GUIDE TO BUILDING ENERGY EFFICIENT HOMES AND SMALL BUILDINGS — 2016

Newfoundland Labrador

This Guide was developed in partnership with:

ThermalWise

BUILDING ENERGY SAVINGS

DISCLAIMER:

This Guide is intended to provide general information on the Part 9.36 energy efficiency requirements of the National Building Code of Canada. This Guide is not a replacement for the National Building Code of Canada and is not intended to provide construction or design advice. We cannot guarantee that all information is current or accurate. Users should verify the information before acting on it. References in this Guide to other sources of information are presented as a convenience to users. The Government of Newfoundland and Labrador does not accept any responsibility for the content, accuracy, reliability, or currency of information contained in this Guide or in sources of information referenced by this Guide. Information in this Guide is provided solely for the user's information and it is provided without warranty, guarantee, or responsibility of any kind, either express or implied. The Government of Newfoundland and Labrador and its employees will not be liable for any loss or damages of any nature, either direct or indirect, arising from use of the information provided in this Guide.

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PREFACE

Originally developed in 2013, this Guide was intended to help individuals, municipalities, designers and contractors understand the 2012 addition of energy efficiency requirements to the National Building Code of Canada. At the time, the Guide was focused exclusively on how these changes would affect the design and construction of houses in the province. However, the addition of energy efficiency requirements to Part 9 of the National Building Code also affects designers and builders of non-residential small buildings.

In 2016 the Guide was updated to include more information that will help these designers and builders. The updated version of the Guide still includes lots of information to help the residential designer/contractor but it now also includes examples of how the Code's energy efficiency requirements affect the construction of more "commercial" buildings.

In addition to information and examples aimed at non-residential buildings, the 2016 updated Guide includes an entirely new section (Section 3) that includes detailed checklists to help designers/contractors of both residential and non-residential Part 9 buildings ensure their projects comply with the energy efficiency requirements of the Code.

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PURPOSE OF THIS GUIDE

This Guide provides a user-friendly overview of the energy efficiency requirements of the National Building Code of Canada. These requirements help make new homes and small buildings cheaper to heat, more comfortable to live or work in, and more durable.

This Guide cannot replace the National Building Code, but serves as an introductory tool to the energy efficiency requirements that will:

1. Introduce you to the benefits of energy efficient buildings,
2. Provide you with an overview of the energy efficiency requirements of the Code,
3. Provide you with some examples of how to comply with the energy efficiency requirements, and
4. Point you toward more information on building sustainably.

The Guide is divided into three main parts:

- The first part explains why energy efficiency is important and how energy efficient building can reduce energy bills, improve comfort levels and make homes and buildings more durable. This first part is targeted at those who are new to the issues but want to learn more about building an energy efficient home or small building.
- The second part is targeted at those who are looking for more detailed information about the energy efficiency requirements of the Code. It provides some examples of the many possible ways users can comply with the energy efficiency requirements.
- The third part includes checklists that can be used as tools to help you determine whether your house or small building will meet the energy efficiency requirements of the Code.

WHAT'S THE NATIONAL BUILDING CODE OF CANADA?

Before turning our attention to the energy efficiency requirements, let's start with what the National Building Code of Canada (referred to as "the Code") is. The Code addresses the design and construction of new buildings and the substantial renovation of existing buildings, and is "objective-based." What does this mean? All the requirements in the Code are linked to one or more of the following objectives:

- Safety
- Health
- Accessibility
- Fire and Structural Protection of Buildings
- Energy Efficiency (as of December 2012)

The Code is developed by the Canada Commission on Building and Fire Codes, a body established by the National Research Council of Canada. To ensure a cross-section of views, the Commission worked with a range of representatives to develop the Code, including:

- consumers,
- builders,
- material suppliers,
- plumbing officials, and
- engineers.

A complete update of the Code is published about every five years, and amendments are added to the latest version. The 2010 edition of the Code was amended in December 2012 to include energy efficiency requirements for the first time. Energy efficiency requirements will be part of the Code for future updates as well.

THE NATIONAL BUILDING CODE IN NEWFOUNDLAND AND LABRADOR

Our province's *Municipalities Act, 1999* and corresponding legislation for cities requires that municipal councils "adopt the National Building Code of Canada and supplements or amendments to that Code" when making regulations concerning the design, construction and alteration of buildings. This means that implementing the energy efficiency requirements of the Code is required in the province's municipalities. Adopting the most recent version of National Building Code and the energy efficiency requirements has a number of benefits. Building to the Code ensures that houses and buildings are safe, comfortable, and now... energy efficient! Owning a new Code-compliant energy efficient house or small building will mean that you'll be spending less money on heating costs and could increase your re-sale value!

SO WHAT IS THE "OBJECTIVE" OF THE ENERGY EFFICIENCY REQUIREMENTS?

The requirements have been designed to reduce the amount of energy it takes to live or work comfortably in a new house or small building. Typically, this can be achieved by adding more insulation, sealing drafts, choosing energy efficient windows and using more efficient heating systems. Because the Code is objective based, you'll have some flexibility over what combination of products and processes you use to make your building more energy efficient, so long as it meets the overall standard. It also allows for innovation because users have a wide variety of options to meet the objective. This is different from a "prescriptive-based" code, where builders and designers are directed to follow certain minimum requirements in a set way, which can be challenging given the diversity in climate, geography and building practices across Canada.

FEATURES OF THIS GUIDE

This Guide was developed to help individuals, municipalities, designers, engineers and contractors understand the Code's energy efficiency requirements. It was specifically developed for Newfoundland and Labrador, and you'll find helpful features throughout, including:

- "Case Studies" showing real-life examples of how people and businesses in Newfoundland and Labrador are adopting the energy efficiency requirements,
- "Tech Tips" to help you get started, and
- Answers to questions you might have about the Code.

These features have unique formatting (callout boxes and different coloured text) so you should notice them as you browse through the Guide.

Originally developed in 2013, this Guide initially focused just on houses. However, as you'll see shortly, the energy efficiency requirements in the Code also apply to small commercial, retail and some industrial buildings. The Guide has been updated in 2016 to include more information that will help designers/builders of non-residential small buildings meet the requirements of the Code.

Additionally, as part of the 2016 update, a few useful tools have been added to the Guide:

- "Prescriptive Pathway Building Envelope Compliance Checklists" for each climate zone have been developed to help designers, contractors, municipalities and inspectors assess the Code compliance of building envelopes;
- An itemized "Airtightness Checklist" is included to help contractors ensure they're meeting the requirements of the Code; and
- A "Mechanical Performance Compliance Checklist" has been developed to help you ensure your mechanical systems meet the efficiency requirements of the Code.

All of these new checklist tools are found in Section 3.

It's important to remember that the Guide can't replace the Code. Instead it aims to shed light on the energy efficiency provisions in an accessible and user-friendly way. We hope it will be of use to municipalities, and that it will help building owners, contractors and designers understand the energy efficiency requirements.

Throughout this Guide, we'll mention additional benefits of the Code's energy efficiency requirements, above and beyond increased energy efficiency. After all, who doesn't appreciate cost savings, durability or better air quality?

SECTION 1

UNDERSTANDING ENERGY EFFICIENCY WHEN BUILDING

Newfoundland and Labrador Tourism / © Barrett & MacKay Photo

ENERGY EFFICIENT BUILDINGS MAKE SENSE

Before we dig into the Code, let's look at why it's worth building energy efficient buildings in the first place. Energy efficient buildings have four big advantages:

1. **They'll save you money.** Sure, it may cost a little more up front to build energy efficiency into your project, but you'll benefit from reduced energy bills the moment you start using the building.

2. **They'll keep you more comfortable.** An energy efficient building will have fewer drafts, the right-sized heating system, and an efficient ventilation system. These features will ensure you and your guests stay comfortable in your new building.

3. **They will likely be worth more.** Consumers are getting smarter. Energy efficient features make a building easier to sell and buyers may be willing to pay more for things like lower power bills and increased comfort. As more energy efficient buildings come on the market, potential buyers will increasingly look for energy efficiency features.

4. **They're often better for the environment.** Using less energy is better for the environment. Energy that is generated from fossil fuels produces greenhouse gas emissions. By reducing your energy consumption from these sources, you'll help reduce greenhouse gas emissions and help tackle climate change.

Of all these advantages, most people find the first one the most compelling. Buying or building an energy efficient house or building is one of the best investments you can make. It pays tax-free dividends immediately, thanks to lower energy bills.

LET'S GET STARTED!

Preparing a build to meet the Code's energy efficiency requirements starts with identifying which type of building you're constructing. Then you'll need to check what climate zone you're in. After that, we'll show you the difference between the prescriptive and performance pathways so you can choose the right path for your when it comes to measuring your building's energy efficiency. From there we'll provide you with an overview and some of the reasons behind the energy efficiency requirements in the Code, and what they mean for walls, floors, ceilings, windows, doors, indoor air (heating, ventilation and air conditioning) and hot water — all those places where energy usage can really add up.

THE CODE'S ENERGY EFFICIENCY REQUIREMENTS AND BUILDING TYPES

The Code's energy efficiency requirements don't apply just to houses. In short, the energy efficiency requirements are contained in Part 9.36 of the Code and apply to all Part 9 buildings.

Part 9 buildings are:

- Three stories or less;
- Have a footprint of 600 m^2 (6456 ft^2) or less; and
- Have residential, office, mercantile or low-to-medium industrial occupancy.

The vast majority of Part 9 buildings are houses (thus the focus in this Guide). But there are also Part 9 buildings that aren't residential. Think of all the small offices, stores, workshops, etc. in the province. These buildings are examples of office, mercantile and low-to-medium industrial occupancy buildings.

If you're building a new Part 9 building, you need to follow the energy efficiency requirements of the Code.

FIND YOUR ZONE

As we mentioned earlier, some of the energy efficiency requirements in the Code depend on where you're building. Given that it can be much colder in the northern parts of the province, it only makes sense that you'd want more insulation in Nain than you'd want in St. John's.

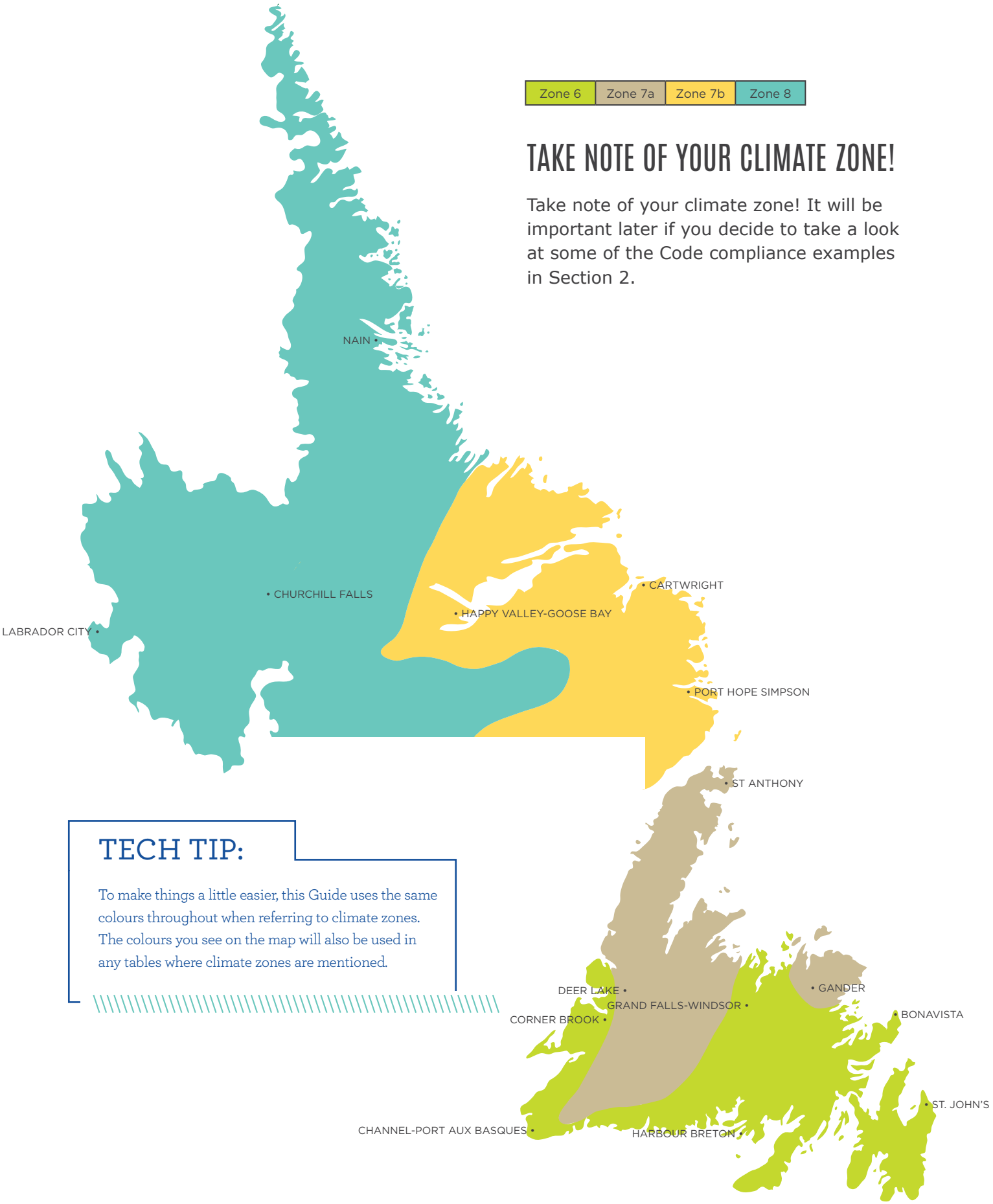
The Code lists some energy efficiency requirements by "climate zones." For the purposes of the Code, a climate zone contains areas that share roughly the same heating requirements. These heating requirements are expressed as "heating degree days," basically a measure of how much heating you need to use to stay comfortable.

The map on the next page shows Newfoundland and Labrador's four climate zones. If your climate zone isn't obvious from the map, you can also refer to the list of municipalities in Appendix A.

WHAT EXACTLY ARE HEATING DEGREE DAYS?

Heating degree days reflect the demand for energy needed to heat a building. They measure how much (the degree part) and for how long (the day part) the outside temperature stays below a certain level. The Code uses 18°C as the base temperature. Heating degree days are calculated by using historic climate data. As an example, for April 1st a town may have 7 degrees as the highest and -1.9 degrees as the lowest temperature, which gives an average of 2.6 degrees, which is subtracted from the base temperature of 18°C to give the heating degree day reading of 15.4. This is repeated for each day of the year and added together. The higher the number of heating degree days, the more heating you'll need to do.

- Zone 6 includes places that have between 4,000 and 4,999 heating degree days
- Zone 7a includes places that have between 5,000 and 5,999 heating degree days
- Zone 7b includes places that have between 6,000 and 6,999 heating degree days
- Zone 8 includes places that have 7,000 or more heating degree days



TAKE NOTE OF YOUR CLIMATE ZONE!

Take note of your climate zone! It will be important later if you decide to take a look at some of the Code compliance examples in Section 2.

TECH TIP:

To make things a little easier, this Guide uses the same colours throughout when referring to climate zones. The colours you see on the map will also be used in any tables where climate zones are mentioned.

TWO PATHWAYS TO COMPLIANCE

Users are provided with a lot of flexibility in meeting the energy efficiency requirements of the Code. As we'll see later in this Guide, the Code doesn't require that contractors use any particular type of construction method or materials. Instead, the Code lists required targets that buildings and building components must meet. Contractors and designers can choose the methods that work best for them and their clients. This is one of the key features of an objective-based Code!

Users planning most residential buildings have the choice of measuring how they comply by following either:

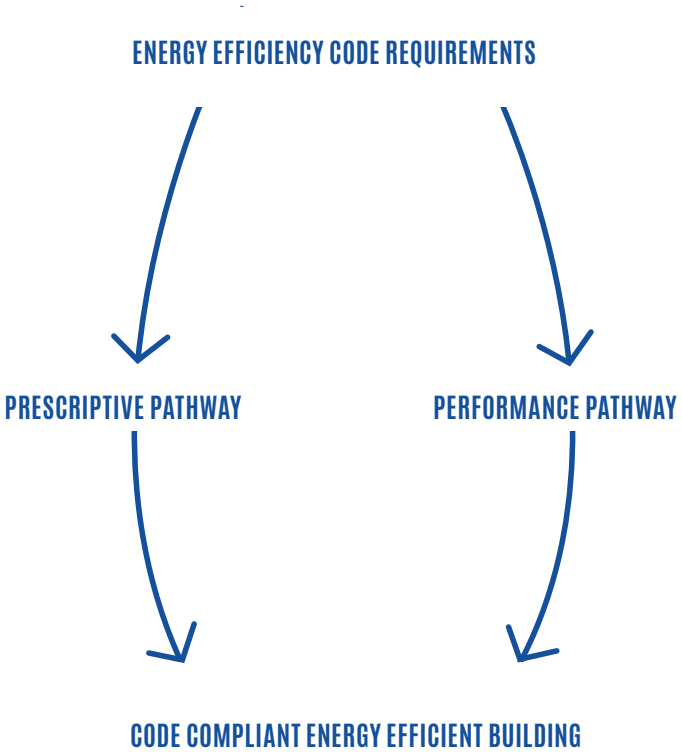
- The Prescriptive Compliance Pathway, or
- The Performance Compliance Pathway.

The basic difference between these two pathways to Code compliance is:

- The Prescriptive Pathway uses a checklist approach to make sure minimum requirements are met, and
- The Performance Pathway uses a computer model to show that the project is meeting minimum energy efficiency requirements.

If you're building a non-residential Part 9 building, the only option will be to use the Prescriptive Pathway to demonstrate Code compliance. If you're building a multi-unit Part 9 residential building you may also only have the option of using the Prescriptive Pathway, depending on how much common space there is. If you're in either of these situations we suggest you take a look at Section 2 of this Guide, where we discuss the pathway options in more detail.

Let's dig into each of these options a little more.



THE PRESCRIPTIVE COMPLIANCE PATHWAY EXPLAINED

In some ways, prescriptive compliance is the most straightforward method for complying with the Code. Think of it like a checklist. Energy efficiency requirements are listed by building component (walls, attics, windows, etc.) and all you need to do is make sure you meet the requirements for each one. You'll find these prescriptive requirements in Code subsections 9.36.2 to 9.36.4.

THE PERFORMANCE COMPLIANCE PATHWAY EXPLAINED

The performance compliance pathway is all about showing that your building is as energy efficient as,

or more energy efficient than, a computer model of a similar building built to the prescriptive requirements.

This option allows users the most flexibility but can be more complicated than taking the prescriptive pathway. Users will likely need to hire an energy modeller or familiarize themselves with energy modelling software. As mentioned earlier, the performance pathway is not available to all projects, but most houses and small apartment buildings may qualify.

Though the performance compliance pathway has fewer prescriptive requirements, there is one really important requirement: each project that chooses the performance compliance pathway needs to demonstrate Code compliance by producing a "Home Performance Compliance Calculation Report."

This computer report includes basic information that demonstrates how the house meets the energy target required by the Code. It is generated using computer software that models the energy consumption of the house you're building. Someone who is familiar with energy modelling will need to generate this report for you. This could be someone on the builder's staff, an energy advisor, an energy modeller or someone else who knows how to use the energy modelling software. Costs for the report often range between $300 and $600.

It's also important to note that a specific EnerGuide rating or certification like R-2000 on its own is not sufficient to demonstrate compliance, unless the authority having jurisdiction indicates that these certifications meet the requirements.

See Section 2 of this Guide for a more complete explanation of the performance compliance pathway. Code subsection 9.36.5 also explains the performance compliance pathway in greater detail.

TECH TIP:

Remember that a "Home Performance Compliance Calculation Report" isn't a design tool. It only shows that a house is compliant with the Code. The report is generated using certain common assumptions when modelling the house. It doesn't necessarily mean the house is going to be comfortable or durable. You need to make sure these issues are addressed by good insulation, ventilation and design.

AN OVERVIEW OF THE REQUIREMENTS

Now that you know your climate zone and the basic differences between prescriptive and performance compliance, it's time to get a sense of what types of energy efficiency requirements are included in the Code. The remainder of this section will provide you with an overview of the types of requirements included in the prescriptive pathway. We've chosen to look at this pathway because it includes all the strategies you'll find in an energy efficient building. Even if you're going to use the performance pathway to demonstrate compliance, you'll want to make sure you build energy efficiency into every part of your building. This is a point that you will want to raise with your designer and/or contractor.

The prescriptive energy efficiency requirements in the Code are separated into three main sections:

1. Minimum insulation and airtightness requirements for attics, walls, windows, doors, floors, etc.;
2. Minimum efficiency requirements for heating, ventilation and air conditioning systems; and
3. Minimum requirements for hot water equipment and systems.

Let's take a look.

REMEMBER

Complying with the National Building Code is required, but you might have a choice between prescriptive and performance compliance.

BUILDING ENVELOPE

The most important part of planning an energy efficient and comfortable house or building is designing the building envelope. The building envelope includes all the parts of a building that separate you, and the heated space inside, from the outdoors.

Building envelope components include:

- Ceilings under attics;
- Cathedral ceilings and flat roofs;
- Exterior walls and walls separating houses from attached garages;
- Windows, doors and skylights;
- Basement walls and floors; and
- Other floors over unheated space, like those over a garage.

These are the questions you should be asking yourself when planning your building envelope:

- How much insulation do I need?
- How will I minimize drafts and air leaks?
- Which windows and doors should I install?

We'll get into more detail and address these questions later in this section when we look at each element of the building envelope. The energy efficiency requirements in the Code, however, also provide you with some help in answering these questions. The Code's prescriptive energy efficiency pathway spells out exactly how much insulation is required and where it's required. It also provides contractors with guidelines for doing air sealing and making sure the building envelope is tight, so cold air doesn't get in. Guidelines on windows and doors are also included in the Code.

WAIT A MINUTE... THE CODE LISTS "EFFECTIVE INSULATION VALUES." WHAT DOES THIS MEAN?

Remember how the Code is objective-based and concerned with meeting certain outcomes or goals instead of requiring specific steps be taken? Effective insulation values are part of this strategy because they describe how "effective" an area is at minimizing heat loss.

Insulation is usually rated by its "R-value" or insulating property. The higher the R-value, the better the insulation is. The better the insulation is, the slower heat moves through it and the warmer you stay inside. When you buy insulation at a store you'll see an R-value on the package. This R-value is a rating for the insulation that's in the package. It's often referred to as the insulation's "nominal" R-value.

EFFECTIVE VS. NOMINAL INSULATION

When you buy insulation and install it in your building, chances are, your wall, ceiling or floor won't have the same R-value as the insulation you've just installed.

Why not? Well, walls, ceilings and floors have other materials in them that have different insulating properties, or R-values. If you were building a wall out of just R-19 fibreglass batts (that is, without a wood frame in the wall), then you would have an R-19 wall. In this case the effective R-value of the wall would be the same as the nominal R-value of the insulation. But walls are more than insulation.

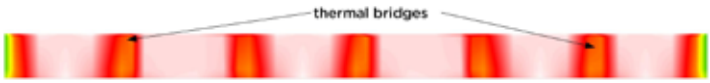
Consider a conventional wood-framed wall where there is both insulation and wood framing studs:

- Everywhere there's a stud, the R-value of the wall is approximately R-5.5 because the R-value for wood is about R-1 per inch. Everywhere there's insulation, the R-value of the wall is approximately R-19 because that's what the insulation's nominal R-value is.
- If the wall has a stud every 16 inches, as most conventional wood frame walls do, then only 77% of the wall is made up of areas with insulation. The rest of the wall is wood framing. Because of this, the R-value of the whole wall is going to be less than the R-19 nominal rating for the insulation. This total performance R-value of the wall is referred to as the effective R-value. In the case of this wall, the effective R-value is R-15.94.

The Code has a number of tables to help users determine the effective R-value of various common walls, ceilings and floors.

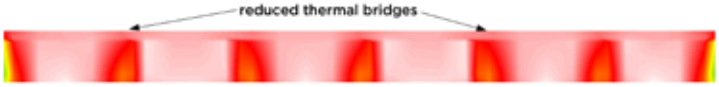
Wall 1 Schematic - No Continuous Rigid Insulation

Wall 1 Thermal Image - Thermal Bridging



Wall 2 Schematic - With Continuous Rigid Insulation

Wall 2 Thermal Image - Reduced Thermal Bridging



TECH TIP:

The easiest way to ensure a better effective R-value for walls is to install continuous exterior or interior rigid insulation. This approach will minimize thermal bridging that takes place through the wood studs in the wall.

ATTICS

Now that we know about effective vs. nominal insulation values, let's look at one of the easiest places to add more insulation: the attic. Attic spaces are also usually the cheapest area to add more insulation. They often contain a lot of room that isn't being used and because of this, not much extra work is involved, meaning fewer additional labour costs.

The Code requires that attics meet certain minimum effective R-values, depending on climate zone. These minimum R-values may be an increase from current common construction practices. However, many builders are currently using techniques that will easily allow them to add more insulation in the attic.

