



ENERGY EFFICIENCY CONSTRUCTION
PROGRAM

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TECHNICAL REQUIREMENTS
SINGLE-FAMILY HOUSES,
TWO-GENERATION HOUSES, AND
SINGLE-FAMILY HOUSES WITH A
DWELLING UNIT

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Québec 

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LEXICON

The definitions in this lexicon have been specifically adapted for the Novoclimat® Program. In the event of discrepancies with common definitions, the definitions herein must be considered as an integral part of the technical requirements for the Novoclimat® Program and take precedence over any other definitions for the certification of a building under the Novoclimat® Program.

ACH: Air changes per hour.

Bathroom: A room used for personal hygiene purposes and equipped with a bathtub or shower.

CCMC: Canadian Construction Materials Centre, which is based at the Institute for Research in Construction of the National Research Council of Canada, and which offers a national evaluation service for all types of construction materials, products, and systems.

Cold-side ducts: The system of ducts located between the heat recovery core of the HRV and the exterior of the building (ducts that supply fresh air from the exterior and discharge exhaust air to the exterior).

Crawl space: Under the Novoclimat® Program, the definition of a crawl space corresponds to that of the NBC 95.

Duplex: A dwelling that is divided into two dwelling units, the smallest of which covers 100% of the storey where it is located.

Dwelling unit: A place of residence. A dwelling unit possesses a separate entrance to the exterior or a common vestibule giving access to the exterior. A dwelling unit contains sanitary, cooking, eating, and sleeping facilities. It is separated from other dwelling units by a partition (wall or floor).

Finished room: A room where finish work is completed on the floor and walls. A space whose floor area corresponds to 35% or less of the total surface area of the storey where it is located may be considered a finished room for the purposes of these technical requirements, regardless of the type of finish material that is installed or intended to be installed.

Heated or temperature-controlled garage: A garage whose exterior-facing walls are insulated in accordance with Chapter 4 of the Québec *Regulation respecting energy conservation in new buildings* and that is equipped or intended to be equipped with a heating or cooling system. Within the meaning of the requirements set out herein, a heated garage is a garage that will be maintained at a temperature above freezing.

HRV-dwelling unit: The performance and specifications of the ventilation equipment required for an apartment building. These HRVs may also be installed in single-family dwellings with no more than 7 finished rooms.

HRV-house: The performance and specifications of the ventilation equipment required for a dwelling, and this, for each dwelling unit that includes an unfinished habitable space corresponding to over 35% of the total surface area of the storey on which it is located or that has more than 7 finished rooms.

Roof balcony: A flat roof formed by a balcony that does not have an attic and is insulated from the inside. This definition applies to flat roofs making up a relatively insignificant part of the total roof surface area.

Semi-detached house or row house: A house attached to another house, each located on its own lot.

Single-family house: A house designed for a single family comprising a single dwelling unit.

Single-family house with a dwelling unit: A house divided into no more than two dwelling units, the smallest of which covers a fraction of the storey on which it is located. This notion has been introduced to differentiate this type of house from a duplex.

Two-generation house: A house that is divided into two dwelling units intended for members of the same family.

Unheated garage: A garage whose exterior-facing walls are not insulated, that is designed to withstand freezing temperatures, and that is not equipped or intended to be equipped with a heating or cooling system.

Warm-side ducts: The system of ducts located between the heat recovery core of the HRV and the spaces served.

Water closet: A room equipped only with a toilet and/or a sink, without a bathtub or shower.

Zone means that part of the total volume of a building that can be depressurized to the same pressure (-50 Pascals). If all parts of the building communicate with each other by openings that are temporarily created to perform the test or that are permanent and if one or more of the blower door fans simultaneously create a pressure differential of 50 Pascals in all these parts, then the building is treated as a single zone.

INTRODUCTION

The technical requirements for the Novoclimat® Program were drafted so as to make it possible to design residential occupancies that meet energy efficiency, comfort, and air quality criteria.

These requirements are grouped together by theme rather than in the usual project design order to make it easier and quicker to refer to them and identify the elements requiring adjustments during the construction phase. This facilitates the work of advisors performing certification inspections.

The technical requirements are composed of two parts (Part One – General Requirements, and Part Two – Requirements for Ventilation Systems) that are broken down as shown in the following example:

2	Part
2.1	Section
2.1.1	Subsection
2.1.1.1	Article
2.1.1.1 a)	Paragraph
2.1.1.1 a) i)	Subparagraph

GENERAL

The main purpose of these technical requirements is to decrease energy consumption, improve the comfort of occupants, and maintain good inside air quality. The main elements of these requirements were drawn from the National Model Energy Code of Canada for Buildings 1997 published by the National Research Council of Canada (NRC), the Québec Construction Code – Chapter 1 - Building, and the National Building Code of Canada 1995 (amended) (NBC 95), and certain requirements of the R-2000 Home Program.

The purpose of the requirements is, more specifically, to

- Reduce building heat loss by using better insulation and increasing the air tightness of the building envelope
- Maintain good inside air quality by choosing healthy materials and installing an efficient ventilation system with fresh air intakes
- Improve the comfort of occupants
- Extend the service life of the building envelope
- Introduce a quality control procedure to verify envelope air tightness using the blower door test

To obtain Novoclimat® certification, a house must comply with the General Requirements (Part 1) as well as the Requirements for Ventilation Systems (Part 2) set forth herein. If an R-2000 house is being built, it must also comply with the special requirements of the R-2000 option. If a model house is being built, it must also comply with the requirements respecting model houses (documents available in the Practical Guide or on the Web site of the Bureau de l'efficacité et de l'innovation énergétiques (the Bureau)).

AREAS OF APPLICATION

The requirements set out herein apply to single-family houses, two-generation houses, and single-family houses with a dwelling unit (that are detached, semi-detached or in a row) and that have a maximum of four levels including the basement. They must be mainly heated with electricity, natural gas, fuel oil, or propane. These units must be designed to be habitable in winter and must be built in Québec.

