

# A.3

## MOTION

### 3. Passive House Guidelines for RS-1

MOVER:

SECONDER:

THAT the document entitled "Passive House Guidelines for RS-1" be approved by Council for use by applicants and staff for development applications in the RS-1 District.

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## *Land Use and Development Policies and Guidelines*

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# Passive House Guidelines for RS-1



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### **Contents**

1. Application and Intent .....	3
2. Context .....	3
3. Passive House: Standard and Requirements .....	3
3.1. Main/Summary Criteria for Certification.....	4
4. Relaxation of Regulations .....	4
4.1. Floor Area Exclusion .....	5
4.2. Relaxation of Height .....	5
4.3. Relaxation of Rear Yard Setback .....	5
4.4. Relaxation of Building Depth .....	5
4.5. Other Relaxations .....	6
5. Permit Application Process .....	7
6. Building Certification Process .....	9
7. Contact Information .....	9
Appendix A: Resources.....	10
Appendix B: Glossary of Terms .....	11

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## **1. Application and Intent**

These guidelines are intended to inform applicants seeking to build a home that meets the Certified Passive House standard in any RS-1 District Schedule zone, and seek related relaxations. A Certified Passive House is one that meets the definition for Certified Passive House in the City of Vancouver Zoning and Development By-law as verified by a Passive House Institute Accredited Building Certifier, as also defined in the Zoning and Development By-law (the “Zoning By-law”). Applicants are required to meet the Certified Passive House standard and make appropriate provisions in building envelope and mechanical design to enable them to achieve Certified Passive House standards in order to seek any related relaxations.

Applicants should review the process and requirements articulated in this document. These guidelines are to be used in conjunction with: typical residential permit application documents; the RS-1 District Schedule of the Zoning and Development By-law; and the City of Vancouver’s “Passive House Design Toolkit for Homes” (see [www.vancouver.ca](http://www.vancouver.ca)). As this guide is intended to advise on zoning considerations under the Zoning By-law, applicants are also encouraged to obtain guidance on Vancouver’s Building By-law No. 10908 (the “Building By-law”) from an experienced professional.

## **2. Context**

Council approved revised Greenest City Action Plan (GCAP) targets in 2011, which included a target stating that all buildings constructed from 2020 onward would be carbon neutral in operations.

Greenhouse gas (GHG) emissions from buildings account for nearly 55% of GHG emissions in Vancouver. Reducing building energy use through rigorous building envelope design like that of Passive House buildings (instead of relying on more complicated mechanical means), presents a powerful and relatively straightforward opportunity to reduce future GHG emissions from buildings.

The City recognizes its role in working towards improving building standards to increase energy efficiency and reduce greenhouse gas emissions. These guidelines are provided to assist applicants in achieving Certified Passive House design, which is consistent with the City of Vancouver’s energy efficient building construction goals.

## **3. Passive House: Standard and Requirements**

Passive House is a well-established ultra-low energy building performance standard and certification process. There are over 40,000 Passive House buildings built in every climate, in every typology.

Passive design is based on the principle that a higher quality thermal envelope can reduce or eliminate costs associated with heating and cooling. With thoughtful design, better energy efficiency can be achieved and costly heating and air conditioning systems are eliminated without sacrificing thermal comfort.

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Passive House Certification is a rigorous quality assurance process that determines whether a building meets all of the requirements of the Passive House standard, and confirms that the building has been designed to achieve high levels of occupant comfort and energy performance.

### **3.1. Main/Summary Criteria for Certification**

- Space Heat Demand: max. 15 kWh/m<sup>2</sup>a OR Heating load max. 10 W/m<sup>2</sup>
  - Pressurization Test Result: max. 0.6 ACH @ 50 Pa (pressurizing and depressurizing)
  - Total Primary Energy Demand: max. 120 kWh/m<sup>2</sup>a
- All heating and cooling calculations are based on the net usable floor area of the building. If cooling (air conditioning) is required, the annual cooling energy demand must also not exceed 15 kWh/m<sup>2</sup>.

