Mike Lubliner, Building Science Specialist

Washington State Energy Code 2018 Residential
Effective July 1, 2020

WSU Code Support Services
Technical support provided in Washington:
• Training (in-person, webinars, video)
• Phone and email inquiry hotline support
• Energy code compliance tools
• Website with educational resources
  WSU Energy Code Website

WSU Technical Assistance Services
• Deliver 80 WSEC-R 2015 trainings to 2,100 attendees
• Reply to over 2,000 hotline calls and emails annually
• Participate in SBCC Energy & Mechanical TAGs
2018 WSEC-R Training Webinars
- Energy Code Overview and 2018 changes
- Duct testing HVAC contractor certification
- HVAC: design, duct leakage testing, commissioning and certificate requirements

To be determined based on state funding $:
- Multifamily (R2) envelope sealing & HRV/ERV
- Insulation Systems: batt, blown, spray foam, CI
- Service Hot Water Systems: HPWH, etc.
- Fenestration: windows, doors & skylights

Energy Code Support in WA State
Residential - Spend an hour on our web page!
- WSU Energy Program
  - 360-956-2042
  - energycode@energy.wsu.edu
  - www.energy.wsu.edu/code
  - Mike Lubliner, Melinda Spencer

Non-residential
- Evergreen Technology Consulting
  - Lisa Rosenow
  - 360-539-5300
  - com.techsupport@waenergycodes.com
  - http://waenergycodes.com

2018 WSEC-R Process & Timeline
- Code change proposals – Spring 2019
- Tech Advisory Groups (TAG) review proposals for SBCC – Summer 2019
- SBCC puts together model codes integrated with proposed changes – Fall 2019
- Public hearings & council votes – Winter 2019
- Council & Legislative Approval – Winter 2020
- Implementation – July 1, 2020 (new permits)
2018 WSEC-R: Past, Current and Future
45% energy savings
(or 55% of the energy consumption in 2006)

R101.2 Scope
- Residential buildings & associated sites, systems & equipment - mixed use
- Maximum & minimum for residential construction in each town, city and county
- R3 - Single & townhomes
- R2 - Multi-family 3 stories or less above grade
  - Corridor style
  - "Garden" style

Code Chapters
- Chapter 1 - Scope and Administration
- Chapter 2 - Definitions
- Chapter 3 - General Requirements
- Chapter 4 - Residential Energy Efficiency
- Chapter 5 - Existing Buildings
- Chapter 6 - Reference Standards
- Appendix A - Default Heat Loss U-Factors
- Appendix RA/RB – R405 Optional Energy Measures
- Appendix C - Exterior Design Conditions
Chapter 4
Residential Energy Efficiency

- R401 - General
- R402 - Building Envelope
- R403 - Systems
- R404 - Electrical Power & Lighting
- R405 - Simulated Performance Alternative
- R406 - Additional Energy Efficiency Credits
- R407 - Certified Passive House

R401 - General

401.2 - Compliance paths
- R402.1 - Prescriptive & R406
- R402.1.4 - UA Alternative & R406
- R405 - Simulated Performance Alternative & R406
- R406 - Energy Credits for SF and low rise MF (raised #)
- R407 - Certified Passive House (New)

Note: Energy Rating Index (ERI/HERS Index) is not an approved compliance path in Washington state. However, ERI may be used by energy raters for IRS $2,000/home builder tax credits.

Prescriptive R-value

<table>
<thead>
<tr>
<th>TABLE R402.1.1 INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT*</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLIMATE ZONE 5 AND MARINE 4</td>
</tr>
<tr>
<td>Fenestration U-Factor</td>
</tr>
<tr>
<td>Skylight U-Factor</td>
</tr>
<tr>
<td>Ceiling R-Value</td>
</tr>
<tr>
<td>Wood Frame Wall R-Value</td>
</tr>
<tr>
<td>Floor R-Value</td>
</tr>
<tr>
<td>Below-Grade Wall R-Value</td>
</tr>
<tr>
<td>Slab R-Value &amp; Depth</td>
</tr>
</tbody>
</table>
Prescriptive U-factor "R-equivalent"

The R-value of insulation shall be determined in accordance with the FTC R-value rule (C.F.R. Title 16, Part 460)

This product is not an FTC-listed R8 HVAC Duct Insulation as far as we know.

