Canadian Home Builders' Association
Net Zero Home Labelling Program for Renovations
Technical Requirements – Version 1

Effective: October 28, 2021
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PREFACE

The Canadian Home Builders' Association (CHBA) is the voice of Canada's residential construction industry. The CHBA's membership includes new home builders, renovators, developers, trades, manufacturers, suppliers, lenders and other professionals. Members commit to act with integrity and professionalism in all aspects of their company's operations. Through the voluntary efforts of its members, the CHBA serves both consumers and producers of housing by promoting quality, affordability and choice in housing for all Canadians.

This voluntary Program further enhances choice in housing for Canadians by providing a rigorous industry-led Technical Requirement for Net Zero Homes, built on Government of Canada programs and tools, and evaluated by trained and licenced Energy Advisors independent of the CHBA. The Program continues CHBA's longstanding tradition of leading the industry in energy efficient and sustainable housing through collaboration with research partners in industry, academia and government.

The CHBA is responsible for developing and updating the Administrative and Technical Requirements as well as supporting tools such as the marketing/communications and educational courses. The Program Participants are responsible for complying with their Agreements, meeting all Program Requirements, and providing attestation documentation to CHBA to that effect.

To keep the program focused, the Technical Requirements concentrate on elements affecting net energy consumption. ***The goal is to maximize participation and enable builders to deliver a market-ready product with off-the-shelf components.***

This Program is not a substitute for local building codes, by-laws and standards that may be in force. Rather it provides a set of ***voluntary requirements*** that are intended to complement, not replace, applicable regulations. Additionally, the Technical Requirements are a compilation of existing initiatives delivered by NRCan as well as applicable recognized North American standards delivered by organizations such as CAN/CSA/ULC, to bring together the most advanced industry best practices in energy efficiency.

Voluntary programs promoting energy efficiency have been in use in Canada for four decades now, with excellent success. CHBA members have been participating in these voluntary programs since the beginning and have been leaders in reducing the energy consumption of the residential sector. This Program continues in that tradition, and attestation to conformance with the Program Requirements enables builders and renovators to identify themselves as CHBA Qualified Net Zero Builders/Renovators, and their products as CHBA Qualified Net Zero/Ready Homes.

In March 2021, the CHBA wrapped up a two-year initiative to develop the Net Zero Renovation Labelling technical and administrative requirements, as well as training and tools for renovators, and conducted a Pilot to validate them. Utilizing the results of the Pilot, a version 1 has been developed and launched in the Fall of 2021. We would like to thank Natural Resources Canada, Office of Energy Efficiency for their contributions towards this initiative. Learn more at www.NetZeroRenos.com.

SUMMARY OF TECHNICAL CHANGES – FOR RENOVATIONS

The exemptions and changes made in developing Version 1.0 of the Net Zero Home Labelling Program for Renovations Technical Requirements are based on Version 1.3 of the Net Zero Home Labelling Program for New Homes Technical Requirements. Below is a summary of the changes that were tested and approved through the Pilot.

Section	Exemption/Change	Reason
3.3 Opaque Assemblies	Exemption – there are no requirements for the slab to be insulated.	Insulating the slab was deemed impractical and cost prohibitive for many renovation projects.
3.3 Opaque Assemblies	Exemption – Rim joists do not need to match or exceed the thermal resistance levels of the walls above grade.	Rim joists may be inaccessible in many renovation projects.
4.4 Solid Burning Fuel Appliances	Change – Fireplaces are allowed in renovations although they must comply with the following: a) CSA B415 or U.S. EPA wood-burning appliance standards 40 CFR Part 60 Subpart AAA, b) have no barometric dampers, c) home must undergo depressurization test as per ERS Technical Procedures V15 with results showing a pressure differential of less than 5 pascals, and d) CO alarms shall be installed as described.	Disallowing site-built fireplaces in renovations could prohibit a large portion of candidate projects. Stringent sealing and testing requirements were put in place to mitigate the health and safety concerns with respect to combustion spillage.
4.8 Air Distribution	Change – If the ductwork system is not completely replaced in a renovation, then only the accessible portions of ductwork must be sealed as per section 4.8.2 provided each duct run can deliver the appropriate amount of air.	Ducts may not be completely accessible, in renovations where they are not fully replaced. Requiring sealing the entire duct runs as per section 4.8.2 of the new houses label may be prohibitive.

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1.0 GENERAL

1.1. Scope and Application

1.1.1 Scope

This document details the minimum Technical Requirements for houses to be recognized as a CHBA Qualified Net Zero Home or a CHBA Qualified Net Zero Ready Home under the Renovations Program.

1.1.2 Application - Eligible Housing Types

1. The Program applies to the following existing buildings:
   (a) Houses, houses with secondary suites, and buildings containing only dwelling units and common spaces, which
      i. are not greater than three storeys in *building height*,
      ii. are not greater than 600 m^2 (6458 sq. ft.) in *building area*, and
      iii. are on permanent foundations or are permanently moored float homes.

NOTE:

1. *Building height* in number of storeys is determined using the local Building Code in force (National, Territorial, or Provincial).

RENOVATION REQUIREMENT

1. To be eligible under the Renovations Program a home must get a pre-renovation EnerGuide rating no sooner than 6 months following occupancy by the first homeowner and the home must undergo upgrades before getting its post-renovation EnerGuide rating.

1.2. Compliance and Verification

1.2.1 Compliance

1. Except as permitted in 1.2.1.3, all *dwelling units* and buildings shall have a modelled level of energy performance, with a rating of 0 GJ as demonstrated by receiving an ERS v15 label under the authority of NRCan, including Net Zero Ready.
2. All *dwelling units* and buildings shall comply with the Program Administrative and Technical Requirements.
3. Where a *dwelling unit* or building is being designated as *Net Zero Ready*, the home shall be modelled in the same way as a *Net Zero Home* (per 1.2.1.1 and the Modelling Guidelines). The final ERS label, in GJ, for the constructed home shall reflect the EnerGuide rating of the home as built. Any on-site renewable energy systems designed and planned for the home to achieve Net Zero, but that aren't installed in the constructed home, are excluded from the final ERS rating. For greater clarity, the EnerGuide rating for the home, in GJ, should be zero with the on-site renewables modelled, and any difference in the EnerGuide rating from 0 GJ should match the on-site renewables that are planned for future installation (seethe Modelling Guidelines).
4. Homes of any age are eligible as long as they meet all program requirements, including having an ERS 0 GJ label using the current version of HOT2000 specified by the program requirements, using results from a Blower Door Test performed within 2 years of application.

