



# Energy Efficiency: Floor & Crawl Space Insulation

(General)



[https://www.energystar.gov/campaign/seal\\_insulate/basement\\_crawlspac](https://www.energystar.gov/campaign/seal_insulate/basement_crawlspac)

## The Importance of Floor and Crawl Space Insulation

20% of home heat loss can happen through your basement. They tend to have poor insulation and the ground does not do very much to retain the heat. Floor and crawl space insulation offer a great way to reduce heat lost underneath your home.

Floor insulation helps keep an even temperature, improving comfort and reducing wear and tear on heating equipment.

Crawl spaces often have dirt floors, exposing the area to moisture and temperature changes. The moisture travels into the house, increasing the risk of mold. This dank air can be stopped if proper air sealing and insulation is in place.

Crawl spaces can be insulated two ways:

- Insulate the floor above the crawl space which prevents warm conditioned air from escaping to the crawl space.
- Insulate the walls to keep the crawl space heated.

## Types of Insulation for Crawl Spaces

### Vapour Barrier

This is a great DIY, affordable option that can protect a home from moisture build up. By laying a sheet of polyethylene directly on the ground you can stop the moisture at the source. While proper air sealing measures are recommended, a sheet of polyethylene that covers most of the ground will reduce moisture transfer by nearly 80% .

### Spray Foam

An alternative is using spray foam that will both insulate while creating a vapour barrier. The drawback is that it is more expensive and usually requires professional installation.

### XPS Foam Board

This can be installed directly to concrete walls using adhesive or strapping and concrete screws (like Tapcon® screws). XPS qualifies as a vapour barrier as long as it is at least 1 inch thick.

### EPS Foam Board

Similar to EPS in its installation, but is produced in a more environmentally friendly fashion and does not qualify as a vapour barrier until it is applied at least 2 inches thick.

### Mineral Wool

This is a good option as it will not burn in the case of a fire, however it does not act as a vapour barrier so a sheet of polyethylene will need to be added.

## What is an R-Value?

- An R-value or “thermal resistance” is a measurement based on its ability to slow or resist the flow of heat through it. A higher number means it will retain heat better.
- An R-value is determined by the properties of a type of material, such as its density, thickness and how easily it allows heat to travel through it.
- When determining R-values of a foundation, look at each layer’s R-value and add them together. (For example, add foam board insulation and concrete’s R-values together.)



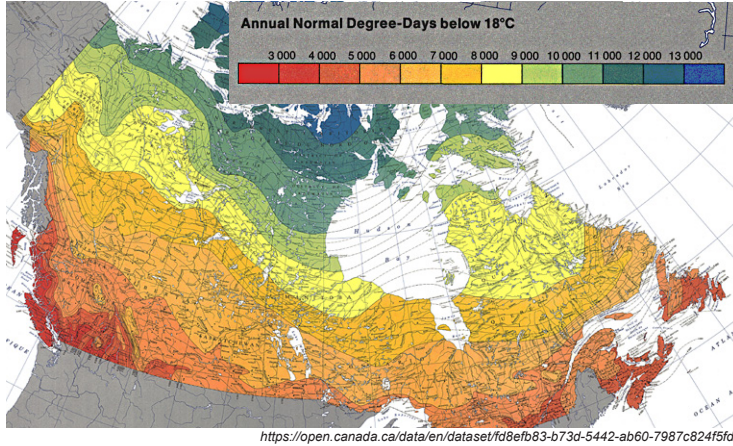
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## Heat Loss from Basements

20% of a home's heat can be lost in basements since they are rarely insulated. Before adding insulating a basement, check your region's recommended R Value minimum.

Use the map and the chart below to determine the recommended R-value in your region.

Note: The HDD or Heating Degree Days determine how much heating a home in each region typically requires.



Heating degree-days (HDD) are a measure of heating demand based on the difference between the average daily outdoor temperature and 18°C. In other words, how many days you can expect to need your heating system running. Each zone experiences a similar number of heating degree-days.

House Component	Zone A	Zone B	Zone C	Zone D
Walls	R 22	R 24	R 27	R 40
Basement Walls	R 19	R 19	R 24	R 25
Floor (over unheated spaces)	R 27	R 31	R 40	R 50

## Energy Savings

Here is an example of a home in Fort Chipewyan, Alberta that currently has R-12 to R-20.

