newly proposed defined term for "common area" which was approved at IECC-C.

Note: This modification incorporates overlapping edits/intent contained in RED1-26, 71 and 72 (those proponents are Aaron Philips, Rob Salcido, Gayathri Vijayakumar). The language in this MOD was further improved by Greg Johnson. In addition, edits were made to align with action on 358.

Staff note: Yellow is used below to identify terms that need to be in italics.

Proponents: Alex Smith, representing NAHB (asmith@nahb.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

R408.1 Scope. This section ~~establishes~~ provides additional efficiency measures and credits ~~to achieve additional energy efficiency in accordance~~ required to comply with Section R401.2.~~5~~1.

R408.2 Additional energy efficiency credit requirements. ~~Two of the additional~~ *Residential buildings* shall earn not less than ten credits from not less than two measures ~~shall be selected from~~ specified in Table R408.2 ~~that meet or exceed a total of ten credits~~. Five additional credits shall be ~~selected~~ earned for *dwelling units* with ~~greater~~ more than 5,000 square feet (465 m^2) of *living space* ~~floor area~~ located above *grade plane*. To earn credit as specified in Table R408.2 for the applicable Climate Zone, each ~~Each~~ measure selected for compliance shall ~~meet~~ comply with the ~~relevant~~ applicable subsections of Section R408 ~~and receive credit as specified in Table R408.2 for the specific Climate Zone~~. Each *dwelling unit* or sleeping unit shall comply with the selected measure to earn credit. Interpolation of credits between measures shall not be permitted.

CLEAN VERSION IF MOD IS APPROVED

R408.1 Scope. This section provides additional efficiency measures and credits required to comply with Section R401.2.1.

R408.2 Additional energy efficiency credit requirements. *Residential buildings* shall earn not less than ten credits from not less than two measures specified in Table R408.2. Five additional credits shall be earned for *dwelling units* with more than 5,000 square feet (465 m^2) of *living space* located above *grade plane*. To earn credit as specified in Table R408.2 for the applicable Climate Zone, each measure selected for compliance shall comply with the applicable subsections of Section R408. Each *dwelling unit* or sleeping unit shall comply with the selected measure to earn credit. Interpolation of credits between measures shall not be permitted.

Revise as follows to add the footnotes:

TABLE R408.2
CREDITS FOR ADDITIONAL ENERGY EFFICIENCY

Portions of table not shown remain unchanged.

Measure Number	Measure Description	Credit Value								
		CZ 0 & 1	CZ 2	CZ 3	CZ 4	CZ 4C	CZ 5	CZ 6	CZ 7	CZ 8
R408.2.1.1 (1)	≥ 2.5% reduction in total UA									
R408.2.1.1 (2)	≥ 5% reduction in total UA									
R408.2.1.1 (3)	> 7.5% reduction in total UA									
R408.2.1.2 (1)	0.22 U-factor windows									
R408.2.1.2 (2)	U factor and SHGC for windows per Table R408.2.1									
R408.2.1.3	Cool roof									
R408.2.2 (1) [b]	High performance cooling system option 1									
R408.2.2 (2) [b]	High performance cooling system option 2									
R408.2.2 (3) [b]	High performance gas furnace option 1									
R408.2.2 (4) [b]	High performance gas furnace option 2									
R408.2.2 (5) [b]	High performance gas furnace and cooling system option 2									
R408.2.2 (6) [b]	High performance gas furnace and heat pump system option 1									
R408.2.2 (7) [b]	High performance gas furnace option 2									
R408.2.2 (8) [b]	High performance heat pump system option 1									
R408.2.2 (9) [b]	High performance heat pump system option 2									
R408.2.2 (10) [b]	High performance heat pump system option 3									
R408.2.2 (11) [b]	Ground source heat pump									
R408.2.2 (12) [b]	Ductless -Single zone									
R408.2.2 (13) [b]	Ductless -Multizone (Non-ducted indoor unit)									
R408.2.2 (14) [b]	Ductless – Multizone (Ducted or Mixed)									
R408.2.3 (1a) [d]	Gas-fired storage water heaters (option 1)									
R408.2.3 (1b) [d]	Gas-fired storage water heaters (option 2)									
R408.2.3 (2a) [d]	Gas-fired instantaneous water heaters (option 1)									
R408.2.3 (2b) [d]	Gas-fired instantaneous water heaters (option 2)									
R408.2.3 (3a) [d]	Electric water heaters (option 1)									
R408.2.3 (3b) [d]	Electric water heaters (option 2)									
R408.2.3 (4) [d]	Electric water heaters (option 3)									
R408.2.3 (5a) [d]	Electric water heaters (option 4)									
R408.2.3 (5b) [d]	Electric water heaters (option 5)									
R408.2.3 (6) [d]	Electric water heaters (option 6)									
R408.2.3 (~~5~~7a) [d]	Solar hot water heating system (option 1)									
R408.2.3 (7b) [d]	Solar hot water heating system (option 2)									