#### **3.1.1. Space Heat Demand**

The building must be designed to have an annual heating and cooling demand as calculated with the Passive House Planning Package (PHPP) of not more than 15 kWh/m<sup>2</sup> per year in heating and 15 kWh/m<sup>2</sup> per year cooling energy OR to be designed with a peak heat load of 10W/m<sup>2</sup>.

#### **3.1.2. Air Sealing**

The Passive House Standard demands a minimum tested airtightness level of 0.6 air changes per hour (ach) @ 50 Pa, both for under pressure and overpressure, during a blower door test, which must be conducted by a licensed technician.

#### **3.1.3. Total Primary Energy Demand**

The total energy to be used for all domestic applications (heating, hot water and domestic electricity) must not exceed 120 kWh per square meter of treated floor area per year.

For a description of the full criteria for certification or for more information please see the Canadian Passive House Institute's web site at: [www.canphi.ca](http://www.canphi.ca) and consult with a Certified Passive House Designer or Consultant.

## **4. Relaxation of Regulations**

Achieving a low-energy, high-efficiency home through high quality thermal envelope design and better insulation will result in thicker walls and ceilings, thus impacting floor area. The City of Vancouver currently has a floor area exclusion in Section 10.33 of the Zoning By-law related to wall thickness. Under this exclusion, applicants may apply to exclude some of the floor area used for insulation, provided that this floor area can be used on site within existing zoning regulations.

Several conditional relaxations have been developed to accommodate the additional thermal insulation required to achieve Certified Passive House. Applicants building new homes in the RS-1 District Schedule may apply for relaxations to increase height, decrease the rear yard, and increase permitted building depth requirements, provided that they achieve Passive House Certification for their new house. These relaxations will allow applicants that apply for the floor area exclusion in Sec 10.33 to use more of the excluded floor area, and build to a high standard of energy efficiency without "losing" floor area. These relaxations may be granted at the discretion of the Director of Planning.

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It should be noted that applicants must consider impacts on neighbouring houses on such issues as privacy, massing, and shadowing in their application.

#### **4.1. Floor Area Exclusion**

The existing floor area exclusion for exterior wall thickness was developed to support applicants who built walls with enhanced insulation value. With more insulation, walls become thicker and this exclusion removes the disincentive of “losing” floor area because of building thicker walls. The exclusion can be found in Section 10.33 of the Zoning and Development By-law. For more information on the exclusion, please see the Planning Administrative Bulletin titled: “Floor Space Exclusion to Accommodate Improved Building Performance (Envelope and Thermal Insulation)”.

If an applicant is seeking a floor area exclusion to accommodate increased insulation, it is currently required that a Building Envelope Professional must be retained to calculate and verify the exclusion. However in the case of a Certified Passive House home meeting Certified Passive House, this requirement may be waived, as the use of PHPP energy modelling and the retention of a Certified Passive House Designer or Consultant or satisfies the same requirement.

#### **4.2. Relaxation of Height**

Applicants building a Certified Passive House home may apply for a relaxation of height via Sec 4.3.6 of the RS-1 District Schedule in the Zoning By-law. The Director of Planning may permit a height increase to accommodate building features designed to reduce energy consumption in a Certified Passive House home to a maximum of 10.7 m. The Director of Planning may consider negligible intrusions into the height (primary and secondary) envelopes bearing in mind that the intent of the regulation is to pull the bulk and massing away from the side property lines in order to preserve light and privacy and mitigate shadowing of adjacent properties. This relaxation is anticipated to remove a barrier to better insulated roofs.

#### **4.3. Relaxation of Rear Yard Setback**

Applicants building a Certified Passive House home may also apply for a relaxation of rear yard setbacks, via Sec 4.6.6 of the RS-1 District Schedule. The Director of Planning may decrease the rear yard requirement to accommodate building features designed to reduce energy consumption in a Certified Passive House home to a maximum of 40% of the depth of the site. This relaxation is anticipated to remove a barrier to building thicker walls; and enable the use of excluded floor area, applied for under Section 10.33 of the Zoning By-law, to be used onsite.

