



## 2018 WASHINGTON STATE ENERGY CODE: RESIDENTIAL Prescriptive Energy Code Compliance for King County

APPLICANT: \_\_\_\_\_ PARCEL: \_\_\_\_\_ PERMIT #: \_\_\_\_\_

**CLIMATE ZONE - 4C**

Openings <sup>a</sup> U-Values			Ceiling Insulation		Walls <sup>a</sup>	Below Grade Walls <sup>c</sup>		Floors	Slab on grade <sup>c</sup>
% floor area	Vertical	Overhead	attic	vaulted <sup>b</sup>	Above Grade	interior	exterior		
Unlimited	0.30	0.50	R-49 or R-38 ADV	R-38	R-21 Int.	R-21 Int.w/ thermal break	R-10	R-30	R-10

NOTE: Energy credit options may affect the component's values

- a. For log structures complying with Standard ICC 400, log walls shall meet requirements for climate zone 5 of ICC 400.
- b. Vaulted ceiling applies to single joist or rafter cavity, not applicable to scissor trusses.
- c. R7.5 continuous insulation installed over an existing slab is equivalent to required slab perimeter insulation when applied complying with section R503.1.1.

Each dwelling unit *in a residential building* shall comply with sufficient options from Table R406.2 (fuel normalization credits) and Table 406.3 (energy credits) to achieve the following minimum number of credits. To claim this credit, the building permit drawings shall specify the option selected and the maximum tested building air leakage, and show the qualifying ventilation system and its control sequence of operation.

- 1. **Small Dwelling Unit: 3 credits**  
Dwelling units less than 1,500 sf in conditioned floor area with less than 300 sf of fenestration area. Additions to existing building that are greater than 500 sf of heated floor area but less than 1,500 sf.
- 2. **Medium Dwelling Unit: 6 credits**  
All dwelling units that are not included in #1 or #3
- 3. **Large Dwelling Unit: 7 credits**  
Dwelling units exceeding 5,000 sf of conditioned floor area
- 4. **Additions less than 500 square feet: 1.5 credits**  
**All other additions shall meet 1-3 above**

number of credits  
required: \_\_\_\_\_

summation of  
credits: \_\_\_\_\_

Summary of Table R406.2				
Heating Options	Fuel Normalization Descriptions	Credits - select ONE heating option		User Notes
1	Combustion heating minimum NAECA <sup>b</sup>	0.0	<input type="radio"/>	
2	Heat pump <sup>c</sup>	1.0	<input type="radio"/>	
3	Electric resistance heat only - furnace or zonal	-1.0	<input type="radio"/>	
4	DHP with zonal electric resistance per option 3.4	0.5	<input type="radio"/>	
5	All other heating systems	-1.0	<input type="radio"/>	

Additional support

Customers who would like additional energy code support may contact:

Kim Barker (she/her/hers)  
kbarker@kingcounty.gov or 206-848-0368

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<b>Table 406.3 – Energy Credits (Single Family)</b>		
<b>Option</b>	<b>Description</b>	<b>Credits: SF</b>
<b>1. EFFICIENT BUILDING ENVELOPE OPTIONS</b>		
Only one option from Items 1.1 through 1.7 may be selected in this category. Compliance with the conductive UA targets is demonstrated using Section R402.1.4, Total UA alternative, where $[1 - (\text{Proposed UA}/\text{Target UA})] >$ the required %UA reduction.		
<input type="radio"/> 1.1	Prescriptive compliance is based on Table R402.1.1 with the following modifications: <b>Vertical fenestration U = 0.24</b>	0.5
<input type="radio"/> 1.2	Prescriptive compliance is based on Table R402.1.1 with the following modifications: <b>Vertical fenestration U = 0.20</b>	1.0
<input type="radio"/> 1.3	Prescriptive compliance is based on Table R402.1.1 with the following modifications: <b>Vertical fenestration U = 0.28</b> Floor R-38 Slab on grade R-10 perimeter and under entire slab below grade slab R-10 perimeter and under entire slab <b>or</b>  Compliance based on Section R402.1.4: Reduce the Total conductive UA by 5%	0.5
<input type="radio"/> 1.4	Prescriptive compliance is based on Table R402.1.1 with the following modifications: <b>Vertical fenestration U = 0.25</b> Wall R-21 plus R-4 ci Floor R-38 Basement wall R-21 int plus R-5 ci Slab on grade R-10 perimeter and under entire slab Below grade slab R-10 perimeter and under entire slab <b>or</b>  Compliance based on Section R402.1.4: Reduce the Total conductive UA by 15%	1.0
<input type="radio"/> 1.5	Prescriptive compliance is based on Table R402.1.1 with the following modifications: <b>Vertical fenestration U = 0.22</b> Ceiling and single-rafter or joist-vaulted R-49 advanced Wood frame wall R-21 int plus R-12 ci Floor R-38 Basement wall R-21 int plus R-12 ci Slab on grade R-10 perimeter and under entire slab Below grade slab R-10 perimeter and under entire slab <b>or</b>  Compliance based on Section R402.1.4: Reduce the Total conductive UA by 30%	2.0
<input type="radio"/> 1.6	Prescriptive compliance is based on Table R402.1.1 with the following modifications: <b>Vertical fenestration U = 0.18</b> Ceiling and single-rafter or joist-vaulted R-60 advanced Wood frame wall R-21 int plus R-16 ci Floor R-48 Basement wall R-21 int plus R-16 ci Slab on grade R-20 perimeter and under entire slab Below grade slab R-20 perimeter and under entire slab <b>or</b>  Compliance based on Section R402.1.4: Reduce the Total conductive UA by 40%.	3.0
<input type="radio"/> 1.7	Advanced framing and raised heel trusses or rafters Vertical Glazing U-0.28 R-49 Advanced (U-0.020) as listed in Section A102.2.1, <i>Ceilings below a vented attic and</i>  R-49 vaulted ceilings with full height of uncompressed insulation extending over the wall top plate at the eaves.	0.5

