WASHINGTON STATE UNIVERSITY
Energy Program

Hello, and welcome to WSU-EP monthly trainings.

This event is being recorded. We ask kindly that you remain muted throughout the presentation. We will answer questions in the Q&A tab. We will attempt to keep up with the chat. We will offer live Q&A with the remaining time at the end of this presentation. We are limited to 500 attendees.

Thank you for your understand and we will begin our presentation at 1pm.

Washington State University
Energy Program

WASHINGTON STATE UNIVERSITY
Energy Program

WSEC-R 2021

A two hour education & update covering the 2021 WSEC-R 2nd Edition

Washington State University
Energy Program

Thank you to our sponsor!

neea

About NEEA

Our Purpose - *The Northwest Energy Efficiency Alliance (NEEA) is an alliance of utilities and energy efficiency organizations that pools resources and shares risks to transform the market for energy efficiency to the benefit of consumers in the Northwest.*

(https://neea.org/about-neea)

Table of Contents

This presentation's purpose is to guide the perspective viewer through a summary review of the WSEC-R & WSEC-R 2021 code update. This education is an estimated two hour class.

Washington State Energy Code Support?

WASHINGTON STATE UNIVERSITY
Energy Program

WASHINGTON STATE ENERGY CODE
LOGIN
Create Account

Residential

WSU Energy Program

energycode@energy.wsu.edu

360-956-2042

Commercial

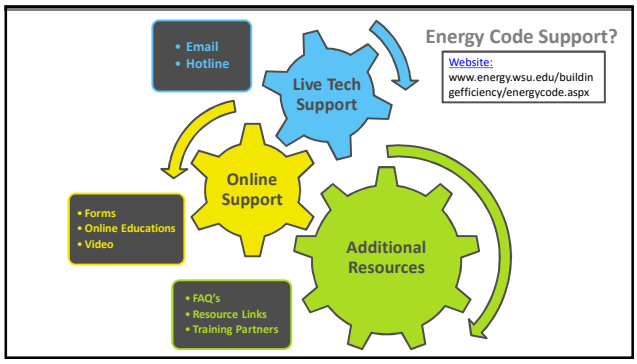
Evergreen Technology Consulting

com.techsupport@waenergycodes.com

360-539-5202

The WSU (Washington State University) Energy Program has a long history of working towards energy efficiency, renewable energy, and sustainable practices. Here is an overview of its history:

Establishment: The WSU Energy Program was established in 1996 as part of the Washington State University Extension. It was initially known as the Washington Energy Extension Service.
Early Focus: In its early years, the program primarily focused on energy conservation and efficiency. It aimed to educate and provide technical assistance to individuals, businesses, and communities in Washington State to promote energy conservation practices.
Growth and Diversification: Over time, the program expanded its scope and initiatives. It began to work on a broader range of energy-related issues, including renewable energy, clean technologies, and sustainable practices. The program became involved in research, development, and deployment of new energy technologies.
Federal Programs and Partnerships: The WSU Energy Program has actively collaborated with federal agencies, including the U.S. Department of Energy (DOE), the U.S. Environmental Protection Agency (EPA), and the U.S. Department of Agriculture (USDA). These partnerships allowed the program to access resources, funding, and expertise to further its mission.
Energy Codes and Standards: The WSU Energy Program played a significant role in the development and implementation of energy codes and standards in Washington State. It worked closely with government agencies, utility companies, and industry stakeholders to establish energy efficiency requirements for buildings and appliances.
Renewable Energy Initiatives: The program has been involved in various renewable energy initiatives, such as solar power, wind energy, bioenergy, and energy storage. It has supported research, demonstration projects, and educational efforts to promote the adoption of renewable energy technologies.
Education and Training: The WSU Energy Program has been actively engaged in providing education and training to professionals, students, and the general public. It offers workshops, seminars, and certification programs on energy efficiency, renewable energy, and sustainable practices.
Focus on Communities: The program has a strong focus on serving communities throughout Washington State. It provides technical assistance, funding support, and resources to help communities develop sustainable energy plans, implement energy projects, and reduce energy consumption.
Continued Innovation: The WSU Energy Program continues to evolve and adapt to changing energy landscapes and emerging technologies. It stays at the forefront of energy research, policy development, and industry trends to address current and future energy challenges.
Overall, the WSU Energy Program has a rich history of promoting energy efficiency, renewable energy, and sustainable practices. Its work has contributed to the advancement of clean energy technologies and the reduction of energy consumption in Washington State and beyond.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• Forms
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Additional Resources
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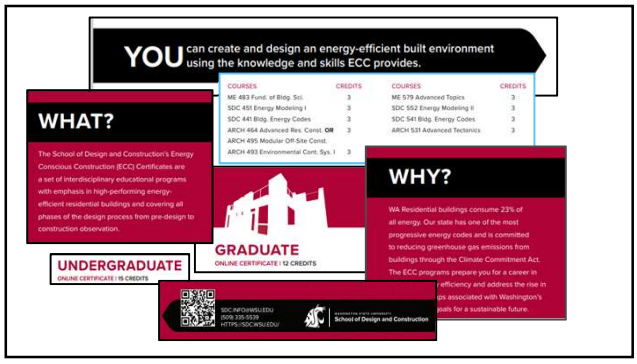
YOU can create and design an energy-efficient built environment using the knowledge and skills ECC provides.
WHAT?
The School of Design and Construction's Energy Conscious Construction (ECC) Certificates are a set of interdisciplinary educational programs with emphasis in high-performing energy-efficient residential buildings and covering all phases of the design process from pre-design to construction observation.
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SDC 451 Energy Modeling I 3
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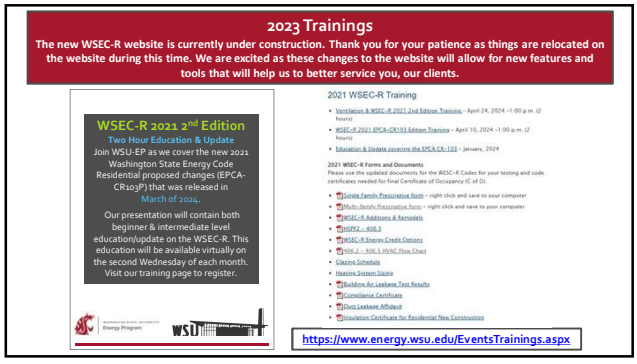
ARCH 464 Advanced Res. Const. OR 3
ARCH 495 Modular Off-Site Const.
ARCH 493 Environmental Cont. Sys. I 3
COURSES
CREDITS
ME 579 Advanced Topics 3
SDC 552 Energy Modeling II 3
SDC 541 Bldg. Energy Codes 3
ARCH 531 Advanced Tectonics 3
GRADUATE
ONLINE CERTIFICATE | 12 CREDITS
UNDERGRADUATE
ONLINE CERTIFICATE | 15 CREDITS
WHY?
WA Residential buildings consume 23% of all energy. Our state has one of the most progressive energy codes and is committed to reducing greenhouse gas emissions from buildings through the Climate Commitment Act. The ECC programs prepare you for a career in efficiency and address the rise in goals for a sustainable future.
SDC.INFO@WSU.EDU
(509) 335-9539
HTTPS://SDC.WSU.EDU/
School of Design and Construction


2023 Trainings
The new WSEC-R website is currently under construction. Thank you for your patience as things are relocated on the website during this time. We are excited as these changes to the website will allow for new features and tools that will help us to better service you, our clients.
WSEC-R 2021 2nd Edition
Two Hour Education & Update
Join WSU-EP as we cover the new 2021 Washington State Energy Code Residential proposed changes (EPCA-CR103P) that was released in March of 2024.
Our presentation will contain both beginner & intermediate level education/update on the WSEC-R. This education will be available virtually on the second Wednesday of each month. Visit our training page to register.
2021 WSEC-R Training
Ventilation & WSEC-R 2021 2nd Edition Trainingx - April 24, 2024 -1:00 p.m. (2 hours)
WSEC-R 2021 EPCA-CR103 Edition Training - April 10, 2024 -1:00 p.m. (2 hours)
Education & Update covering the EPCA CR-103 - January, 2024
2021 WSEC-R Forms and Documents
Please use the updated documents for the WESC-R Codes for your testing and code certificates needed for final Certificate of Occupancy (C of O).
Single Family Prescriptive form – right click and save to your computer
Multi-family Prescriptive form – right click and save to your computer
WSEC-R Addtions & Remodels
WSPF2 – 406.3
WSEC-R Energy Credit Options
406.2 – 406.3 HVAC Flow Chart
Glazing Schedule
Heating System Sizing
Building Air Leakage Test Results
Compliance Certificate
Duct Leakage Affidavit
Insulation Certificate for Residential New Construction
https://www.energy.wsu.edu/EventsTrainings.aspx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2024
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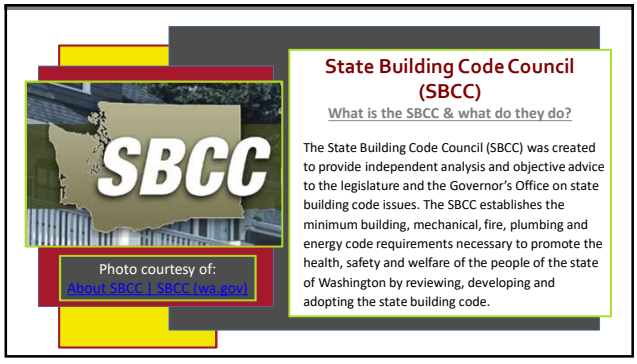
2024 WABO Annual Education Institute
Monday, March 25 - Thursday, March 28, 2024
Lynnwood Event Center
3711 196th St SW
Lynnwood, WA 98036
WABO
Home (wabo.org)

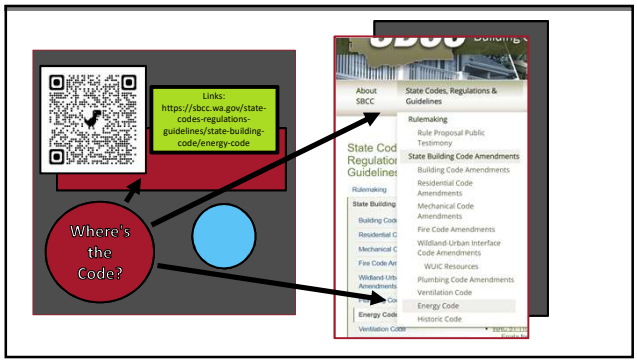

SBCC
Photo courtesy of:
About SBCC | SBCC (wa.gov)
State Building Code Council (SBCC)
What is the SBCC & what do they do?
The State Building Code Council (SBCC) was created to provide independent analysis and objective advice to the legislature and the Governor's Office on state building code issues. The SBCC establishes the minimum building, mechanical, fire, plumbing and energy code requirements necessary to promote the health, safety and welfare of the people of the state of Washington by reviewing, developing and adopting the state building code.

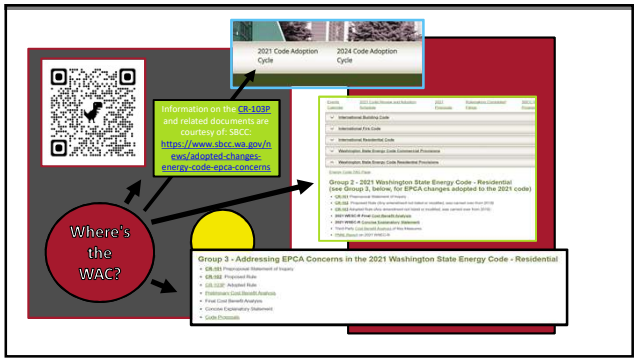
REVISED EFFECTIVE DATE FOR 2021 CODES
MARCH 15, 2024

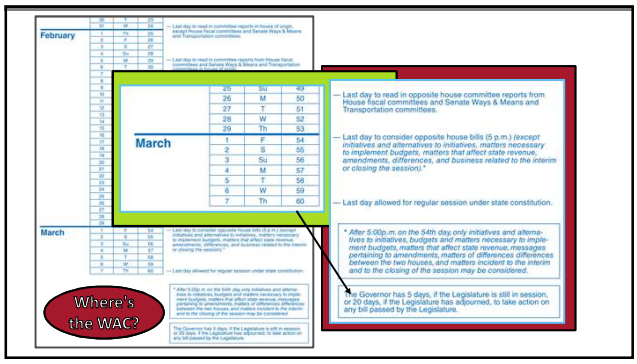
The State Building Code Council voted on May 24, 2023, to delay the effective date of the 2021 codes for 120 days, which changed the effective date from July 1, 2023 to October 29, 2023. On September 15, 2023, the State Building Code Council agreed on another delay. The new effective date for all building codes is March 15, 2024.

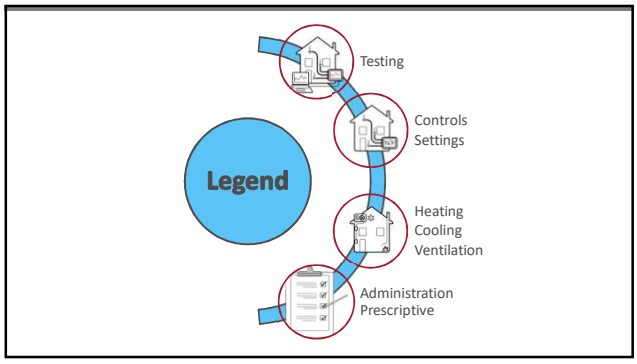
The Council is also entering rulemaking to modify sections in the commercial and residential energy codes to address legal uncertainty stemming from the decision in California Restaurant Association v. City of Berkeley recently issued by the Ninth Circuit Court of Appeals.

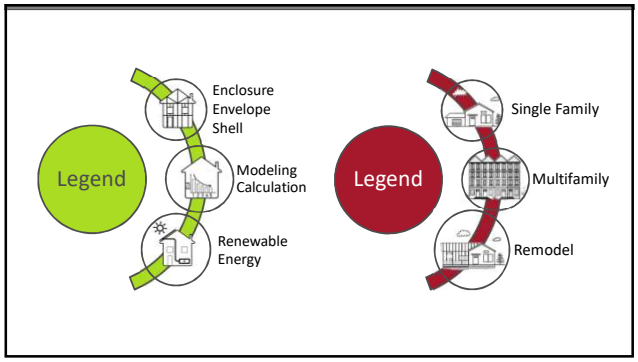
Information on SBCC and related documents are courtesy of:
The State Building Code Council






February
March
March
Where's the WAC?
— Last day to read in opposite house committee reports from House fiscal committees and Senate Ways & Means and Transportation committees.
— Last day to consider opposite house bills (5 p.m.) (except initiatives and alternatives to initiatives, matters necessary to implement budgets, matters that affect state revenue, amendments, differences, and business related to the interim or closing the session).*
— Last day allowed for regular session under state constitution.
* After 5:00p.m. on the 54th day only initiatives and alternatives to initiatives, budgets and matters necessary to implement budgets, matters that affect state revenue, messages pertaining to amendments, matters of differences differences between the two houses, and matters incident to the interim and to the closing of the session may be considered.
The Governor has 5 days, if the Legislature is still in session, or 20 days, if the Legislature has adjourned, to take action on any bill passed by the Legislature.


Legend
Testing
Controls
Settings
Heating
Cooling
Ventilation
Administration
Prescriptive


Legend
Enclosure
Envelope
Shell
Modeling
Calculation
Renewable
Energy
Legend
Single Family
Multifamily
Remodel

What is Chapter 1?

Chapter 1 is Scope and Administration, "Office stuff".

Key (new & existing) points in Chapter 1 for the purposes of this education. Chapter 1 covers the administrate practice such as permitting, fee, work orders, process (inspections and enforcement).

- Scope of Work defines building types that shall comply with WSEC -**R101.2**
  - Mixed use must be separately considered - **R101.4.1**
- New "lingo" for digital submittal for permits - **R103.1**
- Required documentation for the permit process - **R103.2**

Also Defines the minimum requirements of:
- Documentation retention time - **R103.5,**
- Fee's - **R104's,**
- Inspections - **R105's,**
- Approval and Standards - **R106 – R108's**
- Additional Administrative Functions - **R109 - R112's**

R103.2 Information on construction documents. Construction documents shall be drawn to scale upon suitable material. Electronic media documents are permitted to be submitted when approved by the code official. Construction documents shall be of sufficient clarity to indicate the location, nature and extent of the work proposed, and show in sufficient detail pertinent data and features of the building, systems and equipment as herein governed.