WHAT ARE THE MOST COMMON TYPES OF ATTIC INSULATION?

Because of how easy it is to install, loose-fill insulation is the most common type of attic insulation. Loose-fill insulation is usually either fibreglass or cellulose (recycled newspaper). Loose-fill insulation is "blown" into the attic. Conventional fibreglass or mineral-wool batt insulation can be used in attics as well.

RAISED-HEEL TRUSSES JUST MAKE SENSE

When asked why he uses raised-heel trusses, Jack Parsons, of K&P Contracting, responded: "It's by far the best return on investment for homeowners."

Raised-heel trusses allow builders to get extra insulation in the attic over the exterior walls near the outside. These areas are often difficult to insulate with regular trusses, so some municipalities and homeowners are demanding that builders change the way trusses are built. Builders like K&P Contracting have recognized the value of using raised-heel trusses as a cost-neutral way to get more insulation into attics.

WALLS

Walls usually make up the largest area of building envelopes. Because of this, it's important to make sure they're well insulated in order to save energy. Having well-insulated walls will also:

- Improve indoor comfort,
- Lower your heating and cooling costs, and
- Help prevent against mold problems.

The Code requires that walls meet minimum effective R-values, depending on climate zone.

Since vinyl siding is quite common in the province, the Guide uses vinyl siding as an illustrative example. It is important to note that other forms of siding, such as wood, have different R-values and may be more environmentally sustainable.

Traditionally, the most common type of wall used in residential construction is a 2x6 wood-framed wall, with R-19 fibreglass insulation. Unfortunately, without extra insulation, this type of wall doesn't meet the prescriptive Code requirements for any of the climate zones here in Newfoundland and Labrador. Because of this, project teams who choose to follow the prescriptive approach to Code compliance will need to modify the walls they're building. Thankfully, many contractors are already doing this!

For examples of walls that meet the Code requirements for houses, and for examples more typical of commercial small buildings, see Section 2.

EXTERIOR RIGID INSULATION: A GREAT WAY TO MEET THE CODE REQUIREMENTS

Warrick Butler, of Butler's Quality Contracting Ltd. in Conception Bay South, knows the advantages of adding more insulation to walls. Butler says he usually tries to add 1.5" of rigid insulation to the exterior of walls because "as a result of the heat loss savings and lower heat bills, the investment to upgrade the insulation is paid back to the homeowner in 4 or 5 years; and the savings continue for the years that follow. It's also better on the environment because it reduces greenhouse gas emissions." Exterior insulation is also a great way to eliminate the thermal bridging caused by the wood studs, which in turn increases the effective insulation value of your wall.

WHAT ARE THE MOST COMMON TYPES OF WALL INSULATION?

In residential construction, fibreglass batt insulation is by far the most common type of insulation. Other options for wall insulation include:

- Mineral-wool batt insulation
- Cellulose insulation
- Rigid extruded or expanded polystyrene board insulation
- Spray-foam insulation products

REMEMBER R-VALUE?

If you're interested in comparing different types of insulation, take a look at each product's R-value. The best way to compare insulations is to look at the R-value per inch. This allows you to compare batt products, which usually come in pre-set thicknesses, to blown and spray-applied insulations, where the thickness can be varied depending on how you choose to apply it.

WHAT'S A THERMAL BRIDGE?

A thermal bridge occurs where an area of insulation isn't continuous and is penetrated by a material that is more prone to heat loss. Think back to our 2x6 wall... Without some sort of exterior or interior continuous layer of insulation, the studs act as thermal bridges. The insulation isn't continuous and heat moves through the wood more easily than it does through the insulated portions of the wall.

WINDOWS AND DOORS

Windows and doors are usually the weakest link in the building envelope. They are often the areas with the lowest insulation value and they can be leaky if installed incorrectly. Despite these drawbacks, windows and doors provide important features like:

- natural light,
- natural ventilation, and
- (of course) a way to enter and exit.

The Code requires that windows and doors meet certain minimum performance requirements. The Code uses U-factors and Energy Ratings when referring to window performance.

Unless you're building a non-residential building, you don't need to worry too much about these ratings if you just want to make sure your windows and doors are Code compliant. Choosing ENERGY STAR certified windows and doors for your climate zone will ensure you comply with the Code.

That said, learning about U-factors and Energy Ratings (ER) is still a good idea! These ratings will help you differentiate between the performance of various ENERGY STAR certified windows. For more information on these terms, see Section 2 of this Guide.

TECH TIP:

Windows or doors made of metal will likely be less energy efficient than ones made from vinyl or fibreglass. This is because metal conducts heat better than vinyl or fibreglass.

WHAT'S ENERGY STAR?

The ENERGY STAR label tells you that a product qualifies as being energy efficient. The Federal Government manages the ENERGY STAR label in Canada. ENERGY STAR qualification for windows and doors depends on climate zone. Make sure you pick the right ENERGY STAR windows and doors for your climate zone.

A FEW COMMON WINDOW TERMS

GLAZING

Glazing refers to the transparent, glass part of windows. Windows can be either single-glazed (one pane of glass), double-glazed (two panes of glass), or triple-glazed (three panes of glass). Multiple glazing allows the windows to trap air, which is a good insulator, to provide more energy efficiency and comfort.

ARGON GAS

Argon gas is the most common type of gas filling in between glazing layers. Argon conducts less heat than air does. This means that argon-filled windows are more efficient than air-filled windows. There are also krypton-filled windows. These are even more efficient than argon-filled windows.

LOW E COATINGS

Low E refers to "low emissivity." Low emissivity coatings reflect heat back into the inside of the building.

BASEMENT WALLS

Under the energy efficiency requirements in the Code, basement insulation is required for all climate zones in our province. This just makes sense. A house or building can lose 20 to 35% of its heat through an uninsulated basement. And keep in mind it's almost always cheaper to insulate a basement during construction, rather than later, after you've moved in.

The Code requires basement walls to meet certain effective R-values, depending on climate zone.

INSULATED CONCRETE FORM BASEMENTS ARE POPULAR IN CENTRAL NEWFOUNDLAND

Based in Bishop's Falls, Newfoundland Styro makes insulated concrete forms (ICFs). ICF foundation and wall construction provides a continuous layer of insulation that meets the effective R-value requirements for basement walls in all Newfoundland and Labrador climate zones.

ICF foundations are popular in Central Newfoundland. This photo shows an ICF foundation built by DET Contracting in Bishop's Falls.

BLANKET INSULATION – A COST-EFFECTIVE WAY TO INSULATE AN UNFINISHED BASEMENT

Sometimes homeowners don't need or want a finished basement. In these cases, contractor Jack Parsons, of K&P Contracting, frequently uses blanket insulation, originally designed for metal buildings. This type of insulation can easily and quickly be installed in a new basement, providing homeowners with high effective R-values at a very reasonable cost. It's a win-win situation for the homeowner and the environment!

FLOORS

Relatively speaking, you don't lose a lot of heat through basement floors that are below the frost level. The reason for this is that the temperature difference between the inside and the outside is less in these areas because the ground below the frost level stays warmer when it's cold outside. The Code's prescriptive energy efficiency section only requires insulation in these types of floors if they're going to be heated.

There are a number of other floor types, however, where you can lose a significant amount of heat. They include:

- floors in contact with the ground that are above the frost line,
- floors over unheated spaces, like those found over garages,
- slabs-on-grade foundations with integral footings,
- heated floors, and
- floors on permafrost.

In the Code, floors have their own prescriptive effective insulation requirements, depending on climate zone and floor type. See Section 2 of this Guide for specific examples.

WHAT'S THE FROST LINE?

The frost line is the depth below the surface of the soil to which groundwater is expected to freeze. The depth of the frost line depends on climate. You should always know where the frost line is before you begin building!

INSULATION TRADE-OFFS

The Code provides some restricted allowances for trading off more insulation in one area of the building envelope for less insulation in another. This should only be pursued when absolutely necessary because of the relatively complicated calculations involved when trying to demonstrate compliance.

It's easier to design your project so that all of the building envelope components meet the prescriptive insulation requirements. If for some reason this simply isn't possible, you should look at the Code for guidance on how to perform these calculations.

AIRTIGHTNESS

"Build tight and ventilate right!" contractors are sometimes known to say. By focusing on the details during construction, you will ensure that your building envelope is airtight and won't let cold air in or warm air out. There are a lot of reasons why this is a good idea:

- An airtight building envelope is more comfortable because there are fewer drafts.
- A leaky building will be drier in the winter. Lower humidity levels can make allergies and respiratory problems worse.
- In an airtight building, you'll be getting more of your fresh air through your ventilation system. Think of the alternative: in a leaky building you're breathing air that comes in through dirty insulation and cracks in the walls.
- An airtight building will take less energy to heat.

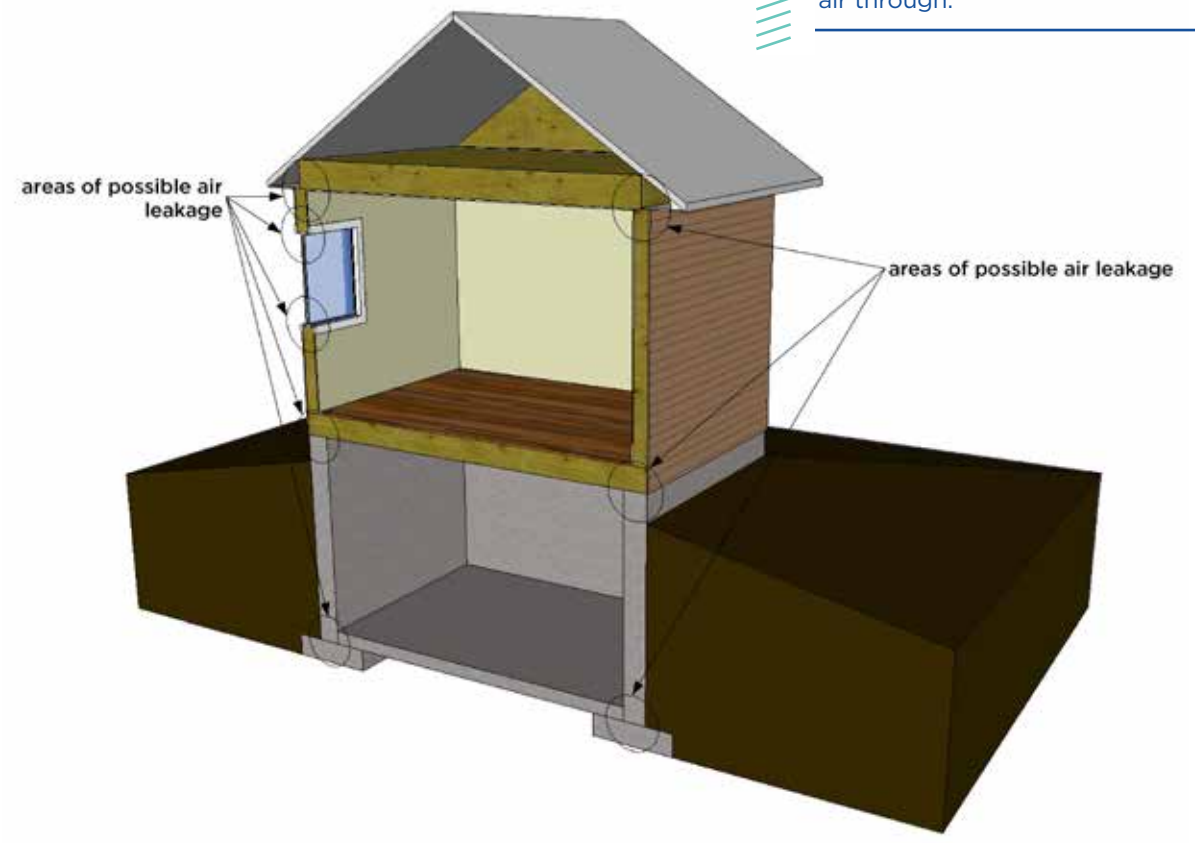
The prescriptive pathway of the Code allows for two main ways to comply with the air leakage requirements:

1. Construct a continuous "air barrier" that follows a list of prescriptive requirements, or
2. Have a blower door test done that proves your building is sufficiently airtight.

Regardless of how you choose to comply, you'll want to pay attention to sealing the common air leakage areas identified in the graphic below:

WHAT'S AN AIR BARRIER?

An air barrier is what keeps your building comfortable and free from drafts. It is usually constructed from materials like plastic, wood and "house wrap." It's part of your walls, ceilings and floors. The only way for an air barrier to be effective is for it to be continuous. If the air barrier has leaks or holes, it won't be a very good air barrier because it will let air through.



When planning an airtight building you'll want to make sure you pay attention to the following:

- Ensure that electrical outlets are properly sealed.
- Ensure that windows are properly installed. Windows should be spray-foamed or taped around the perimeter to ensure that air doesn't leak in around them.
- Pay careful attention to where floors and ceilings meet walls. These areas should be properly sealed.
- Minimize the number of penetrations you have in your building envelope and make sure you properly seal the ones you do have. Wires and pipes entering your building will penetrate the air barrier and can be a source of air leakage. Try to minimize these

Subsections 9.36.2.9 and 9.36.2.10 of the Code deal with air leakage and are very detailed. They provide a lot of excellent guidelines. We've also included an air sealing compliance checklist in Section 3 of the Guide. We suggest you take a look!

BLOWER DOOR TESTING

Terry Walsh, of Terry Walsh Contracting in St. John's, knows the importance of air leakage control. He's had blower door tests done on houses his company has built to help him confirm his crew is doing a good job when it comes to air leakage control.

Getting a blower door test done is a good way to check how you're doing when it comes to controlling air leakage. A blower door is a powerful fan that mounts in the frame of an exterior door. While pushing air out of your building, the device quantifies how much air leakage you have in your building envelope.

MECHANICAL SYSTEMS

HEATING AND AIR CONDITIONING SYSTEMS

Now that you've got a well-insulated and airtight building, it's important to make sure that your heating and cooling systems are up to the task. In our province, almost 70% of residential energy use goes towards providing space heating! Choosing and installing an efficient and properly designed heating system can help reduce energy consumption, and your power bill.

The energy efficiency section of the Code includes a number of requirements for heating and air conditioning systems. Some of the more important ones are:

- Keeping systems and system parts in heated indoor space, unless they're designed for outdoor use. An air-conditioning unit is an example of a system that is designed for outdoor use. Ducts for heating, on the other hand, are not things you'd want to install outside!
- Making sure that thermostat controls are designed so they can't call for heating and cooling at the same time. This is definitely a no-win situation that you want to avoid!
- Making sure heating and cooling systems meet certain minimum performance standards.

RULE OF THUMB, OR RULE OF DUMB?

Properly sizing heating and cooling systems is crucial. Installers, designers or suppliers should be doing room-by-room load calculations to ensure your heating/cooling system is right for your building. Rule of thumb just doesn't work when it comes to heating system design!

AIR-SOURCE HEAT PUMPS CAN SAVE YOU MONEY

In more temperate areas of the province, air-source heat pumps can be a great way to reduce your heating costs. Ductless "minisplit" heat pumps are becoming increasingly popular because they are relatively cheap to install and they offer significant savings over baseboard electric heating.

VENTILATION SYSTEMS

Consumers in our province are smart. They're now expecting a heat recovery ventilation (HRV) system in a new house.

HRVs transfer heat from the warm exhaust air leaving your house to the incoming fresh air. They typically transfer between 60 and 80% of the heat. This reduces the energy required for heat and makes your house more comfortable.

Heat recovery ventilation is also frequently used in small commercial Part 9 buildings.

When installed, HRVs are required by the Code to meet certain minimum performance ratings. One of the easiest ways to make sure your HRV meets these requirements is to install an ENERGY STAR certified HRV. All ENERGY STAR certified HRVs will meet the required performance ratings.

HOT WATER

Approximately 20% of provincial residential energy use goes towards heating water. In newer, more energy efficient houses, this percentage is actually higher because less of the pie is spent on space heating. Because of this, it's important to focus on designing and installing an efficient hot water system.

The Code requires that hot water heaters meet minimum performance requirements. These requirements are specific to equipment type. The Code also requires that piping on either side of a storage tank is insulated with pipe insulation. There are additional Code requirements for pool heaters. Some other best practices for hot water heating include:

- Compact system design – Centralizing hot water needs by placing kitchens, bathrooms and laundry rooms close together will minimize piping needs. This saves money on materials and will also mean less heat loss from hot water sitting in long runs of pipe.

- Low-flow showerheads and fixtures – Though not required by the Code, low-flow showerheads and fixtures are a great way to lower your demand for hot water. A lower demand means a lower hot water heating bill!

DESIGN DEFINITELY MATTERS

HRVs are only as good as their system design. Running HRV ducts in unheated areas (like the attic) can reduce the system's efficiency and occupant comfort.

- It's best practice to keep HRV ducts in conditioned spaces.
- If you absolutely must run ducts in the attic, make sure they're well insulated and sealed. The Code has specific requirements for these cases.

A REVIEW

Now that you have a better sense of what's included in the energy efficiency requirements of the National Building Code, you'll appreciate why it's important to:

- ☐ Know your climate zone
- ☐ Know the difference between effective and nominal R-value
- ☐ Know what the effective R-values of your building envelope components are
- ☐ Pay attention to the details during construction to make sure your building is airtight
- ☐ Make sure that heating, ventilation and cooling equipment meets minimum Code requirements
- ☐ Choose hot water equipment and system designs that meet the minimum Code requirements
- ☐ Make sure that heating/cooling, ventilation and hot water systems are designed and sized properly for your space

Interested in taking a closer look at the Code requirements and some compliance examples? The next section of the Guide awaits!

SECTION 2

A CLOSER LOOK AT ENERGY EFFICIENCY AND THE CODE

A CLOSER LOOK AT ENERGY EFFICIENCY AND THE CODE

So, you're building a Part 9 building and you want to make sure it complies with the energy efficiency requirements of the National Building Code? This section of the Guide provides you with an overview of these energy efficiency requirements.

It also provides you with examples of options that will help you comply with the Code. Keep in mind that they are by no means comprehensive. There are a number of other ways to comply that aren't listed in this Guide. To make sure your project complies, you'll want to check the Code requirements, and to make that easier, each explanation in this section refers to the subsection in the Code where you'll be able to find more information.

Remember that certain Code requirements depend on where your project is located within the province!

DO YOU KNOW YOUR CLIMATE ZONE?

Zone 6	Zone 7a	Zone 7b	Zone 8

Some of the energy efficiency requirements of the Code vary depending on where you are located in the province. The introduction section of the Guide provides an overview of the province's climate zones. Appendix A also lists the climate zone for each municipality in the province.

Make sure you know your climate zone before you read this section of the Guide.

HOW DO THE ENERGY EFFICIENCY REQUIREMENTS APPLY TO MY PROJECT?

See subsection 9.36.1.3 of the National Building Code for specifics and to ensure your project complies.

The energy efficiency requirements in Part 9.36 of the National Building Code apply to a number of different types of Part 9 buildings. As we mentioned earlier, this includes both houses and non-residential smaller buildings, including offices, gas stations, garages, etc.

If you're building a Part 9 house, you have the option of choosing either prescriptive or performance compliance. You can also choose either prescriptive or performance compliance if you're building a Part 9 residential building (such as a small apartment building) where common spaces make up 20% or less of the building's total floor area.

Common spaces include:

- Hallways,
- Entrances, and
- Common living space like community kitchens or lounges in dormitories.

The performance pathway isn't available for all Part 9 building types, however. The table below shows the options that are available for most Part 9 buildings. Please consult the Code for information on the options available to other Part 9 buildings.

WHAT'S A COMMON SPACE? AND HOW DOES IT AFFECT WHETHER I CAN USE THE PERFORMANCE COMPLIANCE PATHWAY?

When referring to common spaces, the Code is referring to shared spaces in apartment, condo or dormitory buildings. Common spaces include:

- Hallways,
- Entryways, and
- Shared spaces such as communal kitchens or lounges.

If over 20% of an all-residential building consists of common spaces, then you must use the prescriptive pathway.

Building Type	Compliance Options	
	Part 9.36 - Prescriptive	Part 9.36 - Performance
• Houses that are three stories or less and have a footprint of ≤600 m² (6,458 ft²) with or without secondary suites • Part 9 residential buildings that contain only residential dwelling units with common spaces ≤20% of the building's total floor area	X	X
• Other Part 9 residential buildings • Part 9 mixed-use buildings that have a total floor area ≤300 m² (3,229 ft²) • Part 9 non-residential buildings (except F2 occupancy) where the total floor area ≤300 m² (3,229 ft²)	X	

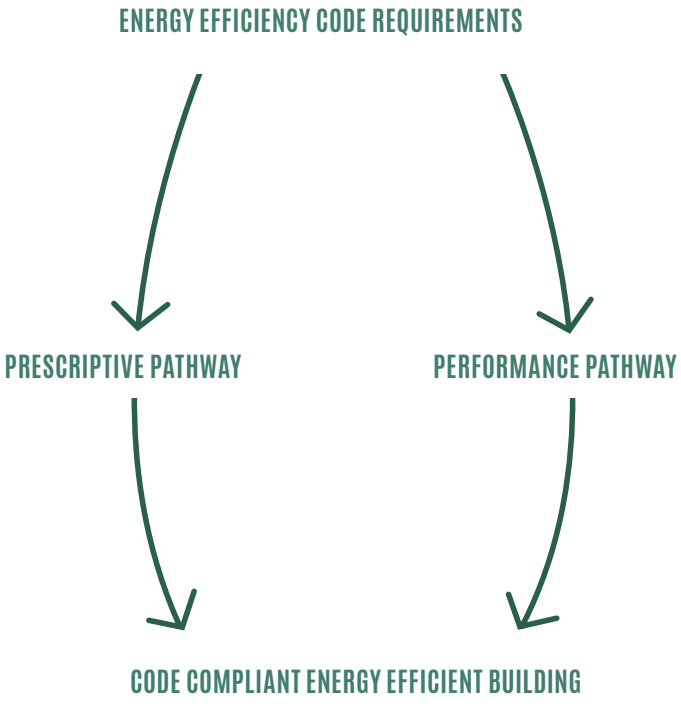
PRESCRIPTIVE OR PERFORMANCE, WHAT'S THE DIFFERENCE?

For prescriptive compliance, a project follows all the individual requirements for each part of the building. Energy efficiency prescriptive requirements are listed in subsections 9.36.2 to 9.36.4 of the Code.

Prescriptive requirements address:

- The building envelope,
- Heating, ventilation and air conditioning equipment, and
- Hot water heating.

For performance compliance, a project demonstrates that it meets a certain energy efficiency performance target. The performance target that needs to be achieved is developed by computer modelling a reference house (because the performance option is only open to houses and some residential buildings) built to the prescriptive minimum requirements for the same location. If you're going to use the performance compliance pathway, you'll likely be hiring an energy modeller or already be an expert yourself.



PRESCRIPTIVE COMPLIANCE

BUILDING ENVELOPE REQUIREMENTS

The first step in planning an energy efficient building is getting the envelope right. Without an energy efficient building envelope design, you'll need a larger heating system and you'll spend more money on heating. You'll also probably be less comfortable overall, either too hot or too cold.

The National Building Code addresses the need for an energy efficient building design by adding minimum insulation and airtightness requirements for building envelopes.

WHAT'S THE BUILDING ENVELOPE?

The building envelope is what separates the inside of your building from the outside. It separates conditioned interior space from unconditioned exterior space. The building envelope includes the walls, floors, ceilings, windows and doors. It's what keeps you warm and comfortable inside when it's cold outside.

HOW DOES THE CODE APPLY TO MY ATTACHED STORAGE GARAGE? IS IT INSIDE OR OUTSIDE OF MY BUILDING ENVELOPE?

Even if you intend to heat your garage you'll need to make sure that the walls, roofs or floors between your house and the attached garage follow the energy efficiency requirements of the National Building Code.

INSULATION REQUIREMENTS FOR CEILINGS, WALLS AND EXPOSED FLOORS

See subsection 9.36.2.6 of the National Building Code for specifics and to ensure your project complies.

In the Code, your building's ceilings, walls and floors over unheated spaces are referred to as "above-ground opaque building assemblies." Above-ground opaque building assemblies include:

- Ceilings below attics,
- Cathedral ceilings and flat roofs,
- Walls, and
- Floors over unheated spaces.

The Code requires that these assemblies meet minimum effective insulation values, depending on climate zone. The Code provides two different sets of effective insulation requirements:

- One for buildings with heat recovery ventilation (usually HRVs), and
- One for buildings without heat recovery ventilation

The Code recognizes the energy savings associated with heat recovery ventilation and allows buildings that use heat recovery ventilation to comply with the Code by meeting lower effective R-values. Heat recovery ventilators (HRVs) are commonplace in new houses in Newfoundland and Labrador and are relatively common in small office buildings. Because of this, all of the examples included in this Guide are for buildings that have heat recovery ventilation installed.

If you're building without an HRV you will need to consult the Code to ensure your building assemblies meet the minimum effective insulation values.

WHAT'S THE DIFFERENCE BETWEEN R-VALUE AND RSI?