The Program applies to new houses and major renovations. Duplexes and houses with three dwelling units or more must comply with the Novoclimat® Program requirements for dwelling units.

The requirements set out herein are in addition to the provisions of municipal by-laws and provincial regulations applicable in Québec as well as those of the National Building Code in force.

All proposed design or assembly methods that that may affect the health or comfort of occupants, air quality, or energy consumption must be approved by the Bureau prior to the start of construction.

At the time of an inspection, all reported abnormalities that may lead, directly or indirectly, to occupant discomfort, a malfunction, an inappropriate increase in energy consumption, or adeterioration in the materials, assembly work, or equipment covered by the requirements herein must be corrected by the contractor before the house can be certified. An attestation of conformity with the Program may be required of the contractor.

The Bureau reserves the right to amend these technical requirements. As warranted, it will send a notice to all accredited contractors. The Bureau is the sole adjudicator of questions concerning the application of the requirements and mitigation measures when they are required.

The zone of application of the Novoclimat[®] Program is limited to the Québec regions located below the 51st parallel.

Part One

1. GENERAL TECHNICAL REQUIREMENTS

1.1 THERMAL RESISTANCE VALUE

1.1.1 The R-total values required for house components are presented in Table 1.1.1. These values include thermal bridge coverage for above-grade walls, header joists, foundation walls, and above-grade floors. The specific requirements for thermal bridge coverages are presented in Subsection 1.1.2.

Table 1.1.1		
Exposed components	R-total	
	RSI	R
Roof	7.22	41
Above-grade floors and header joists	4.31 *	24.5 *
Foundation walls	2.99 *	17 *
Above-grade floors exposed to cold	5.2 *	29.5 *
Basement floor	0.88	5
Slab-on-grade	1.32	7.5
* Includes thermal bridge coverages		

- a) An exposed component is a part of the envelope of a heated or air-conditioned space that is in contact with the exterior air or the ground or that is adjacent to an unheated space.

If a living space is designed to be habitable (without requiring major modifications to the structure after the construction phase), this space must be insulated and made airtight in compliance with Novoclimat® requirements. This work must be the responsibility of the accredited builder who registered the building and must be completed before the building can be certified.
- b) The abbreviation R-total corresponds to the total thermal resistance of the entire assembly, including the insulation, the sheathing, finish materials, air films, etc., but does not take into consideration the framing components of the assembly. The recognized thermal resistance for the materials are those indicated in the Model National Energy Code of Canada for Houses 1997 published by the National Research Council of Canada (NRC), the most recent version of the CCMC Registry of Product Evaluations, or the reports provided by a recognized independent laboratory.
- c) The access opening to the attic must have the same thermal resistance as that prescribed for roofs.
- d) The thermal resistance of garage components must comply with the *Regulation respecting energy conservation in new buildings*.

- e) For the foundation, the prescribed thermal resistance must cover the entire height of the wall. Exceptionally, for foundation walls, when the mechanical components (e.g., electric panels, plumbing conduits, etc.) must be installed in the walls in such a way as to not break the finish, the thermal resistance behind these components may be lower than the total prescribed thermal resistance but may not be lower than that of the thermal bridge coverage required for a foundation wall.
 - f) Above-grade floors exposed to cold include all floors that are not in contact with the ground such as above-grade cantilevered floors, floors above unheated spaces or spaces that cannot be adequately heated, and floors over heated and unheated garages.
 - g) When the basement is accessible from one side (difference in height between the part of the property accessible from the ground floor and the part accessible from the basement), slab-on-grade insulation must be installed over the entire section of floor located less than 600 mm (2 ft.) below the finished exterior ground level.
 - h) Roof balconies must have a total thermal resistance (R-total) and thermal bridge coverage equivalent to the values prescribed for the walls below them to which they are attached.
 - i) Special measures must be taken for rooms under a garage. Consult the Bureau for the required information.
- 1.1.2 The thermal resistance (R-total) prescribed in Table 1.1.1 includes thermal bridge coverage composed of a continuous insulating product as specified below:
- a) Above-grade walls, foundation walls, and header joists must be covered with a continuous insulating product with a minimum thermal resistance as follows:
 - i) RSI 0.7 (R-4) for wall assemblies with studs every 400 mm c/c (16 in. c/c) as well as for header joists,
 - ii) RSI 0.53 (R-3) for wall assemblies with studs every 600 mm c/c (24 in. c/c),
 - iii) For wall assemblies constructed of metal studs, the thermal resistance of thermal bridge coverages must be higher than the values listed in articles 1.1.2(a)(i) and 1.1.2(a)(ii). In such cases, the thermal resistance must be sufficiently high to ensure an effective overall thermal resistance value equivalent to a similar assembly built using wood studs.
 - b) For above-grade cantilevered floors or floors above an unheated garage, the continuous insulating product must have a minimum thermal resistance of RSI 1.32 (R-7.5).
 - c) For above-grade floors above a heated garage, the continuous insulating product must be rigid and have a thermal resistance of
 - i) RSI 0.88 (R-5) for floors built with joists made of softwood lumber,
 - ii) RSI 0.26 (R-1.5) for floors built with I-joists,
 - iii) Continuous insulation is not compulsory for floors built with open web joists.
 - d) No thermal bridge coverage is required for above-grade party walls adjacent to a heated garage.
 - e) The required continuous insulation product must cover the entire assembly (studs, sill plates, lintels, sole plates, joists, beams, columns, etc.) on either the outside or inside surface or a combination of the two. However, if the floors and header joists are not built with polyurethane insulation sprayed on site and I-joists or open web joists, all the required continuous insulation must be installed on the outside.
 - f) The installation, during the fall and winter, of materials with low water vapour permeance on the outside surface of other wall insulation must be performed according to the Novoclimat® Program protocol. In certain regions, if a panel with low water vapour permeance is installed on the outside surface of other wall insulation, its thermal resistance must be increased to comply with Article 9.25.1.2 of the NBC 95.
- 1.1.3 When the exposed part of a party wall between two single-family semi-detached or row houses does not possess the thermal resistance required on the cold side of the wall, the party wall must be insulated to a minimum thermal resistance of RSI 2.2 (R-12.5) on each side and must cover a minimum width of 1.2 m (4 ft.) beginning from the outside.

