Navigating the 2021 Energy Codes

Session I: Residential

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Speakers

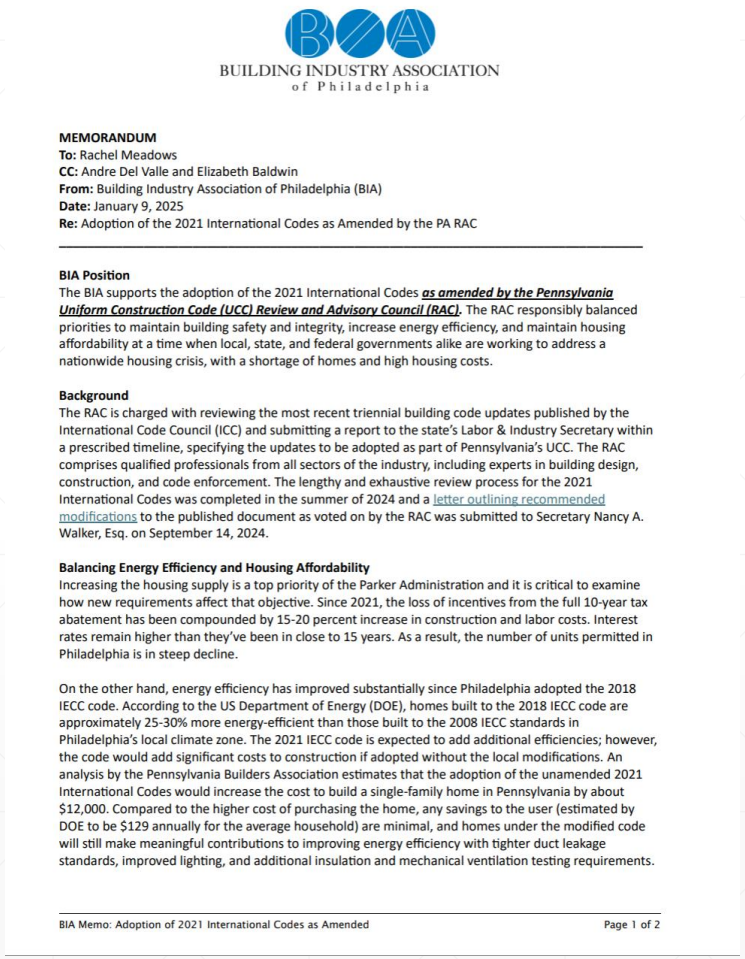
Thanks to these members for their time and expertise putting together this presentation.

Big Picture

Code Adoption Process Notes

- Review and Advisory Council (RAC)
  - Public comment period
  - Public testimony
  - Final voting / rule making
- BIA Advocacy
- Important to note: PA vs Philadelphia regulations
- Timeline for implementation and resources

BIA Advocacy



BUILDING INDUSTRY ASSOCIATION
of Philadelphia

MEMORANDUM
To: Rachel Meadows
CC: Andre Del Valle and Elizabeth Baldwin
From: Building Industry Association of Philadelphia (BIA)
Date: January 9, 2025
Re: Adoption of the 2021 International Codes as Amended by the PA RAC

BIA Position
The BIA supports the adoption of the 2021 International Codes ***as amended by the Pennsylvania Uniform Construction Code (UCC) Review and Advisory Council (RAC)***. The RAC responsibly balanced priorities to maintain building safety and integrity, increase energy efficiency, and maintain housing affordability at a time when local, state, and federal governments alike are working to address a nationwide housing crisis, with a shortage of homes and high housing costs.

Background
The RAC is charged with reviewing the most recent triennial building code updates published by the International Code Council (ICC) and submitting a report to the state's Labor & Industry Secretary within a prescribed timeline, specifying the updates to be adopted as part of Pennsylvania's UCC. The RAC comprises qualified professionals from all sectors of the industry, including experts in building design, construction, and code enforcement. The lengthy and exhaustive review process for the 2021 International Codes was completed in the summer of 2024 and a letter outlining recommended modifications to the published document as voted on by the RAC was submitted to Secretary Nancy A. Walker, Esq. on September 14, 2024.

Balancing Energy Efficiency and Housing Affordability
Increasing the housing supply is a top priority of the Parker Administration and it is critical to examine how new requirements affect that objective. Since 2021, the loss of incentives from the full 10-year tax abatement has been compounded by 15-20 percent increase in construction and labor costs. Interest rates remain higher than they've been in close to 15 years. As a result, the number of units permitted in Philadelphia is in steep decline.