R408.2.3 (68) [c]	Compact hot water distribution									
R408.2.4 (1) [c]	More efficient distribution system									
R408.2.4 (2) [c]	100% of ducts in conditioned space									
R408.2.4 (3) [c]	Reduced total duct leakage									
R408.2.5 (1) [c]	2 ACH50 air leakage rate with ERV or HRV installed									
R408.2.5 (2) [c]	2 ACH50 air leakage rate with balanced ventilation									
R408.2.5 (3) [c]	1.5 ACH50 air leakage rated with ERV or HRV installed									
R408.2.5 (4) [c]	1 ACH50 air leakage rate with ERV or HRV installed									
R408.2.6 [a]	Energy efficient appliances	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.7	Renewable energy measure									
R408.2.9 [c]	Demand responsive thermostat									

a. Where the measure is selected, each *dwelling unit,* sleeping unit, and ~~other space~~ *common areas* where the measure is applicable must have the measure installed.

b. Where multiple heating or cooling systems are installed, credits shall be determined using a weighted average of the square footage served by each system.

c. Where the measure is selected, each *dwelling unit* and sleeping unit must comply with the measure.

d. Where the measure is selected, each *dwelling* unit shall be served by a water heater meeting the applicable requirements. Where multiple service water heating systems are installed, credits shall be determined using a weighted average of the square footage served by each system.

Revise as follows:

R408.2.3 Reduced energy use in service water-heating options. For measure numbers R408.2.3 (1) through R408.2.3 (~~5~~7), the installed hot water system shall meet one of the Uniform Energy Factors (UEF) or Solar Uniform Energy Factors (SUEF)~~:~~ in Table R408.2.3. For measure number R408.2.3 (~~6~~8), the *dwelling unit* hot water distribution system shall comply with R408.2.3.1.

To field or plan review verify that the system meets the prescribed limit, one of the following must be done:

1. At plan review, referencing ounces of water per foot of tube on plans as per Table R403.5.4.

2. At rough in (plumbing), referencing ounces of water per foot of tube installed as per Table R403.5.4.

3. At final inspection. In accordance with Department of Energy's Zero Energy Ready Home National Specification (Rev. 07 or higher) footnote on Hot water delivery systems.

Revise as follows:

TABLE R408.2.3

Service water-heating efficiencies

Portions of table not shown remain unchanged.

