

We will be starting soon!

Thanks for joining us



Energy Code Implementation: Single Family New Construction



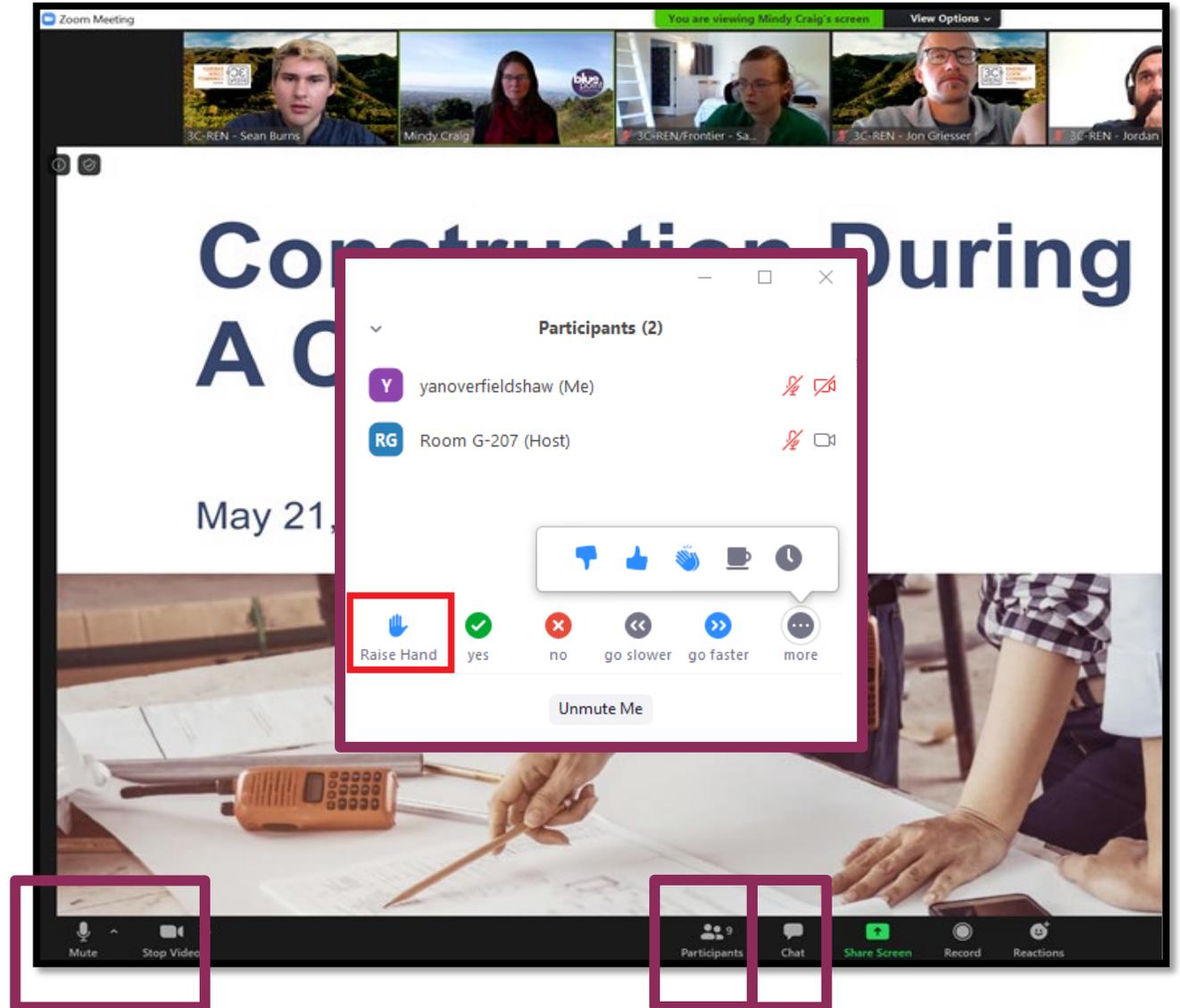
Jennifer Rennick, AIA, CEA – In Balance Green Consulting
Grant Murphy, CEA – In Balance Green Consulting

February 14, 2024



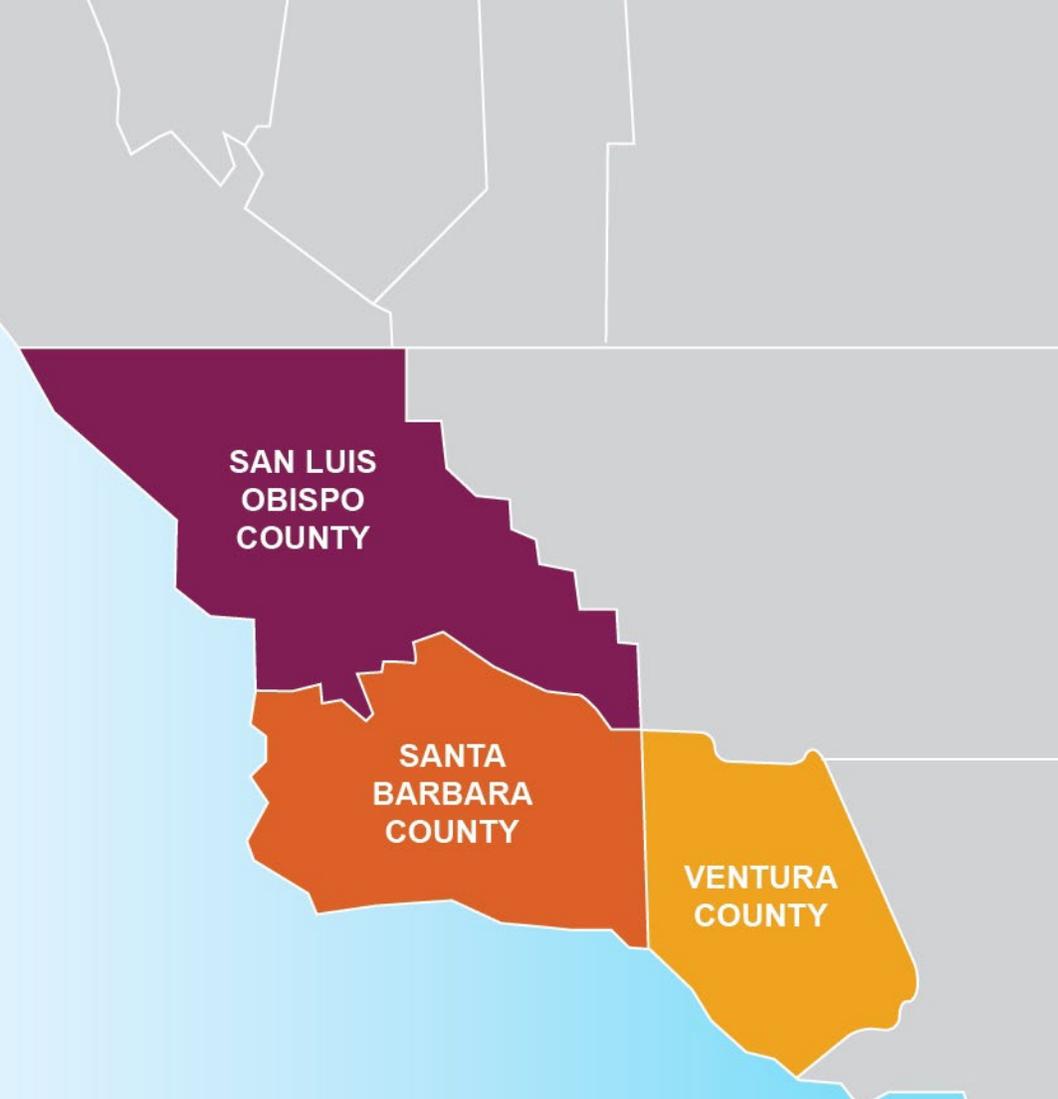
Zoom Orientation

- Please be sure your full name is displayed
- Please **mute** upon joining
- Use "Chat" box to share questions or comments
- Under "Participant" select "Raise Hand" to share a question or comment verbally
- The session may be **recorded** and posted to 3C-REN's on-demand page. Feel free to ask questions via the chat and keep video off if you want to remain anonymous in the recording.



3C-REN: Tri-County Regional Energy Network

- Three counties working together to improve energy efficiency in the region
- Services for –
 - **Building Professionals:** industry events, training, and energy code compliance support
 - **Households:** free and discounted home upgrades
- Funded by ratepayer dollars that 3C-REN returns to the region





ENERGY
CODE
CONNECT

- Serves all building professionals
- Three services –
 - **Energy Code Coach**
 - **Training and Support**
 - **Regional Forums**
- Makes the Energy Code easy to follow

Energy Code Coach:
3c-ren.org/codes
805.781.1201

Event Registration:
3c-ren.org/events





BUILDING PERFORMANCE TRAINING

- Serves current and prospective building professionals
- Expert instruction:
 - **Technical skills**
 - **Soft skills**
- Helps workers to thrive in an evolving industry

Event Registration:
3c-ren.org/events





HOME
ENERGY
SAVINGS

Multifamily (5+ units)

- No cost technical assistance
- Rebates up to \$750/apartment plus additional rebates for specialty measures like heat pumps

Single Family (up to 4 units)

- Sign up to participate!
- Get paid for the metered energy savings of your customers

Enrollment:
3C-REN.org/contractor-participation



Energy Code Implementation Series

Since the energy code update took effect in January 2023, the industry is adjusting to design, detailing and construction to meet compliance. In this series, we'll review the code requirements with a focus on what to include in construction documents to streamline the permitting process and tips for construction to ease sign-offs and occupancy.

- Energy Code Implementation: Single Family New Construction
- Energy Code Implementation: Single Family Additions and Alterations
- Energy Code Implementation: ADUs
- Energy Code Implementation: Multi-Family
- Energy Code Implementation: Non-Residential

<https://www.3c-ren.org/calendar-of-events-and-trainings/>



Today's Learning Objectives

- Understand the current metrics used in the energy code for evaluating compliance, and how choices for electric or gas equipment may impact that compliance.
- Review key mandatory measures, the prescriptive “recipe card” approach, and the options for using the building performance approach.
- Recognize where barriers or stumbling blocks may occur within permitting and construction and tips for documentation to smooth out the process.
- How to access resources for energy code compliance

1.5 AIA HSW LU approved for this course
0.15 ICC CEU approved for this course



Agenda

1. 2022 Energy Code –Broad Overview
2. Single Family Residential –High Level Changes
3. Attics and Rafter Roof Insulation
4. IAQ Ventilation
5. Battery and Electric Ready
6. Heat Pump for Space Conditioning
7. Domestic Water Heating





**2022 Energy Code:
CEC Triennial Cycle
Big-Picture Goals
Code Reorganization**

California Energy Commission (CEC)

Our Responsibilities

- Advancing State Energy Policy
- Achieving Energy Efficiency
- Investing in Energy Innovation
- Developing Renewable Energy
- Transforming Transportation
- Overseeing Energy Infrastructure
- Preparing for Energy Emergencies

EXPLORE OUR CORE RESPONSIBILITIES >



TITLE 24, Part 6

California's Building Energy Efficiency Standards (aka the Energy Code) is updated every three years by the CEC. The process includes engagement with the public, industry experts, in-house expertise, and other stakeholders.



ABOUT

The California Energy Commission is leading the state to a 100 percent clean energy future. As the state's primary energy policy and planning agency, the Energy Commission is committed to reducing energy costs and environmental impacts of energy use while ensuring a safe, resilient, and reliable supply of energy.

