

Section 10.2. Energy Efficiency

10.2.1. Energy Design Building Classification

10.2.1.1. Application

- 1) Except as permitted by Sentence (2), a *building* shall be designed and constructed in conformance with this Subsection for the purpose of energy efficiency.
- 2) A structure that cannot be identified by the characteristics of a *building* in this Subsection shall comply with the requirements of 10.2.1.2., or as deemed *acceptable* to the Chief Building Official.
- 3) To meet the energy efficiency requirements of Articles 10.2.1.2. to 10.2.1.6., the design requirements of Subsection 10.2.2. shall form an integral part of this Subsection.
- 4) For the purposes of Part 10 and the classification of applicable energy design requirements of a *building*, the application of these requirements are to be applied to a *building* or that portion of a *building*, which for the purposes of energy and emissions performance, is designed to function as an independent entity. (See Note A-10.2.1.1.(4).)
- 5) Except as permitted by Sentence (6), a balcony, including those that are enclosed, shall be designed and constructed as unconditioned ambient space, exterior to the *building* envelope, without the provision of heating, cooling, or gas connection.
- 6) A *building* with not more than 2 principle *dwelling units* may be provided with a gas connection serving a balcony that is not enclosed.

10.2.1.2. Buildings Without Residential or Commercial Components

- 1) All *buildings*, except those included in 10.2.1.3 through 10.2.1.6,
 - a) shall be designed in compliance with (See Note A-10.2.1.2.(1)(a).)
 - i) 10.2.2.2. or 10.2.2.3., or
 - ii) 10.2.2.2. in a *building* required to be designed to Part 9 by Division A, 1.3.3.3.,
 - b) **reserved**,
 - c) **reserved**,
 - d) **reserved**,
 - e) shall be provided with vestibules in compliance with Article 10.2.2.8.,
 - f) shall be provided with metering equipment in compliance with Article 10.2.2.9,
 - g) shall be provided with lighting in conformance with Article 10.2.2.10.,
 - h) **reserved**,
 - i) shall comply with Article 10.2.2.15. where fire places are provided, and
 - j) may provide exterior heated spaces in compliance with Article 10.2.2.22.

10.2.1.3. Residential Buildings of 7 Storeys or More, and Commercial Buildings (with or without residential components)

- 1) All *buildings* containing Group C, D, or E *Major Occupancies*, except those included in 10.2.1.4 through 10.2.1.6.,
 - a) shall be designed in compliance with energy and emissions performance per Article 10.2.2.5,
 - b) **reserved**,
 - c) **reserved**,
 - d) **reserved**,
 - e) shall be provided with vestibules in compliance with Article 10.2.2.8.,
 - f) shall be provided with metering equipment in compliance with Article 10.2.2.9,
 - g) shall be provided with lighting in compliance with Article 10.2.2.10.,
 - h) **reserved**,

- i) shall comply with Article 10.2.2.15., where domestic gas fireplaces are provided,
- j) shall provide airtightness testing in compliance with Article 10.2.2.21, and
- k) may provide exterior heated spaces in compliance with Article 10.2.2.22.

10.2.1.4. Residential Buildings of 4 to 6 Storeys, and Mixed-Use Residential Buildings of 1 to 6 Storeys

1) Except for *buildings* included in 10.2.1.5 or 10.2.1.6, a *building* which is less than 7 storeys in *building height*, and which is classified as a Group C *major occupancy*, and containing no other *occupancies* (excluding Group D or E *major occupancy* on the first or second storeys, or Group F Division 3 (Storage Garage) *occupancy* subsidiary to the Group C *major occupancy*),

- a) shall be designed in compliance with
 - i) energy and emissions performance per Article 10.2.2.5, or
 - ii) Articles 10.2.2.2. or 10.2.2.3., excluding *building* envelope trade-off and whole *building* energy modelling options, and provided with the thermal performance of Articles 10.2.2.6. and 10.2.2.7., and heat recovery ventilators in compliance with 10.2.2.17.
- b) shall be provided with vestibules in compliance with Article 10.2.2.8.,
- c) shall be provided with metering equipment in compliance with Article 10.2.2.9.,
- d) shall be provided with lighting in compliance with Article 10.2.2.10.,
- e) shall be provided with mechanical equipment in compliance with Articles 10.2.2.11. through 10.2.2.14.,
- f) shall comply with Article 10.2.2.15., where domestic gas fireplaces are provided,
- g) shall provide airtightness testing in accordance with Article 10.2.2.21, and
- h) may provide exterior heated spaces in compliance with Article 10.2.2.22.

