



Energy Efficiency: Attic Insulation

(General)

The Importance of Insulation

- The largest energy requirement in your home is consumed by home heating.
- To get the most out of your heating equipment, ensure as little heat as possible escapes your home.
- Proper insulation will reduce your family's environmental impact while saving money on monthly utilities.



stock.adobe.com/ca/free

- Insulation is responsible for limiting heat into and out of the home. Heat escapes through windows, doors, foundations, electrical outlets & receptacles.
- While these are important areas to insulate, no area covers more square footage than a home's roof and walls. If they are not insulated properly, heat will escape outside with ease, especially in a home's attic.

Typical Attic Insulation Materials

Types of Blown In Loose Fill

Available in bags, and as the name suggests, are a fluffy fibrous material that is blown into a space with a blower machine. If installed by hand it will be labour intensive and unevenly distributed.

Things You Should Know

- Allows for customizable depth or R Value.
- Works best for attics with existing undamaged insulation, that needs an improved R-value.
- Best insulation option for attics that have irregular joist spacing or lots of obstructions.
- Great option for DIYers who want to avoid hiring a professional.

Fiberglass

- 2.2 - 2.7 R-Value per inch
- Lightweight and affordable
- Non-combustible
- Moisture does not change its effectiveness
- Settles more than other materials, will require a thicker layer.

Cellulose

- 3.0 - 3.8 R-Value per inch
- Most common blow-in insulation material.
- Made of post consumer paper fibers. Treated for fire resistance.
- Most susceptible to developing mold or rotting.

Mineral Wool

- 3.0 - 3.3 R-Value per inch
- Provides fire resistance. Made of fibers from rock or recycled slag from furnaces.
- More costly option

<https://inspectapedia.com/insulation/Rock-wool-insulation-identification.php>

Types of Batts

Batts are a fluffy and flexible type of insulation that comes in bags or rolls in various thicknesses. Available in 16-24 inch widths in order to fit between most studs or joists. They are available with or without vapour barrier paper attached to them.

Things You Should Know

- Can be used for attics or wall insulation.
- Works best in attics with few obstructions and lots of headroom to maneuver during installation.
- Will require some measuring and cutting to fit into stud and joist spaces, around inset light fixtures and wires.

Fiberglass

- 2.9 - 4.3 R-Value per inch
- Inexpensive and commonly used.
- Moistures does not affect its effectiveness
- Can cause irritability to lungs and skin. Best to wear long sleeves, gloves, facemask and eye protection.

<https://www.certainteed.com/building-insulation/products/high-performance-fiberglass-batts/>

Other common types of Batt Insulation include but are not limited to Cotton, Cellulose and Mineral Wool.



stock.adobe.com/ca/free



wikipedia.org



stock.adobe.com/ca/free

Old Insulation

- Homes built prior to the 1940's were rarely insulated, and if your home was built after this point the insulation may have settled or deteriorated due to dampness and time.
- Some homes may have newspapers, wood shavings etc instead of traditional insulation and those materials can remain as long as they are dry but you may want to add an additional layer of modern insulation.
- Home's built before 1990 often used a material called Vermiculite, which may contain asbestos. If you see grainy, lightweight, loose-looking insulation with shiny flecks, it could contain asbestos. Extra precautions should be taken. Call a professional to inspect it and have it professionally removed.

Energy Savings

Example A

A home in a Northern climate with an average 1600 square foot ceiling has added 6" blown-in cellulose in order to achieve R60 insulation. This small change could save up to \$300/year and reduce greenhouse gas emissions by up to 700 kilograms of carbon dioxide equivalent per year.

Example B

In comparison, another Northern climate home with a poorly insulated 1600 s.f. ceiling has added 12" blown-in cellulose in order to achieve R60 insulation. This upgrade could save as much as \$1,400/year and reduce greenhouse gas emissions by up to 3,200 kilograms of carbon dioxide equivalent per year.

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 indicates a higher insulation value.
- An R-value is determined by the properties of a type of material, such as its conductive properties, density and thickness.
- When determining R-values of a wall or attic, it is important to note that they can be added together.
 - ◆ If there are multiple layers of materials it is important to take note of each layer's R-value and add them together to calculate a total thermal resistance.



stock.adobe.com/ca/free

- ◆ For example a home's walls could have vinyl siding with foam board insulation (a rigid, firm block of fiberglass), with additional loose and fluffy "blow-in" material on top. Add the R-value numbers of both of these to get the true R-value of your walls.

