

Klickitat County Building Department
228 W. Main Street, MS-CH-20
Goldendale, WA 98620
(800) 583-8078 or (509) 773-3706
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2015 International Energy Conservation Code of the State of Washington

(Referred to as the 2015 WSEC for this Handout)

This packet shall be completed and submitted to the Building Department as part of the plan review. Failure to complete the packet may result in delay of plan review.

1. **VIAQ:** Ventilation and Indoor Air Quality (VIAQ) is part of the International Residential Code (IRC). You will need to choose a method of meeting the requirements for whole house ventilation and outdoor air requirements.
2. **WSEC:** Washington State Energy Code (WSEC) has requirements for insulation, doors, windows and energy efficiency. You will need to determine how you are obtaining credits. If choosing a compliance method other than Prescriptive, additional documentation shall be required.
3. **Duct Testing Affidavit:** If applicable, duct testing will be required. A Duct Leakage Affidavit must be completed by a certified testing agency and submitted to the Building Department. **Occupancy of the structure cannot be allowed if this requirement has not been completed.**
4. **Building Air Leakage Testing:** "Blower Door Testing" is required on all new construction. Verification of an air leakage test shall be completed by a certified testing agency and submitted to the Building Department. **Occupancy of the structure cannot be allowed if this requirement has not been completed.**
5. **Insulation Certificate:** The insulation installer shall sign, date and post the certificate in a conspicuous location on the job site. **Certificate shall be completed and posted at the time of inspection.**
6. **Compliance Certificate:** A permanent certificate shall be completed by the builder or registered design professional and posted on a wall in the space where the furnace is located, a utility room, or an approved location inside the building. When located on an electrical panel, the certificate shall not cover or obstruct the visibility of the circuit directory label, service disconnect label, or other required labels. **Certificate must be completely filled out and posted on site at time of final inspection.** This requirement is the responsibility of the builder or designer.

Prescriptive Energy Code Compliance for All Climate Zones in Washington

Project Information

Contact Information

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This project will use the requirements of the Prescriptive Path below and incorporate the the minimum values listed. In addition, based on the size of the structure, the appropriate number of additional credits are checked as chosen by the permit applicant.

Authorized Representative _____ Date _____

| All Climate Zones | | |
|---|----------------------|-----------------------|
| | R-Value ^a | U-Factor ^a |
| Fenestration U-Factor ^b | n/a | 0.30 |
| Skylight U-Factor | n/a | 0.50 |
| Glazed Fenestration SHGC ^{b,e} | n/a | n/a |
| Ceiling ^k | 49 ^l | 0.026 |
| Wood Frame Wall ^{g,m,n} | 21 int | 0.056 |
| Mass Wall R-Value ⁱ | 21/21 ^h | 0.056 |
| Floor | 30 ^q | 0.029 |
| Below Grade Wall ^{c,m} | 10/15/21 int + TB | 0.042 |
| Slab ^d R-Value & Depth | 10, 2 ft | n/a |

*Table R402.1.1 and Table R402.1.3 Footnotes included on Page 2.

Each dwelling unit in a residential building shall comply with sufficient options from Table R406.2 so as to achieve the following minimum number of credits:

- 1. Small Dwelling Unit: 1.5 credits**
Dwelling units less than 1500 square feet in conditioned floor area with less than 300 square feet of fenestration area. Additions to existing building that are greater than 500 square feet of heated floor area but less than 1500 square feet.
- 2. Medium Dwelling Unit: 3.5 credits**
All dwelling units that are not included in #1 or #3. **Exception:** Dwelling units serving R-2 occupancies shall require 2.5 credits.
- 3. Large Dwelling Unit: 4.5 credits**
Dwelling units exceeding 5000 square feet of conditioned floor area.
- 4. Additions less than 500 square feet: .5 credits**