10.2.1.5. Residential Buildings of 1 to 3 Storeys

1) Except for *buildings* included in 10.2.1.6, a *building* which is less than 4 storeys in *building height*, and which is entirely classified as Group C *major occupancy*, excluding Group F Division 3 (Storage Garage) *occupancy* subsidiary to the Group C *major occupancy*,

- a) shall be provided with thermal performance in compliance with Article 10.2.2.6.,
- b) shall be provided with exterior closures and fenestration with thermal performance in compliance with Article 10.2.2.7.,
- c) shall be provided with vestibules in compliance with Article 10.2.2.8.,
- d) shall be provided with metering equipment in compliance with Article 10.2.2.9.,
- e) shall be provided with lighting in compliance with Article 10.2.2.10.,
- f) comply with Articles 10.2.2.11. through 10.2.2.13. where domestic hot water heating is provided,
- g) shall comply with Article 10.2.2.14. where domestic gas heated furnaces or make-up air units are provided,
- h) shall comply with Article 10.2.2.15. where domestic gas fireplaces are provided,
- i) shall be provided with and heat recovery ventilators in compliance with Article 10.2.2.17.,
- j) shall be designed with a solar photovoltaic ready pipe run in compliance with Article 10.2.2.19.,
- k) shall provide documentation in compliance with Article 10.2.2.20.,
- l) shall provide airtightness testing in compliance with Article 10.2.2.21, and
- m) may provide exterior heated spaces in compliance with Article 10.2.2.22.

10.2.1.6. Residential Buildings with Not More Than 2 Principal Dwelling Units

1) Except as otherwise required in this Subsection, a Group C *building* of *residential* use throughout, containing not more than 2 primary *dwelling units* and their contained *ancillary residential suites* or subsidiary structures with conditioned space, shall (See Note A-10.2.1.6.(1).)

- a) be designed with thermal performance in compliance with Article 10.2.2.6.,
- b) be designed with exterior closures and fenestration with thermal performance in compliance with Article 10.2.2.7.,
- c) be provided with metering equipment in compliance with Article 10.2.2.9.,

- d) be provided with lighting in compliance with Article 10.2.2.10.,
- e) comply with Article 10.2.2.11. through 10.2.2.13., where domestic hot water heating is provided,
- f) comply with Article 10.2.2.14., where domestic gas heated furnaces or make-up air units are provided,
- g) comply with Article 10.2.2.15. and 10.2.2.16., where domestic gas fireplaces are provided,
- h) be provided with heat recovery ventilators in compliance with Article 10.2.2.17.,
- i) be designed with a solar photovoltaic ready pipe run in compliance with Article 10.2.2.18 or 10.2.2.19.,
- j) provide documentation in compliance with Article 10.2.2.20., and
- k) provide airtightness testing in compliance with Article 10.2.2.21.

10.2.2. Design Measures for Energy Efficiency

10.2.2.1. Application

- 1) This Subsection applies to all *buildings* and parts of the *buildings* that are required to be energy efficient under Subsection 10.2.1.

10.2.2.2. ANSI/ASHRAE/IESNA 90.1

- 1) A *building* designed in accordance with this Article shall, be designed and constructed in accordance with ANSI/ASHRAE/IESNA 90.1, “Energy Standard for Buildings, except Low-Rise Residential Buildings”, and
- 2) A *building* is designed in accordance with Sentence (1), shall be designed with
 - a) a climate zone of 4,
 - b) ventilation in compliance with ASHRAE 62-2001 (except addendum n), or if applicable, 6.2.2.1.(3)(b) of the Building By-law,
 - c) the 5% in Table 11.5.1.5. Building Envelope, Exception a., being replaced by 2%, if designed in compliance with ASHRAE 90.1, Section 11,
 - d) the 5% in Table G3.1.5.a. Building Envelope, Exception 1., being replaced by 2%, if designed in compliance with ASHRAE 90.1, Appendix G,
 - e) no requirement to comply with the Fenestration Orientation provisions of ASHRAE 90.1, Article 5.5.4.5.,
 - f) no requirement to comply with Automatic Receptacle Control, per ASHRAE 90.1, Article 8.4.2.