[About the Energy Commission](#)
[CEC's 45th Anniversary Events](#)

energy.ca.gov

DIVISIONS

- Efficiency
- Energy Assessments
- Energy Research and Development
- Fuels and Transportation
- Renewable Energy
- Siting, Transmission, and Environmental Protection

LEADERSHIP



Gavin Newsom
California Governor



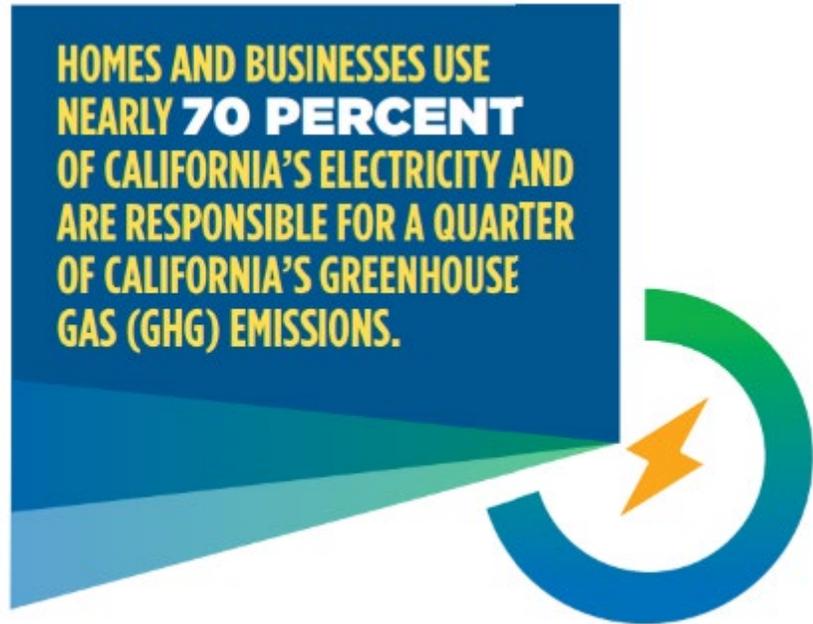
Wade Crowfoot
Secretary for Natural Resources



David Hochschild
Chair, California Energy Commission



Big Picture Goals for the 2022 Code Updates



- Encourage heat pump technology for space and water heating
- Establish electric-ready requirements for single family homes
- Expand PV systems and battery storage standards
- Strengthen ventilation standards



Subchapter Reorganization

2019 Code

All Buildings -Sections 100 and 110

High-Rise Residential, Nonresidential,
Hotel/Motel -Sections 120, 130, 140,
and 141

Low-Rise Residential -Section 150.0-
150.2

2022 Code

All Buildings -Sections 100 and 110

Nonresidential, Hotel/Motel -Sections
120, 130, 140, and 141

Single-Family Residential -Section
150.0-150.2 (includes duplexes and
townhouses)

New Sections

Multifamily Buildings -Sections 160,
170, 180 (low and high rise)



Single Family Residence

Review High Level Changes

Highlight Key Changes under the Performance Method

Single Family High-Level Changes

- Performance method added new source energy design rating (EDR) metric
- Baseline space conditioning and water heating updates include heat pumps
- Attic system insulation
- Kitchen range hood air flow rates
- Ventilation duct sizing
- Electric ready
- Battery ready

Many of the changes effecting energy efficiency have become part of the Mandatory requirements.



The Energy Code –Three Compliance Terms

Mandatory Requirements

Energy efficiency measures that are applicable to all projects.

Prescriptive Component Package

Mandatory Requirements are applicable

Follow all the parts of the prescriptive package

Note: used to determine the Standard Design Building

Essentially a **checklist** approach

Performance Method

Mandatory Requirements are applicable

Other components or measures can be traded-off as long as the Proposed Design Building can be shown to be more energy efficiency than a similar sized Standard Design Building (baseline building)

Energy modeling approach

Energy Design Ratings (EDR)

EDR1

Energy Source Design Rating
(New proxy for carbon)

Source EDR1 :

- Envelope
- IAQ
- HVAC
- DHW
- Unregulated loads

Efficiency EDR2 and Total EDR2

Energy Efficiency Design Rating + Solar Electric Generation and Demand Flexibility Design Rating

Efficiency EDR2 :

- Envelope
- IAQ
- HVAC
- DHW
- Unregulated loads

Total EDR2 :

Efficiency EDR2

+

- Solar PV
- Battery Storage
- Precooling



Example of Single Family Performance Method Results

When all three –Source EDR1, Efficiency EDR2, and Total EDR2 –have a positive compliance margin value, the project complies.

	Energy Design Ratings:			Compliance Margins:		
	Source (EDR1)	Efficiency ¹ (EDR2)	Total ² (EDR2)	Source (EDR1)	Efficiency (EDR2)	Total ² (EDR2)
Standard Design	38.4	48.6	34.9			
Proposed Design	25.2	47.0	26.5	13.2	1.6	8.4

Result³: **COMPLIES**

¹ Efficiency measures include improvements like a better building envelope and more efficient equipment
² Total EDR includes efficiency, photovoltaics and batteries
³ Building complies when all source, efficiency and total margins are greater than or equal to zero

Standard Design PV Capacity: 2.42 kWdc

PV System resized to 2.42 kWdc (a factor of 1.208) to achieve 'Standard Design PV' PV scaling

Performance Method (Computer Modeling)



Ductless Systems



Ducted Systems



SanCO2

Water Heating

Key Take-Away for 2022:

The **Standard Design** now includes efficient electric heat pump space heating and heat pump water heating.





Attics and Rafter Roof Insulation

New Construction Roofs/Ceiling – Prescriptive Vented Attics

TABLE 150.1-A COMPONENT PACKAGE – Single-Family Standard Building Design

NR = Not Required
REQ = Required

Single-Family			Climate Zone															
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
			Building Envelope Insulation															
Option B (meets 150.1(c)9A)	Below Roof Deck Insulation ^{1,2} (With Air Space)	NR	NR	NR	R 19	NR	NR	NR	R 19									
	Ceiling Insulation	R 38	R 38	R 30	R 38	R 30	R 30	R 30	R 38									
	Radiant Barrier	NR	REQ	REQ	NR	REQ	REQ	REQ	NR									
Option C (meets 150.1(c)9B)	Ceiling Insulation	R 38	R 30	R 30	R 30	R 30	R 30	R 30	R 30	R 30	R 30	R 38						
	Radiant Barrier	NR	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	NR

Ducts
in the
Attic

Roofs/
Ceilings

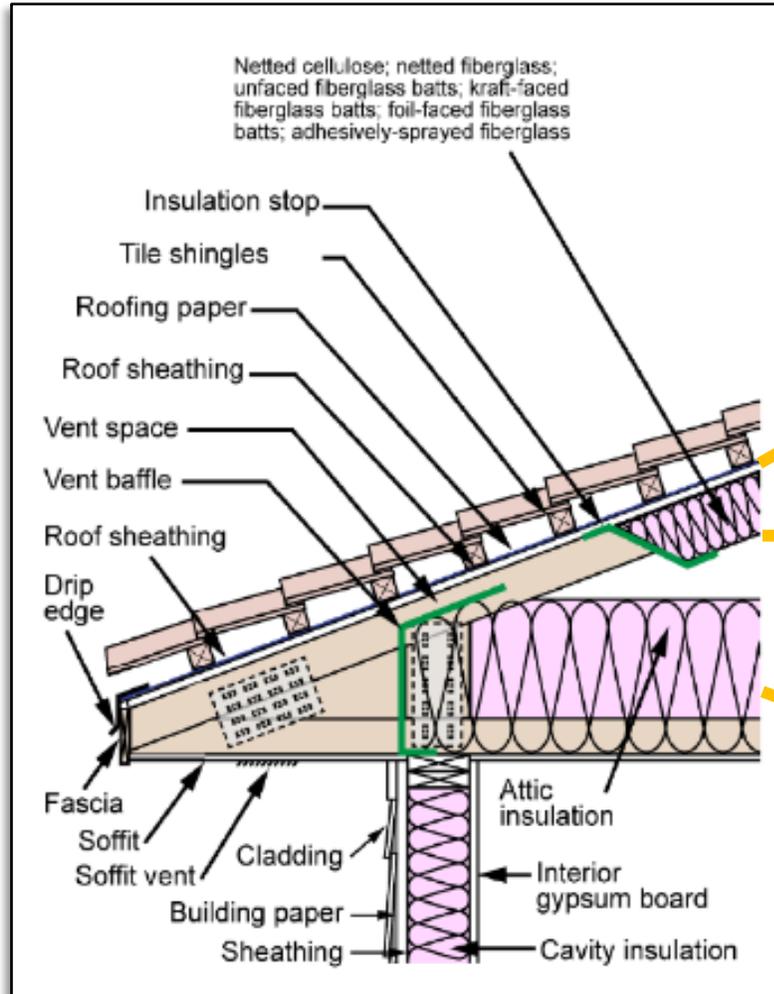
Ducts and
Air-handler
in the
Conditioned
Space; HERS

Footnote requirements to TABLE 150.1-A:

1. Install the specified R-Value with an air space present between the roofing and the roof deck. Such as standard installation of concrete or clay tile.
2. R-values shown for below roof deck insulation are for wood-frame construction with insulation installed between the framing members. **Alternatives including insulation above rafters or above roof deck shall comply with the performance standards**



New Construction –Option B, Vented Attic - Ducts in the Attic



Note: Applies to Climate Zones 4 and 8-16

Footnote 1: Air-space between the *Roofing* and the *Roof-Deck* (aka Roof Sheathing)

R-19 Prescriptive
Below Roof-Deck
Insulation

R-38 Prescriptive
Ceiling Insulation

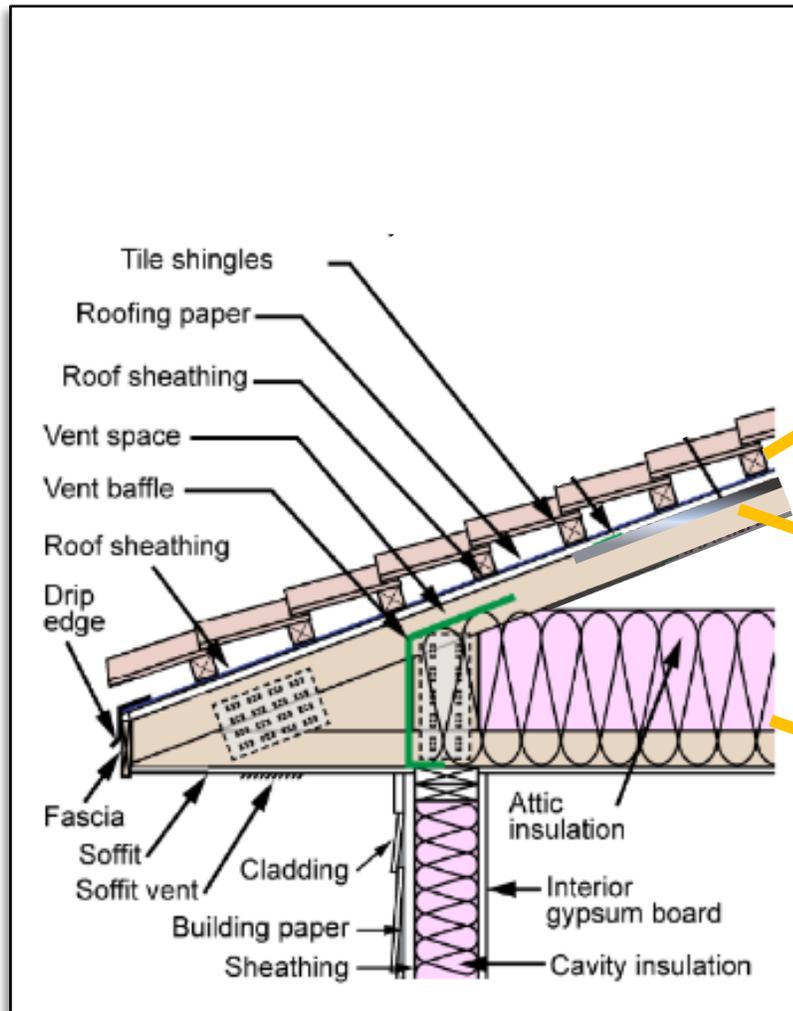
This is the
Baseline for the
Performance
Method



Image credit: CEC

New Construction –Option B, Vented Attic - Ducts in the Attic

Note: Applies to Climate Zones (CZ) 1-3 and 5-7



Footnote 1: Air-space between the *Roofing* and the *Roof-Deck* (aka Sheathing)

Radiant Barrier, per CZ

**R-30 or R-38, per CZ
Prescriptive Ceiling
Insulation**

This is the
Baseline for the
Performance
Method



Modified CEC Image

New Mandatory Measure – Vented Attic, with Ducts in the Attic

Climate Zones (CZ) 4 and 8-16:

- Weighted average U-factor of roof deck assembly cannot exceed U-0.184
- Applies to insulation either above or below the roof deck or a combination of the two
- Examples: R-19 under roof-deck or R-5 exterior continuous insulation.