1.2.2 Verification and Administrative Requirements

1. Conformance with the Technical Requirements shall be verified by a CHBA Qualified Net Zero Service Organization (SO) and Energy Advisor (EA), as described in the "CHBA Net Zero Home Labelling Administrative Requirements" per the SO and EA Agreements.

2. The plan evaluation, airtightness testing, and inspection of every Net Zero/Ready Home shall be carried out by a CHBA Qualified Net Zero EA to confirm that this requirement has been met.

1.3. Reference Publications

This program is built on the EnerGuide Rating System, R-2000 and ENERGY STAR® for New Homes initiatives of the federal Department, Natural Resources Canada (NRCan). These CHBA Net Zero Home Labelling Program Technical Requirements compile the relevant technical requirements from each of these three NRCan initiatives to simplify meeting the CHBA Net Zero requirements. Throughout this document, it is noted where clauses are sourced from the NRCan initiatives.

Table 1: Reference Publications

Issuing Agency	Document	Reference
NRCan	2012 R-2000 Standard	M144-223/2012E-PDF or ISBN 978-1-100-20133-7
NRCan	ENERGY STAR® for New Homes (ESNH) Standard v12 or v17	M144-237/2012-6E-PDF or ISBN 978-1-100-25853-9
NRCan	EnerGuide Rating System (ERS) v15	ISBN 978-1-100-25693-1
CHBA	Net Zero Home Labelling Program Administrative Requirements	
CHBA	Net Zero Home Labelling Program Technical Procedures Guidebook	

1.4. Definitions and Abbreviated Terms

1.4.1 General Terms

1. Words and phrases used in this document that are not included in the list of definitions in sub-section 1.4.2. shall have the meanings that are commonly assigned to them in the context in which they are used, taking into account the specialized use of terms by the various trades and professions to which the terminology applies.
2. The terms home, house and housing are used generically in this document to describe *dwelling units*, housing forms, and residential buildings, that are within the scope of this document.
3. The term “shall be installed” in reference to equipment or components means that the equipment or component is mandatory.
4. The term “shall conform with” in reference to equipment, components or methods means that the conformance is mandatory where such equipment or components are installed.
5. For definitions of the terms CHBA Qualified Net Zero Service Organization, Energy Advisor, Trainer, and Builder/Renovator, see the Program Administrative Requirements document.

1.4.2 Defined Terms

CHBA Project Registration Workbook

This spreadsheet is used to track the completion of both the Technical and Administrative Requirements in order to ensure program compliance. The Project Registration Workbook includes six tabs. Each labelled home is required to complete the three mandatory tabs which are: General Information, Technical Information, and Verification Checklist & Attestation. The remaining three tabs are used report the requirements of the possible installed or modelled Photovoltaic system. The reporting requirements are described in the Administrative Requirements as well as Section 2.2.4 Energy Production.

CHBA Qualified Net Zero Home

A CHBA Qualified Net Zero Home that is labelled under the Program is a home that is recognized by CHBA, on the basis of the attestations by the builder/renovator, its Qualified Net Zero Service Organization and a Qualified Net Zero Energy Advisor to have met the Technical Requirements, including the energy performance rating using NRCan's EnerGuide Rating System (ERS) to be designed, modelled and constructed to produce as much energy (from on-site renewable energy sources) as it consumes on an annual basis.

CHBA Qualified Net Zero Ready Home

A CHBA Qualified Net Zero Ready Home that is labelled under the Program is a home that is recognized by CHBA, on the basis of the attestations by the builder/renovator, its Qualified Net Zero Service Organization and a Qualified Net Zero Energy Advisor to have met the Technical Requirements, including the energy performance rating using NRCan's EnerGuide Rating System (ERS) to be a Net Zero Home that has a renewable energy system designed for it that will allow it to achieve Net Zero Home performance, but the renewable energy system is not yet installed.

On-site Renewable Energy

For the purposes of this Program, "on-site" shall refer to systems installed within the same legally defined property.

NRCan Reference house

The house being rated as if it were built according to the energy efficiency requirements of the building code.

2.0 GENERAL REQUIREMENTS

2.1 Compliance with Building Codes and Regulations

Source: ESNH v12.6 & R-2000 NZE Pilot.

2.1.1 Building Codes and Regulations

1. Net Zero/Ready Homes shall comply with the applicable building codes and regulations, in addition to the requirements of this Program.
2. This Program is not a substitute for local, provincial, or territorial building codes; it is an additional set of requirements that are intentionally more stringent in the areas of energy efficiency and net energy consumption.
3. Where an overlap exists, the more stringent requirement shall apply.
4. In the unlikely event that there should appear to be a conflict between the applicable building codes and regulations and any requirement of this Program, the builder/renovator should contact CHBA. There should be no such conflicts, and all homes in this Program must comply with the applicable building codes and regulations.

Source: ESNH v12.6 & R-2000 NZE Pilot.

2.1.2 Energy Efficiency Regulations

1. Equipment and products that are regulated under Canada's Energy Efficiency Regulations shall comply with the technical requirements of the regulations.

2. Compliance with Sentence 1 can be demonstrated by
   (a) Having the energy performance of the installed equipment verified for compliance with the Energy Efficiency Regulations, by a test and certification body accredited by the Standards Council of Canada for energy performance verification of that equipment, or
   (b) Having the installed equipment bear an energy efficiency verification mark from a test and certification body accredited by the Standards Council of Canada for energy performance verification, or
   (c) Identifying the installed equipment in the NRCan searchable product list of compliant equipment.

NOTE:

1. For more information on Canada's Energy Efficiency Regulations, and to find NRCan's searchable product list of equipment and products that comply with the Energy Efficiency Regulations, refer to http://www.nrcan.gc.ca/energy/regulations-codes-standards/6861.

Source: R-2000 NZE Pilot.

2.1.3 Eligible Technologies

1. Equipment and technologies used to meet the requirements of Sections 2, 3, and 4 shall be commercially available and suitable for the intended application.
2. Suitability for the intended application shall be demonstrated in part through conformance to applicable recognized North American standards.

2.2 Proposed House

Source: R-2000 NZE Pilot.

2.2.1 General

1. The proposed house shall mean a model of the as-built house used to simulate energy performance.
2. Energy performance of the proposed house shall be determined using the energy modelling methods and tools of Section 2.4.
3. The proposed house shall be representative of the energy used by the as-built house for
   (a) Space heating,
   (b) Domestic water heating,
   (c) Ventilation, and
   (d) Space cooling where installed in accordance with Sections 2.2.3 and 4.2.
4. The proposed house shall have an assumed energy use representing
   (a) Occupant plug and lighting loads, and
   (b) Major appliances.

Source: R-2000 NZE Pilot.