Table 408.2.3
Service water-heating efficiencies

Measure Number	Water Heater	Size and Draw Pattern	Type	Efficiency
R408.2.3 (1) (a)	Gas-fired storage water heaters (option 1)	All storage volumes, all draw patterns		UEF ≥ 0.81
R408.2.3 (1) (b)	Gas-fired storage water heaters (option 2)	≤ 55 gallons, Medium		UEF ≥ 0.81
		≤ 55 gallons, High		UEF ≥ 0.86
		>55 gallons, Medium or High		UEF ≥ 0.86
		Rated input capacity > 75,000 Btu/h		UEF ≥ 0.86 or E_t ≥ 94%
R408.2.3 (2) (a)	Gas-fired instantaneous water heater (option 1)	All storage volumes, Medium or High		UEF ≥ 0.925
R408.2.3 (2) (b)	Gas-fired instantaneous water heater (option 2)	All storage volumes, Medium or High		UEF ≥ 0.95
R408.2.3 (3) (a)	Electric water heaters (option 1)	All storage volumes, Low, Medium, or High	Integrated HPWH	UEF ≥ 3.30
R408.2.3 (3) (b)	Electric water heaters (option 2)	All storage volumes, Low, Medium, or High	Integrated HPWH	UEF ≥ 3.75
R408.2.3 (4)	Electric water heaters (option 3)		Integrated HPWH, 120 Volt/15 Amp Circuit	UEF ≥ 2.20
R408.2.3 (45a) R408.2.3 (5) (b)	Electric water heaters (option 4)		Split-system HPWH	UEF ≥ 2.20
	Electric water heaters (option 5)		Split-system HPWH	UEF ≥ 3.75

R408.2.3 (6)	Electric water heaters (option 6)	Rated input capacity > 12 kW		COP ≥ 3.00
R408.2.3 (~~5~~7a)	Solar water heaters (option 1)	All storage volumes, all draw patterns	Electric backup	SUEF ≥ 3.00
R408.2.3 (7b)	Solar water heaters (option 2)	All storage volumes, all draw patterns	Gas backup	SUEF ≥ 1.80

UEF = Uniform Energy Factor, E_t = Thermal Efficiency, COP = Coefficient of Performance

International Energy Conservation Code
Code Change Proposal Tracking Sheet

Proposal #	RED1-026-22 Additional energy efficiency
CDP ID #	967
Code	IECC RE
Code Section(s)	R408.1
Location	base
Proponent	Aaron Phillips aphillips@asphaltroofing.org
Proposal Status	SC rev
Subcommittee	RE Econ, Model, Metric
Subcommittee Notes	Motion to Disapprove: Jay Crandell; 2nd Rob Salcido
Recommendation	Reason Statement: Disapproved based on proponent request and prior action on RED1-73
Vote	Disapprove 15/0/0
Recommendation Date	April 11, 2023
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 #	RED1-079-22 R408 total UA improvement options
CDP ID #	1252
Code	IECC RE
Code Section(s)	R408.2 Table
Location	base
Proponent	Amy Boyce amy.boyce@imt.org
Proposal Status	SC rev
Subcommittee	RE Econ, Model, Metric
Subcommittee Notes	Motion to Approve as Modified: Amy Boyce; 2nd Jay Crandell
Recommendation	Reason Statement: Proposal expands the availability of credits for additional improvements in total UA
Vote	Approve 14/0/1
Recommendation Date	April 11, 2023
Next Step	To Subcommittee To Advisory Group_____ To Consensus Committee_____X_____
Consensus Committee	
Committee Response	
Vote	Affirmative_____ Negative_____ Table_____ To Subcommittee_____
Date	

TABLE R408.2 CREDITS FOR ADDITIONAL ENERGY EFFICIENCY

Portions of table not shown remain unchanged.

Measure Number	Measure Description	Credit Value								
		Climate Zone 0 & 1	Climate Zone 2	Climate Zone 3	Climate Zone 4	Climate Zone 4C	Climate Zone 5	Climate Zone 6	Climate Zone 7	Climate Zone 8
R408.2.1.1(1)	≥2.5% Reduction in total UA	0	0	0	1	1	1	1	1	1
R408.2.1.1(2)	≥5% reduction in total UA	0	1	1	2	2	3	3	3	3
R408.2.1.1(3)	>7.5% reduction in total UA	0	1	2	2	2	3	3	4	4
R408.2.1.1(4)	>10% reduction in total UA	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.1.1(5)	> 15% reduction in total UA	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.1.1(6)	>20% reduction in total UA	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.1.1(7)	>30% reduction in total UA	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD