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Table 406.3 – Energy Credits (Single Family)		
Option	Description	Credits: SF
<b>2. AIR LEAKAGE CONTROL AND EFFICIENT VENTILATION OPTIONS</b>		
Only one option from Items 2.1 through 2.4 may be selected in this category.		
<input type="radio"/> 2.1	<p>Compliance based on R402.4.1.2: Reduce the tested air leakage to <b>3.0 air changes per hour</b> maximum at 50 Pascals</p> <p align="center"><b><u>and</u></b></p> <p>All whole house ventilation requirements as determined by Section M1505.4 of the <i>International Residential Code</i> shall be met with a high efficiency fan(s) (<b>maximum 0.35 watts/cfm</b>), not interlocked with the furnace fan (if present). Ventilation systems using a furnace including an ECM motor are allowed, provided that they are controlled to operate at low speed in ventilation only mode.</p> <p>To qualify to claim this credit, the building permit drawings shall specify the option being selected and the maximum tested building air leakage, and shall show the qualifying ventilation system and its control sequence of operation.</p>	0.5
<input type="radio"/> 2.2	<p>Compliance based on Section R402.4.1.2: Reduce the tested air leakage to <b>2.0 air changes per hour maximum at 50 Pascals</b></p> <p align="center"><b><u>and</u></b></p> <p>All whole house ventilation requirements as determined by Section M1505.4 of the <i>International Residential Code</i> be met with a heat recovery ventilation system with minimum sensible heat recovery efficiency of <b>0.65</b>.<sup>1</sup></p>	1.0
<input type="radio"/> 2.3	<p>Compliance based on Section R402.4.1.2: Reduce the tested air leakage to <b>1.5 air changes per hour</b> maximum at 50 Pascals</p> <p align="center"><b><u>and</u></b></p> <p>All whole house ventilation requirements as determined by Section M1505.4 of the <i>International Residential Code</i> shall be met with a heat recovery ventilation system with minimum sensible heat recovery efficiency of <b>0.75</b>.<sup>1</sup></p>	1.5
<input type="radio"/> 2.4	<p>Compliance based on Section R402.4.1.2: Reduce the tested air leakage to <b>0.6 air changes per hour</b> maximum at 50 Pascals</p> <p align="center"><b><u>and</u></b></p> <p>All whole house ventilation requirements as determined by Section M1505.4 of the <i>International Residential Code</i> shall be met with a heat recovery ventilation system with minimum sensible heat recovery efficiency of <b>0.80</b>. <b>Duct installation shall comply with Section R403.3.7</b>.<sup>1</sup></p>	2.0
<sup>1</sup> To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the maximum tested building air leakage and shall show the heat recovery ventilation system.		

**Blower door test calculated flow: BLDG Volume \_\_\_\_\_ ft.<sup>3</sup> x 5 ACH / 60 min. = \_\_\_\_\_ cfm**  
 Adjusted rate per Energy Credit Option \_\_\_\_\_ ACH  
 (volume calculated based on average wall height of 8.5 ft.)