#### **4.4. Relaxation of Building Depth**

Applicants building a Certified Passive House home may also apply for a relaxation to increase permitted building depth via Sec 4.16.4 of the RS-1 District Schedule. The Director of Planning may increase the permitted building depth to accommodate building features designed to reduce energy consumption in a Certified Passive House home to a maximum of 40% of the depth of the site. This relaxation is anticipated to remove a barrier to building thicker walls, that is: having some floor area excluded, and not being able to use all of the floor area on site.

It should be noted that the rear yard compatibility depth provision in RS-1 would not apply if an applicant sought the increased building depth allowance of 4.16.4.

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#### 4.5 Other Relaxations

The following table is a quick reference for existing conditional allowances that are available for Passive House or “green” building features, both the ones outlined in this guideline as well as other pre-existing relaxations.

For more information, applicants may consult the relevant regulation (eg: the RS-1 District Schedule), and also the related Zoning By-law Administration Bulletin (eg: *Passive Design: Natural Ventilation and Light*). All of the above can be found at [vancouver.ca](http://vancouver.ca)

Conditional Allowance for Passive House or “Green” Feature	Applicable Policy or Regulation
Allow increase in building height for Certified Passive House home	RS-1 District Schedule in Zoning By-law, Section, 4.3.6
Allow decrease in required rear yard depth for Certified Passive House home	RS-1 District Schedule in Zoning By-law, Section, 4.6.6
Allow increase in permitted building depth for Certified Passive House home	RS-1 District Schedule in Zoning By-law, Section, 4.16.4
Allow floor area exclusion for increased insulation	Zoning By-law, Section 10.33
Allow green walls to project into required yard	Zoning By-law, Section 10.7.1
Allow floor area exclusion for venting skylights, opening clerestory windows or other similar features	RS, RT, RM, C-3A and I-C3 District Schedules in Zoning By-law, Section 4.7.2 (or 4.7.3) (or 4.7.4)
Allow increase in building height for venting skylights, opening clerestory windows or other similar features	Zoning By-law, Section 10.11.1
Relax building height regulations for roof-mounted energy technologies and to provide access to green roofs	Zoning By-law, Section 10.11.1
Relax side yard and overhang requirements for fixed external shading devices	Zoning By-law, Section 10.7.1

The table below highlights requirement equivalencies for Passive House/energy efficiency in the Building By-law, valid until June 30, 2016.

Building Components	Requirement
Fenestration	NAFS-08 rated and labelled (or letter demonstrating)
Exterior Accessible Doors	Passive House Certified
Heat Recovery Ventilator	CSA Certification or UL-C Certified

## 5. Permit Application Process

The following process outlines the requirements of the application process. This process and associated requirements – as well as typical requirements for a single-family dwelling application in the RS-1 District Schedule - must be adhered to.

Please note the different roles and responsibilities of the:

- *Certified Passive House Designer (CPHD)*,
- *Certified Passive House Consultant (CPHC)*,
- *Certified Energy Advisor (CEA)*, and
- *Passive House Institute Accredited Building Certifier (Building Certifier)*.

See definitions of these terms in Appendix B. Also note that it is possible to engage a *CPHD* or *CPHC* who is also a *CEA*, and can thus serve in both roles.

1. Before scheduling a pre-application appointment with the Housing Review branch, applicants should consult this document and all typical application documents (such as the “Intake Checklist”). When scheduling the appointment, applicants should note that the application will be for a Certified Passive House home, and that the project team will be requesting related relaxations.
2. At the pre-application meeting, applicants must provide the City of Vancouver with a letter from a *CPHD* or *CPHC* (see definitions in Appendix B) confirming that he/she has been engaged to model and advise for the project. A member of the project team - such as designer, builder or *CEA* - may serve in this role provided that they are a credentialed *CPHD* or *CPHC*.