On the other hand, energy efficiency has improved substantially since Philadelphia adopted the 2018 IECC code. According to the US Department of Energy (DOE), homes built to the 2018 IECC code are approximately 25-30% more energy-efficient than those built to the 2008 IECC standards in Philadelphia's local climate zone. The 2021 IECC code is expected to add additional efficiencies; however, the code would add significant costs to construction if adopted without the local modifications. An analysis by the Pennsylvania Builders Association estimates that the adoption of the unamended 2021 International Codes would increase the cost to build a single-family home in Pennsylvania by about $12,000. Compared to the higher cost of purchasing the home, any savings to the user (estimated by DOE to be $129 annually for the average household) are minimal, and homes under the modified code will still make meaningful contributions to improving energy efficiency with tighter duct leakage standards, improved lighting, and additional insulation and mechanical ventilation testing requirements.

BIA Memo: Adoption of 2021 International Codes as Amended Page 1 of 2

- Code reviews and statewide public comment process
- Memorandum of BIA position
- Pricing studies (PA and Philadelphia)
- Multiple stakeholder listening sessions with City of Philadelphia
- Testimony at state and city levels

Philadelphia vs PA – Different Requirements

Code Section	Description	Applicability
Tables N1102.1.2 & N1102.1.3	Insulation Values	2018 values across state
N1101.13.5 + N1108 options	Add'l Energy Features	Philadelphia Only
N1103.3.5 and N1103.3.6	Duct Testing for Ducts / Air Handlers All Located in Conditioned Spaces	Philadelphia Only
N1103.3.7	Return Air Plenums	Philadelphia Only
N1104.1	Lighting Equipment	Philadelphia Only
N1104.2	Interior Lighting Controls	Philadelphia Only
N1104.3	Exterior Lighting Controls	Philadelphia Only

Timeline & Resources Available through L&I

- January 1, 2026 – June 30, 2026: grace period
- July 1, 2026: full implementation of 2021 I-Codes + local modifications

L&I Energy Code Compliance Materials

L&I FAQ: What are the significant changes between the 2018 and 2021 International Energy Conservation Code (IECC)?

Residential Energy Code Compliance Pathways

Choose a Compliance Pathway

Prescriptive	Prescriptive	Performance	Performance	Performance	PA Alternative
R-Value (No tradeoffs)	U-Factor (tradeoffs within individual components) UA (tradeoffs between components)	Simulated Performance Alternative R405	ERI Compliance Alternative R406	Above Code Program	Prescriptive

Choose a Compliance Pathway

Permit Application Documentation

METHOD	Permit Detail		Qualifications
Prescriptive	Compliance Summary	HVAC Design Worksheet for one and two family	Design Prof
Prescriptive UA Alternative	ResCheck 4.6.5 (or higher)	Same as above	Design Prof
Simulated Performance	Prelim Report	Same as above	Depends upon method
ERI Performance	Prelim Report	Same as above	HERS Rater
Above Code Programs	Prelim Report	Same as above (NR for Energy Star)	Depends upon method

Philadelphia L&I Code Update Presentation, June 2019

Prescriptive R402.1

- Most familiar and straightforward path – builders, architects, plans examiners
- Each building component must meet the exact insulation or window performance values listed in the code tables
- No trade-offs allowed
- Demonstrated using REScheck
- Additional Efficiency Package Requirements


REScheck Software Version 4.7.1

Compliance Certificate

Project Sample Report

Energy Code: Utah Energy Conservation Code
Location: Saint George, Utah
Construction Type: Single-family
Project Type: New Construction
Conditioned Floor Area: 2,184 ft2
Glazing Area 15%
Climate Zone: 3 (3215 HDD)
Permit Date: July 1, 2021
Permit Number:

Construction Site: Sample Street, Saint George, UT
Owner/Agent: Sample Report, Sample Purposes Only
Designer/Contractor: Tekreca Hvac Design, Residential Hvac Design & Calculations, 702-823-8187

Compliance: Passes using UA trade-off
Compliance: 27.8% Better Than Code Maximum UA: 678 Your UA: 634 Maximum SHGC: 0.40 Your SHGC: 0.25