10.2.2.3. National Energy Code of Canada for Buildings

- 1) A *building*, other than a Part 9 *building*, designed in accordance with this Article shall be designed and constructed in accordance with the National Energy Code of Canada for Buildings (NECB), except that the provisions of this By-law shall apply where the NECB refers to the National Building Code of Canada (NBCC), and shall be designed with
 - a) a climate zone of 4,
 - b) ventilation in compliance with ASHRAE 62-2001 (except addendum n),
 - c) no requirement to comply with vestibules provision of NECB Article 3.2.2.1.,
 - d) window-to-wall and skylight-to-roof area ratios of the reference *building* identical to area ratios of the proposed *building*, to a maximum of 40% for windows and to a maximum of 5% for skylights, identical to area ratios of the proposed *building*,
 - e) a vertical glazing Solar Heat Gain Coefficient which does not exceed an assembly maximum of 0.36,
 - f) a skylight Solar Heat Gain Coefficient for all types, which does not exceed an assembly maximum of 0.40, where the ratio of the aggregate skylight area to roof area is less than or equal to 3.0%.

10.2.2.4. Reserved

10.2.2.5. Zero Emissions Building Plan (ZEBP) - Performance Limits

- 1) Except as permitted by Sentence (4), for a *building* required to comply with this Article, any energy modelling shall comply with:
- the applicable requirements of Part 8 of the NECB, and
 - the City of Vancouver Energy Modelling Guidelines.
- 2) Except as permitted in Sentence (3) and (4), a *building* designed with this Article shall demonstrate the performance values of the proposed *building* comply with the limits in Table 10.2.2.5.A.
- 3) Compliance with the GHGI limits in Table 10.2.2.5.A is not required where a *building* can demonstrate the performance values of the proposed *building* comply with the TEUI and TEDI limits in Table 10.2.2.5.B.
- 4) *Buildings* and *major occupancies* designed and constructed to conform to the certification criteria for the Passive House Standard, are deemed to comply with this Article provided the design's energy model is
- version 9 or newer of the Passive House Planning Package, and
 - prepared by a Certified Passive House Designer, or Certified Passive House Consultant.
- (See Note A-10.2.2.5.(4).)

Table 10.2.2.5.A
Maximum Energy Use and Emissions Intensities
 Forming part of Sentence 10.2.2.5.(2)

Occupancy Classification ⁽¹⁾	Total Energy Use Intensity (kWh/m ² a)	Thermal Energy Demand Intensity (kWh/m ² a)	Greenhouse Gas Intensity (kgCO _{2e} /m ² a)
Group C <i>occupancies</i> in <i>buildings</i> up to 6 <i>Storeys</i>	110	25	5.5
Group C <i>occupancies</i> in <i>buildings</i> over 6 <i>Storeys</i> , except Hotel and Motel	130	45	14
Hotel and Motel <i>occupancies</i>	170	30	14
Group D and E <i>occupancies</i> , except Office	170	30	5
Office <i>occupancies</i>	130	30	7
All other <i>occupancies</i>	Comply with ASHRAE 90.1, Section 11 (ECB) or Appendix G performance paths in accordance with Article 10.2.2.2., or NECB Part 8 performance path in accordance with Article 10.2.2.3.		

Table 10.2.2.5.B
Maximum Energy Use and Emissions Intensities
 Forming part of Sentence 10.2.2.5.(3)

Occupancy Classification	Total Energy Use Intensity (kWh/m ² a)	Thermal Energy Demand Intensity (kWh/m ² a)	Greenhouse Gas Intensity (kgCO _{2e} /m ² a)
Residential <i>occupancies</i> in <i>buildings</i> over 6 <i>Storeys</i>	120	30	6
Hotel and Motel <i>occupancies</i>	140	20	8
Group D and E <i>occupancies</i> , except Office	120	20	3
Office <i>occupancies</i>	100	20	3

10.2.2.6. Building Envelope Opaque Elements

- 1) Except as otherwise required in this Subsection, a *building* required to comply with this Article shall be comply with the performance values in Table 10.2.2.6., between
- heated space and unheated space,
 - heated space and exterior air,
 - heated space and exterior *soil*,

- d) heating floor assemblies and heated space,
- e) heating floor assemblies and unheated space,
- f) heating floor assemblies and exterior air, and
- g) heating floor assemblies and exterior *soil*.

