



We will be starting soon!

Thanks for joining us



What Energy Consultants Need to Know About HERS Measures



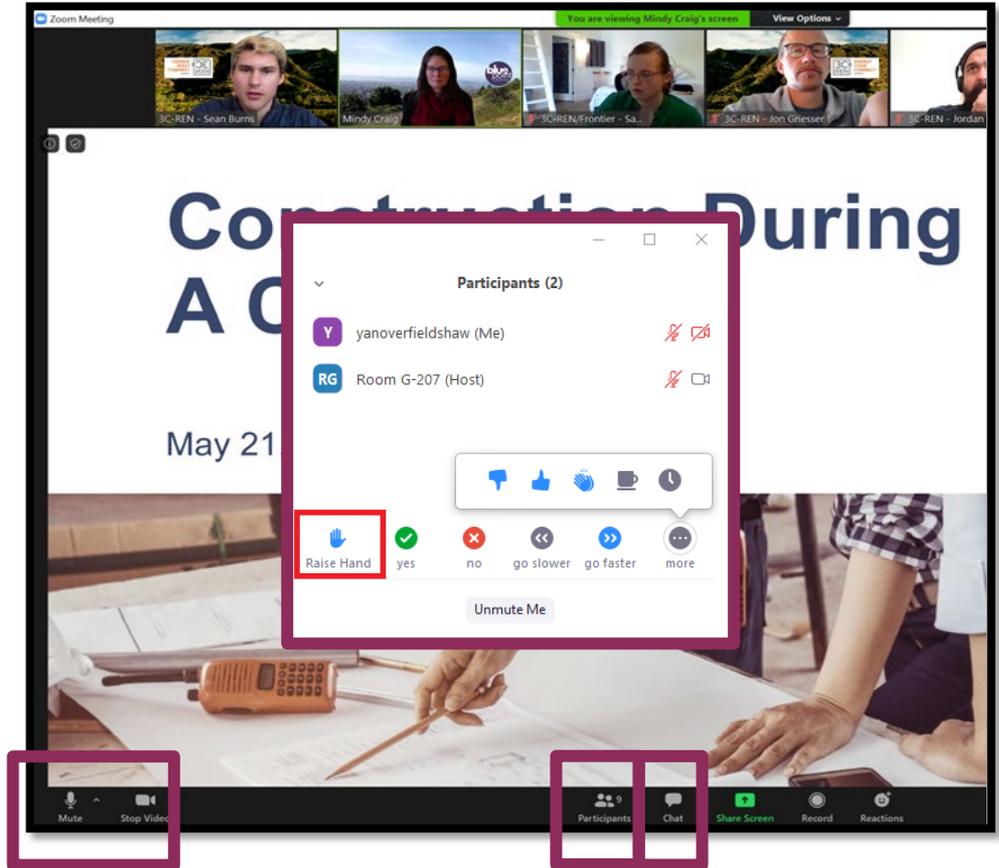
Russ King – Coded Energy

December 5, 2023



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





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What Energy Consultants Need to Know about HERS Measures

Instructor: Russell King, M.E.

Introduction



- **FACT:** It is a lot *harder* to make a house comply under the **2022 Code** than the **2019 Code**.
- **FACT:** This will result in more HERS measures being specified for compliance.
- **FACT:** Some of these HERS measures can no longer be “modeled away” if they fail.

Introduction



- From the energy consultant's perspective, modeling HERS measures is as simple as checking a box.
- As a responsible professional, energy consultants need make sure that the features they model can actually be installed.
- This includes being able to pass any diagnostic tests.