Envelope Assemblies

Assembly	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	U-Factor	UA
Wall 1: Wood Frame, 16" o.c.	625	19.0	0.0	0.060	25
Door 1: Glass SHGC: 0.22	66			0.300	20
Window 1: 4A5-2ov:2 glazing, clr low-e outr. argon gas, vnl frm mat. clr inn SHGC: 0.25	16			0.300	5
Window 2: 4A5-2ov:2 glazing, clr low-e outr. argon gas, vnl frm mat. clr inn SHGC: 0.25	36			0.300	11
Window 3: 4B5-2fv:2 glazing, clr low-e outr. argon gas, vnl frm mat. clr inn SHGC: 0.25	84			0.300	25
Wall 2: Wood Frame, 16" o.c.	630	19.0	0.0	0.060	35
Window 1: 4A5-2ov:2 glazing, clr low-e outr. argon gas, vnl frm mat. clr inn	48			0.300	14

U.S. DEPARTMENT OF ENERGY

REScheck™

Prescriptive UA Alternative R402.1.5

- UA alternative allows trade-offs between envelope components.
- Instead of meeting each individual R-value exactly, the building must have a total heat loss equal to or less than the prescriptive code baseline.
- Teams can compensate weaker performance in one area with stronger performance elsewhere. (Example: The improved windows offset the slightly weaker walls.)
- REScheck
- Additional Efficiency Package Requirements

Additional Efficiency Package Options R408

- REQUIRED in Philadelphia
- Not mandatory outside of Philadelphia
- Pick one:
  - Enhanced Envelope Performance – UA is 95% or less than prescriptive max
  - **More efficient HVAC equipment performance option**
  - **Reduced energy use in service water-heating option**
  - **More efficient duct thermal distribution system option**
  - Improved air sealing and efficient ventilation system option

R402 - Insulation Values

- Maintaining 2018 Values – **across state**

Climate Zone	Ceilings		Wood Frame Walls		Basement Walls	
	2015/2018	2021	2015/2018	2021	2015/2018	2021
1	30	30	13	13 or **0+10**	0	0
2	38	**49**	13	13 or **0+10**	0	0
3	38	**49**	20 or 13+5	**20 or 13+5 or 0+15**	5/13	5/13
4	49	**60**	20 or 13+5	**20+5 or 13+10 or 0+15**	10/13	10/13
5	49	**60**	20 or 13+5	**20+5 or 13+10 or 0+15**	10/13	**15/19 or 13+5**
6	49	**60**	20+5 or 13+10	20+5 or 13+10 or **0+20**	15/19	**15/19 or 13+5**
7	49	**60**	20+5 or 13+10	20+5 or 13+10 or **0+20**	15/19	**15/19 or 13+5**
8	49	**60**	20+5 or 13+10	20+5 or 13+10 or **0+20**	15/19	**15/19 or 13+5**

