2012 IECC with Washington State Amendments

Gary Nordeen, Luke Howard, Tanya Beavers
(360) 956-2042
energycode@energy.wsu.edu

Produced with funding from:

[Logos: NEEA, Washington State University]
WSU Energy Program
Building Science Team

Staff provides building science expertise for:

• Residential energy code technical assistance
• Voluntary programs, Northwest ENERGY STAR Homes
• Research and development, Building America
• Community-based upgrade programs
• Industry training and certifications; HERS, BPI, ENERGY STAR, PTCS
WSU Energy Program
Energy Code Support

Technical support provided in WA:
• Training offered throughout WA State
• Phone and email inquiry hotline support
• Energy code compliance tools
• Website
• Technical Advisory Groups (TAGs)
Energy Code Support in WA State

Residential
• Washington State University Energy Program
  • 360–956–2042
  • energycode@energy.wsu.edu
  • www.energy.wsu.edu/code
  • Gary Nordeen, Luke Howard, Tanya Beavers

Non-residential
• Northwest Energy Efficiency Council
  • Lisa Rosenow
  • 206–624–0283
  • wsec@putnamprice.com
  • www.neec.net
Code Development Process

**Agency** – State Building Code Council

**Cycle** – every three years

**Energy Code Technical Advisory Group (TAG)** – 26 individuals who represent the various stakeholders in the construction industry

- SBCC approved transition to 2012 IECC with WA State amendments on Nov 30, 2012.
- Still needs to sit through current legislative session before finalized.

How Did We Get Here?

• 1978 – First Washington State Energy Code

• 1980 – Creation of Northwest Power Planning Council by Congress

• 1983 – First regional Power Plan by NWPPC
  ○ Plan included *Model Conservation Standards* (MCS)

  ○ Halfway to full MCS requirements

• 1991 – Washington State Legislature mandates Energy Code requirements be raised to full MCS levels
What did we get?
1980 to 2008

• From 1980 to 2008 energy efficiency has:
  • Saved more than 4,000 average megawatts

• How much is 4,000 average megawatts?
  • Enough energy to power all of Idaho and Western Montana and a city the size of Eugene (pop. 156,000)
What did we get?
1980 to 2008

• ½ the growth in electricity demand was met from conservation
• 8–10 coal or gas fired generation plants did not have to be built
• 15 million tons less CO2 in 2008 alone
• In 2008 consumers paid $1.8 billion less for electricity—even after paying for conservation programs
2011

• Saved 211 average megawatts
  • Enough electricity for 188,000 homes
  • Saved consumers $3.1 billion in energy costs in 2011 alone
• From 1980 to 2011 conservation has saved 5,000 average megawatts
  • Enough electricity to power ALL of Montana and Idaho
• 50% of the savings come from Washington
• 20% of the savings come from energy codes
Energy efficiency as a resource in the Pacific Northwest, 2012

- Hydropower: 46%
- Energy efficiency: 17%
- Natural gas: 7%
- Coal: 12%
- Nuclear: 3%
- Wind: 6%
- Biomass: 1%
## Code Layout

<table>
<thead>
<tr>
<th>2009 WSEC</th>
<th>2012 WSEC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chapters 1-10</td>
<td>Chapters 1-4 (RE)</td>
</tr>
<tr>
<td>SF, Duplex, Townhouses</td>
<td>SF, Duplex, Townhouses, R-2, R-3, R-4 buildings ≤ 3 stories in height*</td>
</tr>
<tr>
<td>Chapters 11-15</td>
<td>Chapters 1-4 (CE)</td>
</tr>
<tr>
<td>Commercial</td>
<td>All Commercial and R-1. Townhouses, R-2, R-3, R-4 buildings &gt; 3 stories in height*</td>
</tr>
<tr>
<td>R- Multi-Family</td>
<td></td>
</tr>
<tr>
<td>Ch. 10 Default U-Factors</td>
<td>Appendix A</td>
</tr>
<tr>
<td>Ch. 3 Design Temperatures</td>
<td>Appendix B</td>
</tr>
<tr>
<td>Chapter 9 Energy Credits</td>
<td>Table 406.2</td>
</tr>
</tbody>
</table>

*Refer to the International Building Code

See Handout
R101.2 Scope

Residential buildings and their:
  • sites
  • associated systems
  • equipment

This code shall be the maximum and minimum energy code for residential construction in each town, city and county.

This addition was added to the IECC to comply with state law – RCW 19.27A.
R101.4.2 Historic Buildings

No change from WSEC – allows building official to allow alternate requirements that result in reasonable degree of efficiency for buildings of historical significance.
R101.4.3 Additions, Alterations, Renovations or Repairs

Existing ceiling, wall or floor cavities exposed during construction provided that these cavities are filled with insulation.

