### 2009 Washington State Energy Code Residential Sections

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Produced with funding from:





#### Washington State University Energy Program Website

- WSEC text
- Builders Field Guide
- Prescriptive and Component Performance Worksheets
- Heating System Sizing worksheets
- Duct Testing Affidavit
- Duct Testing Standard
- Air Leakage Testing
- Duct Testing Calculator

www.energy.wsu.edu/code

#### **Energy Code Support**

#### Residential

- Washington State University Extension Energy Program
- 360-956-2042
- <u>energycode@energy.wsu.edu</u>
- <u>www.energy.wsu.edu/code</u>
- Gary Nordeen, Luke Howard, Emily Salzberg, Tanya Beavers

#### Non-residential

- Northwest Energy Efficiency Council
- Lisa Rosenow
- 206-624-0283
- <u>Lisa@putnamprice.com</u>
- <u>www.neec.net</u>

# WSEC Layout (101.3)

- Chapters 1-10 are for <u>single family</u> residential bldgs
- Chapters 11-15 are for <u>commercial and multi-</u> <u>family bldgs.</u>
- Shared Chapters
  - Chapter 2 Definitions
  - Chapter 7 Standards
  - Chapter 10 Default U-Factors

# Alterations: Building Envelope (101.3.2.5)

- Insulation levels in remodeled buildings do not have to meet current requirements but framing cavities must be filled to their full depth when exposed.
  - 2 X 4 walls must be insulated to R-15
  - 2 X 6 walls must be insulated to R- 21
  - Roof/ceiling assemblies need required space for ventilation

#### Furnace Replacement (101.3.2.6)

- Duct \*sealing and testing is required when a space conditioning system is altered including
  - Air handler replacement
  - Outdoor condensing unit (AC or HP)
  - Cooling or heating coils
  - Furnace heat exchanger
  - \*Current emergency rule in effect until the end of August requires testing but no sealing

# Duct Testing (existing houses)

#### Max. leakage rates:

- <u>8% CFA for Total duct leakage</u>
- 6% CFA for Leakage to exterior

<del>Or</del>

Or

Post installation duct leakage reduced k



-Verification by 3<sup>rd</sup> party inspector that all accessible leaks have been sealed

Emergency rule requires test result to be documented on the affidavit and submitted to the building department and home owner

Duct testing standards are posted at:

www.energy.wsu.edu/code



#### **Exceptions:**

- If all ductwork is contained within the conditioned space *or* less than 40 lineal feet outside conditioned space
- Ducts that have been previously tested
- Ducts containing asbestos



# Certificate (105.4)

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

Certificate is posted at: <u>www.energy.wsu.edu/code</u>

Property Address:											
Conditioned Floor Area Date _						/	1				
Builder or registered design professional :											
Signature:											
R-Values											
Ceiling:	Vaulted	R	Floors	Over uncondit	ioned s	pace	R				
	Attic	R	_	Slab on	grade	floor	R				
Walls: A	bove grade	R	Doors_				_R				
В	selow, int.	R					R				
В	selow, ext.	R					_R				
	U-Factors and SHGC										
NFRC rating (or) Windows U- SHGC-											
Default ra	ting (Chapter 1	0 WSEC 2009)	Skyl	ights U		SHO	GC				
Chapter 9	) Option(s)			Total Chpt.	9 Crea	dits					
	He	ating, Cooli	ing & Doi	nestic Hot Wa	ıter						
System			Туре				Efficiency				
Heating											
Cooling						_					
DHW		Duet &	Ruildina	tie I aakana		_					
All ducts	& HVAC in	conditioned	l space (	ues (no)	Incui	latio	1 P				
An aucis & HVAC in conditioned space (yes/no) insulation R											
Test TargetCEM@25DaTest DesultCEM@25Da											
Building	air leakage ta	- urget: SLA<	 0.000 <b>3</b> 0 -	Tested leaka	e: SLA	<u> </u>					
Onsite Renewable Fnerov Flortric Power System											
System type: Rated annual generationKwh											