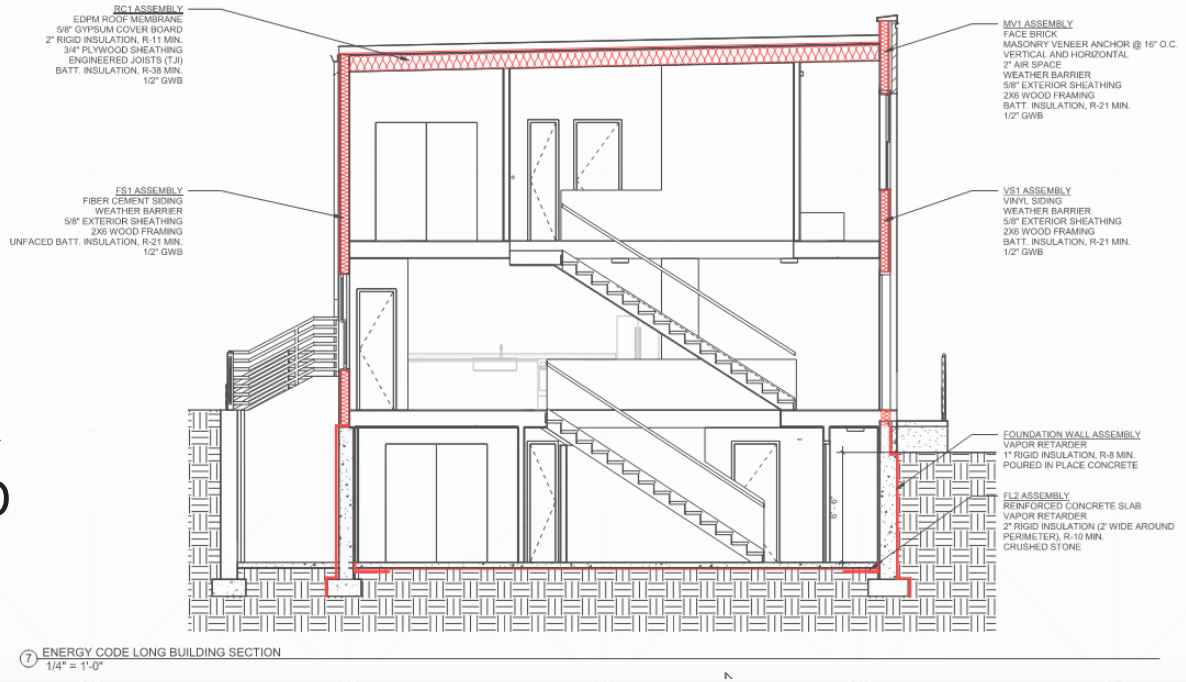
R402 - Insulation Values

- Statewide residential insulation values

CZ	2018 Ceilings	Wood Framed Walls	Basement Walls
4	49	20 or 13+5	10/13

R402 –Maintaining U Values Building Thermal Envelope

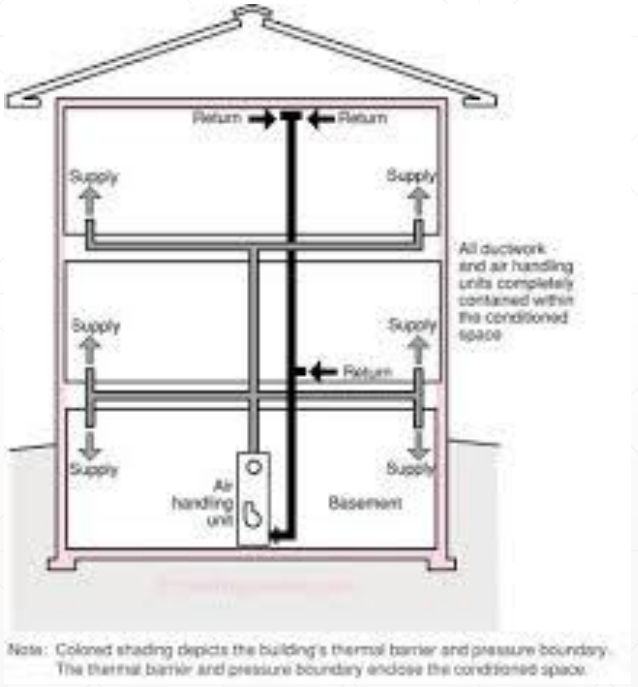
- **Basement Walls** – when insulated, must be from top of the basement wall to the basement floor OR 10’ below grade.
  - **What is a Basement wall**? Defined as a wall that is at least 50% below grade AND enclosing conditioned space (within the thermal envelope).



R403 – Ductwork

R403.3.1: Ducts located outside of conditioned space

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

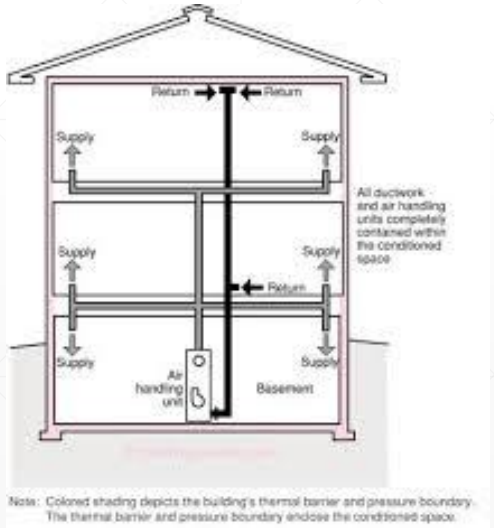


Note: Colored shading depicts the building's thermal barrier and pressure boundary. The thermal barrier and pressure boundary enclose the conditioned space.