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<b>Table 406.3 – Energy Credits (Single Family)</b>		
<b>Option</b>	<b>Description</b>	<b>Credits: SF</b>
<b>3. HIGH EFFICIENCY HVAC EQUIPMENT OPTIONS</b>		
Only one option from Items 3.1 through 3.6 may be selected in this category.		
<input type="radio"/> 3.1 <sup>2</sup>	Energy Star rated (U.S. North) Gas or propane furnace with minimum AFUE of 95% <i>or</i> Energy Star rated (U.S. North) Gas or propane boiler with minimum AFUE of 90%. <sup>2</sup>	1.0
<input type="radio"/> 3.2 <sup>2</sup>	Air-source centrally ducted heat pump with minimum HSPF of 9.5. <sup>3</sup>	1.0
<input type="radio"/> 3.3 <sup>2</sup>	Closed-loop ground source heat pump; with a minimum COP of 3.3 <i>or</i> Open loop water source heat pump with a maximum pumping hydraulic head of 150 feet and minimum COP of 3.6. <sup>3</sup>	1.5
<input type="radio"/> 3.4	Ductless mini-split heat pump system, zonal control: In homes where the primary space heating system is zonal electric heating, a ductless mini-split heat pump system with a minimum HSPF of 10.0 shall be installed and provide heating to the largest zone of the housing unit. <sup>4</sup>	1.5
<input type="radio"/> 3.5 <sup>2</sup>	Air-source, centrally ducted heat pump with minimum HSPF of 11.0. <sup>4</sup>	1.5
<input type="radio"/> 3.6 <sup>2</sup>	Ductless split system heat pumps with no electric resistance heating in the primary living areas. A ductless heat pump system with a minimum HSPF of 10 shall be sized and installed to provide heat to entire dwelling unit at the design outdoor air temperature.  To qualify to claim this credit, the building permit drawings shall specify the option being selected, the heated floor area calculation, the heating equipment type(s), the minimum equipment efficiency, and total installed heat capacity (by equipment type).	2.0
<sup>2</sup> An alternative heating source sized at a maximum of 0.5 W/sf (equivalent) of heated floor area or 500 W, whichever is bigger, may be installed in the dwelling unit.		
<sup>3</sup> To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the heating equipment type and the minimum equipment efficiency.		
<sup>4</sup> To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the heating equipment type and the minimum equipment efficiency.		
<b>4. HIGH EFFICIENCY HVAC DISTRIBUTION SYSTEM OPTIONS</b>		
<input type="radio"/> 4.1	All supply and return ducts located in an unconditioned attic shall be deeply buried in ceiling insulation in accordance with Section R403.3.7.  For mechanical equipment located outside the conditioned space, a maximum of 10 linear feet of return duct and 5 linear feet of supply duct connections to the equipment may be outside the deeply buried insulation. All metallic ducts located outside the conditioned space must have both transverse and longitudinal joints sealed with mastic. If flex ducts are used, they cannot contain splices.  Duct leakage shall be limited to 3 cfm per 100 square feet of conditioned floor area.  Air handler(s) shall be located within the conditioned space.	0.5
<input type="radio"/> 4.2	HVAC equipment and associated duct system(s) installation shall comply with the requirements of Section R403.3.7.  Locating system components in conditioned crawl spaces is not permitted under this option.  Electric resistance heat and ductless heat pumps are not permitted under this option.  Direct combustion heating equipment with AFUE less than 80% is not permitted under this option.  To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the heating equipment type and shall show the location of the heating and cooling equipment and all the ductwork.	1.0

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Table 406.3 – Energy Credits (Single Family)		
Option	Description	Credits: SF
<b>5. EFFICIENT WATER HEATING OPTIONS</b>		
Only one option from Items 5.2 through 5.6 may be selected in this category. Item 5.1 may be combined with any option.		
<input type="radio"/> 5.1	A drain water heat recovery unit(s) shall be installed, which captures waste water heat from all and only the showers, and has a minimum efficiency of 40% if installed for equal flow or a minimum efficiency of 54% if installed for unequal flow. Such units shall be rated in accordance with CSA B55.1 or IAPMO IGC 346-2017 and be so labeled.  To qualify to claim this credit, the building permit drawings shall include a plumbing diagram that specifies the drain water heat recovery units and the plumbing layout needed to install it. Labels or other documentation shall be provided that demonstrates that the unit complies with the standard.	0.5
<input type="radio"/> 5.2	Water heating system shall include one of the following: Energy Star rated gas or propane water heater with a minimum UEF of 0.80. <sup>5</sup>	0.5
<input type="radio"/> 5.3	Water heating system shall include one of the following: Energy Star rated gas or propane water heater with a minimum UEF of 0.91 <b>or</b> Solar water heating supplementing a minimum standard water heater. Solar water heating will provide a rated minimum savings of 85 therms or 2000 kWh based on the Solar Rating and Certification Corporation (SRCC) Annual Performance of OG-300 Certified Solar Water Heating Systems <b>or</b> Water heater heated by ground source heat pump meeting requirements of Option 3.3.  To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the water heater equipment type and the minimum equipment efficiency and, for solar water heating systems, the calculation of minimum energy savings.	1.0
<input type="radio"/> 5.4	Water heating system shall include one of the following: Electric heat pump water heater meeting the standards for Tier I of NEEA's advanced water heating specification	1.5
<input type="radio"/> 5.5	Water heating system shall include one of the following: Electric heat pump water heater meeting the standards for Tier III of NEEA's advanced water heating specification	2.0
<input type="radio"/> 5.6	Water heating system shall include one of the following: Electric heat pump water heater with a minimum UEF of 2.9 and utilizing a split system configuration with the air-to-refrigerant heat exchanger located outdoors. Equipment shall meet Section 4, requirements for all units, of the NEEA standard <i>Advanced Water Heating Specification</i> with the UEF noted above	2.5
<sup>5</sup> To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the water heater equipment type and the minimum equipment efficiency.		

