# CITY OF MERCER ISLAND

DEVELOPMENT SERVICES GROUP
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## 2015 WSEC & IRC Ventilation Worksheet (Effective July 1, 2016)

INFORMATION IN THESE WORKSHEETS MUST BE INCLUDED IN THE CONSTRUCTION DOCUMENTS

This set of worksheets has been developed to assist permit applicants with documenting compliance with the 2015 Washington State Energy Code. The following worksheets provide much of the required documentation for plan review. **The details, systems, and ratings noted here must also be shown on the drawings.**

### PRESCRIPTIVE ENERGY CODE COMPLIANCE FOR CLIMATE ZONE MARINE 4

| Component | Fenestration [1] | | Ceiling w/ Attic | Vaulted Ceiling | Wood Framed Wall (Int.)[2] | Mass Wall (Above grade) | Below-Grade Wall [2,3] | Framed Floor | Slab R-Value & Depth |
|---|---|---|---|---|---|---|---|---|---|
| | Vertical | Overhead | | | | | | | |
| Prescriptive Value | U-0.30 max. | U-0.50 max. | R-49 min. | R-38 min. | R-21 min. | R-21 min. | R-10/15/21 int. + TB | R-30 min. | R-10 min. 2' |

[1] *Fenestration is defined as skylights, roof windows, vertical windows (fixed or moveable), opaque doors, glazed doors, glazed block and combination opaque/glazed doors. Fenestration includes products with glass and non-glass glazing materials.*

[2] *Int. (intermediate framing) denotes standard framing 16" o.c. with headers insulated with a minimum R-10 insulation.*

[3] *10/15/21 +TB" means R-10 continuous insulation on the exterior of the wall, or R-15 on the continuous insulation on the interior of the wall, or R-21 cavity insulation plus a thermal break between the slab and the basement wall at the interior of the basement wall. "10/15/21 +TB" shall be permitted to be met with R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the wall. "TB" means thermal break between floor slab and basement wall.*

### Whole House Ventilation (Prescriptive)

**Please check the appropriate box to describe which of the four prescriptive Whole House Ventilation Systems you will be using AND fill in the required whole house ventilation rate in CFM's.** (See "2015 Residential Whole House Ventilation Rate" Handout.) A complete system required by one of the sections noted below must be specified on the drawings.

| | WHOLE HOUSE VENTILATION METHOD | Whole House Ventilation Rate |
|---|---|---|
| ☐ | Intermittent Whole House Ventilation Using Exhaust Fans & Fresh Air Inlets. (IRC M1507.3.4) | |
| ☑ | Intermittent Whole House Ventilation Integrated with a Forced Air System. (IRC M1507.3.5) | |
| ☐ | Intermittent Whole House Ventilation using a Supply Fan. (IRC M1507.3.6) | |
| ☐ | Intermittent Whole House Ventilation Using a Heat Recovery Ventilation System (IRC M1507.3.7) | |

### Source Specific Exhaust Ventilation & Fan Efficiency

Required in each kitchen, bathroom, water closet compartment, laundry room, indoor swimming pool, spa and other rooms where water vapor or cooking odor is produced. (IRC M 1507.4) Fan efficiency from WAC 51-11R – Table R403.6.1. Kitchen Hoods greater than 400 cfm require makeup air per IRC M1503.4

Minimum Source Specific Ventilation Capacity Requirements

| | Bathrooms – Utility Rooms | | Kitchens | In-line fan |
|---|---|---|---|---|
| Intermittently operating | 50 cfm min | | 100 cfm min | |
| Continuous operation | 20 cfm min | | 25 cfm min | |
| Minimum Efficacy (cfm/watt) | 1.4 cfm/watt if <90cfm | 2.8 cfm/watt if >90cfm | 2.8 cfm/watt | 2.8 cfm/watt |

### Energy Efficiency Credits

Each dwelling unit shall comply with sufficient options from WSEC Table R406.2 so as to achieve the following minimum number of credits as described on the reverse side of this page.

| | |
|---|---|
| ☐ | **Small Dwelling Unit: 1.5 credits** (Dwelling units less than 1500 SF in conditioned floor area with less than 300 square feet of fenestration area. Additions to existing building that are greater than 500 SF of heated floor area, but less than 1500 SF. **TOTAL SQUARE FEET OF FENESTRATION:** _____ (doors, windows, skylights) |
| ☑ | **Medium Dwelling Unit: 3.5 credits** (All dwelling units not included in #1 or #3. Exception: Dwelling units serving R-2 occupancies shall require 2.5 credits. |
| ☐ | **Large Dwelling Unit: 4.5 credits** (Dwelling Units exceeding 5000 SF of conditioned floor area. |
| ☐ | Additions less than 500 SF: 0.5 credits |