R403 – Ductwork

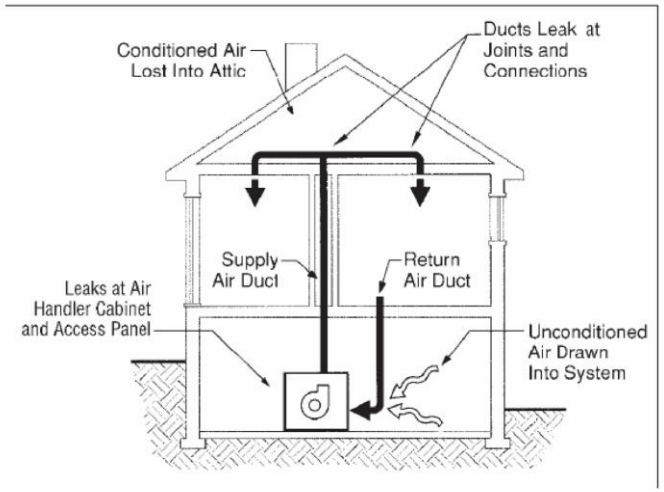
R403.3.2: Ducts located in conditioned space

- For ductwork to be considered inside *conditioned space,* it shall comply with one of the following:
  - 1. the duct system shall be located completely within the *continuous air barrier* and within the building thermal envelope.
  - 2. Ductwork in ventilated attic spaces shall be buried within the ceiling insulation in accordance with Section R403.3.3 and all of the following conditions exist:
    - 2.1 The air handler is located within the *continuous air barrier* and within the *building thermal envelope*
    - 2.2 The duct leakage, as measured by a rough-in test of the ducts or a post construction total system leakage test to outside the *building thermal envelope* in accordance with Section R403.3.6, us less than or equal to 1.5 cubic feet per minute or 100 square feet of *conditioned floor area* served by the duct system.
    - 2.3 The ceiling insulation R-Value installed against the insulated duct is greater than or equal to the proposed ceiling insulation R-value, less the R-Value of the insulation on the duct.
  - 3. Ductwork in floor cavities located over unconditioned space shall comply with all of the following:
    - 3.1 A *continuous air barrier* installed between unconditioned space and the duct
    - 3.2 Insulation installed in accordance with Section R402.2.7
    - 3.3 A minimum R-19 insulation installed in the cavity width separating the duct from unconditioned space.
  - 4. Ductwork located within *exterior walls* of the *building thermal envelope* shall comply with the following:
    - 4.1 A *continuous air barrier* installed between unconditioned space and the duct.
    - 4.2 Minimum R-10 insulation installed in the cavity width separating the duct from the outside sheathing.
    - 4.3 The remainder of the cavity insulation shall be fully insulated to the drywall side.



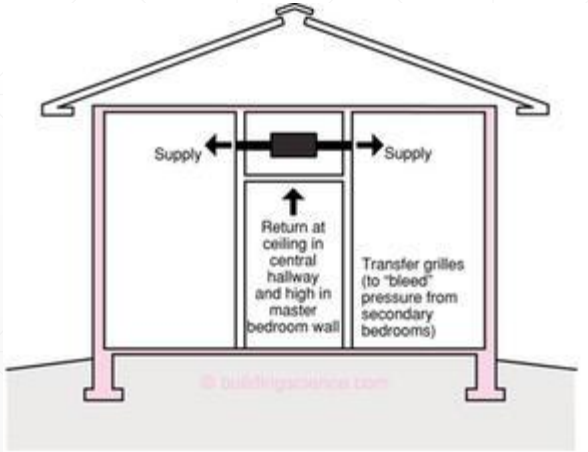
Note: Colored shading depicts the building's thermal barrier and pressure boundary. The thermal barrier and pressure boundary enclose the conditioned space.

