



**Building Performance
Assurance Council**

BPAC Single Family Simple Verification Pilot

Pilot Program – Values and Technical Approach

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Introduction

The following document outlines the proposed technical aspects of the BPAC Single Family Simple Verification (SFSV) Program. This document has been prepared with assistance and input from the BPAC Technical Committee. Information for this report was taken from the previous SFSV scope document, dated 2019-07-19 as well as previous draft proposals dated 2018-12-05 and memo of understanding dated 2019-04-23.

This document outlines the steps of the pilot program, technical aspects and the default values and inputs for PHPP to be used in the pilot phase of the Program. This document is also intended to help inform the overall scope of work required by reviewers for this program.

Pilot Program Outline

Consulting and certification costs for single family homes have historically been prohibitively expensive, making up a greater percentage of the overall project budget compared to larger buildings; much of the same work is required regardless of a building's size, and with naturally smaller budgets, the financial burden of this work prohibits wider adoption of high-performance buildings. This program was developed to address this issue, both by reducing the amount of consulting time required by the project consultant, as well as the review time on the part of the reviewer. Together, these cost reductions will make the program more attractive for a wider audience of single-family homeowners.

To achieve this, specific portions of the PHPP have been targeted for simplification of their inputs through the provision of standardized inputs. The inputs targeted are those that have an outsized influence on project cost through high required time investments, and for which conservative standard values can be determined that are broadly applicable with a high degree of confidence. The default inputs provided in this document are intended to serve for the initial pilot phase of this program, and will be reviewed and revisited regularly as data is collected both from energy models used for certification through this program and from measured, real-world utility data collected from certified projects.

Table 1: Pilot Program Steps

Steps		Description	Status
1	Value Development	Development and selection of default values to be used in PHPP. The initial value selection is outlined in this document.	Complete
2	Value Testing and Adjustment	Values used by Passive House Canada to test within existing, certified PH projects that meet eligibility criteria. Resulting verification values will be recorded and compared to the full certification results. Further testing may be required depending if further adjustments to the values are required.	Complete
3	Reporting	After the testing phase, a summary of the results and values will be consolidated in a report. This will be used as a reference and basis for the SFSV program documentation.	Ongoing

Main Eligibility Criteria

For reference in this document, the following are the main aspects for a project to be considered eligible for the SFSV program. Reviewers participating in the testing steps should determine the eligibility of their example projects first before continuing to enter the default values. The pilot phase will also help determine if these criteria are appropriate. At the reviewer’s discretion, they may choose to accept a project into the pilot program if it project falls outside of one or more of these criteria.

- Projects must be a single or maximum duplex, ground oriented dwelling (limited to Part 9 Homes in Canada/residential buildings in the US)
- Maximum of 4000 sqft (372m²) floor space area
- Maximum SAR = 4.0
- Maximum A/V = 1.18
- Projects must use electric utility services (i.e. electric heat pump for heating and hot water) Gas may be considered if project location is 50km+ away from enough electrical supply



- Projects will use one type of ground condition – slab, crawlspace, heated basement, or unheated basement

Projects will be heavily encouraged to use designPH, especially for the shading analysis. However, it will be up to the discretion of the reviewer whether they will conduct an SFSV verification for the set price without a designPH model.

Value Development

The proposed default values are outlined in the following section and are organized by PHPP tab, based on PHPP v10.4a, along with the rationale or points for further discussion. The appendix also includes a list of the direct entry cells that will be defaulted for further clarity. These values may be adjusted in the future, based on results observed from projects in the pilot program. On the release of PHPP-mini or a revised version DesignPH that allows detailed mechanical system modelling, the SFSV program and guidance documentation may be updated to allow use of those programs without being paired with a full PHPP model.

A simple guidance document will be produced to guide designers/modelers through inputting the appropriate default values, creating links between pages to eliminate errors in input, and other modeling conventions as required. This document will be distributed to each applicant at the time of signup for the pilot program.

Verification Tab

Most information on this tab that may impact the design will remain as defaults (such as interior temperature setpoints, etc.). The electricity/internal heat gain utilizations should be left at default residential values. The maximum dwellings would be 2.

Calculation electricity / Internal heat gains
Building type:

Internal heat gains
Utilisation pattern:
Values:

Occupancy

At this time, the intent is to only allow for buildings aiming for *Classic* certification. If a site will use on-site generation, such as PV, it will be up to the discretion of the reviewer whether or not to include that review in the SFSV price.



Climate Tab

This tab will remain the same. Custom weather files can be used for sensitivity testing but will not be allowed for verification. Requests for new certified climate data sets will be processed through BPAC.

