



2009 Washington Energy Code

Residential Section

The Most Significant Changes



101.3.2.5

Alterations: Building Envelope

- ❖ All alterations, repairs and additions to existing buildings must comply with code;
- ❖ Sets out minimum R-value of insulation for any framing cavities exposed during the repair, which must be filled to their full depth.
 - ❖ 2x4 walls must be insulated to R-15
 - ❖ 2x6 walls must be insulated to R-21



101.3.2.6

Alterations: Mechanical Systems

Temporary revision for furnace replacement:
The contractor is required to test the system and provide the test results to the building official and the homeowner. It is up to the homeowner to decide if they want to seal their duct system.

This code change is valid until March 19, 2011, during which time it is expected the SBCC will enter into permanent rulemaking.

105.4 Certificate

- ❖ Posted within 3' of electrical panel, listing:
 - ❖ Insulation R-Values
 - ❖ Window U-Factors
 - ❖ HVAC type and efficiency
 - ❖ Duct Leakage rates
 - ❖ Air Leakage/blower door

- ❖ Sample certificate posted at:
 - www.energy.wsu.edu/code

Property Address: _____			
Conditioned Floor Area _____		Date ____/____/____	
Building or registered design professional : _____			
<i>R-VALUES</i>			
Ceiling:		Floors:	
Vaulted	R-_____	Over unconditioned space	R-_____
Attic	R-_____	Slab on grade floor	R-_____
Walls:		Perimeter depth/full slab _____	
Above grade (std/int/adv)	R-_____	Ext. opaque door assembly	R-_____
Below grade, interior	R-_____		R-_____
Below grade, exterior	R-_____		R-_____
<i>U-FACTORS and SHGC</i>			
NRFC weighted rating (or)	Windows	U-_____	SHGC-_____
Default weighted rating <small>(Chapter 10 WSEC 2009)</small>	Skylights	U-_____	SHGC-_____
<i>HEATING, COOLING & SERVICE WATER HEATING</i>			
System	Type	Efficiency	Inside conditioned space
Heating			(yes/no)
Cooling			(yes/no)
DHW			(yes/no)
<i>Duct & Building Air Leakage</i>			
All ducts located within conditioned space (yes/no)		Insulation R-_____	
Test Method: ___ Total leakage ___ Leakage to exterior ___ Air handler present			
Test Target _____ CFM@25Pa		Test Result _____ CFM@25Pa	
Building air leakage target: SLA<0.00030		Building tested air leakage: SLA=_____	
<i>ONSITE RENEWABLE ENERGY ELECTRIC POWER SYSTEM</i>			
System type: _____		Rated annual generation _____ Kwh	
<i>The appropriate section of this certificate shall be updated whenever modifications are made to the building</i>			

302.1

Exterior Design Conditions

- ❖ Requires system sizing for heating or cooling design temperatures be selected from new Table 3-1
- ❖ Lists 100+ locations in Wash.
- ❖ Up to 150% of design still allowable

TABLE 3-1
OUTDOOR DESIGN TEMPERATURES

<u>Location</u>	<u>Outdoor Design Temp. (in °F) (heating)</u>	<u>Outdoor Design Temp. (in °F) (cooling)</u>
<u>Aberdeen 20 NNE</u>	<u>25.0</u>	<u>83</u>
<u>Anacortes</u>	<u>24.0</u>	<u>72</u>
<u>Anatone</u>	<u>-4.0</u>	<u>89</u>
<u>Auburn</u>	<u>25.0</u>	<u>84</u>
<u>Battleground</u>	<u>19.0</u>	<u>91</u>
<u>Bellevue</u>	<u>24.0</u>	<u>83</u>
<u>Bellingham 2 N</u>	<u>19.0</u>	<u>78</u>
<u>Blaine</u>	<u>17.0</u>	<u>73</u>
<u>Bremerton</u>	<u>29.0</u>	<u>83</u>
<u>Burlington</u>	<u>19.0</u>	<u>77</u>
<u>Chehalis</u>	<u>21.0</u>	<u>87</u>

Full table shown in code



Building Envelope: Three Paths to Compliance

- ❖ **Chapter 4 – Systems Analysis**
 - ❖ Requires modeling software
- ❖ **Chapter 5 – Component Performance**
 - ❖ Whole building approach allows U factor trades to meet Target UA
- ❖ **Chapter 6 - Prescriptive**
 - ❖ Establishes requirements for each component of building envelope



Chapter 4

Systems Analysis

- ❖ **Same procedure as 2006 Code**
 - ❖ **Model Target (Code) house**
 - ❖ **Model Proposed house**
 - ❖ **Proposed house must be at least 8% more efficient than the Target house to be in 'compliance'**
 - ❖ **Target (Code) House is a similar building whose enclosure elements and energy-consuming systems are designed in accordance with Chapter 5**
 - ❖ **Requires use of whole house modeling software**



Chapter 5

Component Performance

- ❖ This prescriptive path establishes the requirements for each component of the building envelope and mechanical systems and also requires Chapter 9 additional credit.
- ❖ Compliance requires use of Component Performance Worksheet
 - ❖ Free download at www.energy.wsu.edu/code
 - ❖ “CP Worksheet” is envelope only analysis tool

502.1.4.5 Roof/Ceiling Insulation

- ❖ When two or more layers of foam insulation are installed, vertical joints must be staggered.