- 1.1.4 In the case of an above-grade party wall between a heated space of the house and a garage, the thermal resistance required must
- Be not less than RSI 3.52 (R-20) for a heated garage
 - Meet the same requirements as exposed above-grade walls for an unheated garage.
- 1.1.5 In the case of a party foundation wall between a heated space of the house and a garage, the minimum required total thermal resistance is RSI 2.99 (R-17), regardless of whether the garage is heated or not.
- 1.1.6 For a basement floor, the required thermal resistance is that listed in the table for a conventional floor whose foundation is suitably protected from freezing and cold by backfill and adequate insulation. Insulating panels must be installed under the floor slab and must have
- A minimum thermal resistance of RSI 0.88 (R-5) over the entire floor,
or
 - A minimum thermal resistance of RSI 1.32 (R-7.5) and cover not less than 1.2 m (4 ft.) around the periphery of the floor,
or
 - A minimum thermal resistance of RSI 1.76 (R-10) and cover the entire floor if the floor contains radiant heating conduits.

In all cases, the basement slab must also be separated from the foundation by a thermal break with a minimum thermal resistance of RSI 0.70 (R-4).

Basement floors must have a vapour barrier membrane. This membrane must be installed directly under the concrete slab, and the joints must be sealed or must overlap by not less than 300 mm (12 in.).

- 1.1.7 Slabs are considered on-grade when they are located less than 600 mm (2 ft.) below the average level of the adjacent ground. In such cases, the slab must be insulated with panels under the slab over the entire surface of the floor as well as vertically down the foundation wall around the edge of the slab to a minimum depth of 600 mm (2 ft.) below the level of the adjacent soil. The insulation must have
- A minimum thermal resistance of RSI 1.32 (R-7.5),
or
 - A thermal resistance of RSI 1.76 (R-10) if the floor contains radiant heating conduits.
- In all cases, the slab-on-grade must also be separated from the foundation by a thermal break with an
- RSI of 1.32 (R-7.5) minimum,
or
 - RSI of 1.76 (R-10), if the floor contains radiant heating conduits.

On-grade floating slabs without a foundation must be insulated according to the same criteria as on-grade slabs with a foundation. However, the edge of the slab must be insulated from the exterior, and the insulation must extend horizontally underground over a minimum distance of 600 mm (2 ft.) around the edge of the building.

All on-grade slabs must have a vapour barrier membrane. The membrane must be installed under the concrete slab and the joints must be sealed or must overlap by not less than 300 mm (12 in.).

- 1.1.8 Crawl spaces are considered heated or unheated in accordance with the conditions and definitions set out in the NBC 95.
- a) Crawl space floors must be covered with polyethylene sheets not less than 0.15 mm thick (6 thousands of an inch). If the sheets are not covered with a layer of concrete not less than 50 mm (2 in.) thick, they must be ballasted and overlapped by not less than 300 mm (12 in.) or sealed.
 - b) Crawl space floors do not need to be insulated.
 - c) The walls of heated crawl spaces must be insulated in accordance with the requirements for foundation walls.

1.2 ENVELOPE AND AIR TIGHTNESS

- 1.2.1 The rate of air leakage of the building envelope (expressed as air changes per hour; ACH) must not exceed 2.5 ACH at 50 Pascals of depressurization before installing the inside finish material (drywall) and after the completion of all work.

However, even if the ACH is less than 2.5 ACH, all sources of air infiltration that could cause local problems should be sealed. Individual leaks must be sufficiently small to prevent air infiltrations and exfiltrations from affecting air quality, causing discomfort, or leading to the deterioration of the building.

The ACH is determined by performing a blower door test in accordance with CAN/CGSB2-149.10-M86 "Determination of the Airtightness of Building Envelopes by the Fan Depressurization Method" or by another method recognized by the Bureau.

- 1.2.2 In the case of single-family semi-detached or row houses, contiguous heated spaces of dwelling units are tested one at a time without depressurization using a fan. The surface area of the envelope (air barrier system) includes the components of the building that separate the dwelling units from each other.

In the case of two-generation houses and single-family houses with a dwelling unit, the whole building is tested as a single zone regardless of the air tightness between the units. The builder must provide for sufficient permanent or temporary openings to enable the blower door test to be performed in a single zone.

- 1.2.3 During the air tightness test, exceptionally, wood stove and fireplace chimneys can be sealed if the stove or fireplace has not yet been installed. No other openings must be sealed if they are meant to remain open when the house is occupied.

- 1.2.4 When the house includes a garage, the garage door used for vehicles must remain open during the test.

All party walls between the garage and an inhabited part of the house must be sealed so as to form an air/gas barrier system.

- 1.2.5 All surfaces of insulated walls, ceilings, and floors must be protected by a vapour barrier. The continuity of the vapour barrier must be ensured by overlapping the joints by 100 mm (4 in.), sealing the joints, or using another method approved by the Bureau. The permeance of the vapour barrier must comply with requirements of the NBC 95.

- a) When the vapour barrier also serves as an air barrier, electrical boxes and cables must be installed in interior walls (or interior side of the vapour barrier, without puncturing it), or airtight junctions sealed to the vapour barrier must be used.

- b) Sheet materials around openings, along the edges of sheets, and at joints between sheets must be permanently sealed on a rigid backing or in such a way as to withstand foreseeable movements.
 - c) When a vapour barrier sheet cannot be adjusted and adequately attached between each joist at the header joists (e.g., open web joists) in such a way as to create an appropriate vapour barrier shield, the header joists must be insulated using polyurethane sprayed on site or pieces of rigid insulation sealed along the entire edge between each joist so as to insulate in the same way as foam polyurethane.
- 1.2.6 Ventilation system air ducts must be equipped with dampers that can ensure sufficient air tightness in the absence of a forced air flow.

All ducts passing through air or vapour barriers must be hermetically sealed to the barriers.