Table R406.2 Summary

| Option | Description | Credit(s) | |
|--------|--|-----------|--------------------------|
| 1a | Efficient Building Envelope 1a | 0.5 | <input type="checkbox"/> |
| 1b | Efficient Building Envelope 1b | 1.0 | <input type="checkbox"/> |
| 1c | Efficient Building Envelope 1c | 2.0 | <input type="checkbox"/> |
| 1d | Efficient Building Envelope 1d | 0.5 | <input type="checkbox"/> |
| 2a | Air Leakage Control and Efficient Ventilation 2a | 0.5 | <input type="checkbox"/> |
| 2b | Air Leakage Control and Efficient Ventilation 2b | 1.0 | <input type="checkbox"/> |
| 2c | Air Leakage Control and Efficient Ventilation 2c | 1.5 | <input type="checkbox"/> |
| 3a | High Efficiency HVAC 3a | 1.0 | <input type="checkbox"/> |
| 3b | High Efficiency HVAC 3b | 1.0 | <input type="checkbox"/> |
| 3c | High Efficiency HVAC 3c | 1.5 | <input type="checkbox"/> |
| 3d | High Efficiency HVAC 3d | 1.0 | <input type="checkbox"/> |
| 4 | High Efficiency HVAC Distribution System | 1.0 | <input type="checkbox"/> |
| 5a | Efficient Water Heating 5a | 0.5 | <input type="checkbox"/> |
| 5b | Efficient Water Heating 5b | 1.0 | <input type="checkbox"/> |
| 5c | Efficient Water Heating 5c | 1.5 | <input type="checkbox"/> |
| 5d | Efficient Water Heating 5d | 0.5 | <input type="checkbox"/> |
| 6 | Renewable Electric Energy | 0.5 | <input type="checkbox"/> |
| | | *1200 kwh | 0.0 |

Total Credits **0.00**

*Please refer to Table R406.2 for complete option descriptions

Table R402.1.1 Footnotes

For SI: 1 foot = 304.8 mm, ci = continuous insulation, int = intermediate framing.

^a R-values are minimums. U-factors and SHGC are maximums. When insulation is installed in a cavity which is less than the label or design thickness of the insulation, the compressed R-value of the insulation from Appendix Table A101.4 shall not be less than the R-value specified in the table.

^b The fenestration U-factor column excludes skylights. The SHGC column applies to all glazed fenestration.

^c "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. "10/13" means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation at the interior of the basement wall. "TB" means thermal break between floor slab and basement wall.

^d R-10 continuous insulation is required under heated slab on grade floors. See R402.2.9.1.

^e There are no SHGC requirements in the Marine Zone.

^f Reserved.

^g Reserved.

^h Reserved.

ⁱ The second R-value applies when more than half the insulation is on the interior of the mass wall.

^j Reserved.

^k For single rafter- or joist-vaulted ceilings, the insulation may be reduced to R-38.

^l Reserved.

^m Int. (intermediate framing) denotes standard framing 16 inches on center with headers insulated with a minimum of R-10 insulation.

Table R402.1.3 Footnote

^a Nonfenestration U-factors shall be obtained from measurement, calculation or an approved source or as specified in Section R402.1.3.

Table 406.2 Energy Credits (2015 Code)

| OPTION | DESCRIPTION | CREDIT(S) | Estimated Cost |
|-----------------|---|-----------|----------------|
| 1a | <p>EFFICIENT BUILDING ENVELOPE 1a: Prescriptive compliance is based on Table R402.1.1 with the following modifications: Vertical fenestration U = 0.28 Floor R-38 Slab on grade R-10 perimeter and under entire slab Below grade slab R-10 perimeter and under entire slab</p> <p>or</p> <p>Compliance based on Section R402.1.4: Reduce the Total UA by 5%.</p> | 0.5 | |
| 1b | <p>EFFICIENT BUILDING ENVELOPE 1b: Prescriptive compliance is based on Table R402.1.1 with the following modifications: Vertical fenestration U = 0.25 Wall R-21 plus R-4 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</p> <p>or</p> <p>Compliance based on Section R402.1.4: Reduce the Total UA by 15%.</p> | 1.0 | |
| 1c | <p>EFFICIENT BUILDING ENVELOPE 1c: Prescriptive compliance is based on Table R402.1.1 with the following modifications: Vertical fenestration U = 0.22 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</p> <p>or</p> <p>Compliance based on Section R402.1.4: Reduce the Total UA by 30%.</p> | 2.0 | |
| 1d ^a | <p>EFFICIENT BUILDING ENVELOPE 1d: Prescriptive compliance is based on Table R402.1.1 with the following modifications: Vertical fenestration U = 0.24</p> | 0.5 | |
| 2a | <p>AIR LEAKAGE CONTROL AND EFFICIENT VENTILATION 2a: Compliance based on R402.4.1.2: Reduce the tested air leakage to 3.0 air changes per hour maximum</p> <p>and</p> <p>All whole house ventilation requirements as determined by Section M1507.3 of the <i>International Residential Code</i> 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.</p> <p>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.</p> | 0.5 | |
| 2b | <p>AIR LEAKAGE CONTROL AND EFFICIENT VENTILATION 2b: Compliance based on Section R402.4.1.2: Reduce the tested air leakage to 2.0 air changes per hour maximum</p> <p>and</p> <p>All whole house ventilation requirements as determined by Section M1507.3 of the <i>International Residential Code</i> shall be met with a heat recovery ventilation system with minimum sensible heat recovery efficiency of 0.70.</p> <p>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.</p> | 1.0 | |