RSI is the metric equivalent of R-value and both measure how much insulation a material provides. The Code uses RSI when referring to thermal resistance. Contractors, suppliers and building owners usually use R-value. For this reason we've used both throughout the Guide. To convert RSI to R-value, multiply by 5.678. To convert R-value to RSI, divide by 5.678.

WHAT'S THE DIFFERENCE BETWEEN EFFECTIVE VS. NOMINAL INSULATION VALUES?

Effective insulation values take into account all the components of an assembly, not just the value of the insulation in the assembly. Effective values are a better measure of how a particular wall, ceiling or floor resists heat flow because effective values include the effect of studs, lintels, etc.

Nominal insulation values are the R-values recorded on building products at the store. You buy R-19 nominal insulation at the store but when you install it in a 2x6, 16" on centre wall, you may only have an effective R-value of around 16.

If you're interested in learning more about how to calculate the effective R-value of a wall, ceiling or floor assembly, please see subsection 9.36.2.4 of the Code.

ABOVE GRADE WALLS

Minimum Effective Insulation Values for Walls in Buildings with HRVs			
Zone 6	Zone 7a	Zone 7b	Zone 8
R-16.86 (RSI 2.97)	R-16.86 (RSI 2.97)	R-17.49 (RSI 3.08)	R-17.49 (RSI 3.08)

Since vinyl siding is quite common in Newfoundland and Labrador, the Guide uses vinyl siding as an illustrative example. It is important to note that other forms of siding, such as wood, have different R-values and may be more environmentally sustainable. Claddings other than vinyl are used in the Guide for some wall assemblies that are more "commercial" in nature.

WHAT'S THE EFFECTIVE R-VALUE OF A CONVENTIONAL 2X6, R-19 WALL?

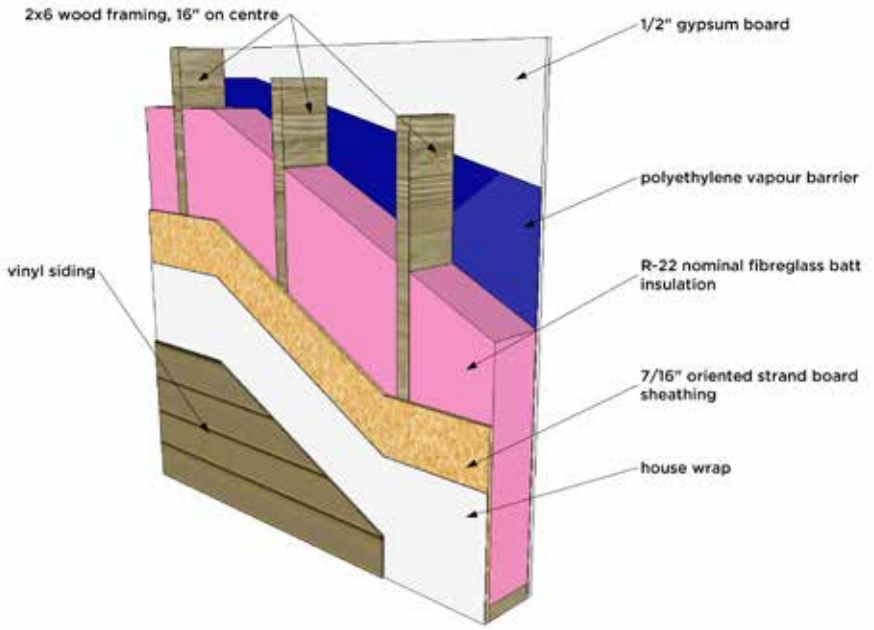
The conventional 2x6 wood frame, 16" on centre wall with nominal R-19 cavity insulation, vinyl siding, oriented strand board (OSB) sheathing and gypsum board finish has an effective R-value of 15.94. This value isn't high enough to meet the Code requirements.

The following are some sample wall types that meet the minimum effective insulation values for these zones:

Zone 6 | Zone 7a

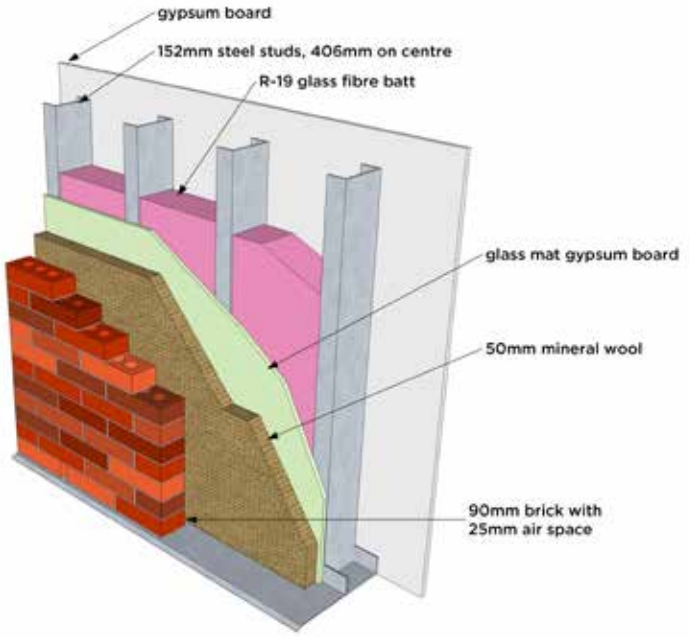
1. AGW-01 R-17.03, RSI 3.00

2x6 wood frame, 16" on centre, R-22 fibreglass batt nominal cavity insulation, 7/16" oriented strand board (OSB) sheathing, 1/2" gypsum board, vinyl siding



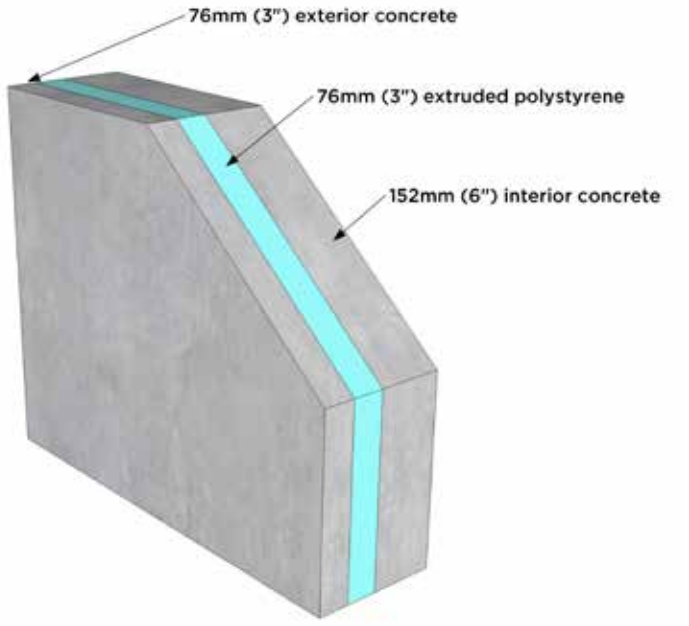
2. AGW-02 R-17.01, RSI 2.99

152mm (6”) metal stud, 406mm (16”) on centre, 3.5 RSI (R-19) glass fibre batt cavity insulation, 50mm (2”) mineral wool continuous insulation, 16mm (0.625”) exterior gypsum board, 16mm (0.625”) interior gypsum board, 90mm (4”) brick cladding, 25mm (1”) air space



3. AGW-03 R-16.95, RSI 2.98

insulated tilt up sandwich panel, 76mm (3”) exterior concrete, 76mm (3”) extruded polystyrene, 152mm (6”) interior concrete

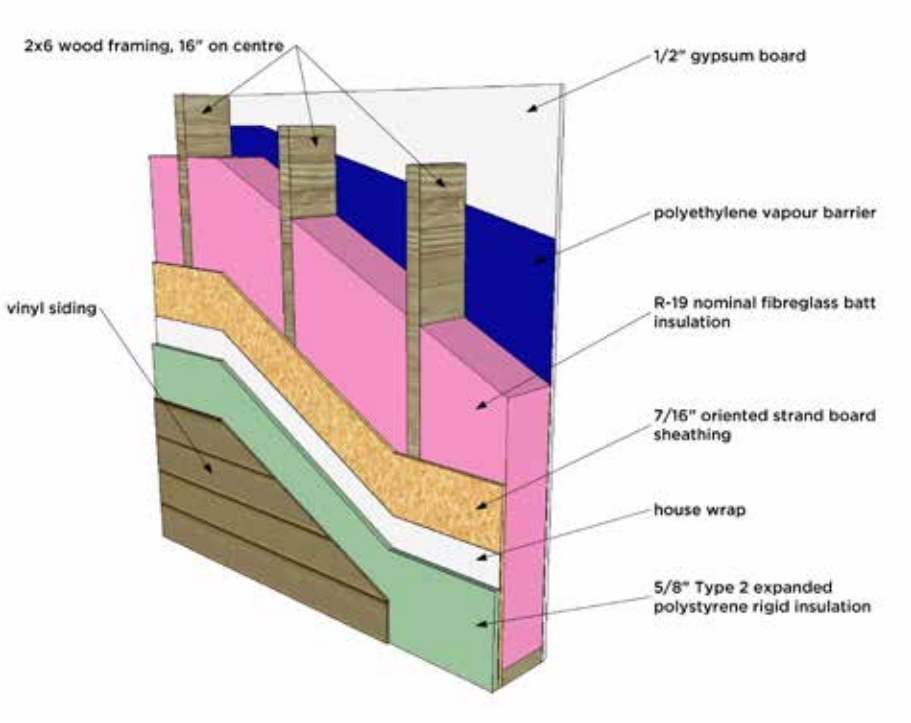


The following are some sample wall types that meet the minimum effective insulation values for all zones:

Zone 6	Zone 7a	Zone 7b	Zone 8

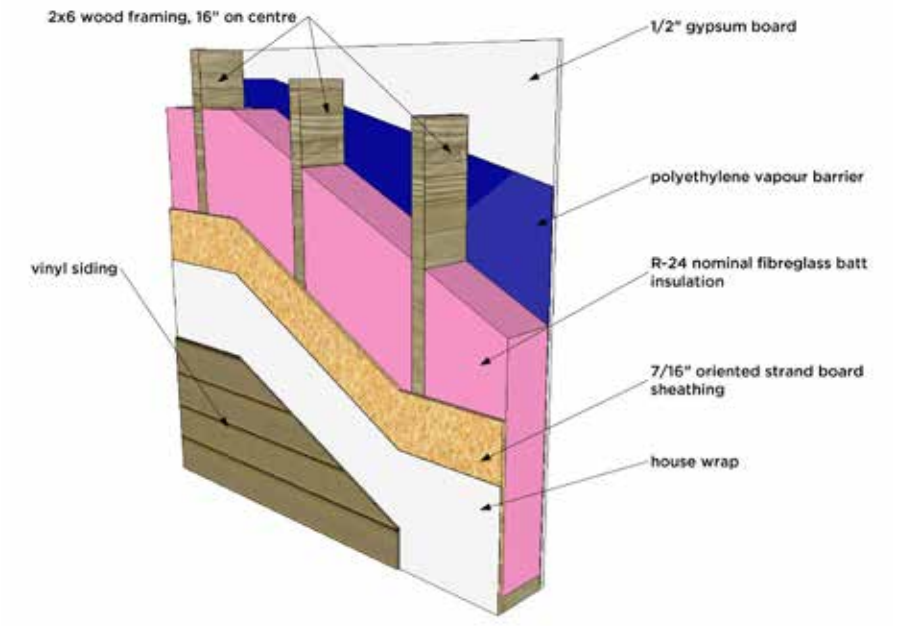
1. AGW-04 R-18.45, RSI 3.25

2x6 wood frame, 16” on centre, R-19 fibreglass batt nominal cavity insulation, 5/8” Type 2 expanded polystyrene (EPS) rigid insulation, 7/16” oriented strand board (OSB) sheathing, 1/2” gypsum board, vinyl siding



2. AGW-05 R-17.65, RSI 3.11

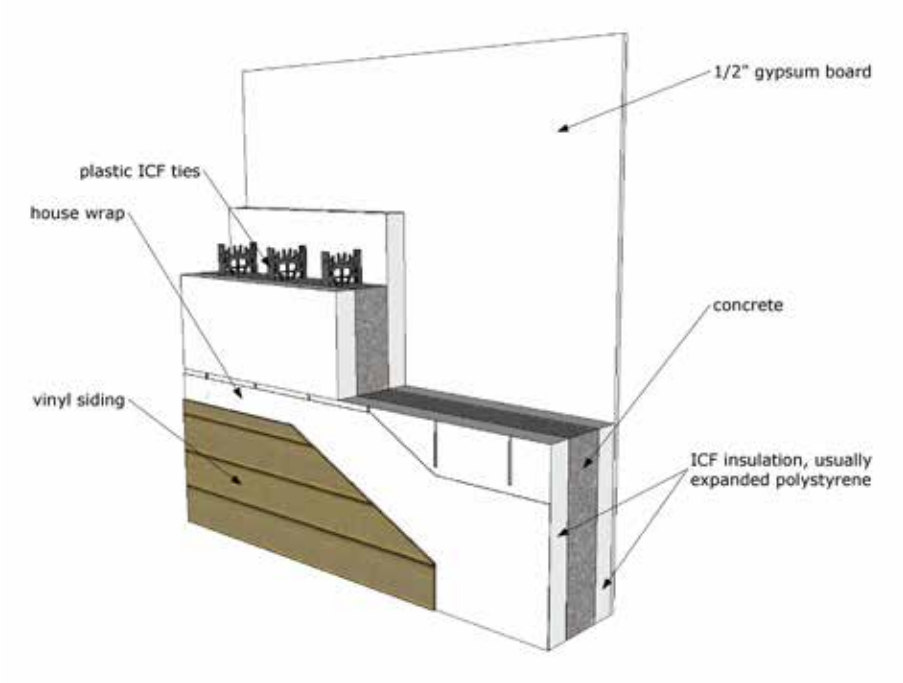
2x6 wood frame, 16” on centre, R-24 nominal fibreglass batt cavity insulation, 7/16” oriented strand board (OSB) sheathing, 1/2” gypsum board, vinyl siding



3. AGW-06

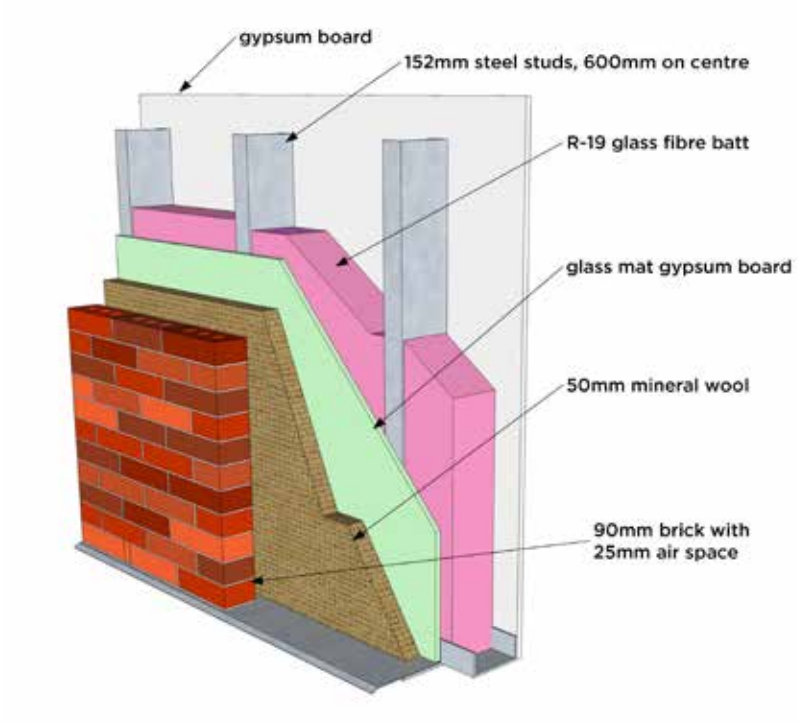
R-21.3 to R-24.02 depending on ICF block, RSI 3.75 to RSI 4.23

4” insulated concrete form (ICF) block wall, vinyl siding, 1/2” gypsum board



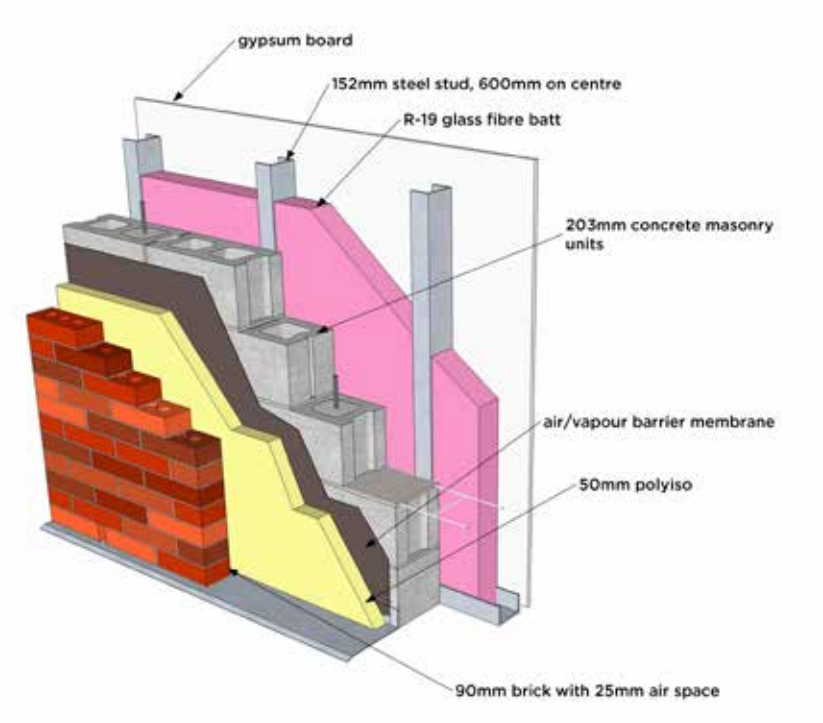
4. AGW-07 R-18.93, RSI 3.33

152mm (6”) metal stud, 600mm (24”) on centre, 3.5 RSI (R-19) glass fibre batt cavity insulation, 50mm (2”) mineral wool continuous insulation, 16mm (0.625”) exterior gypsum board, 16mm (0.625”) interior gypsum board, 90mm (4”) brick cladding, 25mm (1”) air space



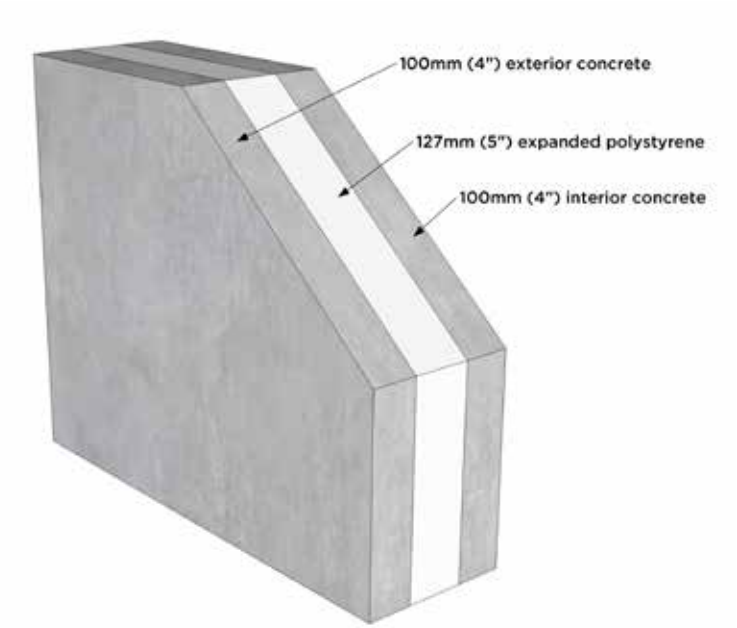
5. AGW-08 R-18.93, RSI 3.33

203mm (8") concrete block, 50mm (2") polyisocyanurate continuous insulation, 152mm (6") metal stud, 600mm (24") on centre, 2.11 RSI (R-12) glass fibre cavity insulation, 16mm (0.625") interior gypsum board, 90mm (4") brick cladding, 25mm (1") air space



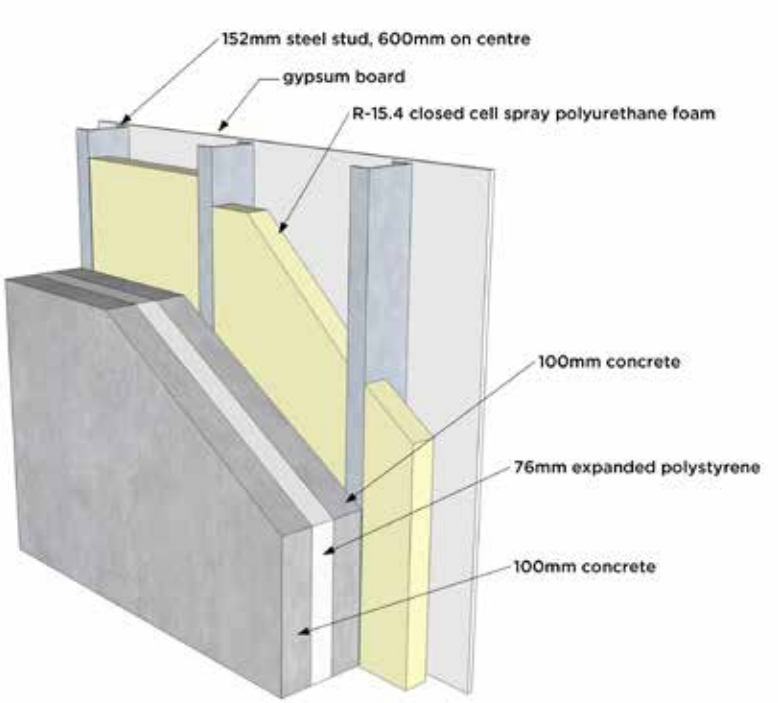
6. AGW-09 R-22.22, RSI 3.91

insulated precast concrete panel, 100mm (4") exterior concrete, 127mm (5") expanded polystyrene, 100mm (4") interior concrete



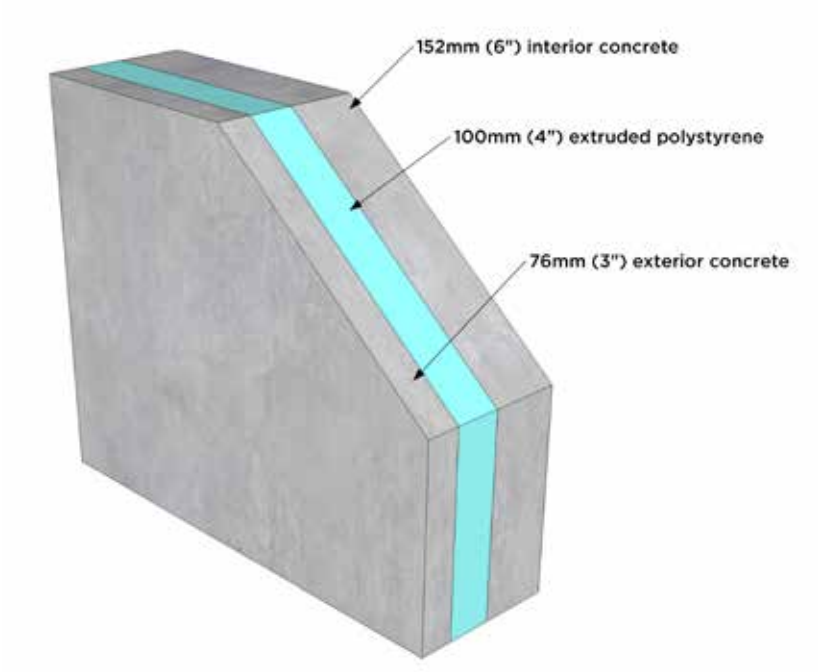
7. AGW-10 R-19.61, RSI 3.45

insulated precast concrete panel, 100mm (4") exterior concrete, 76mm (3") expanded polystyrene, 100mm (4") interior concrete, 152mm (6") metal stud, 600mm (24") on centre, RSI 2.7 (R-15.4) sprayed closed cell polyurethane foam, 12.7mm (0.5") interior gypsum board



8. AGW-11 R-22.22, RSI 3.91

insulated tilt up sandwich panel, 76mm (3") exterior concrete, 100mm (4") extruded polystyrene, 152mm (6") interior concrete



ATTICS

Increasing your attic insulation is one of the easiest and most cost-effective ways to add insulation to your building envelope.