2.2.2 Energy Efficiency Targets

1. The proposed house when modelled with the standard mechanical conditions given in Table 2 below shall have annual space heating energy consumption (MJ) that is at least 33% lower than the corresponding *NRCan reference house*. This is tracked using Tab 2: Technical Information in the CHBA Project Registration Workbook.

NOTE:

1. Refer to the Modelling Guidelines for additional details.

2. All heat losses and gains through the envelope are considered. Losses generally include the heat energy that is lost through wall, floor and ceiling/roof assemblies, as well as components in the assembly such as doors, windows, and skylights. Losses through exhaust ventilation and air leakage through the building envelope are also accounted for. Heat gains include solar gains through windows and skylights, as well as internal gains, which include heat generated by occupants and equipment inside the building which is not specifically designed for space heating. Equipment that commonly provides internal gains include refrigerators, dryers, cooking equipment, lighting, and other devices which generate heat as part of their operation.
3. The specifications in Table 2 below are provided for determination of the building envelope target only and are not required to be installed in the proposed house.

Table 2: Standard mechanical conditions for determination of building envelope energy loss target

Function	Component	Efficiency
Space heating	Electric baseboards	100%
Water heating	Electric storage	0.86 EF
Ventilation	Balanced with heat recovery	SRE: 60% at 0°C, 55% at -25°C Fan efficacy: 0.48 L/s/W at 0°C

Source: R-2000 NZE Pilot.

2.2.3 Space Cooling Requirements

1. For occupant comfort, every home is required to undergo an assessment of whether the house surpasses a threshold for space cooling. The cooling load is based on a threshold of no more than 2 MJ/m^3 as calculated using Tab 2: Technical Information in the CHBA Project Registration Workbook.
2. If the cooling load exceeds the threshold, then the energy consumption for space cooling shall be included in the total annual energy consumption for the home. Although this Program does not require that a space cooling system be installed in the home, it is highly recommended. (See Builder/Renovator and Energy Advisor Agreements for attestations.)

NOTE:

1. Refer to the Modelling Guidelines for additional details such as temperature settings for modelling.
2. If a space cooling system is supplied with the home, then it should be modelled into the energy base load along with an adequate amount of renewable energy production to off-set the space cooling energy consumption.
3. If a space cooling system is not supplied with the home, the renewable energy system must be designed to generate sufficient extra on-site renewable energy that it may power a worst-case "off the shelf" space cooling system that might be installed in the future.

Source: R-2000 NZE Pilot.

2.2.4 Energy Production

1. Electricity generation using renewable technologies as described in Section 2.5.2 shall be of sufficient capacity such that the net energy consumption of the proposed house is not greater than 0 GJ.
2. Where a space cooling system as described in Section 2.2.3 is not installed, the renewable energy system must be designed to generate sufficient extra on-site renewable energy that it may power a worst-case "off the shelf" space cooling system that might be installed in the future.

NOTE:

1. It is recommended that a professional third-party solar designer be consulted to provide a PV system design for Net Zero Ready projects. See the ERS Technical Procedures for reference on how to enter the values into HOT2000.
2. Net Zero Homes installing PV must complete Tab 3: Photovoltaic (PV) System Commissioning Report.
3. Net Zero Ready Homes modelling roof mounted PV must complete Tab 4: NRCan Photovoltaic (PV) Ready Checklist.
4. Net Zero Ready Homes modelling Ground Mounted PV must complete Tab 5: Ground Mounted PV Ready Checklist.

2.3 As-Built House

Source: R-2000 NZE Pilot.

2.3.1 General

1. The as-built house shall mean the house as constructed.
2. It must be practical to install the renewable energy system for the house on-site using good engineering design and installation practices.
3. Where the modelled renewable energy system is not installed, the house is eligible to be qualified as Net Zero Ready.

2.4 Energy Modelling

Source: R-2000 NZE Pilot.

2.4.1 Modelling Methods and Calculations

1. A 0 GJ rating shall be achieved using modelling methods and calculations in conformance with the EnerGuide Rating System v15, using HOT2000 v11 and Tab 2: Technical Information in the CHBA Project Registration Workbook.

2.5 Renewable and Energy Production Systems

Source: R-2000 NZE Pilot.

2.5.1 Scope and Application

1. It is the responsibility of the builder/renovator to determine the requirements of their local electrical utility prior to designing or attempting to connect a Net Zero Home into a public utility grid.
2. This Subsection covers the minimum technical requirements of the design, specification, and installation of systems, components and assemblies used to produce energy, and to distribute, control and monitor energy production.

Source: R-2000 NZE Pilot.

2.5.2 Power Generation

1. Solar photovoltaic modules shall be certified to the most current and applicable version of the relevant industry standards for their specific technology type as published by CAN/CSA/ULC and as accepted by the authority having jurisdiction, including compliance with prevailing code requirements locally in force (including but not limited to the Canadian Electrical Code, National Building Code, National Fire Code, regional/provincial equivalent codes, etc.). Consider such reference standards as CAN/CSA C61215-08 (R2013) “Crystalline Silicon Terrestrial Photovoltaic (PV) Modules – Design Qualifications and Type Approval”, ULC/ORD C1703-01 “Flat Plate Photovoltaic Modules and Panels”, CAN/CSA C61646-10 (R2014) “Thin-film Terrestrial Photovoltaic (PV) Modules - Design Qualification and Type Approval”, ULC/ORD- C1703-01 “Flat Plate Photovoltaic Modules and Panels”, or others as may be appropriate.
2. Design and installation of wind energy systems shall comply with the most current and applicable version of the relevant industry standards for their specific technology type as published by

CAN/CSA/ULC and as accepted by the authority having jurisdiction, including compliance with prevailing code requirements locally in force (including but not limited to the Canadian Electrical Code, National Building Code, National Fire Code, regional/provincial equivalent codes, etc.). Consider such reference standards as CAN/CSA C61400-2-08 (R2013) "Wind turbines - Part 2: Design Requirements for Small Wind Turbines", or others as may be appropriate.

NOTE:

1. Installation of small wind energy systems may not be permitted in some areas due to zoning restrictions. The Canadian Wind Energy Association has further information available for small wind energy projects at: http://canwea.ca/wind-facts/small-wind-energy/.
2. In the case of a ground-mount PV system for a Net Zero Home the "Photovoltaic (PV) System Commissioning Report" must still be completed, and for a Net Zero Ready Home the "Ground Mounted PV Ready Checklist" must be completed. The NRCan "Photovoltaic Ready Guidelines" should be referenced to ensure:
   (a) Code compliance,
   (b) Identification of PV Ready components,
   (c) Adequate space allocated for the inverter and connection hardware (either on the wall in the electrical room or at the ground mount system),
   (d) Electrical panel rating is of sufficient size

Source: R-2000 NZE Pilot.