Introduction



- Don't “check the box” without knowing exactly what the **implications** are.
- Energy Consultants need to **communicate** the potential costs and requirements of each HERS measure they specify.
- When you specify a HERS measure, send your client the **RA reference (aka Protocols)** for the measures modeled. See Table RA2-1.
- Also know the requirements on the applicable CF2R and CF3R

Most of the HERS Measures for 2022:

- QII
- Duct location, surface area and R-value
- VLLDCS
- LLAHU
- Return Duct design
- Air filter device design
- Bypass ducts (zoned)
- Refrigerant charge
- Fault indicator display
- HVAC System Airflow
- Fan watt draw
- EER/SEER
- Heat Pump Capacity
- Evaporatively cooled condensers
- Whole house fan
- Duct sealing
- CFV Cooling
- IAQ – continuous or intermittent airflow
- Reduced infiltration
- Higher than default SPF R-values
- Pipe insulation credits
- Parallel piping
- Compact distribution
- Demand Recirculation
- Drain Water Heat Recovery Device
- Multiple Recirc loop (MF)



What you should know about . . .

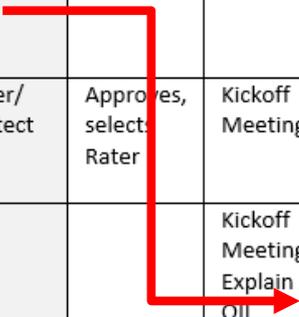
Quality Insulation Installation (QII)

- It is now a **prescriptive** measure.
- Exception: Prescriptive additions 700 SF or less.
- Instead of an **extra credit for doing it**, there will be a **big penalty for NOT doing it**.
- Go to www.energycodeace.com and search for “Decoding QII”. Download the handout from the more recent session (this year).
- Includes the “**CaICERTS QII Handbook**”



QII Process by Construction Phase

	Predesign	Design	Design Review	Grading	Framing	Rough-In	Insulation	Drywall	Finish	Final Inspection
	1	2	3	4	5	6	7	8	9	10
Energy Consultant A	Specifies QII	Kickoff Meeting	Register CF1R, assign Rater in registry							
Builder/Architect B	Approves, selects Rater	Kickoff Meeting	Sign CF1R							Provide all documents to occupant
HERS Rater C		Kickoff Meeting Explain QII	Work out sampling details (if any)	Coordinate with trades off site	Coordinate with trades on site	ENV-21 inspections	ENV-22 inspections	ENV-23 inspections	Finish CF3Rs in registry	
Insulation Installer D		Kickoff Meeting		Acknowledges QII requirements	Understands QII requirements	Pre-insulate ENV-21	Install batt and other insulation ENV-22	Loose fill ceiling insulation ENV-23	Finish CF2Rs	
Framer E		Kickoff Meeting			Frame continuous air barrier					
Drywall Installer F		Kickoff Meeting						install and seal drywall		
Misc Trades G		Kickoff Meeting			Hard covers and draft stops	Caulk and seal ENV-21		Caulk and seal		
	1	2	3	4	5	6	7	8	9	10



Make sure this flow of information happens



QII Process by Construction Phase

	Predesign	Design	Design Review	Grading	Framing	Rough-In	Insulation	Drywall	Finish	Final Inspection
	1	2	3	4	5	6	7	8	9	10
Energy Consultant A	Specifies QII	Kickoff Meeting	Register CF1R, assign Rater in registry			Or else . . .				Oh, Crap! We failed QII. Fix it NOW!
Builder/ Architect B	Approves, selects Rater	Kickoff Meeting	Sign CF1R							Provide all documents to occupant
HERS Rater C		Kickoff Meeting Explain QII	Work out sampling details (if any)	Coordinate with trades off site	Coordinate with trades on site	ENV-21 inspections	ENV-22 inspections	ENV-23 inspections	Finish CF3Rs in registry	
Insulation Installer D		Kickoff Meeting		Acknowledges QII requirements	Understands QII requirements	Pre-insulate ENV-21	Install batt and other insulation ENV-22	Loose fill ceiling insulation ENV-23	Finish CF2Rs	
Framer E		Kickoff Meeting			Frame continuous air barrier					
Drywall Installer F		Kickoff Meeting						install and seal drywall		
Misc Trades G		Kickoff Meeting			Hard covers and draft stops	Caulk and seal ENV-21		Caulk and seal		
	1	2	3	4	5	6	7	8	9	10



QII – Builder Tips for New Projects

If the project needs QII (shown on CF1R-PRF-01):