- 2x4 framed walls insulated to R–15
- 2x6 framed walls insulated to R–21

*WSEC language added for clarification*
R101.4.3 Additions, Alterations, Renovations or Repairs

The building official can allow for less than full compliance if physically impossible and/or economically impractical and:

1. The alteration or repair improves the energy efficiency of the building; or

2. The alteration or repair is energy efficient and is necessary for the health, safety, and welfare of the general public.

No change from WSEC
R101.4.3.1 Mechanical Systems

WSEC language regarding duct testing in existing houses added in its entirety.

- Testing required but sealing is not
- Test results must be recorded on affidavit and presented to homeowner and building department

No change from WSEC
Duct Testing for Existing Construction

• Testing must be completed by certified technician
• Results provided to homeowner and building official on affidavit
• Exceptions:
  • Less than 40 lineal feet of ductwork outside conditioned space (combined supply and return)
  • Ducts containing asbestos
  • Ducts that have previously been tested
  • Ducts in additions less than 750 ft²
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 airtight.
4. Additions of less than 750 square feet.
R101.4.4 Change in Occupancy or Use

Change of use needs to be brought into full compliance.

No change from WSEC
R102.1.1 Above Code Programs

- The Code Official or other authority having jurisdiction shall be permitted to deem a national, state or local energy efficiency program to exceed the energy efficiency required by this code.

- This section of IECC deleted because of minimum–maximum code conflict.
R104.2.1. Wall Insulation Inspection

Wall insulation inspection after all wall insulation is in place and prior to cover.

WSEC language added because it is required by RCW 19.27A
R303.1.1 Insulation Certification

Insulation installers shall provide a certification listing:

- Type
- Manufacturer
- R-value of insulation installed in each element of the building thermal envelope.
R303.1.1.1 Insulation Certification

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.
R303.1.1 Insulation 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.
R303.1.1 Insulation Certification

The insulation installer shall sign, date and post the certification in a conspicuous location on the job site.
Definition: NOMINAL R-VALUE:

The thermal resistance of insulation alone as determined in accordance with the U.S. Federal Trade Commission R-value rule.

www.ftc.gov/bcp/rulemaking/rvalue/index.shtml
R302.2 Exterior Design Conditions

- The heating or cooling outdoor design temperatures shall be selected from Appendix C.

No change from WSEC.

Table 3-1 added as Appendix C.
R303.1.3 Fenestration Product Rating

Exception:
Units without NFRC ratings produced by a small business* may be assigned default U-factors from Table R303.1.3(4) for vertical fenestration.

*See definition of “small business” in Chapter 2 [RE].
R401.2 Compliance

Projects shall comply with Sections identified as “mandatory” and with either:

- Prescriptive
- U–Factor Alternative
- Performance Approach

*In addition, projects shall comply with Section R406 (2009 WSEC Chapter 9).*
R401.2 Tools for Compliance

- Prescriptive – WSU form
- U-Factor Alternative – REScheck or other approved method
- Performance Approach – as required in R405

Check WSU’s Energy Code webpage for compliance tool information as it becomes available: [www.energy.wsu.edu/code](www.energy.wsu.edu/code)
This project will use the requirements of the Prescriptive Path below and incorporate 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** ___________________________

### 1. Small Dwelling Unit: 0.5 points
- Efficient Building Envelope 1a: 0.5
- Efficient Building Envelope 1b: 1.0
- Efficient Building Envelope 1c: 2.0

### 2. Medium Dwelling Unit: 1.5 points
- Air Leakage Control and Efficient Ventilation 2a: 0.5
- Air Leakage Control and Efficient Ventilation 2b: 1.0
- Air Leakage Control and Efficient Ventilation 2c: 1.5

### 3. Large Dwelling Unit: 2.5 points
- High Efficiency HVAC 3a: 0.5
- High Efficiency HVAC 3b: 1.0
- High Efficiency HVAC 3c: 2.0
- High Efficiency HVAC 3d: 1.0

### 4. High Efficiency HVAC Distribution System: 1.0

### 5. Efficient Water Heating: 0.5

### 6. Renewable Electric Energy: 0.5

**Total Credits:** 0.00

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**All Climate Zones**

<table>
<thead>
<tr>
<th>Description</th>
<th>R-Value</th>
<th>U-Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fenestration U-Factor</td>
<td>n/a</td>
<td>0.30</td>
</tr>
<tr>
<td>Skylight U-Factor</td>
<td>n/a</td>
<td>0.50</td>
</tr>
<tr>
<td>Glazed Fenestration SHGC</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Ceiling</td>
<td>49</td>
<td>0.026</td>
</tr>
<tr>
<td>Wood Frame Wall R-Value</td>
<td>21 int</td>
<td>0.056</td>
</tr>
<tr>
<td>Mass Wall R-Value</td>
<td>21/21 int + TB</td>
<td>0.042</td>
</tr>
<tr>
<td>Floor</td>
<td>30</td>
<td>0.029</td>
</tr>
<tr>
<td>Slab R-Value &amp; Depth</td>
<td>10, 2 ft</td>
<td>n/a</td>
</tr>
</tbody>
</table>

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

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Each dwelling unit in one and two-family dwellings and townhouses, as defined in Section 101.2 of the International Residential Code shall comply with sufficient options from Table R406.2 so as to achieve the following minimum number of credits:

- **Small Dwelling Unit:** 0.5 points
  - 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 less than 750 square feet of heated floor

- **Medium Dwelling Unit:** 1.5 points
  - All dwelling units that are not included in #1 or #3, including additions over 750 square feet.