New Requirement for 2022 Code

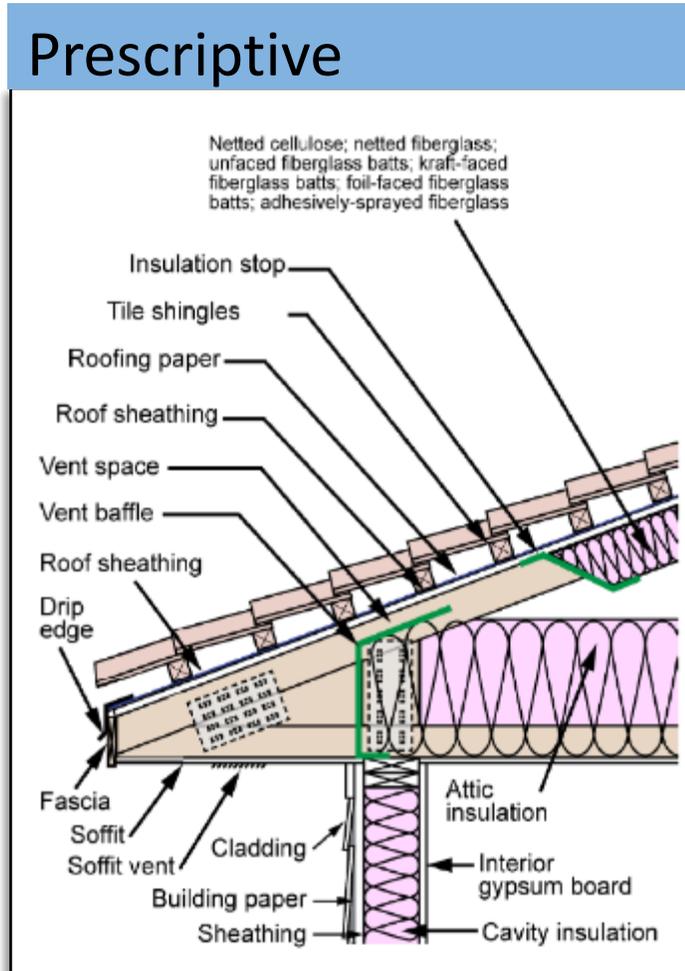


Image credit: CEC

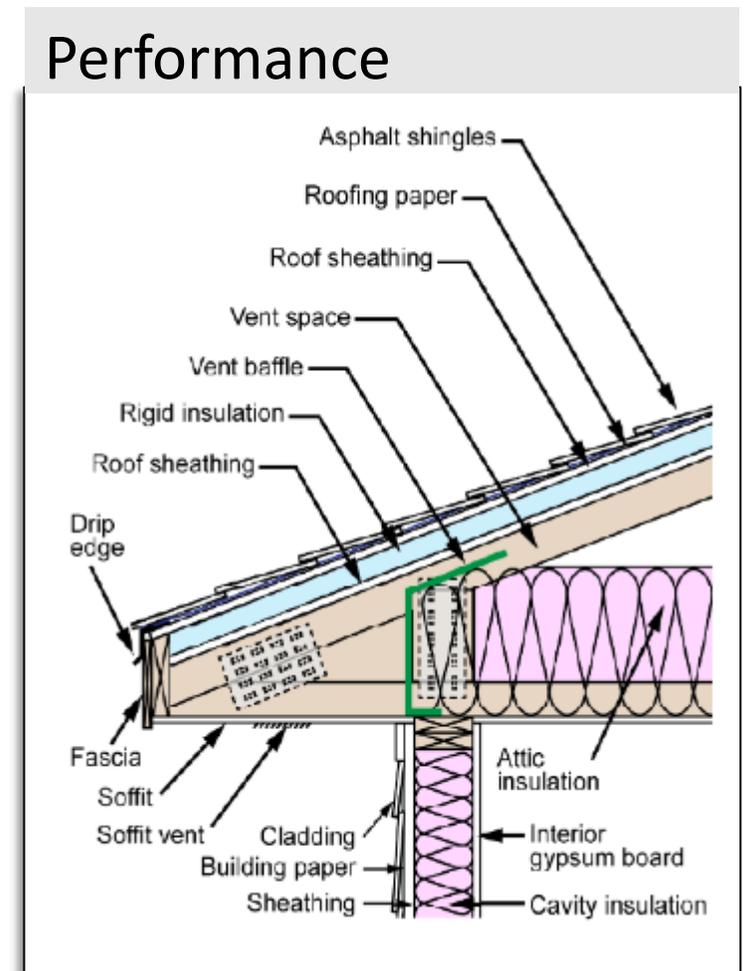
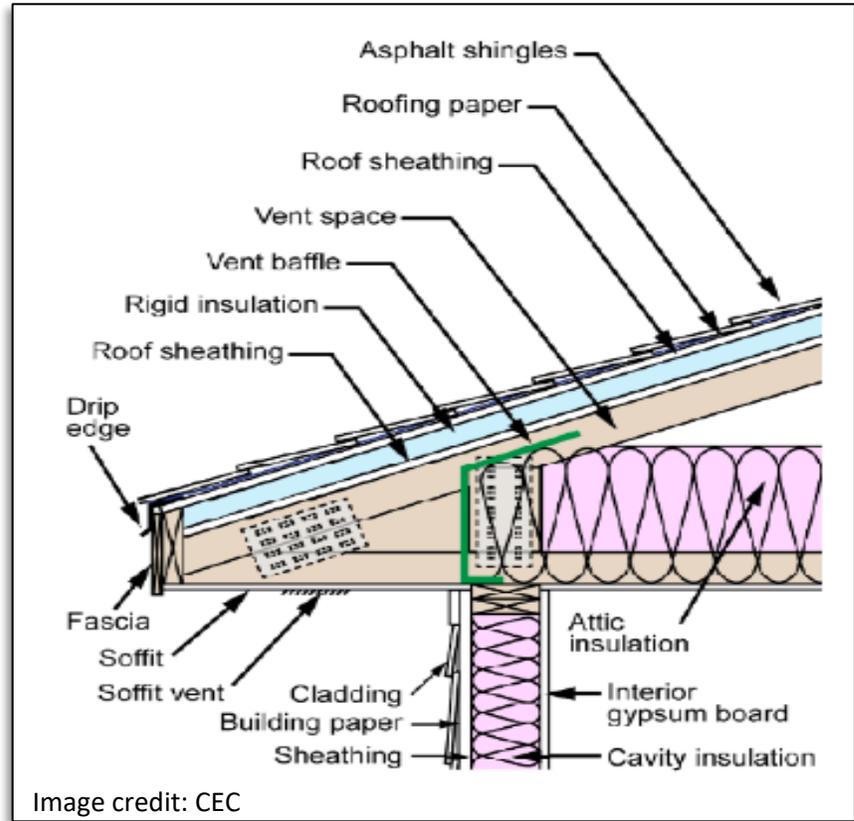


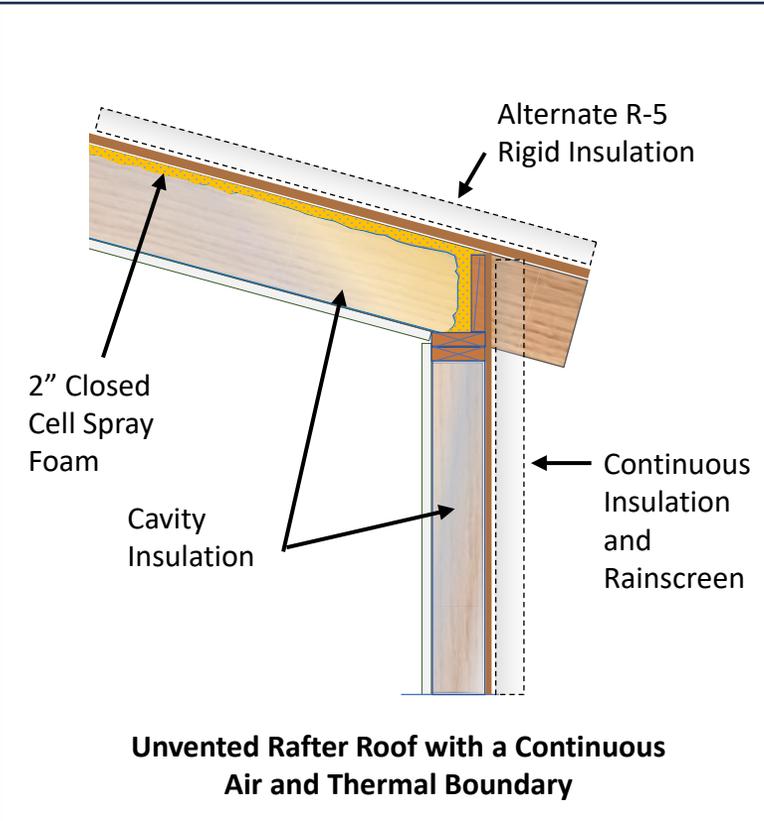
Image credit: CEC

Performance Method

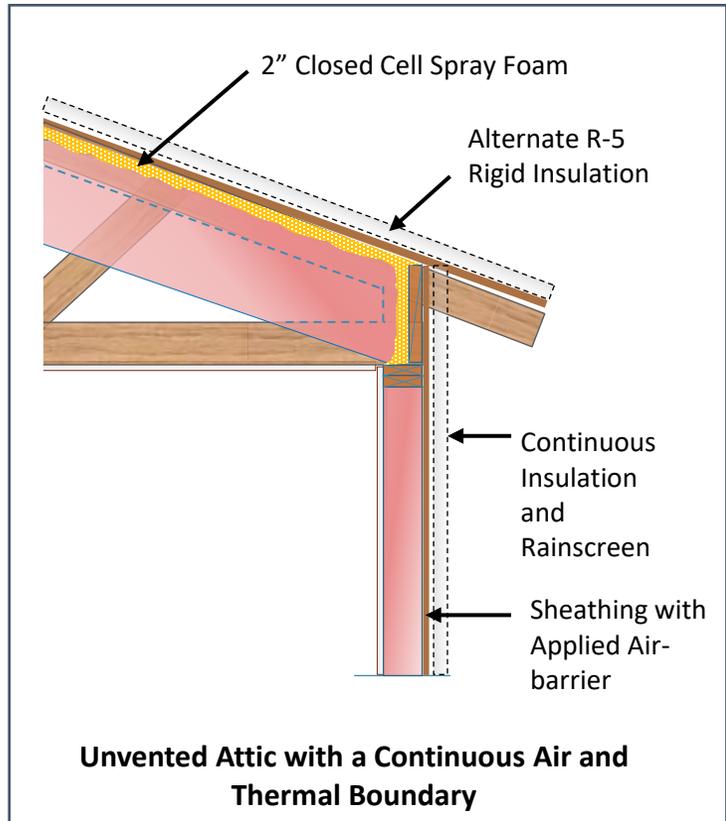
Vented Attic with above Roof-Deck Continuous Insulation (CI)



Rafter Roof Assemblies – Vented or Unvented



Un-Vented Attics



Performance Method –Key Attributes (Inputs)

Vented or Unvented Attic

Re: Insulation Depth at Roof Deck

Location and Total R-value, with or without Framing

General JA4 Residential T24 Performance Layers

Attic

Unventilated

Truss Heel Height: inches

Insulation covers framing at underside of roof deck

This tab is used to edit the attributes of the assembly used for Residential Title 24 Performance calculations in the software.

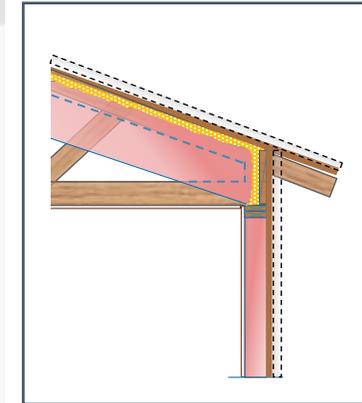
Insulation

Location	Insulation	Framing	Thickness
Ceiling:	<input type="text" value="- no insulation -"/>	<input type="text" value="2x4 @ 24 in. O.C."/>	
Above Roof Deck:	<input type="text" value="0"/> R-value	<input type="text" value="None"/>	<input type="text" value="0"/> inches
Below Roof Deck:	<input type="text" value="30"/> R-value	<input type="text" value="Wood"/>	<input type="text" value="3.5"/> inches

Other

Exterior Wall Finish:

Non standard spray foam insulation requiring QII Inspection



Unvented Attic with a Continuous Air and Thermal Boundary

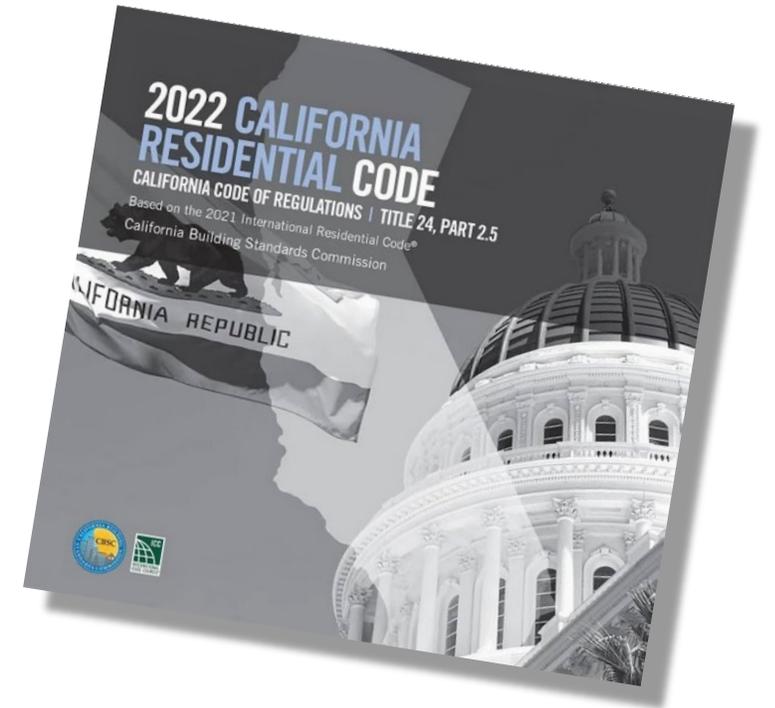


Note: The Energy Code does not specifically address condensation potential , nor the amount and area of attic ventilation or vapor diffusion, nor insulation type(s)... those regulations are in the Residential Code