## 2015 WSCE – Table R406.2 – circle the options that you will be using for this project

| OPTION | DESCRIPTION | CREDIT(S) |
|---|---|---|
| 1a ✓ | **EFFICIENT BUILDING ENVELOPE 1a:**<br>Vertical fenestration U = 0.28<br>Floor R-38<br>Slab on grade R-10 perimeter and under entire slab Below grade slab R-10 perimeter and under entire slab.<br>**OR** Compliance based on Section R402.1.4: Reduce the Total UA by 5%. | 0.5 |
| 1b | **EFFICIENT BUILDING ENVELOPE 1b:**<br>Vertical fenestration U = 0.25<br>Wall R-21 plus R-4 Floor R-38<br>Basement wall R-21 int plus R-5 ci<br>Slab on grade R-10 perimeter and under entire slab Below grade slab R-10 perimeter and under entire slab.<br>**OR** Compliance based on Section R402.1.4: Reduce the Total UA by 15%. | 1.0 |
| 1c | **EFFICIENT BUILDING ENVELOPE 1c:**<br>Prescriptive compliance is based on Table R402.1.1 with the following modifications: Vertical fenestration U = 0.22<br>Ceiling and single-rafter or joist-vaulted R-49 advanced Wood frame wall R-21 int plus R-12 ci<br>Floor R-38<br>Basement wall R-21 int plus R-12 ci<br>Slab on grade R-10 perimeter and under entire slab Below grade slab R-10 perimeter and under entire slab<br>**OR** Compliance based on Section R402.1.4: Reduce the Total UA by 30%. | 2.0 |
| 1d | **EFFICIENT BUILDING ENVELOPE 1d:**<br>Prescriptive compliance is based on Table R402.1.1 with the following modifications: Vertical fenestration U = 0.31. Projects using this option may not use Option 1a, 1b or 1c. | 0.5 |
| 2a ✓ | **AIR LEAKAGE CONTROL AND EFFICIENT VENTILATION 2a:**<br>Compliance based on R402.4.1.2: Reduce the tested air leakage to 3.0 air changes per hour maximum<br>**AND** All whole house ventilation requirements as determined by Section M1507.3 of the *International Residential Code* shall be met with a high efficiency fan (maximum 0.35 watts/cfm), not interlocked with the furnace fan. 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.<br>***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 qualifying ventilation system.*** | 0.5 |
| 2b | **AIR LEAKAGE CONTROL AND EFFICIENT VENTILATION 2b:**<br>Compliance based on Section R402.4.1.2: Reduce the tested air leakage to 2.0 air changes per hour maximum<br>**AND** All whole house ventilation requirements as determined by Section M1507.3 of the *International Residential Code* shall be met with a heat recovery ventilation system with minimum sensible heat recovery efficiency of 0.70.<br>***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.*** | 1.0 |
| 2c | **AIR LEAKAGE CONTROL AND EFFICIENT VENTILATION 2c:**<br>Compliance based on Section R402.4.1.2: Reduce the tested air leakage to 1.5 air changes per hour maximum.<br>**AND** All whole house ventilation requirements as determined by Section M1507.3 of the *International Residential Code* shall be met with a heat recovery ventilation system with minimum sensible heat recovery efficiency of 0.85.<br>***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.*** | 1.5 |
| 3a ✓ | **HIGH EFFICIENCY HVAC EQUIPMENT 3a:**<br>Gas, propane or oil-fired furnace with minimum AFUE of 94%, or Gas, propane or oiled-fired boiler with minimum AFUE of 92%.<br>Projects may only include credit from one space heating option, 3a, 3b, 3c or 3d. When a housing unit has two pieces of equipment (i.e., two furnaces) both must meet the standard to receive the credit.<br>***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.*** | 1.0 |
| 3b | **HIGH EFFICIENCY HVAC EQUIPMENT 3b:**<br>Air-source heat pump with minimum HSPF of 9.0. Projects may only include credit from one space heating option, 3a, 3b, 3c or 3d. When a housing unit has two pieces of equipment (i.e., two furnaces) both must meet the standard to receive the credit.<br>***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.*** | 1.0 |
| 3c | **HIGH EFFICIENCY HVAC EQUIPMENT 3c:**<br>Closed-loop ground source heat pump; with a minimum COP of 3.3<br>**OR** Open loop water source heat pump with a maximum pumping hydraulic head of 150 feet and minimum COP of 3.6. Projects may only include credit from one space heating option, 3a, 3b, 3c or 3d. When a housing unit has two pieces of equipment (i.e., two furnaces) both must meet the standard to receive the credit.<br>***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.*** | 1.5 |
| 3d | **HIGH EFFICIENCY HVAC EQUIPMENT 3d:**<br>Ductless Split System Heat Pumps, Zonal Control: In homes where the primary space heating system is zonal electric heating, a ductless heat pump system shall be installed and provide heating to the largest zone of the housing unit. Projects may only include credit from one space heating option, 3a, 3b, 3c or 3d. When a housing unit has two pieces of equipment (i.e., two furnaces) both must meet the standard to receive the credit.<br>***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.*** | 1.0 |