Table 10.2.2.6.
Minimum Effective Thermal Resistance of Assemblies in Buildings of Group C Major Occupancy
 Forming part of Sentences 10.2.2.6.(1)

Building Assembly	Assembly Minimum RSI Value (m ² K/W)
Attic Space ⁽¹⁾	8.5
Roof Joist Assemblies for residential <i>buildings</i> with not more than 2 principal <i>dwelling units</i> (Cathedral Ceilings/Flat Roofs)	4.3
Roof Assemblies other residential <i>buildings</i> with not more than 2 principal <i>dwelling units</i> (Cathedral Ceilings / Flat Roofs)	5.28
Walls (including frame crawl space walls) ⁽³⁾	3.85
Foundation Walls	3.85
Box and Rim Joists	3.85
Concrete or Masonry Walls (other than foundation walls)	3.85
Suspended Floors (framed)	4.2
Suspended Floors (concrete slab)	4.2
Concrete Slabs on Ground at, above, or below grade (insulation under all slab area and around edge of slab)	2.5
Radiant Heating Suspended Floor Assembly Over Heated Area (insulation between heated floor and heated area below) ⁽²⁾	2.5
Concrete Balconies, Eyebrows, and Exposed Slab Edge (wrapped or using manufacturer thermal break in structure)	0.42

Notes to Table 10.2.2.6.:

- (1) The thermal resistance rating of attic space insulation may be reduced to value required for frame walls for a distance of 1200 mm from the exterior wall. A minimum nominal RSI of 3.52 m²K/W is required above the top plate in the attic space
- (2) Not applicable when heating elements or piping are located within a concrete topping on a suspended floor assembly or within an internally heated suspended slab.
- (3) Headers and lintels: cavities between structural members are to be fully insulated, except where a framing plan provided by the builder, architect, designer, or engineer indicates that full-depth solid headers are structurally required.

2) Insulation and the installation of insulation in a *building* designed to the requirements of Part 9 shall comply with Subsection 9.25.2. or Part 5.

3) The effective total “R” value of the opaque envelope area, the non-opaque envelope area, and the overall envelope area, calculated by a design professional, shall be submitted as part of an application for a *permit*.
 (See Note A-10.2.2.6.)

10.2.2.7. Building Envelope Windows, Skylights, Doors and Other Glazed Products

1) Except as otherwise required in this Subsection and as permitted by Sentence (2), a *building* required to comply with this Article shall comply with the performance values in Table 10.2.2.7.(1).

Table 10.2.2.7.(1)
Maximum Thermal Transmittance of Exterior Closures and Fenestration
 Forming part of Sentence 10.2.2.7.(1)

Type of Closure	Assembly Maximum USI Value (W/(m ² K))
Windows and sliding doors or folding doors with glazing	1.4
Curtainwall and window wall assemblies	1.4
Storefront curtainwall, window, and door assemblies	2.27
Doors with or without glazing ⁽¹⁾	1.8
Doors with a required fire resistance rating	Exempt
Roof access hatches	2.9
Skylights (not larger than 1220 mm in both directions), roof windows and sloped glazing systems	2.4
Skylights larger than 1220 mm in both directions	2.95
Tubular daylight devices	2.6

Notes to Table 10.2.2.7.(1):

(1) Includes doors swinging on a vertical axis with or without glazing, door transoms, and sidelites.

2) A maximum of one entry door assembly consisting of one or two leafs installed in the principle entrance of a *building*, together with attached transoms and sidelites all within a single rough opening, need not comply with Table 10.2.2.7.(1), where constructed of thermally broken metal or wood with multiple panes of glass, which may be argon filled, or coated with a low-e coating.

3) The thermal transmittance of factory glazed products within the scope of existing certification programs shall be indicated by labels applied to the products at the manufacturing location. The thermal transmittance of site glazed products and products outside the scope of existing certification programs shall be suitably documented.