1. Energy compliance path per Section R401.2.
2. Insulation materials and their R-values.
3. Fenestration U-factors and SHGCs.
4. Area-weighted U-factor and SHGC calculations.
5. Mechanical system design criteria.
6. Mechanical and service water heating system and equipment types, sizes and efficiencies.
7. Equipment and systems controls.
8. Duct sealing, duct and pipe insulation and location.
9. Air sealing details.

R103.2.1 Building thermal envelope depiction. The building's thermal envelope shall be represented on the construction documents.

Summary of Chapter 1 WSEC - Residential 2021 EPCA Edition:

- ✓ Add section that enforces the use of digital permitting.
- ✓ R-2 designated projects, corridor loaded required to comply with the WSEC-C (commercial).
- ✓ Alignment to national code sections
- ✓ List of everything that needs to be included for a permit.

What is Chapter 2?

Chapter 2 is Definitions, "Geeky stuff".

Key (new & existing) points in Chapter 2 for the purposes of this education.

Chapter 2 consists of definitions as they apply to the WSEC-R

- U-Factor/F-Factor
- Whole House Mechanical System
- Zone
- Residential Building
- Renewable Energy Certificate
- Renewable Energy Resources
- Ready access to

- Advanced Framed Walls
- Air Barrier
- Vapor Barrier
- Building Thermal Envelope
- Continuous insulation (CI)
- Dwelling Unit Enclosure Area

Chapter 2

RESIDENTIAL BUILDING. For this code, the following building types are residential buildings:

1. Detached one- and two-family dwellings
2. Multiple single-family dwellings (townhouses)
3. Group R-3 occupancy areas in buildings three stories or less in height above grade plane whose dwelling units are accessed directly from the exterior.
4. Group R-2 occupancy areas in buildings three stories or less in height above grade plane whose dwelling units are accessed directly from the exterior.
5. Accessory structures to residential buildings.

Group R-2 buildings with dwelling units accessed from interior corridors or other interior spaces are not residential buildings.

Chapter 2

ADVANCED FRAMED WALLS. Studs framed on 24-inch centers with double top plate and single bottom plate. Corners use two studs or other means of fully insulating corners, and one stud is used to support each header. Headers consist of double 2x material with R-10 insulation between the header and exterior sheathing. Interior partition wall/exterior wall intersections are fully insulated in the exterior wall. (See Standard Framing and Appendix A, of chapter 51-11C WAC.)

INTERMEDIATE FRAMED WALLS. Studs framed on 16-inch centers with double top plate and single bottom plate. Corners use two studs or other means of fully insulating corners, and each opening is framed by two studs. Headers shall be insulated to R-10.

CONTINUOUS INSULATION (C.I.). Insulating material that is continuous across all structural members without thermal bridges other than fasteners and service openings. It is installed on the interior or exterior or is integral to any opaque surface of the building envelope.

DUCTLESS MINI-SPLIT HEAT PUMP SYSTEM. A heating and cooling system that is comprised of one or multiple indoor evaporator/air-handling units and an outdoor condensing unit that is connected by refrigerant piping and electrical wiring. A ductless mini-split system is capable of cooling or heating one or more rooms without the use of a central ductwork system.

DWELLING UNIT ENCLOSURE AREA. The sum of the area of ceiling, floors and walls separating a dwelling unit's conditioned space from the exterior or from adjacent conditioned or unconditioned spaces. Wall height shall be measured from the finished floor of the dwelling unit to the underside of the floor above

Chapter 2

RENEWABLE ENERGY CERTIFICATE (REC). An instrument that represents the environmental attributes of one megawatt hour of renewable energy; also known as an energy attribute certificate (EAC).

RENEWABLE ENERGY RESOURCES. Energy derived from solar radiation, wind, waves, tides, landfill gas, biogas, biomass or extracted from hot fluid or steam heated within the earth.

FAQ courtesy of: King County

Summary of Chapter 2 WSEC - Residential 2021 EPCA Edition:

- ✓ Definition of Residential Buildings moving R-2 designated projects that are corridor loaded will now be required to comply with the WSEC-C (commercial).
- ✓ REC/EAC credits
- ✓ Approved Agency
- ✓ New/altered definitions worth reading.

What is Chapter 3?

Chapter 3 is General Requirements, "Important, where else would it go?".
This chapter covers design, defaults/set points and labeling/reporting specification requirements for the WSEC-R
Key (new & existing) points in Chapter 3 for the purposes of this education.

Defines climate zones for every city in WA state - **R301.1**
Defines design conditions (think Manual J) - **R302.1 &302.2**
Materials, Systems & Equipment - **R303**
Identification & Labeling - **303.1.**
Default exception - **R303.1.1.1**
Fenestration Rating Req. (NFRC) - **R303.1.3**
Insulation product rating - **R303.1.4**
Installation of exterior insulation - **R303.2**
Maintenance Information - **R303.3**

Chapter 3

TABLE R303.1.3(3)
SMALL BUSINESS COMPLIANCE TABLE
DEFAULT *U*-FACTORS FOR VERTICAL FENESTRATION

Vertical Fenestration Description				Frame Type		
Panes	Low-e[a]	Spacer	Fill	Any Frame	Aluminum Thermal Break[b]	Wood/Vinyl/ Fiberglass
Double[c]	A	Any	Argon	0.48	0.41	0.32
	B	Any	Argon	0.48	0.39	0.30
	C	Any	Argon	0.44	0.37	0.28
	C	High-Performance	Argon	0.42	0.35	Deemed to comply[e]
Triple[d]	A	Any	Air	0.50	0.44	0.28
	B	Any	Air	0.45	0.39	0.22
	C	Any	Air	0.41	0.34	0.20
	Any double low-e	Any	Air	0.35	0.32	0.18

a. Low-eA (emissivity) shall be 0.24 to 0.16.
Low-eB (emissivity) shall be 0.15 to 0.08.
Low-eC (emissivity) shall be 0.07 or less.
b. Aluminum thermal break. The aluminum thermal break framed window shall incorporate the following minimum design characteristics:
1). The thermal conductivity of the thermal break material shall be not more than 3.6 (Btu-in/h/ft²/°F.
2). The thermal break material must produce a gap in the frame material of not less than 0.210 inches; and
3). All metal framing members of the products exposed to interior and exterior air shall incorporate a thermal break meeting the criteria in 1) and 2) above.
c. A minimum air space of 0.375 inches between panes of glass is required for double glazing.
d. A minimum air space of 0.25 inches between panes of glass is required for triple glazing.
e. Deemed to comply glazing shall not be used for performance compliance.

TABLE R303.1.3(4)
DEFAULT *U*-FACTORS FOR SKYLIGHTS

Fenestration Type	Frame Type: Aluminum Without Thermal Break	Aluminum With Thermal Break	Reinforced Vinyl/ Aluminum-Clad Wood or Vinyl	Wood or Vinyl/ Clad Wood/ Vinyl without Reinforcing
Single Glazing: glass acrylic/polycarb.	U-1.58 U-1.52	U-1.51 U-1.45	U-1.40 U-1.34	U-1.19 U-1.11
Double Glazing: air argon	U-1.05 U-1.02	U-0.88 U-0.86	U-0.84 U-0.80	U-0.67 U-0.64
Double Glazing, e=0.20: air argon	U-0.96 U-0.91	U-0.80 U-0.75	U-0.75 U-0.70	U-0.59 U-0.54
Double Glazing, e=0.10: air argon	U-0.94 U-0.89	U-0.79 U-0.73	U-0.74 U-0.68	U-0.58 U-0.52
Double Glazing, e=0.05				

TABLE R303.1.3(1)
DEFAULT GLAZED WINDOW, GLASS DOOR AND SKYLIGHT *U*-FACTOR

FRAME TYPE	WINDOW AND GLASS DOOR		SKYLIGHT
	SINGLE PANE	DOUBLE PANE	
Metal	1.20	0.80	See Table R303.1.3(4)
Metal with Thermal Break*	1.10	0.65	
Nonmetal or Metal Clad	0.95	0.55	
Glazed Block		0.60	

Images from WSEC-R

Summary of Chapter 3 WSEC - Residential 2021 EPCA Edition:

- ✓ Standards, "Best Practices", and Labeling
- ✓ Default fenestration requirements for doors and glazing
- ✓ Garage door labeling and reported efficiency values
- ✓ Maintenance Information
- ✓ Product Rating Requirements

What is Chapter 4?

Chapter 4 is Residential Energy Efficiencies, "The nitty gritty stuff".
Chapter 4 is best handled when divided into each of the categories. Chapter 4 is the largest of the chapters of WSEC-R with each section referenced below.

General - **R401**
Building Thermal Envelope - **R402**
Systems - **R403**
Electrical Power & Lighting - **R404**
Total Building Performance - **R405**
Additional Energy Efficiency Req. - **R406**
Certified Passive House - **R407**

Scope of work, Compliance & Certification.
Chapter 4, section R401 covers the beginning of the journey by defining the administrative process and inspections.

R-401.1 Scope of Work

- Moves R-2 Corridor loaded multifamily buildings to the WSEC-C (Commercial).

R401.2 Compliance

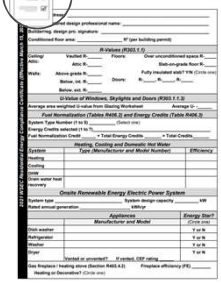
- This defines which parts of the WSEC-R each housing type designation shall be required to comply with.

R 401.3 Certification

- This section defines the requirement of the use of a certificate that shall be installed in the dwelling.

Chapter 4

General R401.3 - Certificate



A permanent certificate shall be completed by the builder or other approved party and posted on a wall in the space where the furnace is located, a utility room, or an approved location inside the building. When located on an electrical panel, the certificate shall not cover or obstruct the visibility of the circuit directory label, service disconnect label, or other required labels. The certificate shall indicate the following:

1. The predominant R-values of insulation installed in or on ceiling/roof, walls, foundation (slab, belowgrade wall, and/or floor) and ducts outside conditioned spaces.
2. U-factors for fenestration and the solar heat gain coefficient (SHGC) of fenestration. Where there is more than one value for each component, the certificate shall indicate the area weighted average value.
3. The results from any required duct system and building envelope air leakage testing done on the building.
4. The results from the whole-house mechanical ventilation system flow rate test.
5. The types, sizes and efficiencies of heating, cooling, whole-house mechanical ventilation, and service water heating appliances. Where a gas-fired unvented room heater, electric furnace, or baseboard electric heater is installed in the residence, the certificate shall list "gas-fired unvented room heater," "electric furnace" or "baseboard electric heater," as appropriate. An efficiency shall not be listed for gas-fired unvented room heaters, electric furnaces or electric baseboard heaters..
6. Where on-site photovoltaic panel systems have been installed, the array capacity, inverter efficiency, panel tilt, orientation and estimated annual electrical generation shall be noted on the certificate.
7. The code edition under which the structure was permitted, and the compliance path used.

The code official may require that documentation for any required test results include an electronic record of the time, date and location of the test. A date-stamped smart phone photo or air leakage testing software may be used to satisfy this requirement.

Summary of Chapter R401 WSEC - Residential 2021 EPCA Edition:

- ✓ Specifies the project type defining its pathway through the code
- ✓ Required pathway compliance and required pathway reporting
- ✓ Certificate "Sticker", commonly missed item!

Building Thermal Envelope:

Chapter 4, section R402 covers key points in the Building Thermal Envelope and states the minimum envelope/shell requirements. This is a pretty large section.

R402.1 General
- Vapor retarders - R402.1.1
- U Values by Component - R402.1.2
- R Value and R Value Computation R402.1.3 & R402.1.4
- R value Table R402.1.3
- Total UA Alternative & Calculations R402.1.5 – 402.1.6

R402.2 Specific Insulation Requirements
- Ceilings and Attics R402.1 – R 402.2.4.1
- Mass Walls R402.2.5
- Steel Framing R402.2.6
- Other Building Components R402.2.7 –R402.2.10

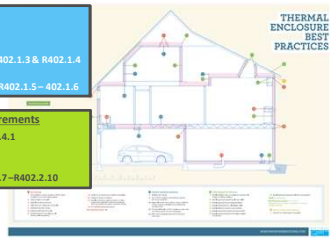


Photo courtesy of: Betterbuiltnw.org

Building Thermal Envelope:

R402.1.5 Total UA Alternative
- If the proposed building thermal envelope UA is less than or equal to the target UA, the building shall be considered in compliance with Table R402.1.2. The proposed UA shall be calculated in accordance with Equation 2. The target UA shall be calculated in accordance with Equation 1. U-factors shall be determined as specified in Section R402.1.6. In addition to UA compliance, the maximum fenestration U-factors of Section R402.5 shall be met.

R402.1.6 U-Factor Reference and Calculations
- The U-factors for typical construction assemblies are included in Appendix A in chapter 51-11C WAC. These values shall be used for all calculations.
- Where proposed construction assemblies are not represented in Appendix A, values shall be calculated in accordance with the ASHRAE Handbook of Fundamentals using the framing factors listed in Appendix A where applicable and shall include the thermal bridging effects of framing materials. The SHGC requirements shall be met in addition to UA compliance.

Building Thermal Envelope:

402.3 Fenestrations
- Vapor Retarders - R402.1.1
- U Values by Component - R402.1.2
- R Value and R Value Computation R402.1.3 & R402.1.4
- R Value Table R402.1.3
- Total UA Alternative & Calculations R402.1.5 – 402.1.6

Photo courtesy of:
WSEC-R Appendix A table of contents

Building Thermal Envelope:

TABLE R402.1.3
INSULATION MINIMUM R-VALUES AND FENESTRATION REQUIREMENTS BY COMPONENTS[a]

	CLIMATE ZONE 5 AND MARINE 4
Fenestration U-Factor[b, i]	0.30
Skylight[b] U-Factor	0.50
Ceiling R-Value[e]	60
Wood Frame Wall[f] R-Value	20+5 or 13+10
Floor R-Value	30
Below-Grade[c, h] Wall R-value	10/15/21 int + 5TB
Slab[d, j] R-Value & Depth	10, 4 ft

a. *R*-values are minimums. *U*-factors and SHGC are maximums. When insulation is installed in a cavity which is less than the label or design thickness of the insulation, the compressed *R*-value of the insulation from Appendix A Table A101.4 of chapter 51-11C WAC 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 percent of the wall cavity insulated and headers insulated with a minimum of R-10 insulation.
i. The first value is cavity insulation, the second value is continuous insulation. Therefore, as an example, "R13+10" means R-13 cavity insulation plus R-10 continuous insulation.
j. A maximum *U*-factor of 0.32 shall apply to vertical fenestration products installed in buildings located above 4000 feet in elevation above sea level, or in windborne debris regions where protection of openings is required under Section R301.2.1.2 of the International Residential Code.

TABLE R402.1.2
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

	CLIMATE ZONE 5 AND MARINE 4
Fenestration U-Factor[b]	0.30
Skylight U-Factor	0.50
Ceiling U-Factor	0.024
Above-Grade Wall U-Factor	0.056
Floor U-Factor	0.029
Slab on Grade *F*-Factor	0.54
Below Grade 2' Depth	
Wall *U*-Factor	0.042
Slab *F*-Factor	0.59
Below Grade 3.5' Depth	
Wall *U*-Factor	0.040
Slab *F*-Factor	0.56
Below Grade 7' Depth	
Wall *U*-Factor	0.035
Slab *F*-Factor	0.50

For SI: 1 foot = 304.8 mm, ci = continuous insulation, int = intermediate framing.
a. *U*-factors or F-factors shall be obtained from measurement, calculation or an approved source, or as specified in Section R402.1.5.
b. A maximum *U*-factor of 0.32 shall apply to vertical fenestration products installed in buildings located above 4000 feet in elevation above sea level, or in windborne debris regions where protection of openings is required under Section R301.2.1.2 of the International Residential Code.