U-values Tab

The U-values tab will be unchanged. Designs can continue to use the U-value calculator for simple wood frame, concrete or other assemblies that can be appropriately characterized by the area-weighting calculator. Material properties will be taken from the common material property list, either from the PHPP Manual or the list created by Peel Passive House (see Component Sharing below). New materials or those that differ from what is listed can be used if supporting documentation can be provided, clearly indicating conductivity values and how these were determined (ASTM or other testing standard reference). These can then be added to the extended materials list. In order to eliminate back and forth on acceptable material properties, the list can be hosted online or provided to the project team once the certifier is engaged on the project.

While custom PHPP assembly calculations may still be an option, the overall intent of the program will be to heavily influence projects to use common Passive House assemblies that are known to work and already have proven values for or have obtained PH certification. Select common assemblies and values will be provided in the guidance documentation, with a more extensive listing integrated into a Passive House Institute catalogue or can be taken from an acceptable 3rd party database. In order to reduce review time, where an assembly uses a clip system or anything that requires the use of the U-value supplement approach, the data **MUST** be taken from one of these sources or from a professionally stamped modelling report. It will be up to a reviewer whether they accept unstamped thermal modelling from outside of PHPP (for example from a trusted thermal modeller).

Projects will be limited to 8 assemblies (roofs, walls, floors). Assemblies with similar construction can be combined and area weighted where reasonable (i.e. two wood framed assemblies but one has 1" less exterior mineral wool). Similar assemblies with only slight variations in thickness will not count against the 8 assembly limit.



Areas Tab

For area inputs, whether completed in DesignPH or not, clear take offs of the drawings are required for review. For each project, the thermal bridge section of the Areas tab should have, at minimum, values for at least one of each of the following details which are likely to occur on every project:

- Foundation slab to wall connection
- Intermediate floor to wall connection (i.e. rim joist)
- Typical building corner (interior only)
- Window and doors, head, sill and jamb

Other details that must be included if they are present on a project can be found in Appendix A. Each of these details will have an associated default conservative value (to be determined and irrespective of construction type) that a project must begin with if they have no other supporting information proving the detail has a lower value. As with assemblies, projects will be heavily influenced to use proven detailing for thermal bridging, specifically from a thermal bridge catalogue.

If the project detail cannot be matched exactly to a catalogue detail, it will be left to the discretion of the certifier if they will accept a “close match” or if a professionally stamped modelling report is required. No detail should be assumed to be “thermal bridge free” without supporting data.

Until the BPAC community produces one or more thermal bridge catalogues populated for North American small building construction, we propose that the following values be used for the pilot:

- For positive assembly thermal bridges, use the default psi-value of 0.02 W/mK
- Negative thermal bridges should be zeroed out, i.e. no 'credit' is obtained from these junctions
 - Exception: for buildings in cold climates, external corners should be modeled with a psi-value of -0.04 W/mK
 - Exception: for buildings in cold climates, wall-to-roof junctions should be modeled with a psi-value of -0.04 W/mK
- For window and door install psi values, use 0.04 W/mK as the default. If the frames are overinsulated, use 0.02 W/mK
 - Exception: For door thresholds, a value of 0.06 W/mK should be used

The psi-values above were determined through testing of certified Passive House projects in cool-temperate and cold climates, the collective experience of the BPAC Technical Committee, and evaluation of psi-values from existing certified Passive House

Components. The values chosen represent a reasonable margin of safety: the negative values are less negative than the values that would result from bespoke thermal bridge modelling, and the positive values represent, on average, an overestimation of the additional heat loss through the quality of junctions & details that are appropriate for buildings of the performance level required for certification through this program.

As with all other elements of the pilot program, these values are subject to change based on review of data collected through the pilot program, and the development of new thermal bridging resources.

For assembly and thermal bridging information, current resources include:

- The Building Envelope Thermal Bridging Guide (<https://www.bchydro.com/powersmart/business/programs/new-construction.html#thermal>)
- The PHI Thermal Bridging Catalogue (https://passipedia.org/basics/building_physics_-_basics/thermal_bridges/thermal_bridges_catalogue)
- BRE Certified Thermal Details (<https://www.bregroup.com/certifiedthermalproducts/>)

Ground Tab

The SFSV guidance manual will direct which ground tab inputs should be linked to entries elsewhere in the spreadsheet, such as to the floor slab U-values in the U-values tab. For project selection, certifiers should pick a project that has one ground condition – a slab, crawlspace, heated basement, or unheated basement.