- **Large Dwelling Unit:** 2.5 points
  - Dwelling units exceeding 5000 square feet of conditioned floor area.
### Window, Skylight and Door Schedule

#### Exempt Swinging Door (24 sq. ft. max.)

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
<th>Width</th>
<th>Height</th>
<th>Ref.</th>
<th>U-factor</th>
<th>Qt.</th>
<th>Feet</th>
<th>Inch</th>
<th>Area</th>
<th>UA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

#### Vertical Fenestration (Windows and doors)

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
<th>Width</th>
<th>Height</th>
<th>Ref.</th>
<th>U-factor</th>
<th>Qt.</th>
<th>Feet</th>
<th>Inch</th>
<th>Area</th>
<th>UA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

#### Overhead Glazing (Skylights)

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
<th>Width</th>
<th>Height</th>
<th>Ref.</th>
<th>U-factor</th>
<th>Qt.</th>
<th>Feet</th>
<th>Inch</th>
<th>Area</th>
<th>UA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

### Project Information

#### Contact Information

### Exempt Glazed Fenestration (15 sq. ft. max.)

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
<th>Width</th>
<th>Height</th>
<th>Ref.</th>
<th>U-factor</th>
<th>Qt.</th>
<th>Feet</th>
<th>Inch</th>
<th>Area</th>
<th>UA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

**Sum of Exempt Door and Window Area and UA**: 0.0

**Sum of Vertical Fenestration Area and UA**: 0.0

**Vertical Fenestration Area Weighted U = UA/Area**: 0.0

**Sum of Overhead Glazing Area and UA**: 0.0

**Overhead Glazing Area Weighted U = UA/Area**: 0.0

**Total Sum of Prescriptive Window and Door Area and UA**: 0.0

**Total Sum of Vertical Fenestration Area and UA**: 0.0

**Total Sum of Overhead Glazing Area and UA**: 0.0

See Handout
Simple Heating System Size: Washington State

The heating system sizing calculator is based on the Prescriptive Requirements of the 2012 Washington State Energy Code (WSEC) and ACCA Manuals x and y. This calculator will calculate heating load 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 2012 WSEC.

Please fill out all of the given drop-down 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 selections you need in the drop-down options, please call the VESU Energy Extension Program at (800) 356-2342 for assistance.

**Heating System Type:**

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

**Design Temperature**

- **Design Temperature Difference (°F)**: 53

**Area of Building**

- Conditioned Floor Area: 2,000 sq ft

**Average Ceiling Height**

- Average Ceiling Height (ft): 9.9

**Glazing and Doors**

- **U-Factor X Area**
  - UA: 0.30
  - Area: 180
  - Value: 54

**Skylights**

- **U-Factor X Area**
  - UA: 0.90
  - Area: 92
  - Value: 83

**Insulation**

- **Attic**
  - **U-Factor X Area**
  - UA: 0.026
  - Area: 158
  - Value: 4.1

- **Single Flat or Sloped Vaulted Ceiling**
  - **U-Factor X Area**
  - UA: 0.012
  - Area: 500
  - Value: 13

- **Above Grade Walls from Figure W**
  - **U-Factor X Area**
  - UA: 0.006
  - Area: 158
  - Value: 9

- **Floors**
  - **U-Factor X Area**
  - UA: 0.025
  - Area: 2,000
  - Value: 50

- **Below Grade Walls from Figure W**
  - **U-Factor X Area**
  - UA: 0.009
  - Area: 158
  - Value: 1.4

- **Slab Below Grade from Figure W**
  - **U-Factor X Area**
  - UA: 0.009
  - Area: 158
  - Value: 1.4

- **Slab on Grade from Figure W**
  - **U-Factor X Area**
  - UA: 0.009
  - Area: 158
  - Value: 1.4

**Location of Ducts**

- **Duct Leakage Coefficient**
  - Value: 1.50

**Sum of UA**

- Value: 315.96

**Envelope Heat Load**

- Value: 6,841 Btu/h per floor

**Air Leakage Heat Load**

- Value: 1,050 Btu/h per floor

**Building Design Heat Load**

- Value: 25,389 Btu/h per floor

**Building and Duct Heat Load**

- Value: 25,443 Btu/h per floor

**Maximum Heat Equipment Duty**

- Value: 40,100 Btu/h per floor
R401.3 Certificate

- Posted within 3’ of electrical panel
  - Insulation
  - Windows
  - HVAC efficiency
  - Duct leakage
  - Air leakage