## 2015 WSCE – Table R406.2 - Continued

| OPTION | DESCRIPTION | CREDIT(S) |
|---|---|---|
| 4 ☐ | HIGH EFFICIENCY HVAC DISTRIBUTION SYSTEM:<br>All heating and cooling system components installed inside the conditioned space. This includes all equipment and distribution system components such as forced air ducts, hydronic piping, hydronic floor heating loop, convectors and radiators. All combustion equipment shall be direct vent or sealed combustion.<br>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 outside the conditioned space must be insulated to a minimum of R-8. 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.<br>***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 |
| 5a ☐ | **EFFICIENT WATER HEATING 5a:**<br>All showerhead and kitchen sink faucets installed in the house shall be rated at 1.75 GPM or less. All other lavatory faucets shall be rated at 1.0 GPM or less.<br>Plumbing Fixtures Flow Ratings. Low flow plumbing fixtures (water closets and urinals) and fittings (faucets and showerheads) shall comply with the following requirements:<br>1. Residential bathroom lavatory sink faucets: Maximum flow rate - 3.8 L/min (1.0 gal/min) when tested in accordance with ASME A112.18.1/CSA B125.1.<br>2. Residential kitchen faucets: Maximum flow rate - 6.6 L/min (1.75 gal/min) when tested in accordance with ASME A112.18.1/CSA B125.1.<br>3. Residential showerheads: Maximum flow rate - 6.6 L/min (1.75 gal/min) when tested in accordance with ASME A112.18.1/CSA B125.1.<br>***To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the maximum flow rates for all showerheads, kitchen sink faucets, and other lavatory faucets.*** | 0.5 |
| 5b ☐ | **EFFICIENT WATER HEATING 5b:**<br>Water heating system shall include one of the following: Gas, propane or oil water heater with a minimum EF of 0.74<br>OR Water heater heated by ground source heat pump meeting the requirements of Option 2c.<br>OR For R-2 occupancy, a central heat pump water heater with an EF greater than 2.0 that would supply DHW to all the units through a ce minimum pipe insulation.<br>***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.*** | 1.0 |
| 5c ✓ | **EFFICIENT WATER HEATING 5c:**<br>Water heating system shall include one of the following: Gas, propane or oil water heater with a minimum EF of 0.91<br>**OR** 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<br>OR Electric heat pump water heater with a minimum EF of 2.0 and storage tank capacity of not less than 50 gallons, and minimum pipe insulation, in Heat Pump Water Heaters<br>***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 the minimum energy savings.*** | 1.5 |
| 5d ☐ | EFFICIENT WATER HEATING 5d:<br>A drain water heat recovery unit(s) shall be installed, which captures waste water heat from all the showers, and has a minimum efficiency of 40% if installed for equal flow or a minimum efficiency of 52% if installed for unequal flow. Such units shall be rated in accordance CSA B55.1 and be so labeled.<br>*To qualify to claim this credit, the building permit drawings shall include a plumbing diagram that specified the drain water heat recovery units and the plumbing layout needed to install it and labels or other documentation shall be provided that demonstrates* ***that the unit complies with the standard.*** | 0.5 |
| 6 ☐ | **RENEWABLE ELECTRIC ENERGY:**<br>For each 1200 kWh of electrical generation per each housing unit provided annually by on-site wind or solar equipment a 0.5 credit shall be allowed, up to 3 credits. Generation shall be calculated as follows:<br>For solar electric systems, the design shall be demonstrated to meet this requirement using the National Renewable Energy Laboratory calculator PVWATTs. ***Documentation noting solar access shall be included on the plans.***<br>For wind generation projects designs shall document annual power generation based on the following factors:<br>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.<br>***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.*** | 0.5 |