R408.2.1.1 Enhanced envelope performance ~~UA~~. The proposed total building thermal envelope *thermal conductance* ~~UA~~ shall be calculated for the proposed building in accordance with Section R402.1.5 and it shall be reduced by not less than the percentage indicated in Table R408.2 in comparison to the reference building. ~~shall meet one of the following:~~

~~1. Not less than 2.5 percent of the total UA of the *building thermal envelope*.~~

~~2. Not less than 5 percent of the total UA of the *building thermal envelope*.~~

~~3. Not less than 7.5 percent of the total UA of the *building thermal envelope*.~~

Reason: This proposal expands the building thermal envelope additional efficiency credits in Table R408.2 to include UA reductions of 10%, 15%, and 20%. The current credits are small because the addressed UA reductions are small (7.5% or less). Buildings can be be relatively easily constructed with a 10% UA reduction or more and credits should be provided for those cases. Many buildings are already doing this to minimize energy consumption, use smaller HVAC equipment, and maximize energy efficiency or effectively utilize renewable energy resources (or minimize impact of using fossil fuel energy sources). The values in the table are shown as "TBD" because the actual credits should be based on an analysis as done for other values in the table for consistency. Modification would be welcome to further improve this proposal, such as eliminating the 2.5% and 7.5% categories while retaining 5%, 10%, 15%, and 20% (possibly then also adding 25% or 30%) to cover a reasonable range of credits for building thermal envelope enhancements.
Finally, Section R408.2.1 is revised to align terminology with that used in Section R402.1.5 to address "total building thermal envelope thermal conductance" as a more comprehensive treatment of the Total UA concept that the code had previously used. Also, the list of UA % improvements is deleted in favor of referencing the same information already located in Table R408.2.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Use of the building thermal envelope additional efficiency credits is optional and this proposal is only expanding the options available (which could actually reduce cost for complying with R408 for buildings which have a UA reduced by more than 7.5%). So, at worst, this proposal has no cost impact and, at best, it could reduce cost for some buildings by affording an appropriate amount of credits for a significantly improved building thermal envelope.

International Energy Conservation Code
Code Change Proposal Tracking Sheet

Proposal #	RED1-083-22 Additional envelope UA eff. Credits
CDP ID #	1341
Code	IECC RE
Code Section(s)	R408.2.1.1 table
Location	base
Proponent	Jay Crandell jcrandell@aresconsulting.biz
Proposal Status	SC rev
Subcommittee	RE Econ, Model, Metric
Subcommittee Notes	Motion to Disapprove: Jay Crandell; 2nd Amy Boyce
Recommendation	Reason Statement: Disapprove at proponent request based on prior action on RED1-79 as modified.
Vote	Disapprove 14/0/1
Recommendation Date	April 11, 2023
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 #	RED1-071-22 Air leakage additional efficiency req
CDP ID #	1120
Code	IECC RE
Code Section(s)	R408.1
Location	base
Proponent	Gayathri Vijayakumar gayathri@swinter.com
Proposal Status	SC rev
Subcommittee	RE Econ, Model, Metric
Subcommittee Notes	Motion to Approve as Modified by SC: Shilpa Surana; 2nd Vladimir Kochkin
Recommendation	Reason Statement: Clarifies language in R408.2.1.1 to align with SC prior action on RED1-79. Introduces reduced air leakage credit for achieving air tightness below the prescriptive air leakage rates and a comparable air leakage reduction credit for R-2 occupancies in R408 in CZ 0-5.
Vote	Approve 13/0/2
Recommendation Date	April 11, 2023
Next Step	To Subcommittee To Advisory Group_____ To Consensus Committee_____X_____
Consensus Committee	
Committee Response	
Vote	Affirmative_____ Negative_____ Table_____ To Subcommittee_____
Date	