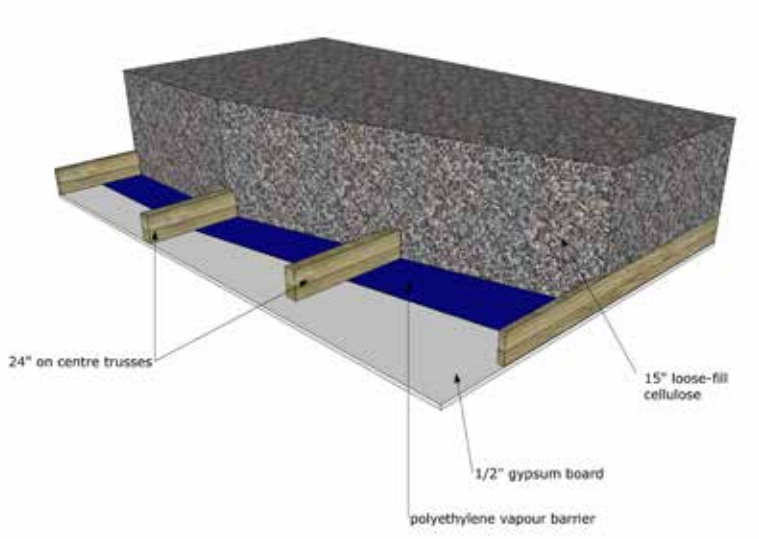
Minimum Effective Insulation Values for Ceilings Below Attics in Buildings with HRVs			
Zone 6	Zone 7a	Zone 7b	Zone 8
R-49.23 (RSI 8.67)	R-49.23 (RSI 8.67)	R-59.22 (RSI 10.43)	R-59.22 (RSI 10.43)

The following are some sample attic insulation options that meet the minimum effective insulation values in these zones:

Zone 6 | Zone 7a

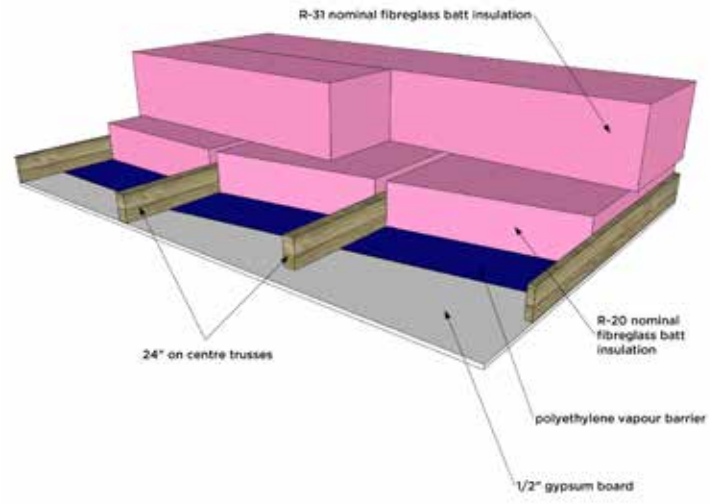
1. CBA-01 R-53.15, RSI 9.36

2x4 manufactured trusses, 24” on centre, 1/2” gypsum board, 15” of blown cellulose insulation



2. CBA-02 R-50.44, RSI 8.88

2x4 manufactured trusses, 24” on centre, 1/2” gypsum board, R-31 fibreglass batt insulation, R-20 fibreglass batt insulation

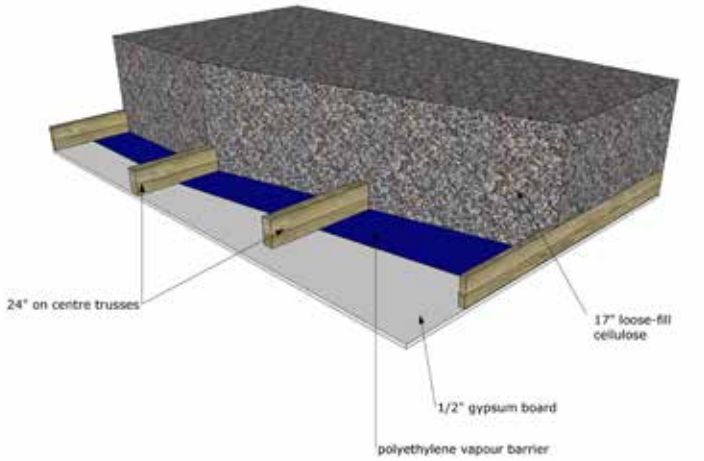


The following are some sample attic insulation options that meet the minimum effective insulation values in all zones:

Zone 6	Zone 7a	Zone 7b	Zone 8

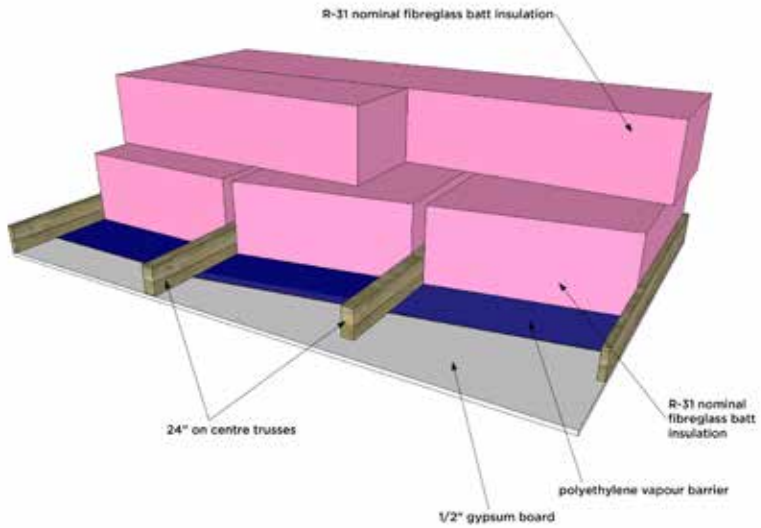
1. CBA-03 R-60.36, RSI 10.63

2x4 manufactured trusses, 24" on centre, 1/2" gypsum board, 17" of blown cellulose insulation



2. CBA-04 R-61.55, RSI 10.84

2x4 manufactured trusses, 24" on centre, 1/2" gypsum board, R-31 fibreglass batt insulation, R-31 fibreglass batt insulation

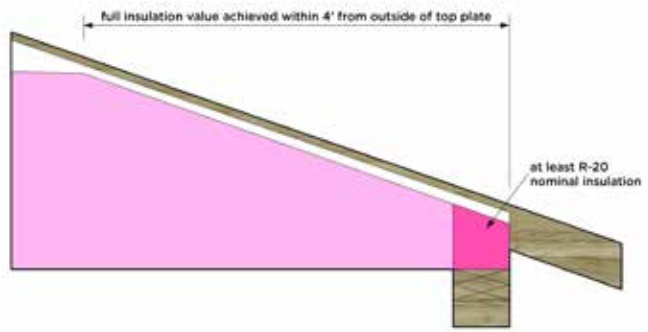


HOW DO I DEAL WITH REDUCED INSULATION AT THE EAVE?

The effective insulation at the outside of the attic, near the wall and eave, will be affected by the roof slope, truss design and required ventilation of the attic space. The Code allows reduced insulation at the eaves provided:

1. Full insulation value is achieved within 4 ft (1200 mm) from the outside of the top plate, and
2. There is at least R-20 nominal insulation over the entire top plate.

You may want to consider using a raised-heel truss to make sure you reach these insulation levels at the edge of the attic. Raised-heel trusses (10" heel height) can be a very cost-effective way to get more insulation over the outside wall.



CATHEDRAL CEILINGS AND FLAT ROOFS

If your building includes a cathedral ceiling or flat roof, you need to make sure that it meets the following minimum effective insulation values for your zone:

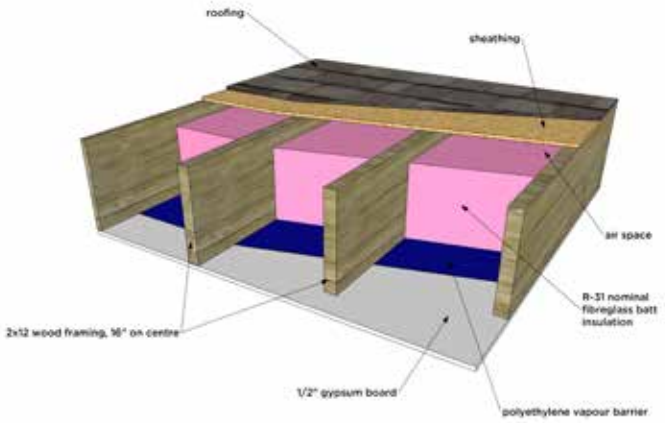
Minimum Effective Insulation Values for Cathedral Ceilings and Flat Roofs in Buildings with HRVs			
Zone 6	Zone 7a	Zone 7b	Zone 8
R-26.52 (RSI 4.67)	R-28.50 (RSI 5.02)	R-28.50 (RSI 5.02)	R-28.50 (RSI 5.02)

The following are some samples of cathedral ceiling and flat roof options that meet minimum effective insulation values in this zone:

Zone 6

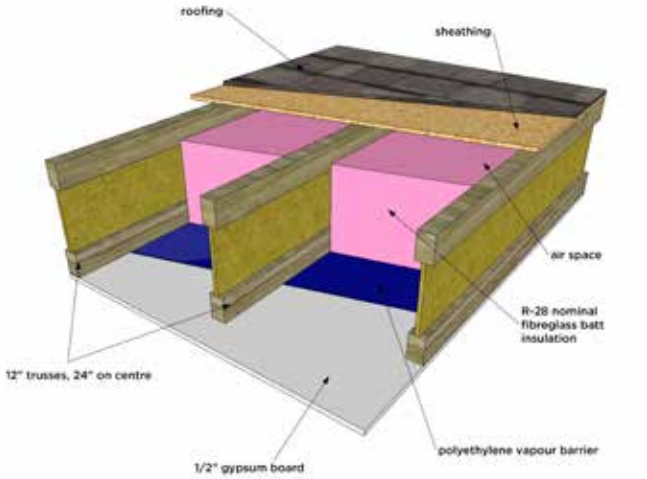
1. CCFR-01 R-27.99, RSI 4.93

2x12 solid lumber, 16” on centre,
R-31 nominal fibreglass batt,
1/2” gypsum



2. CCFR-02 R-27.82, RSI 4.90

12” trusses, 24” on centre, R-28
nominal fibreglass batt, 1/2” gypsum

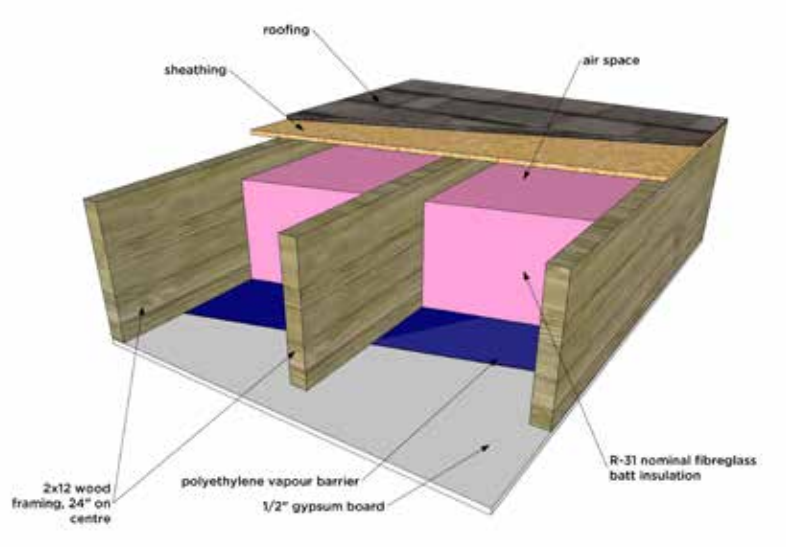


The following are some samples of cathedral ceiling and flat roof options that meet the minimum effective insulation values in all zones:

Zone 6	Zone 7a	Zone 7b	Zone 8

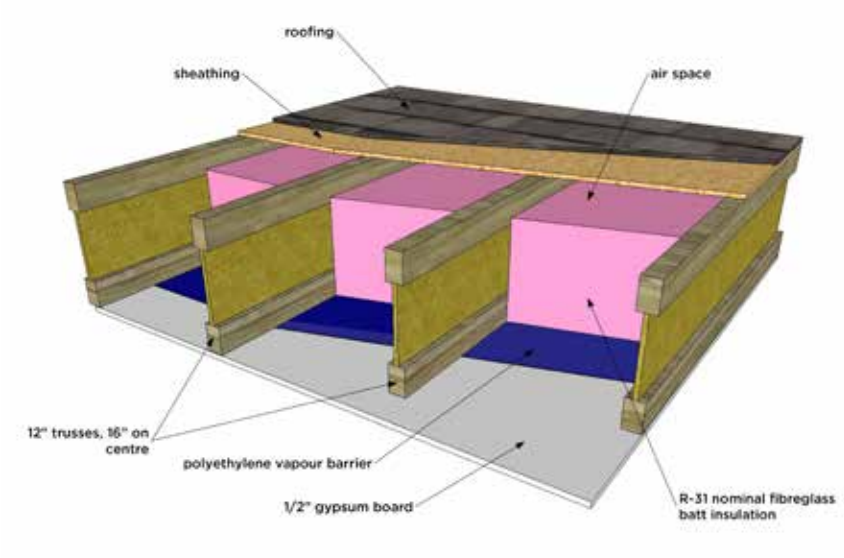
1. CCFR-03 R-28.90, RSI 5.09

2x12 wood framing, 24" on centre,
R-31 nominal fibreglass batt,
1/2" gypsum



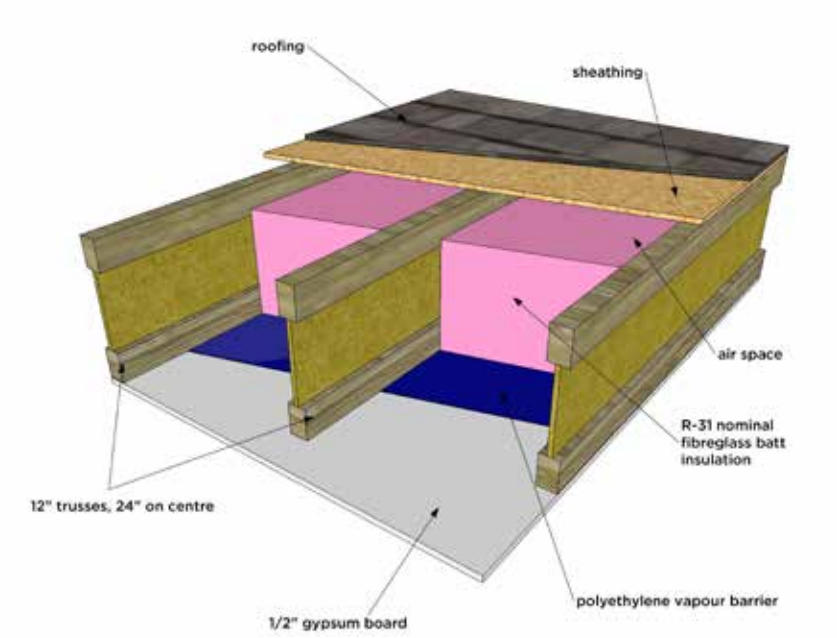
2. CCFR-04 R-29.47, RSI 5.19

12" trusses, 16" on centre, R-31
nominal fibreglass batt,
1/2" gypsum



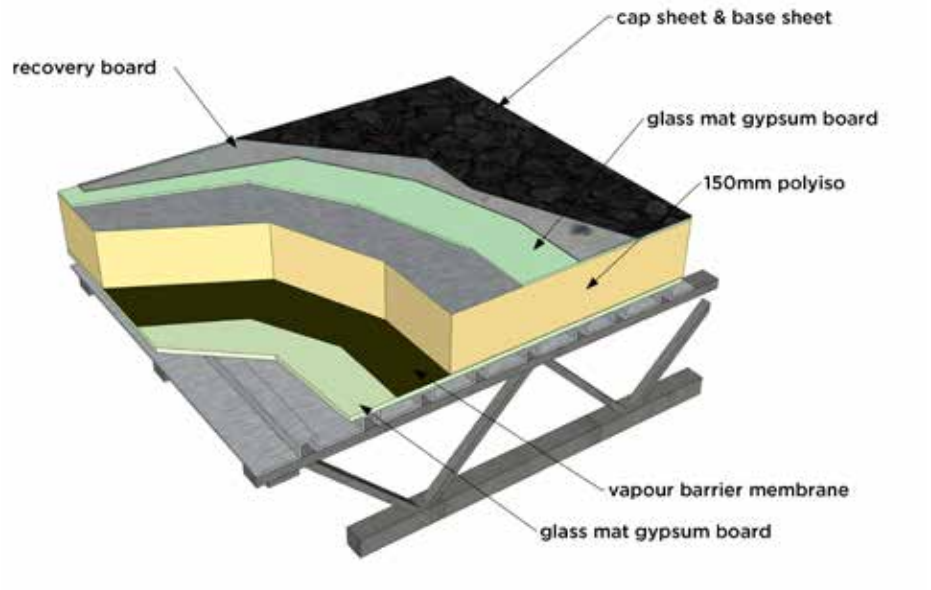
3. CCFR-05 R-30.32, RSI 5.34

12” trusses, 24” on centre, R-31 nominal fibreglass batt, 1/2” gypsum



4. CCFR-06 R-31.25, RSI 5.50

150mm polyisocyanurate insulation over metal roof deck



FLOORS OVER UNHEATED SPACES

Minimum Effective Insulation Values for Floors Over Unheated Spaces in Buildings with HRVs			
Zone 6	Zone 7a	Zone 7b	Zone 8
R-26.52 (RSI 4.67)	R-28.50 (RSI 5.02)	R-28.50 (RSI 5.02)	R-28.50 (RSI 5.02)

WHERE WOULD I FIND A FLOOR OVER AN UNHEATED SPACE?

Floors over unheated spaces include, but are not limited to:

- Floors over garages, even if you intend to heat the garage
- Cantilevered floors over the outside of your building

TECH TIP:

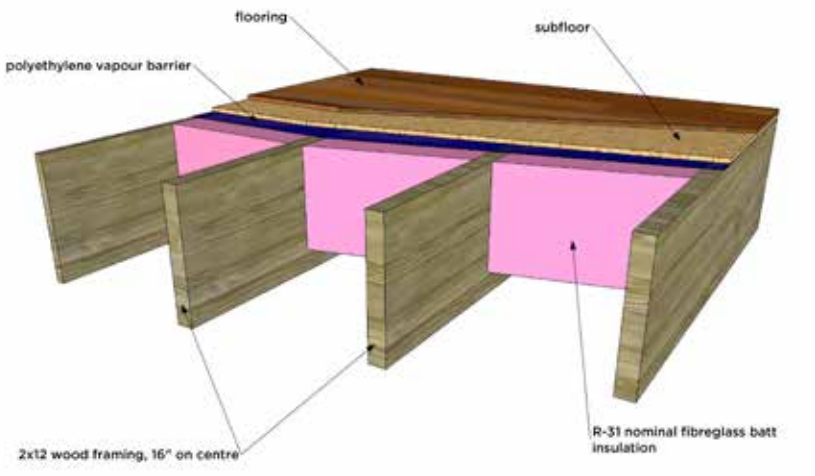
You should notice that floors are treated much like cathedral ceilings and flat roofs when it comes to the details. The only difference is that the vapour barrier is on the other side (but still the warm side).

The following are some sample floor options that meet the minimum effective insulation values for all zones:

Zone 6 | Zone 7a | Zone 7b | Zone 8

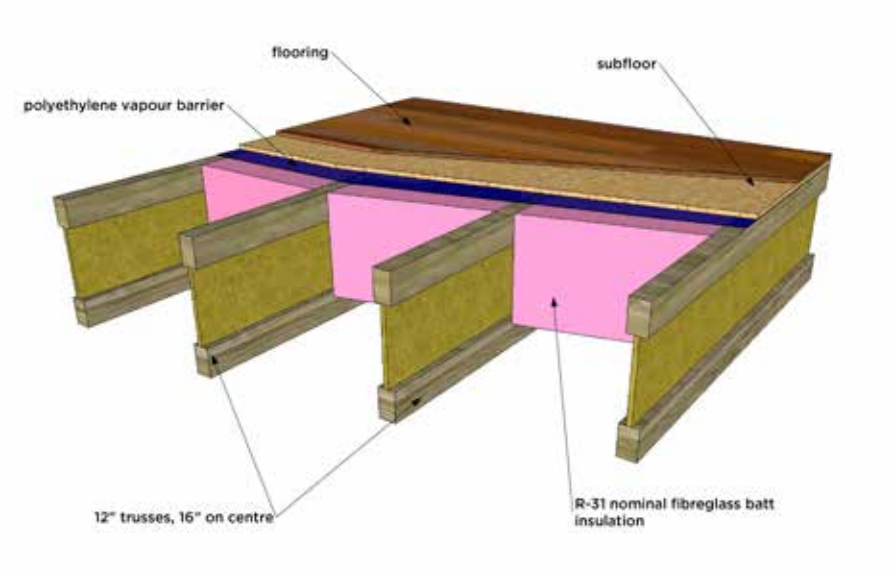
1. FOUS-01 R-28.84, RSI 5.08

2x12 solid lumber, 16" on centre,
R-31 nominal fibreglass batt,
1/2" plywood



2. FOUS-02 R-32.32, RSI 5.34

12” trusses, 16” on centre, R-31 nominal fibreglass batt, 1/2” plywood



REQUIREMENTS FOR ATTIC HATCH INSULATION

See subsection 9.36.2.7 of the National Building Code for specifics and to ensure your project complies.

When it comes to energy efficiency, attic hatches are the weak spot in ceilings. Frequently, they’re poorly insulated and often the source of a lot of air leakage.

The Code requires that attic hatches between conditioned and unconditioned space need to be insulated to at least R-14.76 (RSI 2.6).

Adding 3” of extruded polystyrene (XPS) on top of your attic hatch will provide you with the required amount of insulation. You should also pay careful attention to air sealing around the attic hatch and make sure that it stays tightly shut to keep cold air out and warm air in.

REQUIREMENTS FOR FENESTRATION, DOORS AND SKYLIGHTS

See subsection 9.36.2.7 of the National Building Code for specifics and to ensure your project complies.

The Code requires windows, doors, skylights and other translucent materials to meet minimum energy efficiency requirements.

WHAT'S FENESTRATION?

"Fenestration" is the word that's used to refer to building envelope assemblies that transfer visible light. Fenestration includes windows, clerestories, translucent wall panels, glass block assemblies, sliding glass doors, etc.

WHAT'S A U-VALUE?

The U-factor or U-value is a measure of how much heat loss occurs through a building material. It is the opposite of R-value, which is a measure of how much a material resists heat loss. Where R-values are usually used when referring to walls, basements or ceilings, U-values are often used when referring to windows, doors and skylights. The lower the U-value, the more energy efficient the product is. U-values are used in the National Building Code to express the energy efficiency requirements for windows, doors, skylights and other translucent materials.

WHAT'S AN ENERGY RATING (ER)?

Energy Ratings, also known as ER numbers, measure the overall performance of windows or doors. They take into account solar energy gain through the glass, and heat loss and air leakage through the entire window or door. The ER number is a unitless number between 0 and 50. The higher the ER number is, the more energy efficient your door or window is. ER numbers are used in the National Building Code to signify the requirements for windows and doors.

WINDOWS AND DOORS

When choosing windows or doors for your project you should make sure that one of the following applies:

1. Their U-values are equal to or lower than the U-value listed in the table below for your zone, or
2. Their ER numbers are equal to or higher than the ER numbers listed in the table below for your zone

	Required Thermal Characteristics of Windows and Doors			
	Zone 6	Zone 7a	Zone 7b	Zone 8
Maximum U-Value	1.60	1.60	1.40	1.40
Minimum Energy Rating	25	25	29	29

Zone 6 | Zone 7a

All Zone 1 ENERGY STAR certified windows and doors will meet the Code requirements for Zones 6 and 7a.

Zone 7b | Zone 8

All Zone 2 ENERGY STAR certified windows and doors will meet the Code requirements for Zones 7b and 8.

Site-built windows and glazed doors have special requirements.
Please check the code if you're building your own windows and doors.

COMMERCIAL STOREFRONT SYSTEMS

Commercial buildings often use storefront systems. If you're constructing a building that uses a storefront window system you'll want to double-check that your chosen system is tested according to the requirements of the Code and that the system's U-value is lower than is required in your climate zone.

SKYLIGHTS

When choosing skylights for your project, you need to make sure that the U-value of the skylight is not higher than the U-value listed in the table below for your zone.

	Required Thermal Characteristics of Skylights			
	Zone 6	Zone 7a	Zone 7b	Zone 8
Maximum U-Value	2.70	2.70	2.40	2.40

Zone 6 | Zone 7a

All Zone 1 ENERGY STAR certified skylights will meet the Code requirements for Zones 6 and 7a.

Zone 7b | Zone 8

All Zone 2 ENERGY STAR certified skylights will meet the Code requirements for Zones 7b and 8.

REQUIREMENTS FOR FOUNDATION WALLS, SLABS AND BASEMENTS

See subsection 9.36.2.8 of the National Building Code for specifics and to ensure your project complies.

There are many different ways to build foundations. The Code requires that most construction types meet minimum effective R-values.