Determining If You Need to Upgrade Your Insulation

There are three main objectives when inspecting attic insulation:

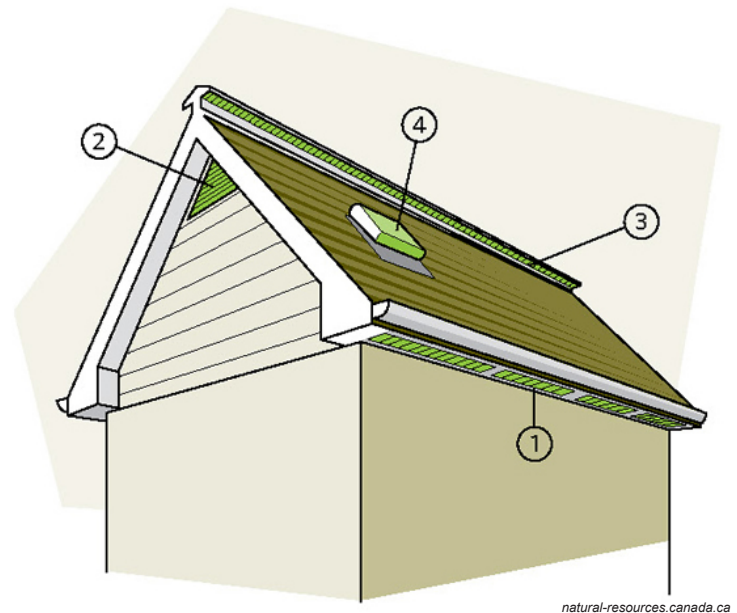
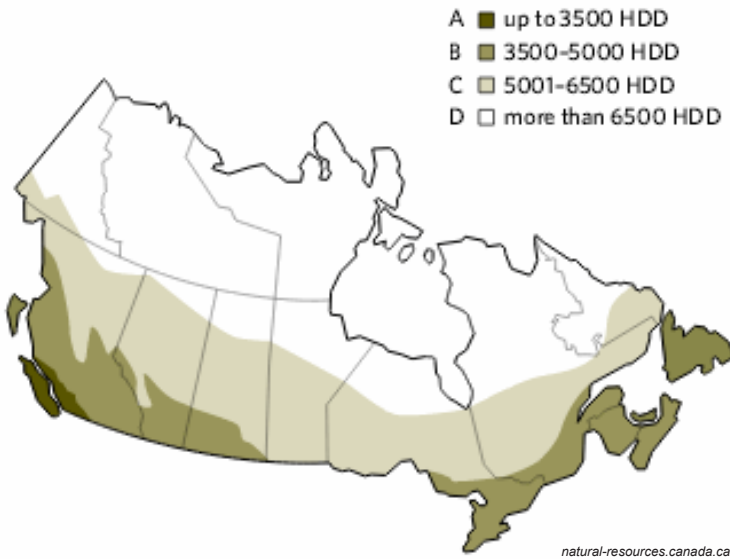
1. Determine what kind of insulation you have.
2. To determine your attic's R-Value.
3. To determine if existing insulation is in good condition.

What to Do

- Take a flashlight, tape measure (to measure insulation depth) and a camera (or smartphone).
- Use a ladder to safely climb into the attic
- Be careful not to step on or compact the attic insulation as this will reduce the R-value.
- Note whether or not the attic hatch is insulated
- Determine whether the attic is evenly insulated. If the insulation appears to be an even depth, measure what appears to be the average depth and take a note of this depth. If not measure the lowest point.
- Look around for signs of damaged insulation. You are looking for:
 - ◆ Wet areas
 - ◆ Dirty or stained insulation
 - ◆ Mold
- If you detect any of these issues, you have a moisture issue. The source could be from a leaky roof, a lack of vapour barrier, lack of attic vents or a bathroom or dryer vent that opens into the space instead of outdoors.
- Take a picture of any damage and determine how much insulation would be needed to replace these pieces. You will need to identify and repair the source of the damage before installing new insulation or else you will continue to have the same issues in the future.
- Take a few photos to help you later confirm the type of insulation you have in your attic, including some that are up close.
- Once you exit the attic use the Insulation Guide at the bottom of the document to determine what type of insulation that is in your attic and identify its R-Value per inch.
- Multiply the R-Value per inch by the depth of your insulation's most shallow area. This will give you your attic's R-Value.
- For example, if you determine that the wall contains fiberglass batt, which has an R-Value of around 2.5 per inch. You then measure 12 inches of insulation depth in the attic. All you need to do is multiply $2.5 \times 12 =$ Total R Value of 30.
- Different climate regions in Canada require different amounts of insulation. Use the chart on the next page to determine what your region's recommended R Value is.

Canadian R Value Regions

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



Different types of ventilation: 1. Soffit vents, 2. Gable end vent, 3. Ridge vent, 4. Roof vent

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

Area of House	Zone A	Zone B	Zone C	Zone D
Attic	R 40	R 50	R 60	R 60

Tips for Installation

Prep the Space

Before adding a new layer of insulation, the work space must be inspected and prepped. This means:

- Place a piece of plywood onto the roof joists to give yourself a safe area to work. Avoiding damage to the ceiling below is a top priority.
- Remove and replace any damaged or moldy insulation
- Remove and replace any insulation that is compressed. Compressed or squashed insulation will act more of a conductor than an insulator.
- This is an opportunity to seal all air gaps. Use caulking and/or spray foam to seal gaps between the ceiling below and piping, electrical boxes or wiring.
- If there is a heater flue (ie chimney or furnace pipe), ensure insulation will not come in contact with the hot piping. One option is to build a barrier sleeve out of sheet metal, using heat resistant caulking. Another is to use plywood to create a box casing around the chimney.
- Recessed lights that are not IC (insulation contact) rated need to be protected. A boxed barrier can be created using non-combustible material such as drywall and seal the seams with spray foam.
- If dampness appears to be an ongoing issue, consider installing rafter vents to the soffits to allow air to the ridge vent (if present) and repair all roof leaks.