- **Evaluate plans very carefully. Look for unclear parts of thermal boundary. (knee walls, hard covers, bump outs, fire places, etc.)**
- **Decide exactly where the thermal boundary will be.**
- **Define responsibilities for trades. (air barriers, blocking, attic vents, sealing around fans, electrical boxes, etc.)**
- **Contact HERS Rater early.**
 - **Ask for checklists, other informational materials.**
 - **Meet at project early. Walk through together.**
 - **Learn to use HERS provider's registry.**

CaLCERTS QII Handbook

Quality Insulation Installation (QII) Handbook



For Installers and HERS Raters

2019 Energy Code



Version: October 14, 2019

- **Basically a condensed version of RA3.5 with pictures and diagrams.**
- **If in doubt, RA3.5 takes precedence.**
- **Updated for 2022. No substantive changes, just more examples.**
- **Downloadable PDF from CaLCERTS website.**

CaICERTS QII Handbook

Draft Stops

A material, device or construction installed to prevent the movement of air within open spaces of concealed areas of building components, such as crawl spaces, floor/ceiling assemblies, wall assemblies, roof/ceiling assemblies and attics.

Note: Draft stops are important components of the air barrier and shall be airtight. Fire blocks constructed of porous insulation materials cannot serve as draft stops since they are not airtight.

This photo shows a draft stop cut from OSB to fit around two ducts going up through a large square chase. This is a smoke/fire requirement in many cases. Notice the open corners in the cut out holes where air can leak through (red arrows). These should be sealed with expansive foam or other approved material.



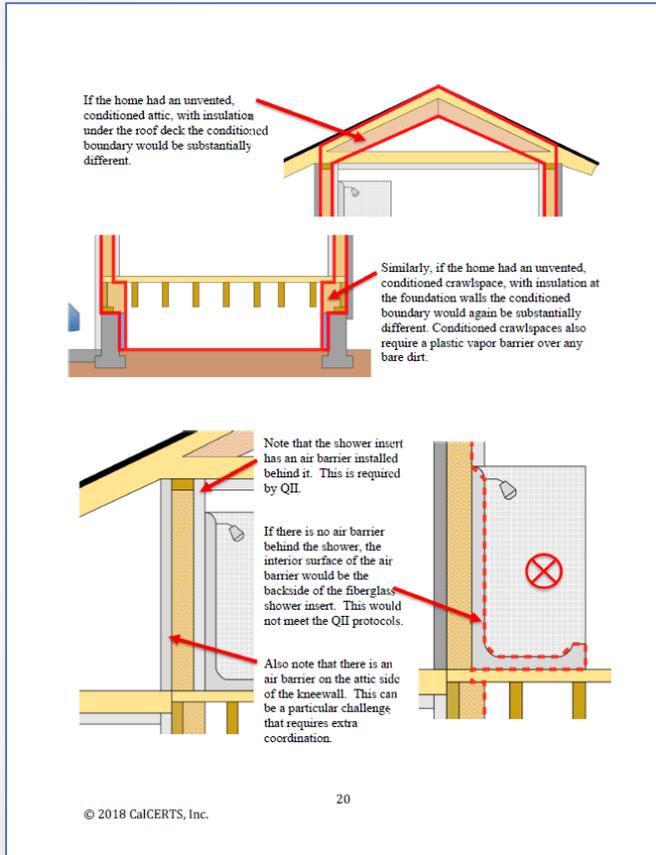
SPF can serve as a draft stop as long as it meets the minimum thickness required to be an air barrier.



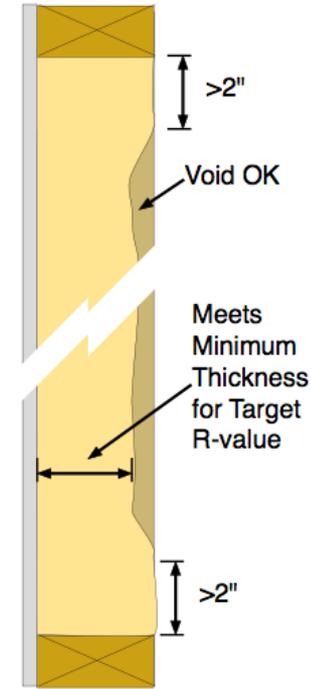
- Draft Stops
- Make ceiling as flat and level as possible.
- Prevent insulation from falling into voids.
- Prevent airflow up from house.