BASEMENTS WITH FLOORS BELOW THE FROST LINE

The most common foundation type in our province is a basement foundation with the floor below the frost line. If this is what you're building, the following minimum effective insulation values apply:

Minimum Effective Insulation Values for Foundation Walls in Buildings with HRVs			
Zone 6	Zone 7a	Zone 7b	Zone 8
R-16.92 (RSI 2.98)	R-16.92 (RSI 2.98)	R-16.92 (RSI 2.98)	R-16.92 (RSI 2.98)

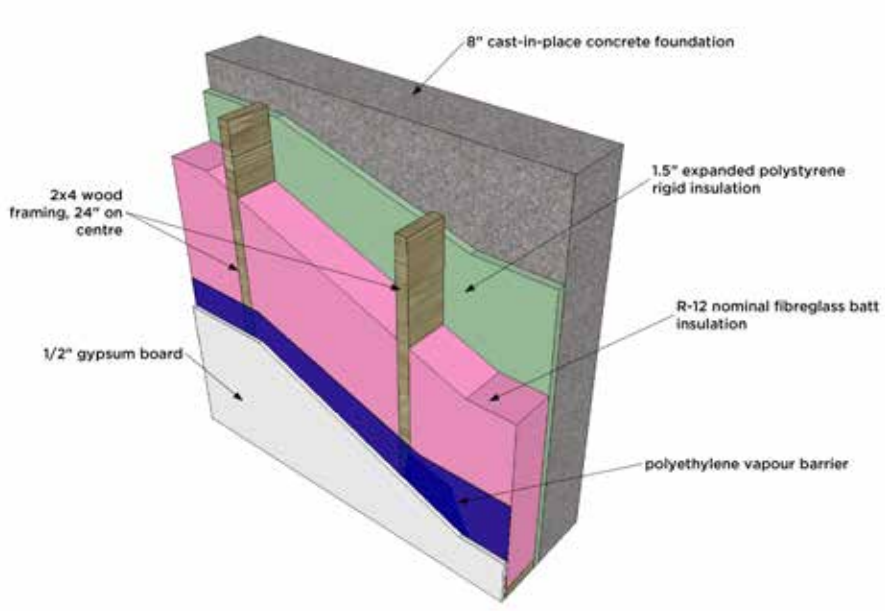
Minimum Effective R-Values for Unheated Floors Below Frost Line in Buildings with HRVs			
Zone 6	Zone 7a	Zone 7b	Zone 8
uninsulated	uninsulated	uninsulated	uninsulated

Here are a few samples of foundation wall types that meet the minimum effective insulation values in all zones:

Zone 6 | Zone 7a | Zone 7b | Zone 8

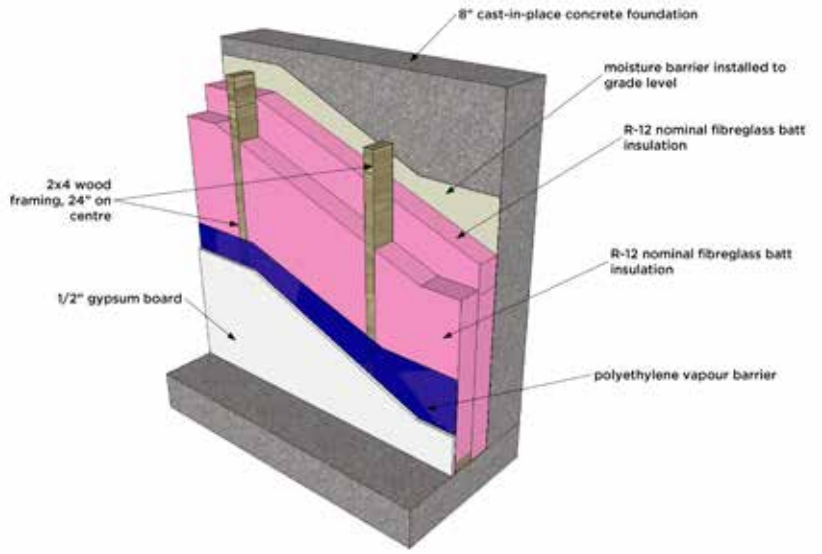
1. FW-01 R-17.37, RSI 3.06

8" cast-in-place concrete foundation, 1.5" Type 2 expanded polystyrene (EPS) rigid foam insulation, 2x4 wood frame wall, 24" on centre, R-12 nominal fibreglass insulation, 1/2" gypsum board



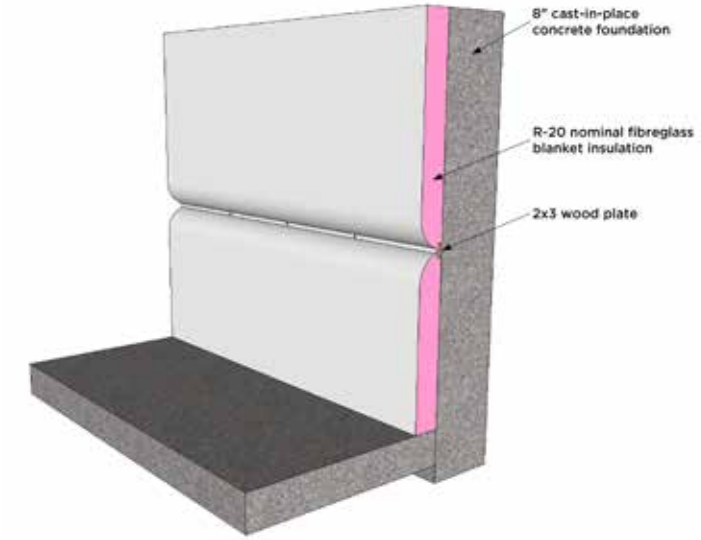
2. FW-02 R-23.33, RSI 4.11

8” cast-in-place concrete foundation,
R-12 nominal fibreglass insulation,
2x4 wood frame wall, 24” on centre,
R-12 nominal fibreglass insulation,
1/2” gypsum board



3. FW-03 R-21.18, RSI 3.73

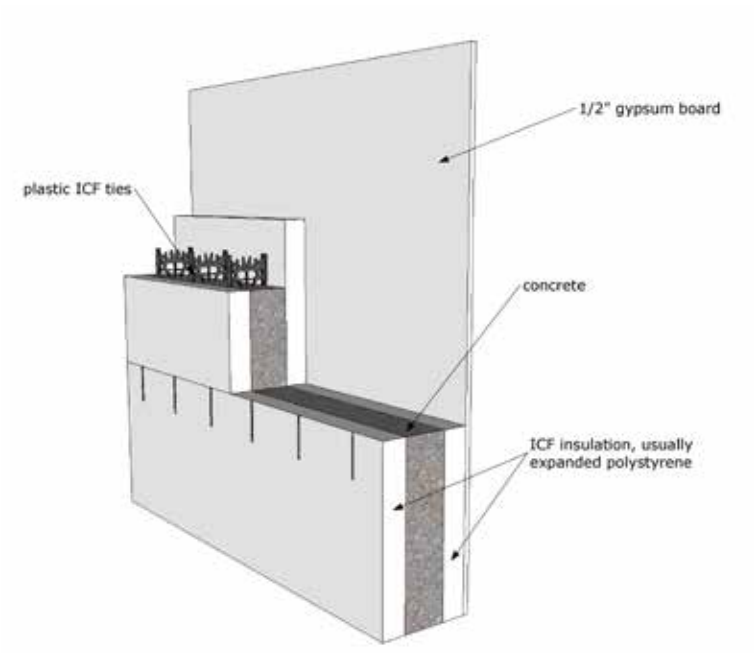
8” cast-in-place concrete foundation,
R-20 blanket insulation



4. FW-04

R-21.3 to R-24.02 depending on
ICF block, RSI 3.75 to RSI 4.23

insulated concrete form (ICF) block
foundation wall, 1/2” gypsum board



HEATED FLOORS IN CONTACT WITH THE GROUND

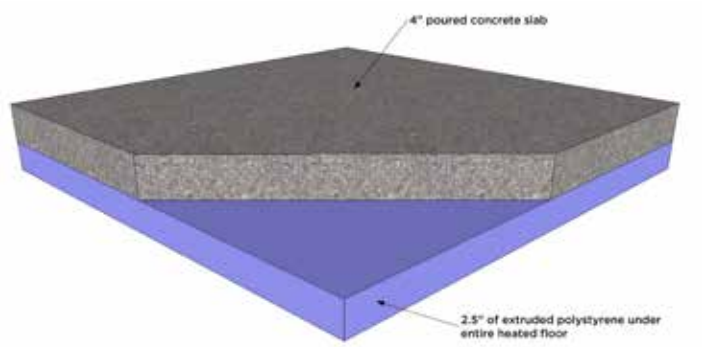
If you plan on heating a floor that is in contact with the ground, you'll need to ensure it meets the following minimum effective insulation values:

Minimum Effective Insulation Values for Heated Floors in Buildings with HRVs			
Zone 6	Zone 7a	Zone 7b	Zone 8
R-13.17 (RSI 2.32)	R-16.13 (RSI 2.84)	R-16.13 (RSI 2.84)	R-16.13 (RSI 2.84)

Zone 6

1. HF-01 R-13.74, RSI 2.42

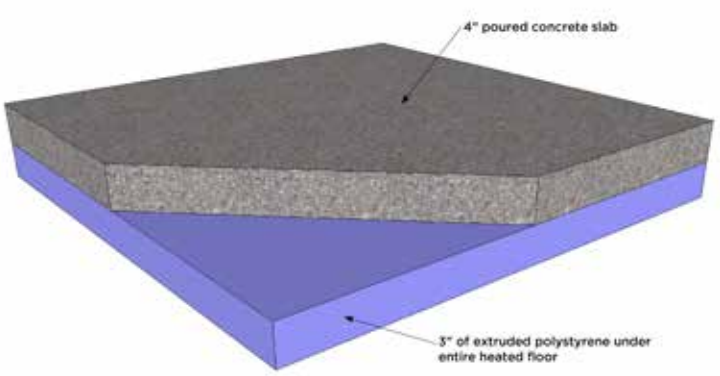
One way you can accomplish the minimum effective insulation value for a heated floor in this zone is by adding 2.5" of extruded polystyrene (XPS) foam under your entire heated floor.



Zone 7a | Zone 7b | Zone 8

2. HF-02 R-16.30, RSI 2.87

In these zones you'll need to add a little extra insulation to meet the minimum effective insulation values. Adding 3" of extruded polystyrene (XPS) foam below your entire heated floor is one way to meet the requirements.

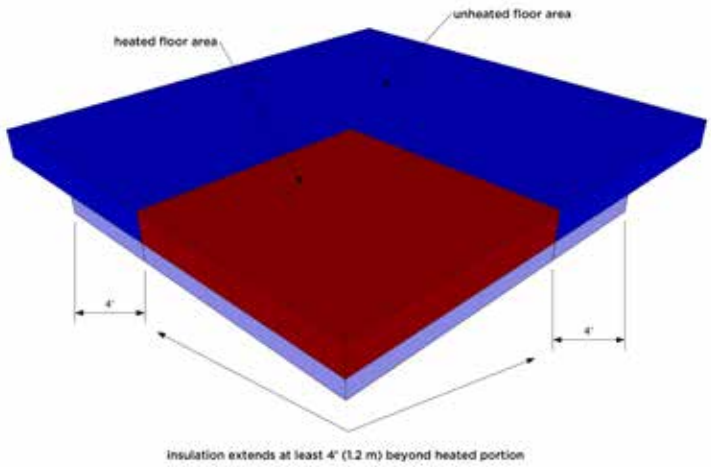


WHAT IF ONLY A PORTION OF MY FLOOR IS GOING TO BE HEATED?

If you're only putting heating ducts, cables or pipes in a portion of your floor, you'll need to make sure:

1. That the heated part of the floor meets the minimum effective R-values for heated floors, and
2. That the minimum effective R-value is also met for floor areas within 4 ft (1.2 m) of the heated portion.

The diagram to the right demonstrates this.



UNHEATED FLOORS ABOVE THE FROST LINE

Unheated floors above the frost line are required to meet the following minimum effective insulation values:

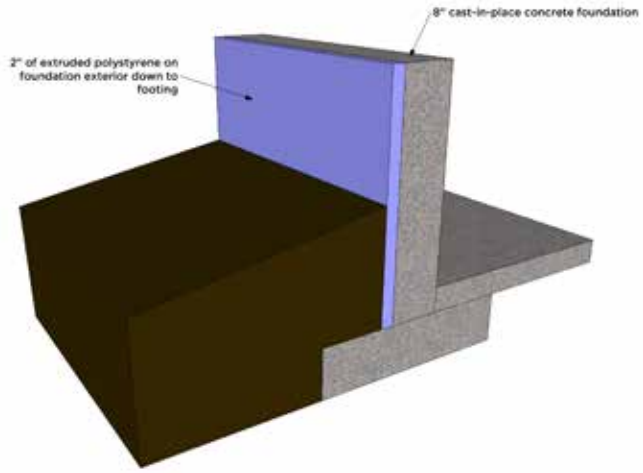
Minimum Effective Insulation Values for Unheated Floors Above Frost Line in Buildings with HRVs			
Zone 6	Zone 7a	Zone 7b	Zone 8
R-11.13 (RSI 1.96)	R-11.13 (RSI 1.96)	R-11.13 (RSI 1.96)	R-11.13 (RSI 1.96)

The following diagrams demonstrate three of the ways the minimum effective insulation values can be accomplished in all zones:

Zone 6 | Zone 7a | Zone 7b | Zone 8

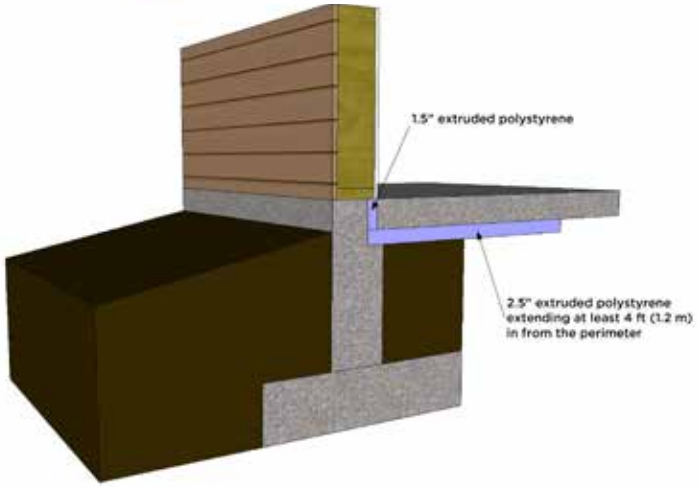
1. UHF-01 R-11.24, RSI 1.98

2" of extruded polystyrene (XPS) on the exterior of the foundation wall down to the footing



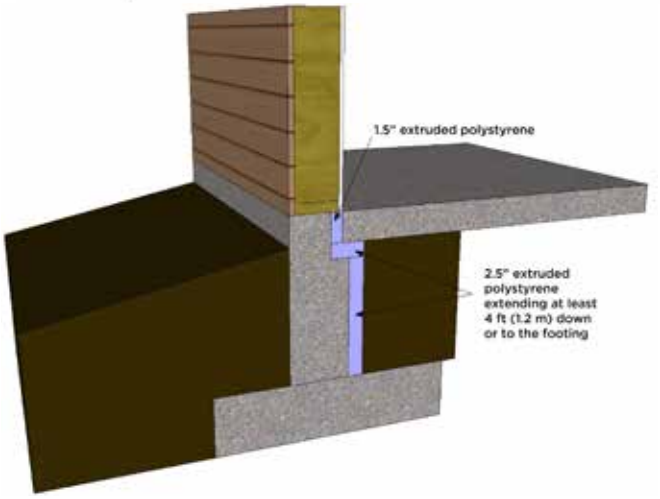
2. UHF-02 R-13.74, RSI 2.42

2.5" of extruded polystyrene (XPS) under the slab extending at least 4 ft (1.2 m) in from the perimeter and 1.5" of extruded polystyrene (XPS) as a thermal break between the slab and the foundation wall or footing



3. UHF-03 R-13.74, RSI 2.42

2.5" of extruded polystyrene (XPS) under the slab extending at least 4 ft (1.2 m) down or to the footing and 1.5" of extruded polystyrene (XPS) as a thermal break between the slab and the foundation wall or footing



SLABS-ON-GRADE WITH INTEGRAL FOOTINGS (THICKENED EDGE SLABS)

Slab-on-grade foundations are becoming increasingly popular. If you're building a slab-on-grade foundation you will need to ensure you meet the following minimum effective insulation values:

Minimum Effective Insulation Values for Slabs-On-Grade with an Integral Footings in Buildings with HRVs			
Zone 6	Zone 7a	Zone 7b	Zone 8
R-11.13 (RSI 1.96)	R-16.13 (RSI 2.84)	R-16.13 (RSI 2.84)	R-21.12 (RSI 3.72)

For slabs-on-grade with integral footings (also known as thickened edge slabs) you need to make sure that:

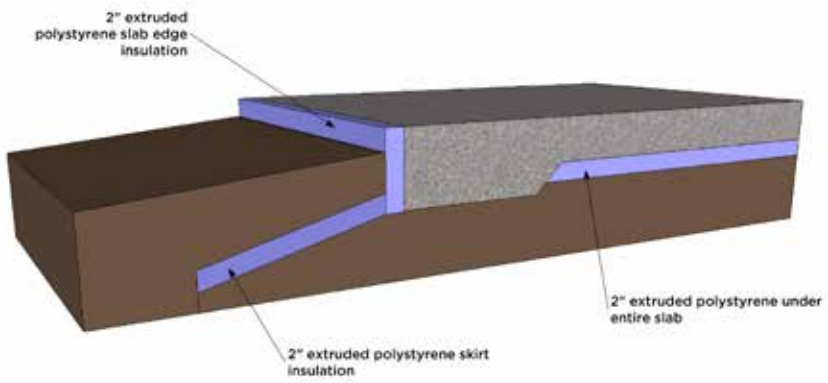
1. The effective R-values are achieved under the entire slab and around all edges, but not necessarily under the integral perimeter footing, and

2. That Code-compliant skirt insulation meeting the same effective R-value is installed around the perimeter.

Zone 6

1. SOG-01 R-11.24, RSI 1.98

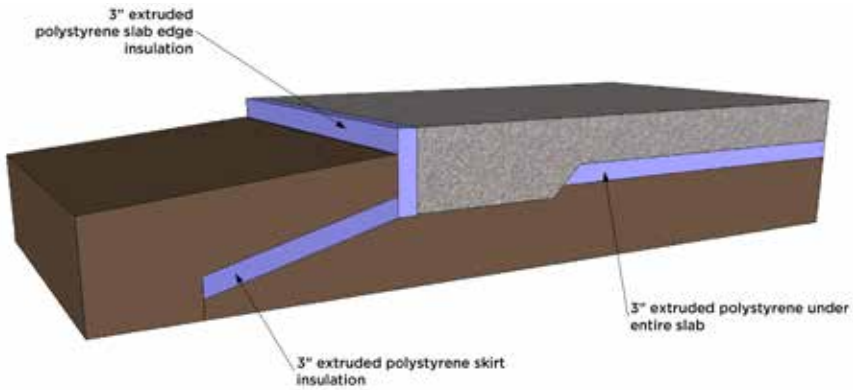
2" of extruded polystyrene (XPS) foam under slab



Zone 6 | Zone 7a | Zone 7b

2. SOG-02 R-16.30, RSI 2.87

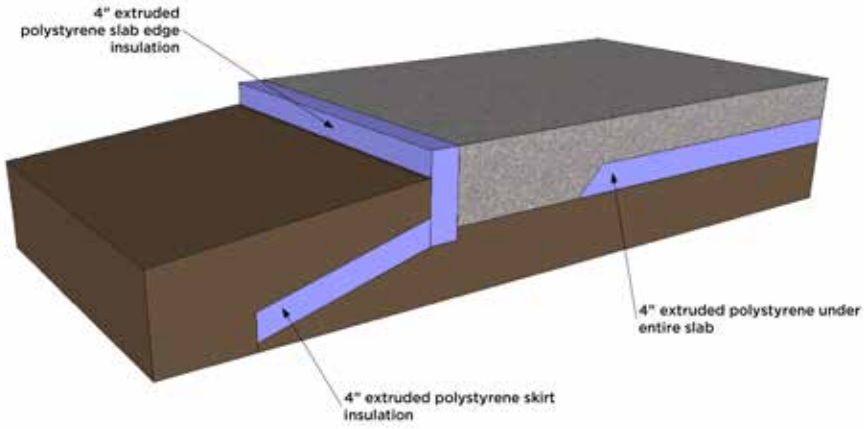
3" of extruded polystyrene (XPS) foam under slab



Zone 6	Zone 7a	Zone 7b	Zone 8

3.SOG-03 R-21.35, RSI 3.76

4” of extruded polystyrene (XPS) foam under slab



WHAT ABOUT WHEN I’M BUILDING A FOUNDATION WHERE A SINGLE FLOOR IS GOING TO BE MADE UP OF SEVERAL OF THE FLOOR TYPES MENTIONED IN THIS SECTION?

In this case, each portion of your floor will need to comply with the minimum effective R-values for its type. Consider a walkout basement: The floor that’s above the frost line, i.e. the walkout portion, should be insulated following the guidelines for floors above the frost line (either heated or unheated). The rest of the basement floor that’s below the frost line can remain uninsulated.

SOME IMPORTANT NOTES ON INSULATION AND CALCULATIONS

See subsection 9.36.2.2 to 9.36.2.4 of the National Building Code for specifics and to ensure your project complies.

The Code provides a number of useful guidelines in subsections 9.36.2.2, 9.36.2.3 and 9.36.2.4 on where to find insulation ratings for common building materials and how to calculate effective insulation values. This information is helpful if you need or want to calculate the effective insulation value of your wall, ceiling or floor assemblies.

Normally this isn't necessary, though. The Code also has a useful appendix with tables to help you determine the effective insulation values for common building envelope assemblies. In addition, there are other good tools out there for determining the effective insulation values for assemblies.

One of the best resources for determining these values for residential building envelope components has been published by Natural Resources Canada as part of the ENERGY STAR for New Homes program:

- The ENERGY STAR for New Homes "Tables for Calculating Effective Thermal Resistance of Opaque Assemblies"

TECH TIP:

All insulation values in the Code are listed in RSI. Remember that this is the metric version of R-value. R-value equals 5.678 x RSI. For example, 5.678 x 2.97 RSI = 16.86 R-value.

REQUIREMENTS FOR CONTINUITY OF INSULATION

See subsection 9.36.2.5 of the National Building Code for specifics and to ensure your project complies.

Remember thermal bridges? These areas of faster heat loss are things that you don't want in your building envelope. To minimize significant thermal bridges, the Code requires that the building envelope insulation be continuous.

Studs and floor joists are not considered thermal bridges under this subsection of the Code. That's because they're already factored into your effective R-values. Significant thermal bridges include:

- Party walls that penetrate the building envelope's insulation plane
- Masonry fireplaces
- Foundation walls that are insulated on the outside below grade and on the inside above grade

If you're building a project with one of these situations please refer to the Code for further details.

INSULATION TRADE-OFFS

See subsection 9.36.2.11 of the National Building Code for specifics and to ensure your project complies.

Wondering what happens if you can't meet the prescriptive R-values in certain areas of the building envelope? Can you add more insulation somewhere else?

The short answer is, "Well... maybe, yes." The Code allows for some limited trade-offs when it comes to reducing insulation in one area and adding more in another. It's generally easier to design your project so that you don't need to do this, though. If you do want to use the trade-off options, you'll need to do some fairly involved calculations. Take a look at Code subsection 9.36.2.11.

AIRTIGHTNESS REQUIREMENTS

See subsections 9.36.2.9 and 9.36.2.10 of the National Building Code for specifics and to ensure your project complies.

Minimizing air leakage is an important part of making sure your house or building is energy efficient, healthy and comfortable. The two main approaches to air leakage compliance available are:

1. Prescriptive (individual items need to be properly air sealed), or
2. Testing (the air barrier is tested on site after construction).

No matter which option you choose, you'll need to make sure that:

1. The air barrier is continuous
2. Windows, doors and skylights comply with minimum air leakage requirements listed in standards AAMA/WDMA/CSA 101/I.S.2/A440 and CSA A440S1
3. Any vehicular access doors in heated garages are weatherstripped around their perimeters
4. All fireplaces have doors, enclosures or other devices to prevent air leakage through the chimney when not in use
5. The air barrier material's locations conform to Code subsection 9.25.5

TECH TIP:

Most builders will choose the prescriptive compliance pathway for air leakage, but it can still be a good idea to have your air barrier installation tested from time to time to see how it's actually performing once the build is complete.

