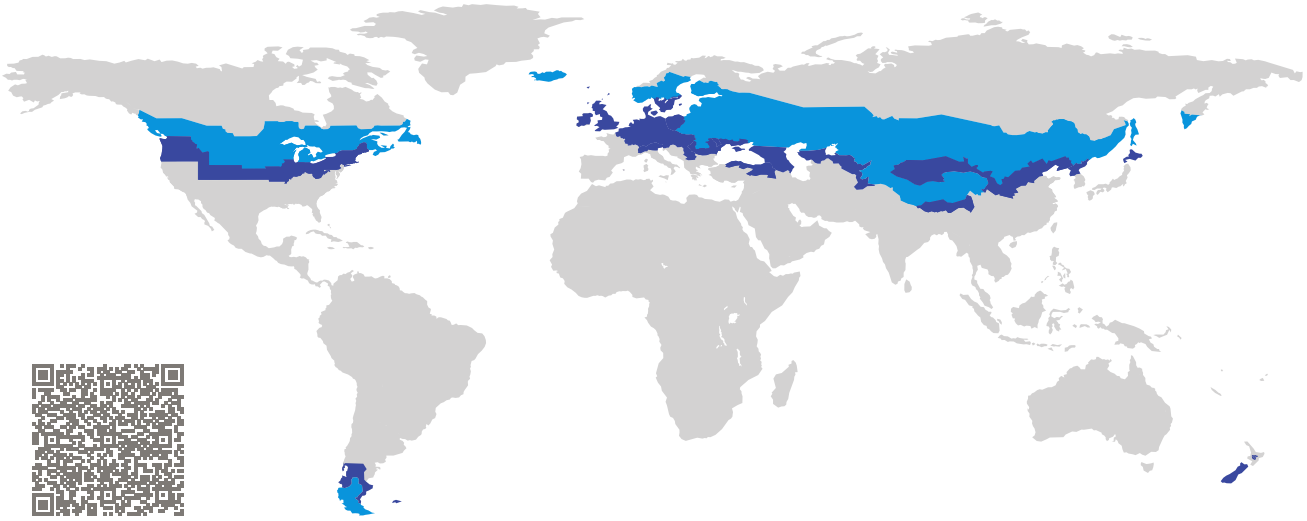
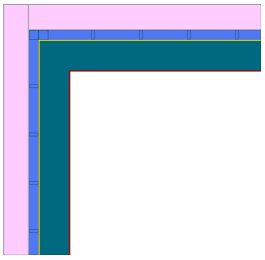
CERTIFICATE

Certified Passive House Component

Component-ID 2080cs02 valid until 31st December 2025

Passive House Institute
Dr. Wolfgang Feist
64283 Darmstadt
Germany





Category: **Construction system**

Manufacturer: **Net-Zero Modular Inc., Woodbine, Canada**

Product name: **Passivhaus retrofit system**

Hygiene criterion

The mininum temperature factor of the interior surfaces is $f_{Rsi=0.25\,m^2\,K/W} \geq 0.75$

Comfort criterion

The U-value of the installed windows is $U_{wi} \leq 0.65\,W/(m^2\,K)$

Efficiency criteria

Heat transfer coefficient of building envelope: $U * f_{PHI} \leq 0.12\,W/(m^2\,K)$

Temperature factor of opaque junctions: $f_{Rsi=0.25\,m^2\,K/W} \geq 0.88$

Thermal bridge-free design for key connection details: $\Psi \leq 0.01\,W/(m\,K)$

An airtightness concept for all components and connection details was provided.