- Certificate is posted at:
  www.energy.wsu.edu/code
Climate Zones

Note that no Counties are listed as Zone 6
### R402.1.1 Prescriptive Requirements

#### TABLE R402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT

<table>
<thead>
<tr>
<th>CLIMATE ZONE</th>
<th>5 AND MARINE 4</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FENESTRATION U-FACTOR</strong></td>
<td>0.30</td>
<td>0.30</td>
</tr>
<tr>
<td><strong>SKYLIGHT U-FACTOR</strong></td>
<td>0.50</td>
<td>0.50</td>
</tr>
<tr>
<td><strong>GLAZED FENESTRATION SHGC</strong></td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td><strong>CEILING R-VALUE</strong></td>
<td>49</td>
<td>49</td>
</tr>
<tr>
<td><strong>WOOD FRAME WALL R-VALUE</strong></td>
<td>21 int</td>
<td>21+5ci</td>
</tr>
<tr>
<td><strong>Mass Wall R-Value</strong></td>
<td>21/21h</td>
<td>21+5h</td>
</tr>
<tr>
<td><strong>FLOOR R-VALUE</strong></td>
<td>30g</td>
<td>30g</td>
</tr>
<tr>
<td><strong>BELOW-GRADE WALL R-VALUE</strong></td>
<td>10/15/21 int + TB</td>
<td>10/15/21 int + TB</td>
</tr>
<tr>
<td><strong>SLAB R-VALUE &amp; DEPTH</strong></td>
<td>10, 2 ft</td>
<td>10, 4 ft</td>
</tr>
</tbody>
</table>

Although the charts in the code still show a Climate Zone 6 remember that all zones have the same requirements
## TABLE R402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT

<table>
<thead>
<tr>
<th>Climate Zone</th>
<th>5,6 and Marine 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fenestration U-factor&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.30</td>
</tr>
<tr>
<td>Skylight&lt;sup&gt;b&lt;/sup&gt; U-factor</td>
<td>0.50</td>
</tr>
<tr>
<td>Glazed Fenestration SHGC&lt;sup&gt;b, e&lt;/sup&gt;</td>
<td>NR</td>
</tr>
<tr>
<td>Ceiling R–Value&lt;sup&gt;k&lt;/sup&gt;</td>
<td>49</td>
</tr>
<tr>
<td>Wooden Frame Wall&lt;sup&gt;g, m, n&lt;/sup&gt; R–Value</td>
<td>21 int</td>
</tr>
<tr>
<td>Mass Wall R–Value&lt;sup&gt;i&lt;/sup&gt;</td>
<td>21/21&lt;sup&gt;h&lt;/sup&gt;</td>
</tr>
<tr>
<td>Floor R–Value</td>
<td>30&lt;sup&gt;g&lt;/sup&gt;</td>
</tr>
<tr>
<td>Below-Grade&lt;sup&gt;c,m&lt;/sup&gt; Wall R–Value</td>
<td>10/15/21 int + TB</td>
</tr>
<tr>
<td>Slab&lt;sup&gt;d&lt;/sup&gt; R–Value &amp; Depth</td>
<td>10, 2 ft</td>
</tr>
</tbody>
</table>

Footnote “K” allows the reduction from R–49 to R–38 for vaulted ceilings.

Footnote “D” requires continuous slab insulation under heated slabs.
### Table 402.1.3
Equivalent U-Factors

<table>
<thead>
<tr>
<th>Climate Zone</th>
<th>5 and Marine 4</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fenestration U-factor</td>
<td>0.30</td>
<td>0.30</td>
</tr>
<tr>
<td>Skylight U-factor</td>
<td>0.50</td>
<td>0.50</td>
</tr>
<tr>
<td>Ceiling U-factor</td>
<td>0.026</td>
<td>0.026</td>
</tr>
<tr>
<td>Wood Frame Wall U-factor</td>
<td>0.056</td>
<td>0.044</td>
</tr>
<tr>
<td>Mass Wall U-factor</td>
<td>0.056</td>
<td>0.044</td>
</tr>
<tr>
<td>Floor U-factor</td>
<td>0.029</td>
<td>0.029</td>
</tr>
<tr>
<td>Below-Grade Wall U-factor</td>
<td>0.042</td>
<td>0.042</td>
</tr>
</tbody>
</table>

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

U–factors in Table 402.1.3 have been modified to reflect the R–values in Table 402.1.1.
R402.1.4 Total UA Alternative

- UA Alternative is formerly known as Component Performance.