#### See website

#### Chapter 2 – 44 New Definitions Added



dic · tio · nary . n. 1: a book everyone should own 2: you might want to buy two just in case 3: maybe yours is old and you need a new dictionary

# **Chapter #3 Design Conditions**

- Table 3-1 added to this chapter
- Lists 100+ locations in Washington
- Lists Outdoor design temperatures for heating and cooling

#### TABLE 3-1 OUTDOOR DESIGN TEMPERATURES

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

#### Three Building Envelope Compliance Methods

- Prescriptive: Chapter 6
  - Cook Book
- Component Performance: Chapter 5
  - Whole Building UA Trade off
  - Most other requirements
- Systems Analysis: Chapter 4
  - Annual energy budget
  - Sophisticated analysis required



#### Systems Analysis – Chapter 4

• Same procedure as always

- Model Target (Code) house
- Model Proposed house



 Proposed house must be at least 8% more efficient than the Target house.

# Ceilings: Two Types

• Attics (R-38 ADV framed or R-49)

Including Standard and Scissor Trusses

• Single Rafter Joist (R-38)

#### **Advanced Framed Roof**



# Walls

- Climate Zone 1
  - R-21 for all paths
  - All paths are intermediate framing (requires R-10 insulated headers)
- Climate Zone 2
  - R-21 for 12% glazing or less
  - R-19+R-5 for other paths

#### **R-21 int. Include Insulated Headers**

#### All Climate Zone 1 Prescriptive Paths require Intermediate Framing











# Substantial contact not required in this application (502.1.4.7 Exception)





# Windows

- Climate Zone 1
  - 13% or less = U-.34
  - 25% or less = U-.32
  - Unlimited = U-.30
- Climate Zone 2
  - 12% or less = U-.32
  - 15% or less = U-.32
  - Unlimited = U-.30



#### Area Weighted U-factors

- Area weighted U-factor allowed for single above grade components (602.7.2)
- **Example of Area Weighted U-Value Calculation:**
- Window #1 area 10 ft2 U = .34 U x A = 3.4
- Window #2 area 15 ft2 U = .28

<u>U x A = 4.2</u>

- Total area 25 ft2Total U x A = 7.6
- Area weighted average 7.6/25 = 0.30



#### **Exception for Ventilated Attics**

 Unvented, conditioned attics are allowed under certain conditions



### **Unvented Attic Criteria**

- Unvented attic contained completely within the building thermal envelope.
- NO vapor retarders installed at ceiling level.

See publication on website for specific details

#### Building Air Leakage Testing (502.4.5)

- Air leakage testing required for new houses
- Blower door equipment is needed
- Maximum leakage allowed:
   .00030 SLA
   (SLA = Specific Leakage Area)



See website

#### **Calculating SLA**

(Specific Leakage Area)

(CFM<sub>50</sub> X 0.055) / (CFA X 144)

- SLA = (CFM50 X .055) / (CFA X 144)
- SLA = (1790 X .055) / (2240 X 144)
- SLA = 98.45 / 322,560
- SLA = .00030



Duct testing Calculator (New Construction)									
At Rough-in (Total Leakage)									
	CFA of Home	Standard <sup>1</sup>	Calculated Target	Test <sup>2</sup> CFM <sub>25</sub>					
Air Handler Present		$\leq$ 6 CFM <sub>25</sub> per 100 sf of CFA							
Air Handler <u>not</u> Present		$\leq$ 4 CFM <sub>25</sub> per 100 sf of CFA							
	P	ost Construction							
	CFA of Home	Standard <sup>1</sup>	Calculated Target	Test <sup>2</sup> CFM <sub>25</sub>					
Air Handler Present (Total Leakage)		$\leq$ 8 CFM <sub>25</sub> per 100 sf of CFA							
Air Handler Present (Leakage to Exterior)		$\leq$ 6 CFM <sub>25</sub> per 100 sf of CFA							
Air Handler <u>not P</u> resent		$\leq$ 4 CFM <sub>25</sub> per 100 sf of CFA							
<ol> <li>Test results must com</li> <li>Test CFM<sub>25</sub> must be ec</li> </ol>	ply with one Jual to or les	of the Standards options. s than the calculated target.							
Air L	eakage testi	ng Calculator (Blower Door Test)							
Standard	CFA of Home	Tested CFM <sub>50</sub>	Test Result						
0.00030 SLA									