RED1-71-22 MODIFICATION (replaces monograph version, edits shown in red) Blue edits added to align with RED1-79 MOD approved at the Env SC on 04/11

Note: This modification REMOVES edits initially proposed to R408.1 and R408.2 as those are now addressed by the MOD to RED1-73. Edits to R408.2.1 remain and changes are shown in red to resolve overlap with RED1-82 and clarify that the measures must be installed in order to earn credit (not just proposed). Edits from RED1-254 & RED1-186 would need to be merged here (not shown). The core change is to introduce a credit measure for reduced air leakage, whether tested at the unit level or building level.

Proponent: Gayathri Vijayakumar, representing Steven Winter Associates, Inc. gvijayakumar@swinter.com)

2024 International Energy Conservation Code [RE Project]

SECTION R408

ADDITIONAL EFFICIENCY REQUIREMENTS

TABLE R408.2
CREDITS FOR ADDITIONAL ENERGY EFFICIENCY

Portions of table not shown remain unchanged.

Measure Number	Measure Description		Credit Value							
		CZ 0 & 1	CZ 2	CZ 3	CZ 4	CZ 4C	CZ 5	CZ 6	CZ 7	CZ 8
R408.2.1.1 (1)	≥ 2.5% reduction in total UA									
R408.2.1.1 (2)	≥ 5% reduction in total UA									
R408.2.1.1 (3)	> 7.5% reduction in total UA									
R408.2.1.1(4)	>10% reduction in total UA									
R408.2.1.1(5)	> 15% reduction in total UA									
R408.2.1.1(6)	>20% reduction in total UA									
R408.2.1.1(7	>30% reduction in total UA									
R408.2.1.2 (1)	0.22 U-factor windows									
R408.2.1.2 (2)	U factor and SHGC for windows per Table R408.2.1									
R408.2.1.3	Cool roof									
R408.2.1.4	Reduced air leakage	TBD	TBD	TBD	TBD	TBD	TBD	0	0	0

R408.2.1 Enhanced envelope options. For enhanced envelope credits, t~~T~~he *building thermal envelope* shall ~~meet the requirements~~ comply with one or more of the following:

1. Section R408.2.1.1 or R408.2.1.2. Credit shall only be permitted from one measure.

2. Section R408.2.1.3.

3. Section R408.2.1.4.

R408.2.1.1 Enhanced envelope performance ~~UA~~. The ~~proposed~~ total *building thermal envelope* thermal conductance TC ~~UA~~ shall be calculated in accordance with Section R402.1.5 and it shall be reduced by not less than the percentage indicated in Table R408.2 in comparison to the reference building. ~~shall meet comply with one of the following:~~

1. ~~Not less than 2.5 percent reduction of the required total UA of the *building thermal envelope*.~~

~~2. Not less than 5 percent reduction of the required total UA of the *building thermal envelope*.~~

~~3. Not less than 7.5 percent reduction of the required total UA of the *building thermal envelope*.~~

R408.2.1.2 Improved fenestration. Vertical fenestration shall meet one of the following:

1. U-factor equal to or less than 0.22.

2. U-factor and SHGC equal or less than that specified in Table R408.2.1.2.

R408.2.1.3 Roof reflectance. Roofs shall comply with one or more of the options in Table R408.2.1.3.

Add new text as follows:

R408.2.1.4 Reduced air leakage. For the reduced air leakage credit, the building ~~or each *dwelling unit* in the building~~ shall have a measured air leakage rate no less than 2.0 ACH50 and no greater than 2.5 ACH50 or the *dwelling units* in the building shall have an average measured air leakage rate no greater than 0.24 cfm50/ft^2.

Reason: This public comment proposes credit for achieving airtightness below the prescriptive air leakage rates in CZ 0-5, as defined in Section R402.5.1.3. However, this credit is not being proposed for values less than 2.0 ACH50 given that another R408 section provides credit for that level airtightness when combined with balanced ventilation. The mod provides an option for multifamily buildings to access the credit when performing dwelling unit tests using the cfm50/ft2 metric rather than building air leakage tests that use the ACH50 metric.