Section R403.3 - Duct Systems



R403.3.6 Duct Leakage Prescriptive Only

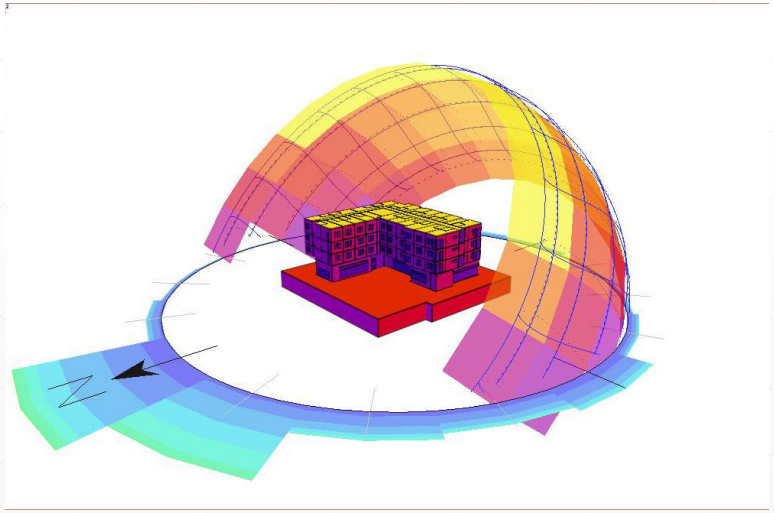
- Systems in conditioned space must be tested!
  Different from PA 2021
- Rough-in test total duct leakage testing.
  - 4% or less and air handler must be installed at time of testing.
  - 3% or less if air handler is NOT installed
- Post construction – must be less than 4%
- **8% or less if ducts in conditioned space at rough or final**



Note: Colored shading depicts the building's thermal barrier and pressure boundary. The thermal barrier and pressure boundary enclose the conditioned space.

Simulated Total Building Performance R405

- Compliance represented in annual energy consumption.
- Considers more than just envelope – includes duct and envelope leakage HVAC, hot water, lighting
- No threshold for total duct leakage
- Requires insulation inspection
- Envelope leakage is dynamic
- Additional EE package **NOT required**



Energy Reduction Index R406

- Must meet a target ERI Score.
- Similar to Performance Pathway but with equipment performance tradeoffs.
- Follows HERS Rating processes without the branding
- Additional EE package **NOT required**

Section R401.2 – Residential Compliance Pathways

PA 2021 IECC	Prescriptive/ UA Tradeoff	Performance	Energy Rating Index	PA Alternative
Mandatory Requirements Apply	Yes	Yes	Yes	No
Prescriptive Requirements Apply	Yes	No	No	No
Energy Use Metric	Overall UA Value	Energy Cost $/year	HERS Index	Not Applicable
Allowable Energy Efficiency Tradeoffs	Insulation, doors & windows only	All except mechanical, electrical & appliances	All	None
Eligible Software	REScheck, HERS Software	HERS Software	HERS Software	Not Applicable
HERS Rating Needed	No	Yes	Yes	No
Envelope Leakage Threshold	3 ACH	5 ACH or 0.3 CFM per sq ft	5 ACH or 0.3 CFM per sq ft	3 ACH
Total Duct Leakage Threshold	4% for ducts in unconditioned space	No Requirement	No Requirement	4% for ducts in unconditioned space

Green text indicates more optionality and therefore a potential cost savings under these alternative pathways

R404 –Exterior and Interior Lighting (Phila. Only)

R404.2: Interior lighting controls

- Permanently installed lighting fixtures shall be controlled with either a dimmer, and occupant sensor control or other control that is installed or built into the fixture

Exception: Lighting controls shall not be required for the following:

1. Bathrooms
2. Hallways
3. Exterior lighting fixtures
4. Lighting designed for safety or security

R404.3: Exterior lighting controls

- Where the total permanently installed exterior lighting power is greater than 30 watts, the permanently installed exterior lighting shall comply with the following:

1. Lighting shall be controlled by a manual on and off switch which permits automatic shut-off actions.

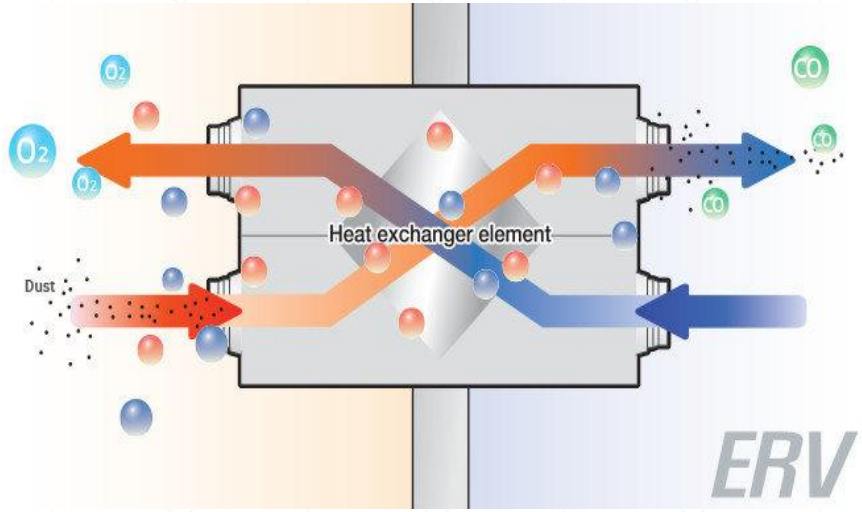
   Exception: Lighting serving multiple *dwelling units.*