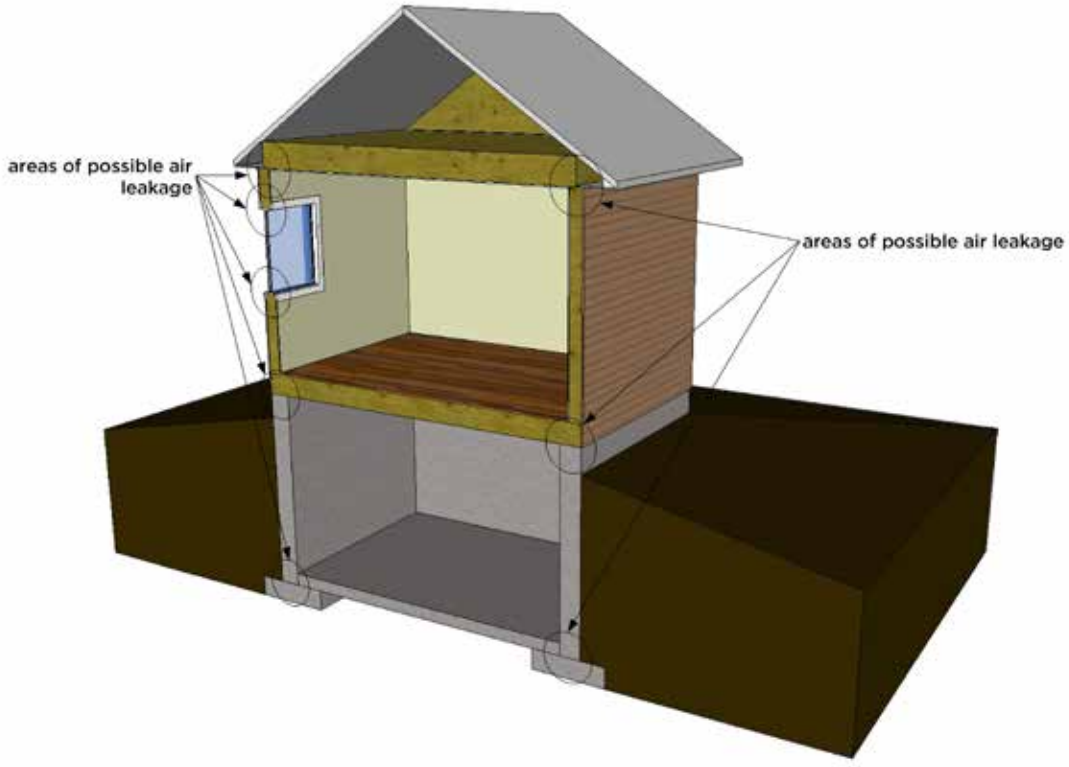
If you're following the prescriptive pathway to air leakage compliance, you'll need to meet 17 requirements. These requirements aren't difficult to meet – they're really just the basics of best-practice air sealing. Because air sealing techniques vary by construction type, it's best to check the Code for specifics. In general these requirements address:

- Rigid panel-type air barrier techniques
- Timber log air barrier techniques
- Sheet material air barrier techniques
- Sealant choices
- Electrical wiring penetrations
- Joints between building envelope assemblies, like walls and floors
- Joints between windows and walls
- Cantilevered floors
- Connections between interior and exterior walls
- Chimney and other roof penetrations, like plumbing stacks
- Areas where ducts penetrate the building envelope, like the exhaust and supply ducts for an HRV
- Party walls

Section 3 contains a detailed air sealing checklist to help contractors, designers and inspectors ensure a project is meeting the minimum prescriptive Code requirements for airtightness.

TECH TIP:

Ensuring that the air barrier is continuous is one of the most important factors to consider when constructing a new building. Paying special attention to air leakage around electrical boxes, windows and wall penetrations is important. Fibreglass insulation stuffed in around windows is not an appropriate air sealing technique. In this photo Sylvester Crocker, St. John's Manager of Technical Services, points out proper air sealing techniques around an electrical box.



HEATING, VENTILATION AND AIR CONDITIONING REQUIREMENTS

After you've focused on getting your building envelope right, you'll need to make sure your heating, ventilation and air conditioning (HVAC) equipment meets Code requirements.

DUCTS

See subsection 9.36.3.2 of the National Building Code for specifics and to ensure your project complies.

Most designers and contractors agree that the best practice is to keep any ducts or plenums carrying conditioned air inside the thermal plane of the building envelope. By keeping ducts inside where it's warm, you won't hurt the efficiency of your ventilation and heating equipment and you'll improve the durability of your system.

If you do need to run ducts outside of the heated envelope you'll need to make sure:

1. That you seal all duct joints with appropriate materials (fabric-backed tape with rubber adhesives is *not* acceptable as a primary sealant), and

2. That all ducts (except for exhaust ducts leading directly outside, such as bathroom fan ducts) are insulated to the same level as is required for above-ground walls.

Insulating and sealing ducts helps prevent condensation. Condensation will affect both the efficiency and durability of your equipment.

WHAT ABOUT ROOF-TOP AIR HANDLERS?

Running ductwork outside of the thermal envelope is more common in small commercial buildings, where there are often roof-top air handlers. In most of these cases, however, there isn't exposed ductwork. If there is, designers and contractors need to ensure that the outside ductwork to these units is insulated to at least the same effective values as is required of the walls.

THE CODE MAKES AN EXCEPTION FOR RECTANGULAR DUCTS IN FLOORS?

This applies mainly to modular-home builders who need to transport their finished houses on public roads. Please consult the Code if you think this applies to your project.

AIR INTAKE AND OUTLET DAMPERS

See subsection 9.36.3.3 of the National Building Code for specifics and to ensure your project complies.

Dampers play an important role in minimizing the unnecessary entry of cold air into your building.

The National Building Code includes a number of requirements affecting dampers. The following two requirements apply except where air intakes and outlets on HRVs and other ventilation systems are designed to run continuously, and except where other regulations are in effect that do not permit dampers:

1. Every exhaust duct opening needs to have either:
   a. A motorized damper, or
   b. A gravity- or spring-operated backflow damper

2. Every outdoor air intake duct needs to have a motorized damper that remains in the "open" position if the damper fails.

TECH TIP:

It's best practice to keep your heating and cooling piping inside your building envelope.

SYSTEM PIPING

See subsection 9.36.3.4 of the National Building Code for specifics and to ensure your project complies

Properly designed and installed piping for heating and cooling systems is crucial. The energy efficiency requirements of the Code reinforce this.

In addition to requiring that piping for heating and cooling systems is properly designed and installed, the Code requires:

- That all piping for heating and air-conditioning systems be located within the plane of insulation (the building envelope), or be insulated to at least the levels required for above-ground walls.

High-temperature refrigerant piping, such as the piping that's found in air-source heat pump installations, is exempt from this requirement.

LOCATION OF HEATING AND AIR-CONDITIONING SYSTEMS

See subsection 9.36.3.5 of the National Building Code for specifics and to ensure your project complies.

This one's simple. The Code requires that you keep all heating and air-conditioning equipment inside the conditioned building envelope, unless the equipment is designated by the manufacturer to be installed outdoors or in unconditioned space. A typical air-conditioner is one example of a piece of equipment that's designed for outdoor use.

THERMOSTATS AND TEMPERATURE CONTROLS

See subsection 9.36.3.6 of the National Building Code for specifics and to ensure your project complies.

Making sure that the temperature controls on your heating and cooling systems work properly will help ensure these systems don't waste energy.

The energy efficiency section of the National Building Code includes a number of important requirements that will help make sure this is the case.

A few of the most important aspects of these Code requirements are:

1. Any thermostat installed must be able to activate the heating or cooling equipment when the temperature in the space fluctuates 0.5°C from the set-point.

2. If you have separate heating and cooling systems that are controlled by separate thermostats, you need to implement a means to prevent the controls from simultaneously calling for heating and cooling.

3. Thermostat controls need to be designed so that lowering the set-point temperature while in heating mode will not activate cooling to reach the lower set-point. The opposite is required for when the system is in cooling mode. The system needs to be designed so that raising the set-point while in cooling mode will not activate heating to reach the higher set-point.

4. Heating and cooling systems should be appropriately zoned to allow for either manual or automatic control.

Heat pumps provide building owners with an efficient way to heat and cool. Many heat pumps are equipped with supplementary resistance electric heaters. The Code includes two requirements that ensure there is no unnecessary use of these electric heaters:

1. Heat pumps with supplementary heaters need to have controls to prevent the supplementary heater operating when the heating load can be met by the heat pump alone. An exception is made for when the heat pump needs to operate in defrost mode.

2. Heat pumps that have a programmable thermostat need to have setback controls that prevent the activation of supplementary heat during the recovery from setback periods. This can be satisfied by:
    a. Installing an integrated separate exterior temperature sensor,
    b. Setting a gradually rising set-point,
    c. Installing controls, or a heat pump with controls, that "learn" when to start recovery mode based on stored data.

TECH TIP:

There are a number of heat pumps coming on the market that have "smarter" controls that "learn" when to start recovery and minimize the use of supplementary heaters.

HEATING AND COOLING IN OFFICE SPACES

It's more common for buildings like small offices to have both heating and cooling equipment installed. This situation is one example of where you'd want to make sure the cooling wasn't "fighting" against the heating system. The Code requires that a project like this have integrated controls that ensure the same space isn't being simultaneously heated and cooled.

When Teamsters Local 855 decided to build a new office building they realized that energy efficiency was important. Rick Gill, President of Local 855, says that with "the members building we simply wanted to lead by example... Investing in energy efficiency will pay off itself over the long term." Their new office

building includes such energy efficient features as south facing glazing, LED lighting with motion sensors and an energy efficient heat pump system with direct digital controls.

Jody Thompson, Construction Project Manager with Trane Atlantic, says that the direct digital controls system along with the energy efficient heat pumps allows them to improve building efficiency during operation through post-contract partnerships on projects like the Teamsters'. "We leverage trending data against the energy profile of a building to ensure that any potential waste is minimized via advanced programming techniques which will yield optimal comfort control while paralleling energy reduction strategies on the forefront of everyday use."

HUMIDIFICATION

See subsection 9.36.3.7 of the National Building Code for specifics and to ensure your project complies.

Most Part 9 buildings built in Newfoundland and Labrador don't have HVAC equipment with integrated humidification systems.

If you're planning a building with an HVAC system that is equipped with a humidification system, you'll need to make sure there is an automatic control device to maintain the humidity levels in the space.

AREAS WITH INDOOR POOLS AND HOT TUBS

See subsection 9.36.3.8 of the National Building Code for specifics and to ensure your project complies.

Heated humid air, like the air found in spaces that contain swimming pools or hot tubs, carries more energy than dry air of the same temperature. It is very important to make sure areas with indoor pools or hot tubs are properly designed. Higher humidity levels can pose a significant risk to the durability of your building. Most Part 9 buildings in Newfoundland and Labrador don't have indoor pools or hot tubs. Please consult the Code if you're building one with an indoor pool or hot tub.

VENTILATION SYSTEMS

Heat recovery ventilation systems (HRVs) aren't required by the energy efficiency requirements of the National Building Code, but it's still a good idea to install one. HRVs are now commonplace the in residential sector and most people looking at new houses or small buildings will expect one.

If you are installing an HRV, the Code requires that the HRV meet certain minimum performance requirements. HRV testing results can be found online at the Home Ventilating Institute (www.hvi.org). This organization maintains a Certified Home Ventilating Products Directory.

HEAT RECOVERY VENTILATION SYSTEMS

See subsection 9.36.3.9 of the National Building Code for specifics and to ensure your project complies.

The easiest way to make sure that your HRV meets the requirements of the Code is to make sure it's an ENERGY STAR certified HRV. All ENERGY STAR certified HRVs will meet the minimum requirements of the Code.

COMMERCIAL HRVs

Non-residential Part 9 buildings will more likely be using "commercial" HRV units. These units may not necessarily be ENERGY STAR certified. That doesn't mean they can't meet the Code's energy efficiency requirements. Instead, designers and contractors should look at the units' sensible recovery efficiency ratings. The system should have a sensible heat-recovery efficiency of:

- at least 60% at an outside air test temperature of 0°C for locations with a 2.5% January design temperature greater than or equal to –10°C, and
- at least 60% at an outside air test temperature of 0°C and at least 55% at an outside air test temperature of –25°C for locations with a 2.5% January design temperature less than –10°C.

MINIMUM EQUIPMENT EFFICIENCY

See subsection 9.36.3.10 of the National Building Code for specifics and to ensure your project complies.

The energy efficiency requirements of the Code include minimum performance ratings for heating and cooling equipment commonly installed in houses and small buildings. For a full list of equipment and minimum performance ratings see the Code. Below is a list of the most common pieces of equipment installed in Part 9 buildings, including their minimum performance ratings:

	Component or Equipment	Heating or Cooling Capacity	Minimum Performance
Heat Pump Equipment	Split system heat pumps	≤ 19 kW (64,800 BTU/hr)	SEER = 14.5 EER = 11.5 HSPF = 7.1
	Single-package system	≤ 19 kW (64,800 BTU/hr)	SEER = 14 EER = 14 HSPF = 7.0
	Open loop ground-source and water-source heat pumps	≤ 40 kW (136,485 BTU/hr)	Cooling COP ≥ 4.75, Heating COP ≥ 3.6
	Closed loop ground-source and water-source heat pumps		Cooling COP ≥ 3.93, Heating COP ≥ 3.1
	Direct-expansion ground-source heat pumps	≤ 21 kW (71,654 BTU/hr)	EER = 13.0 Heating COP = 3.1
Boilers and Furnaces	Electric boilers	≤ 88 kW (300,268 BTU/hr)	Must be equipped with automatic water temperature control
	Gas-fired boilers	≤ 88 kW (300,268 BTU/hr)	AFUE ≥ 90%
	Oil-fired boilers	≤ 88 kW (300,268 BTU/hr)	AFUE ≥ 85%
	Gas-fired warm-air furnaces	≤ 65.9 kW (224,860 BTU/hr)	AFUE ≥ 92%
	Oil-fired warm-air furnaces	≤ 66 kW (225,201 BTU/hr)	AFUE ≥ 85%
Stoves and Fireplaces	Gas-fired fireplaces and stoves	all	Have a sealed, direct-vent and a pilot on-demand, interrupted or intermittent ignition system without a standing pilot light
	Solid-fuel-burning space-heating equipment (fireplaces, stoves, inserts, etc.)	all	Be either EPA certified or meet CSA B415.1 standards

TECH TIP:

In addition to choosing an energy efficient heating/cooling system, you'll want to make sure the system is properly sized and designed for your space. Installers of heating/cooling systems should be using room-by-room load calculations to size equipment properly. The rule of thumb just doesn't work.

WHAT DO ALL THE ABBREVIATIONS STAND FOR?

There are a lot of abbreviations used when talking about the performance of heating and cooling systems. Here are a few of the more common ones, what they stand for and when they're used:

AFUE

Annual Fuel Utilization Efficiency is used to express the performance of combustion appliances like oil furnaces and boilers. A higher AFUE is better.

COP

Coefficient Of Performance is usually used to describe the efficiency of heat pumps. A higher COP is better.

EER

The *Energy Efficiency Ratio* expresses the cooling performance of heat pumps and air conditioners. A higher EER is better.

SEER

The *Seasonal Energy Efficiency Ratio* expresses the cooling performance of heat pumps and air conditioners. A higher SEER is better.

HSPF

The *Heating Season Performance Factor* expresses the heating performance of heat pumps. A higher HSPF is better.

SERVICE HOT WATER

HOT WATER HEATING EQUIPMENT EFFICIENCY

See subsection 9.36.4.2 of the National Building Code for specifics and to ensure your project complies.

Approximately 20% of residential energy use goes towards heating hot water. As we improve the insulation in buildings, and the heating requirements drop, hot water energy usage becomes a bigger piece of the pie. The National Building Code includes minimum performance requirements for hot water heating systems. The Code also requires that all hot water equipment is installed in a conditioned space, unless components are required to be installed outdoors.

The Code includes performance requirements for a wide variety of system types. Below are some of the most common system types and the minimum performance requirements:

ELECTRIC HOT WATER HEATER TANKS WITH INPUT LESS THAN 12 KW (MOST ELECTRIC HOT WATER TANKS)

Electric hot water heater tanks must meet maximum standby loss requirements. Standby loss numbers are provided by manufacturers for their hot water heaters. Standby loss is the amount of heat lost to the surrounding air from the water in the tank. It is measured in watts (W). The Code uses an equation that depends on where the tank's inlet is located and what size it is. We've simplified things a bit to create the table below for common hot water heater sizes.

Rated Storage Capacity in Litres (imperial gallons)	Maximum Standby Loss (W) for Top Inlet Tank	Maximum Standby Loss (W) for Bottom Inlet Tank
114 L (25 imp gal)	57.8	62.8
136 L (30 imp gal)	62.2	67.2
182 L (40 imp gal)	71.4	76.4
272 L (60 imp gal)	89.9	94.9
364 L (80 imp gal)	133.3	138.3

STORAGE-TYPE OIL-FIRED HOT WATER HEATERS LESS THAN 104,070 BTU/HR (30.5 KW)

Most oil-fired hot water heaters fall into this category. Oil-fired hot water heaters are rated according to their Energy Factor (EF). A higher Energy Factor is better. Like electric hot water heaters, the minimum performance rating depends on the system's size. Here are some minimum ratings for common oil-fired storage hot water heaters:

Rated Storage Capacity in Litres (US gallons)	Minimum Energy Factor (EF)
121 L (32 US gal)	0.53
189 L (50 US gal)	0.50
227 L (60 US gal)	0.48

GAS-FIRED STORAGE HOT WATER HEATERS LESS THAN 75,067 BTU/HR (22 KW)

Most gas-fired storage hot water heaters will fall into this category. Like oil-fired hot water heaters, gas-fired hot water heaters are rated according to their Energy Factor. Here are some minimum ratings for common gas-fired storage hot water heaters:

Rated Storage Capacity in Litres (US gallons)	Minimum Energy Factor (EF)
121 L (32 US gal)	0.61
189 L (50 US gal)	0.58
227 L (60 US gal)	0.56

OTHER HOT WATER HEATERS

Here are some minimum performance requirements for other common hot water heaters:

Type	Performance Requirement
Tankless gas-fired	EF ≥ 0.8
Tankless electric	None
Tankless combined space and water heating system	Thermal Performance Factor = 0.65

PIPING FOR HOT WATER SYSTEMS

See subsection 9.36.4.4 of the National Building Code for specifics and to ensure your project complies.

After you've made sure your hot water heater meets the minimum Code requirements, you'll want to turn your attention to your system design. How you design your hot water system has a significant impact on the system's energy efficiency. One of the easiest ways to ensure your hot water system is as energy efficient as possible is to insulate the hot water pipes on either side of your storage tank.

The Code requires that:

1. The first 8 ft (2 m) of outlet and inlet piping from a storage tank is insulated with piping insulation that is at least 0.5" (12 mm) thick

2. All piping that is part of a recirculating loop is insulated with piping insulation that is at least 0.5" (12 mm) thick

3. Any piping that is part of the hot water system that is located outside the building envelope or in unconditioned space is insulated to the same level as is required for above-ground walls

TECH TIP:

When insulating pipes, make sure to pay special attention to the elbows where the pipe bends. Cutting the pipe insulation at 45 degrees so that it fits snugly on a 90 degree bend will ensure that the pipe is better insulated. Taping the pipe insulation joints with an appropriate tape will also help minimize heat loss.

CONTROLS

See subsection 9.36.4.5 of the National Building Code for specifics and to ensure your project complies.

Like your space heating or cooling system, you want to be able to control your hot water heater.

The Code requires that any storage tank hot water heater has an automatic temperature control capable of adjusting the temperature of the water.

SOLAR THERMAL SYSTEMS AND SOLAR DOMESTIC HOT WATER SYSTEMS

See subsections 9.36.3.11 and 9.36.4.3 of the National Building Code for specifics and to ensure your project complies.

Solar thermal systems can be a good way to reduce both your space and water heating needs. Systems need to be properly designed to make sure they work optimally. The Code requires that:

1. All solar thermal and solar domestic hot water systems conform to manufacturer's design requirements and installation procedures and be installed in accordance with the National Plumbing Code

2. Any hot water storage tanks associated with these solar systems be installed in conditioned space

INDOOR SWIMMING POOL CONTROLS

See subsection 9.36.4.5 of the National Building Code for specifics and to ensure your project complies.

It takes a lot of energy to heat a swimming pool. To make sure this is done in the most energy-efficient way, and so that you don't heat the swimming pool when you don't need to, the Code requires that:

1. Indoor swimming pool heaters have a readily accessible and clearly labelled thermostat that allows the heater to be shut off without adjusting the thermostat setting

2. Pumps and heaters for indoor swimming pools have timers or other controls that can be set to automatically turn them off when they're not needed

PERFORMANCE COMPLIANCE

See Division B subsection 9.36.5 and Division C subsection 2.2.8 of the National Building Code for specifics and to ensure your project complies.

The performance compliance pathway will most likely be used exclusively by single-detatched houses. This is because the Code requires that all non-residential buildings and residential buildings with over 20% common space use the prescriptive pathway.

The performance compliance pathway is about showing that the house you're building is as energy efficient as, or more energy efficient than, a similar house modelled to the prescriptive requirements. To demonstrate this, you will need to complete an energy model for two houses:

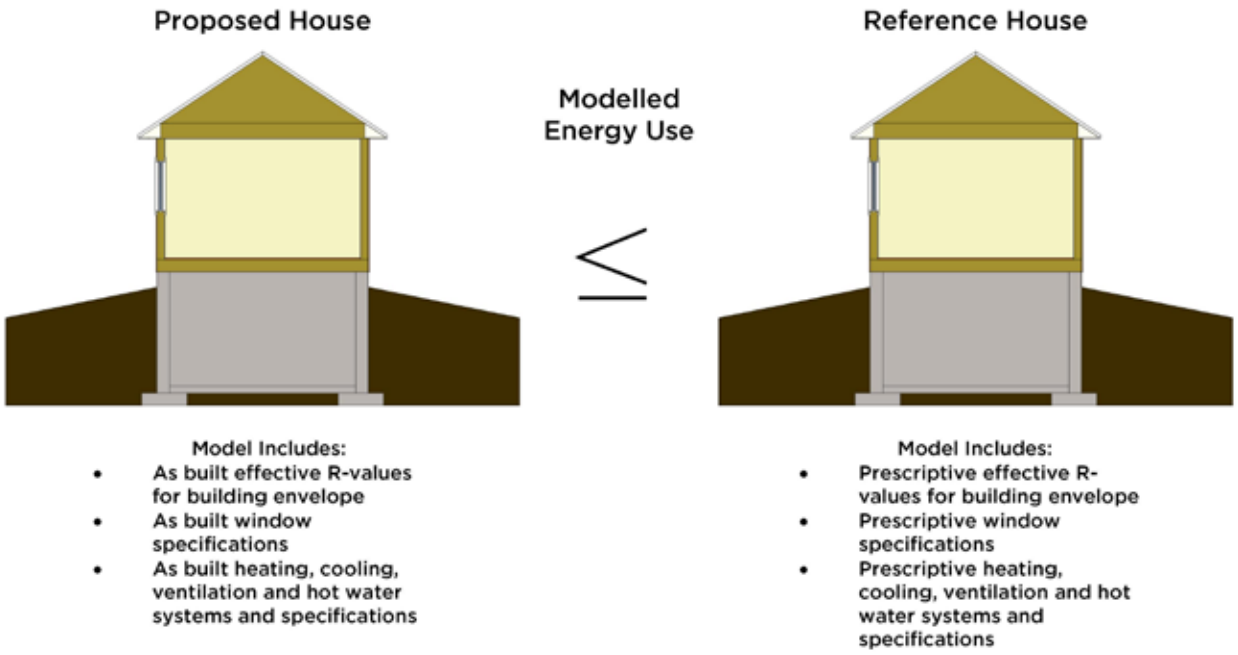
1. The one that you're planning to build – referred to in the Code as the "proposed house," and

2. A fictional house, based on the geometry and location of the proposed house, but using the Code's prescriptive requirements for all components and systems. In the Code this house is referred to as the "reference house."

If the modelled energy performance of the proposed house is equal to or less than the modelled energy performance of the reference house, then your house is compliant with the Code's energy efficiency requirements.

To demonstrate compliance under the performance pathway, you'll need to produce a report that details the results of your energy modelling and provides some basic information on your proposed house. This report is called a "Home Performance Compliance Calculation Report."

It's important to remember that this report only shows compliance with the energy efficiency requirements of the Code. It's not an indication of the home's comfort, durability or quality. These important factors rely on good design and construction!