It was confirmed that the structure will dry out within 12 months and there is no risk of moisture-related damage.

cold climate

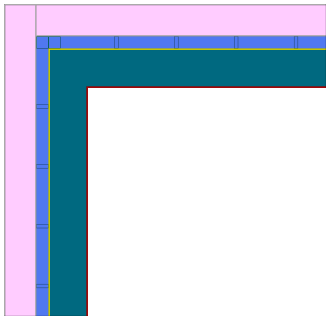
CERTIFIED COMPONENT

Passive House Institute

Net-Zero Modular Inc.
Woodbine Avenue Suite 500 Markham ON L3R 6G2, 7030 Woodbine, Canada
✉ info@modularpassivhaus.com | https://modularpassivhaus.com

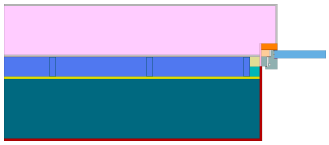
Opaque building envelope

The system is made of a main support layer and wall/roof modules in-between that are connected to the main supports. The main supports are made from steel tubing (120 mm x 120 mm) running vertically on the wall, horizontal over the flat roof, and with the pitch of the roof for a pitched roof.
The modules are formed by a series of steel pro-files (120 mm x 40 mm) running in the same direc-tion as the main supports. Those modules also have a sandwich panel on the outside made from a fibre cement board on the inside and outside with XPS insulation in between. For construction the main supports are first mounted to the existing wall. Then the wall/roof modules are hung between the main supports and connected using a special connecting mechanism
For the floor an insulation layer made from PU-foam boards is placed above the existing floor slab.
For a pitched roof a special connection mechanism is used to connect the main supports of the wall with the main supports of the roof. Then the roof modules are placed on the main supports on the roof and connected using the same connection mechanism. For a flat roof the same procedure is carried out. Here the main support structure is elevated 5 cm above the existing roof to prevent carrying the load to the existing roof structure.
The system is designed to be produced offsite and then carried onto the jobsite module by module. Through this steel construction method retrofits of buildings with multiple stories are possible.



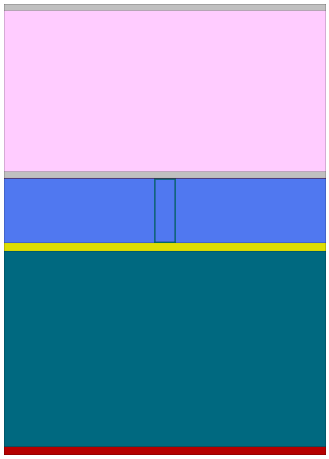
Windows

Windows are placed in the insulation layer on the outside surface of the main support layer. For the connection of the window to the main support structure a block of wood is used. For the certification a passive house suitable win-dow was uses. All calculation were carried out using a triple pane wood-aluminum window.



Airtightness concept

Airtightness is ensured by using the inner fibre cement board of the sandwich panel. The connections of the modules and to the windows are to be sealed with airtight tape.



Summary of values

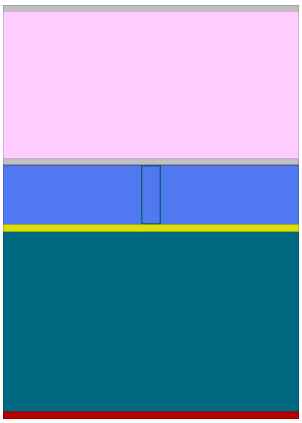
Opaque assemblies		U-value W/(m² K)	Thickness mm
exterior wall	(EW1) 	0.12	840
flat roof	(FR1) 	0.11	709
floor slab	(FS1) 	0.20	340
pitched roof	(RO1) 	0.09	645

Frame Cuts with ”dummy window - cold” from ”dummy window manufacturer” (0001)					
Frame values		Frame width b_f mm	U-value frame U_f W/(m^2 K)	Ψ-glazing edge Ψ_g W/(m K)	Temp. Factor $f_{Rsi=0.25}$ [-]
Bottom	(OB1) 	100	0.74	0.022	0.75
Top	(OH1) 	100	0.56	0.023	0.77
Lateral	(OJ1) 	100	0.56	0.023	0.77
Threshold	(OT1) 	100	0.98	0.026	0.70
Spacer: Super Spacer TriSeal / T-Spacer Premium Plus				Secondary seal: Butyl	