Building Thermal Envelope:

Energy Program — **Insulation Certificate for Residential New Construction**

Permit #:
House address or lot number:

Walls	**Blown or Sprayed Fiberglass or Cellulose - Walls**
Type of insulation:	R-value per inch:
Manufacturer:	Coverage area:
Fill Density: 1.8lbs./ft³ Cellulose: 3.5-4.3Lbs./ft³	Installed Density Per Ft.²:
R-value:	Bag count:
Floor	**Blown or Sprayed Fiberglass or Cellulose - Ceiling**
Type of insulation:	Settled R-value per inch:
Manufacturer:	Coverage area:
R-value:	Bag count:
Flat Ceiling/Attic	**Sprayed Polyurethane Foam (SPF)**
Type of insulation:	Density: ☐ 0.5Lbs./ft³ ☐ 2.0Lbs./ft³
Manufacturer:	Installed thickness:
R-value:	R-value of installed thickness:
Single Rafter Joist Vaulted Ceiling	Building component installed: (circle one) walls floor ceiling
Type of insulation:	
Manufacturer:	
R-value:	
Insulation Installer	
Company name:	
Installer name: (Print)	
Installer signature:	
Date:	
Phone number:	
Email:	

Washington State Energy Code Reference
See attached page for specifications

Property address: _____
Builder/applicant/design professional name: _____

WSEC-R 2021 Edition Testing Results

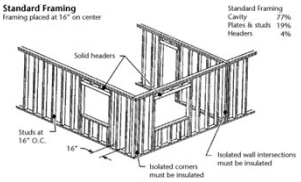
HVAC System Duct Leakage Testing (R403.3)	Circle one
All ductwork and air handler in conditioned space? (See Option 4.2)	Y or N
All ductwork in unconditioned space pressure tested at 3% total leakage, and air handler in conditioned space? (See Option 4.1.)	Y or N
All ductwork & air handler outside conditioned space insulated to minimum R-8?	Y or N
Air handler present at duct leakage test? (Total leakage 4% if yes, 3% if no)	Y or N
HVAC leakage to outside test conducted at final?	Y or N
Do HVAC duct leakage tests include GPS and time stamp verification?	Y or N
HVAC system leakage test calculated design target: _____	CFM @ 25 Pa
HVAC system leakage test measured results: _____	CFM @ 25 Pa
Building Leakage Testing (R402.4.1.2)	
Dwelling unit leakage test calculated design target: _____	ACH @ 50 Pa
Dwelling unit leakage test, measured results: _____	ACH @ 50 Pa
Whole Building Leakage test (R2 non-corridor only) design target: _____	CFM/sf @ 50 Pa
Whole Building Leakage test (R2 non-corridor only) measured: _____	CFM/sf @ 50 Pa
Do building leakage tests include GPS and time stamp verification?	Y or N
Whole House Ventilation System Measured Flow Rates (M1507.4 (R1404))	Circle one
Are the system controls correctly labeled?	Y or N
Has the owner been provided with the system operation and maintenance (O&M) instructions were provided to the building owner?	Y or N
Provided to: _____ on: _____ (date)	
Whole House Ventilation System Type: (Circle one)	
(1) Whole house exhaust fan, location _____	
(2) Balanced HRV/ ERV, location _____	
For R2 tow-rise, serves more than one unit?	Y or N
(3) Supply or HRV/ ERV integral to the air handler. Describe system control sequence of operations or reference to design submittal: _____	
Do WHV flow tests include GPS & time stamp verification?	Y or N
HRV/ERV sensible heat recovery efficiency: _____	
Commissioning Notes: _____	

Other Mandatory Requirements	Circle one
All other mandatory requirements of WSEC-R have been met?	Y or N

Standard Framing

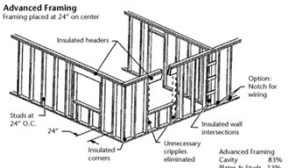
Framing placed at 16" on center

Standard Framing
Cavity 77%
Plates & studs 19%
Headers 4%



Advanced Framing

Framing placed at 24" on center



Advanced Framing
Cavity 83%
Plates & Studs 13%
Headers 4%

Note: Approximately 25% less wood in advanced frame walls.

Intermediate Framing

Framing placed at 16" on center
Insulated headers, corners and intersections

Intermediate Framing
Cavity 78%
Plates & Studs 18%
Headers 4%

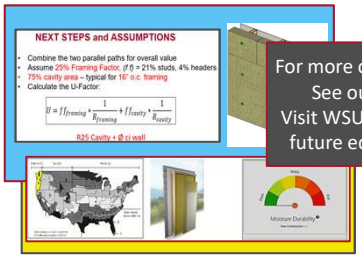
ADVANCED FRAMED WALLS; Definitions R202

Studs framed on 24-inch centers with double top plate and single bottom plate. Corners use two studs or other means of fully insulating corners, and one stud is used to support each header. Headers consist of double 2x material with R-10 insulation between the header and exterior sheathing. Interior partition wall/exterior wall intersections are fully insulated in the exterior wall. (See Standard Framing and Appendix A of this code.)

Building Thermal Envelope:

Photo Courtesy of: Rockwool.com

Photo Courtesy of: Foam Plastic Applications for better buildings



For more on continuous insulation,
See our upcoming CI class.
Visit WSU-EP Training Website for future education opportunities.

Building Thermal Envelope:

High Efficiency Storm Window Systems

QUANTAPANEL IGS Storm Windows

No video, image of site

Storm Windows

Not the same old storm windows of the past
High performance and aesthetically pleasing, garage conversion perhaps?

Low E Storm Windows - QuantaPanel

Building Thermal Envelope:

R402.4 Air Leakage

- Building Thermal Envelope Air Leakage
- Installation of the Building Thermal Envelope
- Testing
- Air Barrier, Air Sealing, & Insulation Chart R402.4.1.1
- Leakage Rate & Dwelling Leakage Rates R402.4.1.3 – R402.4.2
- Fenestration Leakage Rate R402.1.3.2

Testing of single-family dwellings and townhouses shall be conducted in accordance with RESNET/ICC 380. Test pressure and leakage rate shall comply with Section R402.1.3.1.

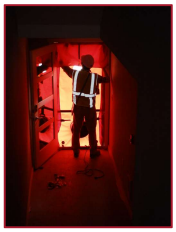
For Group R-2 occupancies, testing shall be conducted in accordance with ASTM E779, ASTM E1827, or ASTM E3158. Test pressure and leakage rate shall comply with Section R402.1.3.2. The individual performing the air leakage test **shall be trained and certified** by a certification body that is, at the time of permit application, and ISO 17024 accredited certification body including, but not limited to, the Air Barrier Association of America.

Building Thermal Envelope:

R402.4.1.3.1 Dwelling unit leakage rate

The maximum air leakage rate for any dwelling unit under any compliance path shall not exceed 4.0 air changes per hour. Testing shall be conducted with a blower door test at a test pressure of 0.2 inches w.g. (50 Pa).

Exception: 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 dwelling must be prior to the 2009 Washington State Energy Code.



Building Thermal Envelope:

R402.4.1.3.2 Group R-2

Multifamily building leakage rate:

For Group R-2 multifamily buildings, the maximum leakage rate for any dwelling unit shall not exceed 0.25 cfm per square foot of the dwelling unit enclosure area.

Testing shall be conducted with a blower door at a test pressure of 0.2 inches w.g. (50 Pa). Doors and windows of adjacent dwelling units (including top and bottom units) shall be open to the outside during the test.

Program Description

Overview

An interactive, 40-hour, 5-day, in-person training program, centered on commercial blower door testing, featuring conceptual learning and practical hands-on instruction from industry experts and representatives from both blower door manufacturers.

Course Description

The purpose is to educate both entry-level and experienced blower door technicians in the planning, preparation, and execution of a blower door airtightness test on commercial and large buildings in conformance with industry standard test methods.

Currently it is the MOST comprehensive blower door testing training program available covering ASTM E3158, E779, E1827, CGSB 149.10, ISO 9972, and USACE (2012) test methods.

The training aims to equip blower door technicians with the knowledge, skills, and abilities necessary to appropriately evaluate, prepare, test, analyze, and report on a building's airtightness performance.
For the purposes of demonstrations, activities, and simulations, this training program uses equipment from two widely used blower door fan manufacturing companies.

Whole Building Airtightness Program - Air Barrier Association of America

Building Thermal Envelope:

R402.4.1.2 Testing

The building or dwelling unit shall be tested for air leakage. Testing shall be conducted in accordance with RESNET/ICC 380, ASTM E779 or ASTM E1827. Test pressure and leakage rate shall comply with Section R402.1.3. A written report of the test results, including verified location and time stamp of the date of the test, shall be signed by the testing agency and provided to the building owner and code official. Testing shall be performed at any time after creation of all penetrations of the building thermal envelope. Once visual inspection has confirmed air sealing (has been conducted in accordance with Table R402.4.1.1), operable windows and doors manufactured by small business are *permitted to be sealed off at the frame prior to the test.*

Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed, beyond the intended weather-stripping or other infiltration control measures;

Dampers including exhaust, intake, makeup air, backdraft and flue dampers shall be closed, but not sealed beyond intended infiltration control measures;

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;

Exterior or interior terminations for continuous ventilation systems and heat recovery ventilators shall be sealed;

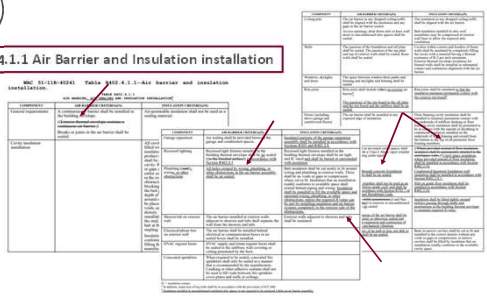
Heating and cooling systems, if installed at the time of the test, shall be turned off; and

Supply and return registers, if installed at the time of the test, shall be fully open.

Exception: Additions less than 500 square feet of conditioned floor area.

Building Thermal Envelope:

R402.4.1.1 Air Barrier and Insulation installation



Building Thermal Envelope:

The interior air barrier here is needed if they are trading off exterior insulation!

TABLE R402.4.1.1 (continued)
AIR BARRIER, AIR SEALING AND INSULATION INSTALLATION*

COMPONENT	AIR BARRIER CRITERIA	INSULATION CRITERIA
Windows, skylights and doors	The space between window/door jambs and framing and skylights and framing shall be sealed.	
Rim joists	Rim joists shall include an exterior air barrier[a]. The junctions of the rim board to the sill plate and the rim board and the subfloor shall be air sealed.	Rim joists shall be insulated so that the insulation maintains permanent contact with the exterior rim board[a].
Floors (including above garage and cantilevered floors)	The air barrier shall be installed at any exposed edge of insulation.	Floor framing cavity insulation shall be installed to maintain permanent contact with the underside of subfloor decking or floor framing cavity insulation shall be permitted to be in contact with the topside of sheathing

Building Thermal Envelope:

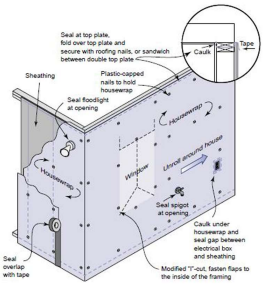


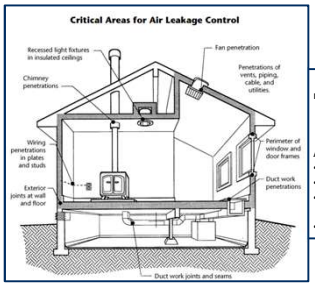
Photo courtesy of : Building America Solution Center (BASC) PNNL

Air Barriers & Air Sealing

Air Barrier: One or more materials joined together in a continuous manner to restrict or prevent the passage of air through the building thermal envelope and its assemblies.

- R402.4.1 Building Thermal Envelope The building thermal envelope shall comply with Sections R402.4.1.1 and R402.4.1.2.
- The sealing methods between dissimilar materials shall allow for differential expansion and contraction.

Building Thermal Envelope:

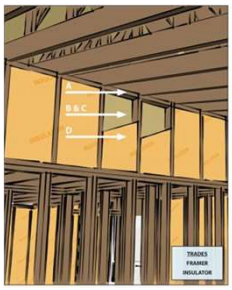


Air leakage control is an important but commonly misunderstood component of the energy efficient house. Tightening the structure with caulking and sealants has several positive impacts.

A tight house will:

- Have lower heating bills due to less heat loss.
- Have fewer drafts and be more comfortable.
- Reduce the chance of mold and rot because moisture can't enter and become trapped in cavities.
- Have a better performing ventilation system.

Building Thermal Envelope:



Air Barriers Behind Tubs (link included)

Images courtesy of : Building America Solution Center (BASC) PNNL

2021 WSEC-R 2nd Edition Air barrier testing

Energy Program

WSU

Single Family
No License required currently

Testing Standard ICC/RESNET 380

Provide test results to AHJ & Owner

4@ACH50 Negative or Positive

Multifamily Certification Required

ASTM E779
ASTM E1827
ASTM E3158

Provide test results to AHJ & Owner

0.25cfm/sf of DUEA @50PA) (WSEC-R)
Positive and/or Negative
(see standard chosen)

R402.4.1.2

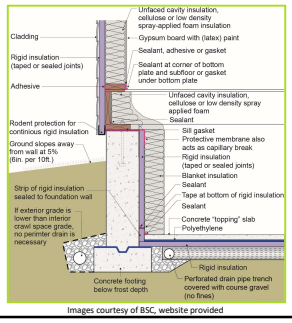
You must pass the test!

No guarded testing

R402.4.1.3.2 Group R-2 multifamily building leakage rate. For Group R-2 multifamily buildings, the maximum leakage rate for any dwelling unit shall not exceed 0.25 cfm per square foot of the dwelling unit enclosure area. Testing shall be conducted with a blower door at a test pressure of 0.2 inches w.g. (50 Pa).

Doors and windows of adjacent dwelling units (including top and bottom units) shall be open to the outside during the test.

Conditioned Crawl & Acknowledgement to BSC:

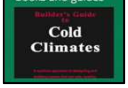


Images courtesy of BSC, website provided

Events
Classes and seminars, in-person and online

Details
Technical guidance for all climate zones

Publications
Classic and current books and guides



Each AHJ must approve a conditioned crawlspace use in their area. Big warning, code says no in high radon areas….

https://buildingscience.com/

Electrical:

R402.4.3 Recessed lighting

Recessed luminaires installed in the building thermal envelope shall be Type IC-rated and certified under ASTM E283 as having an air leakage rate not more than 2.0 cfm (0.944 L/s) when tested at a 1.57 psf (75 Pa) pressure differential and shall have a label attached showing compliance with this test method. All recessed luminaires shall be sealed with a gasket or caulk between the housing and the interior wall or ceiling covering.

R402.4.4 Electrical and communication outlet boxes (air-sealed boxes)

Electrical and communication outlet boxes installed in the building thermal envelope shall be sealed to limit air leakage between conditioned and unconditioned spaces. Electrical and communication outlet boxes shall be tested in accordance with NEMA OS 4, Requirements for Air-Sealed Boxes for Electrical and Communication Applications, and shall have an air leakage rate of not greater than 2.0 cubic feet per minute (0.944 L/s) at a pressure differential of 1.57 psf (75 Pa).

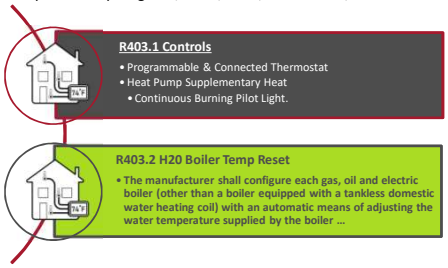
Electrical and communication outlet boxes shall be marked [11] OTS-5010.1 "NEMA OS 4" or "OS 4" in accordance with NEMA OS 4. Electrical and communication outlet boxes shall be installed per the manufacturer's instructions and with any supplied components required to achieve compliance with NEMA OS 4.

Summary of Chapter R402 WSEC - Residential 2021 EPCA Edition:

- ✓ The Ceiling U-value has decreased to 0.024
- ✓ The Ceiling R-Value has increased to R-60
- ✓ The wall cavity R-Value has increased to R20+5. This modification means that wall assemblies require Continuous Insulation
- ✓ The wall U-Value for UA is 0.056.
- ✓ Air Leakage requirements are more stringent
  - 4 ACH@50Pa
  - 0.25 cfm per square foot of dwelling unit area maximum.
- ✓ New electrical outlet specifications on air tightness.
- ✓ New air barrier specification

Control(s) Systems

Chapter 4 section R403 covers key points in Systems. This is the largest of the sections in Chapter 4. It generally covers anything that; heats, cools, or ventilates, and their distribution.