2.5.3 Inverters and Controllers

1. Alternating Current (AC) and Direct Current (DC) power supplies, such as inverters and DC charge controllers, shall comply with the most current and applicable version of the relevant industry standards for their specific technology type as published by CAN/CSA/ULC and as accepted by the authority having jurisdiction, including compliance with prevailing code requirements locally in force (including but not limited to the Canadian Electrical Code, National Building Code, National Fire Code, regional/provincial equivalent codes, etc.). Consider such reference standards as CAN/CSA C22.2 NO. 257-06 (R2015) "Interconnecting Inverter-Based Micro-Distributed Resources to Distribution Systems".

2.5.4 Energy Monitoring

1. Net Zero Homes: An energy monitoring system shall be installed that provides electricity production and consumption data both in real time and aggregated over daily, weekly, and monthly time periods.
2. Net Zero Ready Homes: An energy monitoring system shall be installed that provides electricity consumption data both in real time and aggregated over daily, weekly, and monthly time periods.
3. Gas and water monitoring is recommended when practical.

NOTE:

1. The intent of this requirement is to provide a feedback mechanism for homeowners to understand how their behaviour and operation of the house affects their energy consumption.

Source: R-2000 NZE Pilot.

2.5.5 Solar Domestic Hot Water Systems

1. Solar domestic hot water systems shall comply with the most current and applicable version of the relevant industry standards for their specific technology type as published by CAN/CSA/ULC and as accepted by the authority having jurisdiction, including compliance with prevailing code requirements locally in force (including but not limited to the Canadian Electrical Code, National Building Code, National Fire Code, regional/provincial equivalent codes, etc.). In the absence of any such requirements, systems shall be in conformance with Article 9.36.4.3 of the 2015 NBC.

3.0 BUILDING ENVELOPE

3.1 General

3.1.1 Scope and Application

1. This Section provides the minimum technical requirements of the design, specification, and installation of systems, components and assemblies of the building envelope.

3.2 Airtightness

Source: R-2000 NZE Pilot.

3.2.1 Tested Airtightness

1. The house shall be constructed sufficiently airtight such that the whole house air leakage is less than or equal to one of the airtightness targets specified in Table 3, when measured in accordance with the as-operated method based on CAN/CGSB 149.10 “Determination of the Airtightness of Building Envelopes by the Fan Depressurization Method” or NRCan “EnerGuide Rating System Technical Procedures Version 15”.

Table 3: Minimum Airtightness Targets

Building Type	ACH@50Pa	NLA@10 Pa		NLR@50 Pa	
		cm^2/m^2	$in^2/100\ ft^2$	$L/s/m^2$	$cfm50/ft^2$
Attached	2.0	1.00	1.44	0.75	0.15
Detached	1.5	0.70	1.00	0.57	0.11

NOTE:

1. There are 3 air tightness metrics recognized; ACH, NLA, NLR. Any one of them can be used, but the building need not comply with all 3.
2. Compartmentalization details are encouraged when designing attached units. Compartmentalization encourages placement of a continuous air barrier through common assemblies (e.g. common walls, floors and ceilings). The placement of an air barrier in these assemblies will not only increase the air tightness of the unit, but will also inhibit transmission of odours and noise between units.

3.3 Opaque Assemblies

Source: ESNH v12.6.

3.3.1 Minimum Effective Thermal Resistance of Opaque Assemblies

1. Effective thermal resistance of opaque assemblies shall not be less than those specified in Table 4 below. Where local prevailing code is more stringent than Table 4, refer to that code.

Table 4: Minimum Effective Thermal Resistance of Opaque Assemblies[1]

Building Assembly	Heating Degree Days[2]					
	<3000	3000-3999	4000-4999	5000-5999	6000-6999	≥7000
	RSI (R)					
	NBC Climate Zones					
	4	5	6	7a	7b	8
Ceilings below attics	6.91 (39.2)	8.67 (49.2)	8.67 (49.2)	10.43 (59.2)	10.43 (59.2)	10.43 (59.2)
Cathedral ceilings and flat roofs	4.67 (26.5)	4.67 (26.5)	4.67 (26.5)	5.02 (28.5)	5.02 (28.5)	5.02 (28.5)
Walls above grade[3]	2.78 (15.8)	3.08 (17.5)	3.08 (17.5)	3.08 (17.5)	3.85 (21.9)	3.85 (21.9)
Floors over unheated spaces	4.67 (26.5)	4.67 (26.5)	4.67 (26.5)	5.02 (28.5)	5.02 (28.5)	5.02 (28.5)
Foundation walls below or in contact with the ground	1.99 (11.3)	2.98 (16.9)	2.98 (16.9)	3.46 (19.6)	3.46 (19.6)	3.97 (22.5)
Unheated floors below frost line	0.88 (5.0)	0.88 (5.0)	0.88 (5.0)	0.88 (5.0)	0.88 (5.0)	0.88 (5.0)
Unheated floors on ground above frost line[4,5,6]	1.96 (11.1)	1.96 (11.1)	1.96 (11.1)	1.96 (11.1)	1.96 (11.1)	1.96 (11.1)
Heated or unheated floors on ground on permafrost[5]	-	-	-	-	4.44 (25.2)	4.44 (25.2)
Heated floors on ground[5]	2.32 (13.2)	2.32 (13.2)	2.32 (13.2)	2.85 (16.2)	2.85 (16.2)	2.85 (16.2)
Slabs on grade with integral footing[4,7,8]	1.96 (11.1)	1.96 (11.1)	1.96 (11.1)	3.72 (21.1)	3.72 (21.1)	4.59 (26.1)

NOTE:

1. Where local building code values are greater, the local code requirements take precedence, per 2.1.1.
2. Where required in this Technical Requirement, the number of heating degree days shall be defined based on applicable building code requirements. Where the applicable building code does not define the number of heating degree days, or where no applicable provincial building code exists, NBC 2012 Appendix C shall be used.
3. Applies to walls that are not common to another heated unit; equally applicable to all references for 'walls above grade' requirements found throughout this Technical Requirement.
4. A nominal RSI 1.76 (R10) will meet the RSI 1.96 (R11.1) requirement and a nominal RSI 3.52 (R20) will meet the RSI 3.72 (R 21.1) requirement.
5. It should be noted that ENERGY STAR® and R-2000 have specific technical requirements for under slab insulation.
6. Includes non-structural slab on grade.
7. Except where prohibited by structural requirements of the building code in effect, insulation requirements apply to under the entire slab, and to a 900 mm (3 ft.) skirt of the same nominal value.
8. Where a slab on grade is also a heated floor, the higher insulation value shall apply.