Junctions	U1 U2 U3 W/(m² K)	Ψ-value Ψ W/(m K)	Temp. factor $f_{Rsi=0.25}$ [-]
Ceiling integration into exterior wall (EW1_EW1_CE_1) 	0.12 0.12	0.001	0.971
Exterior corner exterior wall (EW1_EW1_ec_1) 	0.12 0.12	–0.072	0.922
Interior corner exterior wall (EW1_EW1_ic_1) 	0.12 0.12	0.318	0.971
Panel joint exterior wall (EW1_EW1_pj_1) 	0.12 0.12	0.000	0.985
Roof parapet flat roof (EW1_FR1_rp_1) 	0.12 0.11	–0.058	0.943
Window bottom operable window in exterior wall (EW1_OB1_1) 	0.12 0.74	0.045	0.808
Window head operable window in exterior wall (EW1_OH1_1) 	0.12 0.56	0.004	0.850
Window jamb operable window in exterior wall (EW1_OJ1_1) 	0.12 0.56	0.004	0.850
Roof eave pitched roof (EW1_RO1_ea_1) 	0.12 0.09	–0.029	0.958
Roof verge pitched roof (EW1_RO1_ve_1) 	0.12 0.09	–0.071	0.947
Panel joint flat roof (FR1_FR1_pj_1) 	0.11 0.11	–0.002	0.986
Threshold to floor slab (FS1_EW1_OT1_1) 	0.20 0.12 0.98	–0.162	0.759
Exterior wall plinth on floor slab (FS1_EW1_1) 	0.20 0.12	0.024	0.782
Exterior wall plinth on floor slab (FS1_EW1_2) 	0.20 0.12	0.054	0.784
Exterior wall plinth on floor slab (FS1_EW1_2) 	0.20 0.12	0.060	0.772
Panel joint pitched roof (RO1_RO1_pj_1) 	0.09 0.09	0.000	0.978

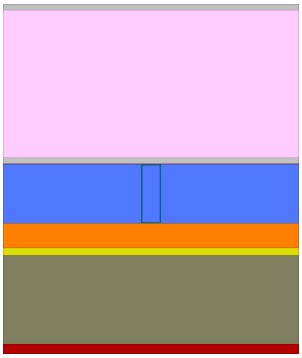
Junctions	U1 U2 U3 W/(m² K)	Ψ-value Ψ W/(m K)	Temp. factor $f_{Rsi=0.25}$ [-]
Roof ridge pitched roof (RO1_RO1_ri_1) 	0.09 0.09	–0.037	0.953

exterior wall (EW1)



Material	Lambda W/(m K)	Thickness (mm)
fibre-cement board	0.350	12
Insulation 040	0.040	300
fibre-cement board	0.350	12
Insulation 040	0.040	1
eq_insulation_steel profile exterior wall Net-Zero retrofit cold	0.789	120
cement mortar/plaster, sand	1.000	15
Old masonry wall 1400 kg/m³	0.650	365
gypsum plaster (interior plaster)	0.570	15
Total thickness: 840 mm		
Rsi: 0.13 m^2 K/W		
Rse: 0.04 m^2 K/W		
U-value: 0.12 W/(m^2 K)		

flat roof (FR1)

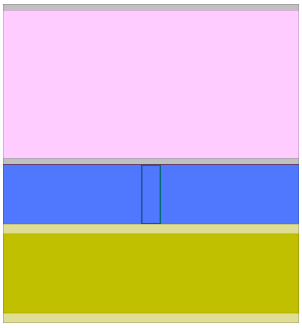


Material	Lambda W/(m K)	Thickness (mm)
fibre-cement board	0.350	12
Insulation 040	0.040	300
fibre-cement board	0.350	12
EQ flat roof I air - steel I Net-Zero retrofit cold	0.862	120
Insulation 040	0.040	50
cement mortar/plaster, sand	1.000	15
concrete (1 % steel)	2.300	180
gypsum plaster (interior plaster)	0.570	20
Total thickness: 709 mm		
Rsi: 0.10 m^2 K/W		
Rse: 0.04 m^2 K/W		
U-value: 0.11 W/(m^2 K)		

floor slab (FS1)