## Window, Skylight and Door Schedule

*Project Information*

RKK Construction Inc
3406 72nd Pl SE
Mercer Island, WA

*Contact Information*

Richard Fisher
1932 1st Ave. Suite 601
Seattle, WA 98101

| | Ref. | U-factor | Qt. | Width Feet | Inch | Height Feet | Inch | Area | UA |
|---|---|---|---|---|---|---|---|---|---|
| Exempt Swinging Door (24 sq. ft. max.) | | | | | | | | 0.0 | 0.00 |
| Exempt Glazed Fenestration (15 sq. ft. max.) | | | | | | | | 0.0 | 0.00 |

### Vertical Fenestration (Windows and doors)

| Component Description | Ref. | U-factor | Qt. | Width Feet | Inch | Height Feet | Inch | Area | UA |
|---|---|---|---|---|---|---|---|---|---|
| Casement | A | 0.28 | 1 | 4 | 0 | 4 | 6 | 18.0 | 5.04 |
| Sidelight | B | 0.28 | 2 | 1 | 6 | 5 | 0 | 15.0 | 4.20 |
| Casement | C,F | 0.28 | 4 | 2 | 6 | 4 | 6 | 45.0 | 12.60 |
| Picture | D | 0.28 | 1 | 4 | 0 | 4 | 6 | 18.0 | 5.04 |
| Casement | E,I | 0.28 | 7 | 2 | 6 | 3 | 6 | 61.3 | 17.15 |
| Casement | H,L | 0.28 | 4 | 2 | 0 | 3 | 6 | 28.0 | 7.84 |
| Casement | K | 0.28 | 3 | 2 | 6 | 4 | 0 | 30.0 | 8.40 |
| Casement | M | 0.28 | 1 | 3 | 0 | 3 | 6 | 10.5 | 2.94 |
| Casement | N,Y | 0.28 | 4 | 3 | 0 | 4 | 6 | 54.0 | 15.12 |
| Casement | O | 0.28 | 2 | 2 | 0 | 3 | 0 | 12.0 | 3.36 |
| Casement | P,Q | 0.28 | 3 | 2 | 0 | 2 | 6 | 15.0 | 4.20 |
| Casement | R | 0.28 | 2 | 2 | 6 | 2 | 6 | 12.5 | 3.50 |
| Casement | S | 0.28 | 2 | 2 | 6 | 4 | 0 | 20.0 | 5.60 |
| Casement | U | 0.28 | 3 | 3 | 0 | 4 | 0 | 36.0 | 10.08 |
| Casement | W | 0.28 | 2 | 2 | 0 | 3 | 6 | 14.0 | 3.92 |
| Casement | X | 0.28 | 2 | 2 | 6 | 2 | 0 | 10.0 | 2.80 |
| Casement | Y | 0.28 | 2 | 3 | 0 | 4 | 6 | 27.0 | 7.56 |
| transom | t | 0.28 | 1 | 65 | 0 | 1 | 6 | 97.5 | 27.30 |
| 0 | 0 | 0.00 | 0 | 0 | 0 | 0 | 0 | 0.0 | 0.00 |
| 0 | 0 | 0.00 | 0 | 0 | 0 | 0 | 0 | 0.0 | 0.00 |
| Exterior Glass Door | 10 | 0.20 | 1 | 3 | 0 | 6 | 8 | 20.0 | 4.00 |
| Exterior Glass Door | 11 | 0.20 | 4 | 2 | 6 | 6 | 8 | 66.7 | 13.33 |
| | | | | | | | | 0.0 | 0.00 |
| | | | | | | | | 0.0 | 0.00 |
| | | | | | | | | 0.0 | 0.00 |
| | | | | | | | | 0.0 | 0.00 |
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| | | | | | | | | 0.0 | 0.00 |
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| | | | | | | | | | 0.0 | 0.00 |
| | | | | | | | | | 0.0 | 0.00 |
| | | | | | | | | | 0.0 | 0.00 |

*Sum of Vertical Fenestration Area and UA* 610.4 163.98

*Vertical Fenestration Area Weighted U = UA/Area* 0.27

**Overhead Glazing (Skylights)**

| Component Description | Ref. | U-factor | Qt. | Width Feet | Width Inch | Height Feet | Height Inch | Area | UA |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | 0.0 | 0.00 |
| | | | | | | | | 0.0 | 0.00 |
| | | | | | | | | 0.0 | 0.00 |
| | | | | | | | | 0.0 | 0.00 |
| | | | | | | | | 0.0 | 0.00 |
| | | | | | | | | 0.0 | 0.00 |

