Energy Program
WASHINGTON STATE UNIVERSITY

2018 Washington State Energy Code-Residential FAQs:
Conditioned Crawlspaces
July 2023

Can crawlspaces be conditioned in Washington?

Conditioned crawlspaces are not mentioned in the WSEC-R, and so the WSEC-R is silent on this issue. Regarding insulation requirements, we recommend conditioned crawlspaces be treated in the same manner as conditioned basements. Ventilation and sealing requirements for conditioned crawlspaces are per Section R408.3 "Unvented Crawl Spaces" of the 2018 IRC (with Washington amendments), available at https://sbcc.wa.gov/sites/default/files/2020-11/2018_IRC_Insert%20Pages_3rdpr.pdf.

The Section in 2018 IRC concerning unvented crawl spaces is R408.3 "Unvented Crawl Spaces". This section with Washington's amendments is as follows:

> ***R408.3 Unvented Crawl Space.*** *Ventilation openings in under-floor spaces specified in Sections R408.1 and R408.2 shall not be required where:*
>
> 1. *Exposed earth is covered with a continuous Class I vapor retarder. Joints of the vapor retarder shall overlap by 6 inches (152 mm) and shall be sealed or taped. The edges of the vapor retarder shall extend at least 6 inches (152 mm) up the stem wall and shall be attached and sealed to the stem wall; and a radon system shall be installed that meets the requirements of Appendix F (Radon) of this code.*
> 2. *Continuously operated mechanical exhaust ventilation is provided at a rate equal to 1 cubic foot per minute (0.47 L/s) for each 50 square feet (4.7 m2) of crawlspace floor area. Exhaust ventilation shall terminate to the exterior.*
>
> ***Exception**: Plenum in existing structures complying with Section M1601.5, if under-floor space is used as a plenum.*[1]

How should the slab or ground of a conditioned crawlspace be sealed?

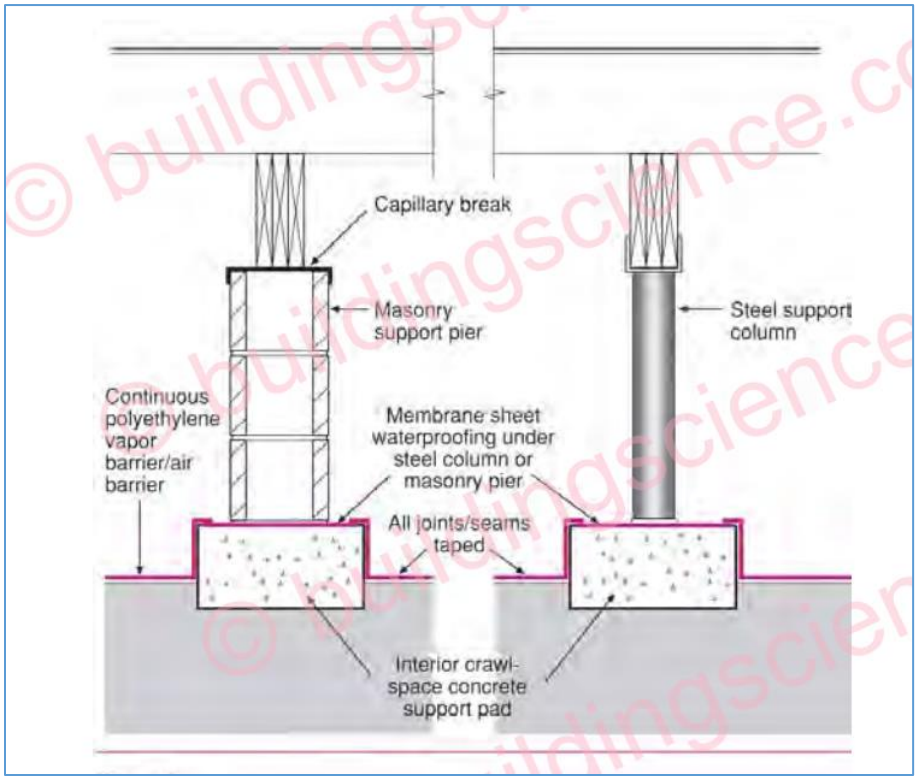
The benefits of conditioned crawlspaces depends on completely sealing the ground or slab. Six mil polyethylene sheeting with overlapping, taped seams meets the minimum code requirements. It is recommended that the areas to be taped be cleaned prior to application of the tape.

However, many do not consider this minimum sufficiently durable over the long run and recommend 20 mil PVC, TPO or other reinforced sheeting with the material manufacturer's recommendation for sealing the seams as best practice. The ground cover must be continuous, including at all support piers and columns, as shown in Figure 1. The edges of the vapor retarder must extend up the stem wall at least 6 inches and must be mechanically attached to the stem wall and sealed.

The attention to detail and materials required for a complete and durable seal increases the material and labor costs.

[1] Note under-floor plenums are prohibited in new structures, per 2018 IRC M1601.5.1.