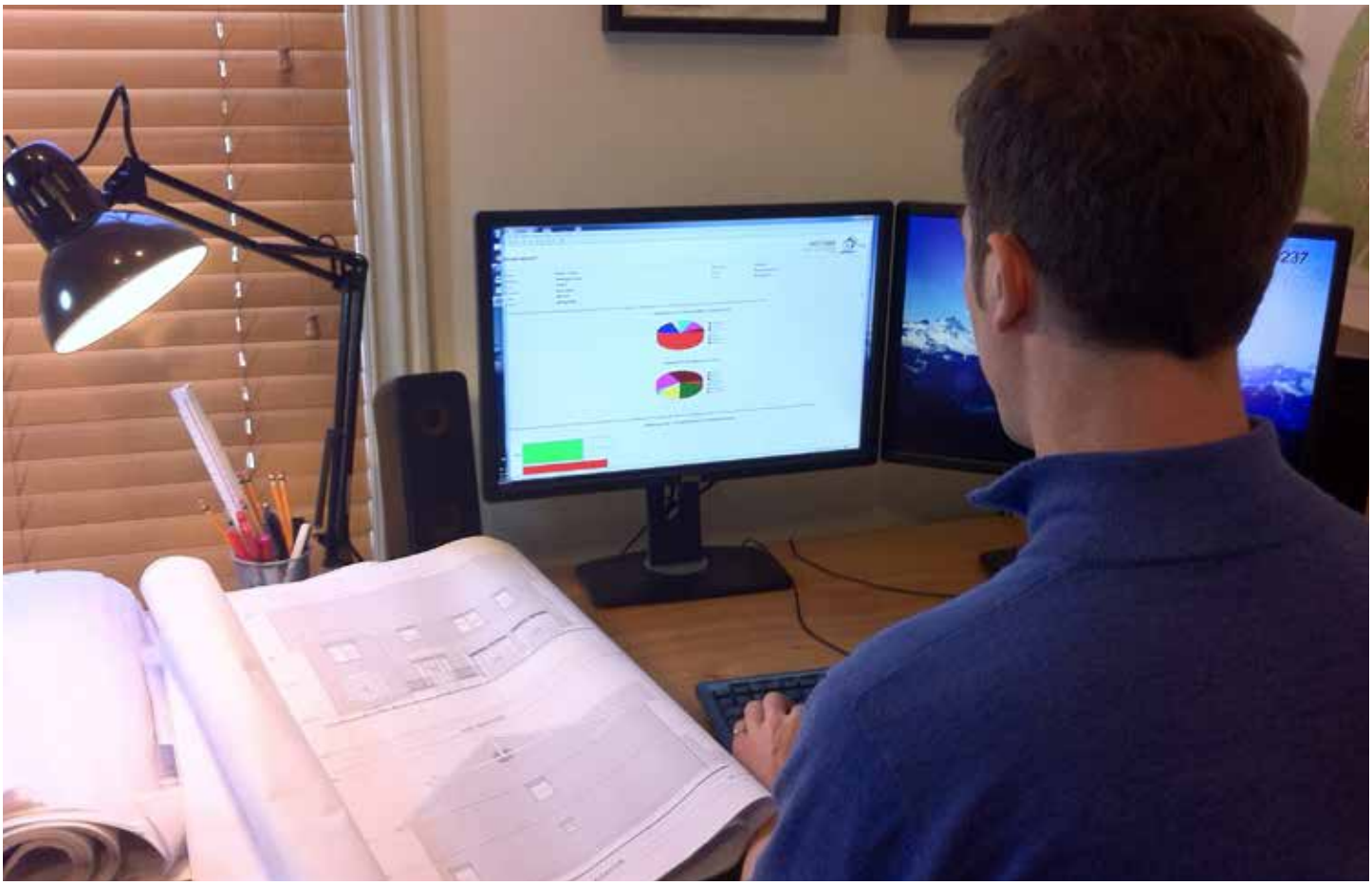


THIS ALL SOUNDS A LITTLE COMPLICATED... WHAT TOOLS ARE AVAILABLE TO PRODUCE CODE COMPLIANCE REPORTS?

You can use any tool as long as it's capable of modelling the proposed house and reference house as required by the Code. The Code doesn't specify or require you to use any particular tool or software. You can even do the calculations by hand – but it'll take you a really long time.

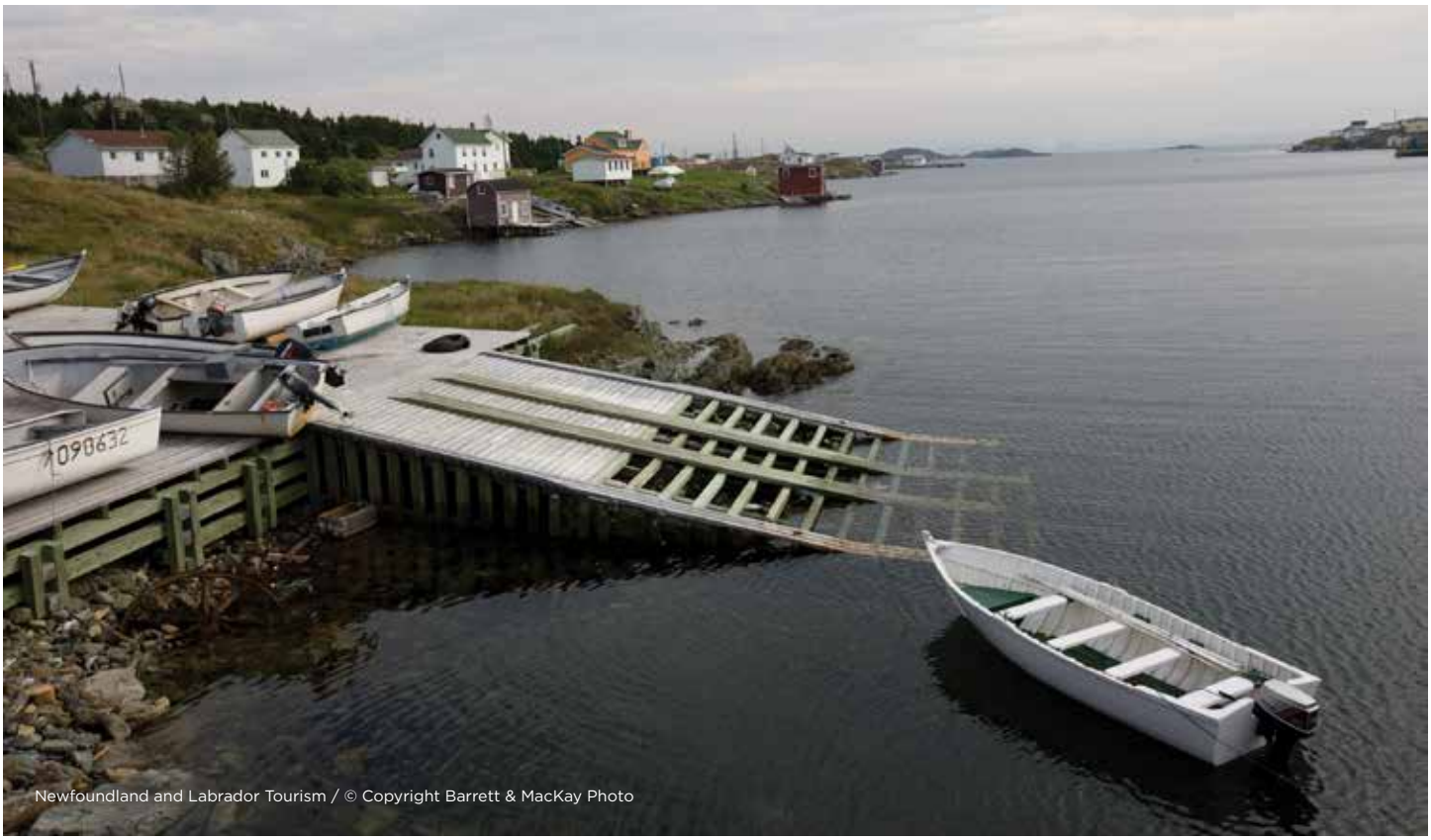
Practically speaking, the most common tool available at this point to do Code compliance runs is HOT2000. This free software program is developed by Natural Resources Canada to model the energy efficiency of houses. It's also the program used to rate houses on the EnerGuide scale. Remember though – an EnerGuide rating does not demonstrate compliance.

HOT2000 requires some skills to use, and although not strictly necessary, you may want to hire an energy modeller to do your Code compliance runs.



SECTION 3

CHECKLISTS



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CHECKLISTS

This section includes checklists that you can use to help you evaluate your project against the Code's energy efficiency requirements. Keep in mind that these checklists are for use with the prescriptive pathway for buildings with heat recovery systems. Also remember that "meeting" the requirements of the checklists doesn't necessarily mean that your project meets all the energy efficiency requirements of the Code. While these checklists will help you determine if you're on the right track, it's always best to consult the Code for all of the requirements. The checklists are by no means a replacement for the Code.

The following is a brief summary of how you can use the three checklists included in this Guide:

1. Airtightness Checklist – This checklist is designed to help you verify that your construction meets the airtightness requirements of the Code. Use it as a guideline to double-check your construction details.

2. Mechanical Performance Checklist – This checklist is designed to help you verify that your building's mechanical equipment meets the minimum performance requirements of the Code. It also provides you with a concise way to list the sizes and performance specifications of your building's installed equipment.

3. Prescriptive Pathway Building Envelope Checklist – This checklist is designed to help you verify your building's envelope design and construction against the minimum Code requirements for effective insulation and window/door/skylight performance. There's one of these checklists for each zone (Zone 6, 7a, 7b & 8). Make sure you're using the right checklist for your zone!

AIRTIGHTNESS CHECKLIST

Use the following checklist to double-check your project's construction and air sealing against some of the most important requirements of the Code.

1. PROJECT CHARACTERISTICS	
Climate Zone:	[ ] Zone 6 [ ] Zone 7a [ ] Zone 7b [ ] Zone 8
Building Type:	[ ] Single Detached House [ ] Semi-Detatched House [ ] Part 9 MURB [ ] Part 9 Commercial [ ] Part 9 Industrial Building
Building Address:	
Name of Builder/Contractor:	

2. UNIQUE BUILDING CHARACTERISTICS

The following conditions often call for special air sealing measures. Use this section of the checklist to double-check to see if your project includes any of these special situations. If so, you'll want to make sure they're adequately air sealed.

Does your project include any of the following?	**Yes**	**No**
Recessed light fixtures in ceilings with air barriers (i.e. ceilings below attics or cathedral ceilings)?		
Cantilevered floors or floors over unheated areas (eg. garages)?		
Knee walls?		
Party walls?		
Insulated concrete form (ICF) construction?		

3. AIRTIGHTNESS CHECKLIST

The following are some important air sealing measures that should be implemented in all projects, where applicable. The measures form the basis of the prescriptive Code requirements.

Is the following true for your project?		**Yes**	**No**	**N/A**
If the air barrier system includes rigid-panel-type material, are all joints sealed?				
If the air barrier system includes flexible sheet material (i.e. poly), are all joints:				
AND	Lapped at least 2 inches (50 mm)?			
	Sealed with a non-hardening sealant (i.e. acoustic sealant)?			
	Structurally supported (eg. fall on a stud or plate)?			
Are all outlets constructed airtight?				
Are all switches constructed airtight?				
Are all recessed light fixtures in ceilings under attics or cathedral ceilings constructed airtight?				

3. AIRTIGHTNESS CHECKLIST continued...				
Is the following true for your project?		**Yes**	**No**	**N/A**
Are all joints between the foundation wall and the sill plate constructed airtight?				
Are all joints between the sill plate and the rim joist constructed airtight?				
Are all joints between the rim joist and the subfloor constructed airtight?				
Are you using AAMA/WDMA/CSA 101/I.S.2/A440 NAFS - North American Fenestration Standard rated windows and doors (these doors and windows meet minimum air leakage requirements)?				
Are all connections between windows, doors and skylights and walls/ceilings sealed using appropriate material (i.e. tape, low-expansion spray-foam, etc.)?				
Are all joints between interior partition walls and exterior walls sealed?				
Do all fireplaces have doors, or enclosures to prevent air movement through the chimney when not in use?				
Are all ducts and vents that penetrate the building envelope/air barrier sealed appropriately?				
If your project has cantilevered floors or floors over unheated spaces:				
OR	Are all joints/junctions sealed between the structural components?			
	Does air barrier material cover structural components and is it sealed to adjacent material?			
If your project has knee walls (often present with half-stories):				
AND	Are joints between knee wall and adjacent assemblies sealed (i.e. knee wall and attic floor and knee wall and sloped ceiling)?			
	Is knee wall air barrier continuous?			
If your project includes party walls, are all areas where the party wall meets the plane of airtightness air sealed?				
If your project includes ICF and the concrete in the form acts as the air barrier, is the air barrier continuous where the concrete meets other air barrier materials (i.e. at window bucks, wall/ceiling interfaces, etc.)?				
For your whole project:				
AND	Is the air barrier continuous?			
	Are all air barrier materials free of holes and cracks?			

PRESCRIPTIVE PATHWAY MECHANICAL PERFORMANCE CHECKLIST

Use the following checklist to double-check your project's construction and air sealing against some of the most important requirements of the Code.

1. PROJECT CHARACTERISTICS	
Climate Zone:	[ ] Zone 6 [ ] Zone 7a [ ] Zone 7b [ ] Zone 8
Building Type:	[ ] Single Detached House [ ] Semi-Detatched House [ ] Part 9 MURB [ ] Part 9 Commercial [ ] Part 9 Industrial Building
Building Address:	
Name of Builder/Contractor:	

2. VENTILATION SYSTEM

This section of the checklist is designed to help you verify your project's ventilation system performance against the performance required by the Code:

1. Determine the type of ventilation system you have (HRV, ERV, or ventilation system without heat recovery).
2. If your project includes a ventilation system that has heat recovery (either an HRV or ERV) verify the system's performance specifications against the Code requirements.

System Details

System Type:	[ ] HRV [ ] ERV [ ] Ventilation without Heat Recovery
Manufacturer:	
Model:	

Heat/Energy Recovery System Performance Characteristics		Specification	Code Requirements	Code Compliant?
AND	Sensible heat-recovery efficiency at 0°C?		60%	
	Sensible heat-recovery efficiency at -25°C?		55%	
OR	Is your HRV/ERV ENERGY STAR certified?		Not required	

3. HEATING/COOLING SYSTEMS

This section of the checklist is designed to help you verify your project's heating/cooling systems' performance against the performance required by the Code. The form has room for up to three systems. Use the following approach:

1. Determine the number and type of systems (boiler, furnace, heat pump, etc.) you have in your project.
2. Write the system details on the form (type, manufacturer, model and size).
3. Determine the Code's performance requirements for each system (using the Guide) and write the requirements on the form.
4. Write your systems' performance specifications on the form and verify against the Code requirements.

1	**System # 1 Details**			
	System Type:			
	Manufacturer:			
	Model:			
	Size:			
	System # 1 Performance Specifications			
	Rating (HSPF, SEER, COP, AFUE, etc.)	Specification	Code Requirement	Code Compliant?
2	**System # 2 Details**			
	System Type:			
	Manufacturer:			
	Model:			
	Size:			
	System # 2 Performance Specifications			
	Rating (HSPF, SEER, COP, AFUE, etc.)	Specification	Code Requirement	Code Compliant?
3	**System # 3 Details**			
	System Type:			
	Manufacturer:			
	Model:			
	Size:			
	System # 3 Performance Specifications			
	Rating (HSPF, SEER, COP, AFUE, etc.)	Specification	Code Requirement	Code Compliant?

4. HOT WATER SYSTEMS

This section of the checklist is designed to help you verify your project's hot water systems' performance against the performance required by the Code. The form has room for up to three systems. Use the following approach:

1. Determine the number and type of systems (electric tank, electric boiler, heat pump, etc.) you have in your project.
2. Write the system details on the form (type, manufacturer, model and size).
3. Determine the Code's performance requirements for each system (using the Guide) and write the requirements on the form.
4. Write your systems' performance specifications on the form and verify against the Code requirements.

1	**System # 1 Details**			
	System Type:			
	Manufacturer:			
	Model:			
	Size:			
	System # 1 Performance Specifications			
	Rating Type (EF, Standby Loss, etc.)	Specification	Code Requirement	Code Compliant?
2	**System # 2 Details**			
	System Type:			
	Manufacturer:			
	Model:			
	Size:			
	System # 2 Performance Specifications			
	Rating Type (EF, Standby Loss, etc.)	Specification	Code Requirement	Code Compliant?
3	**System # 3 Details**			
	System Type:			
	Manufacturer:			
	Model:			
	Size:			
	System # 3 Performance Specifications			
	Rating Type (EF, Standby Loss, etc.)	Specification	Code Requirement	Code Compliant?

PRESCRIPTIVE PATHWAY BUILDING ENVELOPE CHECKLISTS

Included in this subsection are four Prescriptive Pathway Building Envelope Checklists, one for each climate zone. Make sure that you choose the checklist that corresponds to your zone.

You'll also find below a summary of the building assemblies and corresponding effective insulation values that are listed earlier in the Guide. You can use this summary to help you quickly fill out the checklist by referencing the assembly's code and using the effective insulation values listed in the summary. If you're using assemblies not found in the Guide you'll need to determine the effective insulation values on your own and list them along with a description of the assembly on the checklist.

SUMMARY OF GUIDE ASSEMBLIES

Use this summary of the Guide's building assemblies to help you fill out the Prescriptive Pathways Building Envelope Checklist. If you're using assemblies that aren't in the Guide you'll need to determine the effective insulation values for those assemblies before filling out the Checklist. Remember the Guide's assemblies are measured against the Code requirements for buildings with heat recovery systems. If your project doesn't include heat recovery please consult the Code to verify that your assemblies meet the requirements.

Assembly Code	Description	Effective RSI	Effective R-Value	Zones Where Compliant
Ceilings Below Attic				
CBA-01	2x4 manufactured trusses, 24" on centre, 1/2" gypsum board, 15" of blown cellulose insulation	9.36	53.15	Zone 6, Zone 7a
CBA-02	2x4 manufactured trusses, 24" on centre, 1/2" gypsum board, R-31 fibreglass batt insulation, R-20 fibreglass batt insulation	8.88	50.44	Zone 6, Zone 7a
CBA-03	2x4 manufactured trusses, 24" on centre, 1/2" gypsum board, 17" of blown cellulose insulation	10.63	60.36	Zone 6, Zone 7a, Zone 7b, Zone 8
CBA-04	2x4 manufactured trusses, 24" on centre, 1/2" gypsum board, R-31 fibreglass batt insulation, R-31 fibreglass batt insulation	10.84	61.55	Zone 6, Zone 7a, Zone 7b, Zone 8
Ceilings Without Attic (Cathedral Ceilings/Flat Roofs)				
CCFR-01	2x12 solid lumber, 16" on centre, R-31 nominal fibreglass batt, 1/2" gypsum	4.93	27.99	Zone 6
CCFR-02	12" trusses, 24" on centre, R-28 nominal fibreglass batt, 1/2" gypsum	4.90	27.82	Zone 6
CCFR-03	2x12 wood framing, 24" on centre, R-31 nominal fibreglass batt, 1/3" gypsum	5.09	28.90	Zone 6, Zone 7a, Zone 7b, Zone 8
CCFR-04	12" trusses, 16" on centre, R-31 nominal fibreglass batt, 1/2" gypsum	5.19	29.47	Zone 6, Zone 7a, Zone 7b, Zone 8
CCFR-05	12" trusses, 24" on centre, R-31 nominal fibreglass batt, 1/2" gypsum	5.34	30.32	Zone 6, Zone 7a, Zone 7b, Zone 8
CCFR-06	150mm polyisocyanurate insulation over metal roof deck	5.50	31.25	Zone 6, Zone 7a, Zone 7b, Zone 8

SUMMARY OF GUIDE ASSEMBLIES CONTINUED...

Assembly Code	Description	Effective RSI	Effective R-Value	Zones Where Compliant
	Above Grade Walls			
AGW-01	2x6 wood frame, 16" on centre, R-22 fibreglass batt nominal cavity insulation, 7/16" oriented strand board (OSB) sheathing, 1/2" gypsum board, vinyl siding	3.00	17.03	Zone 6 Zone 7a
AGW-02	152mm (6") metal stud, 406mm (16") on centre, 3.5 RSI (R-19) glass fibre batt cavity insulation, 50mm (2") mineral wool continuous insulation, 16mm (0.625") exterior gypsum board, 16mm (0.625") interior gypsum board, 90mm (4") brick cladding, 25mm (1") air space	2.99	17.01	Zone 6 Zone 7a
AGW-03	insulated tilt up sandwich panel, 76mm (3") exterior concrete, 76mm (3") extruded polystyrene, 152mm (6") interior concrete	2.98	16.95	Zone 6 Zone 7a
AGW-04	2x6 wood frame, 16" on centre, R-19 fibreglass batt nominal cavity insulation, 5/8" Type 2 expanded polystyrene (EPS) rigid insulation, 7/16" oriented strand board (OSB) sheathing, 1/2" gypsum board, vinyl siding	3.25	18.45	Zone 6 Zone 7a Zone 7b Zone 8
AGW-05	2x6 wood frame, 16" on centre, R-24 fibreglass batt nominal cavity insulation, 7/16" oriented strand board (OSB) sheathing, 1/2" gypsum board, vinyl siding	3.11	17.65	Zone 6 Zone 7a Zone 7b Zone 8
AGW-06	4" insulated concrete form (ICF) block wall, vinyl siding, 1/2" gypsum board	3.75	21.30	Zone 6 Zone 7a Zone 7b Zone 8
AGW-07	152mm (6") metal stud, 600mm (24") on centre, 3.5 RSI (R-19) glass fibre batt cavity insulation, 50mm (2") mineral wool continuous insulation, 16mm (0.625") exterior gypsum board, 16mm (0.625") interior gypsum board, 90mm (4") brick cladding, 25mm (1") air space	3.33	18.93	Zone 6 Zone 7a Zone 7b Zone 8
AGW-08	203mm (8") concrete block, 50mm (2") polyisocyanurate continuous insulation, 152mm (6") metal stud, 600mm (24") on centre, 2.11 RSI (R12) glass fibre cavity insulation, 12.7mm (0.5") interior gypsum board, 90mm (4") brick cladding, 25mm (1") air space	3.33	18.93	Zone 6 Zone 7a Zone 7b Zone 8
AGW-09	insulated precast concrete panel, 100mm (4") exterior concrete, 127mm (5") expanded polystyrene, 100mm (4") interior concrete	3.91	22.22	Zone 6 Zone 7a Zone 7b Zone 8
AGW-10	insulated precast concrete panel, 100mm (4") exterior concrete, 76mm (3") expanded polystyrene, 100mm (4") interior concrete, 152mm (6") metal stud, 600mm (24") on centre, RSI 2.7 (R 15.4) sprayed closed cell polyurethane foam, 12.7mm (0.5") interior gypsum board	3.45	19.61	Zone 6 Zone 7a Zone 7b Zone 8
AGW-11	insulated tilt up sandwich panel, 76mm (3") exterior concrete, 100mm (4") extruded polystyrene, 152mm (6") interior concrete	3.91	22.22	Zone 6 Zone 7a Zone 7b Zone 8

SUMMARY OF GUIDE ASSEMBLIES CONTINUED...

Assembly Code	Description	Effective RSI	Effective R-Value	Zones Where Compliant
Floors Over Unheated Spaces				
FOUS-01	2x12 solid lumber, 16" on centre, R-31 nominal fibreglass batt, 1/2" plywood	5.08	28.84	Zone 6, Zone 7a, Zone 7b, Zone 8
FOUS-02	12" trusses, 16" on centre, R-31 nominal fibreglass batt, 1/2" plywood	5.34	32.32	Zone 6, Zone 7a, Zone 7b, Zone 8
Foundation Walls				
FW-01	8" cast-in-place concrete foundation, 1.5" Type 2 expanded polystyrene (EPS) rigid foam insulation, 2x4 wood frame wall, 24" on centre, R-12 nominal fibreglass insulation, 1/2" gypsum board	3.06	17.37	Zone 6, Zone 7a, Zone 7b, Zone 8
FW-02	8" cast-in-place concrete foundation, R-12 nominal fibreglass insulation, 2x4 wood frame wall, 24" on centre, R-12 nominal fibreglass insulation, 1/2" gypsum board	4.11	23.33	Zone 6, Zone 7a, Zone 7b, Zone 8
FW-03	8" cast-in-place concrete foundation, R-20 blanket insulation	3.73	21.18	Zone 6, Zone 7a, Zone 7b, Zone 8
FW-04	insulated concrete form (ICF) block foundation wall, 1/2" gypsum board	3.75	21.30	Zone 6, Zone 7a, Zone 7b, Zone 8
Unheated Basement Floor Above Frost Line				
UHF-01	2" of extruded polystyrene (XPS) on the exterior of the foundation wall down to the footing	1.98	11.24	Zone 6, Zone 7a, Zone 7b, Zone 8
UHF-02	2.5" of extruded polystyrene (XPS) under the slab extending at least 4 ft (1.2 m) in from the perimeter and 1.5" of extruded polystyrene (XPS) as a thermal break between the slab and the foundation wall or footing	2.42	13.74	Zone 6, Zone 7a, Zone 7b, Zone 8
UHF-03	2.5" of extruded polystyrene (XPS) under the slab extending at least 4 ft (1.2 m) down or to the footing and 1.5" of extruded polystyrene (XPS) as a thermal break between the slab and the foundation wall or footing	2.42	13.74	Zone 6, Zone 7a, Zone 7b, Zone 8
Heated Basement Slab				
HF-01	2.5" of extruded polystyrene (XPS) foam under slab	2.42	13.74	Zone 6
HF-02	3" of extruded polystyrene (XPS) foam under slab	2.87	13.74	Zone 6, Zone 7a, Zone 7b, Zone 8
Slabs-On-Grade with Integral Footing				
SOG-01	2" of extruded polystyrene (XPS) foam under slab	1.98	13.74	Zone 6
SOG-02	3" of extruded polystyrene (XPS) foam under slab	2.87	16.30	Zone 6, Zone 7a, Zone 7b
SOG-03	4" of extruded polystyrene (XPS) foam under slab	3.76	21.35	Zone 6, Zone 7a, Zone 7b, Zone 8

Zone 6

ZONE 6 - PRESCRIPTIVE PATHWAY BUILDING ENVELOPE CHECKLIST FOR PROJECTS WITH HEAT RECOVERY VENTILATION

1. PROJECT CHARACTERISTICS	
Climate Zone:	Zone 6
Building Type:	[ ] Single Detached House [ ] Semi-Detatched House [ ] Part 9 MURB [ ] Part 9 Commercial [ ] Part 9 Industrial Building
Building Address:	
Name of Builder/Contractor:	

2. WINDOWS, DOORS AND SKYLIGHTS

This section of the checklist is designed to help you verify your project's windows, doors and skylights against the energy performance requirements of the Code. Use the following approach to fill out this section of the checklist:

1. Collect the performance specifications for your windows/doors/skylights (U-values, ERs and ENERGY STAR qualifications), and
2. Check your performance specifications against the Code requirements for your climate zone using the questions below.