The sections of ventilation, heating, and cooling ducts that must exceptionally pass through a garage, an attic, or any other unheated space must be hermetically sealed along the entire length of transverse and longitudinal joints.

Through-the-wall air conditioners are prohibited under the Program.

- 1.2.7 Under the Novoclimat® Program, the assembly of airtight materials must
- a) Withstand air movements
 - b) Be rigid and strong enough to withstand air pressure differentials
 - c) Be continuous, by sealing joints, edges, air spaces, holes, and tears
 - d) Have a long service life

1.3 DOORS AND WINDOWS

- 1.3.1 All windows, sliding patio doors, large glass patio doors, and glazed entry doors must have double sealed glazing, argon or krypton between the glazing, a low emissivity coating (low-e), an insulating glass spacer, and A2 air tightness approval in compliance with CAN/CSA-440-M90.

For south-facing windows, the low emissivity coating (low-e) is not compulsory if the window is manufactured with triple sealed glazing.

Entry door glazing is not required to have a low emissivity coating (low-e) or argon or krypton if the glazed surface area is less than or equal to 0.46 sq. m. (5 sq. ft.) or is decorative.

All windows (save basement windows) must be installed in the wall in such a way that the glazing is located in the insulated part of the wall. Ideally, the glazing must be located at the centre of the R-total value of the materials or further inside, but must not exceed the vertical axis of the intermediary sheathing of the wall. If the window is not located in compliance with this requirement, additional insulation must be installed.

- 1.3.2 Entry doors, excluding sliding patio doors and large glass patio doors, must be steel doors insulated with polyurethane in compliance with CAN/CGSB-82.5-M88. The exterior doors of heated garages must have an average minimum thermal resistance of RSI 2.1 (R-11.9).
- 1.3.3 The frames of aluminium and steel doors and windows must have a thermal break. The frames must be insulated with slow expansion polyurethane or another method that is recognized by the Bureau.

- 1.3.4 Basement window frames must be separated from the foundation in such a way as to have a thermal resistance of not less than RSI 0.7 (R-4) from the central axis of the glazing to the insulation installed on the inner or outer surface of the foundation. If the insulation of the frame does not have this thermal resistance, additional insulation must be installed between the frame and the foundation to attain the required thermal resistance.

If the frame does not touch the interior insulation of the foundation wall, an insulating material with a minimum thermal resistance of RSI 0.7 (R-4) must be added to ensure the continuity of the insulation.

1.4 INTERIOR AIR QUALITY AND CARBON MONOXIDE

- 1.4.1 Latex paint must be used for all major indoor painting work.
- 1.4.2 Flexible floor coverings must be installed using a water-based adhesive known to release low levels of contaminants into the ambient air of the house.
- 1.4.3 The use of healthy materials is strongly recommended. If the components of exterior walls are likely to release contaminants into the ambient air, additional sealing work may be required to contain the gases emitted by materials outside habitable spaces.
- 1.4.4 When the house has a garage with one or more doors giving direct access to the house, residential carbon monoxide detectors must be installed inside the house near each door leading to the garage.

As an alternative, carbon monoxide detectors may also be installed not less than 5 m (16 ft. 5 in.) from each bedroom. In this case, if the basement has a door leading to the garage, at least one carbon monoxide detector must also be installed there.

The required detectors must be in compliance with CSA-6.19, have an integrated alarm, be powered by electricity, be configured so that there is no disconnecter between the overvoltage protection device and the detector, and must also be mechanically installed at the height recommended by the manufacturer.

- 1.4.5 When the house has a garage with one or more doors giving direct access to the house, the doors must be gas-tight and must be equipped with an automatic mechanical closing device.

1.5 MAIN SPACE HEATING SYSTEMS

- 1.5.1 All of the following heating systems are eligible: autonomous appliances such as baseboard heaters, convection heaters, and radiant panels as well as forced air and hot water systems that use electrical, heating oil, natural gas, propane, or heat pump heat generators.
- 1.5.2 Appliance performance must comply with the *Regulation respecting the energy efficiency of electrical or hydrocarbon-fuelled appliances*.
- 1.5.3 Heating appliances must be regulated by electronic thermostats (with electronic temperature detection and heating modulation for autonomous electric heating) for autonomous electric heating appliances in decentralized installations or programmable electronic thermostats for central heating systems.

Programmable thermostats are not compulsory for heat pumps and radiant heating systems.

For hydronic heating appliances such as hot water baseboard and convection heaters, electronic thermostats with proportional controls must be connected to mechanical modulating control valves with an electric motor. Thermostatic valves are not authorized.

For “all-or-nothing” heating appliances such as unit heaters and unit ventilators, electronic thermostats without modulating control valves must be used.

1.6 DOMESTIC HOT WATER HEATING SYSTEMS

- 1.6.1 Appliance performance must comply with the *Regulation respecting the energy efficiency of electrical or hydrocarbon-fuelled appliances*.
- 1.6.2 Fuel-fired heating appliances must be installed in compliance with Section 1.7 “Fuel-fired Heating Appliances” herein so as to provide protection against depressurization.
- 1.6.3 Natural gas-fired storage hot water heaters with an input less than 22 kW must be in compliance with CSA 4.1-M98.
- 1.6.4 Oil-fired storage hot water heaters with an input less than or equal to 30.5 kW and a capacity not exceeding 190 L must comply with CAN/CSA-B211-00.

1.7 FUEL-FIRED HEATING APPLIANCES

- 1.7.1 Wood-, granule-, and biomass-burning stoves must comply with local requirements and meet one or more of the following performance and air emission standards:
 - CSA B415.1-M92: Performance Testing of Stoves, Inserts and Low to Medium Burn Rate Factory Built Fireplaces
 - 40 CFR Part 60: Wood Burning Appliance Standards (1990), Environmental Protection Agency (EPA), United States.

Fireplaces must be of the advanced combustion type. They must be equipped with tight-fitting doors with high-temperature-resistant glass. The combustion chamber and heat exchanger must have an insulated envelope. The interior of the combustion chamber must also be covered with refractory bricks or be designed to maintain an elevated temperature. These appliances must comply with government and local fire safety and air emission requirements.