Insulation Product Rating

The double-sided foam core is around 8 millimeters thick and has an actual R-value of around 3, conservatively.

Prescriptive Path Footnotes
Existing Slab Footnote (f)

Log Structure:
New footnote (g) & delete footnote (n)

Additional Energy Credits - Yikes
Dwelling or Sleeping Unit Energy Credits

- Small (<1,500 sf)
  - 1.5 credits in 2015 (3.0 starts July 1, 2020)

- Medium (1,500 – 5,000 sf)
  - 3.5 credits in 2015 (6.0 starts July, 1, 2020)

- Large Dwelling (>5,000 sf)
  - 4.5 Credits (7.0 starts July 1, 2020)

- Low-rise Multifamily (all sizes)
  - 1.5 credits (4.5 starts July 1, 2020)

- Additions less than 500 sf
  - 0.5 Credit (1.5 starts July 1, 2020)
R406.2 Carbon emission calculation. This section establishes a base calculation and second step to determine the equivalent carbon emissions of the options specified. The permit shall include the base fuel selection to be used and the periods specified in Table R406.2 shall be used to modify the requirements in Section R406.3. The sum of credits from Tables R406.2 and R406.3 shall meet the requirements of Section R406.3.

<table>
<thead>
<tr>
<th>Option</th>
<th>Description of Primary Heating Source</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Alternative fuel type heating system</td>
<td>0.00</td>
</tr>
<tr>
<td>2</td>
<td>Pre-existing heating systems</td>
<td>0.00</td>
</tr>
<tr>
<td>3</td>
<td>Fuel heating system installed</td>
<td>0.00</td>
</tr>
<tr>
<td>4</td>
<td>Heat recovery systems</td>
<td>0.00</td>
</tr>
<tr>
<td>5</td>
<td>All other heating systems</td>
<td>0.00</td>
</tr>
</tbody>
</table>

(1) Envelope Credits

(23)
### (1) Envelope Credits (cont.)

<table>
<thead>
<tr>
<th>OPTION</th>
<th>DESCRIPTION</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.8</td>
<td></td>
<td>3.0</td>
</tr>
<tr>
<td>1.9</td>
<td></td>
<td>2.5</td>
</tr>
</tbody>
</table>

### (2) Air Leakage Control & Ventilation System Effectiveness Credits

<table>
<thead>
<tr>
<th>OPTION</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>Advanced framing and sealed nail heads of walls</td>
</tr>
<tr>
<td>2.2</td>
<td>Advanced framing and sealed nail heads of ceilings</td>
</tr>
</tbody>
</table>

### (2) Air Leakage Control & Ventilation System Effectiveness Credits (cont.)

<table>
<thead>
<tr>
<th>OPTION</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1</td>
<td>Total duct leakage and air infiltration &lt;= 0.5% of conditioned space volume</td>
</tr>
<tr>
<td>3.2</td>
<td>Total duct leakage and air infiltration &lt;= 0.5% of conditioned space volume (cont.)</td>
</tr>
</tbody>
</table>

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### (3) HVAC Credits

<table>
<thead>
<tr>
<th>Credits</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>HVAC</td>
<td>......</td>
</tr>
<tr>
<td>HVAC</td>
<td>......</td>
</tr>
<tr>
<td>HVAC</td>
<td>......</td>
</tr>
</tbody>
</table>

### (3) HVAC Credits (cont.)

<table>
<thead>
<tr>
<th>Credits</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>HVAC</td>
<td>......</td>
</tr>
<tr>
<td>HVAC</td>
<td>......</td>
</tr>
<tr>
<td>HVAC</td>
<td>......</td>
</tr>
</tbody>
</table>

### (4) HVAC Distribution Credits

<table>
<thead>
<tr>
<th>Distribution</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distribution</td>
<td>......</td>
</tr>
<tr>
<td>Distribution</td>
<td>......</td>
</tr>
<tr>
<td>Distribution</td>
<td>......</td>
</tr>
</tbody>
</table>
### (6) Renewable Electric Energy Credits