*Sum of Overhead Glazing Area and UA* 0.0 0.00

*Overhead Glazing Area Weighted U = UA/Area* 0.00

***Total Sum of Fenestration Area and UA*** ***(for heating system sizing calculations)*** 610.4 163.98

## Simple Heating System Size: Washington State

This heating system sizing calculator is based on the Prescriptive Requirements of the 2015 Washington State Energy Code (WSEC) and ACCA Manuals J and S. This calculator will calculate heating loads only. ACCA procedures for sizing cooling systems should be used to determine cooling loads.

The glazing (window) and door portion of this calculator assumes the installed glazing and door products have an area weighted average U-factor of 0.30. The incorporated insulation requirements are the minimum prescriptive amounts specified by the 2015 WSEC.

Please fill out all of the green drop-downs and boxes that are applicable to your project. As you make selections in the drop-downs for each section, some values will be calculated for you. If you do not see the selection you need in the drop-down options, please call the WSU Energy Extension Program at (360) 956-2042 for assistance.

| *Project Information* | *Contact Information* |
|---|---|
| RKK Construction | Richard A Fisher Architects |
| 3406 72nd Pl SE | 1932 1st Ave. Suite 601 |
| Mercer Island, WA | Seattle, WA 98101 |

**Heating System Type:** (●) All Other Systems ( ) Heat Pump

*To see detailed instructions for each section, place your cursor on the word "Instructions".*

### Design Temperature

Instructions — Mercer Island

Design Temperature Difference (ΔT) 45
*ΔT = Indoor (70 degrees) - Outdoor Design Temp*

### Area of Building

**Conditioned Floor Area**

Instructions — Conditioned Floor Area (sq ft) 4,020

**Average Ceiling Height**

Instructions — Average Ceiling Height (ft) 9.5

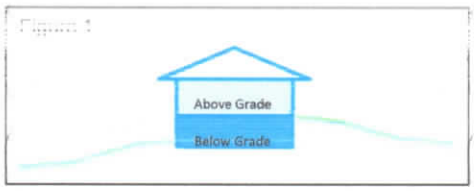
Conditioned Volume 38,190

| | | U-Factor | X | Area | = | UA |
|---|---|---|---|---|---|---|
| **Glazing and Doors** | Instructions | 0.30 | | 610 | | 183.00 |
| **Skylights** | Instructions | 0.50 | | 0 | | --- |
| **Insulation** | | | | | | |
| Attic | Instructions: R-49 | 0.026 | | 1,918 | | 49.87 |
| **Single Rafter or Joist Vaulted Ceilings** | Instructions: R-38 Vented | 0.027 | | 0 | | |
| **Above Grade Walls** *(see Figure 1)* | Instructions: R-21 Intermediate | 0.056 | | 2,958 | | 165.65 |
| Floors | Instructions: R-38 | 0.025 | | 1,918 | | 47.95 |
| **Below Grade Walls** *(see Figure 1)* | Instructions: R-21 Interior | 0.042 | | 0 | | |
| **Slab Below Grade** *(see Figure 1)* | Instructions: Select conditioning | No selection | | 0 | | --- |
| Slab on Grade *(see Figure 1)* | Instructions: R-10 Fully Insulated | 0.300 | | 0 | | |

### Location of Ducts

Instructions — Conditioned Space

**Duct Leakage Coefficient**
1.00




| | | |
|---|---|---|
| **Sum of UA** | 446.47 | |
| **Envelope Heat Load** *Sum of UA X ΔT* | 20,091 | Btu / Hour |
| **Air Leakage Heat Load** *Volume X .0 6 X ΔT X .018* | 18,560 | Btu / Hour |
| **Building Design Heat Load** *Air Leakage + Envelope Heat Loss* | 38,651 | Btu / Hour |
| **Building and Duct Heat Load** *Ducts in unconditioned space: Sum of Building Heat Loss X 1.10* *Ducts in conditioned space: Sum of Building Heat Loss X 1* | 38,651 | Btu / Hour |
| **Maximum Heat Equipment Output** *Building and Duct Heat Loss X 1.40 for Forced Air Furnace* *Building and Duct Heat Loss X 1.25 for Heat Pump* | 54,112 | Btu / Hour |