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Table 406.3 – Energy Credits (Single Family)		
Option	Description	Credits: SF
<b>6. RENEWABLE ELECTRIC ENERGY OPTION</b>		
○ 6.1	<p>For each 1200 kWh of electrical generation per housing unit provided annually by on-site wind or solar equipment a 1.0 credit shall be allowed, up to 3 credits. Generation shall be calculated as follows:</p> <p>For solar electric systems, the design shall be demonstrated to meet this requirement using the National Renewable Energy Laboratory calculator PVWATTS or approved alternate by the code official.</p> <p>Documentation noting solar access shall be included on the plans. For wind generation projects designs shall document annual power generation based on the following factors: the wind turbine power curve; average annual wind speed at the site; frequency distribution of the wind speed at the site and height of the tower.</p> <p>To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall show the photovoltaic or wind turbine equipment type, provide documentation of solar and wind access, and include a calculation of the minimum annual energy power production.</p>	1.0
<b>7. APPLIANCE PACKAGE OPTION</b>		
○ 7.1	<p>All of the following appliances shall be new and installed in the dwelling unit and shall meet the following standards:</p> <p>Dishwasher – Energy Star rated Refrigerator (if provided) – Energy Star rated Washing machine – Energy Star rated Dryer – Energy Star rated, ventless dryer with minimum CEF rating of 5.2.</p> <p>To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall show the appliance type and provide documentation of Energy Star compliance. At the time of inspection, all appliances shall be installed and connected to utilities. Dryer ducts and exterior dryer vent caps are not permitted to be installed in the dwelling unit.</p>	0.5

**R403.7 Equipment sizing and efficiency rating.** Heating and cooling equipment shall be sized in accordance with ACCA Manual S based on building loads calculated in accordance with ACCA Manual J or other *approved* heating and cooling calculation methodologies. The output capacity of heating and cooling equipment shall not be greater than that of the smallest available equipment size that exceeds the loads calculated, including allowable oversizing limits. Equipment shall meet the minimum federal efficiency standards as referenced in Tables C403.3.2(1), C403.3.2(2), C403.3.2(3), C403.3.2(4), C403.3.2(5), C403.3.2(6), C403.3.2(7), C403.3.2(8) and C403.3.2(9) and tested and rated in accordance with the applicable test procedure.



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**Building Heat Loss Calculation / U-factor Equivalent Compliance**

Use common U-values from Appendix A, WAC chapter 51-11C or ASHRAE Handbook of Fundamentals Multiply component's area by U-value. Compliance achieved if Proposed is less than Code Allowable.

	Proposed components					CODE ALLOWABLE		
	Insulation Value	U-Value	Area	U*A=		U-Value	Area	U*A=
Attic Area					Opening area entered as 15% of total floor area =>	0.027		
Vaulted Roof Area						0.026		
Existing Attic Area								
Existing Vaulted Roof Area								
Skylights						0.500		
New Windows / Doors						0.300		
Existing Windows / Doors								
Exterior Wall Area (net area)						0.056		
Existing Wall Area (net area)								
Floor Area over unheated area						0.029		
Existing Floor over unheated area								
Slab on Grade linear feet				ft.		0.54		
Existing Slab on Grade linear feet				ft.				
Below Grade Walls (net area)						0.042		
Existing Below Grade Walls								
		<b>Total UA heat loss:</b>				<b>TOTAL heat loss allowed:</b>		

Energy Credit Option reduction in Total UA				Maximum Heat Loss Allowed
Option 1.3: 5%	Option 1.4: 15%	Option 1.5: 30%	Option 1.6: 40%	

# Heating & Cooling System Sizing & Equipment Selection

The building code and the energy code require that heating and cooling equipment be selected based on calculated heating and cooling loads using an approved method. Equipment specified may not be greater than the smallest available equipment size that exceeds the loads calculated.

Single family homes, duplexes, and townhouses using electric zonal heating as the primary heat source must install an inverter-driven ductless mini-split heat pump in the largest zone in the dwelling, unless the total heating equipment installed is 2kW or less.

Note, options selected from Tables R406.2 & R406.3 for project compliance may affect the heating system selection and efficiency.

## Sizing Tools

- [HVAC Sizing Tool](#) from BetterBuiltNW, which is based on [Manual J](#)
- [Heating System Sizing Worksheet](#) from WSU Energy Program (if building has heating only, no cooling)
- Other that size equipment in accordance with ACCA Manual S based on building loads calculated in accordance with ACCA Manual J

## Interior Design Temperatures (WSEC R302.1):

- Maximum of 72°F (22°C) for heating and
- Minimum of 75°F (24°C) for cooling

## Exterior Design Temperatures (WSEC Table RC-1):

LOCATION	OUTDOOR DESIGN TEMP HEATING (°F)	OUTDOOR DESIGN TEMP COOLING (°F)
Auburn	25	84
Bellevue	24	83
Grotto	21	84
Redmond	17	83
Seattle: SeaTac AP	24	83
Snoqualmie Pass	6	80
Stampede Pass	7	76
Stevens Pass	6	77
Vashon Island	28	78

## System Controls

- Forced air systems must include an Energy Star certified programmable thermostat capable of a minimum 5-2 schedule.
- Systems which include supplementary heat for heat pumps must have auxillary heat lock out controls, set to 35°F or less.
- Continuously burning pilot lights are prohibited on gas appliances.