Table 406.2 Energy Credits (2015 Code)

| OPTION | DESCRIPTION | CREDIT(S) | Estimated Cost |
|-----------------|---|-----------|----------------|
| 2c | <p>AIR LEAKAGE CONTROL AND EFFICIENT VENTILATION 2c: Compliance based on Section R402.4.1.2: Reduce the tested air leakage to 1.5 air changes per hour maximum</p> <p>and All whole house ventilation requirements as determined by Section M1507.3 of the <i>International Residential Code</i> shall be met with a heat recovery ventilation system with minimum sensible heat recovery efficiency of 0.85.</p> <p>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.</p> | 1.5 | |
| 3a ^b | <p>HIGH EFFICIENCY HVAC EQUIPMENT 3a: Gas, propane or oil-fired furnace with minimum AFUE of 94%, or Gas, propane or oil-fired boiler with minimum AFUE of 92%</p> <p>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.</p> | 1.0 | |
| 3b ^b | <p>HIGH EFFICIENCY HVAC EQUIPMENT 3b: Air-source heat pump with minimum HSPF of 9.0</p> <p>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.</p> | 1.0 | |
| 3c ^b | <p>HIGH EFFICIENCY HVAC EQUIPMENT 3c: Closed-loop ground source heat pump; with a minimum COP of 3.3</p> <p>or Open loop water source heat pump with a maximum pumping hydraulic head of 150 feet and minimum COP of 3.6</p> <p>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.</p> | 1.5 | |
| 3d ^b | <p>HIGH EFFICIENCY HVAC EQUIPMENT 3d: 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.</p> <p>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.</p> | 1.0 | |
| 4 | <p>HIGH EFFICIENCY HVAC DISTRIBUTION SYSTEM: 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.</p> <p>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.</p> <p>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.</p> <p>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.</p> | 1.0 | |

Table 406.2 Energy Credits (2015 Code)

| OPTION | DESCRIPTION | CREDIT(S) | Estimated Cost |
|--------|---|-----------|----------------|
| 5a | <p>EFFICIENT WATER HEATING 5a: 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.^c 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.</p> | 0.5 | |
| 5b | <p>EFFICIENT WATER HEATING 5b: Water heating system shall include one of the following: Gas, propane or oil water heater with a minimum EF of 0.74 or Water heater heated by ground source heat pump meeting the requirements of Option 3c. 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 central water loop insulated with R-8 minimum pipe insulation. 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.</p> | 1.0 | |
| 5c | <p>EFFICIENT WATER HEATING 5c: Water heating system shall include one of the following: Gas, propane or oil water heater with a minimum EF of 0.91 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 or Electric heat pump water heater with a minimum EF of 2.0 and meeting the standards of NEEA's Northern Climate Specifications for Heat Pump Water Heaters 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.</p> | 1.5 | |
| 5d | <p>EFFICIENT WATER HEATING 5d: 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. 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.</p> | 0.5 | |

Table 406.2 Energy Credits (2015 Code)

| OPTION | DESCRIPTION | CREDIT(S) | Estimated Cost |
|--------|--|-----------|----------------|
| 6 | <p>RENEWABLE ELECTRIC ENERGY:</p> <p>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:</p> <p>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.</p> <p>For wind generation projects designs shall document annual power generation based on the following factors:</p> <p>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> | 0.5 | |

Whole House Ventilation

M1507.1 General. Local exhaust and whole-house mechanical ventilation systems and equipment shall be designed in accordance with this section.

M1507.2 Recirculation of air. Exhaust air from bathrooms and toilet rooms shall not be recirculated within a residence or to another dwelling unit and shall be exhausted directly to the outdoors. Exhaust air from bathrooms and toilet rooms shall not discharge into an attic, crawl space or other areas of the building.