Applicants must also identify which relaxations they will be seeking, and provide the City with supporting documents and conceptual drawings. City staff may then direct applicants and provide feedback at the pre-application meeting that will inform their application. It should be noted that applicants must consider impacts on neighbouring houses on such issues as privacy, massing, and shadowing in their application.

If an applicant is seeking a floor area exclusion to accommodate increased insulation, it is currently required that a Building Envelope Professional must be retained to calculate and verify the exclusion. However in the case of a home meeting Certified Passive House, this requirement may be waived, as the use of PHPP energy modelling and the retention of a *CPHD* or *CPHC* satisfies the same requirement.

3. Following the pre-app meeting, applicants are advised to model the project using a current version of the Passive House Planning Package (PHPP) software, and to revise the design as necessary to meet or exceed the “Passive House Classic” requirements as maintained by the Passive House Institute.

The applicant must engage a *CEA* (see definition in Appendix B). Again, it is possible to engage a *CEA* who is also a *CPHD* or *CPHC*, and can thus serve in both roles. The *CEA* must review the proposed assemblies, submit a detailed copy of the City of Vancouver’s “Pre-Permit Checklist”, and otherwise comply with pre-permit requirements for one- and two-family housing.

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It should be noted that Certified Passive House applicants are not required to prepare a Hot 2000 model or to submit a “P-file” number. Instead applicants must submit the pre-construction PHPP model (an electronic copy of the Excel file) along with a printout of the “verification” page and relevant notes.

In addition to the PHPP file, applicants must provide the Housing Review Branch with a letter from a *Building Certifier* (see definition in Appendix B) stating that the project design and specifications have been reviewed and, in the opinion of the *Building Certifier*, the project is capable of achieving Passive House certification if built to the design and specifications noted in the *Building Certifier’s* letter.

Once the design, assemblies and components have been identified, and all of the above satisfied, applicants may submit their Development Building (DB) permit application to the Housing Review Branch via the typical process. Applicants must provide typical application materials and drawings, in addition to the materials that specify and document which relaxations are being sought as a Certified Passive House home.

4. At mid-construction, a *CEA* will conduct a site visit in accordance with requirements for all one- and two-family permit applications. The *CEA* will verify that all assemblies, insulation materials, and components (including windows, doors and ventilation equipment) are installed as per the specifications provided in the *Building Certifier’s* letter. The *CEA* will conduct a mid-construction blower door test to the EN 13829 protocol, with modifications as prescribed by the Passive House Institute, in lieu of the Hot 2000 protocol. The *CEA* will provide the applicant with documentation verifying the construction details and the EN 13829 blower door test results as attachments to the typical “Pre-Drywall Checklist”, so that it may be submitted to the City.

In addition to the typical *CEA* review, the applicant must also at this time provide the City with a letter from the retained *CPHD* or *CPHC* that contains:

- a statement that the *CPHD/C* attended and inspected the construction of the house and that the installed assemblies and components match those specified in the *Building Certifier’s* letter,
- the results of the *CEA’s* mid-construction blower door test, and
- a statement that there are no known barriers to the project achieving “Passive House Classic” certification by the Passive House Institute.

Again, please note that it is possible to engage a *CPHD* or *CPHC* who is also a *CEA*, and can thus serve in both roles.

5. Prior to final inspection, the *CEA* must conduct a review and final door blower test. This test must be conducted to the EN 13829 protocol, with modifications as prescribed by the Passive House Institute (eg both pressurization and depressurization). The *CEA* will provide the applicant with documentation of mechanical and other construction details, as well as a report on the results of the EN 13829/PHI blower door test, so that it may be submitted to the City.