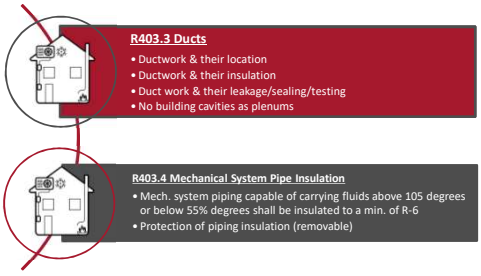
R403.1 Controls

- Programmable & Connected Thermostat
- Heat Pump Supplementary Heat
- Continuous Burning Pilot Light.

R403.2 H20 Boiler Temp Reset

- The manufacturer shall configure each gas, oil and electric boiler (other than a boiler equipped with a tankless domestic water heating coil) with an automatic means of adjusting the water temperature supplied by the boiler …

Duct Systems



R403.3 Ducts

- Ductwork & their location
- Ductwork & their insulation
- Duct work & their leakage/sealing/testing
- No building cavities as plenums

R403.4 Mechanical System Pipe Insulation

- Mech. system piping capable of carrying fluids above 105 degrees or below 55% degrees shall be insulated to a min. of R-6
- Protection of piping insulation (removable)

Duct Systems

R403.3.5 Duct Testing

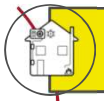
- Ducts shall be leak tested in accordance with WSU RS-33, using the maximum duct leakage rates specified.
- EXCEPTION: A duct air leakage test shall not be required for ducts serving ventilation systems that are not integrated with the ducts serving heating or cooling systems.
- A written report of the results shall be signed by the party conducting the test and provided to the code official.

R403.3.6 Duct leakage.

The total leakage of the ducts, where measured in accordance with Section R403.3.3, shall be as follows:

- Test for ducts within thermal envelope: Where all ducts and air handlers are located entirely within the building thermal envelope, total leakage shall be less than or equal to 8.0 cubic feet per minute (226.6 L/min) per 100 square feet (9.29 m2) of conditioned floor area. For forced air ducts, a maximum of 10 linear feet of return ducts and 5 linear feet of supply ducts may be located outside the conditioned space. All metallic ducts located outside the conditioned space must have both transverse and longitudinal joints sealed with mastic. If flex ducts are used, they cannot contain splices. Flex duct connections must be made with nylon straps and installed using a plastic strapping tensioning tool. Ducts located in crawl spaces do not qualify for this exception.

Water Systems



R403.5 Service Hot Water Systems

- Circulation Pump, Demand Circ. Pumps &, Heat Trace Requirements
- Water distribution, distribution efficiencies & installation Location. *(note, this is where the electric water tank must be in conditioned space is located)*

R403.6 Mechanical Ventilation

- This section defines the ventilation requirements for the different dwelling types.
- It covers sound, distribution efficiencies, & unit energy use per cfm.
- Establishes Testing/commissioning requirements

Water Systems

R403.5.2 Water volume determination.

The volume shall be the sum of the internal volumes of pipe, fittings, valves, meters, and manifolds between the nearest source of heated water and the termination of the fixture supply pipe. Water heaters, circulating water systems, and heat trace temperature maintenance systems shall be considered to be sources of heated water.

The volume in the piping shall be determined from Table C404.3.1 in the Washington State Energy Code, Commercial Provisions or Table L502.7 of the Uniform Plumbing Code. The volume contained within fixture shutoff valves, within flexible water supply connectors to a fixture fitting and within a fixture fitting shall not be included in the water volume determination.

Where heated water is supplied by a recirculating system or heat-traced piping, the volume shall include the portion of the fitting on the branch pipe that supplies water to the fixture.

How long should you wait for hot water?

Volume in the Pipe (ounces)	Minimum Time-to-Tap (seconds) at Selected Flow Rates					
	0.25 gpm	0.5 gpm	1 gpm	1.5 gpm	2 gpm	2.5 gpm
2	4	1.9	0.9	0.6	0.5	0.4
4	8	4	1.9	1.2	0.9	0.8
8	15	8	4	2.5	1.9	1.5
16	30	15	8	5	4	3
24	45	23	11	8	6	5
32	60	30	15	10	8	6
64	120	60	30	20	15	12
128	240	120	60	40	30	24

Compact water design

ASPE Time-to-Tap Performance Criteria

	Acceptable Performance	1 – 10 seconds
	Marginal Performance	11 – 30 seconds
	Unacceptable Performance	31+ seconds

Source: Domestic Water Heating Design Manual – 2nd Edition, ASPE, 2003, page 234

Water Systems

How to Find the Volume of a Pipe

The volume of fluid in a pipe can be found given the inner diameter of the pipe and the length. To estimate pipe volume, use the following formula:

$volume = \pi \times \frac{d^2}{4} \times h$

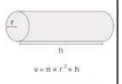
Thus, the volume of a pipe is equal to pi times the pipe diameter d squared over 4, times the length of the pipe h.

Formula to Calculate **Pipe Volume**

$v = \pi \times \frac{d^2}{4} \times h$

This formula is derived from the cylinder volume formula, which can also be used if you know the radius of the pipe.

$volume = \pi \times r^2 \times h$



$v = \pi \times r^2 \times h$

Find the diameter and length of the pipe in inches or millimeters. Use our feet and inches calculator to calculate a length in inches or millimeters.

Pipe Volume Calculator

Calculate the volume of a pipe given its inner diameter and length. The calculator will also find how much that volume of water weighs.

Diameter: in
Length: ft
CALCULATE

Results:

Volume: cu in, gallons

Weight: lbs

https://www.inchcalculator.com/pipe-volume-calculator/

Water Systems

R403.5.7.1 Supplementary Heat for HP H20 Heating

- Supplementary heat for heat pump water heating systems. Heat pumps used for water heating and having supplementary water heating equipment shall have controls that limit supplementary water heating equipment operation to only those times when one of the following applies:
- 1. The heat pump water heater cannot meet hot water demand.
- 2. For heat pumps located in unconditioned space, the outside air temperature is below 40°F (4°C).
- 3. The heat pump is operating in defrost mode.
- 4. The vapor compression cycle malfunctions or loses power.
- Exception: Heat trace temperature maintenance systems, provided the system capacity does not exceed the capacity of the heat pump water heating system.

HVAC Systems

R 403.7 Equipment Sizing

- Requires Manual J & S or other approved calc.
- Cooling shall not exceed the smallest available equipment size that meets the load calcs.
- Gas Fire Place Efficiencies

R 403.8 Systems Servicing Multiple Dwelling Units

- Systems serving multiple dwelling units shall comply with Sections C403 and C404 of the WSEC--Commercial Provisions in lieu of Section R403.

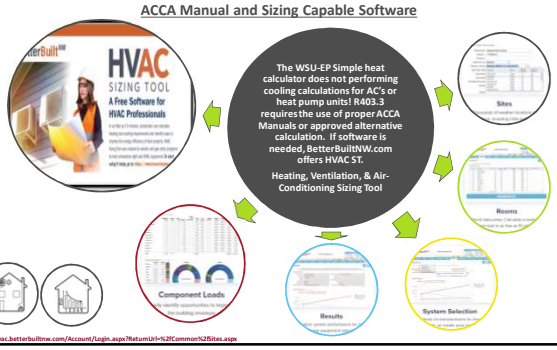
HVAC Systems

ACCA Manual Types J, S, D, & T:

- As you can see there is a lot to the design and implementation of and HVAC system. All homes are required to provide a Manual J and provide the equipment selected to meet the Manual J.
- This is the bare bones minimum the code requires. As you can see by the chart on my right that there is a lot more to good system HVAC design, installation and commissioning.

Image courtesy of ACCA

ACCA Manual and Sizing Capable Software



Washington State Building Code Council

Improving the built environment by promoting health, safety and welfare

1500 Jefferson Street SE ♦ P.O. Box 41449 ♦ Olympia, Washington 98504
(360) 407-9277 ♦ e-mail sbcc@ga.wa.gov ♦ www.sbcc.wa.gov

STATE BUILDING CODE OPINION NO. 23-08

CODE: 2018/2021 Washington State Energy Code

SECTION: Primarily R405, R406, and C406, cited efficiency values

QUESTION: Our current residential and commercial energy codes specify certain equipment performance minimums in terms of their tested HSPF. Beginning next year, the HSPF is being replaced with HSPF2 to reflect a new testing method that better represents actual operating conditions. This creates a problem for determining compliance with the energy code since new equipment will only be listed with HSPF2, not an HSPF rating, that is currently in the 2018 code.

Will the SBCC be providing a conversion chart to providing equivalence between HSPF and HSPF2 for the Commercial and Residential energy codes?

ANSWER: **The attached table from AHRI and CEE may be used to convert SEER, EER and HSPF to the new DOE efficiency standards.**

SUPERSEDES: 23-04, 22-02
REQUESTED BY: SBCC

How do I convert from Appendix M ratings to Appendix M1?

If looking to convert Appendix M ratings to new Appendix M1 ratings, AHRI recommends using the following crosswalk. To use, multiply the Appendix M rating (SEER, EER, HSPF) by the appropriate number of the corresponding Appendix M1 heading (SEER2, EER2, HSPF2) in the table below.

System Type	SEER2	EER2	HSPF2
Ducted	0.95	0.95	0.85
Ductless	1.00	1.00	0.90
Packaged	0.95	0.95	0.84

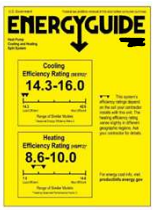
How do I convert from Appendix M1 ratings to Appendix M?

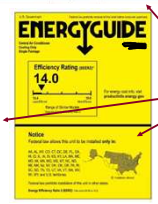
If looking to convert new Appendix M1 ratings to Appendix M values, AHRI recommends using the following equations below.

System Type	Equation
Split System Air Conditioner and Heat Pump	SEER = SEER2 X 1.05
Split System Air Conditioner and Heat Pump	EER = EER2 X 1.04
Split System Heat Pump	HSPF = HSPF2 X 1.16
Packaged Air Conditioner and Heat Pump	SEER = SEER2 X 1.04
Packaged Air Conditioner and Heat Pump	EER = EER2 X 1.04
Packaged Heat Pump	HSPF = HSPF2 X 1.18
Ductless Heat Pump	HSPF = HSPF2 X 1.12
Space Constrained System	SEER = SEER2 X 1.01
Space Constrained System	HSPF = HSPF2 X 1.17
Small Duct High Velocity System	SEER = SEER2 X 1.00
Small Duct High Velocity System	HSPF = HSPF2 X 1.18

[1] US Department of Energy 10 CFR Part 430 Subpart B – Uniform Test Method for Measuring the Energy Consumption of Central Air Conditioners and Heat Pumps.

System Type	SEER2	EER2	HSPF2
Ducted	0.95	0.95	0.85
Ductless	1.00	1.00	0.90
Packaged	0.95	0.95	0.84





Sticker, Charts, & HSPF2

Use the crosswalk to select your equipment for the 406.3 charts

Make sure your sticker has the correct location selected on the map.

Ventilating Systems

R403.6 Mechanical Ventilation.

- **The buildings complying with Section R402.4.1 shall be provided with mechanical ventilation that meets the requirements of Section M1505 in the International Residential Code or Section 403 in the WA Mechanical Code, as applicable, or with other approved means of ventilation.**
- **Outdoor air intakes & exhausts shall have automatic or gravity dampers that close when the ventilation system is not operating.**

Ventilation Systems

R403.6.1 Whole-House Mechanical Ventilation System Fan Efficacy.

- Mechanical ventilation system fans shall meet the efficacy requirements of Table R403.6.1 at one or more rating points. Fans shall be tested in accordance with HVI 916 and listed.
- The airflow shall be reported in the product listing or on the label.
- Fan efficacy shall be reported in the product listing or shall be derived from the input power and airflow values reported in the product listing on the label. Fan efficacy for fully ducted HRV, ERV, balanced, and in-line fans shall be determined at a static pressure of not less than 0.2 inch w.c. (49.85 Pa).
- Fan efficacy for ducted range hoods, bathroom and utility room fans shall be determined at a static pressure of not less than 0.1 inch w.c. (24.91 Pa).

Ventilation Systems

R403.6.2 Testing.

Mechanical ventilation systems shall be tested and verified to provide the minimum ventilation flow rates required by Section R403.6. Testing shall be performed according to the ventilation equipment manufacturer's instructions, or by using a flow hood or box, flow grid, or other airflow measuring device at the mechanical ventilation fan's inlet terminals or grilles, outlet terminals or grilles, or in the connected ventilation ducts.

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.

EXCEPTION:

Kitchen range hoods that are ducted to the outside with 6-inch (152 mm) or larger duct and not more than one 90-degree (1.57 rad) elbow or equivalent in the duct run.

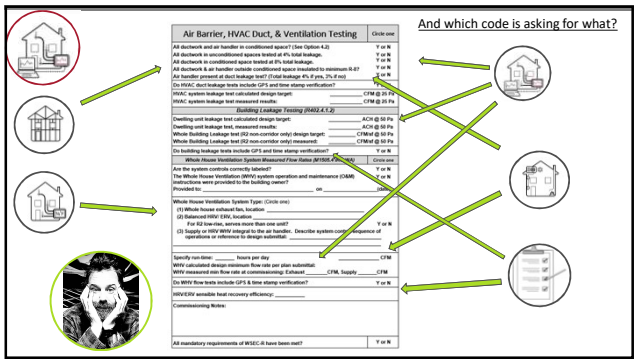
Ventilation Systems

TABLE R403.6.1
WHOLE-DWELLING MECHANICAL VENTILATION SYSTEM FAN EFFICACY[a]

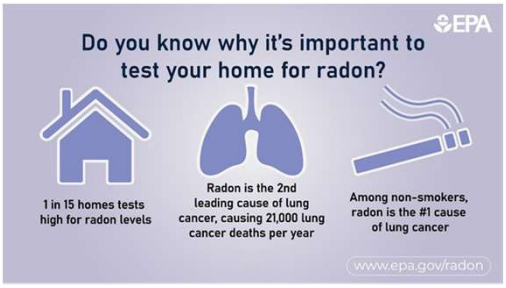
SYSTEM TYPE	AIR FLOW RATE (CFM)	MINIMUM EFFICACY (CFM/WATT)
HRV, ERV or balanced	Any	1.2 cfm/watt
Range hoods	Any	2.8 cfm/watt
In-line supply or exhaust fan	Any	3.8 cfm/watt
Other exhaust fan	<90	2.8 cfm/watt
	≥90	3.5 cfm/watt

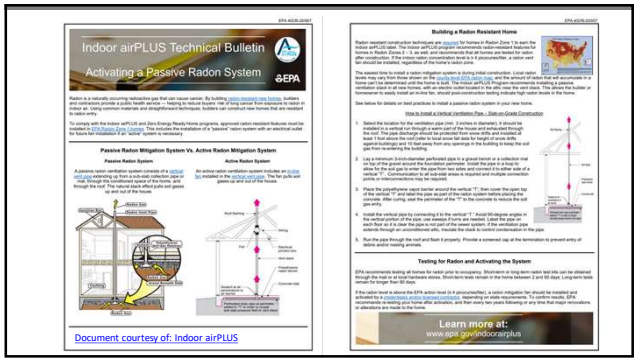
For SI: 1 cfm = 28.3 L/min.

a. Design outdoor or exhaust airflow rate/watts of fan used.

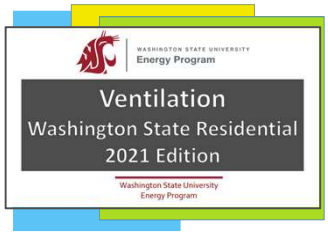


EPA & Radon Gas



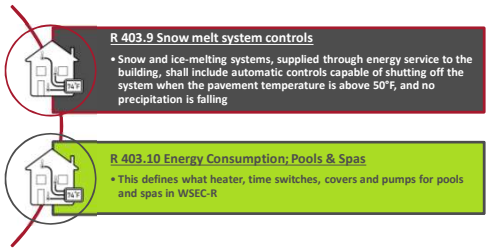


Document courtesy of: Indoor airPLUS



See WSU-EP 2021 WSC-R Ventilation class for more on Ventilation as well as Radon and how it is addressed in the WAC codes.