Just So You Know

- Blown-in insulation is relatively simple and can be added into an attic in addition to existing insulation, provided that the existing insulation is in good condition.
- Blown-in insulation comes in bags and as the name implies, is installed with a blower system.
- A trained professional, equipped with a blower and multiple bags of insulation (assume 38 bags per 1000 sf adding 11.25" settled depth) insulation should be able to complete an installation in 4 to 6 hours provided there are not extensive repairs or preventative maintenance projects required.

Installing Blow-in Insulation

- Install temporary rulers or pieces of wood to the roof joists below, to make gauging the depth of the blow-in insulation easy to measure later on.
- Install temporary blocking around access hatch to ensure no material escapes during installation.
- Operating the blow-in insulation system (blower) is a two person job. One person operates the machine, including loading bags of insulation and turning the machine on and off, while the other person will operate the hose.
- The hose operator should fill an area furthest from the attic hatch and work their way back to the hatch.
- Always fill blow-in insulation over the top of the joists until they are covered to prevent thermal bridging (heat will escape through wood).
- Always avoid obstructing soffit vents with insulation material.
- In order to ensure that an R60 R-rating is achieved, the loose fill must reach an 12" settled depth. Do not compress the insulation as it will reduce efficiency. Even distribution is very important.
- If the top of the attic hatch is uninsulated, install a sheet of rigid foam board insulation on top.

Installing Batt Insulation

- Even though you may have bought batt insulation to fit the average joist cavity size, it is important to remember to always pre-cut lengths of Batt to fit the space perfectly. Any folding, rolling or excessive squishing will reduce the R-value. Cut to ½ inch larger than the cavity.
- Use a utility knife or chef's knife to cut batt to length.
- You will find nooks and crannies (squares, thin rectangles, triangles etc) in the framing of all homes. It is important to always pre cut the Batt to fit perfectly.
- When there is wiring present, cut a slit in the back of the Batt so that a small section of Batt can be tucked behind the wiring to ensure both sides of the wire or cable is insulated.
- Always avoid obstructing soffit vents with insulation material.

- Electrical boxes can cause thermal bridging, allowing heat to escape via conduction. Ensure that the box is insulated. If it is not, you can use a spray foam around the edges and if possible behind the box as well. Insert the Batt to fit as you have with the other gaps, starting on the top half. Now that you've worked your way down to the bottom half near the electrical box. Cut an opening to fit around the electrical box as snugly as possible.



stock.adobe.com/ca/free

Insulation Guide

Insulation	R Value	Identifying What You Have
Fibreglass Batts	2X4 = R-11 2X6 = R-19 2X10 = R-30 R 2.9-3.8/inch	Pink or yellow blankets found in Walls, Ceilings, Attics and Floors.
Cotton-Fibre Batts	2X4 = R-13 2X6 = R-19-21 2x10 = R-30 R 3.0-3.7/inch	Light blue to dark blue fluffy cotton, made from blue jean manufacturing Cut-offs. Found in Walls, Ceilings, Attics and Floors.
Rockwool Batts	2X4 = R-13 2X6 = R-22 2x10 = R-33 R 2.8-3.7/inch	Dark gray or black batts with paper facing. Found in Walls, Ceilings, Attics and Floors. Mostly used in industrial settings but sometimes found in residential.
Fibreglass Loose Fill	R 2.2 - 2.7/ inch (varies based on density)	Pink, yellow or white fluffy material that comes compressed in bags. Mostly found in Attics and Walls.
Cellulose Loose Fill	R 3.0-3.7/inch	Gray finely chopped up newspaper with fire retardant added, found mostly in Attics and Walls.
Vermiculite Loose Fill	R 2.4/inch	Looks like kitty litter or very small mica flakes. May contain asbestos. This is no longer in use.
Extruded Polystyrene (ExPS or XPS) Rigid Foam	R 5.0/inch	Blue or pink rigid board. Excellent for exterior sealing or insulating basement walls. Can be applied directly to concrete.
Expanded Polystyrene (EPS) Rigid Foam	R 3.6 - 4.4/inch	A foam board, usually white in color found in basements
Rigid Polyisocyanurate	R 6.0 - 6.5/inch	Foam boards with foil facing to improve radiative insulation.
Low Density Spray Foam	R 3.8/inch	Yellowish, white foam that goes on wet and dries quickly. Expands as it is applied.
High Density Spray Foam	R 6.5/inch	Yellowish, white foam that goes on wet and dries quickly. Expands as it is applied.