CO_2RE Home$avers

Attic Insulation

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About CO_2RE

Created *by* Edmontonians *for* Edmontonians...

Carbon Dioxide Reduction Edmonton (CO_2RE) is a developing organization formed to implement Edmonton's Community-Wide Greenhouse Gas Emissions (GHG) Reduction and Energy Strategy. CO_2RE is supported by the City of Edmonton and a group of local organizations dedicated to implementing the strategy and reducing greenhouse gas (GHG) emissions in our city.

The CO_2RE mission is to work with Edmonton residents, businesses, institutions and industry providing services, programs and initiatives to assist in reducing energy use, thereby reducing the levels of the GHG emissions that are responsible for Climate Change.

CO_2RE goals include:

- up to a 6% reduction in GHG emissions (from 1990 levels) by the year 2010 and
- a 20% reduction in GHG emissions (from 1990 levels) by the year 2020.

Do your part...

We can do many things to reduce our emissions – and that includes making our homes and lifestyles more energy efficient. The publications in this series are a first step, providing Edmonton with specific how-to guides on improving home energy efficiency, saving money and reducing GHG emissions.

For more ideas on how to become more energy efficient, log onto our website at **www.co2re.ca!**

Free Membership

Why get a membership? Becoming a $C0_2RE$ member is free and the more people who join us in taking action on climate change, the faster we will achieve our goals. CO_2RE is working with local companies to offer incentives on energy-efficient products and programs to further assist homeowners. You'll also receive a regular newsletter with new ideas and updates. Sign up today at **www.co2re.ca.**

Industrial and commercial/institutional companies can contact our manager at 944-CORE (2673) to find out how they can participate.

Should You Re-Insulate?

Heat loss from air leakage elsewhere in the home such as conduction through un-insulated basement walls is often more significant than ceiling heat loss. If the basement walls are insulated, you've applied caulking and weatherstripping to windows/ doors and other leakage areas, improving the attic's insulation and air tightness is the next step.

How do you decide if the attic needs to be insulated? If the present insulation value is below the Alberta Building Code minimum recommended levels of RSI 6 (R34) you probably need additional insulation.

Additional insulation and air sealing of the attic will reduce both heat loss and heat gain, helping to eliminate cold air currents (drafts) and heat loss in winter plus reduce summer heat buildup. Heat loss cannot be reduced to zero. Heat energy will always move through the ceiling materials but you can reduce the heat loss to an acceptable level.

This booklet is designed to help you decide, with how-to information – whether you plan to do it yourself or hire an insulation contractor to do the job.

The table below shows the **Low, High** and **Average**, yearly heating system gas usage - due to heat loss through the attic. Figures are based on the analysis of the results from 4,000 EnerGuide home audits of Edmonton homes.

Homes are grouped by age and building characteristics using forecast average 2004/05 natural gas costs of $10 a Gigajoule/ GJ.

Home Age	Low Usage	High Usage	Average Usage	Average Cost
1900-1919	0.60 GJ	50.57 GJ	14.13 GJ	$141.30
1920-1929	3.91 GJ	57.36 GJ	15.69 GJ	$156.90
1930-1939	4.77 GJ	70.18 GJ	14.85 GJ	$148.50
1940-1949	3.52 GJ	60.47 GJ	12.13 GJ	$121.30
1950-1959	3.07 GJ	94.96 GJ	12.44 GJ	$124.40
1960-1967	4.06 GJ	103.29 GJ	15.47 GJ	$154.70
1968-1979	1.56 GJ	61.01 GJ	14.72 GJ	$147.20
1980-1989	0.37 GJ	55.38 GJ	11.73 GJ	$117.30
1990-2003	4.29 GJ	53.51 GJ	10.28 GJ	$102.80

In a home with an under insulated attic, 5% to 15% of the total home heat loss can be through the attic, half is lost by conduction, the other half due to warm air leakage.

How Much Insulation Is Needed?

A reasonable ceiling insulation level is a minimum overall RSI value of 6.34 (R36). The RSI value (R value) refers to the resistance to heat flow – the higher the better. If the present insulation level is close to the recommended minimum value – at least RSI 6 (R34), conduction heat loss will be very small.

When adequate insulation is in place, significant heat loss reductions can also be achieved by reducing air leakage into the attic.

One-half of that heat is normally lost by conduction, which is heat flow right through the present insulation. The other half of the heat is lost because of warm air leakage through tiny holes or cracks around recessed light fixtures, ceiling electrical boxes, the chimney, plumbing stacks, attic hatch and other openings into the attic space.

Example tables provided are based on upgrading attic insulation to a minimum RSI 6 (R34) value to reduce conductive heat loss. Tables show the reductions in gas usage and costs for 2004/05 based on an averaged cost of $10 a Gigajoule (GJ) for natural gas.

The savings figures listed do not include cost savings achievable by air sealing to reduce warm air leakage into the attic. Heating system gas usage figures are provided in gigajoules (GJ) and were derived from an analysis of the results of 4,000 local EnerGuide home audits.

Upgrading Attic Insulation

Example 1 – Homes 1900 to 1939

EnerGuide Results	Gas (GJ)	Yearly Costs	Tonnes GHG
Average Gas Usage	14.89	$148.90	0.74
Potential Gas Savings	6.86		
Potential Cost Savings *		$68.57	
GHG Savings ** (CO_2)			**0.34**

Savings of $68 a year and a GHG emission reduction of 340 kilograms/ yr

Example 2 – Homes 1940 to 1967

EnerGuide Results	Gas (GJ)	Yearly Costs	Tonnes GHG
Average Gas Usage	13.35	$133.50	0.66
Potential Gas Savings	5.22		
Potential Cost Savings *		$52.20	
GHG Savings ** (CO_2)			*0.26*

Savings of $52 a year and a GHG emission reduction of 260 kilograms/ yr

Example 3 – Homes 1968 to 1979

EnerGuide Results	Gas (GJ)	Yearly Costs	Tonnes GHG
Average Gas Usage	14.72	$147.20	0.73
Potential Gas Savings	5.70		
Potential Cost Savings *		$57.00	
GHG Savings ** (CO_2)			**0.28**

Savings of $57 a year and a GHG emission reduction of 280 kilograms/ yr

In 1981 Alberta adopted the National Building Code, which required a minimum attic insulation level of RSI 6 (R34) for residential construction. As indicated by the following tables, costs savings achievable by upgrading ceiling insulation for homes built after 1981 is very small.

Example 4 – Homes 1980 to 1989

EnerGuide Results	Gas (GJ)	Yearly Costs	Tonnes GHG
Average Gas Usage	11.73	$117.30	0.58
Potential Gas Savings	2.53		
Potential Cost Savings *		$25.30	
GHG Savings ** (CO_2)			**0.13**

Savings of $25 a year and a GHG emission reduction of 130 kilograms/ yr

Example 5 – Homes 1990 to 2003

EnerGuide Results	Gas (GJ)	Yearly Costs	Tonnes GHG
Average Gas Usage	10.28	$102.80	0.51
Potential Gas Savings	1.05		
Potential Cost Savings *		$10.50	
GHG Savings ** (CO_2)			**0.05**

Savings of $10 a year and a GHG emission reduction of 50 kilograms/ yr

** Based on costs of $10/ GJ (2004/05 costs).*
*** Greenhouse Gas Emission (GHG) savings based on average gas usage savings.*

Due to the vast differences in local home sizes and existing attic insulation levels it is not possible to provide an averaged cost or even a cost range. Although the cost savings and GHG reductions achieved directly through increasing attic insulation for the average home are fairly small, there are a number of additional benefits:

- You have the opportunity to air seal the attic (ceiling penetrations) doubling your overall cost savings and GHG reductions.
- Increasing the insulation and air sealing will help eliminate cool air currents and drafts making your home more comfortable.
- Increased attic insulation levels will help keep your home cooler in the summer by reducing attic heat penetration into the home interior.

