

STATE BUILDING CODE COUNCIL

Washington State Energy Code Development Standard Energy Code Proposal Form

May 2018

Log No. 19-WSEC-R20

Code being amended: Commercial Provisions X Residential Provisions

Code Section # R402.4.1.2 Testing

Brief Description:

For the purpose of air leakage testing only, the volume of the living space shall be the conditioned floor area (square feet) multiplied by 8.5 (feet).

Proposed code change text:

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). For this test only, the volume of the home shall be the conditioned floor area ft² (m²) multiplied by 8.5 ft. (2.6m). 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 or interior terminations for continuous ventilation systems and heat recovery ventilators shall be 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.

Exceptions:

- 1. Additions less than 500 square feet of conditioned floor area.
- 2. Additions tested with the existing home having a combined maximum air leakage rate of 7 air changes per hour. To qualify for this exception, the date of construction of the existing house must be prior to the 2009 Washington State Energy Code.

Purpose of code change:

The method for setting targets for air leakage control are not well aligned with the benefits of air leakage control. Under the current code, a home with a 10 foot average ceiling height is allowed a 20% higher blower door test result than a building with an average ceiling height of 8 feet. But the benefits of air sealing are greater for the taller home. Taller buildings are exposed to greater infiltration impacts related to stack pressure and wind exposure.

The effort required to air seal a home is not meaningfully related to ceiling height. The two illustrations provided below shows the dominant air leakage pathways in homes. You will note that the air leakage details called out in these illustrations are not related wall height. They illustrate air leakage pathways that exist in most homes regardless of height. (Pacific Northwest National Laboratory Buildings Technology Program, <u>Air Leakage Guide</u>, U.S. Department of Energy, 2011)

Any additional cost for air sealing a taller home is not related to meeting the air leakage requirements. Interior drywall required to create an interior air barrier will be installed regardless of this requirement. A taller wall using and exterior air barrier will require more structural board, weather resistive barriers or exterior insulation. But all will be installed to meet other building code requirements.

National studies show that wall heights are increasing. (Home Innovations Research Labs, Trends and opportunities in the U.S. Building Materials Market, 2018 International Builders' Show) This will increase allowable building energy use if the air leakage testing method is not modified as recommended by this proposal.

This proposal will simplify the code and improve code compliance. This method ties the formula for determining the blower door test result to the conditioned floor area printed on the design documents and a fixed multiplier, 8.5 feet. This addresses miscalculations of the ceiling height we have observed in some test results. In some cases we have observed cases where the ceiling height used in developing the target air leakage rate for the building have been overstated to increase the allowance.

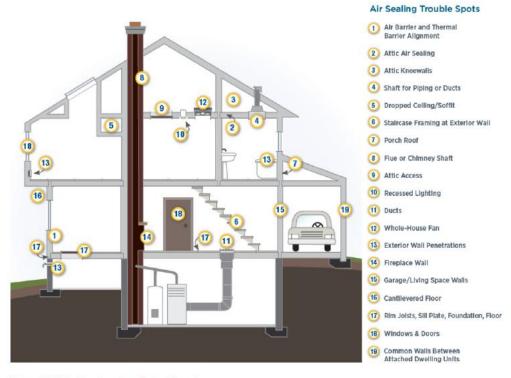
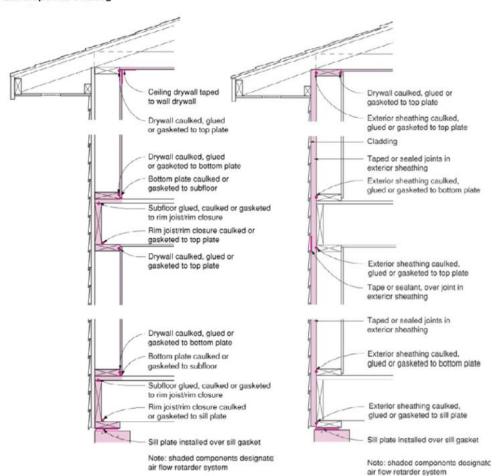