M1507.3.1 System design. Each dwelling unit or guestroom shall be equipped with a ventilation system complying with one of the methods listed below. Compliance is also permitted to be demonstrated through compliance with the International Mechanical Code or ASHRAE Standard 62.2.

M1507.3.2 Control and operation.

1. Location of controls. Controls for all ventilation systems shall be readily accessible by the occupant.
2. Instructions. Operating instructions for whole-house ventilation systems shall be provided to the occupant by the installer of the system.
3. Local exhaust systems. Local exhaust systems shall be controlled by manual switches, dehumidistats, timers, or other approved means.
4. Continuous whole-house ventilation systems. Continuous whole-house ventilation systems shall operate continuously and be equipped with an override control. A "fan on" switch shall be permitted as override control. Controls shall be capable of operating the ventilation system without energizing other energy-consuming appliances. A clearly visible label shall be affixed to the controls that reads "Whole House Ventilation (see operating instructions)".
5. Intermittent whole-house ventilation systems. Intermittent whole-house ventilation systems shall comply with the following:
 - 5.1 They shall be capable of operating intermittently and continuously.
 - 5.2 They shall have controls capable of operating the exhaust fans, forced-air system fans, or supply fans without energizing other energy consuming appliance.
 - 5.3 The system shall be designed so that it can operate automatically based on the type of control timer installed.
 - 5.4 The intermittent mechanical ventilation system shall operate at least one hour out of every four.
 - 5.5 The system shall have a manual control and automatic control, such as a 24-hour clock timer.
 - 5.6 At the time of final inspection, the automatic control shall be set to operate the whole-house fan according to the schedule used to calculate the whole-house fan sizing.
 - 5.7 A label shall be affixed to the control that reads "Whole House Ventilation (see operating instructions)".

M1507.3.2.1 Operating instructions. Installers shall provide the manufacturer's installation, operating instructions, and a whole-house ventilation system operation description.

M1507.3.3 Mechanical ventilation rate. The whole-house mechanical ventilation system shall provide outdoor air to each dwelling unit at a continuous rate of not less than that determined in accordance with Table M1507.3.3(1).

Exception: The whole-house mechanical ventilation system is permitted to operate intermittently where the system has controls that enable operation for not less than 25 percent of each 4 hour segment and the ventilation rate prescribed in Table M1507.3.3(1) is multiplied by the factor determined in accordance with Table M1507.3.3(2).

- Option I:** Whole-house ventilation using exhaust fans (IRC M1507.3.4)
- Option II:** Whole-house ventilation integrated with a forced-air system. (IRC M1507.3.5)
- Option III:** Whole-house ventilation using a supply fan. (IRC M1507.3.6)
- Option IV:** Whole-house ventilation using a heat recovery ventilation system (IRC M1507.3.7)

M1507.3.4.4 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). Where outdoor air supplies are separated from exhaust points by doors, provisions shall be made to ensure air flow by installation of distribution ducts, undercutting doors, installation of grilles, transoms, or similar means. Doors shall be undercut to a minimum of $\frac{1}{2}$ inch above the surface of the finish floor covering.

**TABLE M1507.3.6.2
PRESCRIPTIVE SUPPLY FAN DUCT SIZING**

| Supply Fan Tested CFM at 0.40" w.g. | | |
|--|------------------------------|--------------------------------|
| Specified Volume from Table M1507.3.3(1) | Minimum Smooth Duct Diameter | Minimum Flexible Duct Diameter |
| 50-90 cfm | 4 inch | 5 inch |
| 90-150 cfm | 5 inch | 6 inch |
| 150-220 cfm | 6 inch | 7 inch |
| 250-400 cfm | 7 inch | 8 inch |

M1507.4 Local exhaust fans. Local exhaust shall be provided in each kitchen, bathroom, water closet, laundry room, indoor swimming pool, spa, and other rooms where water vapor or cooking odor is produced. Local exhaust systems shall be designed to have the capacity to exhaust the minimum air flow rate determined in accordance with Table M1507.4.

**TABLE M1507.4
MINIMUM REQUIRED LOCAL EXHAUST RATES FOR
ONE - AND TWO-FAMILY DWELLINGS**

| AREA TO BE EXHAUSTED | EXHAUST RATES |
|---|---|
| Kitchens | 100 cfm intermittent or 25 cfm continuous |
| Bathrooms - toilet rooms Laundry rooms Indoor swimming pools & spas | Mechanical exhaust capacity of 50 cfm intermittent or 20 cfm continuous |

M1507.4.2 Local exhaust controls. Local exhaust systems shall be controlled by manual switches, dehumidistats, timers, or other approved means. Local exhaust system controls shall be readily accessible.