California Residential Code – Title 24, Part 2.5

R806.5 Unvented Attic and Unvented Enclosed Rafter Assemblies

- Section R806.5 –Primary intention is to mitigate against condensation at the roof structural sheathing.
- ‘Spells out’ the requirements for use of air-permeable and air-impermeable insulations.
- List the requirements for unvented attics that use *only* air-permeable insulation for IECC Climate Zones 1,2, & 3
 - Vapor diffusion ports (20 perm min rating), and shall serve as an air barrier between the attic and the exterior of the building
 - Where only air-permeable insulation installed directly below the roof structural sheathing, an air supply flow rate of 50 cfm per 1,000 sf of ceiling area must be provided



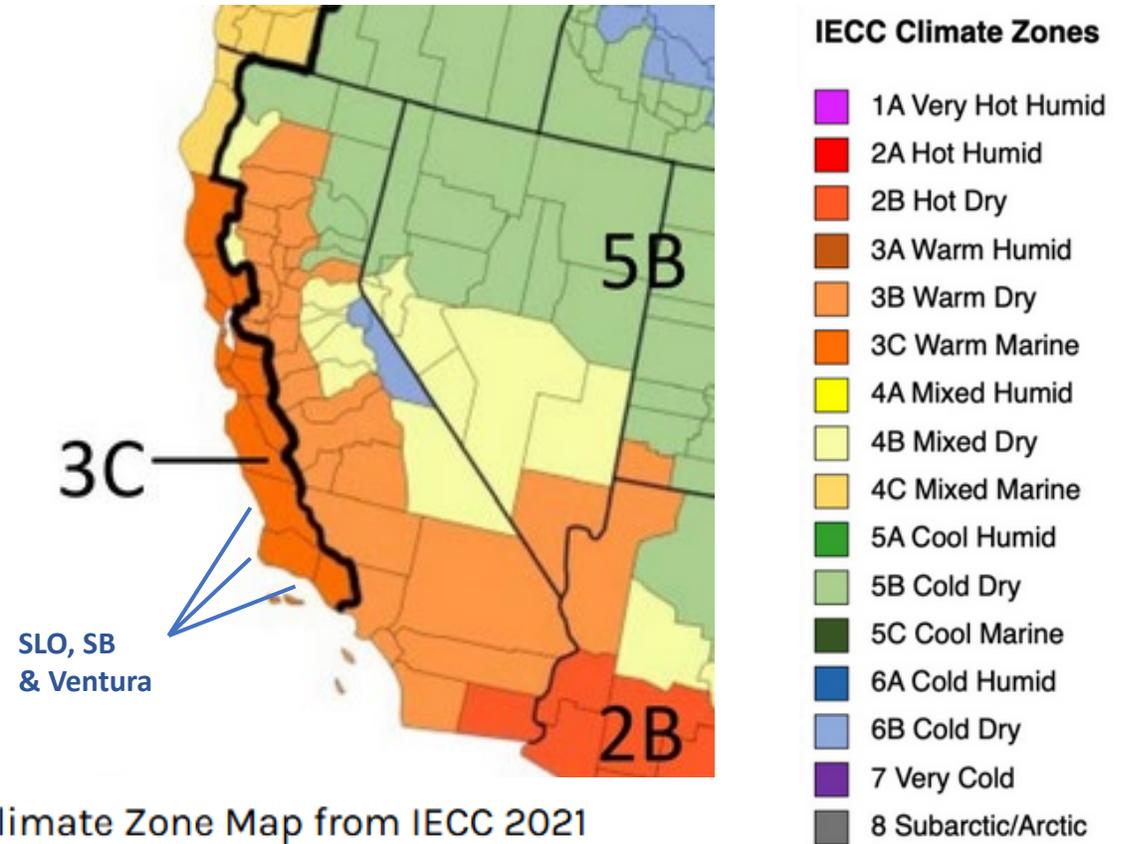
Part 2.5 is Based on the International Energy Conservation Code (IECC)

TABLE R806.5

INSULATION FOR CONDENSATION CONTROL

CLIMATE ZONE	MINIMUM RIGID BOARD ON AIR-IMPERMEABLE INSULATION R-VALUE ^{a, b}
2B and 3B tile roof only	0 (none required)
1, 2A, 2B, 3A, 3B, 3C	R-5
4C	R-10
4A, 4B	R-15
5	R-20
6	R-25
7	R-30
8	R-35

b. Alternatively, sufficient continuous insulation shall be installed directly above the structural roof sheathing to maintain the monthly average temperature of the underside of the structural roof sheathing above 45°F (7°C). For calculation purposes, an interior air temperature of 68°F (20°C) is assumed and the exterior air temperature is assumed to be the monthly average outside air temperature of the three coldest months.



Keep in Mind:
The IECC Climate Zones Differ from California's Energy Code Climate Zones



T24, Part 2.5

Chapter 7 Walls

Section R702

3C-REN is comprised of San Luis Obispo, Santa Barbara, and Ventura Counties, and are IECC climate zone '3C' or '3(marine)'

TABLE R702.7(5)
IECC VS. CALIFORNIA ENERGY CODE CLIMATE ZONE COMPARISON

IECC ^a	CALIFORNIA ENERGY CODE	DESCRIPTION ^b
6	16	Includes Alpine, Mono Counties
5	11, 12, 16	Includes Siskiyou, Modoc, Lassen, Plumas, Sierra, Nevada Counties
4 (marine)	1, 2, 16	Includes Del Norte and Humboldt Counties
4	2, 12, 13, 16	Includes Inyo, Trinity, Lake, El Dorado, Amador, Calaveras, Tuolumne, Mariposa Counties
3	8, 9, 10, 11, 12, 13, 14, 15, 16	Includes Shasta, Tehama, Butte, Glenn, Colusa, Yuba, Contra Costa, Sutter, Yolo, Sacramento, Placer, San Joaquin, Solano, Stanislaus, Merced, Madera, Fresno, Kings, Tulare, Kern, Ventura, Los Angeles, Orange, San Bernardino, Riverside Counties
3 (marine)	1, 2, 3, 4, 5, 6, 9, 12, 16	Includes Mendocino, Sonoma, Marin, San Francisco, San Mateo, Alameda, Santa Cruz, Monterey, San Benito, San Luis Obispo, Santa Barbara, Ventura, San Diego Counties
2	14, 16	Includes Imperial County

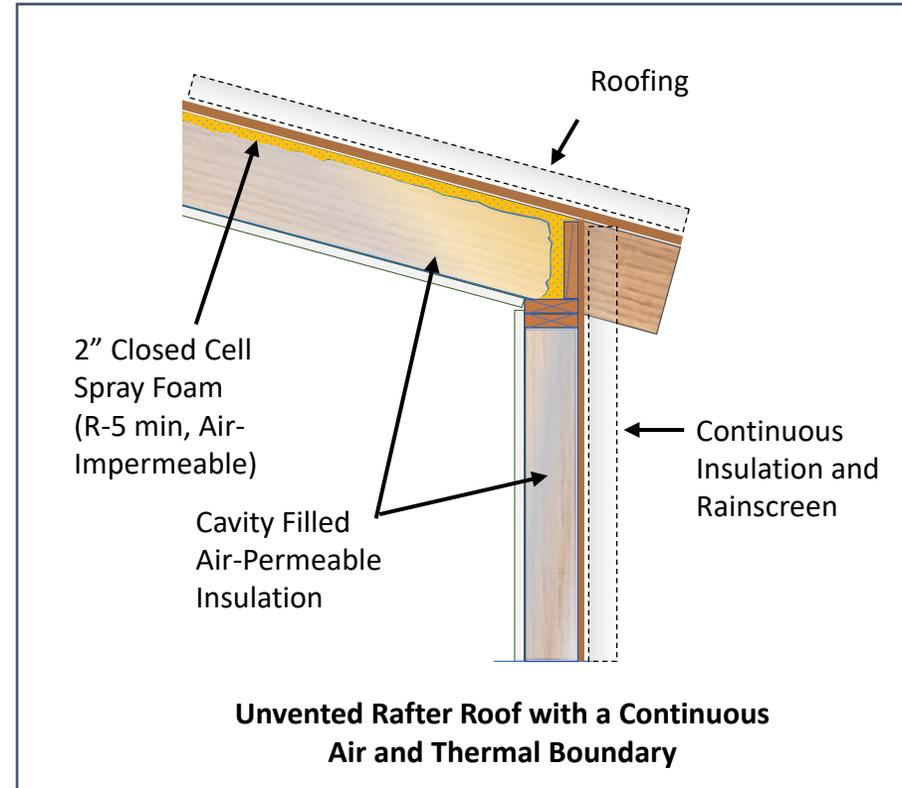
a. IECC Climate Zones 1, 7 and 8 do not occur in California, nor do any IECC moist climate zones.

b. IECC boundaries are defined by county political boundary lines. California Energy Code boundaries are based on metes and bounds specifications aligned with climate-affecting geographic features, which often do not coincide with county lines.



Unvented Rafter Roof –Blown-in over Spray Foam

Keep in Mind:
Typically, 2” of Closed-Cell
Spray Foam is needed as
an Air-Impermeable
Insulation



Excerpts from R806.5.5.1.3

- Where both [air-impermeable](#) and [air-permeable](#) insulation are provided, the [air-impermeable insulation](#) shall be applied in direct contact with the underside of the structural roof sheathing...
- ...[meet the] R-values in Table R806.5 for condensation control.
- ... [air-permeable](#) insulation shall be installed directly under the [air-impermeable insulation](#).

Reminder:

Table R806.5 for IECC Climate Zone 3C is R-5 for condensation control.

Unvented Rafter Roof – Batt over Spray Foam

Excerpt from form CEC-CF2R-ENV-21-QII-H:

A. Air Barrier Materials

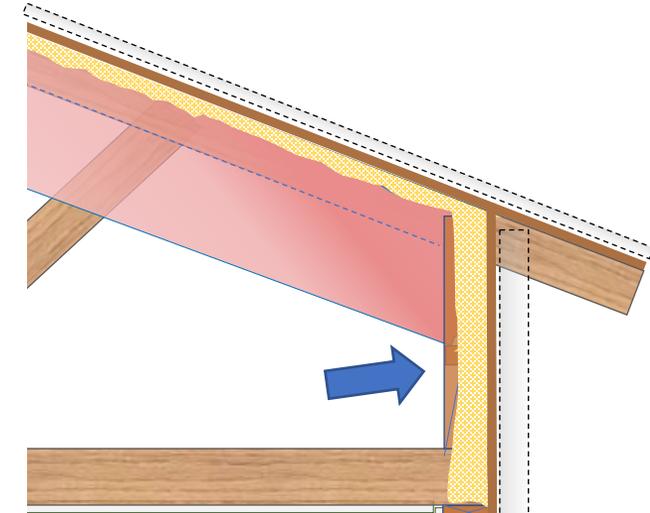
Note: SPF insulation is an acceptable air barrier and sealant when installed to a minimum thickness of 2 inches for closed cell and 5.5 inches for open cell, except where not allowed by manufacturer (e.g., flues, vents, can lights, etc.).



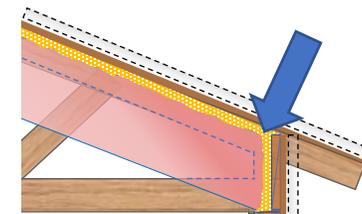
2" Closed Cell Spray Foam is adhered to underside of roof deck.



Remaining cavity is filled with Batt Insulation. (Blown-in insulation would also be acceptable.)