Window and Door Characteristics		Code Requirements	Yes/No/ NA?	Code Compliant?
Are all your windows and doors tested in accordance with CSA A440 or NFRC 100? Most commerical windows and doors are. If not, you'll need to follow the Code requirements for site built windows/doors (see Code Table 9.36.2.7.C).		NA		NA
OR	Do all windows and doors have U-values less than:	1.60		
	Do all windows and doors have energy ratings (ER) more than:	25		
	Are all windows and doors ENERGY STAR certified for the following zone:	Zone 1		
Skylight Characteristics				
If your project has skylights, do all skylights have U-values less than:		2.70		

3. ZONE 6 OPAQUE BUILDING ENVELOPE ASSEMBLIES

This section of the checklist is designed to help you verify your project's building assemblies' effective insulation values against the effective insulation values required by the Code. Use the following approach to fill out this section of the checklist:

1. For each assembly type either: a) Choose the appropriate assembly from the Guide, or; b) Describe the assembly your project is using.
2. List either the assembly's effective RSI- or R-Value in the appropriate column (the assemblies in the Guide already have calculated effective insulation values).
3. Check to see that your assembly's effective insulation value is equal to or greater than the Code minimum.

Assembly Type	1) NL Guide Pre-Calculated Assembly Reference # Or Description of Assembly	2) Assembly RSI-Value	2) Assembly R-Value	3) Code Minimum Required Effective RSI	3) Code Minimum Required Effective R-Value
Ceilings Below Attic				8.67	49.23
Ceilings Without Attic (Cathedral Ceiling/Flat Roof)				4.67	26.52
Above Grade Walls				2.97	16.86
Floors over Unheated Spaces				4.67	26.52
Foundation Walls				2.98	16.92
Unheated Basement Floor Above Frost Line				1.96	11.13
Heated Basement Slab				2.32	13.17
Slabs-on-grade an integral footings				1.96	11.13
Other assembly (eg. skylight shafts, etc.)					
Other assembly (eg. skylight shafts, etc.)					
Other assembly (eg. skylight shafts, etc.)					

Zone 7a

ZONE 7A - PRESCRIPTIVE PATHWAY BUILDING ENVELOPE CHECKLIST FOR PROJECTS WITH HEAT RECOVERY VENTILATION

1. PROJECT CHARACTERISTICS	
Climate Zone:	Zone 7a
Building Type:	[ ] Single Detached House [ ] Semi-Detatched House [ ] Part 9 MURB [ ] Part 9 Commercial [ ] Part 9 Industrial Building
Building Address:	
Name of Builder/Contractor:	

2. WINDOWS, DOORS AND SKYLIGHTS

This section of the checklist is designed to help you verify your project's windows, doors and skylights against the energy performance requirements of the Code. Use the following approach to fill out this section of the checklist:

1. Collect the performance specifications for your windows/doors/skylights (U-values, ERs and ENERGY STAR qualifications), and
2. Check your performance specifications against the Code requirements for your climate zone using the questions below.

Window and Door Characteristics		Code Requirements	Yes/No/ NA?	Code Compliant?
Are all your windows and doors tested in accordance with CSA A440 or NFRC 100? Most commerical windows and doors are. If not, you'll need to follow the Code requirements for site built windows/doors (see Code Table 9.36.2.7.C).		NA		NA
OR	Do all windows and doors have U-values less than:	1.60		
	Do all windows and doors have energy ratings (ER) more than:	25		
	Are all windows and doors ENERGY STAR certified for the following zone:	Zone 1		
Skylight Characteristics				
If your project has skylights, do all skylights have U-values less than:		2.70		

3. ZONE 7A OPAQUE BUILDING ENVELOPE ASSEMBLIES

This section of the checklist is designed to help you verify your project's building assemblies' effective insulation values against the effective insulation values required by the Code. Use the following approach to fill out this section of the checklist:

1. For each assembly type either: a) Choose the appropriate assembly from the Guide, or; b) Describe the assembly your project is using.
2. List either the assembly's effective RSI- or R-Value in the appropriate column (the assemblies in the Guide already have calculated effective insulation values).
3. Check to see that your assembly's effective insulation value is equal to or greater than the Code minimum.

Assembly Type	1) NL Guide Pre-Calculated Assembly Reference # Or Description of Assembly	2) Assembly RSI-Value	2) Assembly R-Value	3) Code Minimum Required Effective RSI	3) Code Minimum Required Effective R-Value
Ceilings Below Attic				8.67	49.23
Ceilings Without Attic (Cathedral Ceiling/Flat Roof)				5.02	28.50
Above Grade Walls				2.97	16.86
Floors over Unheated Spaces				5.02	28.50
Foundation Walls				2.98	16.92
Unheated Basement Floor Above Frost Line				1.96	11.13
Heated Basement Slab				2.84	16.13
Slabs-on-grade with integral footings				2.84	16.13
Other assembly (eg. skylight shafts, etc.)					
Other assembly (eg. skylight shafts, etc.)					
Other assembly (eg. skylight shafts, etc.)					

Zone 7b

ZONE 7B - PRESCRIPTIVE PATHWAY BUILDING ENVELOPE CHECKLIST FOR PROJECTS WITH HEAT RECOVERY VENTILATION

1. PROJECT CHARACTERISTICS	
Climate Zone:	Zone 7b
Building Type:	[ ] Single Detached House [ ] Semi-Detatched House [ ] Part 9 MURB [ ] Part 9 Commercial [ ] Part 9 Industrial Building
Building Address:	
Name of Builder/Contractor:	

2. WINDOWS, DOORS AND SKYLIGHTS

This section of the checklist is designed to help you verify your project's windows, doors and skylights against the energy performance requirements of the Code. Use the following approach to fill out this section of the checklist:

1. Collect the performance specifications for your windows/doors/skylights (U-values, ERs and ENERGY STAR qualifications), and
2. Check your performance specifications against the Code requirements for your climate zone using the questions below.

Window and Door Characteristics		Code Requirements	Yes/No/ NA?	Code Compliant?
Are all your windows and doors tested in accordance with CSA A440 or NFRC 100? Most commerical windows and doors are. If not, you'll need to follow the Code requirements for site built windows/doors (see Code Table 9.36.2.7.C).		NA		NA
OR	Do all windows and doors have U-values less than:	1.40		
	Do all windows and doors have energy ratings (ER) more than:	29		
	Are all windows and doors ENERGY STAR certified for the following zone:	Zone 2		
Skylight Characteristics				
If your project has skylights, do all skylights have U-values less than:		2.40		

3. ZONE 7B OPAQUE BUILDING ENVELOPE ASSEMBLIES

This section of the checklist is designed to help you verify your project's building assemblies' effective insulation values against the effective insulation values required by the Code. Use the following approach to fill out this section of the checklist:

1. For each assembly type either: a) Choose the appropriate assembly from the Guide, or; b) Describe the assembly your project is using.
2. List either the assembly's effective RSI- or R-Value in the appropriate column (the assemblies in the Guide already have calculated effective insulation values).
3. Check to see that your assembly's effective insulation value is equal to or greater than the Code minimum.

Assembly Type	1) NL Guide Pre-Calculated Assembly Reference # Or Description of Assembly	2) Assembly RSI-Value	2) Assembly R-Value	3) Code Minimum Required Effective RSI	3) Code Minimum Required Effective R-Value
Ceilings Below Attic				10.43	59.22
Ceilings Without Attic (Cathedral Ceiling/Flat Roof)				5.02	28.50
Above Grade Walls				3.08	17.49
Floors over Unheated Spaces				5.02	28.50
Foundation Walls				2.98	16.92
Unheated Basement Floor Above Frost Line				1.96	11.13
Heated Basement Slab				2.84	16.13
Slabs-on-grade with integral footings				2.84	16.13
Other assembly (eg. skylight shafts, etc.)					
Other assembly (eg. skylight shafts, etc.)					
Other assembly (eg. skylight shafts, etc.)					

Zone 8

ZONE 8 - PRESCRIPTIVE PATHWAY BUILDING ENVELOPE CHECKLIST FOR PROJECTS WITH HEAT RECOVERY VENTILATION

1. PROJECT CHARACTERISTICS	
Climate Zone:	Zone 8
Building Type:	[ ] Single Detached House [ ] Semi-Detatched House [ ] Part 9 MURB [ ] Part 9 Commercial [ ] Part 9 Industrial Building
Building Address:	
Name of Builder/Contractor:	

2. WINDOWS, DOORS AND SKYLIGHTS

This section of the checklist is designed to help you verify your project's windows, doors and skylights against the energy performance requirements of the Code. Use the following approach to fill out this section of the checklist:

1. Collect the performance specifications for your windows/doors/skylights (U-values, ERs and ENERGY STAR qualifications), and
2. Check your performance specifications against the Code requirements for your climate zone using the questions below.

Window and Door Characteristics		Code Requirements	Yes/No/ NA?	Code Compliant?
Are all your windows and doors tested in accordance with CSA A440 or NFRC 100? Most commerical windows and doors are. If not, you'll need to follow the Code requirements for site built windows/doors (see Code Table 9.36.2.7.C).		NA		NA
OR	Do all windows and doors have U-values less than:	1.40		
	Do all windows and doors have energy ratings (ER) more than:	29		
	Are all windows and doors ENERGY STAR certified for the following zone:	Zone 2		
Skylight Characteristics				
If your project has skylights, do all skylights have U-values less than:		2.40		

3. ZONE 8 OPAQUE BUILDING ENVELOPE ASSEMBLIES

This section of the checklist is designed to help you verify your project's building assemblies' effective insulation values against the effective insulation values required by the Code. Use the following approach to fill out this section of the checklist:

1. For each assembly type either: a) Choose the appropriate assembly from the Guide, or; b) Describe the assembly your project is using.
2. List either the assembly's effective RSI- or R-Value in the appropriate column (the assemblies in the Guide already have calculated effective insulation values).
3. Check to see that your assembly's effective insulation value is equal to or greater than the Code minimum.

Assembly Type	1) NL Guide Pre-Calculated Assembly Reference # Or Description of Assembly	2) Assembly RSI-Value	2) Assembly R-Value	3) Code Minimum Required Effective RSI	3) Code Minimum Required Effective R-Value
Ceilings Below Attic				10.43	59.22
Ceilings Without Attic (Cathedral Ceiling/Flat Roof)				5.02	28.50
Above Grade Walls				3.08	17.49
Floors over Unheated Spaces				5.02	28.50
Foundation Walls				2.98	16.92
Unheated Basement Floor Above Frost Line				1.96	11.13
Heated Basement Slab				2.84	16.13
Slabs-on-grade with integral footings				3.72	21.12
Other assembly (eg. skylight shafts, etc.)					
Other assembly (eg. skylight shafts, etc.)					
Other assembly (eg. skylight shafts, etc.)					

APPENDICES

APPENDIX A – MUNICIPALITIES BY CLIMATE ZONE

CLIMATE ZONES Zone 6 | Zone 7a | Zone 7b | Zone 8

OFFICIAL NAME	CLIMATE ZONE
Admirals Beach	6
Anchor Point	7a
Appleton	6
Aquaforte	6
Arnold's Cove	6
Avondale	6
Badger	7a
Baie Verte	7a
Baine Harbour	6
Bauline	6
Bay Bulls	6
Bay de Verde	6
Bay L'Argent	6
Bay Roberts	6
Baytona	6
Beachside	7a
Bellburns	7a
Belleoram	6
Birchy Bay	7a
Bird Cove	7a
Bishop's Cove	6
Bishop's Falls	6
Bonavista	6
Botwood	6
Branch	6
Brent's Cove	7a
Brighton	7a
Brigus	6
Bryant's Cove	6
Buchans	7a
Burgeo	6
Burin	6
Burlington	7a
Burnt Islands	6
Campbellton	6
Cape Broyle	6
Cape St. George	6
Carbonear	6
Carmanville	7a
Cartwright	7b
Centreville-Wareham-Trinity	7a

OFFICIAL NAME	CLIMATE ZONE
Chance Cove	6
Change Islands	7a
Channel-Port aux Basques	6
Chapel Arm	6
Charlottetown (Labrador)	7b
Clarenville	6
Clarke's Beach	6
Coachman's Cove	7a
Colinet	6
Colliers	6
Come By Chance	6
Comfort Cove-Newstead	6
Conception Bay South	6
Conception Harbour	6
Conche	7a
Cook's Harbour	7a
Cormack	7a
Corner Brook	6
Cottlesville	6
Cow Head	7a
Cox's Cove	6
Crow Head	6
Cupids	6
Daniel's Harbour	7a
Deer Lake	7a
Dover	7a
Duntara	6
Eastport	6
Elliston	6
Embree	6
Englee	7a
English Harbour East	6
Fermeuse	6
Ferryland	6
Flatrock	6
Fleur de Lys	7a
Flower's Cove	7a
Fogo Island	7a
Forteau	7b
Fortune	6
Fox Cove-Mortier	6
Fox Harbour	6

CLIMATE ZONES Zone 6 | Zone 7a | Zone 7b | Zone 8

OFFICIAL NAME	CLIMATE ZONE
Frenchman's Cove	6
Gallants	6
Gambo	6
Gander	7a
Garnish	6
Gaskiers-Point La Haye	6
Gaultois	6
Gillams	6
Glenburnie-Birchy Head-Shoal Brook	6
Glenwood	6
Glovertown	6
Goose Cove East	7a
Grand Bank	6
Grand Falls-Windsor	6
Grand Le Pierre	6
Greenspond	7a
Hampden	7a
Hant's Harbour	6
Happy Adventure	6
Happy Valley-Goose Bay	7b
Harbour Breton	6
Harbour Grace	6
Harbour Main-Chapel's Cove-Lakeview	6
Hare Bay	7a
Hawke's Bay	7a
Heart's Content	6
Heart's Delight-Islington	6
Heart's Desire	6
Hermitage-Sandyville	6
Holyrood	6
Hopedale	8
Howley	7a
Hughes Brook	6
Humber Arm South	6
Indian Bay	7a
Irishtown-Summerside	6
Isle aux Morts	6
Jackson's Arm	7a
Keels	6
King's Cove	6
King's Point	7a
Kippens	6
La Scie	7a
Labrador City	8
Lamaline	6
L'Anse au Clair	7b
L'Anse au Loup	7b
Lark Harbour	6
Lawn	6

OFFICIAL NAME	CLIMATE ZONE
Leading Tickles	6
Lewin's Cove	6
Lewisporte	6
Little Bay	6
Little Bay East	6
Little Bay Islands	7a
Little Burnt Bay	6
Logy Bay-Middle Cove-Outer Cove	6
Long Harbour-Mount Arlington Heights	6
Lord's Cove	6
Lourdes	6
Lumsden	7a
Lushes Bight-Beaumont-Beaumont North	7a
Main Brook	7a
Makkovik	7b
Mary's Harbour	7b
Marystown	6
Massey Drive	6
McIver's	6
Meadows	6
Middle Arm	7a
Miles Cove	7a
Millertown	7a
Milltown-Head of Bay D'Espoir	6
Ming's Bight	7a
Morrisville	6
Mount Carmel-Mitchells Brook-St. Catherine's	6
Mount Moriah	6
Mount Pearl	6
Musgrave Harbour	7a
Musgravetown	6
Nain	8
New Perlican	6
New-Wes-Valley	7a
Nippers Harbour	7a
Norman's Cove-Long Cove	6
Norris Arm	6
Norris Point	7a
North River	6
North West River	7b
Northern Arm	6
Old Perlican	6
Pacquet	7a
Paradise	6
Parker's Cove	6
Parsons Pond	7a
Pasadena	7a
Peterview	6
Petty Harbour-Maddox Cove	6

CLIMATE ZONES Zone 6 | Zone 7a | Zone 7b | Zone 8

OFFICIAL NAME	CLIMATE ZONE
Pilley's Island	7a
Pinware	7b
Placentia	6
Point au Gaul	6
Point Lance	6
Point Leamington	6
Point May	6
Point of Bay	6
Pool's Cove	6
Port Anson	7a
Port au Choix	7a
Port au Port East	6
Port au Port West-Aguathuna-Felix Cove	6
Port Blandford	6
Port Hope Simpson	7b
Port Kirwan	6
Port Rexton	6
Port Saunders	7a
Portugal Cove South	6
Portugal Cove-St. Philip's	6
Postville	7b
Pouch Cove	6
Raleigh	7a
Ramea	6
Red Bay	7b
Red Harbour	7a
Reidville	7a
Rencontre East	6
Renews-Cappahayden	6
Rigolet	7b
River of Ponds	7a
Riverhead	6
Robert's Arm	7a
Rocky Harbour	7a
Roddickton-Bide Arm	7a
Rose Blanche-Harbour Le Cou	6
Rushoon	6
Salmon Cove	6
Salvage	6
Sandringham	6
Sandy Cove	6
Seal Cove, F.B	6
Seal Cove, W.B	7a
Small Point-Adam's Cove-Blackhead-Broad Cove	6
South Brook	7a
South River	6
Southern Harbour	6
Spaniard's Bay	6
Springdale	7a
St. Alban's	6
St. Anthony	7a
St. Bernard's-Jacques Fontaine	6
St. Brendan's	7a
St. Bride's	6
St. George's	6
St. Jacques-Coomb's Cove	6
St. John's	6
St. Joseph's	6
St. Lawrence	6
St. Lewis	7b
St. Lunaire-Griquet	7a
St. Mary's	6
St. Paul's	7a
St. Shott's	6
St. Vincent's-St. Stephen's-Peter's River	6
Steady Brook	6
Stephenville	6
Stephenville Crossing	6
Summerford	6
Sunnyside (Trinity Bay)	6
Terra Nova	6
Terrenceville	6
Tilt Cove	7a
Torbay	6
Traytown	6
Trepassey	6
Trinity	6
Trinity Bay North	6
Triton	7a
Trout River	6
Twillingate	6
Upper Island Cove	6
Victoria	6
Wabana	6
Wabush	8
West St. Modeste	7b
Westport	7a
Whitbourne	6
Whiteway	6
Winterland	6
Winterton	6
Witless Bay	6
Woodstock	7a
Woody Point	6
York Harbour	6

APPENDIX B – FURTHER RESOURCES

Building Science Corporation *www.buildingscience.com* **:** The resources available on this website combine building physics, systems design concepts, and an awareness of sustainability to promote the design and construction of buildings that aim to be more durable, healthier, more sustainable and more economical.

Canadian Mortgage and Housing Corporation (CMHC) *www.cmhc-schl.gc.ca* **:** CMHC's website provides information, resources, and case studies on important housing research related to energy efficiency and green building. The CMHC is one of Canada's leading organizations dealing with mortgage loan insurance, mortgage-backed securities, and housing policy and programs.

National Research Council Canada (NRC) *www.nrc-cnrc.gc.ca* : As Canada's premier organization for research and development, the NRC provides access to a large database of high quality research publications. The NRC is also responsible for developing national model construction codes such as the National Building Code of Canada.

Green Building Advisor *www.greenbuildingadvisor.com* **:** This website contains blogs, videos and articles, design details and strategies, and product guides directly related to green building and energy efficiency.

Canadian Home Builders' Association (CHBA) *www.chba.ca* **:** As the leading homebuilders' association in Canada, the CHBA website contains information on building, buying and renovating homes as well as R-2000 building standards and much more.

National Model Construction Code Documents *www.nationalcodes.nrc.gc.ca* **:** Through this website from the National Research Council Canada you can purchase various codes and access information and training videos on national model construction codes.

Office of Energy Efficiency – Energy Efficient Homes *www.oee.nrcan.gc.ca/residential/17617* **:** From Natural Resources Canada, the OEE-Energy Efficient Homes website is a great source for information on various energy efficiency standards, ratings systems, available grants and incentives, and energy efficiency products.

Turn Back the Tide *www.turnbackthetide.ca* **:** This website from the Government of Newfoundland and Labrador provides important information for homeowners, businesses and communities on how to save energy and become greener.

Office of Climate Change and Energy Efficiency *www.exec.gov.nl.ca/exec/cceeet/* **:** This department of the Government of Newfoundland and Labrador links to reports and websites outlining the Government's strategy and policy development on climate change and energy efficiency.

APPENDIX C – GLOSSARY OF TERMS

Air Barrier System	the components of a building that prevent or reduce outdoor air from entering a house or indoor air from leaving a house
Annual Fuel Utilization Efficiency (AFUE)	used to express the performance of combustion appliances like oil furnaces and boilers
Blower Door Test	a way to test how airtight a building is by using a fan and a pressure-sensing device to test air pressure created by the fan
Building Envelope	all the parts of the house that separate the heated space inside from the outdoors
Climate Zone	an area that has roughly the same heating requirements
Coefficient Of Performance (COP)	usually used to describe the efficiency of heat pumps. A higher COP is better.
Common Space	shared spaces in an apartment, condo, or dormitory building. Includes hallways, entryways, and communal kitchens.
Compliance Report	required for any project using the performance compliance pathway. This report includes basic information that demonstrates how the house meets the energy target required by the Code.
Effective Insulation Value	takes into account all the components of an assembly, not just the R-value of the insulation in the assembly
EnerGuide	EnerGuide provides a rating of a home's energy performance and compares this against the standard, which shows how improvements may be made that will be grant-eligible through the Natural Resources Canada EnerGuide for Houses program. On a scale from 1 to 100, a higher number represents a tighter, more energy efficient home.
Energy Efficiency Ratio (EER)	expresses the cooling performance of heat pumps and air conditioners. A higher EER is better.
Energy Model	computer software that uses proposed construction details, occupant behaviour, and mechanical systems to predict the energy efficiency of a home
Energy Rating (ER)	measure of the overall performance of windows or doors

ENERGY STAR	a labelling system for energy efficient products
Fenestration	term referring to building envelope assemblies that transfer visible light. These include windows, clerestories, skylights, translucent wall panels, glass block assemblies, sliding glass doors, etc.
Frost Line	the depth below the surface of the soil to which groundwater is expected to freeze
Heat Recovery Ventilation	an energy recovery ventilation system that recovers heat from outgoing air and transfers it into incoming air. It provides clean, fresh air, while also saving money by reducing the need to further heat the incoming air.
Heating Degree Day	reflects the demand for energy to heat a building. Measure of how much and for how long the temperature outside stays below a certain level.
Heating Season Performance Factor (HSPF)	expresses the heating performance of heat pumps. A higher HSPF is better.
Insulated Concrete Form (ICF)	forms made of insulating material, into which concrete can be poured, to make walls
National Building Code of Canada	the foundation of design and construction regulations across Canada
Nominal Insulation Value	the R-values recorded on building products at the store
Performance Compliance Pathway	achieving energy efficiency code compliance by showing that a proposed house is as energy efficient as, or more energy efficient than, a house meeting prescriptive requirements. This is proven through energy modelling.
Prescriptive Compliance Pathway	achieving energy efficiency code compliance by meeting the listed requirements for each building component. See Code subsection 9.36.2 to 9.36.4
R-2000	R-2000 homes consume 30% less energy than traditional homes. Created and administered by NRCan, R-2000 homes must be new homes.
Raised-heel Truss	allows builders to get extra insulation in the attic in the area over the exterior walls, an often difficult area to insulate
RSI	a measure of how effective a building material is at reducing heat loss. Is the same as R-value but uses the metric system. The Code uses RSI.

R-Value	a measure of how effective a building material is at reducing heat loss. Is the same as RSI but uses the imperial (US) measurement system.
Seasonal Energy Efficiency Ratio (SEER)	expresses the cooling performance of heat pumps and air conditioners. A higher SEER is better.
Thermal Break	using continuous insulation between building components with lower insulation values. The purpose is to reduce thermal bridging. This is commonly used to separate floor slabs from foundation walls.
Thermal Bridge	occurs where an area of insulation is broken by material that is prone to heat loss
U-Factors	a measure of how much heat loss occurs through a building material. Often used when referring to windows, doors, and skylights.
Vapour Barrier	a layer inside of a wall, floor, or ceiling that prevents water vapour from passing through it