**TABLE M1507.3.3(1)
CONTINUOUS WHOLE-HOUSE MECHANICAL VENTILATION SYSTEM
AIRFLOW RATE REQUIREMENTS**

| DWELLING UNIT FLOOR AREA (square feet) | NUMBER OF BEDROOMS | | | | |
|--|--------------------|-----|-----|-----|-----|
| | 0-1 | 2-3 | 4-5 | 6-7 | >7 |
| | Airflow in CFM | | | | |
| < 1,500 | 30 | 45 | 60 | 75 | 90 |
| 1,501 - 3,000 | 45 | 60 | 75 | 90 | 105 |
| 3,001 - 4,500 | 60 | 75 | 90 | 105 | 120 |
| 4,501 - 6,000 | 75 | 90 | 105 | 120 | 135 |
| 6,001 - 7,500 | 90 | 105 | 120 | 135 | 150 |
| > 7,500 | 105 | 120 | 135 | 150 | 165 |

**TABLE M1507.3.3(2)
INTERMITTENT WHOLE-HOUSE MECHANICAL VENTILATION RATE FACTORS^{a,b}**

| RUN-TIME PERCENTAGE IN EACH 4-HOUR SEGMENT | 25% | 33% | 50% | 66% | 75% | 100% |
|--|-----|-----|-----|-----|-----|------|
| Factor ^a | 4 | 3 | 2 | 1.5 | 1.3 | 1.0 |

a. For ventilation system run time values between those given, the factors are permitted to be determined by interpolation.
b. Extrapolation beyond the table is prohibited.

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 openings for continuous ventilation systems and heat recovery ventilators shall be closed and sealed;
5. Heating and cooling systems, if installed at the time of the test, shall be turned off; and
6. Supply and return registers, if installed at the time of the test, shall be fully open.

Duct Testing Calculator (New Construction)

| | |
|-------------------------|--|
| House address or lot #: | |
| Conditioned Floor Area: | |
| Duct tester location: | |
| Pressure tap location: | |
| Ring (if applicable): | Open <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> |

At Rough-In or Post Construction

| Test Method | Standard ¹ | Calculated Target | Test ¹ CFM ₂₅ |
|---|---|-------------------|-------------------------------------|
| Air Handler Present (Leakage to Exterior or Total Leakage) | ≤ 4 CFM ₂₅ per 100 sf of CFA | | |
| Air Handler <u>not</u> Present (Leakage to Exterior or Total Leakage) | ≤ 3 CFM ₂₅ per 100 sf of CFA | | |

1. Test CFM₂₅ must be equal to or less than the calculated target.

Air Leakage testing Calculator (Blower Door Test)

| | | |
|--|--------------------------|---|
| Conditioned Floor Area: | | Calculated Volume (cubic feet) |
| Ceiling Height (ft) | | 0 |
| Standard | Tested CFM ₅₀ | Calculated Test Result (ACH ₅₀) |
| ≤5.0 ACH ₅₀ (CFM ₅₀ X 60 ÷ conditioned Volume) | | |

Glossary

Rough-In: After installation of the complete air distribution system but before installation of insulation and sheet rock. Allows for access to all duct seams and connections for re-evaluation of seal integrity if standard is not met in initial test.

Post Construction: At or near final inspection. The home must be complete enough to pressurize the home to 25 pa.

Total Leakage: Aggregation of the entire systems duct leakage in a duct test.

Leakage to Exterior: Aggregation of all duct system leaks to the exterior of the CFA in a duct test.

Pascal (pa): Unit of pressure

CFA: Conditioned floor area in square feet

CFM₂₅: Cubic feet per minute of air leakage at 25 pascals of pressure

CFM₅₀: Cubic feet per minute of air leakage at 50 pascals of pressure

Conditioned Volume: Volume of conditioned space (CFA X ceiling height)

ACH₅₀: Air changes per hour at 50 pascals of pressure

Duct Testing Code Language

R403.2.2 Sealing (Mandatory). Ducts, air handlers, and filter boxes shall be sealed. Joints and seams shall comply with either the *International Mechanical Code* or *International Residential Code*, as applicable.