CalCERTS QII Handbook

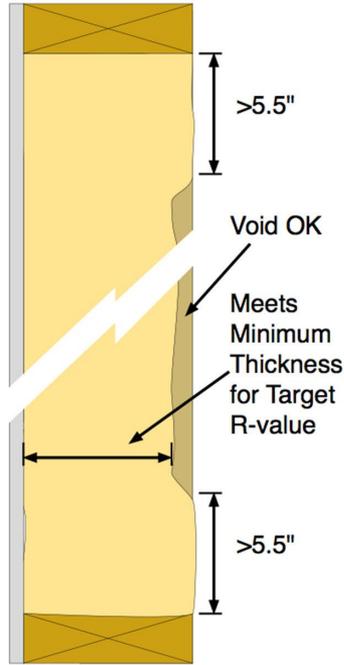
- Tub and shower inserts on an exterior wall, must have air barrier behind them.



CaICERTS QII Handbook



ccSPF Stud Bay
(Side View)



ocSPF Stud Bay
> 2 x 4
(Side View)

- Two kinds of spray on polyurethane foam (SPF).
- Open cell (ocSPF) and closed cell (ccSPF).
- Can be an air barrier if thick enough and voids are OK.

CaICERTS QII Handbook

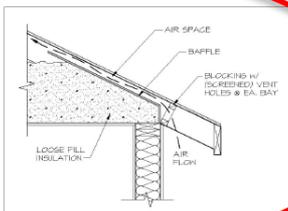
General Requirements for Walls, Roof/Ceilings and Floors (see RA3.5.X.1.1)

Walls, Roof/Ceilings and Floors: All Materials

- Materials shall comply with, and be installed in conformance with, all applicable building codes for building.
- Materials shall meet California Quality Standards for Insulating Material, Title 24, Part 12, Chapter 4, Article 3 listed in the California Department of Consumer Affairs Consumer Guide and Directory of Certified Insulating Materials.
- Materials shall comply with flame spread rating and smoke density requirements of Chapter 26 and Section 720 of the Title 24, Part 2: all installations with exposed facings must use fire retardant facings which have been tested and certified not to exceed a flame spread of 25 and a smoke development rating of 450. Insulation facings that do not touch a ceiling, wall, or floor surface, and faced batts on the undersides of roofs with an air space between the ceiling and facing are considered exposed applications.
- Materials shall be installed according to manufacturer specifications and instructions.
- Hard covers or draft stops shall be placed over all drop ceiling areas and interior wall cavities to keep insulation in place and stop air movement. If hard covers or draft stops are missing or incomplete, they shall be completed before insulation is installed. (See example in Definitions section)

Required eave ventilation shall not be obstructed - the net free-ventilation area of the eave vent shall be maintained. (See example in Definitions section)

- Eave vent baffles shall be installed to prevent air movement under or into the insulation material.



- Insulation (except SPF) shall cover all recessed lighting fixtures that penetrate the ceiling shall be listed for zero clearance insulation contact (IC), have a label that certifies it as airtight when tested to ASTM E283.



- Attic venting
- Baffling insulation away from eave vents.

CaICERTS QII Handbook

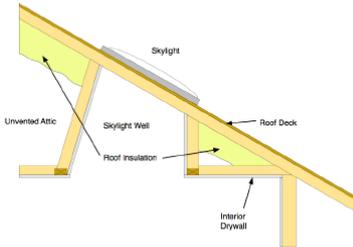
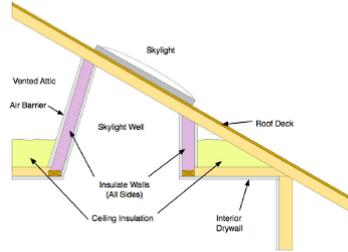
- The exposed attic side of insulation shall be completely covered with rigid board insulation or an air barrier.