**Opt Description - July 2020 (Pts)**

<table>
<thead>
<tr>
<th>Description</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>HSPF 9.5 centrally ducted heat pump</td>
<td>1.0</td>
</tr>
<tr>
<td>All ducts and furnace inside the conditioned space</td>
<td>1.0</td>
</tr>
<tr>
<td>9 ACHi10, Energy Star 0.3 cfm/sf</td>
<td>0.5</td>
</tr>
<tr>
<td>R-38 Floors (R10 under slab) and U-0.28 windows and door average</td>
<td>0.5</td>
</tr>
<tr>
<td>Heat pump water heater NEEA Tier 3</td>
<td>2.0</td>
</tr>
<tr>
<td>Fuel equalization heat pump credit</td>
<td>1.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>6.0</strong></td>
</tr>
</tbody>
</table>

### (7) Appliance Credits

**Appliance Credits**

- Heat pump 1,501 to 5,000 sf homes (6.0 credits)
- All Electric Heat Pump
- HSPF 9.5 centrally ducted heat pump
- All ducts and furnace inside the conditioned space
- 9 ACHi10, Energy Star 0.3 cfm/sf
- R-38 Floors (R10 under slab) and U-0.28 windows and door average
- Heat pump water heater NEEA Tier 3
- Fuel equalization heat pump credit
- **Total 6.0 credits**
### Heat Pump & Gas DHW

<table>
<thead>
<tr>
<th>Opt</th>
<th>Description - July 2020</th>
<th>Pts</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.5a</td>
<td>11.0 HSPF centrally ducted heat pump</td>
<td>1.5</td>
</tr>
<tr>
<td>4.2</td>
<td>All ducts and furnace inside the conditioned space</td>
<td>1.0</td>
</tr>
<tr>
<td>2.1</td>
<td>3 ACH&lt;sub&gt;50&lt;/sub&gt; Energy Star 0.3 cfm/sf</td>
<td>0.5</td>
</tr>
<tr>
<td>1.4</td>
<td>U-0.25 windows, R38 crawl/R10 under slab, R21 with R4 CI on exterior walls</td>
<td>1.0</td>
</tr>
<tr>
<td>5b</td>
<td>Gas water heater ≥ 0.91 UEF</td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td>Heat HP equalization heat pump credit</td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>6.0</strong></td>
</tr>
</tbody>
</table>

### Gas Heat + HPWH

<table>
<thead>
<tr>
<th>Opt</th>
<th>Description - July 2020</th>
<th>Pts</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1a</td>
<td>95% AFUE gas furnace</td>
<td>1.0</td>
</tr>
<tr>
<td>4.2</td>
<td>All ducts and furnace inside the conditioned space</td>
<td>1.0</td>
</tr>
<tr>
<td>2.1</td>
<td>3 ACH&lt;sub&gt;50&lt;/sub&gt; Energy Star 0.3 cfm/sf</td>
<td>0.5</td>
</tr>
<tr>
<td>1.4</td>
<td>U-0.25 windows, R38 crawl/R10 under slab, R21 with R4 CI on exterior walls</td>
<td>1.0</td>
</tr>
<tr>
<td>5b</td>
<td>Heat pump water heater NEEA Tier III</td>
<td>2.0</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>6.0</strong></td>
</tr>
</tbody>
</table>

### Electric Resistance Heat Low-rise R2 Multifamily

<table>
<thead>
<tr>
<th>Opt</th>
<th>Description - July 2020</th>
<th>Pts</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5</td>
<td>U-0.22 windows, R38 crawl or R10 under slab, R21 with R4 CI on walls</td>
<td>1.5</td>
</tr>
<tr>
<td>2.1</td>
<td>0.25 cfm/sf (2 ACH&lt;sub&gt;50&lt;/sub&gt;) tested + 65% HRV/ERV</td>
<td>1.5</td>
</tr>
<tr>
<td>7.1</td>
<td>Appliance Credit: Energy Star dishwasher, washer, refrigerator (if provided) and vent-less dryer (CEF 5.2)</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>Does not include fuel normalization credit per Table R406.2.</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>4.5</strong></td>
</tr>
</tbody>
</table>

Note: The tables represent the points awarded for different construction and energy efficiency measures in the context of Heat Pump & Gas DHW, Gas Heat + HPWH, and Electric Resistance Heat Low-rise R2 Multifamily.
Electric Resistance Heat
Low-rise R2 Multifamily - BTVR