(See Note A-10.2.2.7.(3).)

10.2.2.8. Building Envelope Vestibules

(See Note A-10.2.2.8.)

1) Except as permitted in Sentence (2), in a *building* required to comply with this Article there shall be an enclosed vestibule in all *building* entrances separating a conditioned space from the exterior, designed such that

- all doors opening into and out of the vestibule shall be equipped with self-closing devices,
- the interior and exterior doors of the vestibule shall be separated by no less than 2.1 m when closed, and the floor area of each vestibule shall not exceed 4.65 m² or 2% of the gross conditioned floor areas for that level of the *building*,
- for spaces having a gross conditioned floor area for that level of the *building* of 3,716.1 m² and greater, and when the doors opening into and out of the vestibule are equipped with automatic, electrically driven, self-closing devices, the interior and exterior doors shall be separated by no less than 4.87 m.
- the exterior envelope of a conditioned vestibule shall comply with the design requirements for a conditioned space, and
- the interior and exterior envelope of an unconditioned vestibule shall comply with the design requirements for a semi heated space.

2) An enclosed vestibule is not required for

- a *building* entrance with revolving doors,
- a door not intended to be used as the *building* entrance,
- a door opening directly to the exterior from a *dwelling unit*,
- a *building* entrance, in a *building* less than 278.7 m² in gross floor area,
- a door that opens directly to the exterior from a space that is less than 278.7 m² and is separate from the *building* entrance,

- f) semi-heated spaces,
- g) an enclosed elevator lobby for *building* entrances directly from parking garages, and
- h) a *building* pursuing certification with the Passive House (PHI) standard.

10.2.2.9. Building Services Submetering

- 1) Every *building* shall be equipped with metering equipment capable of collecting *building* energy performance data for the *building* and for every portion of the *building* which supports a separate use or *occupancy*.
- 2) Submetering required by this Article shall include the following
 - a) hot water generated by a central hot water generation system
 - b) natural gas used for air handling systems in common areas, and
 - c) natural gas used for domestic hot water in amenity spaces, pools and spas.

10.2.2.10. Lighting in Residential Buildings

(See Note A-10.2.2.10.)

- 1) Where a portion of a residential *building* or a portion of a multi-use *building* located above a garage or on an adjacent grade contains more than 20 residential *suites*, the *building* shall be designed with
 - a) *occupancy* based lighting sensor controls, located in all *exit* stair shafts and parking garages, compatible with the requirements of Sentence 3.2.7.3.(1) of Division B, and
 - b) a switch near the principal entrance of each residential *suite* that
 - i) controls all lighting fixtures within the *suite*, except lights serving corridors, stairs, washrooms, and rooms with no exterior window.
 - ii) with an override on each floor, serving that floor, of a multilevel suite
- 2) Except as permitted by Sentence (3), permanent ancillary exterior lighting of a *building* of *residential* occupancy or the *residential* portion of a multi-use *building*, or those parts of a *building* facing a *lane*, that is required to conform to this Article shall
 - a) be provided with fixtures that are appropriately shielded that
 - i) utilize full cut-off optics or are fully shielded fore luminaires that emit over 600 lumens, or any luminaire installed along the side or back yard, and
 - ii) are partially shielded and utilize a diffusing cover for luminaires that emit 600 lumens or less.
 - b) be mounted no higher than 4 m above grade or the balcony surface it illuminates along the side yard, back yard, and similar outward facing courtyards or setbacks of the *building*,
 - c) be provided with dimmer and timer controls,
 - d) minimize lighting of adjacent exterior properties and properties across a *street*, *lane*, or *public way*,
- 3) Where exterior lighting is required by this By-law or other regulator enactments to provide illumination along paths of pedestrian or vehicular travel, fire department access, or equipment signage or lighting, it need not comply with the requirements of Sentence (2).

10.2.2.11. Hot Water Tank Piping

- 1) In a *building* required to comply with this Article, the first 3 m of non-recirculating hot water piping leading from both electrically heated and gas heated hot water tanks, and the last 1 m of piping leading to the hot water tank connection, shall have insulation with a minimum RSI value of 0.35.