Figure 4: Building America—air sealing trouble spots

Envelope Air Sealing



Your amendment if	iust meet one or the	e following criteria. Se	elect at least one:	
Addresses a crit	ical life/safety need		Consistency	with state or federal regulations.
the code. X Addresses a speci	clarifies the intent of fic state policy or st gy conservation is a	atute.	_	unique character of the state. ors and omissions.
Check the building	types that would be	impacted by your co	de change:	
X Single family/dup	lex/townhome	Multi-family	4 + stories	Institutional
X Multi-family 1 – 3	stories	Commercial /	'Retail	Industrial
Your name	Chuck Murray		Email address bill.kraus@comr	chuck.murray@commerce.wa.gov
Your organization	Commerce, State	Energy Office	Phone number	360 725-3113, 360-725-5011
Other contact name	a Rill Krauc		- 2	,

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Economic Impact Data Sheet

Briefly summarize your proposal's primary economic impacts and benefits to building owners, tenants and businesses.

LCCA worksheet results are posted below. Three cases are illustrated. As noted in the explanatory statement above, Commerce does not believe there is a real difference in cost of air sealing a home with a taller wall. Most air leakage sites are not related with wall height. But, for the sake of this analysis we have added cost savings and increases to the life cycle assessment.

- Base= 2200 SF home with 8 foot wall heightCost savings \$100
- Alt 1 = 2200 SF home with 8.5 foot wall height Cost \$0
- Alt 2 = 2200 SF home with 10 foot wall height Cost for taller home \$500

Results summary:

The results of the live cycle cost show that the home with the 8' wall will result in some increased energy use and life cycle cost.

The building with taller walls will have more than \$1000 of energy savings, twice the value of the additional cost evaluated.

Energy Savings were adopted from SEEM runs developed in support of the C406 code change proposal.

Provide your best estimate of the construction cost (or cost savings) of your code change proposal? (See OFM Life Cycle Cost Analysis tool and Instructions; use these Inputs. Webinars on the tool can be found Here and Here)

\$Click here to enter text./square foot (For residential projects, also provide \$Click here to enter text./ dwelling unit)

Show calculations here, and list sources for costs/savings, or attach backup data pages

As noted in the introduction, and on the LCCT tables.

Provide your best estimate of the annual energy savings (or additional energy use) for your code change proposal?

Click here to enter text.KWH/ square foot (or) from -.27 to plus 1.18 KBTU/ square foot

(For residential projects, also provide 2600 KBTU / dwelling unit)

Show calculations here, and list sources for energy savings estimates, or attach backup data pages

Energy Savings were adopted from SEEM runs developed in support of the C406 code change proposal. Economic evaluation using the required LCCT model.

List any code enforcement time for additional plan review or inspections that your proposal will require, in hours per permit application:

This will simplify code implementation. The conditioned floor area is typically on the plans, but not the home volume. The proposed method for setting the air leakage target will be based on the conditioned floor area X 8.5 feet tall. The existing system of calculating the volume of homes is more complex and subject to error.

Executive Report

Project Information	
Project:	Air Leakage - Medium Home - Gas
Address:	
Company:	
Contact:	
Contact Phone:	
Contact Email:	

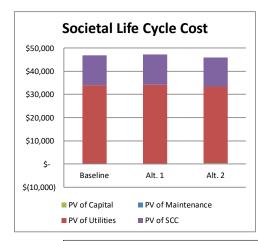
Key Analysis Va	Building Characteristics			
Study Period (years)	50	Gross (Sq.Ft)	2,200	
Nominal Discount Rate	5.00%	Useable (Sq.Ft)	2,200	
Maintenance Escalation	1.00%	Space Efficiency	100.0%	
Zero Year (Current Year)	2020	Project Phase	0	
Construction Years	0	Building Type	0	