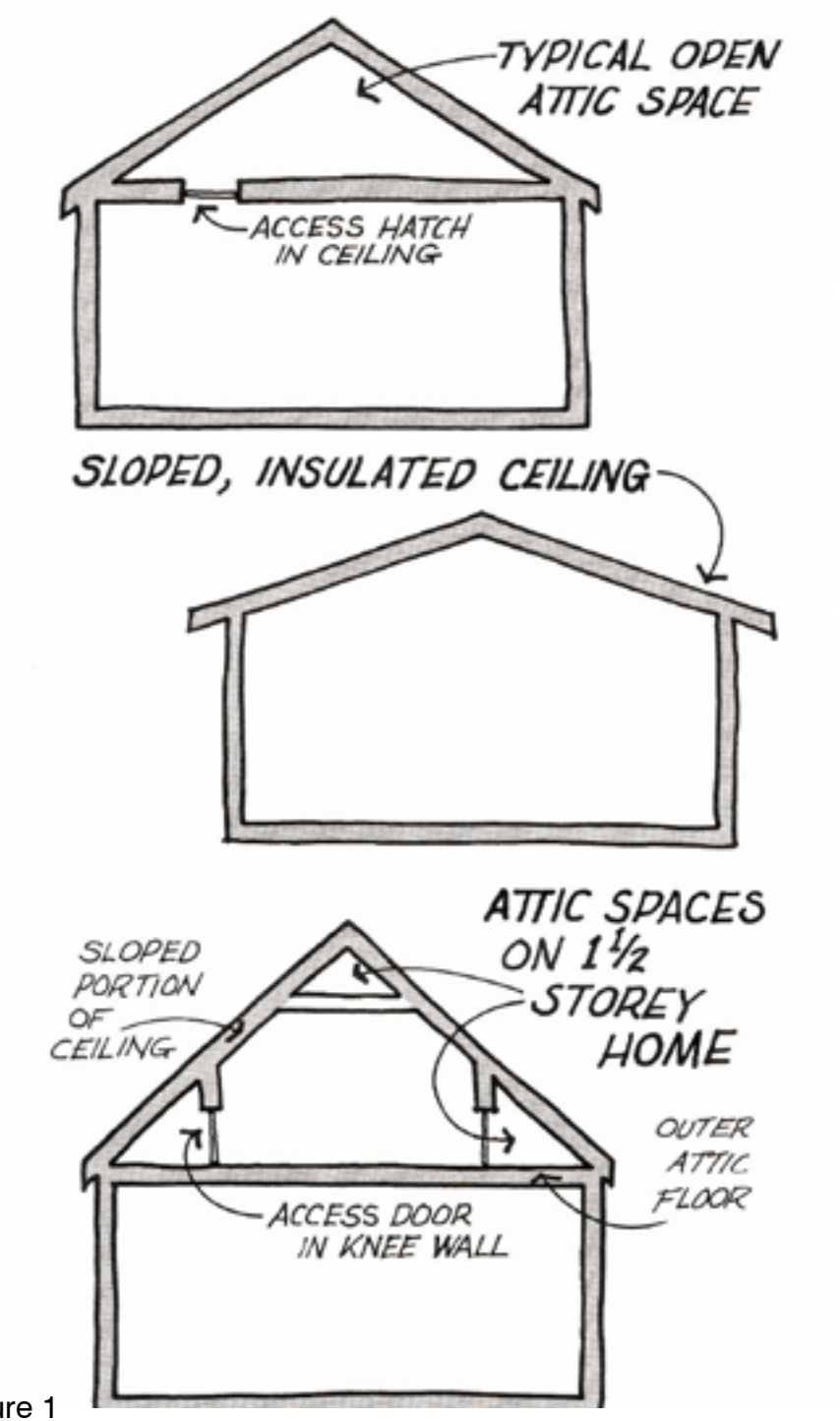
TYPICAL OPEN ATTIC SPACE
ACCESS HATCH IN CEILING
SLOPED, INSULATED CEILING
ATTIC SPACES ON 1½ STOREY HOME
SLOPED PORTION OF CEILING
OUTER ATTIC FLOOR
ACCESS DOOR IN KNEE WALL

Figure 1

Figure 1 shows the types of attics and ceilings discussed in this booklet. Most Edmonton homes are in one of these basic categories. Newer area homes have more varied roof designs combining characteristics from each of the basic categories.

Checking the Attic

Most attic spaces have access doors or hatches, often located in closets or hallways. It may be necessary to drill holes in closet ceilings or in other out-of-the-way places to check the condition of the insulation and vapour barrier in homes with a sloped, open-beam ceiling.

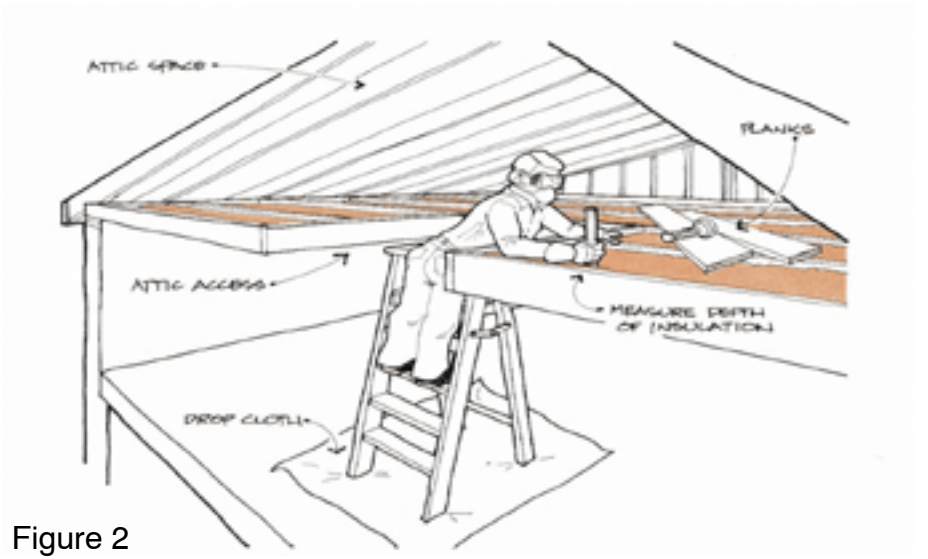

Figure 2

When working in the attic space, take care to stay on the ceiling joists or use planks as a platform. Use a large flashlight or extension cord light. You should wear both gloves and a mask (Figure 2).

With a ruler measure the depth of the present insulation. Use the RSI value (R value) shown in Table 1 as a guide to calculate the total insulation value. If you have difficulty identifying the insulation type, show some to a knowledgeable neighbour, or take a sample to a local building supply outlet for identification.

Check the condition of the vapour barrier. This can be a thin polyethylene sheet applied between the joists and the ceiling finish or may be tarpaper attached to batt insulation. Scrape away a bit of insulation to see if a vapour barrier exists. If so, perform a spot check for cuts or rips and repair any holes.

In older homes you may not find a vapour barrier. Check around electrical fixture outlet boxes, chimney and plumbing stacks to see if there are gaps where air leakage can occur. Replace the insulation you've moved in these areas before leaving the attic space.