10.2.2.12. Domestic Gas-Heated Hot Water Heaters

- 1) In a *building* required to comply with this Article, gas-heated appliances providing domestic hot water only shall have a uniform energy factor of not less than 0.78 or alternatively a thermal efficiency of not less than 90%, as determined by the following
 - a) CSA P3-04, “Testing Method for Measuring Energy Consumption and Determining Efficiencies of Gas-Fired Storage Water Heaters”,
 - b) CSA P7-10, “Testing Method for Measuring Energy Loss of Gas-Fired Instantaneous Water Heaters”,
 - c) CSA C191-04, “Performance of electric storage tank water heaters for domestic hot water service”, or

- d) CSA 4.3/ANSI Z21.10.3, “Gas Water Heaters Volume III, Storage Water Heaters, with Input Ratings above 75,000 Btu per hour, Circulating and Instantaneous”.

10.2.2.13. Domestic Gas-Heated Boilers

1) In a *building* required to comply with this Article, domestic gas-heated boilers providing heat, or heat and domestic hot water, shall have an Annual Fuel Utilization Efficiency (AFUE) rating of not less than 92%, as tested using CSA P.2-07, “Testing Method for Measuring the Annual Fuel Utilization Efficiency of Residential Gas-fired Furnaces and Boilers”.

10.2.2.14. Domestic Gas-Heated Furnaces or Make Up Air Units

1) In a *building* required to comply with this Article, domestic gas-heated furnaces or make up air units shall have an Annual Fuel Utilization Efficiency (AFUE) rating of not less than 92%, as tested using CSA 2.6/ANSI Z83.8, “Gas unit heaters, gas packaged heaters, gas utility heaters and gas-fired duct furnaces”.

10.2.2.15. Domestic Gas-Fired Fireplaces

(See Note A-10.2.2.15.)

1) In a *building* required to comply with this Article, domestic gas-fired fireplaces in conditioned spaces shall be equipped with

- a) intermittent pilot ignition (IPI) systems,
- b) on-demand ignition systems that automatically shut off within
 - i) 7 days of appliance non-use in a one or two family dwelling *building*, or
 - ii) 6 hours of appliance non-use in a multifamily dwelling, or
- c) match ignition.

2) In a *building* required to comply with this Article, domestic gas-fired fireplaces shall be direct vented (Naturally Aspirating Fuel-Fired Appliances (NAFFVA) are not permitted).

3) In a *building* required to comply with this Article, domestic gas-fired fireplaces must be on a timer.

4) Where exterior gas fireplaces are provided as an ancillary equipment to a *building* required to comply with this Article, then the exterior fireplaces shall be considered as part of the *building* for the purposes of this Part.

10.2.2.16. Domestic Wood Burning Heating Appliances

1) In a *building* required to comply with this Article, and except for cooking stoves and ranges, a wood domestic burning heating appliance installed in a residential *dwelling unit* shall be tested in accordance with CAN/CSA B415.1-10 “Performance Testing of Solid-Fuel-Burning Heating Appliances” or EPA Title 40, Part 60, Subpart AAA - “Standards of Performance for New Residential Wood Heaters”, and shall

- a) produce not more than 2.5 grams per hour of particulate air contaminant emissions for catalytic appliances, or
- b) produce not more than 4.5 grams per hour of particulate air contaminant emissions for non-catalytic appliances.

2) Open masonry fireplaces and factory-built fireplaces are not permitted.

10.2.2.17. Domestic Heat Recovery Ventilators

1) In a *building* required to comply with this Article, each dwelling unit shall be served by a heat recovery ventilator located in

- a) each dwelling *unit*, or
- b) a commonly accessible location if serving multiple *dwelling units*.

2) In a *building* required to comply with this Article, components of mechanical ventilation systems not specifically described in this Subsection shall be designed, constructed and installed in accordance with good engineering practice and as described in the ASHRAE Handbooks and Standards, HRAI Digest, TECA Ventilation Guideline, Hydronics Institute Manuals or the SMACNA manuals.