RENOVATION REQUIREMENT

1. In a renovation, effective thermal resistance of opaque assemblies shall be insulated according to the follow iteration of Table 4:

Renovation Table: Minimum Effective Thermal Resistance of Opaque Assemblies[1]

Building Assembly	Heating Degree Days[2]					
	<3000	3000-3999	4000-4999	5000-5999	6000-6999	≥7000
	RSI (R)					
	NBC Climate Zones					
	4	5	6	7a	7b	8
Ceilings below attics	6.91 (39.2)	8.67 (49.2)	8.67 (49.2)	10.43 (59.2)	10.43 (59.2)	10.43 (59.2)
Cathedral ceilings and flat roofs	4.67 (26.5)	4.67 (26.5)	4.67 (26.5)	5.02 (28.5)	5.02 (28.5)	5.02 (28.5)
Walls above grade[3]	2.78 (15.8)	3.08 (17.5)	3.08 (17.5)	3.08 (17.5)	3.85 (21.9)	3.85 (21.9)
Floors over unheated spaces	4.67 (26.5)	4.67 (26.5)	4.67 (26.5)	5.02 (28.5)	5.02 (28.5)	5.02 (28.5)
Foundation walls below or in contact with the ground	1.99 (11.3)	2.98 (16.9)	2.98 (16.9)	3.46 (19.6)	3.46 (19.6)	3.97 (22.5)

NOTE:

1. When deciding if the floor on or below grade should be insulated the renovator should consider the head height impacts that insulation may have and the intended living conditions of the room - finished or unfinished.
2. In a renovation where additional living space is added to increase the *building area,* the additional living space shall comply with the Minimum Effective Thermal Resistance of Opaque Assemblies as defined in Table 4. For example, if a renovated home were to add an extension that extends the building area by 100m^2 and has an unheated slab on grade floor above the frost line, then the 100m^2 floor shall have an RSI no less than 1.96.

Source: ESNH v12.6.

3.3.2 Eligible Insulation

1. Except as permitted in 3.3.2.2, thermal characteristics of eligible insulation materials shall conform to the requirements of:
   - CAN/CGSB 51.25-M87 Thermal Insulation, Phenolic, Faced
   - CGSB 51-GP-27M Thermal Insulation, Polystyrene, Loose Fill
   - CAN/ULC-S701-11 Thermal Insulation, Polystyrene, Boards and Pipe Covering
   - CAN/ULC-S702-09 Mineral Fibre Thermal Insulation for Buildings
   - CAN/ULC-S703-01 Cellulose Fibre Insulation (CFI) for Buildings
   - CAN/ULC-S704-11 Thermal Insulation, Polyurethane and Polyisocyanurate, Boards, Faced
   - CAN/ULC-S705.1-01 Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density, Material - Specification
   - CAN/ULC-S706-02 Wood Fibre Thermal Insulation for Buildings
   - CAN/ULC-S712.1-10 Standard for Thermal Insulation - Light Density, Open Cell Spray Applied Semi-Rigid Polyurethane Foam - Material Specification, or
   - CAN/ULC-S716.1-12 Standard for Exterior Insulation and Finish Systems (EIFS) - Materials and Systems

2. For a specific insulation product not conforming to the standards listed in 3.3.2.1, the thermal resistance, or long term thermal resistance values where applicable, are permitted to be used as reported by the Canadian Construction Materials Centre (CCMC) or the National Research Council (NRC) in the evaluation of such a product.

NOTE:

1. The above material standards shall be used, unless a more current edition of the materials standards is referenced in the applicable Building Code, in which case, the edition in the applicable Building Code shall be used.

Source: ESNH v12.6.

3.3.3 Wall and Floor Assemblies Below or in Contact with the Ground

1. Where the distance between the top of a foundation wall and the line of the finished grade is more than 600 mm (2 ft), the effective thermal resistance for the above-ground portion of the foundation wall shall be not less than that required for the thermal resistance for walls above grade listed in Table 4.
2. Except as permitted in 3.3.3.3, the below ground portion of insulation required for foundation walls below or in contact with ground shall extend down to the level of the top of the floor that comprises part of the heated boundary.
3. A gap of not greater than 150 mm (6 in) is permitted between the bottom edge of the interior foundation wall insulation and the floor where insulation is provided on the interior face of a foundation wall below or in contact with ground, and where the top of the floor in contact with the ground that comprises part of the heated boundary is equal to or greater than 1.2 m (4 ft) below finished grade.
4. The foundation wall insulation is permitted to be split into interior and exterior portions provided the interior and exterior portions each have an effective thermal resistance not less than is required in Table 4, and they are overlapped a distance of not less than four times the distance separating the planes of insulation.
5. Except where prohibited by structural requirements of the building code in effect, or, where there is insulation on the exterior of the foundation wall down to the footing, basement floor assemblies where sub-slab insulation has been installed shall have a thermal break between the basement floor slab and foundation walls with a thermal resistance, at a minimum, equivalent to the sub-slab insulation installed.

Source: ESNH v12.6.

3.3.4 Ceilings Below Attics

1. For ceilings below attics under sloped roofs, the thermal resistance shall be continuous to the outermost edge of the exterior wall but is permitted to be reduced to the extent imposed by the roof slope and minimum venting clearance.

Source: ESNH v12.6.

3.3.5 Rim Joists

1. Rim joists shall have a thermal resistance not less than that of walls above grade.

RENOVATION REQUIREMENT

1. Net Zero Renovations do not need to meet the requirements of Section 3.3.5.

3.5 Fenestration and Doors

Source: ESNH v12.6 & R-2000 NZE Pilot.

3.5.1 Fenestration

1. Except as provided in 3.4.1.2, all fenestration systems (including skylights and tubular skylights) shall be:
   (a) ENERGY STAR certified or
   (b) tested in accordance with CAN/CSA-A440.2-14/A440.3-14 – "Fenestration energy performance / User guide to CSA A440.2-14, Fenestration energy performance" or National Fenestration Rating Council's NRFC 100: "Procedure for Determining Fenestration Product U-factors" and NFRC 200: "Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence" and be constructed with minimum
      i. double-glazed with low-e glass,
      ii. inert gas-fill,
      iii. insulated spacers, and
      iv. a thermally broken frame or sash where it is metal.
2. Decorative windows, including side lights, windows in doors, half-circle windows, leaded windows, transoms and other specialty glazing products, including site-built windows, need not comply with 3.4.1.1 provided that:
   (a) they are, at a minimum, double-glazed, and
   (b) the total glazing area of such decorative or specialty glazing does not exceed 15% of the total glazing surface area of the house.