# Residential Construction Energy Compliance: King County

## Common U-Values for various framed elements

CEILING		FRAMING			FLOOR			
TYPE	Insulation	Standard	Intermed.	Advanced	Insulation	Post & Beam	Joists	
<b>Flat</b>	R-19	0.049		0.047	R-0	0.112	0.134	
	R-30	0.036		0.032	R-11	0.052	0.056	
	R-38	0.031		0.026	R-19	0.038	0.041	
	R-49	0.027		0.020	R-22	0.034	0.037	
	R-60	0.025		0.017	R-25	0.032	0.034	
<b>cissor truss</b>	4:12 pitch R-30 sci	0.043		0.031	R-30	0.028	0.029	
	4:12 pitch R-38 sci	0.040		0.025	R-38	0.024	0.025	
	4:12 pitch R-49 sci	0.030		0.020	<b>SLAB on GRADE</b>			
	5:12 pitch R-30	0.039		0.032	<b>UNHEATED SLAB</b>			
	5:12 pitch R-38	0.035		0.026	UNHEATED SLAB	uninsulated	0.73	R-10 fully insulated
5:12 pitch R-49	0.032		0.020	all 2 ft horiz w/o tb*	0.70		R-15 fully insulated	0.31
<b>Vaulted</b>		16" OC	24" OC	24" OC	R-5 2-ft vert/horiz	0.58	<b>HEATED SLAB</b>	
	vented 2x10	R-19	0.049	0.048	R-10 2-ft vert/horiz	0.54	R0 uninsulated	0.84
	vented 2x12	R-30	0.034	0.033	R-15 2-ft vert/horiz	0.52	R5 fully insulated	0.74
vented 2x14	R-38	0.027	0.027	0.027	R-5 4-ft vert/horiz	0.54	R10 fully insulated	0.55
unvented 2x10	R-30	0.034	0.033	0.033	R-10 4-ft vert/horiz	0.48	R15 fully insulated	0.44
unvented 2x12	R-38	0.029	0.027	0.027	R-15 4-ft vert/horiz	0.45	R20 fully insulated	0.39
					R-10 fully insulated	0.36	R30 fully insulated	0.32

WALLS		FRAMING			BELOW GRADE WALLS			Slab
Insulation	TYPE	Standard	Intermed.	Advanced	depth	U-value	F-factor	
<b>apped Wood Siding</b>					2 ft below grade	uninsulated	0.350	0.59
2 x 4 WOOD	R-11	0.088	0.086	0.084		R-11 interior	0.066	0.68
	R-13	0.082	0.08	0.078		R-11 interior w/tb*	0.070	0.60
	R-15	0.076	0.073	0.071		R-21 interior	0.043	0.69
2 x 6 WOOD	R-19	0.062	0.058	0.055		R-21 interior w/tb*	0.045	0.61
	R-21	0.057	0.054	0.051		R-10 exterior	0.070	0.60
	R-22	0.059	0.055	0.052		R-12 exterior	0.061	0.60
	(2) R-11	0.060	0.057	0.054	3.5 ft below grade	uninsulated	0.278	0.53
2 x 8 WOOD	R-25	0.051	0.047	0.045		R-11 interior	0.062	0.63
<b>T1-11 Siding</b>						R-11 interior w/tb*	0.064	0.57
2 x 4 WOOD	R-11	0.094	0.092	0.09		R-21 interior	0.041	0.64
	R-13	0.088	0.085	0.083		R-21 interior w/tb*	0.042	0.57
	R-15	0.081	0.078	0.075		R-10 exterior	0.064	0.57
2 x 6 WOOD	R-19	0.065	0.061	0.058		R-12 exterior	0.057	0.57
	R-21	0.06	0.056	0.053	7 ft below grade	uninsulated	0.193	0.46
	R-22	0.062	0.058	0.054		R-11 interior	0.054	0.56
	(2) R-11	0.063	0.059	0.056		R-11 interior w/tb*	0.056	0.42
2 x 8 WOOD	R-25	0.053	0.049	0.046		R-21 interior	0.037	0.57
<b>METAL STUDS</b>						R-21 interior w/tb*	0.038	0.43
			16" OC	24" OC		R-10 exterior	0.056	0.42
4-inch	R-11		0.132	0.116		R-12 exterior	0.050	0.42
4-inch	R-13		0.124	0.108	* w/tb = with thermal break			
4-inch	R-15		0.118	0.102	<b>Log Walls (consult ICC 400)</b>			
6-inch	R-19		0.109	0.094				
6-inch	R-21		0.106	0.090				
8-inch	R-25		0.08	0.091				