Example: The PNNL MF prototype has a footprint of 120 ft x 65 ft, with a building height of 25.5 ft.

That results in a volume of 198,900 ft^3 (if we include the breezeway as enclosed space). If the whole-building is tested for air leakage, achieving 2 ACH50 allows up to 6,630 cfm50 of air leakage through the exterior envelope. If we divide the same 6,630 cfm50 by the exterior envelope area (25,035 ft^2), this is equivalent to 0.26 cfm50/ft^2. However, different multifamily configurations will have different equivalencies so at least a 10% reduction over the code requirements seemed warranted to earn credit.

Other edits are editorial to provide better clarity of the original intent of this section.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.

Where selected as a measure, some additional labor cost associated with the greater attention to air-sealing practices would be applicable. Where not deemed cost-effective, this measure simply would not be selected.

International Energy Conservation Code
Code Change Proposal Tracking Sheet

Proposal #	RED1-082-22 R408 enhanced envelope clarification
CDP ID #	956
Code	IECC RE
Code Section(s)	R408.2.1
Location	base
Proponent	Aaron Phillips aphillips@asphaltroofing.org
Proposal Status	SC rev
Subcommittee	RE Econ, Model, Metric
Subcommittee Notes	Motion to Disapprove: Rob Salcido; 2nd Aaron Gary
Recommendation	Reason Statement: Disapproved based on prior action on RED1-71
Vote	Disapprove 15/0/0
Recommendation Date	April 11, 2023
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 #	RED1-257-22 Minimum roof reflectance
CDP ID #	957
Code	IECC RE
Code Section(s)	R408.2.1.3 Table
Location	base
Proponent	Aaron Phillips
Proposal Status	SC rev
Subcommittee	RE Econ, Model, Metric
Subcommittee Notes	Motion to Approve: Jay Crandell; 2nd Ben Edwards
Recommendation	Reason Statement: Clarifies footnotes and aligns IECC-R provision with IRC Ch11 provision.
Vote	Approve 13/0/2
Recommendation Date	April 11, 2023
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 #	RED1-258-22 Minimum roof reflectance
CDP ID #	1434
Code	IECC RE
Code Section(s)	R408.2.1.3 Table
Location	base
Proponent	Glen Clapper
Proposal Status	SC rev
Subcommittee	RE Econ, Model, Metric
Subcommittee Notes	Motion to Disapprove: Shilpa Surana; 2nd Alamelu Brooks
Recommendation	Reason Statement: Proposal reduces the stringency of the roof reflectance values for low slope roof in R408. The reflectance values in the public comment draft were supported by the Consensus Committee in Round 1. Roof reflectance values align with the current low slope roof requirements for single family and multifamily buildings in California.
Vote	Disapprove 11/0/4
Recommendation Date	April 11, 2023
Next Step	To Subcommittee To Advisory Group_____ To Consensus Committee_____X_____
Consensus Committee	
Committee Response	
Vote	Affirmative_____ Negative_____ Table_____ To Subcommittee_____
Date	

RECD1-12-22 not heard by a subcommittee

Proponents: Gayathri Vijayakumar, representing Steven Winter Associates, Inc. (gvijayakumar@swinter.com)

2024 International Energy Conservation Code [RE Project]

CHAPTER 2 [RE] DEFINITIONS

SECTION R202

GENERAL DEFINITIONS

Add new text as follows:

BIODIESEL BLEND. A homogeneous mixture of hydrocarbon oils and mono alkyl esters of long chain fatty acids.

FUEL GAS. A natural gas, manufactured gas, liquified petroleum gas or a mixture of these.

FUEL OIL. Kerosene or any hydrocarbon oil having a flash point not less than 100°F (38°C).