Shine the flashlight around the attic and examine the evenness of the insulation layer. Are there bare spots or piles of material?

Look for moisture damage – wet insulation, compressed insulation or water stains on rafters, joists or roof sheathing. Moisture problems can be caused by inadequate attic ventilation or severe air leakage into the attic space.

If moisture problems are the result of a leaky roof, repairs must be made before adding insulation. (Check the roof from the attic during a rainstorm to pinpoint where it is leaking). Severe hail damage, poorly installed vents or mechanical damage affect roof performance. Age can be a factor. Asphalt shingles, for example, have a life expectancy of 15 to 20 years.

If the insulation in the attic space is in good condition – evenly distributed, dry and not settled – more insulation can readily be added. **Remember to seal all the air leaks first.**

Guide to Types of Insulation

Choosing insulation or checking the condition of existing insulation is difficult without some knowledge of the characteristics of each type of material. Table 1 helps do both.

All the insulation materials listed in Table 1 are acceptable for use under current Edmonton Building Code requirements. The Canadian General Standards Board has established further stringent standards. The standards give the assurance that the insulation material will perform well when applied properly. It is important to ensure the insulation material is applied at its proper density to get the correct RSI/R value.

A concern with all materials is to keep insulation clear of heat sources that are a potential fire hazard. For example, the Alberta Building Code requires a two-inch clearance around a chimney. When choosing an insulation material consider its RSI/R value, ease of application, specific application requirements, availability, weight and cost.

Table 1 - Common Types of Attic Insulation

Material and Description	Insulation Value[1]	General Comments
Glass Fibre Batts Glass spun into long fibre, woven, coated with a binder then cured. Uniform widths, lengths and thickness available.	RSI 2.2/100 mm (R3.2/inch)	Fits best into standard joist and stud spaces. Does not fit readily into irregular spaces. Fire resistant. Eye, skin, respiratory irritation at installation. Slight moisture has little effect on R-value.

Material and Description	Insulation Value[1]	General Comments
Cellulose Fibre Blown Finely milled newsprint chemically treated to resist fire and fungal growth.	RSI 2.5/100 mm (R3.6/inch)	Fills irregular horizontal spaces. A blown-in type that can be installed with rented equipment or hand-poured using manufacturers recommendations. Should not be covered with heavier types of insulation, which may compress it. Will settle too much if not blown properly. Additives provide fire, corrosion, vermin and fungal resistance. Slight moisture has little effect on R-value.
Glass Fibre Blown A similar material to glass fibre batts but chopped for blowing or pouring applications.	RSI 1.9/100 mm (R2.7/inch)	Fills irregular horizontal spaces. Will settle if not blown properly. Lightest loose-fill insulation. Should not be covered with heavier types of insulation, which compress it. Fire resistant. Slight moisture has little effect on R-value. Eye, skin, respiratory irritant at installation.
Mineral Wool Blown: Industrial slag melted, fibrized and annealed with a fine film of oil. ***Rock Wool Blown:*** Natural rock, melted fibrized and bonded with oil and binders.	RSI 1.9/100 mm (R2.7/inch) RSI 1.9/100 mm (R2.7/inch)	Fills irregular horizontal spaces. Should not be covered with heavier types of insulation, which may compress it. Will settle if not blown properly. High fire resistance. Slight moisture has little effect on R-value. Eye, skin, respiratory irritant at installation.
Various types include: Rigid Board Expanded polystyrene; Extruded polystyrene; Glass fibreboard; and polyurethane. Uniform widths, lengths and thicknesses available.	RSI value ranges from 2.5 to 4.2/100 mm (R3.6 to R6.0/inch) depending on type.	Lightweight; can be installed interior or exterior where little space is available (Cathedral ceiling, flat roof). Some types must be properly covered with a thermal barrier on room side: 12.7 mm (½ inch) gypsum board or equivalent. Some types must be protected from sunlight.

[1] Use these values for existing insulation only. For new insulation check the manufacturers' specifications.

Note: All insulation materials must be kept clear of any heat source (chimney, recessed lights, etc.) to avoid any potential fire hazard (see Figures 4, 5 and 9).

Although the weight of additional insulation materials should have no effect on the existing ceiling, it is recommended that any weak areas be strengthened before the attic is insulated.

Pre-1970's area homes may find attic insulation consisting of wood shavings (RSI 1.7/100 mm or R2.5/inch). There is no need to remove the shavings prior to adding additional insulation unless there is high moisture content, mould growth in the shavings or you are going to install a new air/ vapour barrier.

Insulating – Getting Started

Should You Hire a Contractor?

Improving the insulation and air tightness of the attic or ceiling is within the skills of the average handy person. However, it is not a pleasant job. While not overly physically demanding, it can be messy and is often done in cramped quarters. Adding ventilation can require working on ladders or the roof surface. In small attic spaces where insulation must be blown in, homeowners will save little cost by doing the job themselves.

The decision to hire a contractor may be the only option if you cannot do the work yourself. Consider:

- Try to gather names of contractors from friends and neighbours who have had insulation installed. Ask if they were pleased (make sure they actually checked the job). If unsuccessful, use the local yellow pages.
- Verify the knowledge level of the contractor by asking questions about R-value, different insulation types, sealing techniques and ventilation. (Base your questions on knowledge gained from articles and this booklet).
- Get detailed cost estimates from different contractors – suspect any that vary widely for an equivalent job. (Remember, it is worth paying a little extra for a proper air-sealing job).
- Details on the contract should include total price, plus a labour and material breakdown, type of insulation and appropriate government standards to which it conforms. Thickness and value of insulation, size of areas to be insulated, areas to be sealed and type of materials used, and a statement of ventilation requirements including any necessary vents.
- Before selecting a contractor, check that the firm is bonded has a provincial licence and is adequately insured. Find out how long the firm has been in business by calling the Better Business Bureau.

No amount of advice will ensure a perfect insulation job but following these steps will increase the chances of getting an acceptable one. Inspect the job before the contractor leaves and before making final payment. Make sure the specifications with regard to insulation type; quantity and quality have been met.

If possible, be at home to count the number of bags of insulation actually used. Check that any air sealing was completed and the ventilation requirements have been satisfied (Table 2). Remember, asking the right questions at the right time will ensure a better-than-average job.

Doing It Yourself

Safety

If you do the job of upgrading your attic insulation and airtightness, make sure safety is uppermost in your mind. Use ladders correctly – support them properly and have someone help steady them. Use a safety rope tied to a secure place when working on the roof.

In the attic space, wear long sleeves with tight-fitting cuffs, gloves and a hat to keep insulation materials from irritating exposed skin. Use a dust mask and goggles (available at building supply stores) because most insulation materials are dusty and may cause skin, eye and respiratory irritation while you are working with them.

The attic can be hot during the summer. Work on cool spring or fall days or on cool summer evenings. Make sure any temporary lighting such as a trouble lamp is securely fastened to rafters. Never use a candle or matches near dusty insulation materials. And, it goes without saying, never smoke on the job!

Permits

Minor renovations such as upgrading the insulation are usually classed as "improvements" and a building permit may not be required. An electrical permit will be needed if any alterations are made to ceiling wiring – removing recessed lights or repositioning outlets for example.