Material	Lambda W/(m K)	Thickness (mm)
cement screet	1.400	60
PU-foam 027	0.027	130
concrete (1 % steel)	2.300	150
Total thickness: 340 mm		
Rsi: 0.17 m^2 K/W		
Rse: - m^2 K/W		
U-value: 0.20 W/(m^2 K)		

pitched roof (RO1)



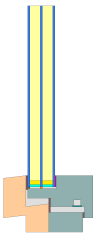
Material	Lambda W/(m K)	Thickness (mm)
fibre-cement board	0.350	12
Insulation 040	0.040	300
fibre-cement board	0.350	12
Insulation 040	0.040	1
EQ_pitched_roof_new I air - steel I Net-Zero retro cold	0.863	120
softwood, OSB – perpendicular to grain direction	0.130	20
EQ_pitched_roof_old I mineral wool - wood I Ne Zero retrofit cold	0.053	160
softwood, OSB – perpendicular to grain direction	0.130	20

Total thickness: 645 mm
Rsi: 0.10 m^2 K/W
Rse: 0.04 m^2 K/W
U-value: 0.09 W/(m^2 K)

Frame Cuts with ”dummy window - cold” from ”dummy window manufacturer” (0001)

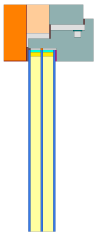
Bottom

b_f = 100 mm
U_f = 0.74 W/(m^2 K)
Ψ_g = 0.022 W/(m K)
f_{Rsi} = 0.75



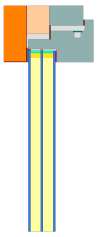
Top

b_f = 100 mm
U_f = 0.56 W/(m^2 K)
Ψ_g = 0.023 W/(m K)
f_{Rsi} = 0.77



Lateral

b_f = 100 mm
U_f = 0.56 W/(m^2 K)
Ψ_g = 0.023 W/(m K)
f_{Rsi} = 0.77



Threshold

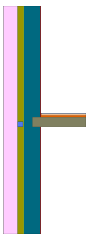
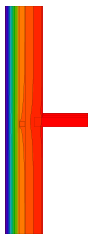
b_f = 100 mm
U_f = 0.98 W/(m^2 K)
Ψ_g = 0.026 W/(m K)
f_{Rsi} = 0.70

Junctions

Ceiling integration

into exterior wall (EW1_EW1_CE_1)

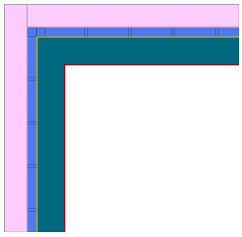
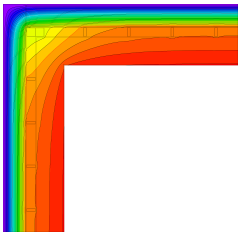
U_{EW1} = 0.12 W/(m² K)
U_{EW1} = 0.12 W/(m² K)
Ψ = 0.001 W/(m K)
f_{Rsi} = 0.971

Exterior corner

exterior wall (EW1_EW1_ec_1)

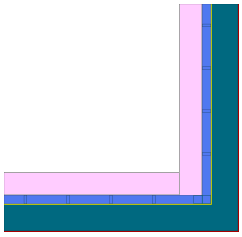
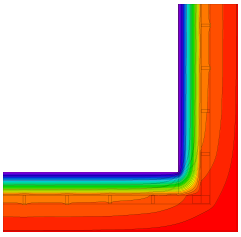
U_{EW1} = 0.12 W/(m² K)
U_{EW1} = 0.12 W/(m² K)
Ψ = –0.072 W/(m K)
f_{Rsi} = 0.922

Interior corner

exterior wall (EW1_EW1_ic_1)

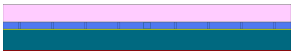
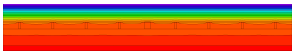
U_{EW1} = 0.12 W/(m² K)
U_{EW1} = 0.12 W/(m² K)
Ψ = 0.318 W/(m K)
f_{Rsi} = 0.971

Panel joint

exterior wall (EW1_EW1_pj_1)