# HVAC Controls (503.8)

- Primary space conditioning systems in each dwelling unit require a programmable thermostat
- Each additional system within a dwelling unit must have an adjustable thermostat
- Programmable stat must have a 5-2 schedule (minimum)



## Heat Pump Controls (503.8.3.5)

- Heat Pumps with supplemental electric resistance heaters shall have controls that:
  - Prevent supplementary heater operation when the load can be met by the heat pump alone
  - Supplementary heat lock out based on outdoor temp.
    - Max. setting of 40<sup>0</sup>F
    - Set to 32<sup>0</sup> or less at final inspection



# Duct Testing (503.10.2)

 Ducts located outside the conditioned space must be tested

 Maximum leakage rates specified in RS-33



See website

#### **Duct Testing Standards**

- Rough-In Testing Targets:
  - Total leakage  $\leq$  6% of the CFA at 25 Pa

— Total leakage ≤ 4% of the CFA at 25 Pa
if air handler has not been installed

- Post Construction Testing Targets:
  - Total leakage  $\leq$  8% of the CFA at 25 Pa

OR

– Leakage to exterior  $\leq$  6% of the CFA at 25 Pa

#### **Duct Testing Exceptions:**

Duct tightness test is <u>not</u> required if:

The air handler and all ducts are located within conditioned space.

#### or

 The furnace is a non-condensing appliance in an unconditioned space with a <u>maximum of 6</u> feet of ductwork in the unconditioned space.



# Related HVAC Code Changes: (503.10.1)

- Ducts cannot displace required insulation
- Building cavities cannot be used as ducts



# Indoor Lighting (505.1)

- 50% of all indoor luminaires (fixtures) shall be high efficacy
- SBCC has released an interpretation about indoor lighting



#### **Outdoor Lighting**



#### Lighting: Linear Fluorescent Fixtures

#### • 505.3 Linear Fluorescent Fixtures:

- This rule applies to typical fluorescent tube fixtures
- Linear fluorescent fixtures must be fitted with T-8 (1" diameter) or smaller lamps (but not T-10 or T-12 lamps)



#### Residential

#### Table 6-1

#### Prescriptive Requirements for Single Family Residential Climate Zone 1

Option	Glazing %	Vertical	Overhead	Door	Ceiling	Vaulted	Wall	Wall	Wall	Floor	Slab
		Glazing	Glazing	U-Factor		Ceiling	Above	(interior)	(exterior)		On
							grade	Below	Below		grade
								grade	grade		
Ι.	13%	.34	.50	.20	R-49 or	R-38	R-21 INT	R-21 TB	R-10	R-30	R-10
					R-38 ADV						
П.	25%	.32	.50	.20	R-49 or	R-38	R-21 INT	R-21 TB	R-10	R-30	R-10
					R-38 ADV						
					11 50 712 1						
111.	Unlimited	.30	.50	.20	R-49 or	R-38	R-21 INT	R-21 TB	R-10	R-30	R-10
					R-38 ADV						

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#### **Table 6-2**

#### Prescriptive Requirements for Single Family Residential Climate Zone 2

Option	Glazing %	Vertical	Overhead	Door	Ceiling	Vaulted	Wall	Wall	Wall	Floor	Slab
		Glazing	Glazing	U-Factor		Ceiling	Above	(interior)	(exterior)		On
							grade	Below	Below		grade
								grade	grade		
Ι.	12%	.32	.50	.20	R-49 or	R-38	R-21 INT	R-21 TB	R-12	R-30	R-10
					R-38 ADV						
	1 E 9/	27	FO	20	P 40 or	0.20		D 31 TD	D 13	D 20	P 10
	15%	.52	.50	.20		R-30	K-19+K-2	R-211D	N-12	K-50	K-10
					K-38 ADV						
.	Unlimited	.30	.50	.20	R-49 or	R-38	R-19+R-5	R-21 TB	R-12	R-30	R-10
					R-38 ADV						