Include the heels and walls of the attic



A Vented Rafter Roof Assembly with a 'Smart' Membrane

Run 'sleepers' along top of trusses or 2x rafters

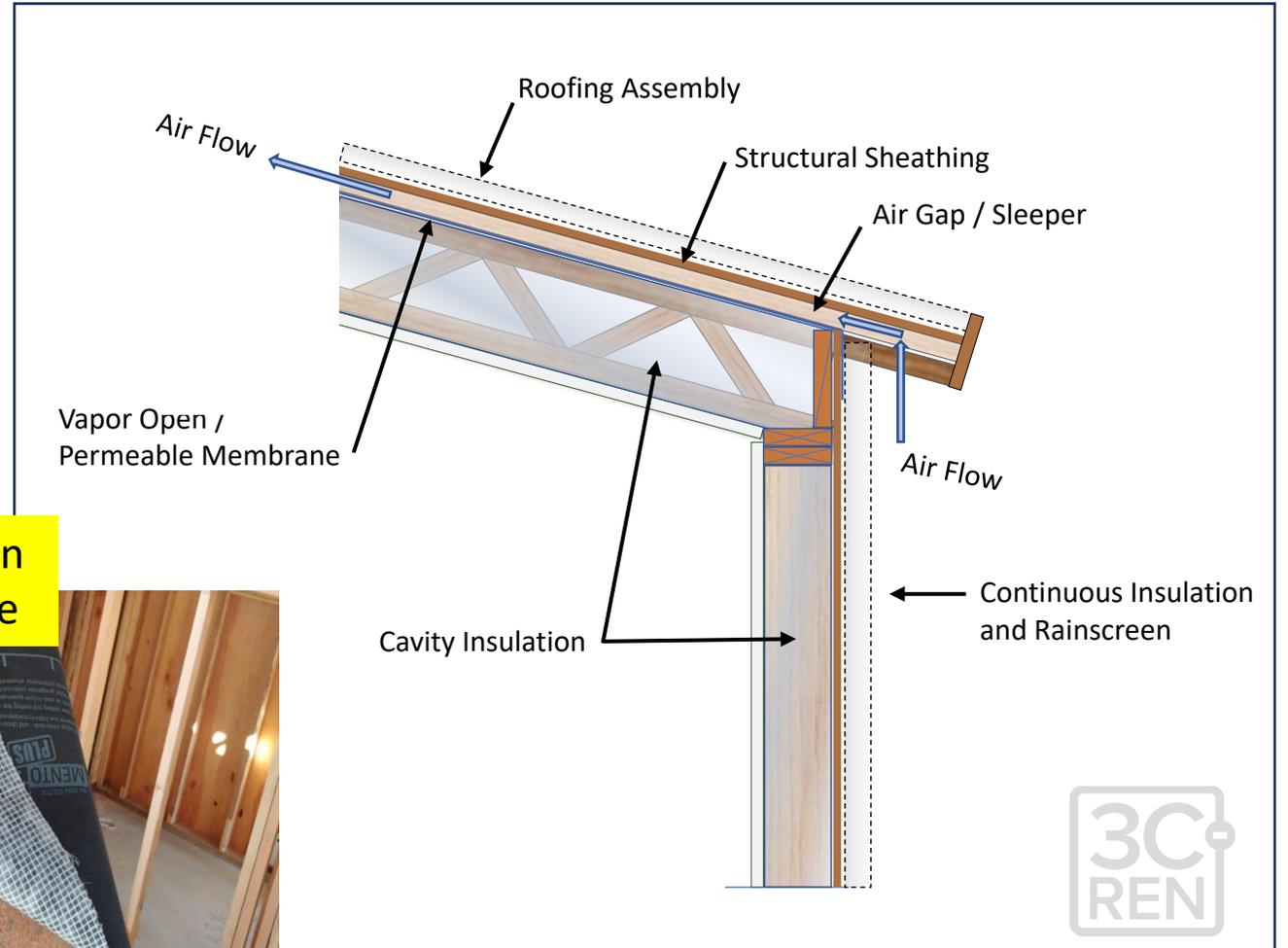


Photo/Project Credit: Cairn Collaborative



Looking from below before insulation

Vapor open membrane





Indoor Air Quality Ventilation



Ventilation –Indoor Air Quality (IAQ)

ASHRAE 62.2 continues to be the basis for Section 150.0(o):

- Quantity of outside air (OA) ventilation,
- Allowable methods of meeting the OA ventilation; and
- Field verification of IAQ system(s)

For newly constructed buildings and additions greater than 1,000 ft²

Section 150.0(o)

- Kitchen Hood Exhaust
- Bathroom Exhaust
- Outside Air (OA)
 - Mechanically Induced
 - Infiltration



Requirements for Ventilation Indoor Air Quality (IAQ)

This equation is for calculating the
'Total required ventilation rate' for the dwelling:

$$Q_{\text{total}} = 0.03A_{\text{floor}} + 7.5(N_{\text{br}} + 1)$$

Where:

Q_{total} = Total required ventilation rate (CFM)

A_{floor} = Conditioned floor area in square feet (ft²)

N_{br} = Number of bedrooms (not fewer than one)

This equation can be a good *estimate* for the required IAQ Ventilation. The calculated required IAQ Ventilation is also dependent on several infiltration rate equations, which can lower the required IAQ Ventilation rate overall.

Required IAQ is based on the total required ventilation rate for the dwelling minus the calculated annually averaged infiltration rate.



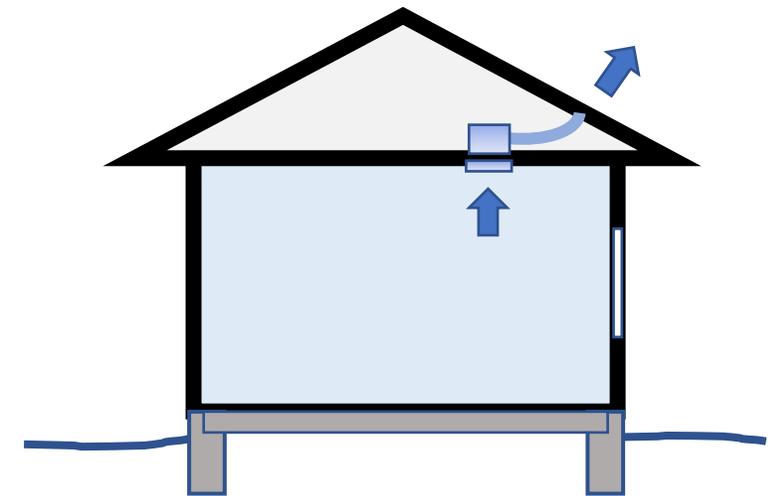
Mechanical Exhaust –Kitchens and Bathrooms

Local Mechanical Exhaust shall be installed in each kitchen and bathroom. Systems shall be rated for airflow in accordance with ASHRAE 62.2 section 7.1.

- **Open (Non-enclosed) Kitchens** shall have demand controls and meet min ventilation flow or capture efficiency requirements
- **Enclosed Kitchens and Bathrooms** can use continuous ventilation systems that are part of Energy or Heat Recovery Balanced Ventilation (ERV/HRV) Systems

Reminder:

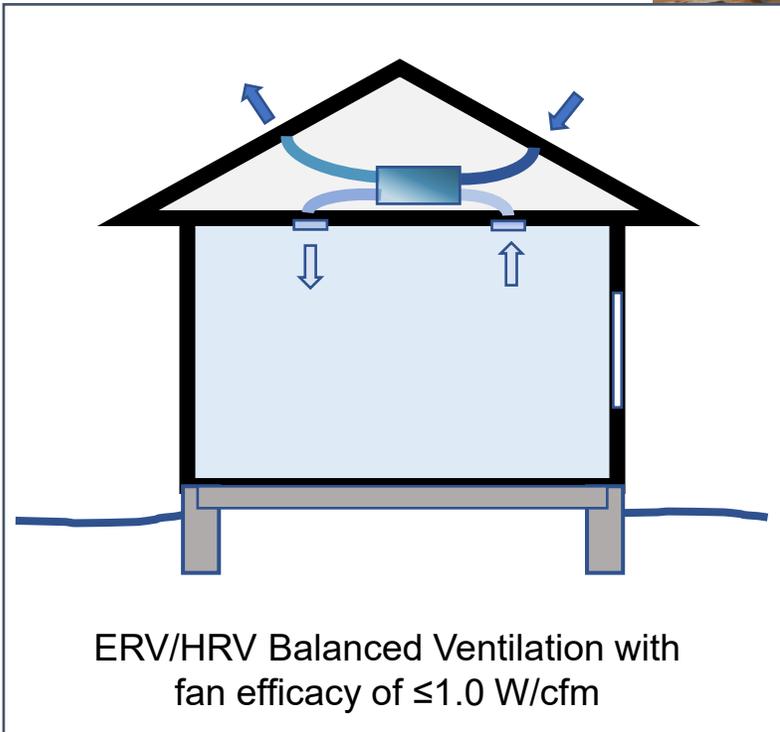
All systems must have occupant **accessible ON-OFF** switches –and if part of IAQ ventilation system be label , "This switch controls the indoor air quality ventilation for the home. Leave it switch in the "on" position at all times unless the **outdoor air quality is very poor.**"



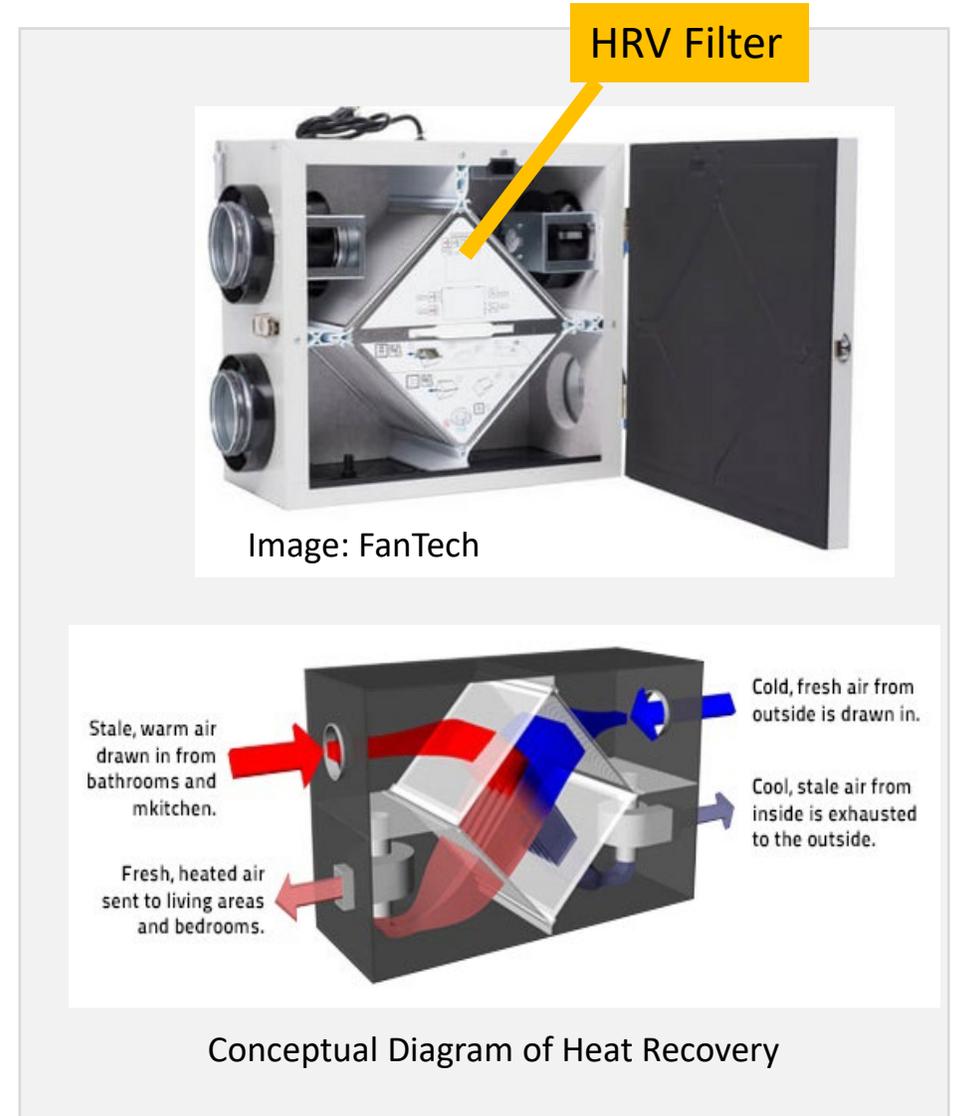
Local Mechanical Exhaust

Balanced Ventilation with Heat Recovery (HRV)

- Whole House Systems
- 'Spot' HRV/ERVs



- Performance Credit Available
- Must be HVI – Certified Products Directory listed for credit (HVI.org)



Ventilation Cooling with a Whole House Fan (WHF) CZ's 8-14 Prescriptive Requirement (or Performance Baseline)

Exception to section

150.1(c)12: New dwelling units with a conditioned floor area of **500 square feet or less** shall **not** be required to comply with the WHF requirements.

