



Indoor airPLUS

Technical Guidance to the Indoor airPLUS Construction Specifications

1. Moisture Control

Sections 1.1 - 1.4: Water-Managed Site and Foundation

1.4 Basements and Crawl Spaces

Insulate and condition basements and crawl spaces as follows:

- Insulate crawl space and basement perimeter walls according to IRC Table N1102.1 or IECC Table 402.1.1 (also see [Specification 1.12](#)); AND
- Seal crawl space and basement perimeter walls to prevent outside air infiltration; AND
- Provide conditioned air at a rate not less than 1 cfm per 50 sq. ft. of horizontal floor area. If radon-resistant features are required (see [Specification 2.1](#)), do not install exhaust ventilation, as described in IRC section R408.3.2.1.

Exceptions:

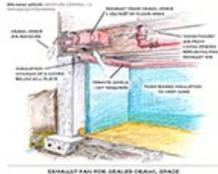
- Homes built in areas designated as flood zones. (Conditioned crawl spaces are not recommended for use in flood zones.)
- Raised pier foundations with no walls.
- Dry climates, as defined by IECC Figure 301.1.
- Marine climates, as defined by IECC Figure 301.1, if no air handler or return ducts are installed in the crawl space.

Note: In each of the preceding exceptions, floors above unconditioned spaces shall be insulated to the IECC-specified R-value and sealed to prevent air infiltration.

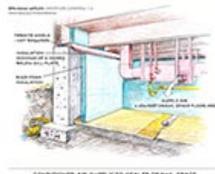
Detailed Illustrations

Click on the image for a full-page version

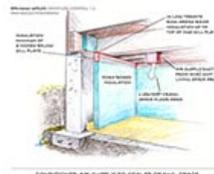
Exhaust fan for sealed crawlspace



Conditioned air supply to sealed crawlspace



Conditioned air supply to seal crawlspace



Why

Crawl spaces and basements can become moisture laden, supporting the growth of mold and the decay of building materials and providing ideal conditions for insect pests and even rodents. Moisture and contaminants can be driven into living spaces by the differences in air pressure between the crawl space/basement and the living spaces above. This exchange can be much greater when forced-air heating and air-conditioning equipment is located in basements and crawl spaces; the strong system airflows can pick up pollutants through any leak in the equipment, plenums or ductwork and quickly disperse them throughout the home.

Building codes traditionally have required the passive venting of crawl spaces to the outdoors, with the vent sizing dependent on the floor area of the crawl space and whether a vapor retarder such as polyethylene was present to reduce moisture entering the crawl space from the soil. However, research has shown that ventilating air entering the crawlspace from outdoors during warm, humid seasons wets rather than dries crawl spaces even if effective drainage and dampproofing systems are installed to keep liquid water out and a vapor retarder is in place on the earth floor.

However, conditioned crawl spaces have been shown to provide better moisture control, and they are more energy efficient. The International Residential Code (2009) provides for un-vented crawl spaces (R408.3). Conditioned crawl spaces have several essential elements:

- Perimeter walls (including an access door opening to the outside, if provided) that are sealed to prevent infiltration of outside air (no passive vents).
- Insulated walls to reduce the transfer of heat either into or out of the space.
- Floor covered with vapor-retardant membrane (with or without a concrete slab covering the vapor retarder) to control soil moisture (see [Specification 1.2](#)).
- Either mechanical exhaust ventilation or conditioned-air supply.
- Floor drains leading to daylight outdoors or to a sump pit.

In warmer weather, a sealed crawl space prevents warm air from entering through wall vents and condensing on surfaces cooled by the ground temperature inside the crawl space. Sealing also produces energy savings by preventing the loss of dryer conditioned air (or during winter months, warmer conditioned air) that has been supplied to the

Please see "[How to Use This Guidance](#)".

Sections 1.1 - 1.4

Water-Managed Site and Foundation

- [1.1 Site and Foundation Drainage](#)
- [1.2 Capillary Breaks](#)
- [1.3 Damp-proof Foundation](#)
- [1.4 Basements and Crawl Spaces](#)
- **BEST PRACTICE:** [Crawl Spaces in Flood Zones](#)

Sections 1.5 - 1.6

Sections 1.7 - 1.10

Sections 1.11 - 1.13

Please refer to the [Construction Specifications 1.4 Insulate and condition basements and crawl spaces as follows](#)."

space.

How

Ventilation openings should not be installed in the crawl space walls (except when an active exhaust fan is located in the wall to provide mechanical ventilation, described below). In addition, the following locations must be air-sealed using caulks, adhesive, air-sealing foam, gaskets or adhesive membranes:

- Exterior entry hatches or doors.
- Joints between the top of the foundation wall and the mud sill, between the mud sill and the rim joist and between the rim joist and the sub-floor.
- Around ducts, pipe conduits or other penetrations through the wall or rim joist.

Foundation walls may be insulated on their outside, inside or, in the case of insulated concrete forms, both sides. Insulating on the outside keeps the foundation wall's temperature and moisture content more uniform throughout the year. If insulation is applied to the interior side of a basement wall, materials that can act as vapor barriers (e.g., polyethylene film, foil-faced paper or vinyl wall covering) should not be used (see [Specification 1.12](#)). The vapor barrier can trap any moisture present in the foundation wall, creating moisture and mold problems on the wall's interior surface.

Moisture and humidity issues are not eliminated once the crawl space is sealed. In the sealed environment, a small amount of moisture or humidity can cause a significant moisture problem unless provisions are made for some level of air exchange with conditioned air. This is accomplished with mechanical ventilation of the crawl space in essentially two ways:

- An exhaust fan inserted into the crawl space wall removes a small amount of air from the crawl space and it is replaced by drawing a small amount of conditioned air from the living space (through cracks and other openings in the floor above into the crawl space). If radon-resistant construction is necessary (see [Specification 2.1](#)), do not implement this option because it can interfere with the operation of the mitigation system.
- A small amount of conditioned air (minimum 1 cfm per 50 sq. ft. of crawl space floor area) is blown directly from the heating and air-conditioning system (from equipment located in the living space above and ducted to the crawl space, or directly from HVAC equipment located in the crawl space).

See also "Ventilation," ([Specification 4.5](#)) for general ventilation needs for the home.

References/Additional Information

- International Residential Code, 2009, R408.3, Unvented Crawl Space. Order a copy of the Codes at www.iccsafe.org/ [EXIT Disclaimer](#).
- International Residential Code, 2009, Figure R301.2(6), Termite Infestation Map. Order a copy of the Codes at www.iccsafe.org/ [EXIT Disclaimer](#).
- International Residential Code, 2009, R318.4, Foam Plastic Protection. Order a copy of the Codes at www.iccsafe.org/ [EXIT Disclaimer](#).
- Performance Guidelines for Basement Envelope Systems and Materials," National Research Council of Canada, Institute for Research in Construction, 2005. See www.nrc-cnrc.gc.ca/ [EXIT Disclaimer](#)

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