Tools for the Job

Depending on the complexity of the attic insulation and sealing job, the material used, and the type of attic, the following may be required:

- Extension or step ladders to gain access to the attic or roof.
- Temporary lighting using trouble lamps.
- Scaffolding when working on the interior of open beam ceilings.
- Planks for support in attic spaces.
- Utility knife, heavy polyethylene, stapler, tape and caulking materials for plugging air leaks, repairing the vapour barrier and installing insulation stops.
- Tape measure, square, hammer, saw, drill, nails and screws for installing new vents.

- Rake or board for spreading loose-fill insulation evenly.
- Rented blowing machine and helper, if using blown-in fibre insulation.

And don't forget those important personal safety items like goggles, dust mask, gloves and hardhat.

Preparing the Attic Space

Background

In a normally heated space, warm air tries to rise through the ceiling. No matter how well the ceiling is built, some air will get out through any tiny crack or hole it can find. Warm air carries moisture with it. As leaking warm air reaches the cooler temperature in the attic, water vapour condenses into droplets on the nearest cool surface. (It forms ice directly if the temperature is cold enough).

Condensation occurs when moist warm air meets a cold surface. Vapour must be removed from the places where it condenses, such as in the insulation or on the roof trusses, or moisture accumulation results.

Proper ventilation ensures that the vapour is gradually carried out before further moisture or ice accumulation occurs. Air moving from the soffit or gable vents picks up the vapour and carries it outside through gable or ridge vents near the roof peak. In cold weather some frost deposits on the underside of the roof may be visible because the outside air is near saturation and cannot remove much water vapour. As the weather warms, this ice gradually changes into water vapour and is removed, if the attic ventilation is adequate.

The greater the insulation level in the attic, the more likely condensation will take place. Air leaking through the increased insulation will be colder and less able to hold the moisture. Therefore, ventilation is more important when insulation is added and stopping air leakage at the ceiling also becomes critical.

First: Control the Air Leakage

A polyethylene vapour barrier is used to stop the movement of water vapour into the insulation of floors, walls and ceilings. Because it also stops air movement it is commonly referred to as the air/ vapour barrier. This barrier must be placed at or near the warm side of the ceiling.

In a typical ceiling there are many "breaks" in the air/ vapour barrier. The attic hatch, plumbing stacks, partition walls, recessed lights, bathroom fans and chimneys all penetrate the layer.

Many older homes do not have an air/ vapour barrier. Controlling air leakage involves plugging all the holes you can find plus improving the air/ vapour barrier. More information on types and applications of caulking and weatherstripping materials can be found in the "Home$avers - Caulking and Weatherstripping" booklet. Controlling air leakage is a two-part problem.

Improving the Air/ Vapour Barrier

When there is no ceiling air/ vapour barrier, the simplest solution is to paint the inside surface with an approved vapour barrier paint. Make sure the interior space is well ventilated when applying this type of paint. You will also need to air seal all ceiling penetrations such as light fixtures or fans. See "Home$avers – Caulking and Weatherstripping" for additional information.

A new air/ vapour barrier can be added to a ceiling without one. Heavy polyethylene strips can be cut from 0.150 mm (6 mil) material and placed between the ceiling joists from above (Figure 3). These are sealed to the joist with a non-hardening material such as acoustical sealant or solvent-based acrylic caulking. This labour intensive method works best when there is no existing insulation to be moved aside. Adding a new air/ vapour barrier helps plug some air leakage in the attic but many other problem areas may remain.

Alternatively you can lay out a new air/ vapour barrier in one or two large pieces. Extend the air/ vapour barrier out to the eaves and simply loop over the ceiling joists (Figure 8) be sure to staple the poly to each side of the joist so it won't move around as you lay it out in a continuous manner. You can seal all air entry points and place the insulation back in the joist cavities as you move across the attic.

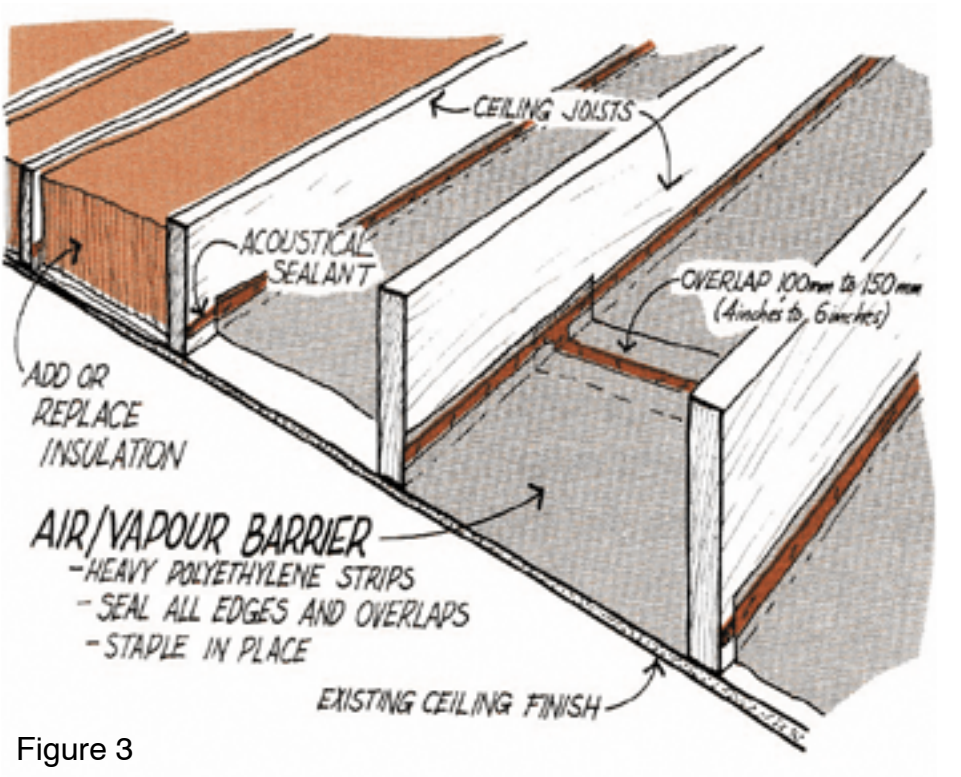

Figure 3

Sealing the Holes

- Around plumbing stacks and kitchen and bathroom exhaust ducts.
- Through recessed lights, electrical boxes and wiring framing holes.
- Along the top plates of interior and exterior partitions.
- Around chimneys.
- Past attic hatches or access doors.