- The house side of the insulation shall be in contact with the drywall or other wall finish.

- The insulation shall be supported so that it will not fall down by either friction fitting to the framing, inset or face stapling of flanges, or using other support such as netting.

- Insulation for all kneewall and skylight shafts shall be completely enclosed by vertical and horizontal framing, including horizontal plates at top and bottom of the insulation.

- In unvented (conditioned) attics, where insulation is applied directly to the underside of the roof deck, kneewalls, skylight shafts, and gable ends shall be insulated to meet or exceed the wall R-value specified on the Certificate of Compliance, and all other required compliance documentation (only where they separate conditioned and unconditioned space).

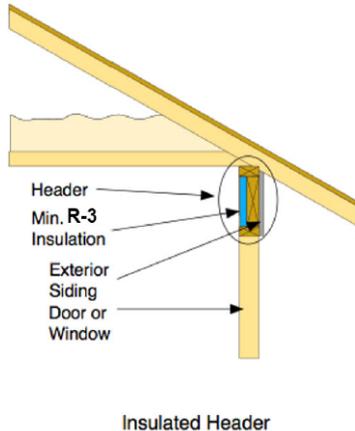


- Knee walls and skylight shafts.
- Must have air barrier on both sides.
- Same R-value as other walls (or modeled separately)
- Same framing as other walls? If not, check CF1R.

CaLCERTS QII Handbook

Special Situations--Window and Door Headers (see RA3.5.X.2.9)

- All window and door headers shall be insulated to a minimum of R-3 between the exterior face of the header and inside surface of the finish wall material.
- Insulation must be installed on the interior side of the header to facilitate verification.
- If exterior rigid sheathing is installed on the entire wall, headers do not need to be insulated.

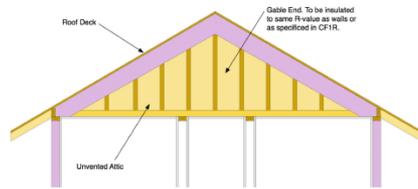


- **Window and Door Headers**
- **Must be insulated**
 - Min R-3 for 2x4
 - **Min R-5 for 2x6 or larger**
- **If rigid exterior siding is used, insulated headers not required**
- **Must be on interior side for inspection (must be inspectable)**

CaICERTS QII Handbook

Attics and Cathedral Ceilings (see RA3.5.X.3.2)

- In unvented attics, where insulation is applied directly to the underside of the roof deck, all gable ends shall be insulated to the same R-value as the exterior walls as specified in the compliance documentation.
- In attics where entry is made for the service of utilities, SPF shall be protected from ignition in accordance with CBC, Part 2, Section 2603, and Part 2.5, Section R316 or the SPF assembly must have been tested in accordance with ICC Evaluation Service Acceptance Criteria AC377. (b).



- ***Unvented*** attics
- Not *exactly* “conditioned space”.
- Different than “high performance attics” which have insulation at roof deck and ceiling, and are vented.

CaICERTS QII Handbook

- **At very end of Handbook:**
- **Check Lists**
 - ENV-21
 - ENV-22
- **Helpful document for installers: “How to Read the Insulation Requirements on a CF1R-PRF-01”**



HERS Measure:

SPF Non-standard R-value

- A subset of QII, but if QII is not already triggered will trigger a single special verification by HERS rater (currently no form for this)
- **Reference: RA3.5.6**
 - Requires manufacturer's specs to support R-value modeled.



HERS Measure:

Duct location Surface Area and R-value

Other names: Buried ducts, etc. (anything with verified duct design)

Reference: RA3.1.4.1.4

- Requires *very careful and precise* HVAC layout – *prior to modeling*.
- Precise data from layout is needed to properly model.