502.1.6.3 ROOF/CEILINGS

Ventilated Attics


- ❖ **New exception for unventilated attics if all five of the listed conditions are met**
 - ❖ **Space is completely contained within thermal envelope**
 - ❖ **No interior vapor retarders are installed on the ceiling side**
 - ❖ **Vented air space for wood shingles or shakes**
 - ❖ **Air impermeable insulation must be/have vapor retarder**
 - ❖ **Options (3) for application of insulation depending on air permeability**

502.4.5

Building Air Leakage Testing

- ❖ Air leakage testing required for new houses
 - ❖ Exception for additions less than 750 sq. feet
- ❖ Maximum leakage allowed: .00030 SLA (Specific Leakage Area)
- ❖ Results recorded on required certificate
- ❖ When required by building official, test conducted in presence of department staff





503.10.1

Ducts

- ❖ **Installation of ducts in exterior walls, floors or ceilings cannot displace required envelope insulation.**
- ❖ **Building cavities cannot be used as ducts.**

503.10.2 and 503.10.3 Duct Testing and Sealing

- ❖ **Ducts located outside the conditioned space must be sealed and tightness verified by leakage testing per Section 503.10.3 and meet maximum leakage rates**



505.1

Interior Lighting

- ❖ **Minimum 50% of all indoor luminaires (fixtures) shall be high efficacy**
 - ❖ **Exception: Lighting that complies with the Prescription Lighting Option in Section 1520 or the Lighting Power Allowance Option in Section 1530**
 - ❖ **The wattage of line voltage incandescent or tungsten-halogen luminaires not containing permanently installed ballasts shall be the maximum labeled wattage of the luminaire.**





505.2 Exterior Lighting

- ❖ Requires high efficacy lighting for all lighting attached to the building
- ❖ High Efficacy Luminaire is defined in Chapter 2. Requires a pin based compact florescent fixture
 - ❖ Exception: a motion sensor + photo daylight control may be used.

**TABLE 5-1
TARGET COMPONENT VALUES FOR SINGLE-FAMILY RESIDENTIAL**

Component	Climate Zone	
	1	2
Glazing % Floor Area	15%	15%
Vertical Glazing U-Factor	U = 0.30	U = 0.30
Overhead Glazing U-Factor	U = 0.50	U = 0.50
Doors	U = 0.200	U = 0.200
Ceilings	U = 0.027	U = 0.027
Walls	U = 0.056	U = 0.056
Floors	U = 0.029	U = 0.029
Slab on Grade	F = 0.36	F = 0.36
Below Grade		
Wall R-Value	R-21	R-21
2' Depth: Walls Slab	U = 0.042 F = 0.59	U = 0.042 F = 0.59
3.5' Depth: Walls Slab	U = 0.041 F = 0.64	U = 0.041 F = 0.64
7' Depth: Walls Slab	U = 0.037 F = 0.57	U = 0.037 F = 0.57

Log and solid timber walls that have a minimum average thickness of 3.5" in spaces with space heating by "other fuels" are exempt from wall target UA and proposed UA calculations.



602.2 Building Envelope Requirements - Exterior Walls

New provision for spray/blown insulation:

- ❖ 4. 2 x 6 framed and insulated to full depth with spray applied or blown insulation having a minimum R-value of 3.6 per inch of thickness.**

**TABLE 6-1
PRESCRIPTIVE REQUIREMENTS^{0,1} FOR SINGLE-FAMILY RESIDENTIAL
CLIMATE ZONE 1**

Option	Glazing Area ¹⁰ , % of Floor	Glazing U-Factor		Door ⁹ U-Factor	Ceiling ²	Vaulted Ceiling ³	Wall ¹² Above Grade	Wall• int ⁴ Below Grade	Wall• ext ⁴ Below Grade	Floor ⁵	Slab ⁶ on Grade
		Vertical	Overhead ¹¹								
I.	13%	0.34	0.50	0.20	R-49 or R-38 adv	R-38	R-21 int ⁷	R-21 TB	R-10	R-30	R-10 2'
II.*	25%	0.32	0.50	0.20	R-49 or R-38 adv	R-38	R-21 int ⁷	R-21 TB	R-10	R-30	R-10 2'
III.	Unlimited	0.30	0.50	0.20	R-49 or R-38 adv	R-38	R-21 int ⁷	R-21 TB	R-10	R-30 / U=0.029	R-10 2'