Components Tab

Window frames and heat recovery ventilation systems should all be Passive House certified with certificates provided to the reviewer. An exemption will be made for one non-certified entrance door, which can be modeled in DesignPH/PHPP with a 10% performance penalty added on top of stated performance. Previously vetted components may also be used at the discretion of the certifier (See Component Sharing).

IGU systems do not require Passive House certification, but should be provided according to ISO 15099. This can be provided via a screen shot from WINDOW, showing the



appropriate gas layers and boundary conditions, or another software package capable of such calculations.

Window installation thermal bridge values follow the same rules as other thermal bridges and must be from a catalogue or accepted 3rd party source, if the default values listed above in this document are not used.

Windows and Shading Tabs

The window tab and shading tab should be populated with outputs from the DesignPH model. Otherwise, at the reviewer's discretion, additional fees beyond the standard SFSV price may be required. A clear window and door schedule are still to be provided.

Ventilation Tab

Eligible projects will be limited to using one or two balanced PH ventilation systems with heat recovery. We will work on creating default values for additional ventilation worksheet to allow the modification of the inputs easily versus expecting the consultant to input from scratch. Kitchen exhausts will be entered according to the PH Extractor Hood Guidelines.

SummerVent Tab

Projects must achieve less than 5% overheating. SFSV Guidelines will provide additional examples for conservative window natural ventilation calculations.

Cooling Units Tab

If active cooling is provided, it must be through heat pump system or dedicated AHRI-tested mini-split system. SEER value is assumed to be 2.5 for all systems.

DHW+Distribution

Only single DHW and distribution network allowed. Electric or CO₂ heat pump systems are allowed. Gas systems are not permitted, except in cases where the project site is 50km or more from sufficient electrical supply.



Pipe lengths are to be modeled with an assumption of 10m per fixture unless a shorter distance can be clearly shown on plumbing drawings. Pipe insulation is to be a minimum of 2" (50mm). The hot water storage tank loss rate is assumed to be 3 W/K.

SolarDHW, PV

These tabs will be hidden by default, but it is up to the discretion of the reviewer whether evaluation and review of the PV system(s) will be included in the SFSV price.

Electricity Tab

All lighting is to be LED. All appliances are to be Energy Star rated. All default PHPP values for appliances and electrical uses will be used unless specific values can be easily demonstrated to be better via an Energy Star rating cut sheet with values converted to the appropriate value for PHPP. Further guidance for conversions will be provided in the guidance documentation, which will point to Peel Passive House's 'A Comparison of Canadian and European energy Standards for Household Appliances'.

Use Non-Res, Electricity Non-Res Tabs

Tabs will be hidden, as their use is not required for the building types covered by this program.

Aux Electricity

Tab will remain the same, though its use should not be required for use in this program.

IHG, IHG Non-Res Tabs

Tabs will be hidden, as their use is not required for the building types covered by this program.



PER Tabs

Only electricity-based systems will be considered for heating. COP of heat pumps will be assumed to be 1.5 for all system types.

Compact Tab

Tab will be hidden.

HP Tab

If not PH certified, the default value for any heat pump COP will be 1.5. At the discretion of the reviewer, projects may use improved values if they use a system that has reliable information that has been previously vetted by a reviewer (for instance, the Sanden systems). This will require sharing of information between reviewers for this previously vetted data (See Component Sharing).

Heat pump COP can be modeled using the PER worksheet, column R in PHPP v9.6 and v10.4. In cases where the default value of 1.5 is to be used, use of the HP tab will not be necessary.

Boiler and District Heating Tabs

Boiler kept as “None” and both tabs will be hidden.

Appendix A: List of Default Thermal Bridges

Assemblies (to be included in the assembly U-value calculations)

- Point Anchors
- Brick ties
- Cladding attachments

Details

- Window to wall connection
 - Fixed Window
 - Head
 - Sill
 - Jamb
 - Operable Window
 - Head
 - Sill
 - Jamb
- Door connection
 - Head
 - Sill
 - Jamb
- Inside Corner
- Masonry shelf angles
- Through wall flashing
- Roof Eaves
- Roof Parapet
- Wall to intermediate floor connection
- Wall to balcony connection
- Base of wall (wall to foundation or below grade wall)
- Wall to cantilevered floor connection
- Basement floor to basement wall
 - Crawlspace
 - Unconditioned
 - Conditioned
- Plumbing or radon vents going through the envelope
- Electrical conduits



- Rainwater drainage penetrations
- Exhaust vents
- Post bases (if intersecting envelope)
- Connections between differing wall assemblies