Note:

Prescriptive Table 150.1-A is largely unchanged



Quiet Cool



Kitchen –Range Hood and Other Exhaust Fans

New Tables 150.0-E, F and G

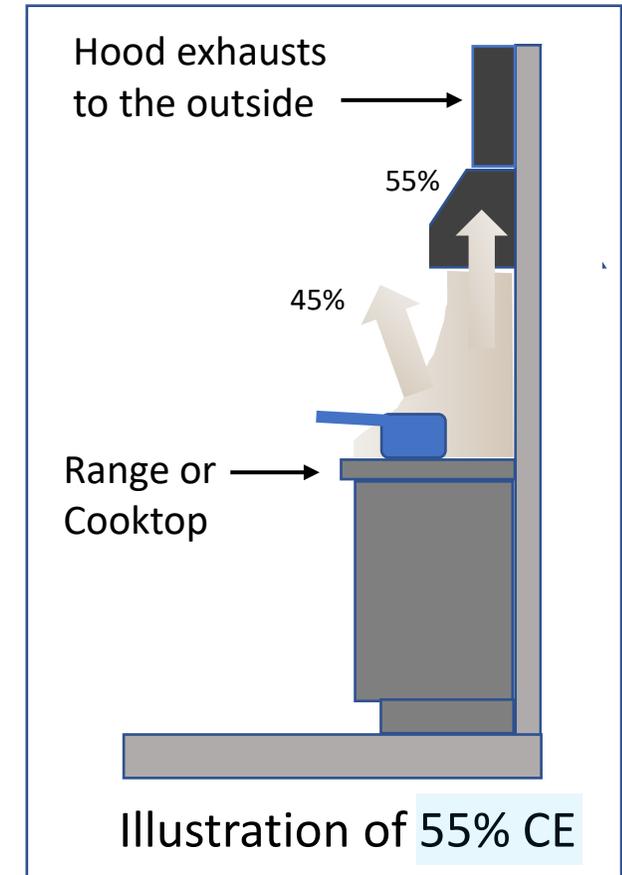
- Table 150.0-G based on home size and fuel type
- Capture Efficiency (CE) performance standard or rated air flow rate

*Table 150.0-G Kitchen Range Hood Airflow Rates (cfm) and ASTM E3087 Capture Efficiency (CE) Ratings
According to Dwelling Unit Floor Area and Kitchen Range Fuel Type*

<u>Dwelling Unit Floor Area (ft²)</u>	<u>Hood Over Electric Range</u>	<u>Hood Over Natural Gas Range</u>
<u>>1500</u>	<u>50% CE or 110 cfm</u>	<u>70% CE or 180 cfm</u>
<u>>1000 - 1500</u>	<u>50% CE or 110 cfm</u>	<u>80% CE or 250 cfm</u>
<u>750 - 1000</u>	<u>55% CE or 130 cfm</u>	<u>85% CE or 280 cfm</u>
<u><750</u>	<u>65% CE or 160 cfm</u>	<u>85% CE or 280 cfm</u>

Note: In this illustration, a hood CE of 55% would only comply for the situations highlighted in blue.

- Other exhaust fans, such as downflow, shall be 300 cfm or 5 ACH for enclosed kitchens



Mechanical Exhaust Ducts –Kitchen and Bathrooms

- Installer to **field test** with air flow hood/grid, or
- Follow **Table 150.0-H Prescriptive** Ventilation System Duct Sizing (ASHRAE 62.2 Table 5-3)
 - Reference cfm of the ventilation exhaust system
 - Minimum duct diameter for both rigid and flex duct
 - Where Duct System:
 - Total duct length is $\leq 25\text{ft}$
 - Duct system has no more than 3 elbows
 - Duct system has exterior termination fitting with a hydraulic diameter \geq to the minimum duct diameter and $>$ than the hydraulic diameter of the fan outlet.

Key Take Away:

Field test exhaust ducts or follow Prescriptive design



Air Flow
Testing
Equipment





Battery Energy Storage and Electric Ready

Energy Storage System (ESS) - “Battery Ready”

- Applicable only to new construction
- Infrastructure is Mandatory
- Battery is an optional credit
- Performance pathway:
 - Min Battery Size of 5 kWh
 - Needs to interface with the ‘Grid’
 - Performance credit is relatively small
 - Battery with PV system can be cost effective

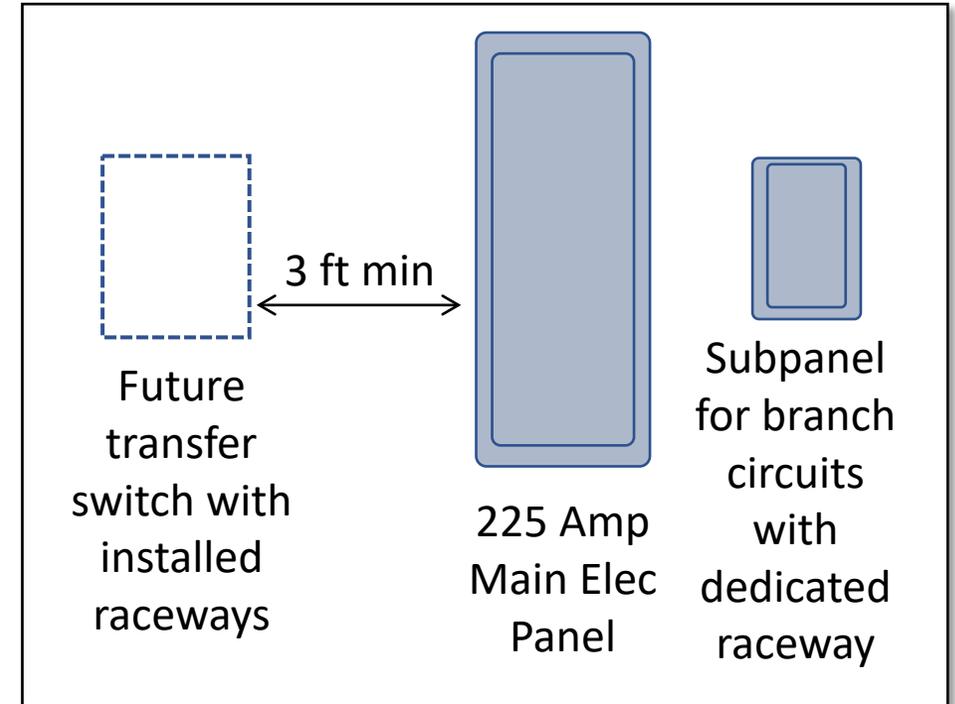
Key Concept:

Intent is to increase a household’s electric generation and storage system to be able to offset evening **electrical grid** usage and address **resiliency**



“Battery Ready” – Infrastructure Required

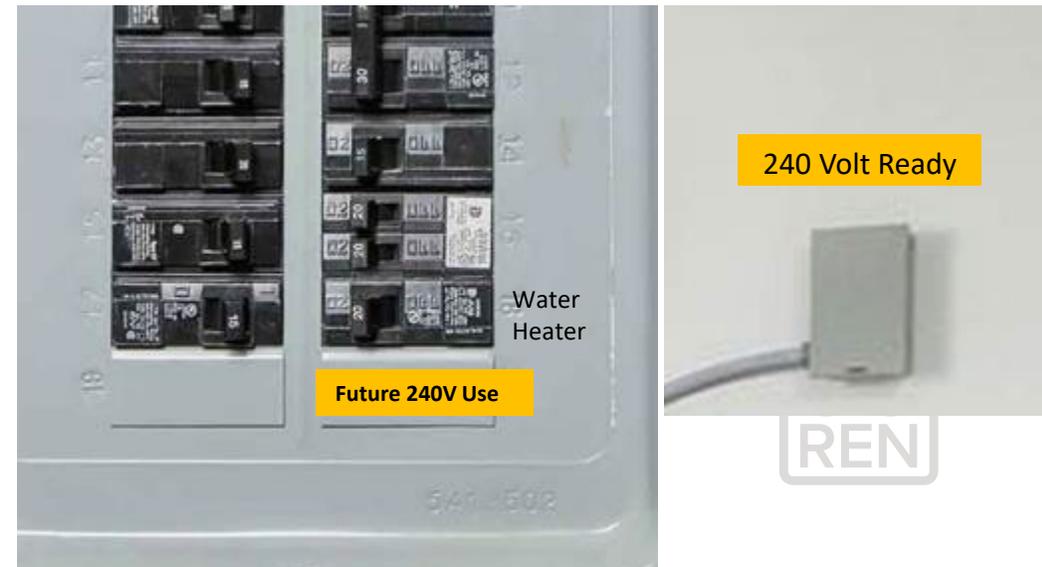
- At least **one** of the following required:
 - **Interconnection equipment** with minimum backed up capacity of 60 amps
 - **Dedicated raceway** (min 1”) from the main service to subpanel that supplies the branch circuits
- A **minimum of 4 branch circuits** shall be identified feeding:
 - **Refrigerator**
 - **One lighting** circuit near the primary egress
 - A **sleeping room receptacle** outlet
- Main panel must have busbar rating of **225 amps minimum**
- Sufficient space shall be reserved to **allow future installation** of a system **isolation equipment or transfer switch** within 3 feet of the main panelboard
- **Raceways** shall be installed between the panelboard and the system isolation equipment or transfer switch location to **allow the connection of backup power source**



“Electric Ready” Infrastructure Required *only where* propane or natural gas appliances are installed in new construction

- **Water heaters**: gas or propane water heaters must be installed in or adjacent to a space large enough for a heat pump water heater HPWH. (2.5' x 2.5' x 7') Must install 240v/20amp or 240v/30amp circuit depending on location - **150.0(n)**
- **Furnaces**: provide conductors rated at 240 volt/ 30 amp to the furnace for future heat pump installation- **150.0(t)**
- **Cooktops**: provide conductors rated at 240 volt/ 50 amp for future cooktop- **150.0(u)**
- **Dryers**: provide conductors rated at 240 volt/ 30 amp feed to dryer - **150.0(v)**

Electric ready items require breaker space and labeling in panel
AND
Electrical feed within 3 ft of non-electric appliance location





Heat Pumps for Space Conditioning and the VCHP Credit

Heat Pump (HP) Space Heating

CZ 3, 4, 13, and 14

Heat pump space heating is Prescriptively required

Note:

Under the Performance pathway HP and/or Gas Furnaces are allowable

Note this exception still applies:

EXCEPTION to Section 150.1(c)6: A supplemental heating unit may be installed in a space served directly or indirectly by a primary heating system, provided that the unit thermal capacity does **not exceed 2 kW or 7,000 Btu/hr** and is **controlled by a time-limiting device not exceeding 30 minutes.**



Outdoor condensing units for the electric heat pump systems

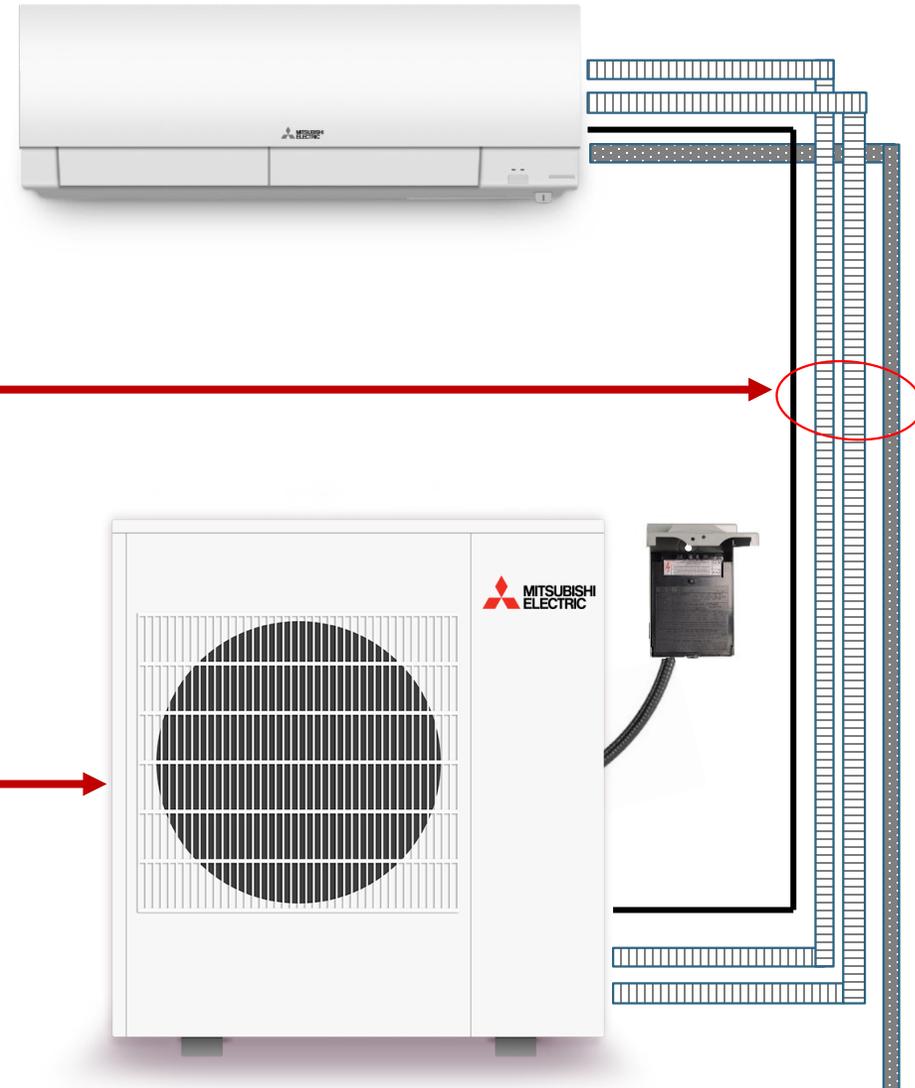


Ductless 'Mini-Split' Heat Pump with Variable Capacity

Indoor Unit –Head with multi-speed fan controls

- Line Set Pair/Piping –Insulated Copper Refrigerant Tubing
- Condensate Line –Drain Hose
- Power Cord –Connecting to the Indoor Unit (aka Communication Wire)

Outdoor Unit –Compressor/Condenser
Includes electronic expansion valve for variable refrigerant flow and multi-speed compressor and fan



Note: Can typically have four indoor units per each outdoor unit.