* Reference Case

1. Minimum requirements for each option listed. For example, if a proposed design has a glazing ratio to the conditioned floor area of 13%, it shall comply with all of the requirements of the 15% glazing option (or higher). Proposed designs which cannot meet the specific requirements of a listed option above may calculate compliance by Chapters 4 or 5 of this Code.
2. Requirement applies to all ceilings except single rafter or joist vaulted ceilings complying with note 3. 'Adv' denotes Advanced Framed Ceiling.
3. Requirement applicable only to single rafter or joist vaulted ceilings.
4. Below grade walls shall be insulated either on the exterior to a minimum level of R-10 continuous, or on the interior as a framed wall. Exterior insulation installed on below grade walls shall be a water resistant material, manufactured for its intended use, and installed according to the manufacturer's specifications. See Section 602.2.
5. Floors over crawl spaces or exposed to ambient air conditions.
6. Required slab perimeter insulation shall be a water resistant material, manufactured for its intended use, and installed according to manufacturer's specifications. See Section 602.4. For slabs inside a foundation wall, the insulation shall be installed to provide a thermal break (TB) between the slab edge and the foundation. Monolithic slabs shall include insulation, installed outside the foundation wall, and shall extend downward from the top of the slab for a minimum distance of 24 inches or downward and then horizontally for a minimum combined distance of 24 inches. Monolithic slabs shall also include R-10 insulation under the non-load-bearing portions of the slab.
7. Int. denotes standard framing 16 inches on center with headers insulated with a minimum of R-10 insulation.
8. Reserved.
9. Doors, including all fire doors, shall be assigned default U-factors from Table 10-6C.
10. Where a maximum glazing area is listed, the total glazing area (combined vertical plus overhead) as a percent of gross conditioned floor area shall be less than or equal to that value. Overhead glazing with U-factor of U=0.35 or less is not included in glazing area limitations.
11. Overhead glazing shall have U-factors determined in accordance with NFRC 100 or as specified in Section 502.1.5.
12. Log and solid timber walls with a minimum average thickness of 3.5" are exempt from this insulation requirement.

**TABLE 6-2
PRESCRIPTIVE REQUIREMENT S^{0,1} FOR SINGLE-FAMILY RESIDENTIAL
CLIMATE ZONE 2**

Option	Glazing Area ¹⁰ % of Floor	Glazing U-Factor		Door ⁹ U-Factor	Ceiling ²	Vaulted Ceiling ³	Wall ¹² Above Grade	Wall• int ⁴ Below Grade	Wall• ext ⁴ Below Grade	Floor ⁵	Slab ⁶ on Grade
		Vertical	Overhead ¹¹								
I.	12%	0.32	0.50	0.20	R-49 or R-38 adv	R-38	R-21 int ⁷	R-21 TB	R-12	R-30	R-10 2'
II.*	15%	0.32	0.50	0.20	R-49 or R-38 adv	R-38	R-19 + R-5	R-21 TB	R-12	R-30	R-10 2'
III.	Unlimited	0.30	0.50	0.20	R-49 or R-38 adv	R-38	R-19 + R-5	R-21 TB	R-12	R-30	R-10 2'

* Reference Case

0. Nominal R-values are for wood frame assemblies only or assemblies built in accordance with Section 601.1.
1. Minimum requirements for each option listed. For example, if a proposed design has a glazing ratio to the conditioned floor of 13%, it shall comply with all of the requirements of the 15% glazing option (or higher). Proposed designs which cannot meet specific requirements of a listed option above may calculate compliance by Chapters 4 or 5 of this Code.
2. Requirement applies to all ceilings except single rafter or joist vaulted ceilings complying with note 3. 'Adv' denotes Advanced Framed Ceiling.
3. Requirement applicable only to single rafter or joist vaulted ceilings.
4. Below grade walls shall be insulated either on the exterior to a minimum level of R-12 continuous, or on the interior as a framed wall. Exterior insulation installed on below grade walls shall be a water resistant material, manufactured for its intended use, and installed according to the manufacturer's specifications. See Section 602.2.
5. Floors over crawl spaces or exposed to ambient air conditions.
6. Required slab perimeter insulation shall be a water resistant material, manufactured for its intended use, and installed according to manufacturer's specifications. See Section 602.4. For slabs inside a foundation wall, the insulation shall be installed to provide a thermal break (TB) between the slab edge and the foundation. Monolithic slabs shall include insulation, installed outside the foundation wall, and shall extend downward from the top of the slab for a minimum distance of 24 inches or downward and then horizontally for a minimum combined distance of 24 inches. Monolithic slabs shall also include R-10 insulation under the non-load-bearing portions of the slab.
7. Int. denotes standard framing 16 inches on center with headers insulated with a minimum of R-10 insulation.
8. Reserved.
9. Doors, including all fire doors, shall be assigned default U-factors from Table 10-6C.
10. Where a maximum glazing area is listed, the total glazing area (combined vertical plus overhead) as a percent of gross conditioned floor area shall be less than or equal to that value. Overhead glazing with U-factor of U=0.35 or less is not included in glazing area limitations.
11. Overhead glazing shall have U-factors determined in accordance with NFRC 100 or as specified in Section 502.1.5.
12. Log and solid timber walls with a minimum average thickness of 3.5" are exempt from this insulation requirement.