All solid fuel-fired appliances must have an exterior air intake with a closing mechanism to prevent air from entering when the appliance is not being used.

If the house is not immediately equipped with a solid fuel-burning appliance (wood stove or fireplace) but has a chimney and is intended to receive this type of appliance, the air intake must be installed and temporarily blocked.

- 1.7.2 Combustion in central heating appliances and systems, supplementary heaters, and drinking water heaters that are fuelled with natural gas, propane, or heating oil must occur in sealed circuits.

Forced draft or induced draft appliances are permitted for appliances that heat drinking water. In these cases, the installation of the appliance must meet the specific criteria of energy distributors, municipal by-laws regulating the supply of combustion air from the outside, and the following conditions:

- a) If there is an air intake, it must not cause discomfort to the occupants.
- b) The appliance must not be subject to detrimental depressurization caused by an exhaust fan in the house. A mechanical pressure compensation device must be installed if detrimental depressurization is possible.

- c) If there is an air intake, it must not reduce the overall air tightness of the house beyond the permitted limit. A blower door test must confirm the air exchange rate of the house, including the installed, unobstructed air intake.
- 1.7.3 In the case of wood-, wood granule-, and biomass-burning appliances and an exhaust device with a capacity exceeding 283 L/s (600 ft³/min), a depressurization evaluation must be performed in accordance with the Novoclimat® Program procedure. Under the R-2000 option, the maximum eligible capacity is 75 L/s (159 ft³/min).
A mechanical pressure compensation device to ensure the entry of an appropriate volume of fresh air must be installed, as warranted.
If the house is not immediately equipped with a solid fuel-burning appliance (wood stove or fireplace) but has a chimney and is intended to receive this type of appliance, the capacity of the exhaust devices must comply with the criteria indicated above.
- 1.7.4 Fireplaces and chimneys abutting or penetrating an insulated exterior wall, floor, or ceiling must be installed so as to ensure the continuity of air tightness and insulation in compliance with the manufacturer's specifications.
- 1.7.5 If the ducts that supply the combustion air to the appliances pass through a heated space, they must be insulated to a minimum thermal resistance of RSI 0.88 (R-5) or according to the manufacturer's recommendations when the ducts are part of a prefabricated component or when they are supplied with the combustion appliance. The ducts must also include a continuous vapour barrier to avoid the formation of condensation on the ducts.
- 1.7.6 In all cases, a residential carbon monoxide detector must be installed in each room where a combustion appliance is located.
As an alternative, carbon monoxide detectors may also be installed not less than 5 m (16 ft. 5 in.) from each bedroom. In this case, if a combustion appliance is located in the basement, at least one carbon monoxide detector must also be installed there.
The required detectors must comply with CSA-6.19, have an integrated alarm, be powered by electricity, be configured so that there is no disconnect between the overvoltage protection device and the detector, and must also be mechanically installed at the height recommended by the manufacturer.

1.8 WATER USE

- 1.8.1 All water closets must have a maximum evacuation capacity of 6 L of water per flush.
- 1.8.2 All sinks and wash basins must be equipped with aerators with a maximum flow of 8.3 L/min at 4.1 kg/cm² of pressure.

1.9 LIGHTING AND OTHER LOADS

- 1.9.1 Electrical outlets used to plug in block heaters and winter holiday decorations must be controllable by switches located inside.
- 1.9.2 Exterior lighting appliances must be controllable from inside, unless they are equipped with a motion detector or a photoelectric controller.

Part Two

2. TECHNICAL REQUIREMENTS FOR VENTILATION SYSTEMS

2.1 STANDARDS AND SPECIAL REQUIREMENTS

- 2.1.1 All mechanical ventilation systems must be designed, installed, and balanced by ventilation specialists accredited by the Bureau or an organization recognized by it.
- 2.1.2 All the dwelling units of a house must be equipped with a heat recovery ventilator (HRV) unique to it (including dwelling units in two-generation houses).
- 2.1.3 All ventilation installations must comply with the requirements herein, Section 9.32 of the NBC 95, the recommendations of the equipment manufacturer, and industry best practices. In the event of discrepancies, the requirements herein must be interpreted as in addition to the NBC 95 and industry best practices.

Certain additional requirements may be required in colder regions so as to ensure the comfort of occupants. See Section 2.15 herein and consult the Bureau for more information.

- 2.1.4 The ventilation needs of all the dwelling units in a house must be calculated by adding the air flow requirements for each room shown in the table below (reproduction of Table 9.32.3.3 of the NBC 95).

	Ventilation Capacity (requirement)	
Master bedroom	10 L/s	21.2 CFM
Other bedrooms	5 L/s	10.6 CFM
Living room	5 L/s	10.6 CFM
Dining room	5 L/s	10.6 CFM
Family room	5 L/s	10.6 CFM
Recreation room	5 L/s	10.6 CFM
Unfinished basement*	10 L/s	21.2 CFM
Other habitable rooms	5 L/s	10.6 CFM
Kitchen	5 L/s	10.6 CFM
Bathroom or water closet room	5 L/s	10.6 CFM
Laundry	5 L/s	10.6 CFM
Utility room	5 L/s	10.6 CFM

* 5 L/s is permitted if the unfinished part of the basement represents less than 2/3 of the total surface area of the basement.

2.2 PLANS FOR APPROVAL

2.2.1 When necessary, the plans of a Novoclimat® house must be submitted for approval and must contain precise instructions for the installation of the proposed ventilation system. The plans must include the following information:

- a) Location of the HRV
- b) Locations of the fresh air intake and exhaust air outlets
- c) Locations of the exhaust vents of the clothes dryer, range hood, and any other appliance that produces exhaust air
- d) Locations of all the fresh air and exhaust air grills
- e) Location of the HRV drain
- f) Locations of all ducts

2.2.2 The ventilation system installer must also provide, in writing, the following information:

- a) Specifications of the selected HRV
- b) Total air flow rate (high speed and low speed)
- c) Dimensions and air flow rates of each grill
- d) Dimensions of all ducts
- e) Materials used for the ducts
- f) Air flow rates of intermittent appliances (range hood and exhaust fans)

2.3 ELIGIBLE UNITS

2.3.1 Eligible heat recovery ventilators (HRV) must be certified by the Home Ventilating Institute (HVI).

The method for defrosting units must not involve the use of a heating element and must not cause internal depressurization of the house.