2. Lighting shall be automatically shut off when daylight is present and satisfies the lighting needs.

3. Controls that override automatic shut-off actions shall not be allowed unless the override automatically returns automatic control to its normal operation within 24 hours.

R403.6 – Mechanical Ventilation

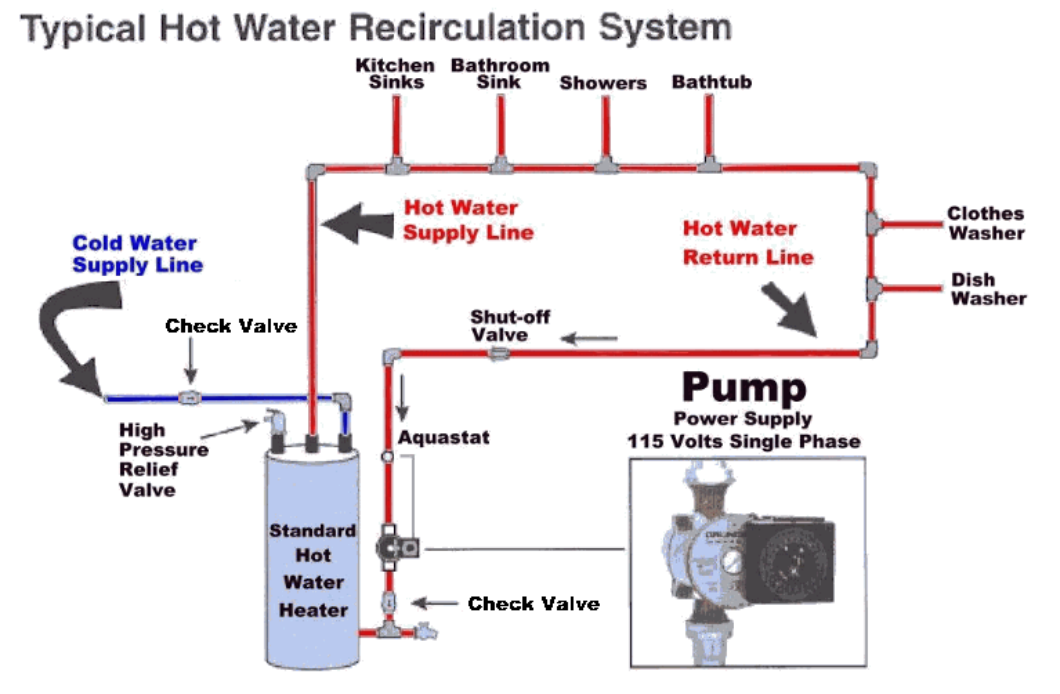
- R402.6.2 Whole-dwelling mechanical ventilation system fan efficacy/ efficiency.
- R403.6.3 Testing- Mechanical Ventilation Must be tested (all pathways)



Section 403.5.1.1 - Recirculation Systems

Key Requirements

- Control system cannot be gravity or thermosyphon
- Control system must turn off when demand is not in use or temperature setpoint is met.
- Exemption: Controls are not required if entire supply and return system is insulated to R-3 or more.



Key Highlights

Key Takeaways

- ✓ **Prescriptive insulation values and levels remain the same.**
- ✓ **New and earlier conversations on pathway of compliance.**
  - Supported by early modeling efforts
  - HERS Rater
- ✓ **Understand the differences and opportunities each path presents to projects.**
  - Understand implications for testing and requirements under each path
- ✓ **New testing requirements.**
  - No more exemption for duct leakage, must be tested
  - New ventilation testing requirements

Next Sessions in the Series:

Session II: April 2, 2026 at 10:30 am

The 2021 Commercial Energy Code:
Technical Impacts on Multifamily Design and Construction

Session III: May 5, 2026 at 10:30 am

The 2021 Commercial Energy Code:
Best Practices, Executional Success, and Common Pitfalls

Thank you