HERS Measure:

Duct location Surface Area and R-value

- *Reduced Duct Surface Area* is only a credit if the installed duct surface area is less than a **default number**.
- What is that default number?
 - See ACM 2.4.6.4 for returns and 2.4.6.5 for supplies
- How do you know how much is going to be installed?
- Surface area is:

duct length x duct diameter x π



HERS Measure: Verification of Low Leakage Ducts in Conditioned Space

Other names: VLLDCS

Reference: RA3.1.4.3.8

- Triggers a leakage to outside test: House is pressurized to 25 Pa with blower door while ducts are pressurized to 25 Pa with duct tester.



HERS Measure: Verification of Low Leakage Ducts in Conditioned Space

- Target leakage is only 25 cfm, regardless of tonnage.
- Recommend a pre-test before any ducts get covered in sheetrock.
- Can be difficult to use a blower door on large custom homes.



HERS Measure:

Low Leakage Air Handler Unit (LLAHU)

Reference: RA3.1.4.3.9

- Unlocks the minimum duct leakage target. (Less than 5% can be specified)
- Don't specify a target too low.
- Can always re-run calcs to match actual measured targets.
- Equipment must be certified/listed on CEC website as LLAHU.



HERS Measure:

Return Duct Design

Table 150.0-B & -C,

Reference: RA3.1.4.4

- Exempts system from *airflow and fan watt draw testing*.
- Requires REALLY BIG DUCTS!
- They will need lots of ROOM, hard elbows, must follow tables, etc.



HERS Measure: Refrigerant Charge

AKAs: RCV, Improved Refrigerant Charge

Reference: RA3.3 and RA3.2

- A prescriptive measure in CZs 2, 8-15.
- An extra credit in other CZs.
- No major change for RCV in 2019
- “Mini splits” require weigh in observation
- Can be difficult to do in the colder months.



HERS Measure:

Airflow and Fan Watt Draw

Reference: RA3.3

- Ensures proper duct design.
- Target airflow is 350 cfm/ton.
- Think of this as a “D-” grade.
- 400+ is much better efficiency and comfort.
- In some cases you can model less than 350 cfm/ton.



HERS Measure:

Airflow and Fan Watt Draw

- New 2019 special targets for “Small Duct High Velocity” systems (e.g., Unico)
250 CFM/ton and 0.62 Watts/CFM
- 2019: Furnace fan watt target dropped from 0.58 to 0.45 W/CFM for gas furnace air-handling units.
 - Non-gas AHUs are still at 0.58 W/CFM



HERS Measure:

Verified SEER/EER

Reference: RA3.4.3 and RA3.4.4.1

- Installed equipment must have AHRI matched components.
- AHRI rated SEER/EER must meet or exceed what was modeled.
- Triggers when over 14 SEER/11.7 EER



HERS Measure:

Heat Pump Heating Capacity

Reference: RA3.4.4.2

New 2019 HERS measure

- Undersized heat pumps will run on electric resistance strips more.
- Compliance software determines minimum size. Value appears on CF1R.
- Installed capacity must meet or exceed.



HERS Measure: Whole House Fans

Reference: RA3.9

New 2019 HERS measure

- A prescriptive measure in some CZs.
- Can be installed without being modeled – not tested.
- If modeled for credit, must meet a certain sizing criteria and HERS verification.



HERS Measure:

Whole House Fans

- Installed unit airflow will be tested.
- Make sure it is installed somewhere that can be tested: Flat ceiling with no obstructions.
- Note requirements for attic ventilation
1.5 CFM/SF of CFA and 1 SF attic ventilation for each 750 cfm of rated fan airflow
- Higher airflow systems may be harder to test.



HERS Measure:

Central Fan Ventilation Cooling Systems (CFVCS)

Reference: RA3.3.4

New 2019 HERS measure

- Do not confuse with CFI ventilation (IAQ)
- Similar to a residential economizer.
- Similar to a whole house fan, but uses air handler to flush house with cool outside air (before it gets hot outside).



HERS Measure:

Central Fan Ventilation Cooling

- Total ventilation airflow will be tested along with total heat and cool system airflow (high speed and ventilation speed)
- Requires special equipment (dampers and controls).
- Requires very careful and precise mechanical design.