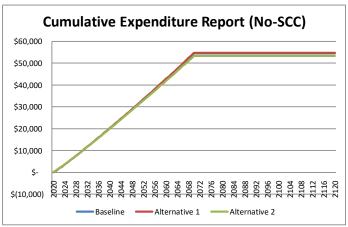
Life Cycle Cost Analysis Bi								
Alternative		Baseline		Alt. 1		Alt. 2		
Energy Use Intenstity (kBtu/sq.ft)		25.8		26.1		24.6		
1st Construction Costs	\$	-	\$	(100)	\$	50	00	
PV of Capital Costs	\$	-	\$	(99)	\$	49	94	
PV of Maintenance Costs	\$	-	\$	-	\$	-		
PV of Utility Costs	\$	34,002	\$	34,246	\$	32,94	12	
Total Life Cycle Cost (LCC)	\$	34,002	\$	34,148	\$	33,43	36	
Net Present Savings (NPS)		N/A	\$	(146)	\$	56	66	

Societal LCC takes into consideration the social cost of carbon dioxide emissions caused by operational energy consumption

(GHG) Social Life Cycle Cost B								
GHG Impact from Utility Consumption		Baseline		Alt. 1		Alt. 2		
Tons of CO2e over Study Period		203		205		197		
% CO2e Reduction vs. Baseline		N/A		-1%		3%		
Present Social Cost of Carbon (SCC)	\$	12,916	\$	13,017	\$	12,478		
Total LCC with SCC	\$	46,918	\$	47,165	\$	45,913		
NPS with SCC		N/A	\$	(247)	\$	1,004		

Warning: OFM Assigned Variables Not Used





Baseline Short Description
8 Foot Ceiling - 5 ach50
Alternative 1 Short Description
8.5 Foot Ceiling 5 ach50
Alternative 2 Short Description
10 Foot Ceiling 5 ach50

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Expenditure Report Page In Constant 2020 \$'s

Vear		Cumulative	e Expenditur	e Summary	Annual	Expenditure	Summary
2021 S	Year		Alt. 1				Alt. 2
2022 S 1,772 S 1,755 S 1,866 S 888 S 890 S	2020						
2023 S 2,670 S 2,654 S 2,760 S 888 S 899 S 2024 S 3,615 S 3,601 S 3,699 S 945 S 947 S 2025 S 4,590 S 4,580 S 4,665 S 976 S 978 S 2026 S 5,575 S 5,567 S 5,661 S 985 S 988 S 2027 S 6,573 S 6,569 S 6,628 S 998 S 1,001 S 2028 S 7,576 S 7,575 S 7,620 S 1,003 S 1,006 S 2029 S 8,592 S 8,594 S 8,624 S 1,016 S 1,009 S 2030 S 9,617 S 9,622 S 9,635 S 1,025 S 1,028 S 2031 S 10,646 S 10,656 S 10,651 S 1,029 S 1,033 S 2031 S 10,646 S 10,656 S 11,693 S 11,670 S 1,034 S 1,038 S 2033 S 12,718 S 12,736 S 12,694 S 1,038 S 1,042 S 2034 S 13,766 S 13,787 S 13,726 S 1,047 S 1,051 S 2035 S 14,818 S 14,843 S 14,761 S 1,052 S 1,056 S 2,035 S 1,818 S 14,843 S 14,761 S 1,055 S 1,055 S 1,051 S 2,037 S 16,930 S 16,964 S 16,839 S 1,056 S 1,061 S 2,037 S 16,930 S 16,964 S 16,839 S 1,056 S 1,061 S 2,037 S 16,930 S 16,964 S 16,839 S 1,056 S 1,061 S 2,037 S 16,930 S 16,964 S 12,801 S 1,056 S 1,061 S 2,034 S 13,787 S 13,726 S 1,056 S 1,061 S 2,034 S 13,787 S 13,276 S 1,056 S 1,061 S 2,034 S 13,787 S 13,726 S 1,056 S 1,061 S 2,034 S 13,844 S 14,761 S 1,055 S 1,056 S 1,061 S 2,034 S 13,847 S 13,947 S 1,056 S 1,061 S 3,034 S 13,844 S 14,761 S 1,056 S 1,061 S 3,034 S 13,844 S 14,761 S 1,056 S 1,061 S 3,040 S 1,040 S 1,0							
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