Systems



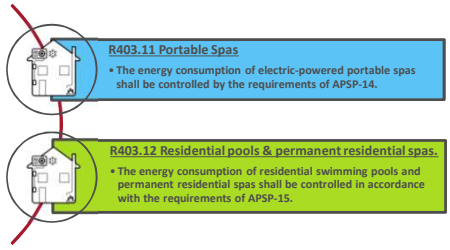
R 403.9 Snow melt system controls

- Snow and ice-melting systems, supplied through energy service to the building, shall include automatic controls capable of shutting off the system when the pavement temperature is above 50°F, and no precipitation is falling

R 403.10 Energy Consumption; Pools & Spas

- This defines what heater, time switches, covers and pumps for pools and spas in WSEC-R

Systems



R403.11 Portable Spas

- The energy consumption of electric-powered portable spas shall be controlled by the requirements of APSP-14.

R403.12 Residential pools & permanent residential spas.

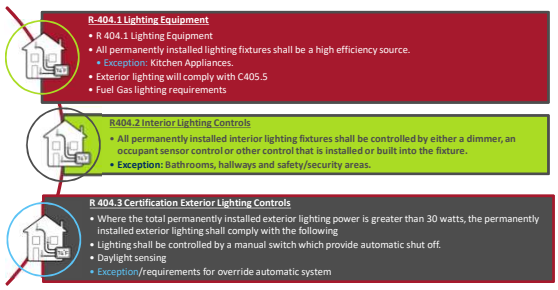
- The energy consumption of residential swimming pools and permanent residential spas shall be controlled in accordance with the requirements of APSP-15.

Summary of Chapter R403 WSEC - Residential 2021 EPCA Edition:

- ✓ Distribution location and efficiencies
  - ✓ Ducts inside now test @ 8% tested leakage rate
  - ✓ Piping and removable covers
- ✓ Dwelling Service H2O Systems, Distribution & Equipment Location
  - ✓ Electric resistive tanks will be required to be installed inside.
- ✓ Mechanical Ventilation Systems
  - ✓ Energy, Sound and Distribution Efficiencies.
- ✓ Equipment Sizing and Selection Calculation(s)
- ✓ Covers Pool and Spa's

Electric Power & Lighting Systems

Chapter 4, section R404 covers lighting efficiencies and control requirements.



R-404.1 Lighting Equipment

- R 404.1 Lighting Equipment
- All permanently installed lighting fixtures shall be a high efficiency source.
  - Exception: Kitchen Appliances.
- Exterior lighting will comply with C405.5
- Fuel Gas lighting requirements

R404.2 Interior Lighting Controls

- **All permanently installed interior lighting fixtures shall be controlled by either a dimmer, an occupant sensor control or other control that is installed or built into the fixture.**
- **Exception: Bathrooms, hallways and safety/security areas.**

R 404.3 Certification Exterior Lighting Controls

- Where the total permanently installed exterior lighting power is greater than 30 watts, the permanently installed exterior lighting shall comply with the following
- Lighting shall be controlled by a manual switch which provide automatic shut off.
- Daylight sensing
- Exception/requirements for override automatic system

Summary of Section R404 WSEC - Residential 2021 EPCA Edition:

- All permanent fixture lighting must be high efficiency lighting.
- Interior lighting shall meet occupancy control requirements.
- Exterior Lighting automatic shut off during daylight hours for lighting over 30 watts.

Total Building Performance

Chapter 4, section R405 covers the total building performance pathway. This section of the chapter establishes the baseline home for the modeling procedure.

R 405.1 Scope

- This section establishes criteria for compliance using total building performance analysis. Such analysis shall include heating, cooling, mechanical ventilation and service water-heating energy only.

R 405.2 Performance based compliance

- Compliance based on total building performance requires that a proposed design meet all of the following:
- The requirements of the sections indicated within Table R405.2.
- For structures less than 1,500 square feet of conditioned floor area, the annual site energy consumption shall be less than or equal to 64 percent of the annual site energy consumption of the standard reference design.
- For structures 1,500 to 5,000 square feet of conditioned floor area, the annual site energy consumption shall be no more than 47 percent of the standard reference design.
- For structures over 5,000 square feet of conditioned floor area, the annual site energy consumption shall be no more than 41 percent of the standard reference design.
- For structures serving Group R-2 occupancies, the annual carbon emissions shall be less than or equal to 61 percent of the annual site energy consumption of the standard reference design. See Section R401.1 and residential building in Section R202 for Group R-2 scope.
- Energy use derived from simulation analysis shall be expressed in BTU(s) per square foot of conditioned floor area per year.

Total Building Performance

405.3 Documentation

- Documentation of the software used for the performance design and the parameters for the building shall be in accordance with Sections R405.3.1 through R405.3.3. R405.3.1 Compliance software tools. Documentation verifying that the methods and accuracy of the compliance software tools conform to the provisions of this section shall be provided to the code official.

R405.3.1 Compliance software tools

- Documentation verifying that the methods and accuracy of the compliance software tools conform to the provisions of this section shall be provided to the code official.

R405.3.2 Compliance report

- Compliance software tools shall generate a report that documents that the proposed design complies with Section R405.2. A compliance report on the proposed design shall be submitted with the application for the building permit. Upon completion of the building, a confirmed compliance report based upon the confirmed condition of the building shall be submitted to the code official before a certificate of occupancy is issued. Compliance reports shall include information in accordance with Sections R405.3.2.1 and R405.3.2.2.

Total Building Performance

R405.3.2.1 Compliance report for permit application

- A compliance reports submitted with the application for building permit shall include all of the following:
- 1. Building street address, or other building site identification.
- 2. The name, organization, and contact information of the individual performing the analysis and generating the compliance report.
- 3. The name and version of the compliance software tool.
- 4. Documentation of all inputs entered into the software used to produce the results for the reference design and/or the rated home.
- 5. A certificate indicating that the proposed design complied with Section R405.2. The certificate shall document the building components' energy specifications that are included in the calculation including: Component-level insulation R-values or U-factors; duct system and building envelope air leakage testing assumptions; and the type and rated efficiencies of proposed heating, cooling, mechanical ventilation, and service water-heating equipment to be installed. If on-site renewable energy systems will be installed, the certificate shall report the type and production size of the proposed system. Additional documentation reporting estimated annual energy production shall be provided.
- 6. When a site-specific report is not generated, the proposed design shall be based on the worst-case orientation and configuration of the rated home.

Total Building Performance

R405.3.2.2 Compliance report for certificate of occupancy

- A compliance report submitted for obtaining the certificate of occupancy shall include all of the following:
- Building street address, or other building site identification.
- Declaration of the total building performance path on the title page of the energy report and the title page of the building plans.
- A statement bearing the name of the individual performing the analysis and generating the report, along with their organization and contact information, indicating that the as-build building complies with Section R405.2.
- The name and version of the compliance software tool. A site-specific energy analysis report that is in compliance with Section R405.2.
- A final confirmed certificate indicating compliance based on inspection, and a statement indicating that the confirmed rated design of the built home complies with Section R405.2. The certificate shall report the energy features that were confirmed to be in the home, including component level insulation R-values or U-factors; results from any required duct system and building envelope air leakage testing; and the type and rated efficiencies of the heating, cooling, mechanical ventilation, and service water-heating equipment installed.
- Where on-site renewable energy systems have been installed, the certificate shall report the type and production size of the installed system. Additional documentation reporting estimated annual energy production shall be provided.

Total Building Performance

R405.4 Calculation Procedure

- Calculation procedure
- General Specs
- Residence Specifications
- UDRH design
- Modeled Distribution Efficiencies.

Photo curtesy of:
Calculator application, came with PC

Total Building Performance

R405.4 Calculation Procedure

- Calculations of the performance design shall be in accordance with Sections R405.4.1 and R405.4.2.

R405.4.1 General

- Except as specified by this section, the standard reference design and proposed design shall be configured and analyzed using identical methods and techniques.

R405.4.2 Residence specifications

- The standard reference design and proposed design shall be configured and analyzed as specified by Table R405.4.2(1). Table R405.4.2(1) shall include by reference all notes contained in Table R402.1.3.

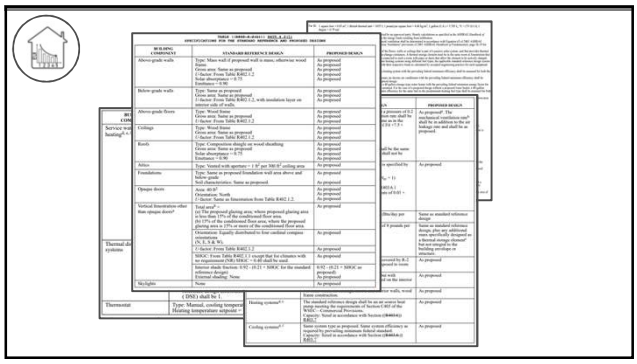
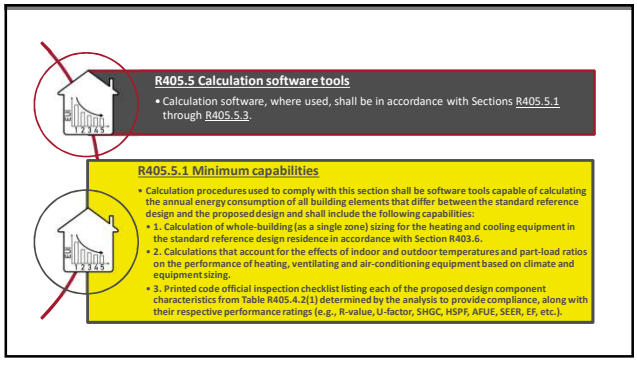


TABLE R405.2(1)
MANDATORY COMPLIANCE MEASURES FOR TOTAL BUILDING PERFORMANCE

Section*	Title	Comments
General		
R401.3	Certificate	
Envelope		
R402.2.1	Vapor retarder	
R402.2.3	Eave baffle	
R402.2.4.1	Access hatches and doors	
R402.2.10.1	Crawlspace wall insulation installations	
R402.4	Air leakage	
R402.5	Maximum fenestration U-factor	
Systems		
R403.1	Controls	
R403.3	Ducts	
R403.4	Mechanical system piping insulation	
R403.5.1	Heated water circulation and temperature maintenance system	
R403.5.3	Drain-water heat recovery units	
R403.5.7	Heat pump water heating	
R403.6	Mechanical ventilation	
R403.7	Equipment sizing and efficiency rating	
R403.8	Systems serving multiple dwelling units	
R403.9	Snow melt system controls	
R403.10	Energy consumption of pools and spas	
R403.11	Portable spas	
R403.12	Residential pools and permanent residential spas	
Electrical Power and Lighting		
R404.1	Lighting equipment	
R404.2	Interior lighting controls	

a. Reference to a code section includes all the relative subsections except as indicated in the table.

If they are installing the component, then the corresponding code referenced section(s) are mandatory.

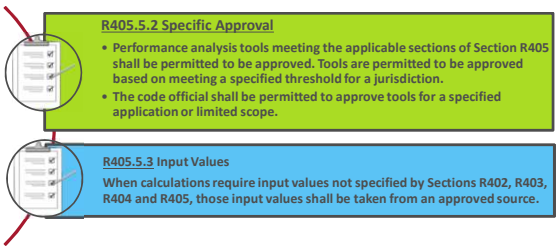


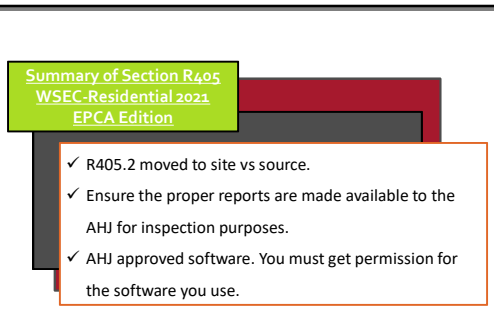
R405.5 Calculation software tools

- Calculation software, where used, shall be in accordance with Sections R405.5.1 through R405.5.3.

R405.5.1 Minimum capabilities

- Calculation procedures used to comply with this section shall be software tools capable of calculating the annual energy consumption of all building elements that differ between the standard reference design and the proposed design and shall include the following capabilities:
  - 1. Calculation of whole-building (as a single zone) sizing for the heating and cooling equipment in the standard reference design residence in accordance with Section R403.6.
  - 2. Calculations that account for the effects of indoor and outdoor temperatures and part-load ratios on the performance of heating, ventilating and air-conditioning equipment based on climate and equipment sizing.
  - 3. Printed code official inspection checklist listing each of the proposed design component characteristics from Table R405.4.2(1) determined by the analysis to provide compliance, along with their respective performance ratings (e.g., R-value, U-factor, SHGC, HSPF, AFUE, SEER, EF, etc.).


R405.5.2 Specific Approval
• Performance analysis tools meeting the applicable sections of Section R405 shall be permitted to be approved. Tools are permitted to be approved based on meeting a specified threshold for a jurisdiction.
• The code official shall be permitted to approve tools for a specified application or limited scope.
R405.5.3 Input Values
When calculations require input values not specified by Sections R402, R403, R404 and R405, those input values shall be taken from an approved source.


Summary of Section R405 WSEC-Residential 2021 EPCA Edition
✓ R405.2 moved to site vs source.
✓ Ensure the proper reports are made available to the AHJ for inspection purposes.
✓ AHJ approved software. You must get permission for the software you use.

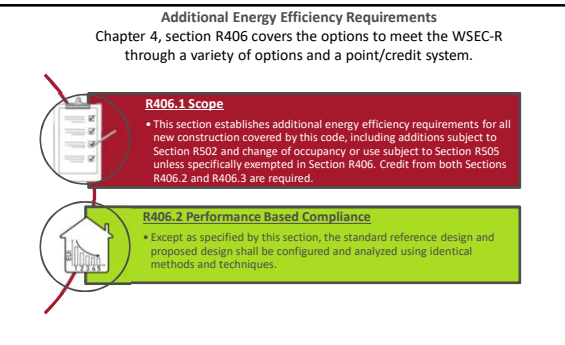

Additional Energy Efficiency Requirements
Chapter 4, section R406 covers the options to meet the WSEC-R through a variety of options and a point/credit system.
R406.1 Scope
• This section establishes additional energy efficiency requirements for all new construction covered by this code, including additions subject to Section R502 and change of occupancy or use subject to Section R505 unless specifically exempted in Section R406. Credit from both Sections R406.2 and R406.3 are required.
R406.2 Performance Based Compliance
• Except as specified by this section, the standard reference design and proposed design shall be configured and analyzed using identical methods and techniques.