HERS Measure:

Duct Sealing

Reference: RA3.1.4.3

- Should be familiar with this measure by now.
- Ducts in conditioned space are more common in 2019 code – still must be tested for leakage.
- Recommend testing at rough if many ducts are to be inaccessible after sheetrock.



HERS Measure:

Mechanical Ventilation (IAQ)

Reference: RA3.7.4.1 (continuous),
RA3.7.4.2 (intermittent)

- Intermittent:
 - is much harder to verify.
 - requires special equipment and controls



HERS Measure:

Mechanical Ventilation (IAQ)

- 2022 calculations for IAQ airflow are more complicated.
- If modeled with envelope leakage less than 2 ACH50, blower door testing is triggered.
- Be careful when specifying fan watts.



HERS Measure:

Multi Family Mechanical Ventilation (IAQ)

New 2022 HERS Requirements

- If not **balanced**, dwelling unit enclosure *must be blower door tested* to be “tight”.
- “Tight” is defined as a target leakage per square foot of dwelling unit surface area. **Must be calculated for each dwelling unit!**
- Testing is probably more expensive than installing a balanced system.

MF Dwelling Unit Enclosure Sealing

From CF3R-ENV-20:

When multifamily attached dwelling units must comply with the maximum dwelling unit enclosure air leakage specified in Standards Section 150.0(o)1Eii, the test shall be conducted with the dwelling unit as if it were exposed to the outdoor air on all sides, top and bottom by opening doors and windows of adjacent dwelling units as specified by RA3.8.3.1.



MF Dwelling Unit Enclosure Sealing

Bottom Line:

- If they install balanced IAQ ventilation:
 - No blower door test required
 - Balanced ventilation will be confirmed as part of the IAQ verification
- If they install exhaust only (or supply only) IAQ ventilation:
 - Must determine target CFM50 (enclosure surface area x 0.3)
 - Measured CFM50 must be less than or equal to target.
 - Test IAQ ventilation airflow as usual.
 - Some MF construction can be very hard to seal (e.g., metal framing)



HERS Measure:

Reduced Infiltration (Blower Door)

Reference: RA3.8

- Should be pretty familiar with this by now.
- Just don't model too low of a number.
- Lower numbers will be easier with QII
- Now references RESNET protocols.



HERS Measure: Pipe Insulation

Reference: RA3.6.3 (PIC-H)

- Must be verified prior to covering up with sheet rock or insulation.
- Can only be taken with trunk and branch hot water distribution systems.



HERS Measure: Parallel Piping

Reference: RA3.6.4

- Must be verified prior to covering up with sheet rock or insulation.
- Requires very careful and precise plumbing layout and design.
- Dictated by architectural layout



HERS Measure:

Compact Distribution

Reference: RA3.6.5

- Must be verified prior to covering up with sheet rock or insulation.
- Requires very careful and precise plumbing layout and design.
- Dictated by architectural layout



HERS Measure:

Demand Recirculation

Reference: RA3.6.6

- Requires additional pipe insulation.
- Must be verified prior to covering up with sheet rock or insulation.
- Requires special equipment and controls.



HERS Measure:

Drain Water Heat Recovery Device

Reference: RA3.6.9

Requires special equipment (certified and listed)

- Different installation methods (horizontal or vertical)
- Must be verified prior to covering up with sheet rock or insulation.
- Recovers heat from a shower and transfers it back to the shower/s or water heater.

That's All



Closing

- Continuing Education Units Available
 - Contact ggautereaux@co.slo.ca.us for AIA LUs
- Coming to Your Inbox Soon!
 - Slides, Recording, & Survey – Please Take It and Help Us Out!
- Upcoming Courses:
 - [Using Life Cycle Assessment & Embodied Carbon Calculators to Make Design and Product Choices](#) (12/7)
 - [Getting Past Heat Pump Objections](#) (12/15)





Thank you!

For more info:
3c-ren.org

For questions:
info@3c-ren.org



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