NOTE:

1. This article also pertains to fenestration systems in curtain walls.
2. Fenestration in door systems, e.g. integrated glazing, sidelights and transoms, applies only to the door system not covered under 3.4.1.2.

3.5.2 Door Systems

1. With the exception of paragraphs 2 and 3 below, exterior door systems shall:
   (a) be ENERGY STAR certified or
   (b) have a U-value which meets or exceeds the minimum energy efficiency requirements of "ENERGY STAR® Technical Specification for Residential Windows, Doors, and Skylights Sold in Canada Version 5.0 – January 1, 2020" (Metrics: Max USI 1.22/U 0.21 or Min ER 34). Testing of energy performance must be done by an organization accredited by the Standards Council of Canada for the scope of the product being certified, or, by NFRC.
2. A maximum of one exterior door system (to a maximum of one single or one double door) that does not comply with paragraph 1 above is permitted per house.
3. Doors to unheated enclosed spaces shall have an insulated core and be installed with weather stripping.

NOTE:

1. This requirement includes, but is not limited to, doors to cold cellars and doors to attached garages.

4.0 MECHANICAL AND ELECTRICAL SYSTEMS

4.1 General

4.1.1 Scope and Application

1. This Section provides the minimum technical requirements of the design, specification, and installation of systems, components and assemblies used to provide space heating and cooling, ventilation, and domestic water heating.
2. Within the scope of this Section is
   (a) equipment required to meet the space and water heating load,
   (b) supplemental equipment that provides space or water heating,
   (c) space cooling equipment,
   (d) fuel-fired equipment that is decorative, and
   (e) ventilation and air distribution systems.
3. Except as required in Article 4.1.2 this Section does not apply to appliances which are intended only for cooking, or to cook stoves with an oven whose volume is greater than 0.028 m^3 (1 ft^3).

Source: R-2000 NZE Pilot.

4.1.2 Lighting and Appliances

1. In addition to off-setting space and water conditioning loads, all Net Zero Homes must provide sufficient energy, generated on-site from renewable sources, to offset electrical base loads. Where ENERGY STAR certified lighting or appliances are installed in Net Zero Homes, Reduced Operating Conditions (ROCs) as stipulated under the ERS will be applied. The ERS Standard Operating Conditions (SOCs) will be applied where a builder (i) does not install ENERGY STAR products or (ii) for the final ERS rating for Net Zero Ready Homes. (The ROCs can be used in the Net Zero Ready Home modelling to show Net Zero compliance.)

Source: ESNH v12.6 & R-2000 NZE Pilot.

4.1.3 Natural Gas-Fired and Propane-Fired Equipment

1. Unless permitted otherwise in 4.3, natural gas-fired and propane-fired space and water heating equipment shall be
   (a) equipped with electronic ignition, and
   (b) independently vented with a sealed vent connected to a
      i. direct-vent system, or
      ii. mechanically-vented system.

NOTE:

1. Naturally aspirated equipment or appliances with standing pilot lights do not meet this requirement.

Source: ESNH v12.6.

4.1.4 Oil-Fired Stoves, Fireplaces and Water Heaters

1. Oil-fired stoves, wood or gas burning fireplaces, and water heaters shall comply with the most current and applicable version of the relevant industry standards for their specific technology type as published by CAN/CSA/ULC and as accepted by the authority having jurisdiction, including compliance with prevailing code requirements locally in force (including but not limited to the Canadian Electrical Code, National Building Code, National Fire Code, regional/provincial equivalent codes, etc.), including such reference standards as CSA B140.3-1962 (R2015) "Oil Burning Stoves and Water Heaters", and
   (a) be a direct-vent system,
   (b) be a forced-draft system, or
   (c) be a terminally mounted induced-draft power venter.

NOTE:

1. Naturally-aspirated appliances or barometric dampers do not meet these requirements.

Source: ESNH v12.6 & R-2000 NZE Pilot.

4.1.5 Combustion Air Supply

1. Combustion air supply ducts and damper systems shall serve no more than one piece of equipment.
2. Combustion air supply for space or water heating equipment terminating in conditioned space shall be equipped with an approved device to control unintended air leakage when air is not required for combustion.

NOTE:

1. This requirement does not apply to natural gas-fired or propane-fired water heating equipment.

Source: R-2000 NZE Pilot.

4.1.6 Unvented Fuel-Fired Appliances

1. Except for natural gas and propane cooking appliances where provision is made to exhaust the products of combustion to the outdoors, unvented fuel-fired appliances are not permitted.
2. Unvented fuel heaters, including denatured alcohol fireplaces, are not permitted.

4.2 Heating and Cooling Systems

Source: R-2000 NZE Pilot.

4.2.1 Sizing of Heating and Cooling Systems

1. Space heating and space cooling appliances shall be sized based on a room-by-room calculation in accordance with CSA F280-12 "Determining the Required Capacity of Residential Space Heating and Cooling Appliances".

NOTE:

1. The intent of this requirement is to ensure that heating and cooling systems are sized correctly. Although the total required heating and cooling system capacity is calculated by this program's compliance software, the room-by-room calculation still needs to be performed according to CSA F280-12.
2. HOT2000 v11 has not been validated for compliance to CSA F280-12. As such, the HOT2000 results should not be used for sizing the system where calculations in accordance with CSA F280-12 are required.

Source: R-2000 NZE Pilot.

4.2.2 Hydronic Heating

1. Hydronic heating systems shall be designed and installed in accordance with CAN/CSA B214-16 "Installation Code for Hydronic Heating Systems".

NOTE:

1. Hydronic systems designed and installed in accordance with the procedures taught in training courses offered by the Canadian Institute of Plumbing and Heating (CIPH) or the Heating, Refrigeration and Air Conditioning Institute of Canada (HRAI) meet this requirement.

Source: R-2000 NZE Pilot.

4.2.3 Air Source Heat Pumps

1. Air-source heat pumps shall be
   (a) tested according to CAN/CSA C656-14 "Performance standard for split-system and single-package air conditioners and heat pumps", and
   (b) in the case of split-systems, the indoor and outdoor units have been tested and are compatible to work together.

NOTE:

1. For modelling purposes, energy efficiency ratings for air source heat pumps are listed at http://oee.nrcan.gc.ca/pml-lmp/index.cfm?action=app.welcome-bienvenue&language_langue=en.
2. Contractors are strongly encouraged to verify that the conditioning system is able to provide the requirements as per the designs intent
3. For clarification of eligible equipment see Canada's Energy Efficiency Regulations as described in Article 2.1.2

Source: R-2000 NZE Pilot.

4.2.4 Earth Energy Systems

1. Earth energy systems (ground or water source) shall follow ANSI/CSA C448 SERIES-16 "Design and installation of ground source heat pump systems for commercial and residential buildings" at a minimum.