- Natural Resources Canada recommends R-40 in northern Canada.
- Many basements and crawl spaces are not drywalled, and headers are easy to get at.
- While the space is tight, there is an opportunity to upgrade the insulation with additional 2" of polystyrene foam board.
- The foam board pieces can be sealed in place with urethane spray foam.
- The chart below shows how much can be saved.

Current Situation	What You Can Do	Material + Labour (\$)	Energy Savings (\$/year)	*GHG Savings (kg CO <sub>2</sub> e/year)	Payback (years)
Basement headers with R-12 insulation	Add 2" XPS foam board insulation	\$500 + \$1000	\$200	500	7
Basement headers with R-20 insulation	Add 2" XPS foam board insulation	\$500 + \$1000	\$100	200	15

\*Green House Gas Savings (kilograms of carbon dioxide equivalent per year)

## Upgrading and What is Involved

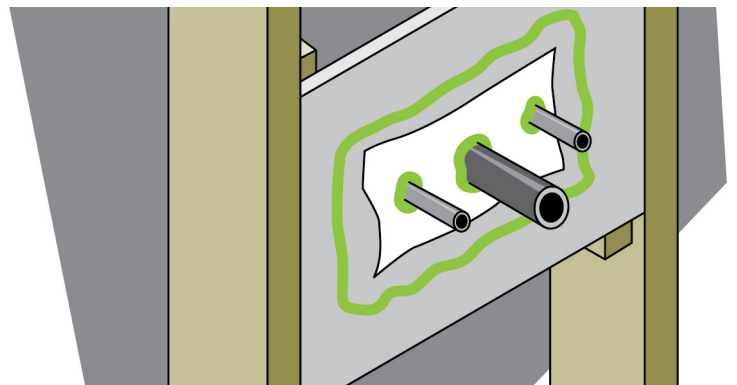
The good news is crawl space insulation is not an all or nothing situation. Often solutions can be found for all budgets and something is always better than nothing when it comes to crawl spaces. Most of the steps below can all be done by untrained home owners and provide a great cost saving opportunity.

### Before Getting Started, Consider the Following

- **Test for Radon Gas** - Radon can be very harmful, a leading cause of cancer that you could possibly be exposed to throughout the period of work.
- **Obstacles** - Remove any debris or sharp rocks from the crawl space as they can get in the way and possibly tear the sheet of polyethylene.
- **Water Leaks** - If there are any signs of water leakage in your basement, it is best to fix the source of the problem before spending time and money on insulation repairs.

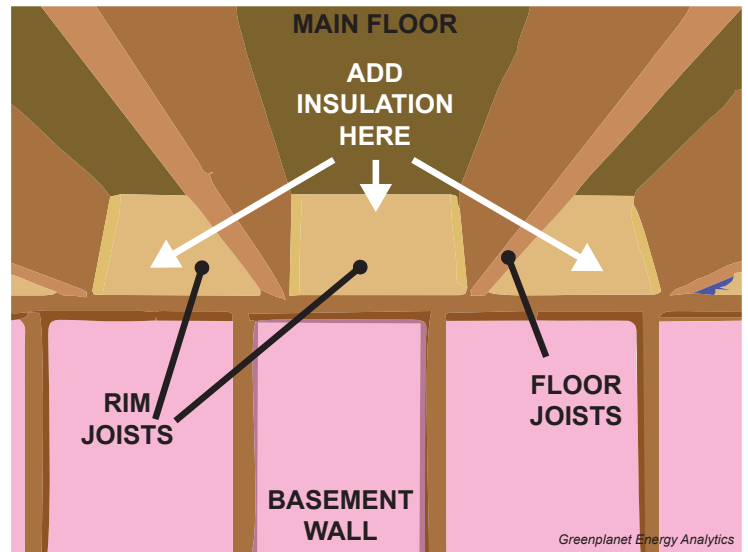
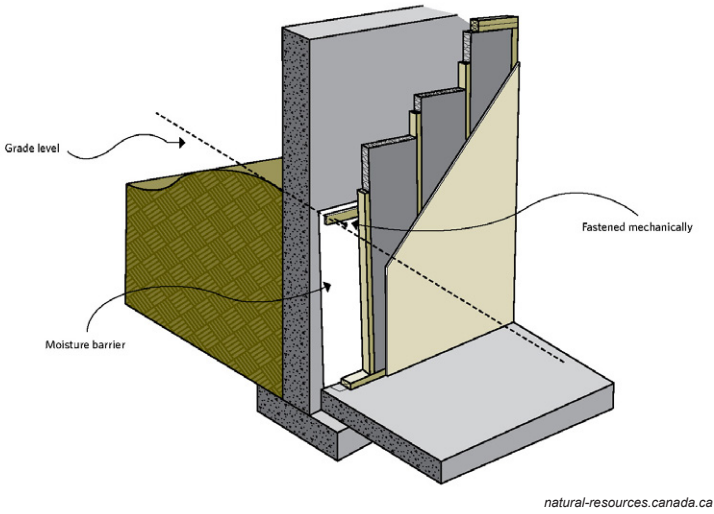