For units that use a fifth intake for the defrosting cycle, the air flow of the intake must be channelled according to Novoclimat® requirements so as to avoid depressurization effects near combustion appliances or to bypass depressurization defrosting.

2.3.2 Efficiency of ventilation systems

- a) For HRV-house ventilation systems, the sensible heat recovery efficiency (SER) certified by the HVI at a calculated outside temperature of -25°C must be equal to or greater than 60%.
- b) For HRV-dwelling unit ventilation systems, the sensible heat recovery efficiency (SER) certified by the HVI at a calculated outside temperature of -25°C must be equal to or greater than 54%.

This type of HRV is normally installed in duplexes, houses with three dwelling units or more, the smaller dwelling unit of two-generation houses, or the smaller dwelling unit of single-family houses with a dwelling unit.

2.4 VENTILATION SYSTEM CONTROLS

2.4.1 Control modes required:

- a) For HRV-house ventilation systems, the HRV control system must include the following modes:
 - i) Stop
 - ii) Low-flow exchange
 - iii) Intermittent low-flow exchange
 - iv) High-flow recirculation
 - v) High-flow exchange controlled by a dehumidistat or a pollution detector with a cyclic timer
- b) For HRV-dwelling unit ventilation systems, the HRV control system must include the following modes:
 - i) Stop
 - ii) Low-flow exchange
 - iii) Recirculation
 - iv) High-flow exchange controlled by a dehumidistat or a pollution detector with a cyclic timer

2.4.2 In all cases, when the dwelling unit has a forced air heating system, the recirculation mode of the HRV is not compulsory, but it must automatically start up the furnace blower when the HRV turns on.

2.4.3 In all cases, the central control of the unit (including all the required functions) must be installed in an open space on the ground floor or in an open space of the dwelling unit (corridor or central wall).

2.4.4 Bathrooms that are ventilated by the HRV must have a control device (timer, push-button, or other) that makes it possible, as needed, to activate the high-flow exchange mode of the unit.

2.5 DUCTS

2.5.1 Unless major constraints have been demonstrated and have been pre-approved by the Bureau, hot and cold air ducts and ducts connected to HRV must always be located in interior walls or floors and not in attics or unheated spaces. One-storey houses with slabs-on-grade or houses with special structural constraints may be considered as exceptional situations by the Bureau.

2.5.2 To minimize problems caused by turbulence and inconveniences caused by air flow noise, the dimensions of the ducts (save for the principal ducts) must comply with the table below if they have not been determined by a competent professional who is independent of the installer:

Secondary and subsequent ducts		Maximum allowable air flow
Round mm (in.)	Rectangular mm (in.)	L/s (CFM)
Secondary and subsequent ducts		Maximum admissible air flow rate
100 (4)	57 or 82.6 x 254 (2 ¼ or 3 ¼ x 10)	19 (40)
125 (5)	57 or 82.6 x 254 (2 ¼ or 3 ¼ x 10)	31 (65)
150 (6)	82.6 or 100 x 254 (3 ¼ or 4 x 10)	52 (110)

- 2.5.3 Short sections of flexible duct are required at the intake and outlet of the HRV, on the warm and cold sides, to attenuate the transfer of vibrations caused by the unit.
- 2.5.4 The exhaust duct on the cold side of the HRV and of clothes dryers and exhaust fans may be flexible regardless of whether they are accessible or not.
- 2.5.5 The supply duct on the cold side of the HRV must be made of galvanized steel that can be cleaned as needed. However, if it remains permanently accessible, this duct must be made of flexible material. Roof spaces of all types are not considered as accessible spaces under the requirements herein.
- 2.5.6 In all cases, the authorized flexible ducts must be suitably installed, be as short as possible, be suitably supported and stretched so as to reduce the roughness caused by the natural cavities on the inside surface, not be crushed, and have a minimum curve radius not less than that of the rigid elbows used to change the air direction.
- 2.5.7 All supply and intake ducts on the warm side of the system (toward the inside of the house) must be made of galvanized steel that can be cleaned as needed.
- 2.5.8 Connections, tees, and right angle elbows with no radius are prohibited for warm-side supply ducts.
- 2.5.9 Duct air tightness:
 - a) All ducts passing through an air or vapour barrier must be hermetically sealed to the barrier.
 - b) Transverse joints, cracks, and holes on all ducts must be covered with aluminium foil tape using the method approved by the Bureau. The air leakage rate of the duct systems must not prevent air flow balancing.
 - c) All sections of ducts that must exceptionally pass through attics and unheated spaces must be hermetically sealed along the entire length of transverse and longitudinal joints.
 - d) All sections of ducts that must exceptionally pass through a heated garage must be hermetically sealed along the entire length of transverse and longitudinal joints.

2.5.10 Thermal resistance required for ducts:

- a) Ducts that are located on the cold side of the HRV (fresh air intake and exhaust outlet) and that pass through a heated space must be insulated along their entire length with insulation with a minimum thermal resistance not less than RSI 0.7 (R-4), installed value.
- b) All sections of ducts that must exceptionally pass through a heated garage must be insulated along their entire length with insulation with a minimum thermal resistance not less than RSI 0.7 (R-4), installed value.
- c) All sections of ducts (warm and cold sides) that must exceptionally pass through attics and unheated spaces must be insulated along their entire length with insulation with a minimum thermal resistance not less than RSI 0.97 (R-5.5), installed value.
- d) All sections of the exhaust ducts from exhaust fans, clothes dryers, and range hoods that pass through an attic or an unheated space must be insulated along their entire length with insulation with a minimum thermal resistance not less than RSI 0.7 (R-4), installed value.
- e) All sections of exhaust ducts from exhaust fans, clothes dryers, and range hoods that do not pass through an attic, but that pass through an inaccessible heated space must be insulated along the entire length of the inaccessible part for a distance of up to 3 m (9.85 ft.) from the outside to the inside. These sections of duct must be insulated using insulation with a minimum thermal resistance of RSI 0.7 (R-4), installed value.