## 2018 Residential Ventilation Compliance Summary

Applicant: \_\_\_\_\_ Parcel: \_\_\_\_\_ Permit Number: \_\_\_\_\_

A whole-house ventilation system is required by the building code ([2018 IRC Section M1505.4](#)) to promote healthy indoor air quality in homes and provide increased comfort for occupants. **This is required for new dwelling units, and additions to existing dwelling units over 500 square feet.**

### WHOLE HOUSE VENTILATION SYSTEM TYPE (see descriptions next page)

Note, if the project has selected an Air Leakage Control and Efficient Ventilation Option from [WSEC Table R406.3](#), the ventilation system type chosen must be consistent with that option's requirements.

- Exempt: addition less than 500 sq.ft. or remodel only  
 Exhaust fan(s) only ([IRC M1505.4.1.2](#))  
 Supply fan(s) only ([IRC M1505.4.1.3](#))  
 Balanced system ([IRC M1505.4.1.4](#)), including HRVs  
 Furnace Integrated Supply ([IRC M1505.4.1.5](#))  
 System will be distributed:  Yes  No (see definition next page)

Floor plans should indicate the location, type, and airflow rate of whole-house ventilation system.

### WHOLE HOUSE VENTILATION SYSTEM AIRFLOW RATE

Step 1: Find airflow rate minimum from Table 1, circle applicable airflow.

Step 2: Multiple airflow rate by applicable multiplier from Table 2, type adjusted airflow in table.

Step 3: Multiply airflow rate by applicable multiplier from Table 3, type adjusted airflow in table.

**Table 1. WHOLE-HOUSE SYSTEM MINIMUM VENTILATION RATES (circle)**

Conditioned Floor Area of the Home in square feet	Number of Bedrooms in the Home				
	Studio & 1 bedroom	2 bedrooms	3 bedrooms	4 bedrooms	5 or more bedrooms
	Airflow in cubic feet per minute (CFM)				
< 500	30	30	35	45	50
501 - 1,000	30	35	40	50	55
1,001 - 1,500	30	40	45	55	60
1,501 - 2,000	35	45	50	60	65
2,001 - 2,500	40	50	55	65	70
2,501 - 3,000	45	55	60	70	75
3,001 - 3,500	50	60	65	75	80
3,501 - 4,000	55	65	70	80	85
4,001 - 4,500	60	70	75	85	90
4,501 - 5,000	65	75	80	90	95
> 5,001	(0.01 x Conditioned Floor Area of the Home in square feet) + [7.5 x (Number of Bedrooms in the Home + 1)]				

**Table 2. WHOLE-HOUSE VENTILATION QUALITY ADJUSTMENT (circle, type adjusted rate)**

SYSTEM TYPE	DISTRIBUTED	NOT DISTRIBUTED	Min. adjusted fan size (CFM)
BALANCED	1.0	1.25	
NOT BALANCED	1.25	1.5	

**Table 3. INTERMITTENT WHOLE-HOUSE VENTILATION RATE FACTORS (circle, type adjusted rate)**

Run-time % in each 4-hour segment	Multiplier	Min. adjusted fan size (CFM)
50% (2 hrs every 4 hrs; 12 hrs /day)	2	
66% (2 hrs 40 min every 4 hrs; 16 hrs /day)	1.5	
75% ( 3 hrs every 4 hrs; 18 hrs /day)	1.3	
100% (continuously operating)	1.0	

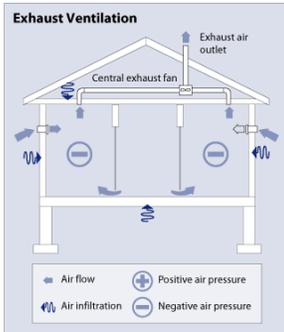
### WHOLE HOUSE VENTILATION SYSTEM SUMMARY

Specify: Location of ventilation equipment: \_\_\_\_\_ Airflow rate (CFM): \_\_\_\_\_ Specify run-time: \_\_\_\_\_

## WHOLE HOUSE VENTILATION SYSTEM TYPES

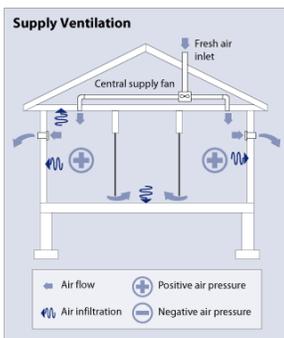
**Balanced whole house ventilation** is any combination of concurrently operating mechanical exhaust and mechanical supply whereby the total mechanical exhaust airflow rate is within 10% or 5 cfm of the total mechanical supply airflow rate, whichever is greater.

**Distributed whole house ventilation** is when outdoor air is supplied directly (not transfer air) to each habitable space and the exhausts air from all kitchen and bathrooms is vented directly to the outside.