In addition to the *CEA* review, applicants must provide the City with a letter from a *Building Certifier* stating that the final PHPP and relevant documentation have been received and are being reviewed for final certification. The *Building Certifier’s* letter must include a suggested date

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by which the City may expect to be notified of final certification to the Passive House Institute standard. Once the project is certified by the Passive House Institute, a copy of the certificate must be provided to the City of Vancouver.

## **6. Building Certification Process**

The permit application process described in the preceding section works in tandem with the process of Passive House Certification. In order to achieve a relaxation as discussed in Section 4 of this document, Passive House Certification must be achieved.

Homes meeting the Passive House certification criteria can be certified as Passive House buildings by any of the Passive House Accredited Building Certifiers operating worldwide. A *Building Certifier* must certify the project plans and the PHPP model. The calculations on which the construction of the building is based and the planning documentation for the building envelope and building services are examined by the *Building Certifier*, and inform part of the process of certification.

Please see section 3.1 of this document for information on the main criteria for certification. For more information on certification, please contact the Canadian Passive House Institute at <http://canphi.ca/>

## **7. Contact Information**

If you have a question that is not answered in this document, please contact:  
[passivehouse@vancouver.ca](mailto:passivehouse@vancouver.ca)

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## **Appendix A: Resources**

### **City of Vancouver Resources**

Passive Design Toolkits

<http://vancouver.ca/home-property-development/passive-design-guidelines.aspx>

Administrative Bulletins Explaining Several Current “Green” Conditional Allowances

<http://vancouver.ca/home-property-development/zoning-bylaw-administrative-bulletins.aspx>

### **Other Resources**

Canadian Passive House Institute

<http://canphi.ca/>

Passivehaus Insitute (International)

<http://passiv.de/en>

\*Note: Links provided are valid as of 2015. The precise links often change or are updated regularly over time. It is recommended that users enter the title provided into their internet search engine to source electronic copies of the documents if link becomes outdated.

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## **Appendix B: Glossary of Terms**

### **ACH**

ACH stands for air changes per hour. This is a metric of house air tightness. ACH is often expressed as ACH50, which is the air changes per hour when the house is depressurized to -50 pascals during a blower door test. The term ACH<sub>n</sub> or NACH refers to "natural" air changes per hour, meaning the rate of air leakage without blower door pressurization or depressurization. ACH<sub>n</sub> or NACH is used by many in the residential HVAC industry for their system sizing calculations.

### **Building Envelope**

A building's envelope describes the entire structure of the building, separating the house from the environment. A Passive House home should have an insulating envelope and an airtight envelope that excludes thermal bridges.

### **Certified Energy Advisor (CEA)**

A CEA is a licensed professional who conducts home energy evaluations. A CEA can evaluate a home, and provide the modeling and testing required for the final certification of a home under EnerGuide. They are trained to use NRCAN's energy simulation software ("HOT2000") and to perform blower door air leakage testing.

### **Passive House (or Passivhaus)**

A type of building that, by design, is extremely energy efficient. Passivhaus design originated in Germany in the 1970's. Some marked features of PH design include a tight building envelope, intentional placement with regard to sun and landscape features, efficient windows, energy recovery ventilation, and dense insulation. While promoting ecologic sustainability, PH also incorporates clean internal environmental standards, protecting inhabitants from mold and other toxicities.

### **Certified Passive House Designer (CPHD)**

A CPHD is a person with significant professional and educational experience in architecture and/or building, that has been certified by the Passive House Institute as an accredited Certified Passive House Designer.

### **Certified Passive House Consultant (CPHC)**

A CPHC is a person certified by the Passive House Institute as an accredited Passive House Consultant.

### **Passive House Institute Accredited Building Certifier (Building Certifier)**

A person accredited by the Passive House Institute in Darmstadt, Germany for the purpose of certifying buildings according to Institute standards for Passive House buildings.

### **PHPP**

Passive House Planning Package: software used to determine whether a building meets Passive House standards. The package assists with house design and window planning as well, to test how different scenarios will impact energy use. Available through the Passive House Institute.

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