Table R406.2 ENERGY EQUALIZATION CREDITS *Single Family Homes*

Heating Options	Description of Primary Heating Source	Supplemental Heating (See footnote b)	2018	2021
1	For combustion heating equipment meeting minimum federal efficiency standards for the equipment listed in Table C403.3.2(5) or C403.3.2(6)	Yes	0	0
2	For an initial heating system using a heat pump that meets federal standards for the equipment listed in Table C403.3.2(2) and supplemental heating provided by electric resistance or a combustion furnace meeting minimum standards listed in Table C403.3.2(5)b found in the 2021 WSEC- COMMERCIAL ENERGY CODE	See footnote b	1.0	1.5
3	For heating system based on electric resistance only (either forced air or Zonal)	N/A	-1.0	0.5
4[c]	For heating system using a heat pump that meets federal standards for the equipment listed in Table C403.3.2(2) or C403.3.2(9) or Air to water heat pump units that are configured to provide both heating and cooling and are rated in accordance with AHRI 550/590	See Manual Design & See footnote c	New	3.0
5	For heating system based on electric resistance with: 1. Inverter-driven ductless mini-split heat pump system installed in the largest zone in the dwelling, or 2. With 2kW or less total installed heating capacity per dwelling	See footnote c	0.5	2.0

a See Section R401.1 and residential building in Section R202 for Group R-2 scope.
b The gas back-up furnace will operate as fan-only when the heat pump is operating. The heat pump shall operate at all temperatures above 38°F (3.3°C) (or lower). Below that "changeover" temperature, the heat pump would not operate to provide space heating. The gas furnace provides heating below 38°F (3.3°C) (or lower).
c Additional points for this HVAC system are included in Table R406.3

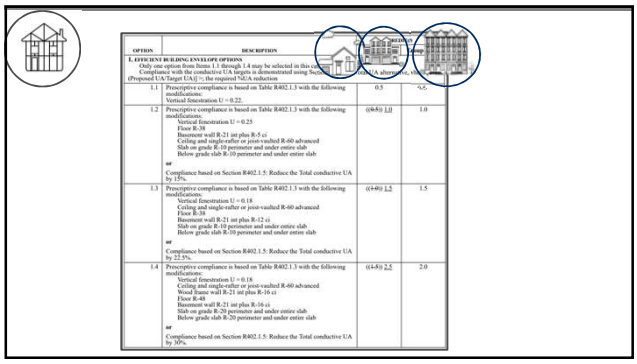
Table R406.2 ENERGY EQUALIZATION CREDITS *Multifamily Homes*

Heating Options	Description of Primary Heating Source	Supplemental Heating	2018	2021
1	For combustion heating equipment meeting minimum federal efficiency standards for the equipment listed in Table C403.3.2(5) or C403.3.2(6)	Yes	0	0
2	For an initial heating system using a heat pump that meets federal standards for the equipment listed in Table C403.3.2(2) and supplemental heating provided by electric resistance or a combustion furnace meeting minimum standards listed in Table C403.3.2(5)b found in the 2021 WSEC- COMMERCIAL ENERGY CODE	See footnote b	1.0	0
3	For heating system based on electric resistance only (either forced air or Zonal)	N/A	-1.0	-0.5
4[c]	For heating system using a heat pump that meets federal standards for the equipment listed in Table C403.3.2(2) or C403.3.2(9) or Air to water heat pump units that are configured to provide both heating and cooling and are rated in accordance with AHRI 550/590	See Manual Design & See footnote c	New	2.0
5	For heating system based on electric resistance with: 1. Inverter-driven ductless mini-split heat pump system installed in the largest zone in the dwelling, or 2. With 2kW or less total installed heating capacity per dwelling	See footnote c	0	0

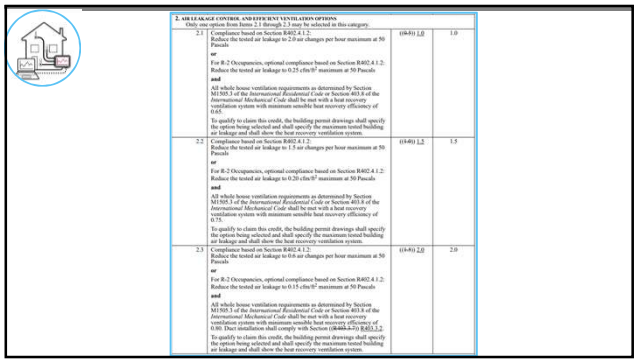
a See Section R401.1 and residential building in Section R202 for Group R-2 scope.
b The gas back-up furnace will operate as fan-only when the heat pump is operating. The heat pump shall operate at all temperatures above 38°F (3.3°C) (or lower). Below that "changeover" temperature, the heat pump would not operate to provide space heating. The gas furnace provides heating below 38°F (3.3°C) (or lower).
c Additional points for this HVAC system are included in Table R406.3

R406.3 Additional Energy Efficiency Requirements

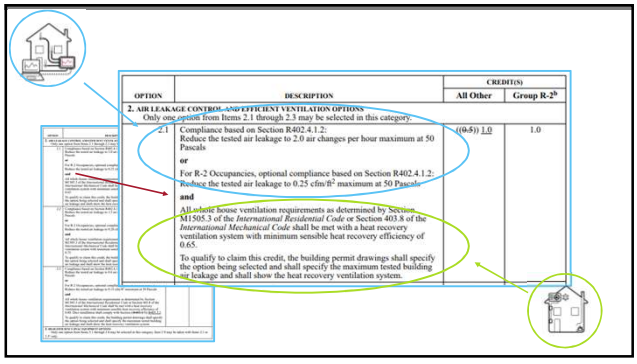
- Each dwelling unit in a residential building shall comply with sufficient options from Tables R406.2 and R406.3 so as to achieve the following minimum number of credits:
- 1. Small Dwelling Unit: ..... ~~(3.0)~~ 5.0 credits
  Dwelling units less than 1500 square feet in conditioned floor area with less than 300 square feet of fenestration area. Additions to existing building greater than 500 square feet of heated floor area but less than 1500 square feet.
- 2. Medium Dwelling Unit: ..... ~~(6.0)~~ 8.0 credits
  All dwelling units that are not included in #1, #3 or #4.
- 3. Large Dwelling Unit: ..... ~~(7.0)~~ 9.0 credits
  Dwelling units exceeding 5000 square feet of conditioned floor area.
- 4. Dwelling units serving Group R-2 occupancies: ..... ~~(4.5)~~ 6.5 credits
  See Section R401.1 and residential building in Section R202 for Group R-2 scope.
- 5. Additions 150 square feet to 500 square feet: ..... ~~(1.5)~~ 2.0 credits
- The drawings included with the building permit application shall identify which options have been selected and the point value of each option, regardless of whether separate mechanical, plumbing, electrical, or other permits are utilized for the project.



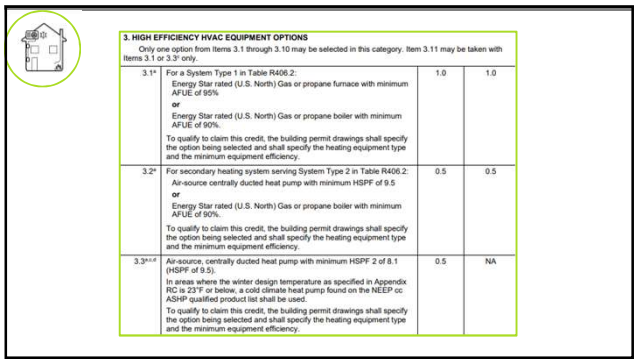
OPTION	DESCRIPTION	CREDIT(S) All Other	CREDIT(S) Group R-2[b]
1. EFFICIENT BUILDING ENVELOPE OPTIONS Only one option from Items 1.1 through 1.4 may be selected in this category. Compliance with the conductive UA targets is demonstrated using Section R402.1.5 UA alternative calculations. (Proposual UA/Target UA)] =: the required %UA reduction			
1.1	Prescriptive compliance is based on Table R402.1.3 with the following modifications: Vertical fenestration U = 0.22.	0.5	0.5
1.2	Prescriptive compliance is based on Table R402.1.3 with the following modifications: Vertical fenestration U = 0.25 Floor R-38 Basement wall R-21 int plus R-5 ci Ceiling and single-rafter or joist-vaulted R-60 advanced Slab on grade R-10 perimeter and under entire slab Below grade slab R-10 perimeter and under entire slab **or** Compliance based on Section R402.1.5: Reduce the Total conductive UA by 15%.	~~(0.5)~~ 1.0	1.0
1.3	Prescriptive compliance is based on Table R402.1.3 with the following modifications: Vertical fenestration U = 0.18 Ceiling and single-rafter or joist-vaulted R-60 advanced Floor R-38 Basement wall R-21 int plus R-12 ci Slab on grade R-10 perimeter and under entire slab Below grade slab R-10 perimeter and under entire slab **or** Compliance based on Section R402.1.5: Reduce the Total conductive UA by 22.5%.	~~(1.0)~~ 1.5	1.5
1.4	Prescriptive compliance is based on Table R402.1.3 with the following modifications: Vertical fenestration U = 0.18 Ceiling and single-rafter or joist-vaulted R-60 advanced Wood frame wall R-21 int plus R-16 ci Floor R-38 Basement wall R-21 int plus R-16 ci Slab on grade R-20 perimeter and under entire slab Below grade slab R-20 perimeter and under entire slab **or** Compliance based on Section R402.1.5: Reduce the Total conductive UA by 30%.	~~(1.5)~~ 2.5	2.0



2. AIR LEAKAGE CONTROL AND EFFICIENT VENTILATION OPTIONS Only one option from Items 2.1 through 2.3 may be selected in this category.			
2.1	Compliance based on Section R402.4.1.2: Reduce the tested air leakage to 2.0 air changes per hour maximum at 50 Pascals **or** For R-2 Occupancies, optional compliance based on Section R402.4.1.2: Reduce the tested air leakage to 0.25 cfm/ft^2 maximum at 50 Pascals **and** All whole house ventilation requirements as determined by Section M1505.3 of the *International Residential Code* or Section 403.8 of the *International Mechanical Code* shall be met with a heat recovery ventilation system with minimum sensible heat recovery efficiency of 0.65. To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the maximum tested building air leakage and shall show the heat recovery ventilation system.	~~(0.5)~~ 1.0	1.0
2.2	Compliance based on Section R402.4.1.2: Reduce the tested air leakage to 1.5 air changes per hour maximum at 50 Pascals **or** For R-2 Occupancies, optional compliance based on Section R402.4.1.2: Reduce the tested air leakage to 0.20 cfm/ft^2 maximum at 50 Pascals **and** All whole house ventilation requirements as determined by Section M1505.3 of the *International Residential Code* or Section 403.8 of the *International Mechanical Code* shall be met with a heat recovery ventilation system with minimum sensible heat recovery efficiency of 0.75. To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the maximum tested building air leakage and shall show the heat recovery ventilation system.	~~(1.0)~~ 1.5	1.5
2.3	Compliance based on Section R402.4.1.2: Reduce the tested air leakage to 0.6 air changes per hour maximum at 50 Pascals **or** For R-2 Occupancies, optional compliance based on Section R402.4.1.2: Reduce the tested air leakage to 0.15 cfm/ft^2 maximum at 50 Pascals **and** All whole house ventilation requirements as determined by Section M1505.3 of the *International Residential Code* or Section 403.8 of the *International Mechanical Code* shall be met with a heat recovery ventilation system with minimum sensible heat recovery efficiency of 0.80. Duct installation shall comply with Section ~~(R403.3.5)~~ R403.3.2. To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the maximum tested building air leakage and shall show the heat recovery ventilation system.	~~(1.0)~~ 2.0	2.0



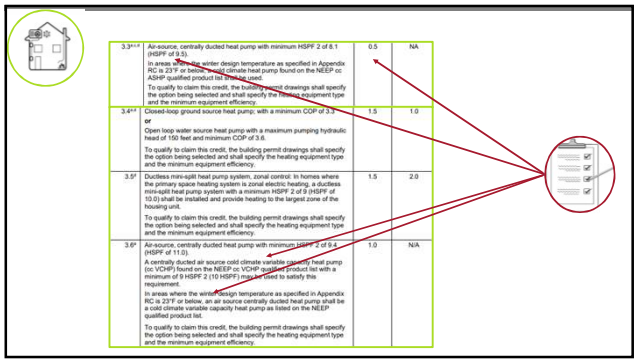
OPTION	DESCRIPTION	CREDIT(S) All Other	CREDIT(S) Group R-2[b]
2. AIR LEAKAGE CONTROL AND EFFICIENT VENTILATION OPTIONS Only one option from Items 2.1 through 2.3 may be selected in this category.			
2.1	Compliance based on Section R402.4.1.2: Reduce the tested air leakage to 2.0 air changes per hour maximum at 50 Pascals **or** For R-2 Occupancies, optional compliance based on Section R402.4.1.2: Reduce the tested air leakage to 0.25 cfm/ft^2 maximum at 50 Pascals **and** All whole house ventilation requirements as determined by Section M1505.3 of the *International Residential Code* or Section 403.8 of the *International Mechanical Code* shall be met with a heat recovery ventilation system with minimum sensible heat recovery efficiency of 0.65. To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the maximum tested building air leakage and shall show the heat recovery ventilation system.	~~(0.5)~~ 1.0	1.0



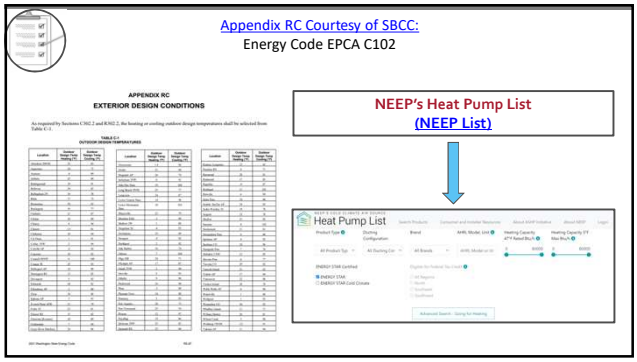
3. HIGH EFFICIENCY HVAC EQUIPMENT OPTIONS

Only one option from Items 3.1 through 3.10 may be selected in this category. Item 3.11 may be taken with Items 3.1 or 3.3[c] only.

3.1[a]	For a System Type 1 in Table R406.2: Energy Star rated (U.S. North) Gas or propane furnace with minimum AFUE of 95% **or** Energy Star rated (U.S. North) Gas or propane boiler with minimum AFUE of 90%. To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the heating equipment type and the minimum equipment efficiency.	1.0	1.0
3.2[a]	For secondary heating system serving System Type 2 in Table R406.2: Air-source centrally ducted heat pump with minimum HSPF of 9.5 **or** Energy Star rated (U.S. North) Gas or propane boiler with minimum AFUE of 90%. To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the heating equipment type and the minimum equipment efficiency.	0.5	0.5
3.3[a,b,c]	Air-source, centrally ducted heat pump with minimum HSPF 2 of 8.1 (HSPF of 9.5). In areas where the winter design temperature as specified in Appendix RC is 23°F or below, a cold climate heat pump found on the NEEP cc ASHP qualified product list shall be used. To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the heating equipment type and the minimum equipment efficiency.	0.5	NA



3.3[a,b,c]	Air-source, centrally ducted heat pump with minimum HSPF 2 of 8.1 (HSPF of 9.5). In areas where the winter design temperature as specified in Appendix RC is 23°F or below, a cold climate heat pump found on the NEEP cc ASHP qualified product list shall be used. To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the heating equipment type and the minimum equipment efficiency.	0.5	NA
3.4[a,d]	Closed-loop ground source heat pump; with a minimum COP of 3.6 **or** Open loop water source heat pump with a maximum pumping hydraulic head of 150 feet and minimum COP of 3.6. To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the heating equipment type and the minimum equipment efficiency.	1.5	1.0
3.5[f]	Ductless mini-split heat pump system, zonal control. In homes where the primary space heating system is zonal electric heating, a ductless mini-split heat pump system with a minimum HSPF 2 of 9 (HSPF of 10.0) shall be installed and provide heating to the largest zone of the housing unit. To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the heating equipment type and the minimum equipment efficiency.	1.5	2.0
3.6[e]	Air-source, centrally ducted heat pump with minimum HSPF 2 of 9.4 (HSPF of 11.0) A centrally ducted air source cold climate variable capacity heat pump (cc VCHP) found on the NEEP cc VCHP qualified product list with a minimum of 9 HSPF 2 (10 HSPF) may be used to satisfy this requirement. In areas where the winter design temperature as specified in Appendix RC is 23°F or below, an air source centrally ducted heat pump shall be a cold climate variable capacity heat pump as listed on the NEEP qualified product list. To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the heating equipment type and the minimum equipment efficiency.	1.0	N/A



Appendix RC Courtesy of SBCC:
Energy Code EPCA C102

APPENDIX RC
EXTERIOR DESIGN CONDITIONS

As required by Sections C302.2 and R302.2, the heating or cooling outdoor design temperatures shall be selected from Table E-1.

