Alterations Worksheet - 2018 Washington State Energy Code

Project Information	*Contact Information*
19-0446 Walsh Remodel	Jin Wan
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The WSEC requirements for alterations are located in Chapter 5 of the code text.
Alterations (remodels) do not need to obtain energy credits from Table R406.3

Additions must meet the requirements for new construction. This includes nonconditioned space being altered to become conditioned space.

Will the wall cavities be exposed? ☑ Yes ☐ No

If yes: Exposed wall cavities must be insulated -
2 X 4 wall studs require **R-15** insulation
2 X 6 wall studs require **R-21** insulation

Will the roof/ceiling framing cavities or attic be exposed? ☐ Yes ☑ No

If yes: Exposed roof/ceiling assemblies must be insulated -
Vaulted ceilings: Insulate to the full depth of the framing member while allowing for the minimum 1" ventilated space

Flat ceilings: Install R-49 insulation or what the attic space can accommodate based on the roof pitch

Will the floor framing cavities be exposed? ☐ Yes ☑ No

If yes: Exposed floor cavities must be insulated to R-30

Are the windows and/or doors being replaced? ☑ Yes ☐ No
(includes both window or door and frames)
If yes: New windows and doors must have an area weighted average U-factor of ≤0.30

Will the heating or cooling system be replaced? ☐ Yes ☑ No

If yes: New equipment must meet current requirements and ducts need to be tested

Will the hot water system be altered? ☐ Yes ☑ No

If yes: New water heating equipment must meet current code requirements

Are more than 50% of the light fixtures being changed? ☐ Yes ☑ No

If yes: 90% of all lamps must be high efficacy (LED or CFL)

R503.1.1 Building envelope. Building envelope assemblies that are part of the alteration shall comply with Section R402.1.1 or R402.1.4, Sections R402.2.1 through R402.2.11, R402.3.1, R402.3.2, R402.4.3 and R402.4.4.

Exception: The following alterations need not comply with the requirements for new construction provided the energy use of the building is not increased:

1. Storm windows installed over existing fenestration.
2. Existing ceiling, wall or floor cavities exposed during construction provided that these cavities are filled with insulation. 2x4 framed walls shall be insulated to a minimum of R-15 and 2x6 framed walls shall be insulated to a minimum of R-21.
3. Construction where the existing roof, wall or floor cavity is not exposed.
4. Roof recover.
5. Roofs without insulation in the cavity and where the sheathing or insulation is exposed during reroofing shall be insulated either above or below the sheathing.
6. Surface-applied window film installed on existing single pane fenestration assemblies to reduce solar heat gain provided the code does not require the glazing fenestration to be replaced.

R503.1.1.1 Replacement fenestration. Where some or all of an existing fenestration unit is replaced with a new fenestration product, including sash and glazing, the replacement fenestration unit shall meet the applicable requirements for *U* -factor and SHGC in Table R402.1.1. Where more than one replacement fenestration unit is being installed, an area-weighted average of the U-factor and SHGC of all replacement fenestration shall be permitted to be used to demonstrate compliance.

R503.1.2 Heating and cooling systems. New heating, cooling and duct systems that are part of the alteration shall comply with Section R403.

Exceptions:

1. Where ducts from an existing heating and cooling system are extended, duct systems with less than 40 linear feet in unconditioned spaces shall not be required to be tested in accordance with Section R403.2.2.
2. Existing duct systems constructed, insulated or sealed with asbestos.

R502.1.1.2 Heating and cooling systems. New heating, cooling and duct systems that are part of the addition shall comply with Section R403.

Exception: The following need not comply with the testing requirements of Section R403.3.3:

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

R503.1.3 Service hot water systems. New service hot water systems that are part of the alteration shall comply with Section R403.5.

R503.1.4 Lighting. New lighting systems that are part of the alteration shall comply with Section R404.1.

Exception: Alterations that replace less than 50 percent of the luminaires in a space, provided that such alterations do not increase the installed interior lighting power.

R503.2 Change in space conditioning. Any nonconditioned or low-energy space that is altered to become *conditioned space* shall be required to be brought into full compliance with this code.

Window, Skylight and Door Schedule

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	Ref.	U-factor	Qt.	Width Feet	Width Inch	Height Feet	Height Inch	Area	UA
Exempt Swinging Door (24 sq. ft. max.)								0.0	0.00
Exempt Glazed Fenestration (15 sq. ft. max.)								0.0	0.00

Vertical Fenestration (Windows and doors)

Component Description	Ref.	U-factor	Qt.	Width Feet	Width Inch	Height Feet	Height Inch	Area	UA
L1		0.30	1	3	0	3	10	11.5	3.45
L2		0.30	1	5	0	3	10	19.2	5.75
L3		0.30	1	3	0	3	10	11.5	3.45
L4		0.30	1	3	0	3	10	11.5	3.45
								0.0	0.00
								0.0	0.00
								0.0	0.00
								0.0	0.00
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								0.0	0.00
								0.0	0.00
								0.0	0.00
								0.0	0.00