Source: R-2000 NZE Pilot.

4.2.5 Natural Gas and Propane Fireplaces

1. Natural gas and propane fireplaces shall be
   (a) direct-vent (sealed), and
   (b) pilot-on-demand, interrupted or intermittent ignition systems without a standing pilot light.

4.3 Systems Providing both Space and Water Heating

Source: ESNH v12.6.

4.3.1 Combined Space and Water Heating Systems

1. Combined space and water heating systems shall be
   (a) of the condensing type, and
   (b) tested by a third party accredited by the Standards Council of Canada according to CSA P.911 "Test method for determining the performance of combined space and water heating systems (combos)". (Applies to forced-air space heating systems only.)

NOTE:

1. CSA P.9-tested systems are listed at http://oee.nrcan.gc.ca/pml-lmp/index.cfm?action=app.searchrecherche&appliance=P9COMBO.

Source: ESNH v12.6 & R-2000 NZE Pilot.

4.3.2 Integrated Mechanical Systems

1. Integrated mechanical systems shall be
   (a) of the condensing type, and
   (b) tested according to CSA P.10-07 (R2012) "Performance of Integrated Mechanical Systems for Residential Heating and Ventilation" and meet or exceed the standard's premium performance requirements.

4.4 Solid Fuel Burning Appliances

Source: R-2000 NZE Pilot.

4.4.1 Indoor Automatically Fueled Appliances

1. Automatically fueled appliances, including pellet stoves, central pellet furnaces and boilers, and pellet fireplaces, shall have
   (a) a thermal efficiency rating of 75% or better, as measured using a lower heating value (LHV) as defined in CAN/CSA B415.1-10 (R2015) "Performance Testing of Solid-Fuel-Burning Heating Appliances" for the highest appliance burn rate only,
   (b) a minimum vertical rise of 1.5 m (5 ft), measured from the appliance flue collar to the exterior termination centre line of the flue/vent, and
   (c) no barometric dampers.

4.4.2 Indoor Manually Fueled Appliances

1. Indoor manually fueled appliances, including stoves, fireplaces, fireplace inserts, and central furnaces and boilers, shall
   (a) be certified to, and
      i. CSA B415 "Performance Testing of Solid-Fuel-Burning Heating Appliances", or
      ii. U.S. Environmental Protection Agency (EPA) wood-burning appliance standards 40 Code of Federal Regulations (CFR) Part 60 Subpart AAA.
   (b) have no barometric dampers.

Source: ESNH v12.6 & R-2000 NZE Pilot.

4.4.3 Outdoor Central Heating Appliances

1. Outdoor central heating appliances, such as hydronic heaters and furnaces, shall be certified to
   (a) CAN/CSA B415.1-10 (R2015) "Performance Testing of Solid-Fuel-Burning Heating Appliances",
   (b) U.S. Environmental Protection Agency (EPA) wood-burning appliance standards 40 Code of Federal Regulations (CFR) Part 60 Subpart AAA, or
   (c) Phase 2 EPA Hydronic Heater Program (White tag) listed at https://www.epa.gov/burnwise/understanding-white-tag.

Source: ESNH v12.6 & R-2000 NZE Pilot.

4.4.4 Masonry Heaters

1. Masonry heaters shall be constructed with
   (a) tight-fitting fuel loading doors that are closed during the burn cycle,
   (b) combustion air control providing high-fire burn only,
   (c) a minimum mass of 800 kg (1760 lbs),

(d) a firebox and heat exchange channels built from refractory components with an overall average wall thickness not exceeding 250 mm (10 in),

(e) a gas path through the internal heat exchange channels downstream of the firebox with at least one 180-degree change in flow direction before entering the chimney, and

(f) the length of the shortest single path from the firebox exit to the chimney entrance at least twice the largest firebox dimension.

NOTE:

1. Site-built fireplaces, with the exception of masonry heaters as specified in 4.4.4, are not permitted.

RENOVATION REQUIREMENT

1. If indoor manually fueled appliances, including stoves, fireplaces, fireplace inserts, and central furnaces and boilers, are in the home they shall be either decommissioned or comply with the following requirements:

   (a) it shall be a solid fuel burning appliance certified to,

      i. CSA B415 "Performance Testing of Solid-Fuel-Burning Heating Appliances", or

      ii. U.S. Environmental Protection Agency (EPA) wood-burning appliance standards 40 Code of Federal Regulations (CFR) Part 60 Subpart AAA,

   (b) have no barometric dampers,

   (c) the home undergoes the exhaust devices depressurization test as per EnerGuide Rating System Technical Procedures Version 15 with results showing a pressure difference of less than 5 pascals, and

   (d) carbon monoxide alarms shall be installed in the room containing the appliance; and within each bedroom, or alternatively, outside each bedroom, but within 5 m of each bedroom door measured following corridors and doorways. At least each floor or level in the dwelling must be equipped with a carbon monoxide alarm. Local codes may have more stringent requirements for carbon monoxide detectors that must be met in addition to these requirements.

NOTE:

1. Because solid-fuel-burning appliances present a risk to health and safety through spillage of combustion gases, and that changes to building systems as part of a renovation can increase this risk, it is important to emphasize that local building codes and standards must be adhered to.

2. The CHBA's "*Fireplaces Information Sheet"* and NRCan's "*Combustion Gases in Your Home – Things You Should Know about Combustion Spillage*" shall be provided by the renovator to a homeowner electing not to decommission an existing site-built fireplace in a renovation.

4.5 Domestic Hot Water Systems

Source: R-2000 NZE Pilot.

4.5.1 Gas-Fired Instantaneous Water Heaters

1. Gas-fired instantaneous water heaters shall be certified to CAN/CSA P.7-10 (R2015) "Test method for Measuring Energy Loss of Gas-Fired Instantaneous Water Heaters".

NOTE:

1. Instantaneous water heaters are also referred to as tankless water heaters or on-demand water heaters.

4.6 Water Heating Energy Conservation

Source: R-2000 NZE Pilot.

4.6.1 Drain Water Heat Recovery

1. Drain water heat recovery (DWHR) units shall conform to CSA B55.2-15, "Drain Water Heat Recovery Units".
2. The minimum efficiency of a drain water heat recovery unit shall be determined in conformance with CSA B55.1-15, "Test Method for Measuring Efficiency and Pressure Loss of Drain Water Heat Recovery Units".

NOTE:

1. Drain water heat recovery (DWHR) units are listed on NRCan's website at: http://oee.nrcan.gc.ca/pml-lmp/index.cfm?action=app.search-recherche&appliance=DWHR.