- The U-factors for typical construction assemblies are included in Appendix A. Appendix A contains default U-factors from 2009 WSEC Chapter 10.

- Language was added with a 15% maximum glazing area for the target house when using the “Total UA Alternative” (Component Performance). 15% is the glazing percentage in RCW 19.27A.
### UA Alternative

**Building Envelope Trade–Off**

<table>
<thead>
<tr>
<th>Component Performance, R-3 Occupancies</th>
<th>Code Target Values</th>
<th>Proposed Design Values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Area</td>
<td>UA</td>
</tr>
<tr>
<td>Vertical Glazing U = 0.300</td>
<td>330</td>
<td>99.0</td>
</tr>
<tr>
<td>Overhead Glazing U = 0.500</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Doors U = 0.200</td>
<td>42</td>
<td>8.4</td>
</tr>
<tr>
<td>Flat/Vaulted Ceilings U = 0.027</td>
<td>1100</td>
<td>29.7</td>
</tr>
<tr>
<td>Wall (above grade) U = 0.056</td>
<td>2032</td>
<td>113.8</td>
</tr>
<tr>
<td>Floors U = 0.029</td>
<td>1100</td>
<td>31.9</td>
</tr>
<tr>
<td>Slab on Grade F = 0.360</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Below Grade</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2' depth, wall U = 0.042</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>2' depth, slab F = 0.590</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>3.5' depth, wall U = 0.041</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>3.5' depth, slab F = 0.640</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>7' depth, wall U = 0.037</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>7' depth, slab F = 0.570</td>
<td>0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

**Target UA Total**: 282.5

**Proposed UA Total**: 280.6

Target Credits from Chpt. 9: 1.0

Proposed Credits from Chpt. 9: 1.0

Qualifies
Location
- State: Washington
- City: Olympia

Project Type
- New Construction

Building Characteristics
- 1- and 2-Family, Detached
- Conditioned Floor Area: 1344 ft²

Efficiency Packages
- Credits: 0.5 Required, 1.5 Proposed

Project Details (optional)
- Title/Site/Permit:
  - Prototype 1344
  - 123 Easy St
  - Olympia, WA 98506
  - Permit #: 123456
  - Permit Date: 10/1/13
- Owner/Agent:
  - Gary Nordeen
  - WSU
  - 905 Plum St SE
  - Olympia, WA 98504
  - Phone: 360-123-45678
- Designer/Contractor:
  - NWPPC
  - Portland, OR

Notes

Compliance Method: UA Trade-Off

Choose the state in which the building will be located.

See Handout
"Other" means a custom entry has been made.
REScheck Software Version 4.5.0 REVIEW

Compliance Certificate

Project  Prototype 1344

Location: Olympia, Washington
Construction Type: Single-family
Project Type: New Construction
Conditioned Floor Area: 1,344 ft²
Glazing Area: 15%
Climate Zone: 4
Permit Date: 10/1/13
Permit Number: 123456

Construction Site:
123 Easy St
Olympia, WA 98506

Owner/Agent:
Gary Nordeen
WSU
905 Plum St SE
Olympia, WA 98504
360-123-45678

Designer/Contractor:
NWPPC
Portland, OR

Compliance: Passes using UA trade-off

Compliance: 7.8% Better Than Code  Maximum UA: 204  Your UA: 188

The % Better or Worse Than Code Index reflects how close to compliance the house is based on code trade-off rules. It DOES NOT provide an estimate of energy use or cost relative to a minimum-code home.

Envelope Assemblies

<table>
<thead>
<tr>
<th>Assembly</th>
<th>Gross Area</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>or Perimeter</td>
</tr>
<tr>
<td>Ceiling 1: Flat Ceiling or Scissor Truss</td>
<td>1,344</td>
</tr>
<tr>
<td>Wall 1: Wood Frame, 16&quot; o.c.</td>
<td>1,184</td>
</tr>
<tr>
<td>Window 1: Vinyl Frame:Double Pane with Low-E</td>
<td>202</td>
</tr>
<tr>
<td>Door 1: Solid</td>
<td>40</td>
</tr>
<tr>
<td>Floor 1: Other Floor: Over Unconditioned Space</td>
<td>1,344</td>
</tr>
</tbody>
</table>

Additional Efficiency Package(s)

Credits: 0.5 Required  1.5 Proposed

<table>
<thead>
<tr>
<th>Description</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>5b: SHW: Fossil fueled EF &gt;=0.82 or solar/heat pump</td>
<td>1.5</td>
</tr>
</tbody>
</table>
## REScheck Software Version 4.5.0 REVIEW

### Inspection Checklist


Requirements: 0.0% were addressed directly in the REScheck software.

Text in the "Comments/Assumptions" column is provided by the user in the REScheck Requirements screen. For each requirement, the user certifies that a code requirement will be met and how that is documented, or that an exception is being claimed. Where compliance is itemized in a separate table, a reference to that table is provided.