<table>
<thead>
<tr>
<th>Opt</th>
<th>Description - July 2020</th>
<th>Pts</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1</td>
<td>3-4 kW PV per unit</td>
<td>3.0</td>
</tr>
<tr>
<td>3.2</td>
<td>0.25 std/1000 sf (or 2 ACH)</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>+ 65% HRV/ERV – tested!!</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>Does not include fuel normalization credits per Table R406.2</td>
<td>1.5</td>
</tr>
</tbody>
</table>

Total: 4.5

R402.1.4 Total UA Alternative

- Total UA Alternative typically used when prescriptive path assembly is not a viable option.
- Default U-factors - typical assemblies are in Appendix A.
- Unlike the prescriptive path, which allows unlimited fenestration (e.g. windows), the UA Alternative and the simulated performance path use 15% in the target home.
• 15% target home also used for standard reference home, just like UA tradeoff compliance. This makes it harder to comply when building over 15%

• No software that WSU is aware of currently meets the requirements of Table 405.5.2(1)

• We may see this for Energy Raters working with builders who desire IRS tax credits in 2020.
Appendix RA

Appendix RA—Optional energy efficiency measures. (For any. Building owners may choose to use
these options in addition to required energy savings in building energy use. This additional energy
efficiency credit may be granted by Section R405.3.)

1.0 credit for wall approximations for non-energy and non-outside wall and:

- A. credit for wall approximations with an above 0.30 square meter wall for single family, two family or four family
- B. credit for wall approximations with a wall less than 0.30 square meter wall for single family, two family or four family

3.0 credit for floor approximations with a floor less than 0.30 square meter floor for single family, two family or four family development.

Where Section R405.3. Requires performance allowance, or a credit, the maximum allowable energy
consumption shall be 50 percent of the value calculated according to Section R405.3.

Appendix RB

Appendix RB—Optional energy efficiency measures. (For any. Building owners may choose to use
these options in addition to required energy savings in building energy use. This additional energy
efficiency credit may be granted by Section R405.3.)

1.0 credit for each new single family, two family or four family dwelling unit.

1.0 credit for each new single family, two family or four family dwelling unit.

1.0 credit for each addition of 500 square feet or greater to a single family, two family or four family

dwelling unit.

Where Section R405.3. Requires performance allowance, or a credit, the maximum allowable energy
consumption shall be 50 percent of the value calculated according to Section R405.3.

R405 - Simulated Performance Alternative

Appendix R405—Simulated Performance Alternative. (For any. Building owners may choose to use
these options in addition to required energy savings in building energy use. This additional energy
efficiency credit may be granted by Section R405.3.)

1.0 credit for each new single family, two family or four family dwelling unit.

1.0 credit for each new single family, two family or four family dwelling unit.

1.0 credit for each addition of 500 square feet or greater to a single family, two family or four family

dwelling unit.

Where Section R405.3. Requires performance allowance, or a credit, the maximum allowable energy
consumption shall be 50 percent of the value calculated according to Section R405.3.
R401.3 Certificate

- A permanent certificate shall be completed by the builder or other approved party
- Posted on a wall in the space where the furnace is located, a utility room, or an approved location inside
- The certificate shall list the R-values of insulation; ceiling/roof, walls, foundation (slab, below-grade wall, and/or floor) and ducts outside conditioned spaces
- U-factors for fenestration (see glazing worksheet)

R401.3 Certificate (cont.)

- Types and efficiencies:
  - HVAC
  - DHW service water heating
  - Appliances
  - Renewables
- Test results & documentation:
  - Ductwork air leakage by certified tester (per RS-33)
  - Envelope air leakage
  - Ventilation flow rate testing & commissioning

R401.3 Certificate - New (cont.)

The code official may require test documentation include an electronic record of the time, date and location of the test, using a date-stamped smart phone photo or air leakage testing software.
R401.3 Certificate (new HVAC tests)

Testing Affidavits & Resources

BREAK
5-10 minutes please
Why Do We Seal Ducts?