- 3) In a *building* required to comply with this Article, a heat recovery ventilator (HRV) shall
- a) be sized to run at its rated speed for continuous operation while achieving a 65% sensible heat recovery efficiency (65% Minimum SRE at 0°C) and be designed and tested in conformance with CAN/CSA-C439,
 - b) be designed and tested to meet the CSA International Standard CAN/CSA-F326-M91, “Residential Mechanical Ventilation Systems”,
 - c) be installed and commissioned by persons trained by the Thermal Environmental Comfort Association (TECA) or the Heating, Refrigeration and Air Conditioning Institute of Canada (HRAI) or equivalent,
 - d) supply outdoor air directly to the principal living area, to each bedroom, and to any *floor area* without a bedroom, including similar rooms within *ancillary residential units*, directly or indirectly, through a central recirculation system with a continuously operating fan,
 - e) be designed to run continuously to comply with the minimum ventilation rates of Table 9.32.3.3.A of Division B,
 - f) not be connected to kitchen and bathroom exhaust fans,
 - g) except for mechanical ducts cast into concrete structure, have exterior connected supply-air ducts and exhaust ducts insulated to not less than RSI 0.75 (R 4.25) and shall have an effective vapour barrier,
 - h) have balanced HRV supply and exhaust air flows within plus or minus 20% of the actual normal operating exhaust capacity,
 - i) be labelled with tested supply and exhaust air flows for high and low settings, measured in CFM, and
 - j) be located in a fully serviceable space that can be readily accessed for replacement or maintenance, and
 - i) designed and installed to operate with an acceptable level of weather and freeze protection if not within a *conditioned space*, and
 - ii) in a *building* containing not more than two primary *dwelling units* and their contained *ancillary residential units*, be within a *conditioned space* and provided with direct access from at least one of the *dwelling units* that it serves.
- 4) In a *building* required to comply with this Article, the HRV system contractor or installer shall provide a completed Mechanical Ventilation Checklist to the Chief Building Official.
- 5) In a *building* required to comply with this Article, a contractor trained in the installation of energy recovery ventilators (ERV) may install an ERV in lieu of a heat recovery ventilator (HRV).

10.2.2.18. Solar Ready Pipe Run

- 1) In a *building* required to comply with this Article, a solar ready pipe chase, consisting of at least two 50 mm PVC pipes, capped at both ends and having at least a 20° angle measured above the horizontal level, shall extend from a location near the service water heater, to the attic space.

10.2.2.19. Solar Photovoltaic Ready Pipe Run

- 1) In a *building* required to comply with this Article, a solar ready pipe chase, consisting of at least one 25 mm pipe or liquid tight flexible electrical conduit or electrical metallic tubing capped at both ends and having at least a 20° angle measured above the horizontal level, shall extend from a location near the electrical panel, to the attic space.

10.2.2.20. Passive House Planning Package (PHPP), EnerGuide, or Other Energy Documentation

- 1) In a *building* required to comply with this Article, at the time of *permit* application, and at the time of final inspection, the owner shall provide to the Chief Building Official *acceptable* documentation, in the form of
- a) a PHPP file from a Certified Passive House Consultant or Designer, or
 - b) an EnerGuide Rating System Audit, or
 - c) for *buildings* ineligible for an EnerGuide Rating System Audit, a Hot2000 file modelled in general mode and using the same baseload assumptions as Energuide for New Homes mode, or equivalent energy modelling documentation, *acceptable* to the Chief Building Official.

2) In a *building* required to comply with this article, at the time of mid-construction inspection, the owner shall provide to the Chief Building Official *acceptable* documentation, in the form of,

- a) a mid-construction checklist
- b) a blower door test result that achieves an *acceptable* level of performance

3) In a *building* required to comply with this Article, and where a *one family dwelling* or *two family dwelling*, with or without *ancillary residential units*, contains *conditioned space* of more than 325 m², including *suites* that are not strata titled, the owner shall

- a) provide a calculation utilizing the EnerGuide rating system to demonstrate that the proposed home has a greenhouse gas (GHG) footprint that is no more than the greenhouse gas (GHG) footprint of a 325 m² home built to the minimum standards in the Building Bylaw, and
- b) meet the requirements of the modeling guidelines for large homes.