<table>
<thead>
<tr>
<th>Section # &amp; Req.ID</th>
<th>Pre-Inspection/Plan Review</th>
<th>Plans Verified Value</th>
<th>Field Verified Value</th>
<th>Complies?</th>
<th>Comments/Assumptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>103.1, 103.2 [PR1]^1</td>
<td>Construction drawings and documentation demonstrate energy code compliance for the building envelope.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>103.1, 103.2, 403.7 [PR3]^1</td>
<td>Construction drawings and documentation demonstrate energy code compliance for lighting and mechanical systems. Systems serving multiple dwelling units must demonstrate compliance with the IECC Commercial Provisions.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>302.1, 403.6 [PR2]^1</td>
<td>Heating and cooling equipment is sized per ACCA Manual S based on loads calculated per ACCA Manual J or other methods approved by the code official.</td>
<td>Heating: Btu/hr____</td>
<td>Heating: Btu/hr____</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Additional Comments/Assumptions:

See Handout
R402.2.1.1 Loose Insulation in Attics

Loose insulation in attic spaces—
Open-blown or poured loose fill insulation may be used in attic spaces where the slope of the ceiling is not more than 3 feet in 12 and there is at least 30 inches of clear distance from the top of the bottom chord of the truss or ceiling joist to the underside of the sheathing at the roof ridge.

Language from WSEC added for clarity when blowing in attic insulation.
R402.2.7 Floors

R402.2.7 Floors. Floor insulation shall be installed to maintain permanent contact with the underside of the subfloor decking.
R402.2.7 Floors

**R402.2.7 Floors.** Insulation supports shall be installed so spacing is no more than 24 inches on center. Foundation vents shall be placed so that the top of the vent is below the lower surface of the floor insulation.
Exceptions:
When foundation vents are not placed so that the top of the vent is below the lower surface of the floor insulation, a permanently attached baffle shall be installed at an angle of 30° from horizontal, to divert air flow below the lower surface of the floor insulation.

WSEC language added for insulation support requirements.
Exceptions:
Substantial contact with the surface being insulated is not required in enclosed floor/ceiling assemblies containing ducts where full depth insulation is installed between the duct and the exterior surface.
R402.2.8 Basement walls

- Exterior Insulation
  - R–10 Continuous

- Interior Insulation
  - R–15 Continuous

R–21 Cavity (allowed but no recommended)
R402.2.8 Basement walls

Vapor retarders below grade are not recommended

R-15 Batt

R-5 Foam

R702.7 Vapor retarders. Class I or II vapor retarders are required on the interior side of frame walls in Climate Zones 5, 6, 7, 8 and Marine 4.

Exceptions:
1. Basement walls.
2. Below grade portion of any wall.
3. Construction where moisture or its freezing will not damage the materials.

2012 INTERNATIONAL RESIDENTIAL CODE®
R402.2.9.1 Radiant slabs (Mandatory)

The entire area of a radiant slab shall be thermally isolated from the soil with a minimum of R–10 insulation.
Unvented crawl spaces are not prescriptively allowed.
R402.2.12 Sunroom insulation
R402.3.5 Sunroom $U$-factor

These sections deleted in their entirety.

These sections deleted. Less stringent than the WSEC.
R402.4.1.2 Air Leakage Testing

Air leakage testing based on “air changes per hour” and not “specific leakage area”.

The IECC maximum leakage rate is 3 ACH\textsubscript{50}.

This was changed to 5 ACH\textsubscript{50} for WA.
R402.4.1.2 Air Leakage Testing

- Blower door testing required for all new construction
- Results reported on certificate
- Home must not exceed maximum leakage rate
  \[ 5.0 \text{ ACH}_{50} = \text{SLA} .00027 \]
R402.4.1.2 Air Leakage Testing

• Test done in closed house condition
• Depressurize house to 50 Pascals
• Air flow through the fan = air flow through leaks in the building envelope
• Convert CFM to ACH50
• Who can test?
How to Calculate $\text{ACH}_{50}$

- Determine leakage rate of house with blower door (CFM @ 50 pascals)
- Calculate to volume of the house ($\text{ft}^3$)

$$\text{ACH}_{50} = \frac{(\text{CFM} \times 60)}{\text{Volume}}$$
How to Calculate $\text{ACH}_{50}$

- 2,000 $\text{Ft}^2$ house
- $\text{Volume} = 16,000 \text{ Ft}^3 \times (2,000 \times 8)$
- Blower door CFM = 1300 CFM
  - $\text{ACH}_{50} = (\text{CFM} \times 60) \div \text{Volume}$
  - $\text{ACH}_{50} = (1300 \times 60) \div 16,000$
  - $\text{ACH}_{50} = 78,000 \div 16,000$
  - $\text{ACH}_{50} = 4.8$
R403.1.2 Heat Pump Supplementary Heat (Mandatory)

All heat pumps installed under this section shall include the capability to lock out the supplementary heat based on outdoor temperature. This control shall have a maximum setting of 40° F. At final inspection, the lock out control shall be set to 35° F or less.