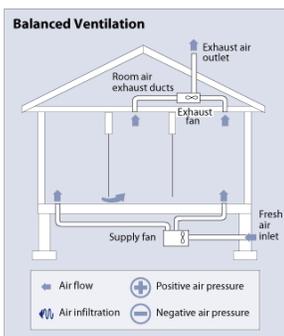
### **Exhaust fan(s) only (IRC M1505.4.1.2)**

This type of system has one or more exhaust fans, such as in bathrooms and laundry rooms, that have controls to provide intermittent or continuous exhaust from the dwelling unit to remove stale, moist air. In this type of system there is no dedicated supply air to replace the exhausted air, so fresh air is brought into the home passively through openings such as windows, window vents, through-wall vents, or leakage in the home's air barrier. With recent air barrier construction requirements and techniques improving, homes are becoming tighter and provide less opportunities for air leakage.



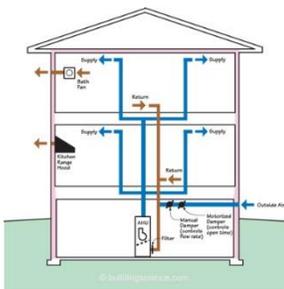
### **Supply fan(s) only (IRC M1505.4.1.3)**

This type of system has one or more supply fans that are provided with controls to provide intermittent or continuous fresh air into the dwelling unit. In this type of system there is no interconnected exhaust fans, so the system works to pressurize the home, pushing stale moist air out of the building through openings such as windows, window vents, through-wall vents, or leakage in the home's air barrier. With recent air barrier construction requirements and techniques improving, homes are becoming tighter and provide less opportunities for air leakage.



### **Balanced system (IRC M1505.4.1.4), including HRVs**

This type of system has both supply and exhaust fans that are provided with controls to provide intermittent or continuous fresh air into the dwelling unit and exhaust from the dwelling unit to remove stale, moist air. When two fans and two duct systems are used, these must provide a balanced airflow rate to operate as designed. A balanced system can also include an energy (or heat) recovery ventilator (ERV/HRV), an appliance that provides both supply and exhaust air in one unit and captures the energy or heat from the exhaust air and transfers it to the supply air via a heat exchanger to minimize energy loss in the system.



### **Furnace Integrated Supply (IRC M1505.4.1.5)**

Previous editions of the codes allowed fresh air to be introduced to the home from an outside air duct connected directly to a home's furnace. This is no longer permitted in the code outright, as the system uses excess energy when the fans in the heating/cooling equipment are required to operate to distribute the air. This type of system may only be used if the heating system air handler fan(s) have multi-speed or variable speed flow capability.

<b>AIR BARRIER AND INSULATION INSTALLATION TABLE R402.4.1.1</b>		
<b>COMPONENT</b>	<b>AIR BARRIER CRITERIA</b>	<b>INSULATION CRITERIA</b>
Air barrier and thermal barrier	A continuous air barrier shall be installed in the building envelope. Exterior thermal envelope contains a continuous air barrier. Breaks or joints in the air barrier shall be sealed.	Air-permeable insulation shall not be used as a sealing material. Class I or II vapor retarders are required on the interior side of framed cavities.
Cavity insulation installation	All cavities in the thermal envelope shall be filled with insulation. The density of the insulation shall be at the manufacturers' product recommendation and said density shall be maintained for all volume of each cavity. Batt type insulation will show no voids or gaps and maintain an even density for the entire cavity. Batt insulation shall be installed in the recommended cavity depth. Where an obstruction in the cavity due to services, blocking, bracing or other obstruction exists, the batt product will be cut to fit the remaining depth of the cavity. Where the batt is cut around obstructions, loose fill insulation shall be placed to fill any surface or concealed voids, and at the manufacturers' specified density. Where faced batt is used, the installation tabs must be stapled to the face of the stud. There shall be no compression to the batt at the edges of the cavity due to inset stapling installation tabs. Insulation that upon installation readily conforms to available space shall be installed filling the entire cavity and within the manufacturers' density recommendation.	
Ceiling/attic	The air barrier in any dropped ceiling/soffit shall be aligned with the insulation and any gaps in the air barrier sealed. Access openings, drop down stair or knee wall doors to unconditioned attic spaces shall be sealed.	Batt insulation installed in attic roof assemblies may be compressed at exterior wall lines to allow for required attic ventilation. The insulation in any dropped ceiling or soffit shall be aligned with the air barrier.
Walls	The junction of the foundation and sill plate shall be sealed. The junction of the top plate and top of exterior walls shall be sealed. Knee walls shall be sealed.	Cavities within corners and headers shall be insulated by completely filling the cavity with a material having a minimum thermal resistance of R-3 per inch. Exterior thermal envelope insulation for framed walls shall be installed in substantial contact and continuous alignment with the air barrier.
Windows, skylights and	Space between window/door jambs and framing and skylights and framing shall be sealed.	
Rim joists	Rim joists shall include the air barrier.	Rim joists shall be insulated
Floors (including above-garage and cantilevered)	The air barrier shall be installed at any exposed edge of insulation.	Installed to maintain permanent contact with underside of subfloor decking or permitted to be in contact with the topside of sheathing or continuous insulation installed on the underside of floor framing and extend from the bottom to the top of all perimeter floor
Crawl space walls	Soil in unvented crawl spaces shall be covered with Class I, black vapor retarder with joints taped.	Where provided in lieu of floor insulation, insulation shall be permanently attached to the crawlspace walls.
Shafts, penetrations	Duct shafts, utility penetrations, and flue shafts opening to exterior or unconditioned space shall be sealed.	
Narrow cavities		Batts in narrow cavities shall be cut to fit and installed to the correct density without any voids or gaps or compression. Narrow cavities shall be filled by insulation that on installation readily conforms to the available cavity space.
Garage separation	Air sealing shall be provided between the garage and conditioned spaces.	
Recessed lighting	Shall be sealed to the drywall.	Shall be air tight, and IC rated.
Plumbing and wiring		Batt insulation shall be cut neatly to fit around wiring and plumbing in exterior walls. There shall be no voids or gaps or compression where cut to fit. Insulation that readily conforms to available space shall extend behind piping and wiring.
Shower and/or tub	Installed at exterior walls adjacent to showers and tubs shall separate them from showers and tubs.	Exterior walls adjacent to showers or tubs shall be insulated
Electrical/phone	Barrier shall be installed behind electrical or communication boxes on exterior wall or install air sealed boxes.	
HVAC register boots	Boots that penetrate building thermal envelope shall be sealed to the subfloor or drywall.	
Concealed Sprinklers	When required to be sealed, fire sprinklers shall only be sealed in a manner that is recommended by the manufacturer. Caulking or other adhesive sealants shall not be used to fill voids between fire sprinkler cover plates and walls or ceilings.	