Sum of Vertical Fenestration Area and UA	53.7	16.10
Vertical Fenestration Area Weighted U = UA/Area		0.30

Overhead Glazing (Skylights)

Component Description	Ref.	U-factor	Qt.	Width Feet	Width Inch	Height Feet	Height Inch	Area	UA
								0.0	0.00
								0.0	0.00
								0.0	0.00
								0.0	0.00
								0.0	0.00
								0.0	0.00

Sum of Overhead Glazing Area and UA	0.0	0.00
Overhead Glazing Area Weighted U = UA/Area		0.00

Total Sum of Fenestration Area and UA ***(for heating system sizing calculations)***	53.7	16.10

These requirements apply to all IRC building types, including detached one- and two-family dwellings and multiple single-family dwellings (townhouses).

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Instructions: This single-family project will use the requirements of the Prescriptive Path below and incorporate the minimum values listed. Based on the size of the structure, the appropriate number of additional credits are checked as chosen by the permit applicant.

Provide all information from the following tables as building permit drawings: Table R402.1 - Insulation and Fenestration Requirements by Component, Table R406.2 - Fuel Normalization Credits and 406.3 - Energy Credits.

Authorized Representative		*Date*	

All Climate Zones (Table R402.1.1)		
	R-Value [a]	**U-Factor [a]**
Fenestration U-Factor [b]	n/a	0.30
Skylight U-Factor [b]	n/a	0.50
Glazed Fenestration SHGC [b,e]	n/a	n/a
Ceiling [e]	49 [j]	0.026
Wood Frame Wall [g,h]	21 int	0.056
Floor	30	0.029
Below Grade Wall [c,h]	10/15/21 int + TB	0.042
Slab [d,f] R-Value & Depth	10, 2 ft	n/a

a	*R*-values are minimums. *U*-factors and SHGC are maximums. When insulation is installed in a cavity that 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.
c	"10/15/21 +5TB" means R-10 continuous insulation on the exterior of the wall, or R-15 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 +5TB" 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. "5TB" means R-5 thermal break between floor slab and basement wall.
d	R-10 continuous insulation is required under heated slab on grade floors. See Section R402.2.9.1.
e	For single rafter- or joist-vaulted ceilings, the insulation may be reduced to R-38 if the full insulation depth extends over the top plate of the exterior wall.
f	R-7.5 continuous insulation installed over an existing slab is deemed to be equivalent to the required perimeter slab insulation when applied to existing slabs complying with Section R503.1.1. If foam plastic is used, it shall meet the requirements for thermal barriers protecting foam plastics.
g	For log structures developed in compliance with Standard ICC 400, log walls shall meet the requirements for *climate zone* 5 of ICC 400.
h	Int. (intermediate framing) denotes framing and insulation as described in Section A103.2.2 including standard framing 16 inches on center, 78% of the wall cavity insulated and headers insulated with a minimum of R-10 insulation.

Each dwelling unit ***in a residential building*** shall comply with sufficient options from Table R406.2 (fuel normalization credits) and Table 406.3 (energy credits) to achieve the following minimum number of credits. To claim this credit, the building permit drawings shall specify the option selected and the maximum tested building air leakage, and show the qualifying ventilation system and its control sequence of operation.

1. **Small Dwelling Unit: 3 credits**
   Dwelling units less than 1,500 sf in conditioned floor area with less than 300 sf of fenestration area.
   Additions to existing building that are greater than 500 sf of heated floor area but less than 1,500 sf.
2. **Medium Dwelling Unit: 6 credits**
   All dwelling units that are not included in #1 or #3
3. **Large Dwelling Unit: 7 credits**
   Dwelling units exceeding 5,000 sf of conditioned floor area
4. **Additions less than 500 square feet: 1.5 credits**
   All other additions shall meet 1-3 above

Before selecting your credits on this Summary table, review the details in Table 406.3 (Single Family), on page 4.