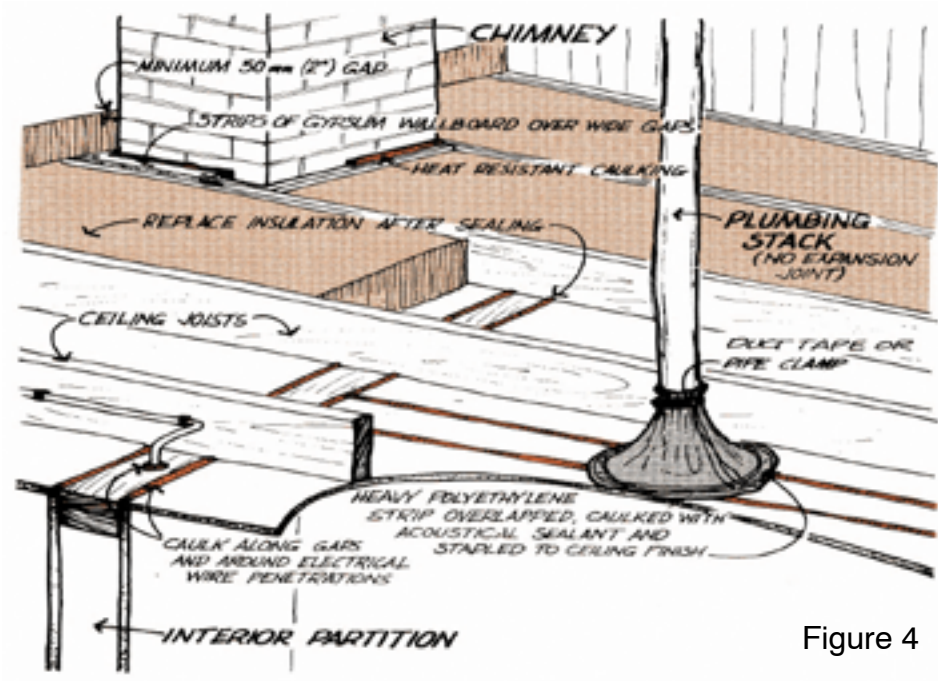

Figure 4

Metal plumbing stacks and exhaust ducts are difficult to seal because they expand and contract as warm air or water flows through them. The best solution with stacks, which have no expansion joint built in, is a flexible seal (Figure 4). Heavy polyethylene, a clamp and duct tape, sealant and staples are used to attach a collar, which allows movement yet maintains the seal.

Plumbing stacks, which have expansion joints, can be secured and sealed at the ceiling surface (Figure 5).

Exhaust ducts, as well as being sealed to the ceiling air/ vapour barrier, must be insulated where they pass through the attic space. If not, moisture condenses on the cold duct surface in the attic, then melts and drips back into the fan each time warm air is exhausted.

Breaks in the air/ vapour barrier caused by electrical outlet boxes and wiring penetrating the ceiling can be plugged with caulking and pieces of heavy polyethylene (Figure 5).

Recessed lights need to be air sealed differently and illustrated in Figure 9.

Caulking can be used to seal any gaps along the tops of interior or exterior wall plates (Figure 4).

Use polyurethane foam for gaps that are over 12 mm (½ inch) in width. Some gaps will have been covered if a new air/ vapour barrier was installed.

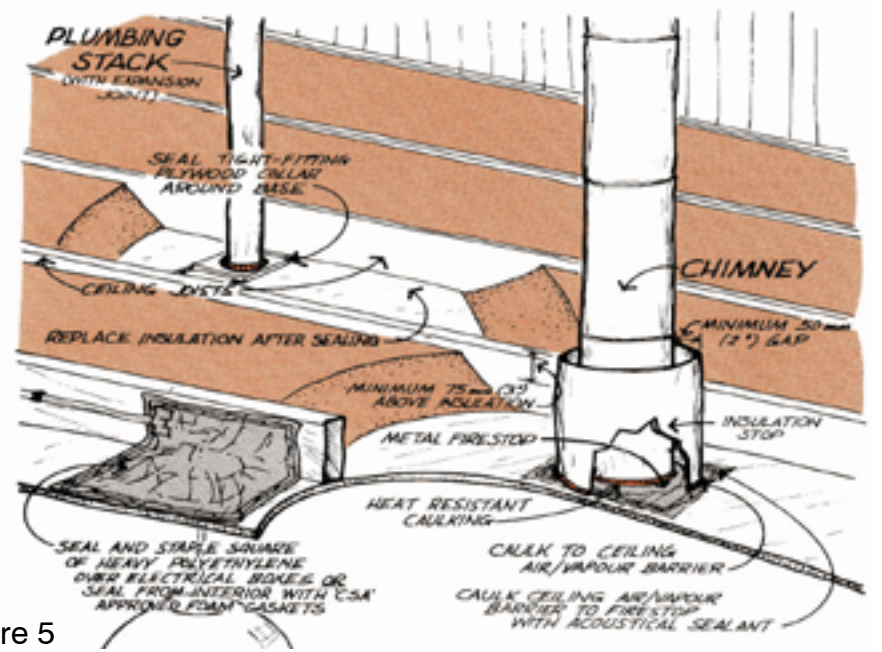

Figure 5

Sealing around chimneys is done in one of the two ways shown in Figures 4 & 5. **It is important to use heat-resistant caulking like muffler cement and metal or gypsum wallboard backing close to sources of high heat.**

Polyethylene cannot be attached or sealed to chimneys. The insulation must be kept at least 50 mm (2 inches) from the chimney surface. Batt insulation can be cut accurately to give the required clearance. A metal or gypsum wallboard barrier (Figure 5) should be used with loose-fill insulation.

The attic hatch is a door to the attic space. It must be insulated (Figure 6) and weatherstripped. Stopping air leakage around the edge is as important as insulating it. If upgrading the insulation levels in the attic space, blocking should be added around the opening to keep loose-fill material from falling on to the hatch. Insulate it with glued-on rigid materials or fiberglass batts (held in place with cotton or burlap) to an insulation value equal to that in the attic.

If doing extensive renovations, consider closing the interior hatch and replacing it with one on an exterior gable end. It is just as convenient and removes a major source of interior air leakage.

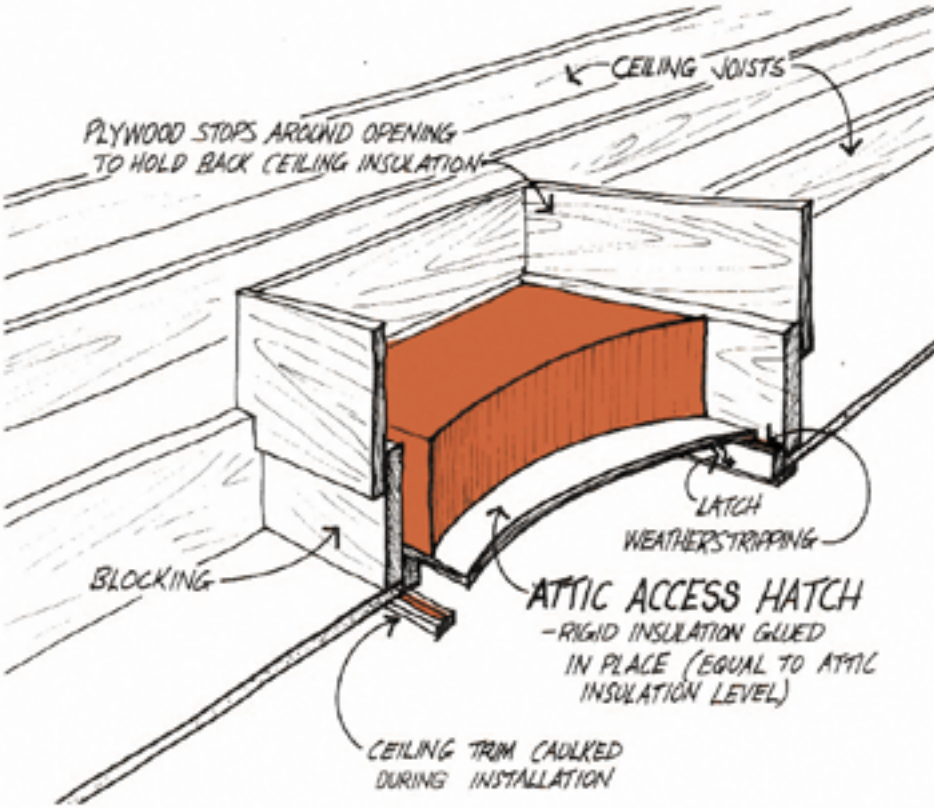

Figure 6

Second: Adequate Attic Ventilation

As mentioned, the attic space requires ventilation to help control moisture build-up regardless of roof space or attic type. The amount of ventilation required is directly proportional to the building ceiling area and is a building code requirement. The correct ratio is 1:300 for unobstructed vents in a steep slope roof (Table 2). For example, if the ceiling area is 140 square metres (1500 square feet), an unobstructed ventilation area of 0.45 square metres (5 square feet) is needed.