2.5.11 Type of insulating sleeve required:

- a) All required insulating sleeves must have an adequate vapour barrier.
- b) Insulating sleeves for galvanized steel ducts must have an aluminium foil vapour barrier. The insulating sleeve must be sealed using aluminium foil tape or using a method approved by the Bureau.

2.5.12 All heating ducts that must exceptionally pass through attics, unheated spaces, or heated garages must comply with the same insulation and air tightness criteria as the ducts on the warm side of the HRV that pass through unheated spaces. The type of insulating sleeve prescribed in Article 2.5.11(b) is also required when the heating ducts are made of galvanized steel.

2.5.13 Ducts passing through spaces where they might be damaged must be adequately protected against mechanical damage using gypsum boards or other rigid finish materials.

2.5.14 Duct noise can be attenuated using silencers for air ducts or rigid elbows to change the air direction. The use of flexible sections of duct is also authorized to attenuate noise in ducts too close to the ventilation unit. The duct must remain permanently accessible.

2.6 BALANCING DAMPERS

2.6.1 All branches of principal ducts and ducts leading to air supply or exhaust grills must be equipped with balancing dampers installed in a permanently accessible place.

Principal balancing dampers must be installed near the HRV before any branch.

Secondary balancing dampers must be located as far as possible from the grill and must be permanently accessible through an unfinished, suspended ceiling or an access opening.

Tertiary dampers must comply with the same criteria as secondary dampers but may be accessible via the grills if there are only two tertiary dampers in a branch that supplies air to a second storey.

- 2.6.2 In the case of tertiary balancing dampers that are accessible via the grills, each damper must be attached so as to not move after the final balancing operation. They must not generate bothersome noise or interfere with adequate air diffusion in the room.
- 2.6.3 When the installed HRV does not have integrated exhaust and supply air dampers, they must be installed before branches on the principal air supply duct to the rooms of the house and on the principal exhaust air duct
- 2.6.4 All balancing dampers must be locked and mechanically attached after the final balancing operation.

2.7 AIR SUPPLY GRILLS

- 2.7.1 Air supply grills must be installed in each bedroom, on each storey without a bedroom, in the principal living area, in rooms serving as an office, and in frequently used work spaces.
- 2.7.2 The choice of grills must take into account the air flow required for each room and the diffusion profile of the air so as to avoid noise from the air flow or uncomfortable air flows or air displacements. Wall-mounted air supply grills must be rectangular.
- 2.7.3 In the case of an installation not combined with a forced air system, the air supply grills must be located at the top of the wall not less than 300 mm (12 in.) from the finished ceiling and must project the air toward the ceiling. The horizontal displacement of the air must be perceptible at approximately 91 cm (3 ft.) from the grill. The air may be distributed using diffusers in the ceilings if there is a device to heat the air supply so as to allow the air to enter at not less than 18°C.
- 2.7.4 In the case of an installation combined with a forced air system, the air supply duct system will be used to distribute fresh air inside the house.
- 2.7.5 The placement of each grill must be planned so as to allow the balancing of air flows even after the finish work has been completed.
- 2.7.6 Air supply grills must be located in the rooms so as to ensure optimal ventilation.

2.8 HRV EXHAUST AIR INTAKE GRILLS AND FORCED AIR SYSTEM AIR RETURN GRILLS

- 2.8.1 An HRV exhaust air intake grill must always be installed in each bathroom. The bathrooms must have an autonomous exhaust fan.
However, if a house has more than three bathrooms, only the three bathrooms used most often by the occupants must be served by the HRV. The others, such as water closets, may have autonomous exhaust fans.
- 2.8.2 HRV exhaust air intake grills must be installed at the top of the walls or on the ceiling, without passing through the attic (see Section 2.5 Ducts). They must be installed as close as possible to sources of humidity, odour, and pollutants, and so as to optimize ventilation in the rooms.
- 2.8.3 Intake grills installed in kitchens must not be located less than 1 m (39 in.) horizontally from the space between the cooking surface of the range up to the ceiling over the range. Intake grills installed in kitchens must have removable, washable filters that can catch grease and dust.
- 2.8.4 Intake grills installed in workshops that may often have suspended dust in the air must have a removable filter that can catch dust and a damper that can be used to close the duct or grill.

- 2.8.5 Air return grills of forced air systems must be installed in open spaces on walls not less than 102 mm (4 in.) above the floor so as to reduce the introduction of dust into the ducts.
- 2.8.6 Forced air systems must have at least one air return grill per storey (including the basement).

2.9 OPERATING NOISE LEVEL

- 2.9.1 Special noise attenuation measures must be taken when the operating noise level of the ventilation system exceeds 40 dBA in areas used for rest and relaxation such as bedrooms, living rooms, and family rooms.
- 2.9.2 Autonomous bathroom exhaust fans must have a maximum noise rating that complies with the NBC 95 when required.