- Health & Safety
- Comfort
- Energy savings
- More durable buildings

Duct Testing Standards

- Total leakage ≤ 4 cfm per 100 sf of conditioned floor area @ 25 Pa for a complete system at rough-in
- Total leakage ≤ 3 cfm per 100 sf of conditioned floor area @ 25 Pa if air handler has not been installed
- Total leakage test: ≤ 4 cfm per 100 sf of conditioned floor area @ 25 Pa at post construction.
- Leakage to exterior test: ≤ 4 cfm per 100 sf of conditioned floor area @ 25 Pa - duct tester & blower door used together to eliminate leakage of ducts "inside" at post construction

Examples

Total leakage

- House size: 2,240 sf
- 2,240 \times 0.04 = 90 CFM maximum

Leakage to exterior (requires a blower door)

- House size: 2,240 sf
- 2,240 \times 0.04 = 90 CFM maximum
**Duct Testing Details**

**Leakage & Energy Loss**
- The hole needs to be connected to the outside
- Heat loss is proportional to temperature and pressure differences
- Holes that see high pressures and high temperature differences are most important for energy savings

**System Deficiencies**
- Hole at Dovetail Connection
Large hole where down drafting furnace connects to supply plenum.

Large Hole

Unsealed Dovetail Connections

Holes
All Joints Must Be Sealed

Mastic is NOT paint – apply “nickel thick”
Don't Do This!

Ducts Cause Problems if Installed Incorrectly!

"I've Got Some Duct Tape"

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Duct Sealants
All joints, seams and connections shall be fastened and sealed.
- See IMC 603.9 or IRC M1601.3 for details
- Closure systems must be installed according to the manufacturer’s listing
- Unlisted duct tape is not permitted as a sealant on any metal ducts

Necessary Equipment
- Duct tester
- Manometer
- Register blocks or "mask"

Residential Duct Insulation
- Attics, crawl spaces, garages require R-8
- In slabs or underground require R-10
- On a roof or exterior of a building require R-8 and a weatherproof barrier
Duct Liner

- Typical duct liner requires 2.5 inches to meet code
- Most duct liner is R-4 per inch

Duct Testing (R403.3.3)

- Duct testing not required when ducts & air handlers are located entirely within building thermal envelope
- A maximum of 10 linear feet of return ducts and 5 linear feet of supply ducts may be located outside
- Buried ducts shall be tested to 3% of conditioned floor area (New 2018)

HVAC in the Conditioned Space “Change”

- Moves HVAC into conditioned space & NOT crawlspace, garage or attic
- By far the most cost-effective measure and largely avoided until 2020
- Requires design planning between builder, HVAC sub and floor plan designer
- Don’t drive an expensive box “on flat tires.” Just do it!
Why HVAC in the Conditioned Space
HVAC in conditioned space, NOT crawlspace, garage or attic:
• Less, smaller “right-sized” ducts & S/R registers
• Install conducive to good installation & QA
• Fewer comfort issues from cold air blasts
• Download and review article from Energy Program web page

How to Move Ducts Inside
“Just do it, or spend more $”

HVAC Inside Ideas - HFH
R403.3.7 Locating Ducts in Conditioned Space

Ducts located in conditioned space shall be constructed of metal or noncombustible material and shall be located in such a manner as to minimize interference with the operation of the building systems. Ducts shall be located in the following areas:

1. Above suspended ceilings
2. Above suspended ceilings
3. Between floors
4. In attics
5. In unconditioned spaces

Ducts shall be installed in such a manner as to minimize interference with the operation of the building systems. Ducts shall be located in the following areas:

1. Above suspended ceilings
2. Above suspended ceilings
3. Between floors
4. In attics
5. In unconditioned spaces
R403.6 “Buried” Ducts

Mechanical rooms with outside combustion air outside the building thermal envelope shall be insulated, sealed and have a door meeting requirements.

Combustion Air

• Mechanical rooms with outside combustion air outside the building thermal envelope shall be insulated, sealed and have a door meeting requirements.
• Combustion air ducts located inside the conditioned space shall be insulated to R-8.
• Many use sealed combustion to get energy credits and eliminate this requirement!!!

Build Tight, Ventilate Right?