However, if there is no effective air/ vapour barrier present, the requirement for the ventilation ratio should be increased to 1:150. In the example given, 0.93 square metres (10 square feet) are required for the same size home. The requirements for other vents are shown in Table 2. Obstructions to free airflow, such as screens and louvers, increase the overall vent size requirements.

All vents must be properly installed to prevent rain or snow penetration. They must be adequately caulked and correctly tied in to the shingle layers. Plan vent locations to avoid areas subject to prevailing high winds in winter. Snow blows into such vents and can cause water problems when it melts. Natural ventilation will adequately ventilate, if there is sufficient vent area for the air to move in and out of the attic.

Table 2

Attic Ventilation Requirements

Ratio: Ventilation Area to Ceiling Area			
	Ceiling with Air/ Vapour Barrier		Ceiling with no Air/ Vapour Barrier
Type of Vent	Steep Slope Roof (over 1 in 6)	Moderate Slope (under 1 in 6)	
Unobstructed opening	1:300	1:150	1:150
Screened opening 3 mm (1/8 inch) 1.5 mm (1/16 inch)	 1:270 1:220	 1:135 1:110	 1:135 1:110
Screened and louvered opening 3mm (1/8 inch) 1.5 mm (1/16 inch)	 1:220 1:200	 1:110 1:100	 1:110 1:100

Examples:

A 112-square metre home with an air/ vapour barrier in place and roof slope over 1 in 6 would require (112 divided by 270) 0.4 square metre of 3 mm screened vent.

A 900 square foot home with no air/ vapour barrier would need (900 divided by 110) 8.2 square feet of 1/8 inch screened louvered vent.

Be generous when calculating for a new home or adding to an existing home, a little more venting is much safer than not enough venting.

Be cautious before installing any type of fan-powered vent. Powered ventilators may help keep the attic space cooler in the summer but they can produce negative pressure that can draw more air through cracks or holes in the ceiling. In the winter the chance of moisture damage can increase due to the higher rate of warm, moist air leakage into the attic.

Air-flow driven ventilators commonly referred to as “Roof Turbines” (small round metal spinning globes) ventilate the attic by creating natural air flow out the peak. Be sure to install sufficient areas of venting in the eaves to supply the air flows required or these units can also create negative pressures in high winds.

If additional venting is required it can be installed as in Figure 7. Ideally, vents should provide roof cross venting from end to end and top to bottom. Keep this in mind when installing new vents: they should be at both the eaves and peak, and distributed evenly along the length on both sides.

Different attic configurations require individual solutions, with the main concern being that all attic spaces are vented properly. Some one-and-a-half storey houses have two or three separate areas to vent. A combination of eave, gable end and ridge vents may be required.

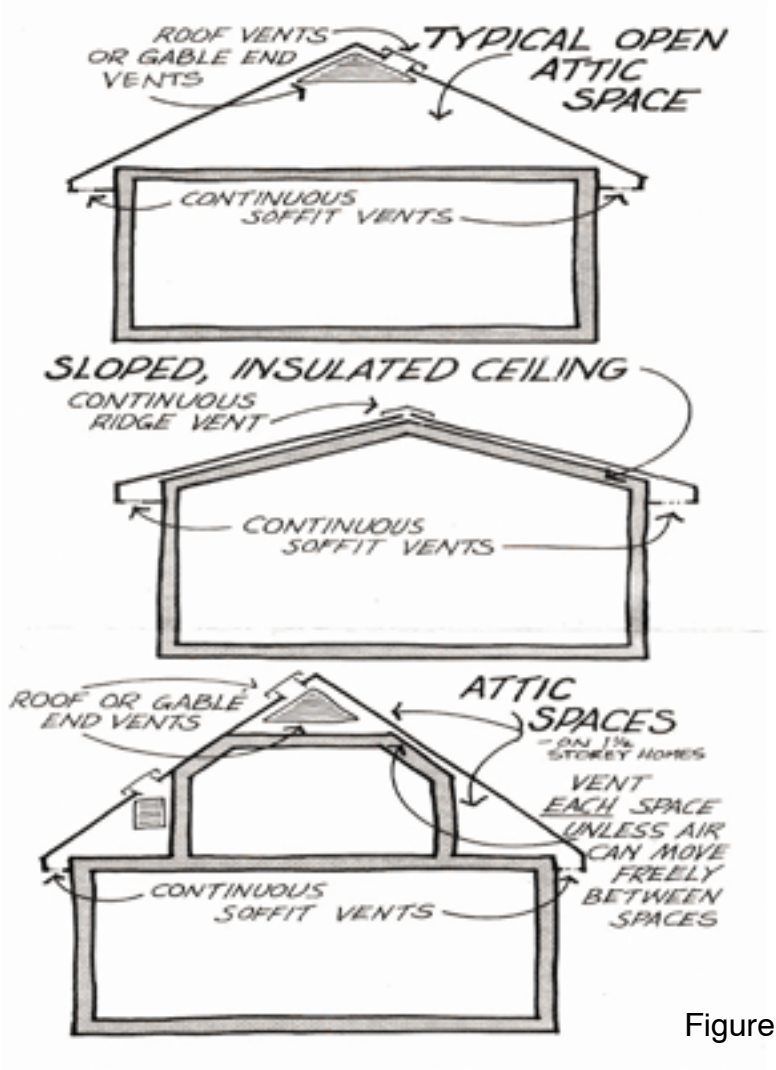

Figure 7

Insulating the Ceiling Space

Insulating the ceiling space will complete the attic upgrading. Whether adding insulation or not, make sure as many sources of air leakage as possible are sealed. Alkyd sealers and enamels properly applied on the inside ceiling surface along with good air sealing of all air entry points can replace a poor, damaged or non-existent vapour barrier in the attic.

The following illustrations and explanations show the techniques of adding insulation – whether doing the job yourself or having the understanding to know if the contractor is doing it properly.

The Open Attic

An easily accessible type of attic space common to most Edmonton homes (Figure 7, top) can be insulated using batt or loose-fill insulation products. It is important to extend the added insulation, regardless of the type, as far into the eave as possible (over the wall below), being careful not to block the path of air from vents. Plywood, waxed cardboard or plastic insulation stops should be installed between the rafters to keep insulation off the soffit (Figure 8). These are available wherever insulation materials are sold.