TABLE C
OUTDOOR DESIGN TEMPERATURES

NEEP's Heat Pump List
(NEEP List)

Energy credit option	New HSPF 2 value	Old HSPF value
3.2 & 3.3 ducted central heat pump	8.1	9.5
3.5 ductless heat pump in main living area + electric resistance in other rooms	9	10
3.6 ducted central heat pump	9.4	11
3.6 ducted central heat pump – NEEP cc VCHP list	8.5	10
3.7 ductless heat pump with no electric resistance (except footnote A)	9	10
3.7 ductless heat pump with no electric resistance ≤ 24,000 Btu (except footnote A)	8.1	9

3.3[a,c,d]	Air-source, centrally ducted heat pump with minimum HSPF 2 of 8.1 (HSPF of 9.5). In areas where the winter design temperature as specified in Appendix RC is 23°F or below, a cold climate heat pump found on the NEEP cc ASHP qualified product list shall be used. To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the heating equipment type and the minimum equipment efficiency.	0.5	NA
3.4[e,f]	Closed-loop ground source heat pump, with a minimum COP of 3.3 **or** Open loop water source heat pump with a maximum pumping hydraulic head of 150 feet and minimum COP of 3.6. To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the heating equipment type and the minimum equipment efficiency.	1.5	1.0
3.5[f]	Ductless mini-split heat pump system, zonal control: In homes where the primary space heating system is zonal electric heating, a ductless mini-split heat pump system with a minimum HSPF 2 of 9 (HSPF of 10.0) shall be installed and provide heating to the largest zone of the housing unit. To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the heating equipment type and the minimum equipment efficiency.	1.5	2.0
3.6[e]	Air-source, centrally ducted heat pump with minimum HSPF 2 of 9.4 (HSPF of 11.0). A centrally ducted air source cold climate variable capacity heat pump (cc VCHP) found on the NEEP cc VCHP qualified product list with a minimum of 8 HSPF 2 (10 HSPF) may be used to satisfy this requirement. In areas where the winter design temperature as specified in Appendix RC is 23°F or below, an air source centrally ducted heat pump shall be a cold climate variable capacity heat pump as listed on the NEEP qualified product list. To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the heating equipment type and the minimum equipment efficiency.	1.0	N/A

3.7[a,d,e]	Ductless split system heat pumps with no electric resistance heating in the primary living areas. A ductless heat pump system with a minimum HSPF 2 of 9 (HSPF of 10) shall be sized and installed to provide heat to entire dwelling unit at the design outdoor air temperature. **Exception:** In homes with total heating loads of 24,000 or less using multi-zone mini-split systems with nominal ratings of 24,000 or less, the minimum HSPF s to claim this credit shall be 8.19 HSPF 2 (or 9 HSPF). To qualify to claim this credit, the building permit drawings shall specify the option being selected, the heated floor area calculation, the heating equipment type(s), the minimum equipment efficiency, and total installed heat capacity (by equipment type).	2.0	3.0
3.8[a,g]	Air-to-water heat pump with minimum COP of 3.2 at 47°F, rated in accordance with AHRI 550/590 by an accredited or certified testing lab. To qualify to claim this credit, the building permit drawings shall specify the option being selected, the heated floor area calculation, the heating equipment type(s), the minimum equipment efficiency, and total installed heat capacity (by equipment type).	1.0	NA
3.9	Gas-fired heat pump(s) meeting ANSI Z21.40.2 and Z21.40.4 or CSA, with a minimum UEF of 1.15. For R-2 Occupancy, gas-fired heat pump(s) meeting ANSI Z21.40.2 and Z21.40.4 or CSA, with a minimum UEF of 1.15, shall serve all units.	1.5	1.5

Couples with Option 1

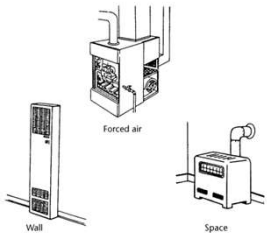
1 For combustion heating equipment meeting minimum federal efficiency standards for the equipment listed in Table C403.3.2(5) or C403.3.2(6)

OPTION	DESCRIPTION	CREDIT(S)	
		All Other	Group R-2[b]
3.10[a]	Combination water heating and space heating system shall include one of the following: Gas-fired heat pump water heater(s) meeting Tier 2 of the NEEA Advanced Water Heating Specification for Gas-Fueled Residential Storage Water Heaters Version 1.0. **or** For R-2 Occupancy, gas-fired heat pump water heater(s) meeting Tier 2 of the NEEA Advanced Water Heating Specification for Gas-Fueled Residential Storage Water Heaters Version 1.0., shall serve all units. **or** For R-2 Occupancy, gas-fired heat pump(s) meeting ANSI Z21.40.2 and Z21.40.4 or CSA, with a minimum UEF of 1.15, shall serve all units. To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the water heater equipment type and the minimum equipment efficiency and, for solar water heating systems, the calculation of the minimum energy savings.	2.5	2.5
3.11[a]	Connected thermostat meeting ENERGY STAR Certified Smart Thermostats/EPA ENERGY STAR specifications. To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the thermostat model.	0.5	0.5

Energy Equalization Option 1
HVAC Selection Available

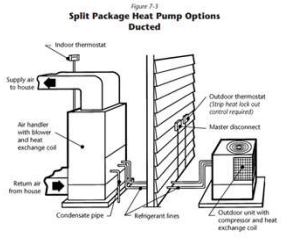
- 3.1
- 3.9
- 3.10
- Possible 3.11

Combustion Heating Systems



Energy Equalization Option 2
HVAC Selection Available

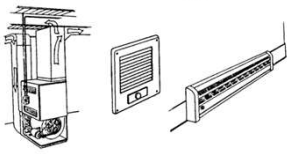
- 3.2
- Possibly 3.11 Need Clarification on Errata.



Energy Equalization Option 3
HVAC Selection Available

N/A

Electric Resistance Heating Systems



Forced air Wall Baseboard

Energy Equalization Option 4
HVAC Selection Available

3.3

3.4

3.6

3.7

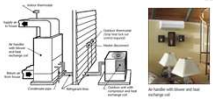
3.8

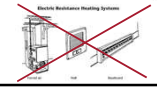
Ground Source Closed Loop System

Cold Climate Heating & Cooling Heat Pump

Hydronic Distribution
Source: Artic Heat Pumps

Ductless





See footnote A

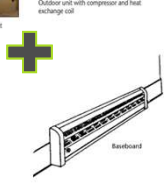
Energy Equalization Option 5
HVAC Selection Available

3.5

Ductless

Air handler with blower and heat exchange coil

Outdoor unit with compressor and heat exchange coil



Wall Baseboard

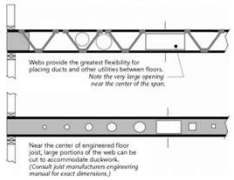
4. HIGH EFFICIENCY HVAC DISTRIBUTION SYSTEM OPTIONS			
4.1	HVAC equipment and associated duct system(s) installation shall comply with the requirements of Section R403.3.2. Electric resistance heat, hydronic heating and ductless heat pumps are not permitted under this option. To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the heating equipment type and shall show the location of the heating and cooling equipment and all the ductwork.	0.5	N/A

ducts in Dropped Ceilings

https://basc.pnnl.gov/resource-guides/ducts-dropped-ceilings#edit-group-scope

Figure A-10

Engineers Trusses Provide Space for Ducts Between Floors



5. EFFICIENT WATER HEATING OPTIONS

Only one option from Items 5.3 through 5.8 may be selected in this category. Items 5.1 and 5.2 may be combined with any option.

OPTION	DESCRIPTION	CREDIT(S)	
		All Other	Group R-2[b]
5.1	A drain water heat recovery unit(s) shall be installed, which captures wastewater heat from at least two showers, including tub/shower combinations. It is acceptable, but not required, for sink water to be connected. Unit shall have a minimum efficiency of 40% if installed for equal flow or a minimum efficiency of 54% if installed for unequal flow. Such units shall be rated in accordance with CSA B55.1 or IAPMO IGC 346-2017 and be so labeled. To qualify to claim this credit, the building permit drawings shall include a plumbing diagram that specifies the drain water heat recovery units and the plumbing layout needed to install it. Labels or other documentation shall be provided that demonstrates that the unit complies with the standard.	0.5	0.5
5.2	For Compact Hot Water Distribution system credit, the volume shall store not more than 16 ounces of water between the nearest source of heated water and the termination of the fixture supply pipe where calculated using Section R403.5.2. *Construction documents* shall indicate the ounces of water in piping between the hot water source and the termination of the fixture supply. When the hot water source is the nearest primed plumbing loop or trunk, this must be primed with an On Demand recirculation pump and must run a dedicated ambient return line from the furthest fixture or end of loop to the water heater. To qualify for this credit, the dwelling must have a minimum of 1.5 bathrooms.	0.5	0.5

5. EFFICIENT WATER HEATING OPTIONS

Only one option from Items 5.3 through 5.8 may be selected in this category. Items 5.1 and 5.2 may be combined with any option.

5.3	Water heating system shall include the following: Energy Star rated gas or propane water heater with a minimum UEF of 0.80. To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the water heater equipment type and the minimum equipment efficiency.	0.5	0.5
5.4	Water heating system shall include one of the following: Energy Star rated gas or propane water heater with a minimum UEF of 0.91 **or** Solar water heating supplementing a minimum standard water heater. Solar water heating will provide a rated minimum savings of 85 therms or 2000 kWh based on the Solar Rating and Certification Corporation (SRCC) Annual Performance of OG-300 Certified Solar Water Heating System **or** Water heater heated by ground source heat pump meeting the requirements of Option 3.4. To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the water heater equipment type and the minimum equipment efficiency and, for solar water heating systems, the calculation of the minimum energy savings.	1.0	1.0

5. EFFICIENT WATER HEATING OPTIONS

Only one option from Items 5.3 through 5.8 may be selected in this category. Items 5.1 and 5.2 may be combined with any option.

5.5	Water heating system shall include one of the following: Gas-fired heat pump water heater(s) meeting Tier 2 of the NEEA Advanced Water Heating Specification for Gas-Fueled Residential Storage Water Heaters Version 1.0. **or** For R-2 Occupancy, gas-fired heat pump water heater(s) meeting Tier 2 of the NEEA Advanced Water Heating Specification for Gas-Fueled Residential Storage Water Heaters Version 1.0. shall supply domestic hot water to all units. **or** For R-2 Occupancy, gas-fired heat pump water heater(s) meeting ANSI Z21.40.2 and Z21.40.4 or CSA, with a minimum UEF of 1.15, shall supply domestic hot water to all units. To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the water heater equipment type and the minimum equipment efficiency and, for solar water heating systems, the calculation of the minimum energy savings.	1.5	1.5

5. EFFICIENT WATER HEATING OPTIONS

Only one option from Items 5.3 through 5.8 may be selected in this category. Items 5.1 and 5.2 may be combined with any option.

5.6	Water heating system shall include one of the following: Electric heat pump water heater meeting the standards for Tier III of NEEA's advanced water heating specification **or** For R-2 Occupancy, electric heat pump water heater(s), meeting the standards for Tier III of NEEA's advanced water heating specification, shall supply domestic hot water to all units. If one water heater is serving more than one dwelling unit, all hot water supply and recirculation piping shall be insulated with R-8 minimum pipe insulation. To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the water heater equipment type and the minimum equipment efficiency.	2.0	2.5

5. EFFICIENT WATER HEATING OPTIONS

Only one option from Items 5.3 through 5.8 may be selected in this category. Items 5.1 and 5.2 may be combined with any option.

5.7	Water heating system shall include one of the following: Electric heat pump water heater with a minimum UEF of 2.9 and utilizing a split system configuration with the air-to-refrigerant heat exchanger located outdoors. Equipment shall meet Section 4, requirements for all units, of the NEEA standard *Advanced Water Heating Specification* with the UEF noted above **or** For R-2 Occupancy, electric heat pump water heater(s), meeting the standards for Tier III of NEEA's advanced water heating specification and utilizing a split system configuration with the air-to-refrigerant heat exchanger located outdoors, shall supply domestic hot water to all units. If one water heater is serving more than one dwelling unit, all hot water supply and recirculation piping shall be insulated with R-8 minimum pipe insulation. To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the water heater equipment type and the minimum equipment efficiency.	2.5	3.0

5. EFFICIENT WATER HEATING OPTIONS

Only one option from Items 5.3 through 5.8 may be selected in this category. Items 5.1 and 5.2 may be combined with any option.

1 For combustion heating equipment meeting minimum federal efficiency standards for the equipment listed in Table C403.3.2(5) or C403.3.2(6)

Couples with Option 1

5.8	Combination water heating and space heating system shall include one of the following: Gas-fired heat pump water heater(s) meeting Tier 2 of the NEEA Advanced Water Heating Specification for Gas-Fueled Residential Storage Water Heaters Version 1.0. **or** For R-2 Occupancy, gas-fired heat pump water heater(s) meeting Tier 2 of the NEEA Advanced Water Heating Specification for Gas-Fueled Residential Storage Water Heaters Version 1.0., shall supply all units. **or** For R-2 Occupancy, gas-fired heat pump(s) meeting ANSI Z21.40.2 and Z21.40.4 or CSA, with a minimum UEF of 1.15, shall supply all units. To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall specify the water heater equipment type and the minimum equipment efficiency and, for solar water heating systems, the calculation of the minimum energy savings.	2.5	2.5

https://pvwatts.nrel.gov/

6. RENEWABLE ELECTRIC ENERGY OPTION

6.1	For each 600 kWh of electrical generation per housing unit provided annually by on-site wind or solar equipment a 0.5 credit shall be allowed, up to 4.5 credits. Generation shall be calculated as follows: For solar electric systems, the design shall be demonstrated to meet this requirement using the National Renewable Energy Laboratory calculator PVWATTs or alternative approved by the code official. Documentation noting solar access shall be included on the plans. For wind generation projects designs shall document annual power generation based on the following factors: The wind turbine power curve; average annual wind speed at the site; frequency distribution of the wind speed at the site and height of the tower. To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall show the photovoltaic or wind turbine equipment type, provide documentation of solar and wind access, and include a calculation of the minimum annual energy power production.	0.5 – 4.5	0.5 – 4.5

7. APPLIANCE PACKAGE OPTION

7.1	All of the following appliances shall be new and installed in the dwelling unit and shall meet the following standards: 1. Dishwasher, standard – Energy Star rated, Most Efficient 2021 or Dishwasher, compact – Energy Star rated (Version 6.0) 2. Refrigerator (if provided) – Energy Star rated (Version 5.1) 3. Washing machine (Residential) – Energy Star rated (Version 8.1) 4. Dryer – Energy Star rated, Most Efficient 2022 To qualify to claim this credit, the building permit drawings shall specify the option being selected and shall show the appliance type and provide documentation of Energy Star compliance. At the time of inspection, all appliances shall be installed and connected to utilities. Dryer ducts and exterior dryer vent caps are not permitted to be installed in the *dwelling unit*.	0.5	1.5

a. An alternative heating source sized at a maximum of 0.5 Watts/ft² (equivalent) of heated floor area or 500 Watts, whichever is bigger, may be installed in the dwelling unit.
b. See Section R401.1 and *residential building* in Section R202 for Group R-2 scope.
c. Option 3.11 can only be taken with Options 3.1 and 3.3. To qualify to claim Option 3.11 with 3.3, the system shall be a 1-2 speed heat pump system. Variable capacity heat pumps are ineligible from claiming this option.
d. This option may only be claimed if serving System Type 4 or 5 from Table R406.2.
e. Primary living areas include living, dining, kitchen, family rooms, and similar areas.
f. Option 3.10 may one be taken with Efficient Water Heating Option 5.1 or 5.2. Equipment sizing for space heating shall be calculated as provided in Section R403.7 with increased capacity to provide a minimum of 75 percent of peak hot water demand or shall be sized in accordance with approved manufacturer's specifications or guidance. Supplementary heat for water heating shall be in accordance with Section R403.5.7.

Summary of Section R406 WSEC - Residential 2021 EPCA Edition

- ✓ R406.2 & R406.3 Options revised to reflect changes in code
- ✓ Additions with 150 square feet or less of conditioned floor area are now exempt from obtaining additional energy efficiency credits (R406.2 & R406.3).
- ✓ Changes to required credit values (Section R406.3).

1. Efficient Building Envelope Options
   1. Four options within this category (down from seven options)
   2. Maximum 2.5 credits possible from this category (down from 3.0)
   3. One glazing only option (1.1), down from two (1.1 and 1.2)
2. Air Leakage and Efficient Ventilation Envelope Options
   1. Three options within this category (down from four options)
   2. Maximum 2.0 credits possible from this category (Remain the same)
   3. All options now require a heat recovery ventilation system
3. High Efficiency HVAC Equipment Options
   1. Eleven options within this category (up from six options)
   2. Maximum 2.5 credits possible from this category (up from 2.0)
4. High Efficiency HVAC Distribution Options
   1. One option within this category (down from two options)
   2. Maximum 0.5 credits possible from this category (down from 1.0)
5. Efficient Water Heating Options
   1. Seven options within this category (up from six options)
   2. Maximum 3.5 credits possible from this category (up from 3.0)
6. Renewable Electric Energy Option
   1. Clarification that half credits can be achieved, though kWh worth the same number of credits: For each 600 kWh of generation, 0.5 credits can be achieved
   2. Maximum 4.5 credits possible from this category (up from 3.0)
7. Appliance Package Option
   1. Dryer must now meet Energy Star "Most Efficient 2022" rating
   2. Maximum 0.5 credits possible from this category

Passive House & Certification.