**AIR INFILTRATION AND TESTING**

The building shall be tested and verified as having an air leakage rate not exceeding 5.0 air changes per hour (ACH). Note, if the project has selected an Air Leakage Control and Efficient Ventilation Option from [WSEC Table R406.3](#), the maximum air leakage allowed may be reduced.

Testing shall be conducted with a blower door at a pressure of 0.2 in. w.g. For this test only, the volume of the home shall be the square feet of conditioned floor area multiplied by 8.5 feet. A written report of the results of the test shall be signed by the party conducting the test and provided to the code official.

**During testing:**

1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed, beyond the intended weatherstripping or other infiltration control measures.
2. Dampers including exhaust, intake, makeup air, backdraft and flue dampers shall be closed, but not sealed beyond intended infiltration control measures.
3. Interior doors, if installed at the time of the test, shall be open, access hatches to conditioned crawl spaces and conditioned attics shall be open.
4. Exterior or interior terminations for continuous ventilation systems and heat recovery ventilators shall be sealed.
5. Heating and cooling systems, if installed at the time of the test, shall be turned off.
6. Supply and return registers, if installed at the time of the test, shall be fully open.

**Exceptions:**

1. Additions less than 500 square feet (46 m<sup>2</sup>) of conditioned floor area.
2. Additions tested with the existing home having a combined maximum air leakage rate of 7 air changes per hour. To qualify for this exception, the date of construction of the existing house must be prior to the 2009 Washington State Energy Code.

**Blower door test calculated flow: BLDG Volume \_\_\_\_\_ ft.<sup>3</sup> x 5 ACH / 60 min. = \_\_\_\_\_ cfm**  
**OR Adjusted rate per Energy Credit Option 2. \_\_\_\_\_**

**Blower door test calculated flow: BLDG Volume \_\_\_\_\_ ft.<sup>3</sup> x \_\_\_\_\_ ACH / 60 min. = \_\_\_\_\_ cfm**

**DUCT LEAKAGE AND TESTING**

1. Ducts shall be leak tested in accordance with WSU RS-33, using the maximum 4 cfm per 100 square feet of conditioned floor area. If the air handler is not installed at the time of the test, total leakage shall be less than or equal to 3 cfm per 100 square feet of conditioned floor area.

**Total sq.ft. \_\_\_\_\_ sq.ft. / 100 sq.ft. X 4 cfm = \_\_\_\_\_ cfm**

**Exceptions:**

1. The total leakage test or leakage to the outdoors is not required for ducts and air handlers located entirely within the building thermal envelope. For forced air ducts, a maximum of 10 linear feet of return ducts and 5 linear feet of supply ducts may be located outside the conditioned space. All metallic ducts located outside the conditioned space must have both transverse and longitudinal joints sealed with mastic. If flex ducts are used, they cannot contain splices. Flex duct connections must be made with nylon straps and installed using a plastic strapping tensioning tool. Ducts located in crawl spaces do not qualify for this exception.
2. A duct air leakage test shall not be required for ducts serving heat or energy recovery ventilators that are not integrated with ducts serving heating or cooling systems.

**A written report of results must be signed by the party conducting the test and provided to the King County Building Inspector.**