LIQUID FUEL. A *fuel oil* or *biodiesel blend*.

Revise text as follows:

CHAPTER 4 [RE] RESIDENTIAL ENERGY EFFICIENCY

SECTION R403

SYSTEMS

R403.1.2 Heat pump supplementary heat. Heat pumps having supplementary electric-resistance, ~~fuel gas~~ *fuel gas*, or *liquid fuel* ~~fuel oil~~ heating systems shall have controls that are configured to prevent supplemental heat operation when the capacity of the heat pump compressor can meet the heating load. ~~Limit supplemental~~ Supplemental heat operation shall be limited to only ~~those times when~~ where one of the following applies:

1. The vapor compression cycle cannot provide the necessary heating energy to satisfy the thermostat setting.
2. The heat pump is operating in defrost mode.
3. The vapor compression cycle malfunctions.
4. The thermostat malfunctions.

R403.2 Hot water boiler temperature reset. The manufacturer shall equip each gas, *liquid fuel* ~~oil~~ and electric boiler (other than a boiler equipped with a tankless domestic water heating coil) with automatic means of adjusting the water temperature supplied by the boiler to ensure incremental change of the inferred heat load will cause an incremental change in the temperature of the water supplied by the boiler. This can be accomplished with outdoor reset, indoor reset or water temperature sensing.

SECTION R404

SYSTEMS

R404.5 Electric readiness. Water heaters, household clothes dryers, ~~conventional~~ and cooking appliances ~~tops and conventional ovens~~ that use ~~fossil fuel~~ *fuel gas* or *liquid fuel* ~~Systems using fossil fuel: water heaters, household clothes dryers, conventional cooking tops or conventional ovens~~ shall comply with ~~the requirements of~~ Sections R404.5.1 through R404.5.4.

SECTION R405

SIMULATED BUILDING PERFORMANCE

TABLE R405.4.2(1)

SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

Heating systems[d, e, j, k]	Fuel Type/Capacity: Same as proposed design	As proposed
	Product class: Same as proposed design	As proposed
	Efficiencies:	As proposed
	Heat pump: Complying with 10 CFR §430.32	As proposed
	~~Non-electric~~ Natural gas, propane and *liquid fuel* ~~fuel oil~~ furnaces: Complying with 10 CFR §430.32	As proposed
	~~Non-electric~~ Natural gas, propane and *liquid fuel* ~~fuel oil~~ boilers: Complying with 10 CFR §430.32	As proposed

APPENDIX RE

ALL-ELECTRIC RESIDENTIAL BUILDINGS

RE102

GENERAL DEFIN~~I~~ITIONS

RE102.1 ALL-ELECTRIC BUILDING. A building that contains no combustion equipment, or plumbing for combustion equipment, installed within the building, or building site.

APPLIANCE. A device or apparatus that is manufactured and designed to utilize energy and for which this code provides specific requirements.

COMBUSTION EQUIPMENT. Any equipment or appliance used for space heating, service water heating, cooking, clothes drying and/or lighting that uses *fuel gas* or *liquid fuel* ~~fuel gas or fuel oil~~.

EQUIPMENT. Piping, ducts, vents, control devices and other components of systems other than appliances that are permanently installed and integrated to provide control of environmental conditions for buildings. This definition shall also include other systems specifically regulated in this code.

~~**FUEL GAS.** A natural gas, manufactured gas, liquified petroleum gas or a mixture of these.~~

~~**FUEL OIL.** Kerosene or any hydrocarbon oil having a flash point not less than 100°F (38°C).~~

Reason: Based on multiple approved RED1's and IRCED1's in this round (IRCED1-10, 340, 292, 116, 335) and the prior round, there are inconsistencies in how we reference 'fuels' that need to be resolved. This proposal resolves those inconsistencies by creating a new term "liquid fuel" that is inclusive of traditional heating oils but also expanded to clearly also include biodiesel blends.

Cost Impact: None