Mother nature’s control of infiltration only in a leaky home:
– May over-ventilate in winter - wastes energy
– Under-ventilate in summer - may create poorer Indoor Air Quality (IAQ)
Ventilation removes IAQ problems at source with kitchen ranges and bath fans
– Whole house ventilation provides continuous dilution of pollutants 24/7, 365
Why Do We Air Seal Envelopes?
Air Leakage Driving Forces

Pressure difference:
• Stack effect
• Wind effect
• Temperature difference effect
• Duct Leakage effect
• HVAC Zone balance

Stack Effect

Air Barriers and Energy Code R402.4

What does the Energy Code require?
• Prescriptive air sealing
• Testing of the air barrier
• Maximum leakage targets
  • 2015 WSEC maximum = 5 ACH
  • 2015 New/Additions
  • 2018 may need 0.5 credit for 3 ACH
  • 2018 may want 2.0 ACH with HRV or ERV 2020 for 1.5 - 2.0 credits
R402.1.2 Air Barrier Testing

Testing:

1. Exhaust ventilation exhaust, or open windows or doors shall be used, but not equal to the room tested shall be exhausted, but not exceeding the room tested, do not exceed.
2. Open windows or doors exhaust, exhaust, or open exhaust, exhaust, do not exceed.
3. Open windows or doors exhaust, exhaust, or open exhaust, exhaust, do not exceed.
4. Open windows or doors exhaust, exhaust, or open exhaust, exhaust, do not exceed.
5. Open windows or doors exhaust, exhaust, or open exhaust, exhaust, do not exceed.
6. Open windows or doors exhaust, exhaust, or open exhaust, exhaust, do not exceed.
7. Open windows or doors exhaust, exhaust, or open exhaust, exhaust, do not exceed.
8. Open windows or doors exhaust, exhaust, or open exhaust, exhaust, do not exceed.
9. Open windows or doors exhaust, exhaust, or open exhaust, exhaust, do not exceed.
10. Open windows or doors exhaust, exhaust, or open exhaust, exhaust, do not exceed.

Exceptions:

1. Open windows or doors exhaust, exhaust, or open exhaust, exhaust, do not exceed.
2. Open windows or doors exhaust, exhaust, or open exhaust, exhaust, do not exceed.
3. Open windows or doors exhaust, exhaust, or open exhaust, exhaust, do not exceed.
4. Open windows or doors exhaust, exhaust, or open exhaust, exhaust, do not exceed.
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8. Open windows or doors exhaust, exhaust, or open exhaust, exhaust, do not exceed.
9. Open windows or doors exhaust, exhaust, or open exhaust, exhaust, do not exceed.

Table R402.4.1.1
Air Barrier and Thermal Barrier

- Building envelope must have continuous air barrier
- Breaks or joints are sealed
- Air-permeable insulation is not an air barrier

Air Sealing Requirements
- See Table R402.4.1.1: Air Barrier & Insulation Installation
- Include checklist of each building component with:
  - QA 101 = who, what, when, where & how?
  - Cost-effective measure, the devil’s in the details
  - Risk of passing envelope test for CO2

QA Tools for New Construction
Maximum Leakage = 5 ACH50
QA Tools for Retrofit – Air Sealing
Maximum Leakage = 7 ACH_{50}

IRC & IMC Ventilation
Whole House Fan Flow Rate ??
• IRC is for single family
• IMC is for multifamily
• WA SBCC amended
• Require balanced in R2
• 62.2-2019 also OK for IRC

Local Exhaust – Kitchens
Kitchens
• 100 cfm intermittent
• 25 cfm continuous
• Systems over 399 cfm must provide makeup air
• Recirculation hood allowed if exhaust is provided for the kitchen
Outdoor Air for Exhaust Only Systems

M1507.3 Ventilation openings. Each habitable space shall be provided with outdoor air inlets or operable windows with an openable area not less than 4 square inches of net free area of opening for each 10 cfm of outdoor air required by Table M1507.3.3(1).

Build Tight, Ventilate Right!

- Requires a systems approach - “built tight”
- Requires design, install, commissioning & M/O to “ventilate right”
- Reduce cavity condensation & durability issues:
  - Seal leaks, ventilate moisture out
  - Warm wall w/CI and roof insulating sheathing or spray foam per: IRC 702.7 (see: Wall vapor retarders), IRC R806.5 (see: Unvented attic and enclosed rafters)
- Avoid HVAC out, can lights, sprinklers, sliders

Wintertime Condensation Issues

Root Cause Issues:
- High indoor RH due to no ventilation
- High occupancy and moisture generation (kitchen and bath fans not used)
- Holes between floors
- Poorly sealed and insulated rim joist
- Moisture condenses on inside of rim joist and OSB becomes a mold issue
CYA on “Gold for Mold”

Darker OSB areas indicate damage

North wall

OSB replaced with plywood

Dark areas exist consistently in spaces between floors

WSU Video Resource

“Built Tight, Ventilate Right”

Duct Sealing for Comfort, Energy and Air Quality

http://www.energy.wsu.edu/videos/duct-sealing

Sealing HVAC system ducts is an extremely cost-effective energy efficiency action that also improves indoor air quality. It shows how ducts move air, where common leaks are, and how to fix them for building professionals or DIY homeowners.