4.7 Ventilation Systems

Source: ESNH v12.6 & R-2000 NZE Pilot.

4.7.1 General

1. To help provide good indoor air quality, a balanced ventilation system with heat recovery shall be provided.
2. The ventilation system must be capable of meeting the principle ventilation air flow rate required by the home.

Source: ESNH v12.6 & R-2000 NZE Pilot.

4.7.2 Required Principle Ventilation Capacity

1. The principle ventilation capacity for residential units shall be achieved through
   (a) a heat recovery ventilator (HRV),
   (b) an energy recovery ventilator (ERV), or
   (c) an integrated mechanical system (IMS)

Source: ESNH v12.6 & R-2000 NZE Pilot.

4.7.3 Design and Installation of Ventilation Systems

1. Ventilation systems for residential units shall be
   (a) designed, installed and balanced in accordance with CAN/CSA F326-M91 (R2014) "Residential Mechanical Ventilation Systems", or Subsection 9.32.3 of the 2015 National Building Code or local equivalent, and
   (b) installed such that the supply and exhaust flows are measured and balanced within 10% at high speed, with a label attached to the equipment indicating the installing company and the measured flow rates, as per Section 4.7 of the ENERGY STAR® for New Homes requirements.
2. The sensible heat recovery efficiency (SRE) shall be taken at an airflow rate greater than or equal to the airflow rate indicated in Table 5 but need not exceed 30 L/s.

NOTE:

1. The applicable SRE corresponding to the airflow rate indicated in Table 5 can also be determined by interpolating between two airflow rates. Extrapolation of SRE values beyond those reported in the HVI Directory is not allowed.
2. The corridor ventilation rate is consistent with ASHRAE Standard 62.1-2010 "Ventilation for Acceptable Indoor Air Quality".

Table 5: Minimum Airflow Rates

Number of Bedrooms	Minimum Airflow Rate (at 0 °C)	
	L/s	CFM
1	16	34
2	18	38
3	22	47
4	26	55
5	30	64
>5	As per good practice such as described in CAN/CSA F326-M91 (R2014) "Residential Mechanical Ventilation Systems"	

NOTE:

1. The applicable airflow rate is determined by the number of bedrooms that was used in the design of the ventilation system.
2. For a listing of products, refer to Section 3 in the HVI "Certified Products Directory", available at: http://hvi.org/proddirectory/index.cfm.
3. Refer to NRCan's website for a list of ENERGY STAR certified products. (http://www.nrcan.gc.ca/energy/products/energystar/why-buy/13631)

Source: ESNH v12.6 & NBC 2015 9.36.3.9

4.7.4 Ventilation Equipment

1. HRV's and ERV's serving individual residential units shall be
   (a) Of the type that is regulated under Canada's Energy Efficiency Regulations as described in Article 2.1.2, or
   (b) ENERGY STAR certified.
2. Integrated HRV air handlers shall
   (a) Be tested to Section 8 of CSA P.10-07 (R2012) "Performance of Integrated Mechanical Systems for Residential Heating and Ventilation", and
   (b) have a defrost mechanism.

NOTE:

1. HRVs and ERVs must be tested in accordance with CAN/CSA C439-18 *Laboratory methods of test for rating the performance of heat/energy-recovery ventilator*s.
2. When tested in conformance with the low-temperature thermal and ventilation test methods described in CAN/CSA-C439-18, HRVs and ERVs shall have a sensible heat-recovery efficiency of at least 60% at an outside air test temperature of 0°C. In addition, locations with a 2.5% January design temperature less than –10°C shall have a sensible heat-recovery efficiency of at least 55% at an outside air test temperature of –25°C.

4.8 Air Distribution Systems

Source: R-2000 NZE Pilot.

4.8.1 Ducts and Plenums

1. Except for exhaust ducts leading directly to the exterior, ducts and plenums carrying conditioned air and located outside the plane of insulation shall
   (a) be insulated to the same level as above grade walls, and
   (b) have all joints sealed with tape or mastic approved for the application, to prevent air leakage.
2. A minimum insulation value of RSI 2.11 (R 12) is permitted for ducts carrying conditioned air located under insulated floors where duct side insulation is increased such that heat loss remains the same.

3. Ducts within and parallel to a wall are not permitted to reduce the insulation of the wall.
4. Ducts within and parallel to a floor or ceiling shall not reduce the effective value of an assembly to less than RSI 2.78 (R 15.8).
5. Ducts carrying untempered outside air through conditioned space shall
   (a) have a minimum thermal resistance of RSI 1.4 (R 8), and
   (b) have a sealed air and vapour barrier on the warm side of the insulation.

Source: ESNH v12.6 & R-2000 NZE Pilot.

4.8.2 Duct Sealing

1. Sealants shall be tape or mastic approved for the application.
2. Except as permitted in 4.8.2.5, heating and cooling system ducts shall be sealed as follows:
   (a) Seal all supply transverse joints, branch take-offs, branch supply joints and manufactured beaded joints on round perimeter pipes located on all floors.
   (b) Seal all return trunks in the basement.
   (c) For common return ducts
      i. seal the drop to the furnace, and the first metre of return ducts measured horizontally from the furnace/air handler connection, and
      ii. within a framed or closed mechanical room seal all the return ducts including joist returns.
3. HRV/ERV and IMS connections to the outdoor vent hoods must be sealed.
4. For dedicated fully ducted ventilation ductwork (e.g. HRV/ERV ducts), all manufactured and site assembled joints must be sealed.
5. The following joints are exempt from additional sealing: self-sealing manufactured pipe, take-offs, and fittings (with manufactured seal or incorporated gaskets); and, snap lock and folded seam longitudinal duct joints.

NOTE:

1. The intent of a sealed duct system is to avoid depressurization, ensure adequate air circulation throughout the house, ensure adequate supply to all rooms, and ensure the ability to properly balance forced-air distribution systems.

RENOVATION REQUIREMENT:

1. If the pre-renovation ductwork system is not completely replaced, then only accessible portions of ductwork must be sealed as per Section 4.8.2 provided each duct run can deliver the appropriate amount of air as calculated by CSA F280-12 “Determining the required capacity of residential space heating and cooling appliances”.

Source: ESNH v12.6.

4.8.3 Interconnection of Ventilation to a Forced-Air Distribution System

1. Where a central forced air system is utilized either fully or in part to distribute ventilation air, the principal exhaust fan control shall be interconnected with the forced air distribution system such that switching on the principal exhaust fan operates the forced air distribution fan.
2. The house air distribution system shall be equipped with an energy-efficient motor (known as brushless DC motors, DC variable speed motors and ECM™ motors). The furnace blower or the air handler can contain the energy-efficient motor.