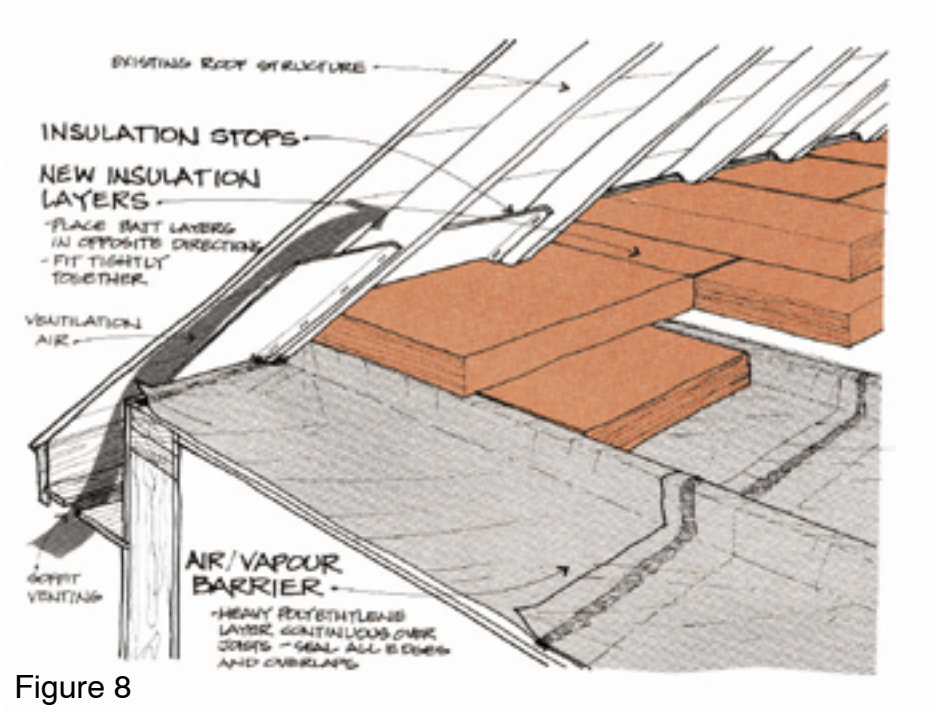

Figure 8

Loose-fill types of insulation are poured by hand or blown into place. A rake or screed board can be used to level it. You should attach markers at various points to indicate the depth above the ceiling joists to maintain a uniform thickness. (These can be caulk line marks, bright ink marks or pieces of lath or string hung from the rafters). **Be careful not to damage the air/ vapour barrier when working in the attic.** Blowing machines for installing these types of insulation yourself are available from area building supply stores and rental firms.

Batt insulation can be installed along with a continuous air/ vapour barrier when there is no insulation or vapour barrier in place (Figure 8). Continuous sheets of heavy polyethylene are draped over and between the ceiling joists. The joist cavities must be clean and the polyethylene fitted and stapled snugly into the spaces with overlapping seams properly caulked and stapled.

The batts should also be fitted snugly together – two or three layers placed in opposite directions with no gaps between works best. Be sure to cut as accurately as possible around obstructions (chimneys, stacks, supports, etc.) by measuring twice and cutting once.

Insulation must not be placed closer than 50 mm (2 inches) to chimneys. (Figure 4 and 5).

Recessed lights must have adequate air space around them to prevent any fire hazard. Figure 9 shows an acceptable method of sealing and insulating around such fixtures. Be sure to check the manufactures specifications and maintain recommended clearances.

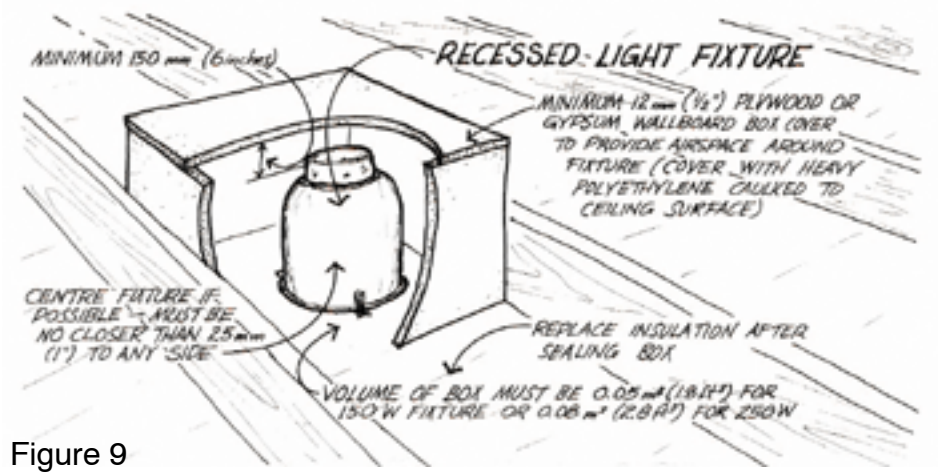

Figure 9

In some cases you may want to consider replacing the recessed fixtures with a standard electrical box and new ceiling fixture.

One-and-a-half Storey Attic Space

The type of attic shown, (Figure 7, bottom) presents a combination of flat and sloped ceilings, as well as walls, which need to be sealed and insulated. The flat attic ceiling can be treated as an open attic space (Figure 8), particularly if there is room to work. If space is limited, blowing loose-fill insulation in may be the only possibility.

The outer attic floor and short support walls (called knee walls) can usually be reached through attic access doors in closets or hallways. An air/ vapour barrier should be installed (if one is not present) and **it is very important to make sure you air seal the ceiling space below the knee walls.** You can then add batt or a combination of batt and loose-fill insulations to the stud cavities (Figure 10).

This wall should be insulated to the depth of the studs. Make sure the batts stay in place against the wall – stapled building paper may be needed to hold them.

If you desire a higher insulation level you can apply rigid insulation or wood strapping and additional batt insulation to the walls. The outer attic floor (the ceiling of the space below) should be insulated to about RSI 6 (R34).

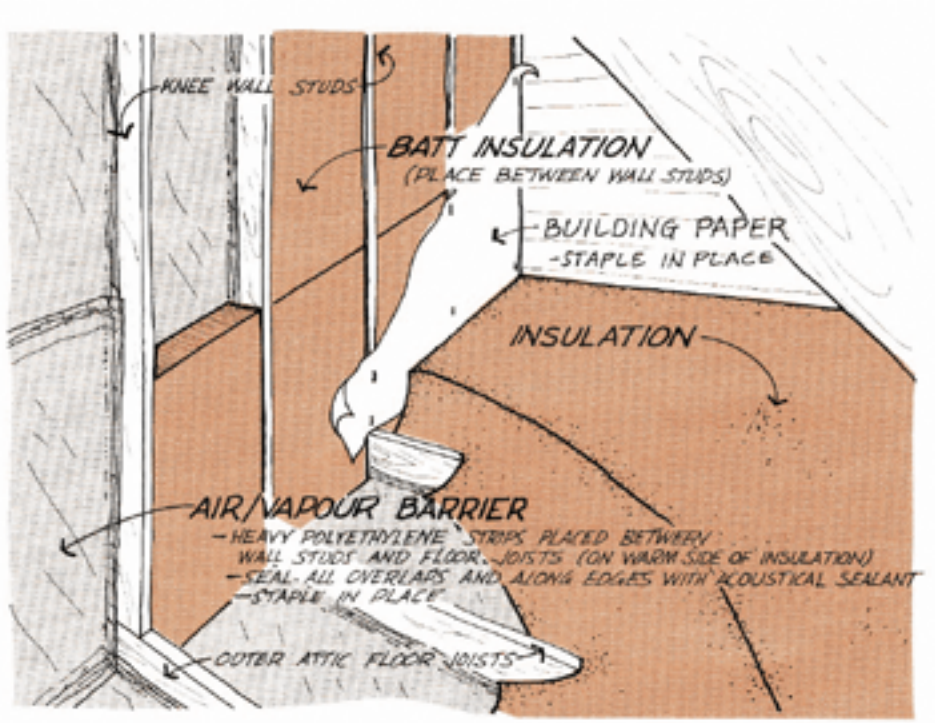

Figure 10

The sloped ceiling portion represents the greatest challenge to insulate and seal. A semi-gloss latex or vapour barrier paint applied to the interior ceiling finish is probably the easiest method to provide the vapour barrier. Insulation is then placed into the roof cavity (if access is possible from above or below). Because the gap is only 4 inches deep you may be better off to fill the entire space with foam (sprayed in place) or batt insulation.