Chapter 4, section R407 covers the use of passive house certification to demonstrate compliance with the WSEC-R code.

R-407.1 General

- This section establishes additional energy efficiency requirements for all new construction covered by this code, including additions subject to Section R502 and change of occupancy or use subject to Section R505 unless specifically exempted in Section R406. Credit from both Sections R406.2 and R406.3 are required.

R407.2 Passive House Institute U.S. (PHIUS)

- Passive House Institute U.S. (PHIUS)
- Prior to the issuance of a building permit, the following items must be provided to the code official:
- A list of compliance features.
- A PHIUS precertification letter. Prior to the issuance of a certificate of occupancy, the following item must be provided to the code official:
- A PHIUS+ 2018 (or later) project certificate.

R 401.3 Passive House Institute (PHI)

- Projects shall comply with Low Energy Building Standard, version 9f or later, including performance calculations by PHI-approved software. Projects shall also comply with the provisions of Section R401 through R404. R407.3.1 PHI documentation. Prior to the issuance of a building permit, the following items must be provided to the code official:
- 1. A list of compliance features.
- 2. A statement from a passive house certifier that the modeled energy performance is congruent with the plans and specifications, and that the modeled performance meets said standard. Prior to the issuance of a certificate of occupancy, the following item must be provided to the code official:
- 1. A PHI Low Energy Building project certificate

Chapter 5

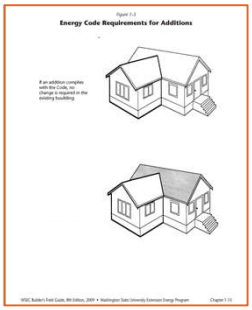
WSEC - Residential Energy Code & 2021 Changes:

What is Chapter 5?

Chapter 5 is Existing Buildings, "Old school stuff".

Chapter 5 is everything existing. It covers additions of new spaces, alterations or change of use of exiting spaces as well as repairs and maintenance.

General – **R501**
Additions– **R502**
Alterations – **R303**
Repairs- **R404**
Change of use- **R405**



General – R501.1 – 501.6
- Scope of work
- General & Thermostats for ADU's
- Compliance & defines Existing Unit types
- Maintenance Historic Buildings

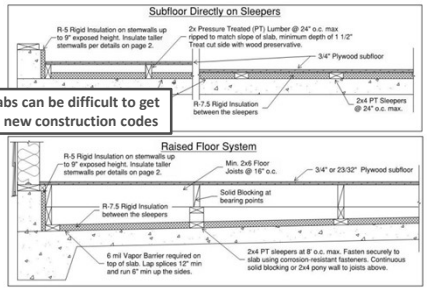
Additions– R502.1 – 502.4
- General & small additions
- Change of use
- Prescriptive compliance
- HVAC Systems, Hot Water, & Lighting
- Existing Plus Compliance

Alterations – R503.1 -503.1.4
- General & Building Envelope requirements, & Replacement of Fenestration
- HVAC and Service Hot Water Heating Requirements.

Repairs- R504.1 & R504.2
- General and Application

Change of Use- R505
- Covers the code section requirements for a change of use.

Existing slabs can be difficult to get convert to new construction codes



Photos courtesy of MyBuildingPermit.com
Guidelines and Tip Sheets | MBP (mybuildingpermit.com)
Tip Sheet 25 Garage Conversions.pdf (wsu.edu)

Remodel / Alteration Worksheet

Will you be exposing the walls?	Will the roof/ceiling framing cavities or attic be exposed?	Will the will the floor framing cavities be exposed?
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
If yes,	If yes,	If yes,
☐ 2 X 4 wall studs require R-15 insulation	Exposed roof or ceiling assemblies must be insulated -	☐ Exposed floor cavities must be insulated to R-30
☐ 2 X 6 wall studs require R-21 insulation	☐ Vaulted ceilings, Insulate to the full depth of the framing member	
☐ If siding is replaced C.I. equal to R-5 may need installed under the siding.	☐ Flat ceilings, install R-60 insulation or what the attic space can accommodate based on the roof pitch	

Are the windows and/or doors being replaced?	Will the heating or cooling system be replaced?	Will the hot water system be altered?	Are more than 10% of the light fixtures being changed?
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
If yes,	If yes,	If yes,	If yes,
☐ New windows and doors (+frames) must have an area weighted average U-factor of ≤0.30	☐ New equipment must meet current requirements and the ducts need to be tested	☐ New water heating equipment must meet current code requirements	☐ 100% of all lamps must be high efficacy

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

R503.1.1 Building envelope.
Building envelope assemblies that are part of the alteration shall comply with Section R402.1.3 or R402.1.5, Sections R402.2.1 through R402.2.11, R402.3.1, R402.3.2, R402.3.5 and R402.4.2.
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 R402.1.3. 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.

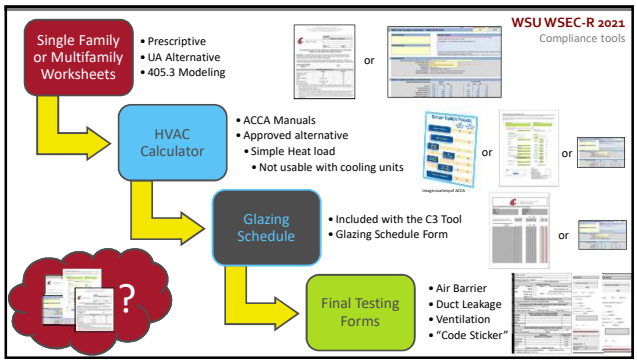
R502.1.1.2 Heating and cooling systems.
New heating, cooling and duct systems that are part of the addition shall comply with Section R403.
Exception:
The following need not comply with the testing requirements of Section R403.3.3:
1. Additions of less than 750 square feet.
2. Duct systems that are documented 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.

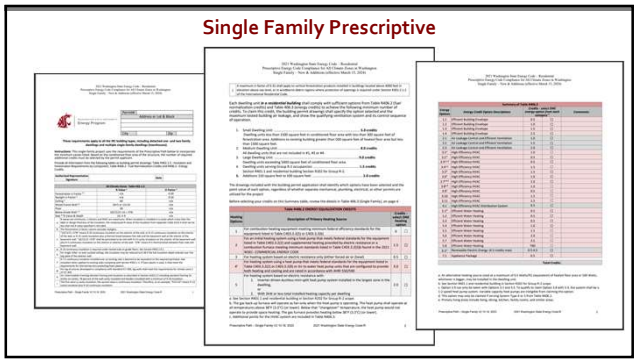
R503.1.4 Lighting.
New lighting systems that are part of the alteration shall comply with Section R404.1.
Exception: Alterations that replace less than 10 percent of the luminaires in a space, provided that such alterations do not increase the installed interior lighting power.

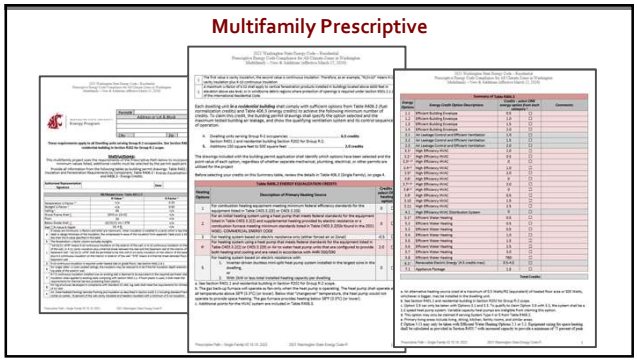
R503.1.3 Service hot water systems.
New service hot water systems that are part of the alteration shall comply with Section R403.5.

Summary of Chapter 5 WSEC – Residential 2021 EPCA Edition:

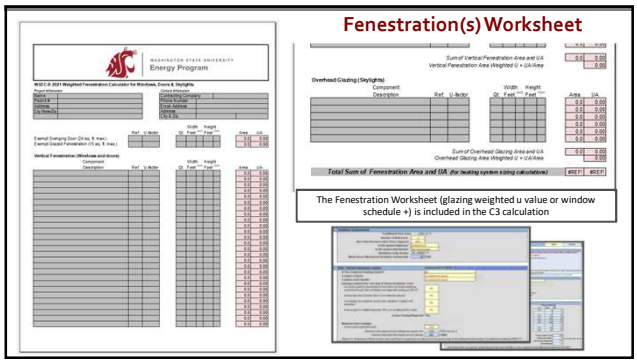
- ✓ 150 sf exception to R406.2 and R406.3 Credit Selection
  - No duct testing
  - No air barrier test required
- ✓ New language about remodeling and equipment:
  - Additions *shall not create an unsafe* or hazardous condition or overload existing building systems.....
- ✓ **R502.3.1.1 Existing ceilings with attic spaces.** Where an addition greater than 150 square feet (9.2 m2) adjoins existing ceilings with attic spaces, the existing attic spaces shall comply with Section R402.
- ✓ **R502.4 Existing plus addition compliance Total Building Performance**.


WSU WSEC-R 2021
Compliance tools
Single Family or Multifamily Worksheets
• Prescriptive
• UA Alternative
• 405.3 Modeling
or
HVAC Calculator
• ACCA Manuals
• Approved alternative
• Simple Heat load
• Not usable with cooling units
or
or
Glazing Schedule
• Included with the C3 Tool
• Glazing Schedule Form
or
?
Final Testing Forms
• Air Barrier
• Duct Leakage
• Ventilation
• "Code Sticker"


Single Family Prescriptive

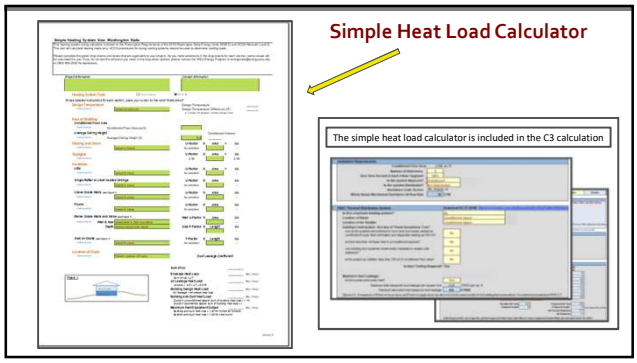

Multifamily Prescriptive

Fenestration(s) Worksheet



The Fenestration Worksheet (glazing weighted u value or window schedule +) is included in the C3 calculation

Simple Heat Load Calculator



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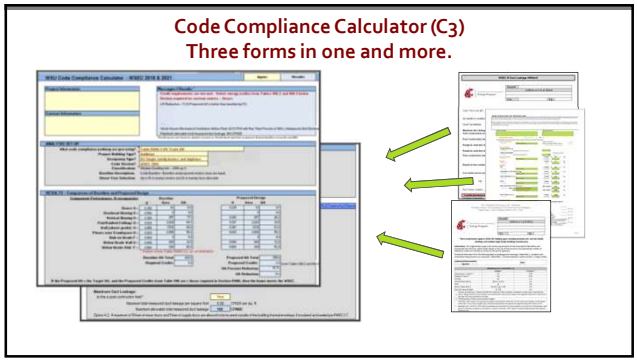
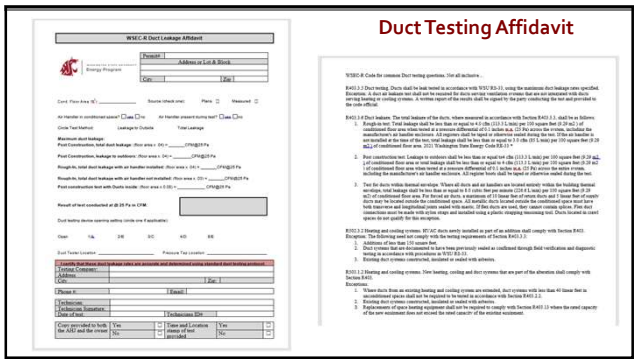
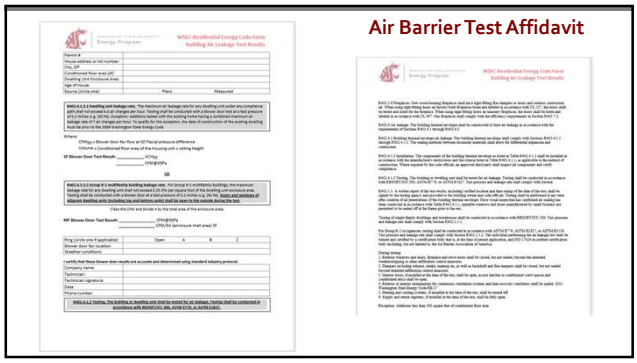
Code Compliance Calculator (C3)
Three forms in one and more.

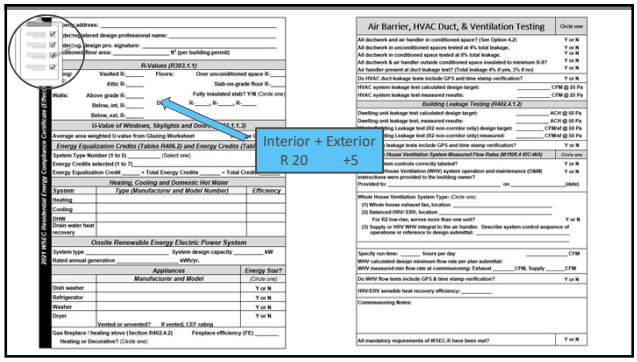


Duct Testing Affidavit



Air Barrier Test Affidavit





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- ✓ **R502.3.1.1 Existing ceilings with attic spaces.** Where an addition greater than 150 square feet (9.2 m2) adjoins existing ceilings with attic spaces, the existing attic spaces shall comply with Section R402.
- ✓ **R502.4 Existing plus addition compliance Total Building Performance**.

APPENDIX RA / RB OPTIONAL ENERGY EFFICIENCY MEASURES

Appendix RA—Optional energy efficiency measures—One step.

Building owners may choose to use this appendix to achieve an additional:

6 percent savings in building energy use. The number of additional energy efficiency credits required by Section R406.3 would be increased by the following amounts:

1.0 credit for each new single-family, two-family and townhouse dwelling unit.

0.5 credit for each new dwelling unit within an R-2 occupancy building.

0.5 credit for each addition smaller than 500 square feet to a single-family, two-family or townhouse dwelling unit.

1.0 credit for each addition of 500 square feet or larger to a single-family, two-family or townhouse dwelling unit. Where Section R405,

Simulated performance alternative, is used, the maximum allowable energy consumption shall be **92 percent** of the value calculated according to Section R405.3.

APPENDIX RA / RB OPTIONAL ENERGY EFFICIENCY MEASURES

Appendix RB—Optional energy efficiency measures—Two step.

Building owners may choose to use this appendix to achieve an additional:

12 percent savings in building energy use. The number of additional energy efficiency credits required by Section R406.3 would be increased by the following amounts:

2.0 credit for each new single-family, two-family and townhouse dwelling unit.

1.0 credit for each new dwelling unit within an R-2 occupancy building. 1.0 credit for each addition smaller than 500 square feet to a single-family, two-family or townhouse dwelling unit.

1.5 credit for each addition of 500 square feet or larger to a single-family, two-family or townhouse dwelling unit.

Where Section R405, Simulated performance alternative, is used, the maximum allowable energy consumption shall be 84 percent of the value calculated according to Section R405.3.

Thank you to our sponsor.

neea

Again!

About NEEA

Our Purpose - *The Northwest Energy Efficiency Alliance (NEEA) is an alliance of utilities and energy efficiency organizations that pools resources and shares risks to transform the market for energy efficiency to the benefit of consumers in the Northwest.*

(https://neea.org/about-neea)

Acknowledgments & Additional Credits

First we must give credit to ICC, whom many slides were gleaned from or copied as there are embodied code text language. We are not able to change the wording as that may have an effect on the our come of the intent of the original language.

It was gleaned for educational purposes only and copies of the full bodied text books from ICC will be necessary to follow along with the classes.

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Questions?

Thank You!

For additional information, visit our website at
www.energy.wsu.edu

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EnergyCode@energy.wsu.edu