Variable Capacity Heat Pump (VCHP) Compliance Option – High Credit, Required Special Features and HERS Triggered

CF1R-PRF-01-E

REQUIRED SPECIAL FEATURES

The following are features that must be installed as condition for meeting the modeled energy performance for this computer analysis.

- Variable capacity heat pump compliance option (verification details from VCHP Staff report, Appendix B, and RA3)
- Compact distribution system basic credit
- Northwest Energy Efficiency Alliance (NEEA) rated heat pump water heater; specific brand/model, or equivalent, must be installed

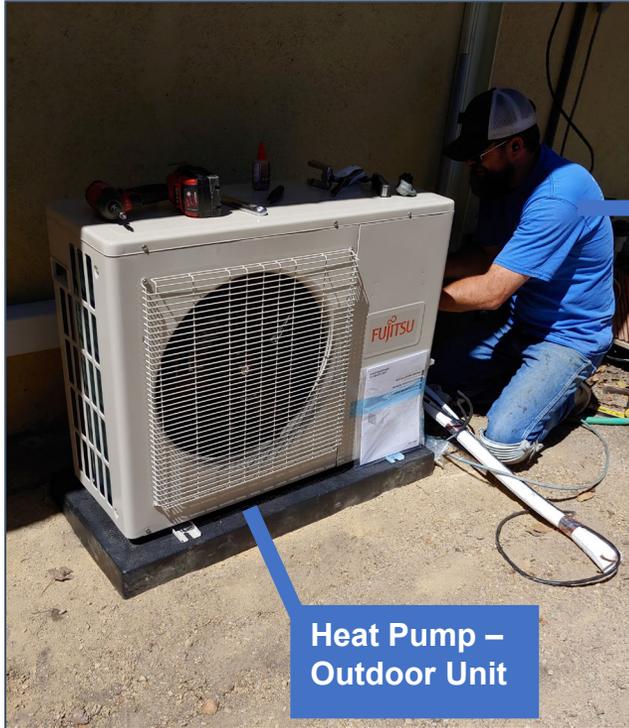
HERS FEATURE SUMMARY

The following is a summary of the features that must be field-verified by a certified HERS Rater as a condition for meeting the modeled energy performance for this computer analysis. Additional detail is provided in the building tables below. Registered CF2Rs and CF3Rs are required to be completed in the HERS Registry

- Quality insulation installation (QII)
- Indoor air quality ventilation
- Kitchen range hood
- Verified EER/EER2
- Verified SEER/SEER2
- Verified Refrigerant Charge
- Airflow in habitable rooms (SC3.1.4.1.7)
- Verified HSPF2
- Verified heat pump rated heating capacity
- Wall-mounted thermostat in zones greater than 150 ft² (SC3.4.5)
- Ductless indoor units located entirely in conditioned space (SC3.1.4.1.8)

Heat Pumps Installation and HERS

Best time to verify refrigerant charge and equipment capacity, efficiency, etc. is during the installation



Installing Contractor

Heat Pump -
Outdoor Unit



Specs in the Box
Needed by HERS Rater



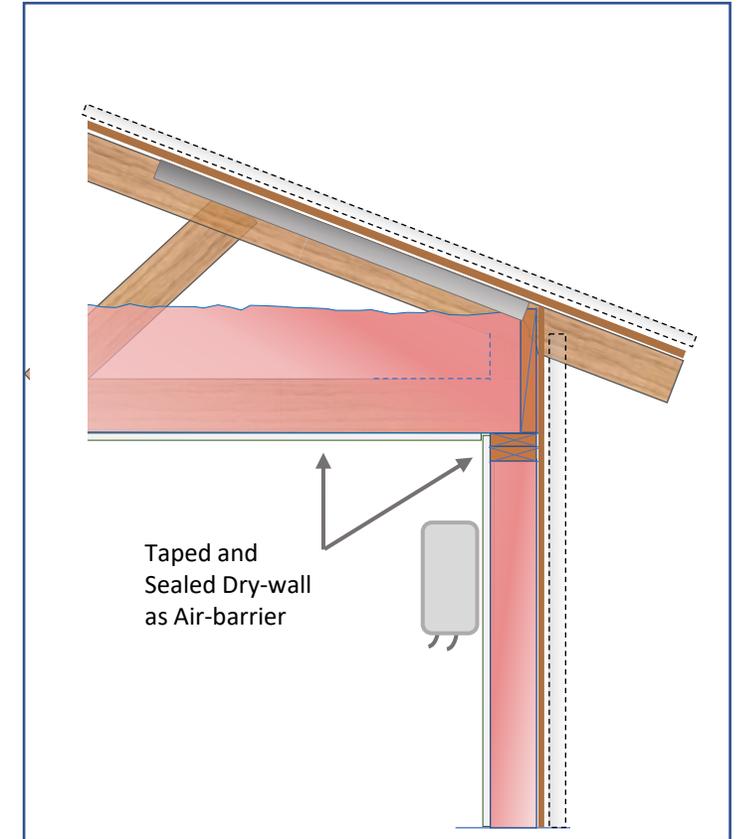
Refrigerant Line Set

Indoor units shall be installed within the air and thermal boundaries, with air flow to each habitable room, i.e. ea bedrm and living area; wall thermostats required in zones larger than 150 sq ft..

Wall and Ceiling Penetrations for the Mechanical System Refrigerant, Condensate, and Communication Lines need to be Air Sealed.



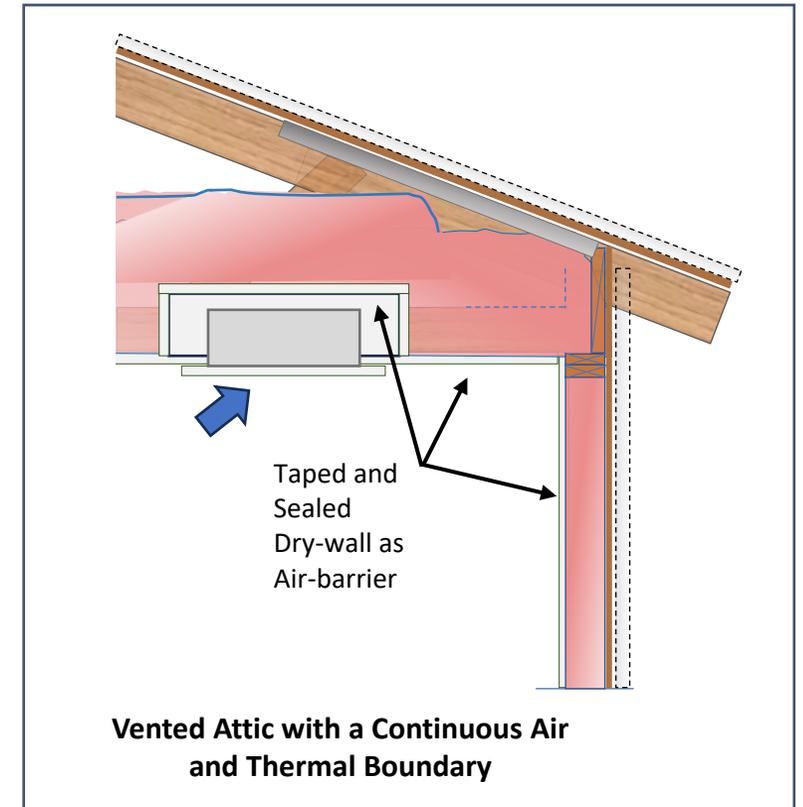
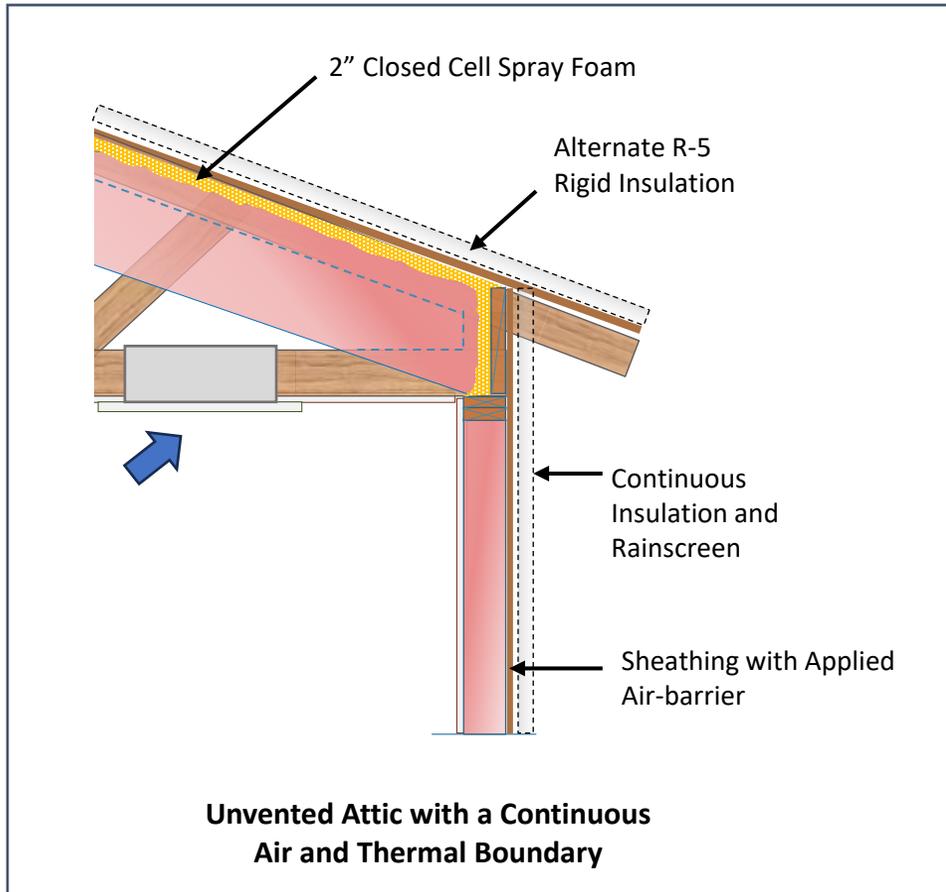
Ductless Wall Mount



Vented Attic with a Continuous Air and Thermal Boundary

VCHP Compliance Credit Impacts the Envelope Enclosure

Indoor units shall be installed within the air and thermal boundaries





Domestic Hot Water



Prescriptive Water Heating Options

CZ 3, 4, 13, and 14

If a heat pump space heating system is used, then Gas Instantaneous (< 200 kBtu/h) water heater is allowable

IF YES,



Heat Pumps for Space Conditioning

THEN GAS is Allowable



Water Heaters –New Construction and Additions (all Climate Zones)

New:

- A **120V HPWH** may be installed in place of a 240V HPWH for new dwelling unit with **1 bedroom or less**.



New:

- For additions and dwelling units that are **500 sq ft or less**, an **instantaneous electric water heater** with **point of use distribution** as specified in RA4.4.5 is allowable



Major Change from 2019 Code: POU Electric tankless for 500 sf or less



Point of Use (POU) -Second Water Heater, Addition < 500sf

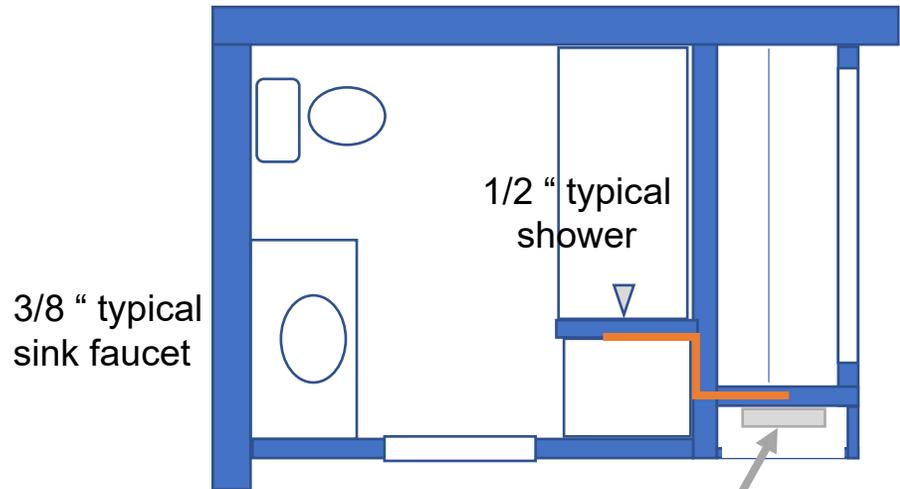
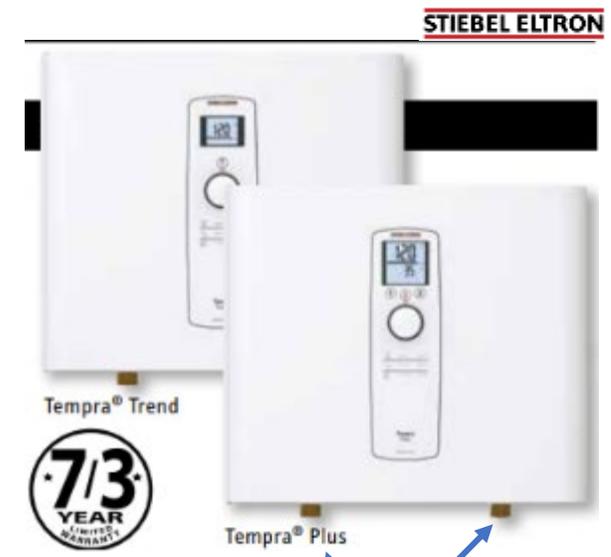


Table 4.4.5

Size Nominal (Inch)	Length of Pipe (feet)
3/8"	15
1/2"	10
3/4"	5

Line size vs Length for each run

Other considerations:
 electric panel size and breaker(s); flush out /filter cleaning



Instantaneous electric water heater with *point of use distribution*

HERS Verification required for pipe insulation.