Exceptions:

1. Air-impermeable spray foam products shall be permitted to be applied without additional joint seals.
2. Where a duct connection is made that is partially inaccessible, three screws or rivets shall be equally spaced on the exposed portion of the joint so as to prevent a hinge effect.
3. Continuously welded and locking-type longitudinal joints and seams in ducts operating at static pressures less than 2 inches of water column (500 Pa) pressure classification shall not require additional closure systems.

Ducts shall be leak tested in accordance with WSU RS-33, using the maximum duct leakage rates specified. Duct tightness shall be verified by either of the following:

1. Postconstruction test: Total leakage shall be less than or equal to 4 cfm (113.3 L/min) per 100 square feet (9.29 m²) of conditioned floor area when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. All register boots shall be taped or otherwise sealed during the test. Leakage to outdoors shall be less than or equal to 4 cfm (133.3 L/min) per 100 square feet of conditioned floor area.
2. Rough-in test: Total leakage shall be less than or equal to 4 cfm (113.3 L/min) per 100 square feet (9.29 m²) of conditioned floor area when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the system, including the manufacturer's air handler enclosure. All registers shall be taped or otherwise sealed during the test. If the air handler is not installed at the time of the test, total leakage shall be less than or equal to 3 cfm (85 L/min) per 100 square feet (9.29 m²) of conditioned floor area.

Exception: The total leakage test is not required for ducts and air handlers located entirely within the building thermal envelope. Ducts located in crawl spaces do not qualify for this exception.

R403.2.2.1 Sealed air handler. Air handlers shall have a manufacturer's designation for an air leakage of no more than 2 percent of the design air flow rate when tested in accordance with ASHRAE 193.

Air Leakage Testing Code Language

R402.4.1.2 Testing. The building or dwelling unit shall be tested and verified as having an air leakage rate of not exceeding 5 air changes per hour. Testing shall be conducted with a blower door at a pressure of 0.2 inches w.g. (50 Pascals). Where required by the *code official*, testing shall be conducted by an *approved* third party. A written report of the results of the test shall be signed by the party conducting the test and provided to the *code official*. Testing shall be performed at any time after creation of all penetrations of the *building thermal envelope*. Once visual inspection has confirmed sealing (see Table R402.4.1.1), operable windows and doors manufactured by *small business* shall be permitted to be sealed off at the frame prior to the test.

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 openings for continuous ventilation systems and heat recovery ventilators shall be closed and sealed;
5. Heating and cooling systems, if installed at the time of the test, shall be turned off; and
6. Supply and return registers, if installed at the time of the test, shall be fully open. HVAC ducts supply and return registers shall not be sealed.

Duct Testing Standard (RS-33)

For New and Existing Construction (2015 WSEC)

New Construction

Based on the protocol for “Total Leakage Testing,” or “Leakage Testing to Outdoors” duct leakage in new construction shall not exceed $0.04 \text{ CFM}_{25} \times \text{floor area}$ (in square feet) served by the system for leakage to outdoors or for total leakage when tested post construction. When testing at rough-in, targets should not exceed $0.04 \text{ CFM}_{25} \times \text{floor area}$ (in square feet) for total leakage or $0.03 \text{ CFM}_{25} \times \text{floor area}$ (in square feet) if the air handler is not installed.

Exception:

1. The total leakage or leakage to outdoors test is not required for ducts and air handlers located within the building thermal envelope. Ducts located in vented or conditioned crawl spaces do not qualify for this exception.
2. A maximum of 10 feet of return ducts and 5 feet of supply ducts are allowed to be located outside of the building thermal envelope.

Existing Construction

When a space-conditioning system is altered by the installation or replacement of space-conditioning equipment (including replacement of the air handler, outdoor condensing unit of a split system air conditioner or heat pump, cooling or heating coil, or the furnace heat exchanger), the duct system that is connected to the new or replacement space-conditioning equipment shall be tested. The test results shall be provided to the building official and the homeowner.

Exception 1: Duct systems that are documented to have been previously sealed as confirmed through field verification and diagnostic testing in accordance with procedures in RS-33.

Exception 2: Ducts with less than 40 linear feet in unconditioned spaces.

Exception 3: Existing duct systems constructed, insulated or sealed with asbestos.

Exception 4: Additions of less than 750 square feet of conditioned floor area.