Figure 1. Air barrier continuity at piers, showing all joints and seems taped and membrane sheet waterproofing under columns or piers



Source: Joseph Lstiburek, Building Science Corporation

Is power venting a conditioned crawlspace required in Washington State for new construction? Yes

The Washington amendments of IRC 2018 "Unvented Crawl Spaces" differs from the unamended version of 2018 IRC in that power venting directly to the exterior is required. Conditioned crawlspaces that are used as plenums are an exception that does not require power venting. However, under-floor plenums are prohibited in new structures, per 2018 IRC Section M1601.5.

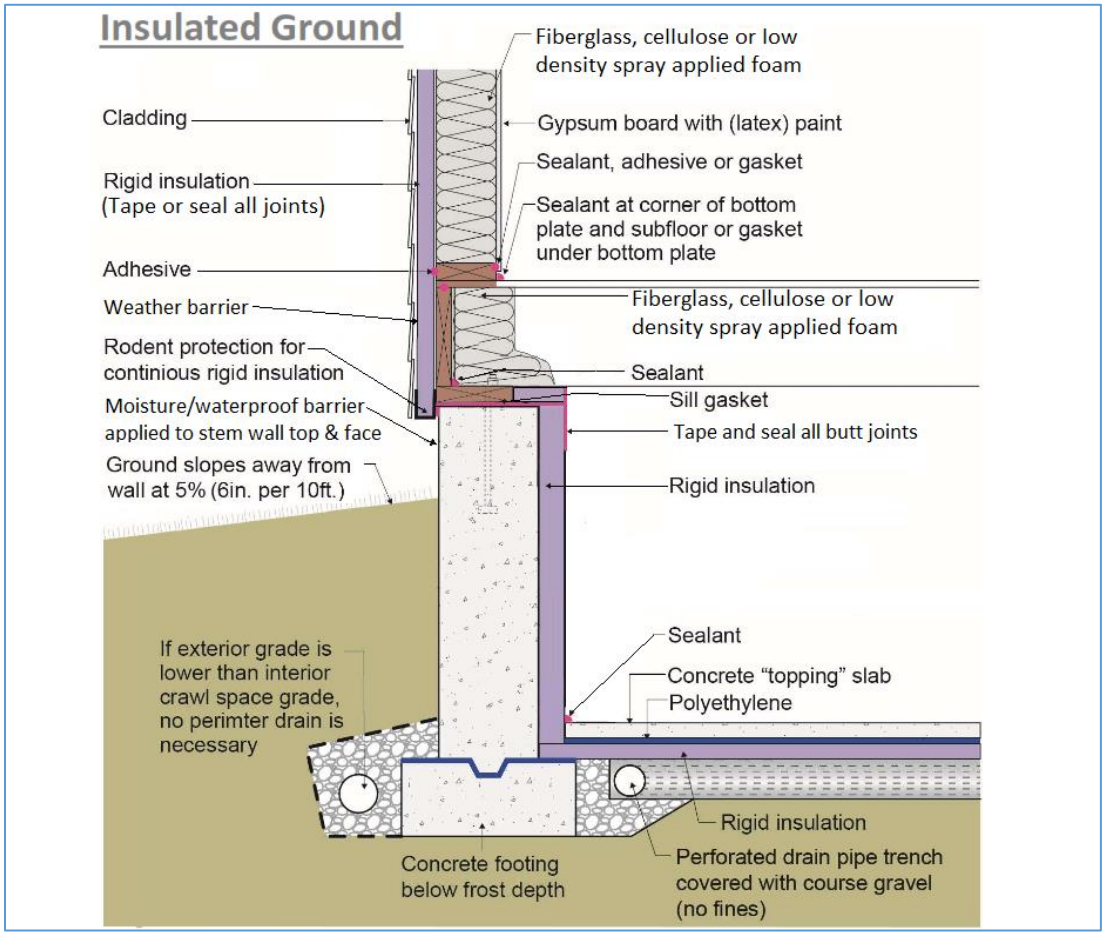
The other alternatives to power venting included in the unamended 2018 IRC are either (1) providing dehumidification or (2) supplying conditioned air to the crawlspace with a return air pathway from the crawlspace. These are not included in the exceptions to power venting in Washington State.

What are insulation requirements for conditioned crawlspaces?

If the crawlspace is conditioned, then the floor above the crawlspace is not part of the building thermal envelope and floor insulation is not required. Instead, the foundation walls and crawlspace slab (or ground) become part of the building thermal envelope.

Insulate a conditioned crawlspace to the same insulation levels as conditioned basements with the walls meeting insulation requirements of below-grade walls and the slab or ground meeting insulation requirements of a below-grade slab, per WSEC-R Section R402.1.1. Figure 2 shows insulation, drainage and sealing recommendations for the Pacific Northwest for the case of a conditioned crawlspace with an insulated topping slab.

Figure 2. **Insulation, drainage and sealing details for a conditioned crawlspace with insulated ground.**



Source: Adapted from Joseph Lstiburek (Building Science Corporation) to reflect recommendations for the Pacific Northwest

Are there advantages of conditioned crawlspaces in Washington State?