WSU Video Resource “Build Tight”

Air Leakage in Homes: The Invisible Thief

http://www.energy.wsu.edu/videos/air-leakage-in-homes_part-01

This air sealing video is divided into 7 chapters:
WSU Video Resource
“Ventilate Right”

BREAK
5-10 minutes please

R402.4.2.1 Gas Fireplace Efficiency
50% FE for Heaters (New)
R402.4.2.1 Gas Pilot Lights (new)

Section R403 - Systems

Central Ducted Heat Pump Control

R403.1.2 Heat pump supplementary heat. Utility air cooled heat pumps shall include controls that require supplemental heat during start-up, set-up, and overhead conditions. These controls shall anticipate even heat loss cooling and last conditions in heating on the first stage of heat. Central ducted equipment that is a type of a heating or cooling equipment with a control that is a type of a heating or cooling equipment.

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R403.7.1 Electric Resistance Zone Heated Units – since 2015

All detached one- and two-family dwellings and multiple single-family dwellings (townhouses) up to three stories in height above grade plane using electric zonal heating as the primary heat source shall install an inverter-driven ductless mini-split heat pump in the largest zone in the dwelling.*

* Does not apply to R-2 construction

1.5 - 2.0 credits allowed from options package 3.6 for single family and multifamily, respectively (increase credits from 2015)12

Section R403
Hot Water Boiler Control

R403.2 Hot water boiler outdoor temperature reset. Hot water boilers that supply heat to the heating of the structure or heating systems shall have an outdoor temperature reset control.

Mechanical Piping Insulation

• Mechanical system piping capable of carrying fluids above 105°F (41°C) or below 55°F (13°C) shall be insulated to a minimum of R-6.

• Exception: Up to 200 feet of hydronic system piping installed within the conditioned space may be insulated with a minimum of ½-inch insulation.
R403.5 Service Hot Water Systems

R403.5.2 DHW Demand Recirculation & Insulation

R403.5.3 Hot Water Pipe Insulation (Prescriptive)

R-3 pipe insulation required on all hot water pipes outside and within the conditioned space.
R403.5.3 Drain Water Heat Recovery

Drain water heat recovery units shall comply with CCA Memo 982-1080-P-100. Drain water heat recovery units shall be in accordance with CCA 2007, Chapter 111-100.

R403.5.4 Electric water heater insulation. An electric storage water heater shall be equipped with a thermal insulation material which is installed in accordance with 111-100.1.1.2 and a heat loss computation utilizing data as referenced in the applicable code shall be performed on the size and method of operation.

R403.7 Equipment Sizing & Efficiency Rating

R403.7.1 Equipment sizing and efficiency rating. Meeting minimum equipment shall be achieved by selecting equipment, according to the applicable Code. The equipment sizing and efficiency rating shall be performed in accordance with 111-100.1.1.2 and 111-100.1.1.3. The minimum equipment shall be selected based on the applicable Code and the applicable Code requirements.

R403.7.2 Equipment sizing and efficiency rating. Meeting minimum equipment shall be achieved by selecting equipment, according to the applicable Code. The equipment sizing and efficiency rating shall be performed in accordance with 111-100.1.1.2 and 111-100.1.1.3. The minimum equipment shall be selected based on the applicable Code and the applicable Code requirements.

R404.1 Lighting Equipment (Mandatory)

A minimum of 90% of lamps in permanently installed lighting fixtures shall be high-efficacy lamps.
Questions & Final Comment

- Happy to discuss after meeting
- Happy to follow-up on email
- Investments made in continued learning of energy, durability and indoor air quality will save your clients money and provide a more sustainable, healthy and durable home!

Join our email update list at energycode@energy.wsu.edu

Send questions, comments and suggestions to:
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(360) 956-2042
energycode@energy.wsu.edu
Thank You!