Climate Zone 2

Alternative 1

- ❖ **Glazing: U-.30 (weighted average)**
- ❖ **OH Glazing: U-.50**
- ❖ **Glazing percentage: 15%**
- ❖ **Doors: U-.20**
- ❖ **Walls: R-21 INT (insulated headers)**
- ❖ **Floors: R-30**
- ❖ **Flat ceilings and vaults: R-49**



Climate Zone 2

Alternative 2

- ❖ **Glazing: U-.28 (weighted average)**
- ❖ **OH Glazing: U-.50**
- ❖ **Glazing percentage: 18%**
- ❖ **Doors: U-.20**
- ❖ **Walls: R-21 INT (insulated headers)**
- ❖ **Floors: R-38**
- ❖ **Flat ceilings and vaults: R-60 ADV**



Climate Zone 2

Alternative 3

- ❖ **Glazing: U-.28 (weighted average)**
- ❖ **OH Glazing: U-.50**
- ❖ **Glazing percentage: 20%**
- ❖ **Doors: U-.20**
- ❖ **Walls: R-35 (2 pound foam in cavity)**
- ❖ **Floors: R-38**
- ❖ **Flat ceilings and vaults: R-49 ADV**



Chapter 9

Energy Credits

- ❖ **Dwelling units must comply with all provisions of one of the three building envelope compliance methods:**
 - ❖ **Prescriptive – Chapter 6**
 - ❖ **Component Performance – Chapter 5**
 - ❖ **Systems Analysis – Chapter 4**
- ❖ **Except for homes developed under Chapter 4 (Systems Analysis), all homes must adopt an additional 1 NET credit from Table 9-1**
- ❖ **Chapter 9 requires obtaining 1 NET credit from a list of options.**



Chapter 9

Energy Credits – Category 1

- ❖ **High Efficiency Heating Equipment/Distribution**
 - ❖ 92% gas or oil or 8.5 heat pump – 1 credit
 - ❖ Ground source heat pump (3.3 COP) – 2 credits
 - ❖ Zonal electric heat – add ductless heat pump – 1 credit
 - ❖ Heating and cooling inside conditioned space – 1 credit



Chapter 9

Energy Credits – Category 2

❖ Efficiency Building Envelope

- ❖ Table 6-1 plus .28 windows, R-38 floors - .5 credit
- ❖ Table 6-1 plus .25 windows, R21+R-4 walls, R-38 floor – 1 credit
- ❖ Table 6-1 plus .22 windows, R-21+R12 walls, R-38 floor – 2 credits



Chapter 9

Energy Credits – Category 3

- ❖ **Air Leakage Control**
 - ❖ Leakage test at .00020 SLA + heat recovery ventilation system - .5 credit
 - ❖ Leakage test at .00015 SLA + heat recovery ventilation system – 1 credit



Chapter 9

Energy Credits – Category 4

❖ Water Heating

- ❖ Gas, propane, oil – EF .62; plus 1.00 and 1.75 GPM faucets - .5 credit
- ❖ Or Electric – EF .93; plus 1.00 and 1.75 GPM faucets - .5 credit

- ❖ Gas, propane, oil – EF .82; plus 1.00 and 1.75 GPM faucets - 1.5 credit
- ❖ Or solar water heating; plus 1.00 and 1.75 GPM faucets - 1.5 credit



Chapter 9

Energy Credits – Category 5

- ❖ **Dwelling Unit Size**
 - ❖ Unit less than 1500 square feet plus 300 sq. ft of windows – 1 credit
 - ❖ Unit over 5000 square feet – minus 1 credit



Chapter 9

Energy Credits – Category 6

- ❖ **Renewable Energy**

- ❖ On-site solar or wind equipment can gain .5 credit for each 1200 kWh of documented annual electrical generation, up to 3.0 credits allowed.