Conditioned crawlspaces clearly have benefits in warm, humid climates, such as the Southeastern United States, where homes are cooled. In climates where warm humid air enters through the vents of a vented crawlspace, moisture can condense on the cold framing members and may eventually result in rot and mold problems. Air conditioning energy use is also reduced because ground coupling assists in cooling the home passively.

The Pacific Northwest, however, is a heating-dominated climate and our summers are not humid. So vented crawlspaces here do not have as much of an issue with condensation on cold floor surfaces. In our climate, conditioned crawlspaces must be power vented directly to the exterior by a continuously operated exhaust fan operating at a rate of 1 cubic foot per minute for each 50 square feet of crawlspace floor area. It is recommended that the floor above the crawlspace be well sealed without any direct return or supply air between the house and the crawlspace.

In most areas of the Pacific Northwest, conditioned crawlspaces incur an energy penalty due to coupling to the cool ground in the winter, as well as due to power venting, although indoor air quality is improved because of negative pressure of the crawlspace created by power venting. However, if the fan fails, indoor air quality worsens because the air now entering the house from the crawlspace does not benefit from passive venting.

In summary, the advantage of conditioned crawlspaces in Washington is:

- Improved indoor air quality, assuming power venting continues to run into the future without failure.

The disadvantages are:

- Energy penalty in most locations in this region
- Worsened indoor air quality if the fan fails or is disabled
- Greater installation labor and material cost to meet best practices for air and moisture sealing.

What are general recommendations for conditioned crawlspaces in the Pacific Northwest?

After testing four Washington homes, Hales et al (2010) made the following recommendations for conditioned crawlspaces in the Pacific Northwest:

- Use foam insulation products for perimeter installation and never install a warm-side vapor retarder with perimeter batt insulation.
- Power-vent the crawlspace and tightly seal the floor above the crawlspace to decouple the house from the crawlspace.
- Require passive or active radon mitigation, depending on the risk for the site[2].
- Direct return or supply air to or from the crawlspace and the house is not recommended in this region.

[2] For more information on radon mitigation, refer to

- 2018 IRC Appendix F "Radon Control Methods"
- "Consumer's Guide to Radon Reduction, How to Fix Your Hom"e, USEPA

Can ducts be located in a conditioned crawlspace to qualify for Option 4.2? No under 2018 WSEC, but Yes under 2021 WSEC

Option 4.2 in WSEC 2018 specifically stated "Locating system components in conditioned crawl spaces is not permitted under this option". The corresponding Option 4.1 under WSEC 2021 does not include this restriction.

Can mechanical equipment (other than ducts) be located in conditioned crawlspaces? Yes but…

If you locate fuel-fired appliances in a crawlspace, the floor over the crawlspace must have a fire-resistance rated material (such as ½" sheet rock) installed on the underside of the floor framing, per 2018 IRC per Section R302.13 "Fire protection of floors". Notice with the Washington amendments of the 2018 IRC, electric-powered heating appliances installed in the crawlspace do not trigger fire barrier requirements.

So in Washington State, you can install an electric furnace or heat pump in a crawl space without being required to install sheetrock or other fire barrier on the underside of the floor.

From 2018 IRC with the Washington amendments:

> ***R302.13 Fire protection of floors****. Floor assemblies that are not required elsewhere in this code to be fire resistance rated, shall be provided with a 1/2-inch (12.7 mm) gypsum wallboard membrane, 5/8-inch (16 mm) wood structural panel membrane, or equivalent on the underside of the floor framing member….*
>
> > ***Exception 2.*** *Floor assemblies located directly over a crawl space not intended for storage or fuel-fired appliances.*

Can conditioned crawlspaces be used as a storage area? Yes but…

Just as with fuel-fired appliances, using a crawlspace for storage will trigger the fire barrier requirement for the floor over the crawlspace.

For More Information

Conditioned crawlspaces in the Pacific Northwest:

- "Unvented Crawl Spaces: Whose idea was that?" by Gary Nordeen, WSU Extension Energy Program, September 25, 2008, https://www.energy.wsu.edu/documents/AHT_Conditioned%20crawl%20spaces%5B1%5D.pdf
- "Vented and Conditioned Crawlspace Performance in Marine and Cold Climates of the Pacific Northwest" by David Hales, Mike Lubliner and Andrew Gordon, *ASHRAE Journal, Buildings XI,* 2010, https://web.ornl.gov/sci/buildings/conf-archive/2010%20B11%20papers/174_Hales.pdf

- "The Scary Crawlspace" by David Hales, *Home Performance Contracting*, January/February 2011, https://basc.pnnl.gov/sites/default/files/resource/HalesD28-1.pdf

General How-To Guides:

- Building America Report -0401 "Conditioned Crawl Space Construction, Performance and Codes" by Joseph Lstiburek, Building Science Corporation, 2004, available at https://www.buildingscience.com/sites/default/files/migrate/pdf/BA-0401_Conditioned_Crawlspace_Construction.pdf
- "Guide to Closing and Conditioning Ventilated Crawlspaces" by Bruce Dickson, BACOS Inc, January 2013, available at https://www.nrel.gov/docs/fy13osti/54859.pdf

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