WSEC language added for clarity. IECC does not cite outdoor temperatures.
Ducts or portions thereof located completely inside the building thermal envelope. Ducts located in crawl spaces do not qualify for this exception.
R403.2.2 Duct Testing (Mandatory)

Duct testing required in all new construction

- Maximum leakage rates are 4% of the conditioned floor area
- Same rate for total leakage and leakage to exterior
- Testing done by certified technician
- Results documented on affidavit
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@25 Pa

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: __________________________
Ducts

• Installation of ducts in exterior walls, floor or ceilings cannot displace required insulation
• Building cavities cannot be used as ducts
R403.4.2 Hot Water Pipe Insulation (Prescriptive)

This IECC section deleted in its

IECC language deleted to minimize confusion. All hot water pipes are required to be insulated to $R=3$ (WSR 13-23-095 EMERGENCY RULE)
403.4.3 Electric Water Heater Insulation

All electric water heaters in unheated spaces or on concrete floors shall be placed on an incompressible, insulated surface with a minimum thermal resistance of R−10.

WSEC language added for water heaters installed in unheated spaces or on slabs.
R404.1 Lighting Equipment (Mandatory)

A minimum of 75 percent of the lamps in permanently installed lighting fixtures shall be high-efficacy lamps.
R404.2 Exterior Lighting

Luminaires providing outdoor lighting and permanently mounted to a residential building or to other buildings on the same lot shall be high efficacy luminaires.

**EXCEPTIONS:**

Permanently installed outdoor luminaires that are not high efficacy shall be allowed provided they are controlled by a motion sensor(s) with integral photocontrol photosensor.

Permanently installed luminaires in or around swimming pools, water features
Residential Rooftop Solar PV Systems

- Installation of residential rooftop solar photovoltaic systems just got easier and less expensive!
Residential Rooftop Solar PV Systems

- What is a solar rooftop solar PV system?
  - A system that converts solar radiation (sunlight) into usable direct current (DC) electricity

- A system will include
  - Solar modules
  - Inverter(s) to change direct current to alternating current
  - Attachment hardware
What has changed to make installations easier?

- The SBCC approved a change to IRC Section M2302 effective July 1, 2014
  - This change allows the installation of residential rooftop solar systems meeting specific criteria without the need for an engineering analysis.
  - Engineering costs can add an additional cost of $500 – $2500+
  - Additional project wait times could be up to 8 weeks
What exempts a PV system from engineering?

- The solar photovoltaic panel system shall be designed for the wind speed of the local area, and shall be installed per the manufacturer's specifications.
- The ground snow load does not exceed 70 pounds per square foot.
What exempts a PV system from engineering?

- The total dead load of modules, supports, mountings, raceways, and all other appurtenances weigh no more than four pounds per square foot.
  - Total weight of PV modules and rails / total surface area of the modules
What exempts a PV system from engineering?

- Photovoltaic modules are not mounted higher than 18 inches above the surface of the roofing to which they are affixed.
What exempts a PV system from engineering?

- Supports for solar modules are to be installed to spread the dead load across as many roof framing members as needed, so that no point load exceeds 50 pounds.
Does this rule exempt solar PV from permits?

- No. You will need:
  - A building permit but some jurisdictions exempt solar PV projects from needing a building permit
  - An electrical permit issued by the jurisdiction or from L&I
  - Fire code requirements must be met
### Checklists

**Building Permit Checklist**

#### OVER-THE-COUNTER BUILDING PERMIT CHECKLIST FOR RESIDENTIAL SOLAR PHOTOVOLTAIC SYSTEMS: ROOFTOP MOUNTED

Contractors can apply for an Over-The-Counter (OTC) permit where the PV system meets the requirements listed in this Checklist. All project plans and supporting documentation must be provided on site for the inspector.

---------- TO BE COMPLETED BY APPLICANT ----------

1. **Project Information**
   - **Property Owner Name:**
   - **Project Address:**
   - **Parcel #:**
   - **City:**
   - **State:**
   - **ZIP:**
   - **Day Phone:**
   - **Contractor Name:**
   - **Contractor License #:**
   - **Contractor Day Phone:**
   - **PV system description (include manufacturer and model # of major equipment):**

2. **Determine if your project qualifies for expedited permitting:**

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>2.</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>3.</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>4.</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>5.</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>6.</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>7.</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>8.</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>9.</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>10.</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
</tbody>
</table>
Checklists

OVER-THE-COUNTER ELECTRICAL PERMIT CHECKLIST FOR RESIDENTIAL SOLAR PHOTOVOLTAIC SYSTEMS

Contractors can apply for an Over-The-Counter (OTC) permit where the PV system meets the requirements listed in this Checklist and uses a template electrical diagram provided by the City or other approved diagram. All project plans and supporting documentation must be provided on site for the inspector.