Summary of Table R406.2				
Heating Options	**Fuel Normalization Descriptions**	**Credits - select ONE heating option**		**User Notes**
1	Combustion heating minimum NAECA[b]	0.0	☉	
2	Heat pump[c]	1.0	☐	
3	Electric resistance heat only - furnace or zonal	-1.0	☐	
4	DHP with zonal electric resistance per option 3.4	0.5	☐	
5	All other heating systems	-1.0	☐	
Energy Options	**Energy Credit Option Descriptions**	**Credits - select ONE energy option from each category [d]**		
1.1	Efficient Building Envelope	0.5	☐	
1.2	Efficient Building Envelope	1.0	☐	
1.3	Efficient Building Envelope	0.5	☐	
1.4	Efficient Building Envelope	1.0	☐	
1.5	Efficient Building Envelope	2.0	☐	
1.6	Efficient Building Envelope	3.0	☐	
1.7	Efficient Building Envelope	0.5	☐	
2.1	Air Leakage Control and Efficient Ventilation	0.5	☐	
2.2	Air Leakage Control and Efficient Ventilation	1.0	☐	
2.3	Air Leakage Control and Efficient Ventilation	1.5	☐	
2.4	Air Leakage Control and Efficient Ventilation	2.0	☐	
3.1[a]	High Efficiency HVAC	1.0	☐	
3.2	High Efficiency HVAC	1.0	☐	
3.3[a]	High Efficiency HVAC	1.5	☐	
3.4	High Efficiency HVAC	1.5	☐	
3.5	High Efficiency HVAC	1.5	☐	
3.6[a]	High Efficiency HVAC	2.0	☐	
4.1	High Efficiency HVAC Distribution System	0.5	☐	
4.2	High Efficiency HVAC Distribution System	1.0	☐	

Summary of Table R406.2 (cont.)				
Energy Options	**Energy Credit Option Descriptions (cont.)**	**Credits - select ONE energy option from each category [d]**		**User Notes**
5.1[d]	Efficient Water Heating	0.5	☐	
5.2	Efficient Water Heating	0.5	☐	
5.3	Efficient Water Heating	1.0	☐	
5.4	Efficient Water Heating	1.5	☐	
5.5	Efficient Water Heating	2.0	☐	
5.6	Efficient Water Heating	2.5	☐	
6.1[e]	Renewable Electric Energy (3 credits max)	1.0	3	Solar Panel layout TBD
7.1	Appliance Package	0.5	☐	
	Total Credits		3.0	CLEAR FORM

a. An alternative heating source sized at a maximum of 0.5 W/sf (equivalent) of heated floor area or 500 W, whichever is bigger, may be installed in the dwelling unit.
b. Equipment listed in Table C403.3.2(4) or C403.3.2(5)
c. Equipment listed in Table C403.3.2(1) or C403.3.2(2)
d. You cannot select more than one option from any category EXCEPT in category 5. Option 5.1 may be combined with options 5.2 through 5.6. See Table 406.3.
e. 1.0 credit for each 1,200 kWh of electrical generation provided annually, up to 3 credits max.
See the complete Table R406.2 for all requirements and option descriptions.

Please print only pages 1 through 3 of this worksheet for submission to your building official.

NREL
NATIONAL RENEWABLE ENERGY LABORATORY

Caution: Photovoltaic system performance predictions calculated by PVWatts® include many inherent assumptions and uncertainties and do not reflect variations between PV technologies nor site-specific characteristics except as represented by PVWatts® inputs. For example, PV modules with better performance are not differentiated within PVWatts® from lesser performing modules. Both NREL and private companies provide more sophisticated PV modeling tools (such as the System Advisor Model at //sam.nrel.gov) that allow for more precise and complex modeling of PV systems.

The expected range is based on 30 years of actual weather data at the given location and is intended to provide an indication of the variation you might see. For more information, please refer to this NREL report: The Error Report.

RESULTS

ASSUMED
20 panels

4600/1200 =3.8 → get 3.0 max credits

4,600 kWh/Year*

System output may range from 4,390 to 4,755 kWh per year near this location.

Month	Solar Radiation (kWh / m^2 / day)	AC Energy (kWh)
January	1.43	156
February	2.40	238
March	3.16	342
April	4.98	507
May	5.17	541
June	5.57	550
July	6.27	629
August	5.95	601
September	4.60	459
October	2.64	280
November	1.46	155
December	1.28	141
Annual	3.74	4,599

Location and Station Identification

Requested Location	98040, USA	
Weather Data Source	Lat, Lng: 47.57, -122.22	0.7 mi
Latitude	47.57° N	
Longitude	122.22° W	

The energy output range is based on analysis of 30 years of historical weather data, and is intended to provide an indication of the possible interannual variability in generation for a Fixed (open rack) PV system at this location.

PV System Specifications

DC System Size	**4.4 kW** DC=0.22 kws x 20 panels
Module Type	**Standard**
Array Type	**Fixed (open rack)**
System Losses	**14.08%**
Array Tilt	**18.43°** 4 roof pitch
Array Azimuth	**180°** South facing roof
DC to AC Size Ratio	**1.2**
Inverter Efficiency	**96%**
Ground Coverage Ratio	**0.4**
Albedo	***From weather file***
Bifacial	**No (0)**

Monthly Irradiance Loss

Jan	Feb	Mar	Apr	May	June
0%	0%	0%	0%	0%	0%

July	Aug	Sept	Oct	Nov	Dec
0%	0%	0%	0%	0%	0%

Performance Metrics

DC Capacity Factor	**11.9%**