10.2.2.21. Building and Dwelling Unit Airtightness Testing

1) In a *building* required to comply with this Article, the *building* and *dwelling units* shall be tested for airtightness in accordance with

- a) ASTM E 779, Standard Test Method for Determining Air Leakage Rate by Fan Pressurization,
- b) USACE Version 3, Air Leakage Test Protocol for Building Envelopes, or
- c) airtightness protocol recognized by Natural Resources Canada for use in homes and buildings labeled under the EnerGuide for New Homes program.

2) A *building* required to comply with this Article shall have, at time of final inspection, maximum tested air leakage rates in conformance with Table 10.2.2.21., or sealed to the satisfaction of the Chief Building Official.

Table 10.2.2.21.
Maximum Tested Air Leakage Rates
Forming part of Sentence 10.2.2.21.(2)

Building Classification	Maximum Tested Air Leakage Rate
<i>Buildings</i> , excluding 1 or 2 Family Dwellings and ground-oriented <i>dwelling units</i>	2.03 L/s/m ² at 75 Pa
Ground-oriented <i>dwelling units</i>	3.5 air changes per hour at 50 Pa
<i>Suites</i> in <i>multi-family</i> buildings	1.23 L/s/m ² at 50 Pa
Laneway houses and subsidiary conditioned suites less than 110 square meters floor area	Normalized leakage area of 2.1 cm ² /m ² @ 10 Pa

10.2.2.22. System Requirements for Heating within Exterior Spaces

(See Note A-10.2.2.22.)

1) Any space heating or occupant heating within an exterior space associated with a *building* shall comply with the requirements of this Article.

2) The design and/or installation of space heating or occupant heating systems within exterior spaces shall be limited to spaces directly served by licensed beverage establishments or licensed food establishments.

3) Any exterior space designed with a heating system and directly served by a licensed beverage establishment or a licensed food establishment, shall prioritize the heating system design in the following order:

- a) In-slab or in-floor radiant heat, using non fossil fuel or low-carbon system,
- b) Electric fixed infrared radiant heat with metal-sheath element,
- c) Heated seating, using non fossil fuel or low-carbon system,
- d) Non-electric radiant heat using non fossil fuel system.

- 4)** In spaces required to comply with Sentence (3), the design of exterior space heating or occupant heating systems shall comply with the following, as applicable,
- a) in-slab or in-floor radiant heat system not exceeding 15W/ft² and incorporating zone-based controls interconnected with a centralized automatic control system with independent zone management,
 - b) electric radiant heat system not exceeding 18W/ft² and incorporating unit-based or zone-based controls, interconnected with a centralized automatic control system with independent unit or zone management,
 - c) heated seating system not exceeding 20W per seat and incorporating zone-based controls, interconnected with
 - i) individual seat shutoff, or
 - ii) a centralized automatic control system with independent zone management, and
 - d) non-electric and non-fossil fuel radiant heat system not exceeding 18W/ft² and incorporating unit-based controls interconnected with a centralized automatic control system with independent zone management.

Table 10.2.2.22.A
Exterior Space or Occupant Heating System Design Requirements
 Forming a part of 10.2.2.22.

System Type	Maximum output	Control type	Management Requirements
In-slab or in-floor radiant heat	15 W/ft ²	Centralized automatic control system	Independent zone management
Electric radiant heat	18 W/ft ²	Centralized automatic control system	Independent unit or zone management
Heated seating	20 W per seat	Centralized automatic control system	Individual seat heater shutoff and independent zone management
Non-electric and non-fossil fuel radiant heat	18 W/ft ²	Centralized automatic control system	Independent zone management

- 5)** Heating systems designed to sentence (3) shall include
- a) an automatic shut-off (ambient temperature sensor – lockout),
 - b) an automatic shut-off (space temperature sensors – integral/ zone), and
 - c) an automatic shut-off using programmable timeclock.
- 6)** Heated zones within a zone-based design shall not exceed 4.8 kW per zone.
- 7)** Heating systems designed with overhead radiant systems within a space containing a ceiling or roof of adequate height, shall be designed with circulation fans interconnected to heating mode operations, with an override for independent fan operation.
- 8)** In a space required to comply with sentence (2), any exterior space designed with a combination of systems contained in sentence (3) shall
- a) comply with the specific requirements pertaining to each system, without duplication of requirements, and
 - b) not contain an area where the combined heating exceeds the performance requirement of the least restrictive system.