Insulation for Piping and Tanks

- **Eliminated** the *additional* requirements from MM Section 150.0(j)
- **Greater alignment** with Section 609.11 of the CA Plumbing Code
- **All hot water piping** shall be insulated per 609.11
- **Unchanged:** Piping surrounded with a minimum of 1 inch of wall insulation, 2 inches of crawl space insulation, or 4 inches of attic insulation, shall not be required to have pipe insulation.

Key Change: Energy Code points to the Plumbing Code



Reference: Section 609.11 of the CA Plumbing Code

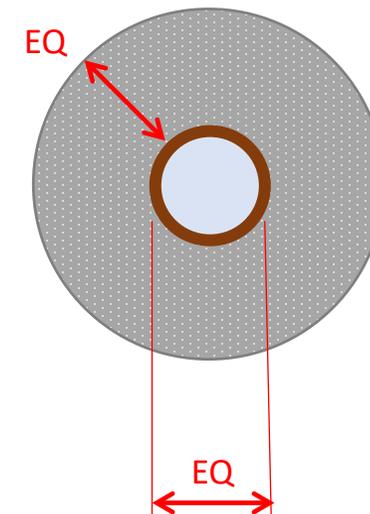
609.11 Pipe Insulation. Insulation of domestic hot water piping shall be in accordance with Section 609.11.1 and Section 609.11.2.

609.11.1 Insulation Requirements. Domestic hot water piping shall be insulated.

609.11.2 Pipe Insulation Wall Thickness. Hot water pipe insulation shall have a minimum wall thickness of not less than the diameter of the pipe for a pipe up to 2 inches (50 mm) in diameter. Insulation wall thickness shall be not less than 2 inches (51 mm) for a pipe of 2 inches (50 mm) or more in diameter.

Exceptions:

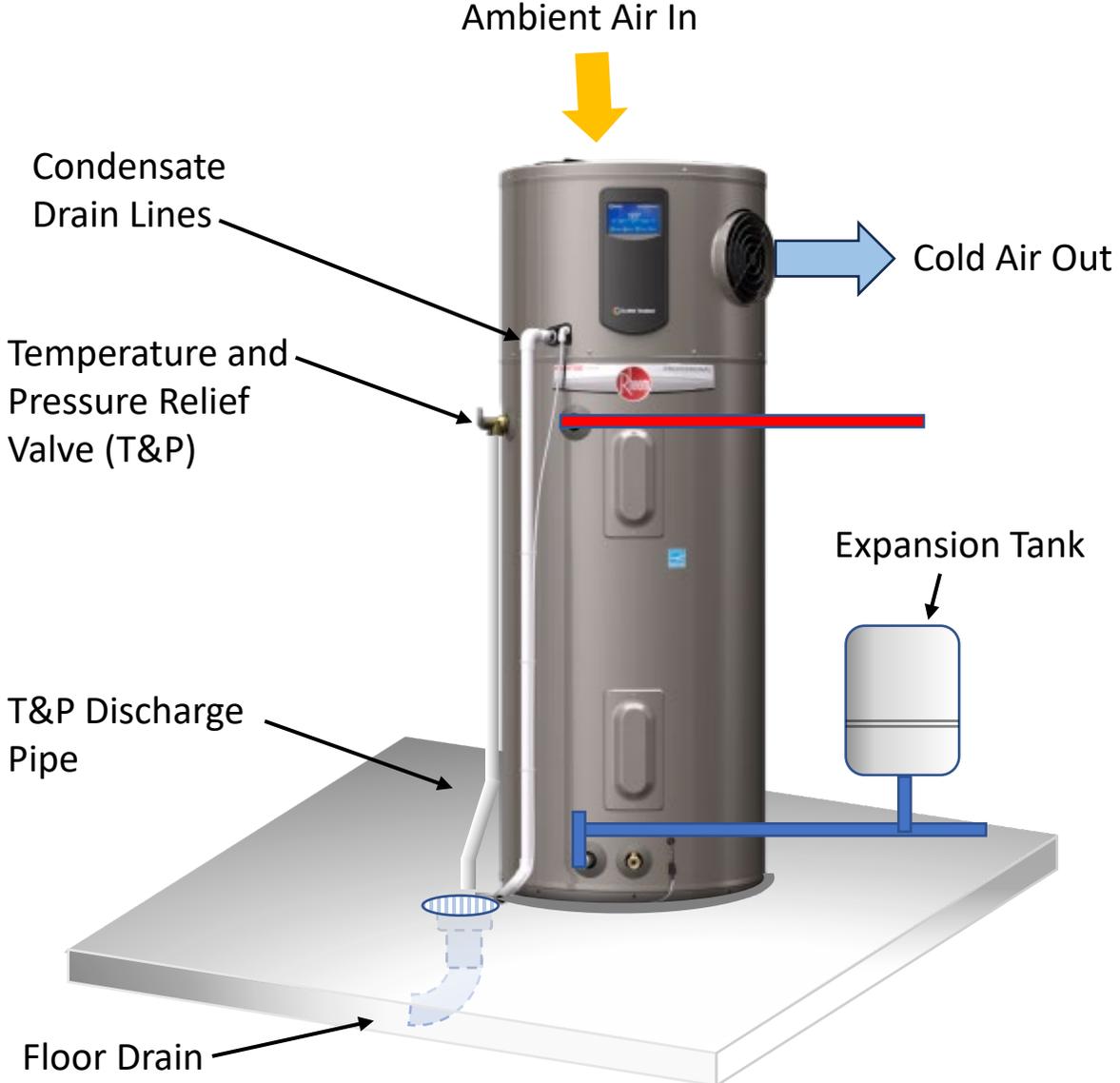
- (1) Piping that penetrates framing members shall not be required to have pipe insulation for the distance of the framing penetration.
- (2) Hot water piping between the fixture control valve or supply stop and the fixture or appliance shall not be required to be insulated.



Main Take Away:
Pipe insulation
thickness shall be
at least as thick as
the pipe diameter



Integrated Heat Pump Water Heater (also known as a Hybrid Water Heater)

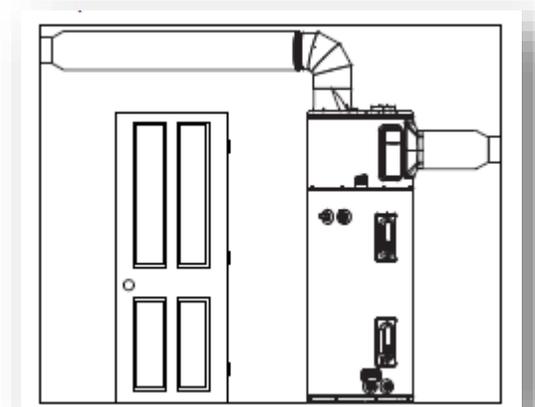


Design Considerations – Integrated HPWH



Image source: Silicon Valley Clean Energy

- Integrated HPWH tanks taller than standard gas or electric units
- Requires clearances on the sides, top and back, for air flow and access to the air filters
- Operating Temp between 45 F and 90 -110F
- Noise typically around 50 db
- Cold, dehumidified, air exhaust
- Needs 750 – 1000 cubic feet volume, or ducted vent kit



Potential Design Constraints

- Customer satisfaction can be adversely influenced by long plumbing runs with integrated HPWH's
- HPWH's typically are not designed to work with recirc pumps and may require a loop tank or other special design considerations
- Some brands will not operate with a recirc pump at all (Sanden) and others will lose the warranty (AO Smith) or turn to electric-resistance-mode only (most models)
- ...because all HPWH's operate best with high-lift, stratification, i.e. cold incoming water



Technical Service Department
Technical Service Bulletin
1-800-432-8373
HeatPump Water Heater w/ Recirculation



A return circulation pipe is sometimes provided in a hot-water system where it is desirable to have hot water available continuously at the fixtures.

A smaller pipe with an inline pump is connected to a point close to the most distant fixture and to a point close to the hot water heater. The pump can run continuously or intermittent circulating enough water to keep the temperature drop in the pipeline during low or no consumption within an acceptable limit.

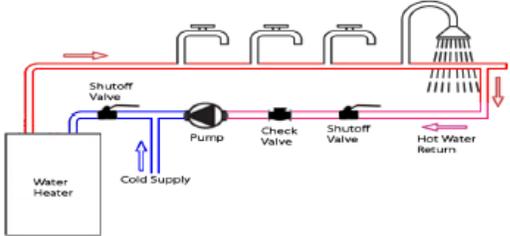
Return circulation in your home is great at providing hot water to your fixtures quickly and reducing the amount of cold water going down the drain while you wait, but hot water is constantly flowing through your pipes. If your pipes are not insulated or insulated well, then your pipes will transmit the heat to the surrounding areas of your home. The more heat energy lost, the more your water heater has to work to maintain the heat in the pipes.

The Rheem HeatPump water heater uses proprietary software to ensure the water heater operates at peak efficiency. This water heater uses an algorithm to determine when the unit should begin a heating cycle. A typical heating cycle is caused due to a sudden drop in temperature in the bottom of the tank when hot water is being used since the incoming water temperature is much cooler than the water in the tank. Due to software program on this water heater, considerations must be made when installing a heat pump water heater in conjunction with a home recirculation system as the inlet water temperature may not be cool enough to activate a heating cycle.

Due to the wide variety of applications and the variability in installation and performance of these systems, Rheem cannot and does not specifically recommend the Rheem HeatPump water heater for use with recirculation systems. We can provide the following guidance that you can use to determine if the Rheem HeatPump water heater will perform in your specific application:

If your recirculation system or pump is designed to help provide hot water to sinks, showers, etc. that are far away from the water heater and does not present a significant continuous heating load, the Rheem HeatPump water heater can generally be used as long as the incoming water temperature to the Rheem HeatPump water heater remains less than 15°F below the thermostat setting and not exceeding 120°F and you have it set for High Demand mode or Electric only mode. Heat Pump only mode may also work in this configuration, but you may have to experiment with your application. Energy Saver mode will not perform well with recirculation systems due to the fact that it takes about a 25°F drop in tank temperature to activate in this mode.

Depending on conditions associated with the specific application, anticipated energy savings from the Rheem HeatPump water heater could be significantly impacted. Using this in a recirculation loop may cause the unit to run excessively. The heat pump portion of the water heater only produces about 1500 watts of energy in the best of conditions (high heat and high humidity conditions) and may not be able to keep up with the demand.



Rheem Water Heating
www.rheem.com
800-432-8373

In keeping with its policy of continuous progress and product improvement, Rheem reserves the right to make changes without notice.

6/7/2019 TB-1331

Questions about Title 24?

3C-REN offers a *free* Code Coach Service



Online:
3c-ren.org/codes

Call:
805.781.1201

Energy Code Coaches are local experts who can help answer your Title 24 questions. Coaches have decades of experience in green building and energy efficiency improvements. They can provide citations and offer advice for your project to help your plans and forms earn approval the first time.

Closing

- Continuing Education Units Available
 - Contact shuskey@co.slo.ca.us for AIA and ICC LUs
- Coming to Your Inbox Soon!
 - Slides, Recording, & Survey – Please Take It and Help Us Out!
- Upcoming Courses:
 - February 20 - [Practical Ways to Address Embodied Carbon](#)
 - February 27 - [Residential Load Calculation and Duct Design for Building Departments](#)
 - March 5 – [ADU Planning and Best Practices](#)
 - March 5 – [Recovery Ventilators: Energy Savings and Compliance Credit in the 2022 Energy Code](#)
 - March 7 - [High Performance Buildings & Careers – Class 1: High Performance Fundamentals Series](#)
- Visit www.3c-ren.org/events for our full catalog of trainings.





Thank you!

For more info:
3c-ren.org

For questions:
info@3c-ren.org



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