In addition, the following requirements must be met:

1. All testing must be done by a qualified technician. The minimum qualification requirement is documented attendance at a duct testing training course approved by the building official. The following existing training programs are recognized as equivalent to this requirement:
 - a. Northwest ENERGY STAR Homes Program, Performance Testing training for new construction.
 - b. Performance Tested Comfort Systems (PTCS) training for existing homes and new construction.

2. Where required by the code official, testing shall be conducted by an approved third party.
3. Duct systems must be designed, sized, and installed using recognized industry standards and International Residential Code (IRC) requirements, so that calculated heating and/or cooling loads are delivered to each zone.

Total Duct Leakage Test

Testing Procedure Application:

This test is appropriate in new construction when ducts are to be tested at the rough-in stage before the house envelope is intact and can also be done post construction. The test measures the total collected leaks in the system at an induced pressure of 25 Pascals (PA). Compared to the leakage to exterior test, the total leakage test is simpler, but does not discriminate between leakage to inside and outside the heated space; as such, this test is not recommended for homes with complete house envelopes and HVAC systems. In such cases, the leakage to outside test is recommended.

Standard:

- 1) For certification, the measured duct leakage must not exceed ***0.04 CFM₂₅ x floor area*** (in square feet) served by the system **when the air handler is installed.**
- 2) The measured duct leakage at rough-in must not exceed ***0.03 CFM₂₅ x floor area*** (in square feet) served by the system **when the air handler is not installed.**
- 3) If testing post construction, the total leakage must not exceed ***0.04 CFM₂₅ x floor area*** (in square feet) served by the system.

Duct Leakage Affidavit (New Construction)

Permit #: _____

House address or lot number: _____

City: _____ Zip: _____

Cond. Floor Area (ft²): _____ Source (circle one): Plans Estimated Measured

Duct tightness testing is not required. The total leakage test is not required for ducts and air handlers located entirely within the building thermal envelope. Ducts located in crawl spaces do not qualify for this exception.

Air Handler in conditioned space? yes no Air Handler present during test? yes no

Circle Test Method: Leakage to Outside Total Leakage

Maximum duct leakage:

Post Construction, total duct leakage: (floor area x .04) = _____ CFM@25 Pa

Post Construction, leakage to outdoors: (floor area x .04) = _____ CFM@25 Pa

Rough-In, total duct leakage with air handler installed: (floor area x .04) = _____ CFM@25 Pa

Rough-In, total duct leakage with air handler not installed: (floor area x .03) = _____ CFM@25 Pa

Test Result: _____ CFM@25Pa

Ring (circle one if applicable): Open 1 2 3

Duct Tester Location: _____ Pressure Tap Location: _____

I certify that these duct leakage rates are accurate and determined using standard duct testing protocol.

Company Name: _____ Technician: _____

Technician Signature: _____

Date: _____

Phone Number: _____

Duct Leakage Test Results (Existing Construction)

Permit #: _____

House address or lot number: _____

City: _____ Zip: _____

Cond. Floor Area (ft²): _____

Duct tightness testing is not required for this residence per exceptions listed at the end of this document

Test Result: _____ CFM@25Pa

Ring (circle one): Open 1 2 3

Duct Tester Location: _____

Pressure Tap Location: _____

I certify that these duct leakage rates are accurate and determined using standard duct testing protocol

Company Name: _____

Duct Testing Technician: _____

Technician Signature: _____ Date: _____

Phone Number: _____

Washington State Energy Code Reference:

R101.4.3.1 Mechanical Systems: When a space-conditioning system is altered by the installation or replacement of space-conditioning equipment (including replacement of the air handler, outdoor condensing unit of a split system air conditioner or heat pump, cooling or heating coil, or the furnace heat exchanger), the duct system that is connected to the new or replacement space-conditioning equipment shall be tested as specified in RS-33. The test results shall be provided to the building official and the homeowner.

Exceptions:

1. Duct systems that are documented to have been previously sealed as confirmed through field verification and diagnostic testing in accordance with procedures in RS-33.
2. Ducts with less than 40 linear feet in unconditioned spaces.
3. Existing duct systems constructed, insulated or sealed with asbestos.
4. Additions of less than 750 square feet.