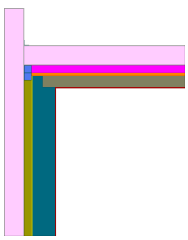
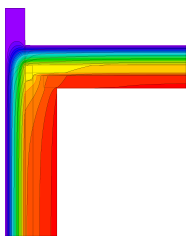
U_{EW1} = 0.12 W/(m² K)
U_{EW1} = 0.12 W/(m² K)
Ψ = 0.000 W/(m K)
f_{Rsi} = 0.985

Roof parapet

flat roof (EW1_FR1_rp_1)

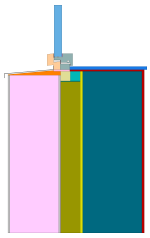
U_{EW1} = 0.12 W/(m² K)
U_{FR1} = 0.11 W/(m² K)
Ψ = –0.058 W/(m K)
f_{Rsi} = 0.943

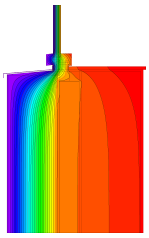



Window bottom

operable window in exterior wall (EW1_OB1_1)

U_{EW1} = 0.12 W/(m² K)
U_{OB1} = 0.74 W/(m² K)
Ψ = 0.045 W/(m K)
f_{Rsi} = 0.808

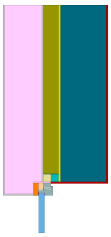


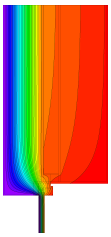


Window head

operable window in exterior wall (EW1_OH1_1)

U_{EW1} = 0.12 W/(m² K)
U_{OH1} = 0.56 W/(m² K)
Ψ = 0.004 W/(m K)
f_{Rsi} = 0.850

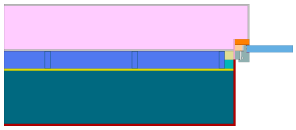


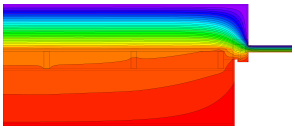


Window jamb

operable window in exterior wall (EW1_OJ1_1)

U_{EW1} = 0.12 W/(m² K)
U_{OJ1} = 0.56 W/(m² K)
Ψ = 0.004 W/(m K)
f_{Rsi} = 0.850

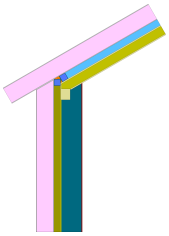


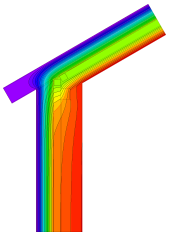


Roof eave

pitched roof (EW1_RO1_ea_1)

U_{EW1} = 0.12 W/(m² K)
U_{RO1} = 0.09 W/(m² K)
Ψ = –0.029 W/(m K)
f_{Rsi} = 0.958

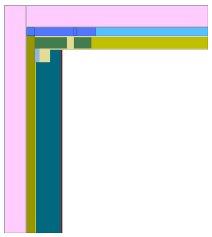


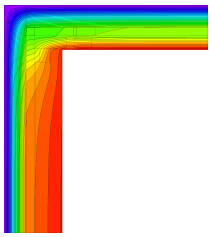


Roof verge

pitched roof (EW1_RO1_ve_1)

U_{EW1} = 0.12 W/(m² K)
U_{RO1} = 0.09 W/(m² K)
Ψ = –0.071 W/(m K)
f_{Rsi} = 0.947

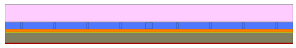
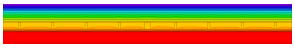




Panel joint

flat roof (FR1_FR1_pj_1)

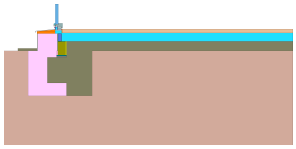
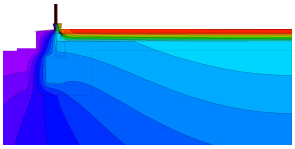
U_{FR1} = 0.11 W/(m² K)
U_{FR1} = 0.11 W/(m² K)
Ψ = –0.002 W/(m K)
f_{Rsi} = 0.986