- **Sump Pump** - Before installing your new insulation, consider installing a sump pump if one does not exist. You may have never experienced flooding but it can provide peace of mind and protect your family's belongings in the future.
- **Air Sealing** - This is an opportunity to either install, repair or replace insulation around water pipes, ducts, gas lines, wiring etc. Spray foam is a great solution to seal around the openings of a wall or floor where these components enter the home.



Sealed plumbing penetrations



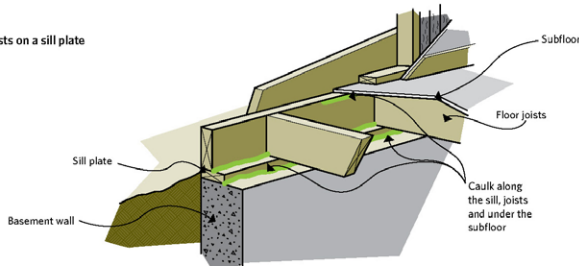


## Insulating a Crawl Space

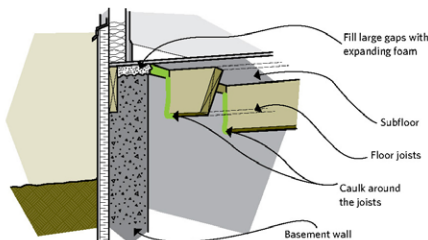
### Vapour Barrier

- If possible, select an opaque white polyethylene vapour barrier as it will brighten the dimly lit space and show any water leaks clearly, hiding mould from the otherside of the barrier which could be confusing at first glance.
- When applying vapour barrier to an exposed dirt floor, overlap the sheets and seal them by using caulking and tape.
- Mechanically fasten it to the walls and permanent obstructions such as columns or building supports to block moisture.

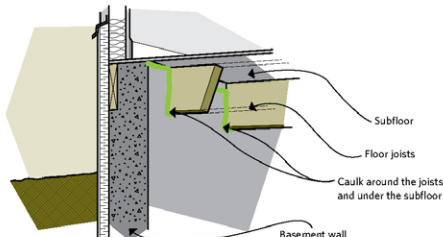
A) Floor joists on a sill plate



B) Floor joists partially cast-in



C) Floor joists fully cast-in



Reducing air leakage in the joist header area

natural-resources.canada.ca

### Insulate Crawl Space Walls

- This can be done from inside or outside the crawl space walls.
- Wall insulation installation is much easier than installing insulation overhead in a tight crawl space.
- Wall studs have more regular spacing compared to the floor joists so there is less material cutting.

For more information on wall insulation check out our wall insulation fact sheet.

### Basement Header Space

Heat loss can occur where the floor is supported by the foundation if it is not insulated properly. This area is referred to as the basement header space.

A **thermal bridge** is an area where heat travels through wooden beams, metal frames or any other gap, wasting valuable heat from your home. Basement headers often act as thermal bridges.

- Two inch XPS (or EPS) foam board insulation is a great tool to block this thermal bridge.
- Always apply foam board directly to wood, behind any wires or plumbing.
- Attach it with caulking and spray foam around the seams.

Basement header space showing areas that need additional insulation to avoid thermal bridging.

### Useful Links

How to Insulate Crawl Spaces

<https://www.ecohome.net/guides/3219/how-to-insulate-crawlspaces/>

Natural Resources Canada - Basement Insulation

<https://www.nrcan.gc.ca/energy-efficiency/energy-efficiency-homes/how-can-i-make-my-home-more-ener/keeping-heat/keeping-heat-chapter-6-basement-insulation/15639>

Comparing Options for Crawl Space Insulation

<https://www.basementsystems.ca/crawl-space/insulated/types-comparison.html>