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### **Energy Credits Chapter 9**

 Dwelling units must choose
 <u>one</u> credit
 from the
 following
 options









# High Efficiency HVAC Equipment

- Gas, propane or oil furnace.
   Min. AFUE 92%
   Or
- Air-source heat pump
   Min. HSPF 8.5
  - Or
- Ground Source Heat Pump
  - Min. COP 3.3

1.0 credit

1.0 credit

2.0 credits

### **High Efficiency HVAC Equipment**

- Ductless split system heat pump
  - House must have electric zonal as primary heating system
  - Ductless heat pump shall provide heating to at least one zone



1.0 credit

High Efficiency HVAC Distribution Components

- All heating and cooling components located inside the conditioned space
  - Must be direct vent or sealed combustion
  - Components located in a conditioned crawl space are not allowed
  - Electric resistance heat is not allowed
  - Direct combustion heating equipment (i.e. room heaters, fireplaces, etc.) with an AFUE less than 80% not allowed
     <u>1.0 credit</u>

# Efficient Building Envelope #1

- Prescriptive compliance based on Table 6-1 (Climate Zone 1) with modifications:
  - Windows U-.28
  - Floor R-38
  - Slab-on-grade R-10 fully insulated
  - Below grade slab R-10 fully insulated or
- Component Performance (Zones 1 and 2)
   Reduce Target UA 5%

.5 credit

# Efficient Building Envelope #2

- Prescriptive compliance based on Table 6-1 (Climate Zone 1) with modifications:
  - <u>Windows U-.25</u>
  - Walls R-21 + R-4
  - Floor R-38
  - Slab-on-grade R-10 fully insulated
  - Below grade slab R-10 fully insulated
  - <u>R-21+R-5 below grade basement walls</u> or
- Component Performance (Zones 1 and 2)
  - <u>Reduce Target UA 15%</u>

#### Super Efficient Building Envelope #3

- Prescriptive compliance based on Table 6-1 (Climate Zone 1) with modifications:
  - Windows U-.22
  - Walls R-21+R-12
  - Floor R-38
  - Slab-on-grade R-10 fully insulated
  - Below grade slab R-10 fully insulated
  - R-21+R-12 below grade basement walls or
- Component Performance (Zones 1 and 2)
  - Reduce Target UA 30%

### Air Leakage Control and Efficient Ventilation

Air Leakage rate reduced to
 .00020 SLA

and



 The Whole House Ventilation System is a heat recovery ventilator

.5 credit

### Additional Air Leakage Control and Efficient Ventilation

Air Leakage rate reduced to
 .00015 SLA

and

 The Whole House Ventilation System is a heat recovery ventilator



1.0 credit

### **Efficient Water Heating**

- Gas, propane or oil water heater
  - Min. EF .62
- Electric water heater
  - Min. EF .93 and
- Low flow faucets
  - Shower and Kitchen sink = 1.75
     GPM
  - All other lav. Faucets = 1.0 GPM



.5 credit

# **High Efficiency Water Heating**

- Gas, propane or oil water heater
  - Min. EF .82
- Solar water heating (supplemental)
  - Min savings 2000
     kWh/year
- Electric heat pump water heater
  - Min. EF 2.0



1.5 credits

#### House size credits and debits

- Dwelling units less than 1500 ft<sup>2</sup>
  - Max. window and door area is 300 ft<sup>2</sup>
  - Includes additions
     less than 750 ft<sup>2</sup>

1.0 credit

 Dwelling units exceeding 5000 ft<sup>2</sup>





#### **Renewable Electric Energy**

- Solar or wind
  - .5 credits per 1200
     kWh of generation
     provided annually
  - 3.0 credits max
  - Documentation
     method outlined in the code