Threshold

to floor slab (FS1_EW1_OT1_1)

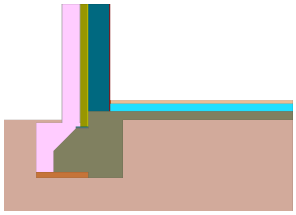
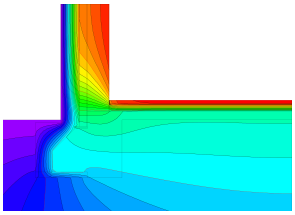
U_{FS1} = 0.20 W/(m² K)
U_{EW1} = 0.12 W/(m² K)
U_{OT1} = 0.98 W/(m² K)
Ψ = –0.162 W/(m K)
f_{Rsi} = 0.759

Exterior wall plinth

on floor slab (FS1_EW1_1)

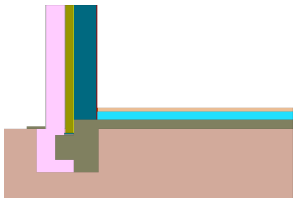
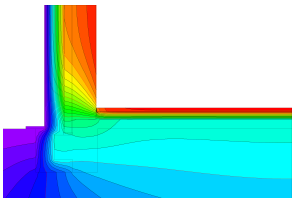
U_{FS1} = 0.20 W/(m² K)
U_{EW1} = 0.12 W/(m² K)
Ψ = 0.024 W/(m K)
f_{Rsi} = 0.782

Exterior wall plinth

on floor slab (FS1_EW1_2)

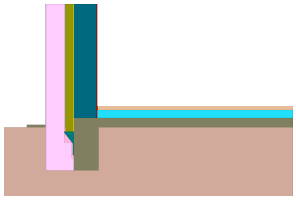
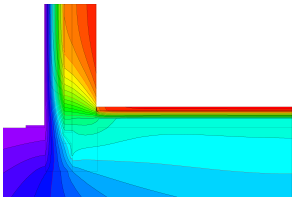
U_{FS1} = 0.20 W/(m² K)
U_{EW1} = 0.12 W/(m² K)
Ψ = 0.054 W/(m K)
f_{Rsi} = 0.784

Exterior wall plinth

on floor slab (FS1_EW1_2)

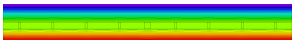
U_{FS1} = 0.20 W/(m² K)
U_{EW1} = 0.12 W/(m² K)
Ψ = 0.060 W/(m K)
f_{Rsi} = 0.772

Panel joint

pitched roof (RO1_RO1_pj_1)

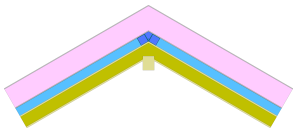
U_{RO1} = 0.09 W/(m² K)
U_{RO1} = 0.09 W/(m² K)
Ψ = 0.000 W/(m K)
f_{Rsi} = 0.978

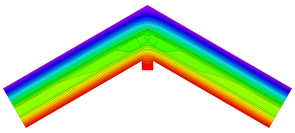


Roof ridge

pitched roof (RO1_RO1_ri_1)

U_{RO1} = 0.09 W/(m² K)
U_{RO1} = 0.09 W/(m² K)
Ψ = –0.037 W/(m K)
f_{Rsi} = 0.953





Disclaimer: The Passive House Institute GmbH (PHI) carries out heat transfer analyses according to the standards set out in the document "Criteria and Algorithms for Certified Passive House Components: Opaque Construction Systems" and based on information provided by the manufacturer. It is the responsibility of the project leader, e.g. the architect to ensure the appropriate assessments have been carried out for specific buildings, which may include more detailed analyses than those carried out for this certification. Use of a certified Passive House component does not guarantee that a construction project will achieve the Passive House, EnerPHit or PHI Low Energy Building standard. In all cases full details are to be made available by the manufacturer on request to the engaged certified Passive House designer or certifier, who will be permitted to check these against the construction information and to perform on-site checks as part of the quality assurance process.