2.10 AIR FLOW BALANCING

- 2.10.1 When the installed HRV does not have integrated measurement stations or specific devices to measure air flows, measurement stations must be installed at the appropriate places before any branches on the principal air supply duct leading toward the rooms of the house and on the principal exhaust air intake duct.
Measurement stations with a 150-mm- (6 in.) diameter tubular sleeve used for standard measurement purposes must
- Be installed on the warm-side ducts of the unit,
 - Be installed in a straight section not less than 300 mm (12 in.) upstream or downstream from obstacles such as balancing dampers, elbows, and branches, and
 - Be installed not less than 750 mm (30 in.) upstream from the HRV air supply outlet.
- After the balancing operation, the measurement stations may be removed and recovered by the installer. However, the installer must install short, retractable sections of duct at the places where the stations were installed to allow for and facilitate the installation, as warranted, of measurement stations by the Novoclimat® evaluator.
The ventilation specialist must provide the equipment required to verify the air flow rates of all installations that require non-standard measurement stations, that is, those with a diameter less than or greater than 150 mm (6 in.).
All air flow measurement methods that differ from those described herein and those recommended by the manufacturer of the HRV must be submitted to the Bureau and must be pre-approved.
- 2.10.2 When balancing the system, a maximum differential of 10% between the total fresh air flow rate and the total exhaust air flow rate will be accepted. In no case must the HRV cause internal depressurization that could interfere with the combustion appliances in the house.
- 2.10.3 In addition, the principal air flow rates measured must have a maximum differential of $\pm 15\%$ with the rates calculated or specified for the ventilation requirements of each dwelling unit.
- 2.10.4 According to the design of the ventilation system, the air flow rate of each grill must be adjusted on the basis of its location. Each air flow rate must have a maximum differential of 15% with the minimum and maximum air flow rates indicated in Table 2.10.4.
Please refer to Subsections 2.7.1 and 2.8.1 herein for the rooms that must be served by a ventilation system.

Table 2.10.4
Minimum and maximum flows for rooms served by the HRV

	Fresh air flow		Exhaust air flow	
	Minimum required	Maximum allowable	Minimum required	Maximum allowable
Kitchen	N/A	N/A	0	N/A
Dining room	4.7 L/s (10 CFM)	11.8 L/s (25 CFM)	N/A	N/A
Living room	4.7 L/s (10 CFM)	18.9 L/s (40 CFM)	N/A	N/A
Family room	4.7 L/s (10 CFM)	18.7 L/s (40 CFM)	N/A	N/A
Office	4.7 L/s (10 CFM)	9.4 L/s (20 CFM)	N/A	
Recreation room	4.7 L/s (10 CFM)	18.9 L/s (40 CFM)	N/A	
Master bedroom	9.4 L/s (20 CFM)	9.4 L/s (20 CFM)	N/A	
Secondary bedroom	4.7 L/s (10 CFM)	9.4 L/s (20 CFM)	N/A	
Principal bathroom	N/A	N/A	23.6 L/s (50 CFM)	35 L/s (75 CFM)
Secondary bathroom	N/A	N/A	14.2 L/s (30 CFM)	35 L/s (75 CFM)
Laundry	N/A	N/A	N/A	N/A
Workshop	N/A	N/A	N/A	N/A
Unfinished basement	4.7 L/s (10 CFM)	18.9 L/s (40 CFM)	N/A	N/A

2.10.5 The installer must balance the total fresh air flow rate, the total exhaust air flow rate, and the air flow rate of all the grills of the system using instruments and a method approved by the Bureau.

2.11 KITCHEN AND BATHROOM VENTILATION

2.11.1 Wall-mounted range hoods must have a minimum air flow rate of 65 L/s/m (3.5 CFM/in.) while range hoods installed over a range in an island must have a minimum air flow rate of 75 L/s/m (4 CFM/in.) over the width of the range. However, the total capacity of the installed range hood must never be less than 50 L/s (106 CFM). The exhaust of range hoods must vent directly to the outdoors.

2.11.2 The principal bathroom is the bathroom used the most often. It must be served by an HRV and have a minimum exhaust air flow rate of 24 L/s (50 CFM). All other bathrooms as well as water closets served by the HRV must have a minimum exhaust air flow rate of 14 L/s (30 CFM). If there is a bathroom serving the principal bedroom and a bathroom for the use of the occupants of the other bedrooms, the bathroom of the principal bedroom will be considered as the bathroom used the most often.

When water closet air is evacuated by an autonomous exhaust fan, the autonomous fan must have a minimum nominal exhaust air flow rate of 25 L/s (53 CFM).

The exhaust air flow rates are minimums and must generally be higher to ensure adequate ventilation of the bathrooms.

2.12 OUTDOOR FRESH AIR INTAKE AND EXHAUST AIR OUTLET VENTS

2.12.1 Fresh air, combustion air, and compensation air intakes must be located not less than 457 mm (18 in.) from the ground or any other surface where snow may accumulate and not less than 183 cm (72 in.) from any exhaust air vent, from the edge of a parking space, and from any other source of contaminants.

- 2.12.2 Air intake and outlet vents must be protected against the weather and have a screen. All air outlet vents (or ducts immediately adjacent to these vents) must be equipped with dampers that can ensure sufficient air tightness in the absence of a forced air flow.
- 2.12.3 HRV air intake vents installed less than 3 m (9.85 ft.) from the ground or any surface where snow may accumulate must be permanently identified.
- 2.12.4 Exhaust air vents must be wall mounted. If, exceptionally, they must be installed on cornices or the roof, the vents must be specially designed for this use. In addition, for exhaust vents on cornices, non-ventilated soffits must be used over a distance of at least 600 mm (24 in.) on each side of the exhaust air vent.

2.13 LOCATION AND INSTALLATION OF THE VENTILATION UNIT

- 2.13.1 The ventilation unit must always be installed in a heated, accessible, clean space and must never be installed in a garage unless it is in an airtight service room.

In such cases, the service room in the garage must be designed such that no contaminants can be transmitted to the interior of the house. The party walls of the garage must be airtight and insulated in compliance with the requirements herein. There must be an opening in the wall between the house and the service room so as to allow adequate depressurization of this room during blower door tests in order to measure and ensure the air tightness of the service room.

- 2.13.2 Unless there are proven constraints, the unit must be located in the basement near the hot water heater and a drain in the floor or near a waste pipe to which it can be connected.
- 2.13.3 The HRV must be installed so as to not transmit vibrations to the house structure.

2.14 DRAINAGE IN A WASTE PIPE

- 2.14.1 All connections to waste pipes must comply with the plumbing code in force.

2.15 AIR SUPPLY HEATING

- 2.15.1 In colder regions and in cases where circulation of low temperature air may cause repeated problems of discomfort, an air supply heating device must be installed.

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