TO BE COMPLETED BY APPLICANT

1. Project Information

<table>
<thead>
<tr>
<th>Property Owner Name:</th>
<th>Click here to enter text</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Address:</td>
<td>Click here to enter text</td>
</tr>
<tr>
<td></td>
<td>City: Click here to enter text</td>
</tr>
<tr>
<td></td>
<td>State: Click here to enter text</td>
</tr>
<tr>
<td></td>
<td>ZIP: Click here to enter text</td>
</tr>
<tr>
<td>Day Phone:</td>
<td>Click here to enter text</td>
</tr>
<tr>
<td>Contractor Name:</td>
<td>Click here to enter text</td>
</tr>
<tr>
<td>Contractor License #:</td>
<td>Click here to enter text</td>
</tr>
<tr>
<td>Contractor Day Phone:</td>
<td>Click here to enter text</td>
</tr>
<tr>
<td>PV system description (Include manufacturer and model# of major equipment):</td>
<td>Click here to enter text</td>
</tr>
</tbody>
</table>

2. Determine if your project qualifies for an Over-the-Counter electrical permit

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>PV modules, inverters, and combiner boxes are identified for use in PV systems.</td>
<td>□ □</td>
</tr>
<tr>
<td>2.</td>
<td>The inverters are listed and labeled in accordance with UL 1741 and are listed for utility interaction. [WAC 51-51 M2902.4]</td>
<td>□ □</td>
</tr>
<tr>
<td>3.</td>
<td>The AC interconnection point is on the load side of service disconnect. [NEC 690.64(B)]</td>
<td>□ □</td>
</tr>
<tr>
<td>4.</td>
<td>The system meets all current NEC, City and Washington Cities Electrical Code requirements.</td>
<td>□ □</td>
</tr>
<tr>
<td>5.</td>
<td>For Split-Phase modules the AC interconnection must be one of the six service disconnects.</td>
<td>□ □</td>
</tr>
<tr>
<td>6.</td>
<td>Maximum load added to the panelboard is based on the rating of the panelboard bus/main OCPD combination. Maximum inverter OCPD may be no greater than 120% of the panelboard bus rating minus the panelboard main OCPD rating in accordance with NEC 70.65.12(D)(2)(3)(b). Acceptable combinations include (check combination that applies);</td>
<td>□ □</td>
</tr>
<tr>
<td>225 amp bus/200 amp main OCPD - 12,440 watts, maximum 70 amp inverter OCPD.</td>
<td>□</td>
<td></td>
</tr>
<tr>
<td>225 amp bus/225 amp main OCPD - 8,640 watts, maximum 45 amp inverter OCPD.</td>
<td>□</td>
<td></td>
</tr>
<tr>
<td>200 amp bus/200 amp main OCPD - 7,860 watts, maximum 40 amp inverter OCPD.</td>
<td>□</td>
<td></td>
</tr>
<tr>
<td>150 amp bus/150 amp main OCPD - 5,760 watts, maximum 30 amp inverter OCPD.</td>
<td>□</td>
<td></td>
</tr>
<tr>
<td>125 amp bus/125 amp main OCPD - 4,800 watts, maximum 25 amp inverter OCPD.</td>
<td>□</td>
<td></td>
</tr>
</tbody>
</table>
Table 406.2 Energy Credits

- All new construction must develop credits from Table 406.2 based on size of dwelling unit.
## Table 406.2 Energy Credits

<table>
<thead>
<tr>
<th>Required Credits</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Houses &lt; 1500 ft²</td>
<td>0.5</td>
</tr>
<tr>
<td>• 300 ft² max. glazing</td>
<td></td>
</tr>
<tr>
<td>• Additions 750 ft²</td>
<td></td>
</tr>
<tr>
<td>Houses ≥ 1500 ft² – 5,000 ft²</td>
<td>1.5</td>
</tr>
<tr>
<td>Houses &gt; 5,000 ft²</td>
<td>2.5</td>
</tr>
</tbody>
</table>
Table 406.2 Energy Credits

- Improvements to building envelope
  - Credits range from .5 to 2.0 credits
- Tighter building with efficient ventilation
  - Credits range from .5 to 1.5 credits
- High Efficiency HVAC
  - Credits range from .5 to 2.0 credits
- Mini Split
  - 1 credit
- All HVAC equipment and ducts inside
  - 1 credit
Table 406.2 Energy Credits

- Efficient water heating
  - Credits range from .5 to 1.5 credits
- Renewable electric energy
  - Credits range from .5 to 3.0 credits