2015 WSEC Residential Energy Compliance Certificate

Property Address: _____ Date: ____ / ____ / ____

Conditioned Floor Area: _____

Builder or registered design professional: _____

Signature: _____

R-Values

Ceiling: Vaulted R-____ Floors: Over unconditioned space R-____
 Attic R-____ Slab on grade floor R-____

Walls: Above grade R-____ Doors: _____ R-____
 Below, int. R-____ R-____
 Below, ext. R-____ R-____

U-Factors and SHGC

NFRC rating (or) Windows U-____ SHGC- N/A
 Default rating (Appendix A WSEC 2015) Skylights U-____ SHGC- N/A

Table 406.2 Option(s) _____ Total 406.2 Credits _____

| Heating, Cooling & Domestic Hot Water | | |
|---------------------------------------|------|------------|
| System | Type | Efficiency |
| Heating | | |
| Cooling | | |
| DHW | | |

Duct & Building Air Leakage

All ducts & HVAC in conditioned space (yes / no) Insulation R-____

Air handler present (yes / no)

Test Target _____ CFM@25Pa Test Result _____ CFM@25Pa

Building air leakage target: $ACH_{50} < 5.0$ - Tested leakage: ACH_{50} - _____

Onsite Renewable Energy Electric Power System

System type: _____ Rated annual generation _____ Kwh

2015 WSEC Residential Energy Compliance Certificate

Property Address: _____ Date: ____ / ____ / ____

Conditioned Floor Area: _____

Builder or registered design professional: _____

Signature: _____

R-Values

Ceiling: Vaulted R-____ Floors: Over unconditioned space R-____
 Attic R-____ Slab on grade floor R-____

Walls: Above grade R-____ Doors: _____ R-____
 Below, int. R-____ R-____
 Below, ext. R-____ R-____

U-Factors and SHGC

NFRC rating (or) Windows U-____ SHGC- N/A
 Default rating (Appendix A WSEC 2015) Skylights U-____ SHGC- N/A

Table 406.2 Option(s) _____ Total 406.2 Credits _____

| Heating, Cooling & Domestic Hot Water | | |
|---------------------------------------|------|------------|
| System | Type | Efficiency |
| Heating | | |
| Cooling | | |
| DHW | | |

Duct & Building Air Leakage

All ducts & HVAC in conditioned space (yes / no) Insulation R-____

Air handler present (yes / no)

Test Target _____ CFM@25Pa Test Result _____ CFM@25Pa

Building air leakage target: $ACH_{50} < 5.0$ - Tested leakage: ACH_{50} - _____

Onsite Renewable Energy Electric Power System

System type: _____ Rated annual generation _____ Kwh

Insulation Certificate for Residential New Construction

Permit #: _____

House address or lot number: _____

Walls

Type of insulation: _____

Manufacturer: _____

R-Value: _____

Blown or Sprayed Fiberglass or Cellulose - Walls

R-Value per Inch: _____

Coverage Area: _____

Bag Count: _____

Floor

Type of insulation: _____

Manufacturer: _____

R-Value: _____

Blown or Sprayed Fiberglass or Cellulose - Ceiling

R-Value per Inch: _____

Coverage Area: _____

Bag Count: _____

Flat Ceiling/Attic

Type of insulation: _____

Manufacturer: _____

R-Value: _____

Sprayed Polyurethane Foam (SPF)

Density: _____

Installed Thickness: _____

R-Value of Installed Thickness: _____

Building Component Installed: walls floor ceiling

Single Rafter Joist Vaulted Ceiling

Type of insulation: _____

Manufacturer: _____

R-Value: _____

Insulation Installer:

Company Name: _____ Installer: _____

Installer Signature: _____ Date: _____

Phone Number: _____

Washington State Energy Code Reference <http://www.energy.wsu.edu/Documents/2012%20Res%20Energy.pdf> :

R303.1 Identification. Materials, systems and equipment shall be identified in a manner that will allow a determination of compliance with the applicable provisions of this code.

R303.1.1 Building thermal envelope insulation. An R-value identification mark shall be applied by the manufacturer to each piece of building thermal envelope insulation 12 inches (305 mm) or greater in width. Alternately, the insulation installers shall provide a certification listing the type, manufacturer and R-value of insulation installed in each element of the building thermal envelope. For blown or sprayed insulation (fiberglass and cellulose), the initial installed thickness, settled thickness, settled R-value, installed density, coverage area and number of bags installed shall be listed on the certification. For sprayed polyurethane foam (SPF) insulation, the installed thickness of the areas covered and R-value of installed thickness shall be listed on the certification. The insulation installer shall sign, date and post the certification in a conspicuous location on the job site.