If you seal the space fully with insulation you need to ensure that all three attic cavities have sufficient venting (Figure 7).

An Alternative method - you could use is to make the knee walls part of the interior space by insulating the full slope of the roof from the floor of the upper attic down the slope ceiling to the ceiling of the first floor. This method avoids the difficulty of trying to air seal and vapour barrier the half storey details.

Using this method may void your shingle warranty if the shingles are petroleum or fiberglass products. It should have little or no effect on cedar shake or tile roofs

An interior option that allows for higher insulation levels is to strap the sloped sections on the inside (Figure 11), adding rigid insulation and a new air/ vapour barrier as shown. Two layers of strapping at right angles can be used to get a higher level of insulation. This method can be carried down the knee walls and over the ceiling if access into the attic or wall spaces is difficult.

Two strapping layers placed at right angles help eliminate "thermal bridges" through solid wood studs. (Wood has a lower resistance to heat flow than insulation). This technique can also apply to open-beam or cathedral ceilings, but the existing ceiling finish will be covered over.

With this method any existing air/ vapour barrier (ceiling) must be well punctured (at least two or three times in each joist space), as it is now on the cold side of the new insulation layer. If foamed plastic insulation is used it must be covered with a minimum of 12 mm (½ inch) thickness of gypsum wallboard.

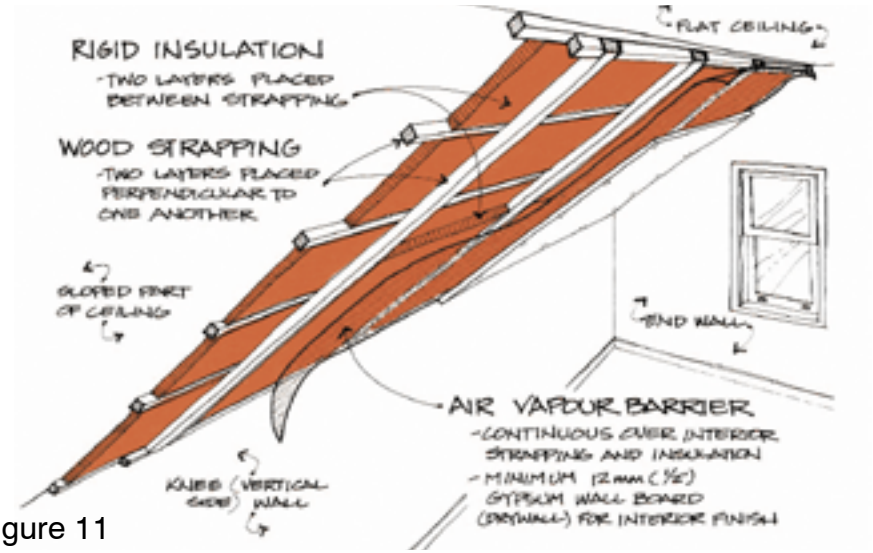

Figure 11

Sloped Ceiling

In addition to the interior ceiling-upgrading method (Figure 11) the exterior of a sloped ceiling can be insulated instead (Figure 12). This is the only solution for an open beam ceiling to retain the interior finish – exposed wood beams, for example.

If the present air/ vapour barrier is not in good condition a new one can be placed over the roof as shown. Ventilation in the existing structure must be blocked and provision made for adequate ventilation above the new insulation layer – usually with continuous soffit and ridge vents.

The use of modern engineered trusses means that insulation levels of RSI 6 (R34) or higher can be obtained but the high cost means it is usually only considered when re-roofing is required.

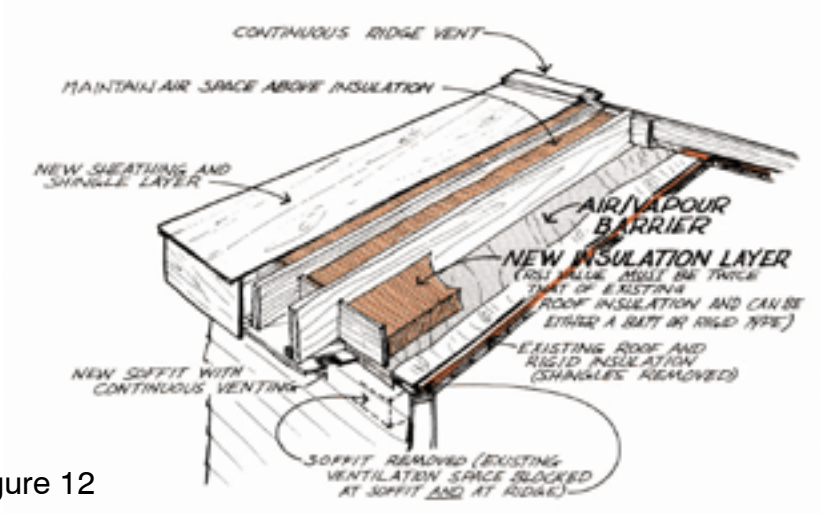

Figure 12

This method can also be applied to a one-and-a-half storey home that has little insulation in place. It is one solution to the problem of covering all the jogs, angles and small spaces.

The Attic Summary

- Seal air leaks in the house and insulate the basement before considering attic insulation.
- Check insulation levels and the condition of the air/ vapour barrier.
- Decide whether to do it yourself or hire a contractor.
- Decide which materials to use and which tools are required.
- Check attic ventilation (install more if required).
- Eliminate air leakage (even if not insulating).
- Add insulation (be careful around heat sources, do not plug vents).
- If you hire a contractor, check the job before paying.
- Insulate and seal the attic hatch.

The benefits of upgrading attic insulation include cost savings and improved comfort in both summer and winter for your family, plus a reduction in the amount of your personal Greenhouse Gas emissions.

Additional Information Sources

Natural Resources Canada – Office of Energy Efficiency

www.oee.nrcan.gc.ca – The Office of Energy Efficiency offers a wide range of free publications, programs and services to help Canadians save energy and reduce the greenhouse gas emissions that contribute to climate change.

EnerGuide for Houses (EGH) evaluations is a program from Natural Resources Canada. This detailed home assessment provides independent expert advice on the different systems of your home and what can be done to improve comfort, reduce energy bills, and cut down on greenhouse gas emissions that contribute to climate change. Consider having an EGH completed on your home.

Recommended Reading: *Keeping the Heat In* is a comprehensive source of energy efficiency how-to information for homeowners. This free publication is available from Natural Resources Canada. **Call toll free at 1-800-387-2000.**

Canada Mortgage and Housing Corp.

www.cmhc.ca/publications – CMHC is a valuable resource for information. The CMHC Order Desk is a one-stop shop for all free and priced publications, fact sheets, reports, videos and other CMHC resources. You can order online, or through their call centre at **1-800-668-2642.**

EPCOR

www.epcor.ca – The website contains information on energy and water efficiency with calculators, tools and downloadable publications to assist you in reducing your energy and water consumption.

Tools include a ***Home Energy Audit,*** a do-it-yourself home audit with a library of resources; ***EPCOR House,*** an animated tour of a typical home with efficiency information; and calculators for most major appliances, plus a ***simple electricity calculator*** and ***water audit tool.*** Tools are located in the EPCOR-Customer Service drop down menus.

Environment Canada

The Green Lane in Environment Canada's internet source for weather and environmental related to clean air, clean water and climate change. Visit them at www.ec.gc.ca

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